Remedial Investigation Feasibility Study Report
Sudbury Road Landfill
Walla Walla, Washington

September 15, 2014

Prepared for:

City of Walla Walla

Prepared by

Schwyn Environmental Services

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Prepared for

City of Walla Walla
55 Moore Street
Walla Walla, WA 99362

Prepared by

Schwyn Environmental Services

4621 South Custer
Spokane, WA 99223

In Association With

FLOYD | SNIDER
601 Union St, Suite 600
Seattle, WA 98101

HERRERA

200 Sixth Avenue, Suite 1100
Seattle, WA 98121

J-U-B ENGINEERS, INC.
2810 W. Clearwater Avenue, Suite 201
Kennewick, WA 99336

TABLE OF CONTENTS

TABLE TITLE

FIGURE TITLE

APPENDIX	TITLE
A	Boring and Well Construction Logs
B	Geophysical Investigation Report
C	Geotechnical Soils Report
D	Laboratory Analytical Reports
E	Aquifer Characterization Report
F	Groundwater Quality Trends and Box Plots
G	Historical Groundwater Data Summary
H	HWA GeoSciences Memorandum
I	Remediation Cost Estimates
J	Proposed Draft Cleanup Action Plan Text

LIST OF ABBREVIATIONS AND ACRONYMS

AO	Agreed Order No. 8456
ALS	ALS Environmental, Inc.
ARAR	Applicable or relevant and appropriate requirement
ASIL	Ambient source impact level
bgl	Below ground level
BNSF	BNSF Railway Company
CAP	Cleanup Action Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
City	City of Walla Walla, Washington
CLP	Contract Laboratory Program
cm/sec	Centimeters per second
COC	Constituent of concern
CSI/A	Contaminant Source Identification/Assessment
DCA	Disproportionate cost analysis
DCAP	Draft Cleanup Action Plan
Ecology	Washington State Department of Ecology
EDR	Environmental Data Resources, Inc.
EM	Electromagnetic
FEMA	Federal Emergency Management Agency
ET	Evapotranspiration
Freon 11	Trichlorofluoromethane
Freon 12	Dichlorodifluoromethane
FS	Feasibility Study
ft^2/day	Square feet per day
ft/ft	Feet per foot
ft/sec	Feet per second
GCL	Geosynthetic clay liner
gpm	Gallons per minute
HASP	Health and Safety Plan
HDPE	High-density polyethylene
Herrera	Herrera Environmental Consultants, Inc.
HHWF	Household Hazardous Waste Facility

HWA	HWA GeoSciences, Inc.
LCRS	Leachate collector and removal system
LF	Linear feet
LFG	Landfill gas
LHG	Washington State Licensed Hydrogeologist
MAG	Magnetic
MCL	maximum contaminant level
MFS	Minimum functional standards
µg/L	Micrograms per liter
mg/L	Milligram per liter
mL/min	Milliliters per minute
MNA	Monitored natural attenuation
MRL	Method reporting level
MSW	Municipal solid waste
MTCA	Washington State Model Toxics Control Act
NGS	National Geodetic Survey
NMOC	Non-methane organic compound
NAVD 88	North American Vertical Datum of 1988
OSWER	Office of Solid Waste and Emergency Response
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PP&L	Pacific Power and Light
PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
RA	Remedial alternative
RAO	Remedial action objective
RCW	Revised Code of Washington
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SCFM	Standard cubic feet per minute
Schwyn	Schwyn Environmental Services, LLC
SDG	Sample delivery group
Site	Sudbury Road Landfill

SM	Standard method
SQER	Small quantity emission rate
SVOC	Semivolatile organic compound
TAP	Toxic air pollutant
TCE	Trichloroethene
TDS	Total dissolved solids
TOC	Total organic carbon
TWL	Tausick Way Landfill
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound
Work Plan	Data Summary and Remedial Investigation Work Plan
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation
WSP	Washington State Penitentiary
WWCHD	Walla Walla County Health Department
Zonge	Zonge International

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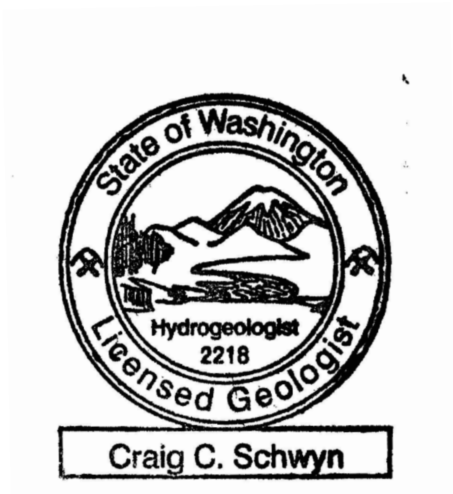
SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

The technical material and data contained in this Remedial Investigation/Feasibility Study document were prepared by Schwyn Environmental Services, LLC, with assistance from Floyd|Snider, Inc., Herrera Environmental Consultants, Inc., J-U-B Engineers, Inc., and USKH, Inc., under the supervision and direction of the undersigned Washington Licensed Hydrogeologist.



Craig C. Schwyn

September 15, 2013

Craig C. Schwyn, LHG | Date
Principal Hydrogeologist

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1.0 INTRODUCTION

This City of Walla Walla, Washington (City) Sudbury Road Landfill (Site) Remedial Investigation (RI)/Feasibility Study (FS) Report has been prepared pursuant to Agreed Order No. 8456 (AO) between the City and the Washington State Department of Ecology (Ecology) effective May 26, 2011. This RI/FS was prepared in accordance with the AO, the Washington State Model Toxics Control Act (MTCA), Chapter 70.105D of the Revised Code of Washington (RCW), and the Washington Administrative Code (WAC) regulations, Chapter 173-340 WAC (Ecology 2007).

1.1 PURPOSE AND OBJECTIVES

The RI/FS was conducted to determine the nature and extent of contamination associated with the landfill and evaluates remedial actions appropriate for the Site. The RI incorporates exploration activities conducted in accordance with the Data Summary and Remedial Investigation Work Plan (Work Plan), Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HASP) (Schwyn 2011) approved by Ecology on January 6, 2012 (Ecology 2012a) and additional field work tasks described in the Sudbury RI Data Gap Review Memorandum (Schwyn 2012) approved by Ecology on August 9, 2012 (Ecology 2012b). The RI portion of this report (Sections 1 through 4) describes the methods used and data collected to close data gaps and characterize the nature and extent of contamination related to the Site. Section 5 presents a conceptual site model that provides the foundation for defining the objectives of the FS.

The purpose of the FS is to develop and evaluate applicable cleanup alternatives and recommend a preferred cleanup alternative for the Site in accordance with Chapters 173-340-350 through 173-340-390 WAC. Based on the results of the RI/FS, a Draft Cleanup Action Plan (CAP) will be prepared for submittal to Ecology in order to satisfy the requirements of the AO. The FS develops the focused set of Site applicable remedial alternatives that were presented and approved by Ecology in the Remedial Alternatives Focusing Study [RA Focusing Study (Schwyn 2013a)]. A list of potential cleanup action technologies were developed in the RA Focusing Study based on the nature and sources of the constituents of concern (COCs) identified for the Site, the environmental medium of concern (groundwater), and the potential exposure pathway (drinking water). Potentially applicable cleanup action technologies were screened against the criteria described in WAC 173-340-350(8)(b) and WAC 173-340-360(2)(a)(b) and a focused list of remedial alternatives was developed for review and approval by Ecology. The RA Focusing Study provided the basis for the alternatives that are further developed as part of this FS.

1.2 REPORT ORGANIZATION

The report is organized as follows:

- Section 1 summarizes existing data and information related to the Site;
- Section 2 presents the RI scope and methods;
- Section 3 presents the RI findings;
- Section 4 establishes draft cleanup levels and COCs;
- Section 5 presents a conceptual site model;
- Section 6 describes the remedial action requirements;
- Section 7 identifies the remedial action objectives (RAOs) and describes the preliminary remedial alternatives screening methodologies;
- Section 8 provides a detailed evaluation of the screened remedial alternatives;
- Section 9 describes the preferred remedial alternative;
- Section 10 presents text for a possible draft cleanup action plan; and
- Section 11 provides references for the sources of information cited throughout the report.

1.3 SITE DESCRIPTION AND SETTING

According to the AO, the Site is referred to as the Sudbury Road Landfill and is generally located at 414 Sudbury Road (now Landfill Road), Walla Walla, Washington 99362, about 4 miles west of the City of Walla Walla and ¼ mile north of Highway 12, in the southwest quarter of Section 14, southeast quarter of Section 15, northeast quarter of Section 22, and northwest quarter of Section 23, Township 7 North, Range 35 East, Willamette Meridian (Figure 1). The landfill area itself is approximately 125 acres and is located in the western portion of an 828.86-acre City-owned parcel of land zoned and used for various waste management purposes (Figure 2). The Site is designated by Ecology as Facility No. 4446540. The AO defines the Site as the extent of contamination caused by the release of hazardous substances at the Site. The Site constitutes a Facility according to RCW 70.105D.020(5).

1.3.1 SURROUNDING LAND USE

The landfill is located in rural southeastern Washington and entirely surrounded by large expanses of rolling land used for dry-land wheat farming. The northern border of the landfill is defined by the 100-foot-wide BNSF Railway Company (BNSF) right-of-way, which was abandoned in 1988. The Washington State Penitentiary (WSP) is located immediately east of the City property, about 6,400 feet east of the landfill. The new State Highway 12 right-of-way lies approximately 300 feet south of the landfill entrance station and approximately 1,200 feet south of the landfill disposal areas. No significant changes to these land uses in the vicinity of the Site are expected in the near future.

1.3.2 SURROUNDING RESIDENTIAL POPULATIONS

Rural housing is located south of State Highway 12, approximately 500 feet south of the landfill scale house and more than 1,400 feet from the southern boundary of the landfill disposal area. Three residences are located to the west of the landfill, between 4,500 feet and more than 8,000 feet from the western landfill boundary. One additional residence lies approximately 9,000 feet southwest of the landfill. The nearest residence north of the landfill is over 7,500 feet away. The WSP and its inmate population are located immediately east of the Site property boundary and more than 1.2 miles east of the landfill itself.

1.3.3 BENEFICIAL USE

According to Chapter 173-200 WAC (Ecology 1990), beneficial uses for waters of the state are defined as the "uses of waters of the state which include but are not limited to use for domestic, stock watering, industrial, commercial, agricultural, irrigation, mining, fish and wildlife maintenance and enhancement, recreation, generation of electric power and preservation of environmental and aesthetic values, and all other uses compatible with the enjoyment of the public waters of the state."

The land use, ecological resources, and cultural resources were considered herein because surface water and groundwater quality may influence other resources and their beneficial uses. To evaluate the potential beneficial uses in the vicinity of the landfill, in 2011 Environmental Data Resources, Inc. (EDR) conducted a search of state, federal, and local databases, as well as independent searches of State of Washington Water Resources and Water Well information databases. Beneficial use information and reports are discussed in the Work Plan. Surrounding land uses and wells are shown on Figure 2.

The potential beneficial uses that may be affected by activities at the landfill if a complete pathway of exposure to Site contaminants is present are the following:

- Water uses and water rights:
  - Groundwater (domestic, municipal, industrial, stock watering, or irrigation); and
  - Surface water (irrigation, stock watering),
- Ecological resources:
  - Wetland areas;
  - Threatened and endangered species habitat areas; and
  - Floodplain,
- Cultural resources:
  - Historic sites; and
  - U.S. Indian reservations.

1.3.3.1 Water Uses and Water Rights

Groundwater Use

Two active supply wells, Well #2 (also referred to as MW-2) and the Garver well, are used for landfill operations. The Garver well is located east of the landfill; it is 1,227 feet deep, constructed in the basalt aquifer, and used for dust control. Well #2 is located south of Area 5 and west of Area 6 (Figure 3). Well #2 is 155 feet deep and constructed in the gravel aquifer; the water is used for dust control, the compost facility, and nonpotable purposes. Bottled drinking water is provided at the Site for potable purposes.

Searches for groundwater use in the vicinity of the landfill focused on wells and water rights within 1.5 miles of the landfill in the hydraulically downgradient directions (northwest, west, and southwest), and 2,000 feet of the landfill in the upgradient and cross-gradient directions (north, east, and south). The search distances conservatively encompass a region around the landfill that could possibly be affected by Site releases. Well information for surrounding properties was collected from several sources: EDR searches; Ecology's water rights information database (Water Resources Explorer, March 9, 2013), which provided copies of water right certificates and other documents detailing location, quantities of water allowed, and original water right holder were obtained; Ecology's Well Log Database (March 9, 2013), which provided available well logs maintained by Ecology detailing depth of well and information on the screened aquifer. In some cases, property owners provided well information and allowed sampling. No new water well reports were available since the Work Plan was published (refer to the Work Plan for water well report documentation).

No residences or water use was evident within the 2,000-foot search area north and east of the landfill. As mentioned above, the nearest wells to the northwest, west, and southwest are approximately 1 to 1.5 miles from the landfill boundary. The WSP is located approximately 1.2 miles east of the landfill. The resident populations of the State Penitentiary are provided City water for potable purposes. The penitentiary grounds are irrigated with well water. The penitentiary property is hydraulically upgradient of the Site and is not affected by landfill activities.

The area south of the landfill is generally rural residential housing. Two water districts provide water to most of the rural housing developments located south of State Highway 12. Several properties maintain water rights related to domestic or irrigation wells that are listed as active. Only two of these properties are within the 2,000-foot search area (see Figure 2):

- The Smith well property, located approximately 1,800 feet south of the landfill, has a certified water right on file with Ecology that allotted up to 11 acre-feet per year to be withdrawn from the old gravel and clay aquifer for irrigation and domestic purposes (Ecology Water Resources Explorer Record #G3-24731CWRIS).
- The Bonneville Power Administration property and substation is located 2,000 feet south of the landfill (3072 Heritage Road) and maintains an active water right (Water Resources Explorer). Several test wells are located on the property [well logs are available in the Hydrogeologic Report (EMCON 1995)], but one well is listed for domestic use. The domestic use well was originally installed in 1941 to a depth of 515 feet into the bedrock and then reconditioned in 1976. No water right information is available for this well in the Ecology Water Resources Explorer.

Four residential properties located northwest, west, and southwest of the landfill maintain their own domestic wells for water supply (Figure 2). No water rights were available in Ecology's Water Resources Explorer for any of these four well users:

- The Camp well is located approximately ¾ mile northwest of the landfill and owned by Camp Properties. A well log is not available for the well.
- The Small well is located approximately ¾ mile west of the landfill on a parcel owned by Mark and Kathleen Small. The well was installed in 1998 to a depth of 100 feet and is screened within gravels.
- The Kinman well is located approximately 1.5 miles west of the landfill and designated for domestic use. The well was installed in 2002 to a depth of 180 feet. The well is screened within a water-bearing gravel layer (Kinman well log).
- Two wells are located on the Schmidt property, which is located approximately 1.5 miles southwest of the landfill. One of the wells is 122 feet deep and designated for domestic purposes. The other well is 780 feet deep, constructed in basalt, and designated for irrigation purposes. No water rights are available for the irrigation well at this time.

Surface Water Use

No perennial creeks or waterways are located within 2,000 feet of the landfill. Three creeks or intermittent streams are identified within 1 mile of the landfill. Mill Creek is the largest and located approximately 1 mile south of the landfill in the Walla Walla Valley. Mud Creek, which is an intermittent stream, lies more than ½ mile northwest of the landfill at its closest point. A tributary of Mud Creek extends along the northern boundary of the landfill (the north drainage ditch). Several surface water rights are listed on Mud Creek and its tributaries. Very little information is available regarding whether these surface water rights are actively used.

1.3.3.2 Ecological Resources

No officially designated wilderness areas, wildlife preserves, or state-designated critical habitat areas are located within a mile of the landfill. Bald eagles, steelhead trout, and bull trout are endangered species listed for Walla Walla County; however, no critical habitat for these species is present at the landfill. Endangered salmon and steelhead species are also listed for Walla Walla County, but they are limited to the Walla Walla River, Mill Creek, the Snake River, and the Columbia River; therefore, no impacts on these species due to the landfill would be expected (refer to relevant material from the EDR Report that is included in the Work Plan).

The National Wetland Inventory identifies wetland areas within the Mill Creek basin, just over a mile from the landfill. No wetlands are identified within 2,000 feet of the landfill.

The nearest 100-year floodplain mapped by the Federal Emergency Management Agency (FEMA) is on Mill Creek, and it does not affect the Site.

1.3.3.3 Cultural Resources

No state or federal historic sites or U.S. Indian Reservations are located within a 1-mile radius of the landfill.

1.3.4 GEOMORPHOLOGY AND DRAINAGE

The Sudbury Road Landfill is located on Pleistocene terrace deposits on the northern flank of the Walla Walla Valley. The terrace surface has been dissected by intermittent drainages formed entirely in unconsolidated soils of the Palouse Formation and the Touchet beds. The southern City property boundary generally coincides with the edge of the terrace, where it drops steeply (approximately 50 feet) down to the Mill Creek and Walla Walla River floodplain (EMCON 1995).

The Site topography ranges in elevation from 904 feet [all elevations referenced to the North American Vertical Datum of 1988 (NAVD 88)] at the top of Area 6 to 782 feet in the southern drainage area (Figure 3). Natural slopes in the area are 20 percent or less (EMCON 1995).

The landfill area consists of a central plateau with elevations dropping to the north, east, and south. The elevation of the central plateau is approximately 840 feet in the vicinity of Well #2. Drainage bottoms located to the south and north lie at approximately 782 and 790 to 800 feet, respectively. The landfill disposal cells have historically been cut into the central plateau or built up on the side slopes of the plateau.

Intermittent drainages flow to the west and southwest around the landfill disposal areas. One intermittent drainage originates in the upland terrace to the east of the landfill and wraps around the east and south edges of Areas 1 and 7 (Figure 2). Another drainage borders the north side of Areas 5 and 6, originating near a minor drainage divide approximately 1,000 feet northeast of Area 7. The drainage extends west to southwest along the northwest property boundary. The draw is commonly called the "north drainage ditch."

Historically, stormwater passed through the north drainage ditch and flowed off-Site to the west, toward Mud Creek. During the last 100 years, the "natural channel" in the landfill area was altered significantly by the Northern Pacific Railroad and by agricultural activities that follow the channel to Mud Creek. More recently, stormwater drainage from portions of municipal solid waste (MSW) disposal Areas 5, 6, and 7 and from farmland north of the landfill was diverted to the north drainage ditch. Stormwater retention ponds (excavated pits) were constructed adjacent to Area 5, where the stormwater either infiltrated the soils and/or evaporated, rather than flowing off-Site.

1.3.5 SITE GEOLOGY

The Site lies on the northern flank of the Walla Walla Valley. The valley is bounded on the east by the Blue Mountains, which consist of a northeast-trending uplifted arch of Columbia River basalt; to the south by Horse Heaven Ridge, which is an extension of the Yakima Fold Belt; and to the north by the Touchet slope, which is an undulating surface of the Columbia Plateau that slopes gently southeast into the Walla Walla Valley. The Walla Walla Valley ends at the Columbia River at Wallula, approximately 27 miles west of the Site.

The subsurface geology beneath the landfill consists of (from upper to lower) Palouse silt; reworked lacustrine silt and clay of the Touchet beds; interbedded alluvial gravels in a clayey, silty, or sandy matrix, underlain by a basal unit informally termed the "old gravel and clay" by R.C. Newcomb (Newcomb 1965); and Columbia River basalt. The unconsolidated to semi-consolidated deposits overlying the Columbia River basalt may be 600 feet or more in thickness.

Vadose zone soils in the landfill area consist of silt, clayey silt, and fine sandy silt, which are interpreted to be soils of the Palouse Formation and the Touchet beds. These silty soils exhibit laboratory permeabilities in the range of 10^{-6} to 10^{-5} centimeters per second (cm/sec) (EMCON 1995; Schwyn 2010a). Underlying the silty soils is a unit consisting of consolidated to semi-consolidated, poorly graded gravel, silty gravel, and silt, which are interpreted to correlate with the “old gravel and clay” unit. Remolded samples of the gravelly silt unit indicated permeability on the order of 10^{-7} cm/sec (EMCON 1995). Geologic cross sections of the Site are shown on Figures 4, 5, and 6.

1.3.6 HYDROGEOLOGY

During the RI, groundwater was first encountered beneath the Site at depths from approximately 30 to 87 feet below ground level (bgl) in the lower silt horizon of the Touchet beds and/or the underlying alluvial gravel termed the “old gravel and clay” aquifer. This aquifer is locally used for domestic water supply purposes. Groundwater elevation contour maps constructed with depth-to-groundwater measurements collected during the June and October 2012 and February 2013 monitoring events are provided on Figures 7, 8, and 9.

The inferred groundwater flow direction is to the west and southwest, with an approximate horizontal gradient of 0.004 feet per foot (ft/ft) beneath the landfill. A vertical downward gradient was noted between the water levels in MW-3 and MW-15 (752.30 and 756.56 feet, respectively, in February 2013).

The groundwater levels in the vicinity of the landfill have been declining since 1997. Between 1997 and 2013, the water level has declined as much as 10 feet in MW-12 (resulting in the deepening of the well in 2008). The water level trends in selected landfill monitoring wells are shown on Figure 10.

The horizontal hydraulic conductivity (geometric mean) of the uppermost aquifer beneath the Site is 1.52×10^{-3} cm/sec, based on rising head slug tests conducted in monitoring wells MW-1, MW-3, MW-11, and MW-12 (EMCON 1995). Based on this information and an effective porosity of 0.3, the average groundwater flow velocity beneath the Site has been reported to be approximately 2.03×10^{-5}

cm/sec (21 feet per year). Pumping and recovery tests conducted during the RI with the use of a new well (MW-15D) screened in the gravel unit suggested more transmissive aquifer characteristics, as described in Sections 2.8 and 3.4

A second, more regional, deep aquifer is present in the underlying Columbia River basalts. Information from the driller's water well reports, within the vicinity of the Site, indicated that the basalt aquifer had a potentiometric surface in the range of 150 to 200 feet bgl and a positive upward gradient (EMCON 1995).

1.4 LANDFILL HISTORY AND DESCRIPTION

The landfill lies within a much larger City-owned parcel of land that was established for various waste management purposes. The earliest references to the City property date back to 1970, when the City proposed to purchase land to develop a spray irrigation farm for the disposal of industrial wastewater from the canning plants that were operating within the City, to provide land on which to dispose of future domestic waste, and to make needed improvements to the existing sewage treatment facilities. In 1970 and 1973, the City purchased a total of 967.17 acres of farmland and had it designated for waste management purposes. The westernmost 125 acres of the City property were set aside for landfill development. From 1971 to 2004, approximately 600 acres of the remaining property were used for the agronomic application of nonhazardous food processing wastewater. In April 2004, Seneca Foods, Inc., canceled the sprayfarm lease with the City and terminated the State Waste Discharge Permit with Ecology due to the declining cannery industry. Since 2004, the sprayfarm portion of the property has been dry land used for wheat farming under leases to another party. Additionally, portions of the former sprayfarm and the northwestern 200 acres of the City property are used for the agronomic application of biosolids, and the City has built an emergency sewer lagoon for the City wastewater/reuse water plant on 10 acres in the southeast corner of the property.

Currently, the City property is split by several linear parcels owned by Pacific Power and Light (PP&L), BNSF, and the Washington State Department of Transportation (WSDOT). PP&L owns a north-south-trending strip of land that cuts across the east side of the City property (approximately 6,000 feet east of the landfill area). Large transmission lines extend over the PP&L land. The City property is further dissected by a BNSF right-of-way that roughly cuts the property into northern and southern halves. The 100-foot-wide right-of-way, which was part of BNSF’s former Attalia to Walla Walla rail line, forms the northern boundary of the landfill. The railroad tracks were removed circa 1988, and the right-of-way functions as a road across the property.

In 2007, 57.79 acres of the original 967.17-acre parcel was acquired by WSDOT for the construction of rerouted State Highway 12. This resulted in approximately 80.5 acres of City land becoming orphaned from the original City property on the south side of the highway. As of 2011, the parcel that is located on the north side of the highway and contiguous with the landfill consists of 828.86 acres, as shown on Figure 2.

1.4.1 LANDFILL DEVELOPMENT

The City used the Tausick Way Landfill (TWL), located within the eastern city limits of Walla Walla, for solid waste disposal from the late 1930s until 1978. By the mid-1970s, the TWL was nearing capacity, and in March 1976, the Walla Walla County Health Department (WWCHD) refused to issue a "Conforming Permit" for the TWL due to the limited remaining area.

Records indicate that planning for the Sudbury Road Landfill began in earnest during the middle of 1976 and continued through 1977. In 1976, the City Engineering Department prepared preliminary design plans for the Site. The plans called for the construction of a road onto the property extending north from Sudbury Road and the construction of a scale house and equipment building in the low valley of the intermittent drainage on the south side of the existing landfill. Three monitoring wells, now known as MW-1a, MW-2 (Well #2), and MW-3a were installed in late 1976. Groundwater samples were collected as part of a monthly program from August 1977 through June 1978 to establish background groundwater quality. On February 28, 1977, the Walla Walla Regional Planning Board of Adjustment granted a Conditional Use Permit to operate a landfill on the property, which was formerly zoned for agriculture use. In March 1977, the City submitted an Engineers Report with an Environmental Impact Statement, an Ecology Application for Disposal Site Permit, and a General Plan of Operation to the WWCHD. The Conforming Permit for the landfill was issued on June 27, 1977. News publications announced that the "New City Landfill on Sudbury Road" was opened to the public on July 10, 1978 (*Walla Walla Union Bulletin* 1978).

1.4.2 WASTE DISPOSAL PROCESS

MSW, asbestos waste, and medical waste have been placed in the landfill. Hazardous wastes have never knowingly been accepted at the landfill. MSW has been placed in five separate areas, commonly referred to as Areas 1, 2, 5, 6, and 7. The disposal area numbers are based on their location and do not imply a sequence of disposal. Asbestos waste has been disposed of in two separate cells. A single medical waste cell has been used. The approximate limits of the refuse disposal areas are shown on Figure 3. Descriptions of the waste filling practices are fully described in the Historical Study Report (Schwyn 2006) and summarized in the following subsections.

1.4.2.1 Area 1

Waste was first placed in Area 1, located on the southeast face of the landfill area, and continued off and on until about 1980 (City of Walla Walla 1988; Schwyn 2006). Area 1 consists of a trench fill disposal cell. The bottom and cover materials are composed of native soil. Area 1 has no leachate collector system or landfill gas (LFG) extraction system. However, the LFG treatment system for Area 6 is constructed on top of the closed Area 1 cell.

The March 1977 Engineers Report (City of Walla Walla 1977) states that “disposal of the refuse would start at the toe of the south slope of the landfill then proceed up the slope to the edge of the plateau. After the south slope has been utilized, refuse would be disposed at the north slope in a similar sequence. Trenches would be excavated as needed perpendicular to the side slopes, generally following the final contour lines.” Records indicate that this process was followed for the most part.

A review of photographs and preliminary design plans indicates that up to three trenches were excavated parallel to the curvature of the hillside. The design plans called for the trenches to be excavated 10 feet deep and 30 feet wide, with a bottom slope of 0.01 and side slope of 0.15. The 1988 Operation Plan (City of Walla Walla 1988) states that “the waste was placed with no compaction equipment on hand.”

Test pits and one soil boring drilled through the waste during the RI indicated that the waste is covered by 11 to more than 17 feet of soil (mostly silt). The waste thickness found during the drilling of a gas well (GW-11) extended from 11 to 48 feet bgl. Several newspapers found near the bottom of the waste were dated January 1979.

In 2005 and 2009, a small amount of MSW originally deposited in Area 1 was removed and deposited in Area 7 to make way for the entrance roads and waste cell excavations that are part of Area 7. The excavations reformed the northern boundary of the cell to the configuration shown on Figure 3. The approximate limits of Area 1 are shown on Figure 3.

1.4.2.2 Area 2

Area 2 is located west of the equipment building on the south-central slope of the landfill property. Reports of Area 2 disposal practices are limited. According to Mr. Al Prouty, the landfill supervisor from 1985 into 1997, waste was placed in Area 2 for temporary disposal while the first trench in Area 5 was being excavated. Mr. Prouty thought the waste was placed in a shallow gully and on the native surface without trenching. An aerial photograph taken in July 1979 indicates that minor trenching may have occurred west of the equipment building; however, deliberate trenches do not appear to have been excavated for Area 2. Area 2 has no leachate collector system or LFG extraction system.

The limits of Area 2 were vague until Schwyn Environmental Services, LLC (Schwyn) conducted a test pit program on May 24, 2005. Additional test pits and one boring were completed during the RI. The approximate limits of Area 2, based on the findings of the test pit programs, are shown on Figures 3 and 12. MSW measured in soil boring SB-24 extended from 3 to 30 feet bgl. The measured thickness of the cover soil ranged from 0.5 to 11 feet thick, with most observations less than 4 feet thick. Several newspapers found in the waste were dated March to December 1979.

1.4.2.3 Area 5

Area 5 is located at the northwest corner of the landfill parcel and was one of the first areas used for MSW disposal. The approximate limits of the disposal area are shown on Figure 3. The bottom and cover materials are composed of native soil. Area 5 has no leachate collector system or active LFG extraction system. One open gas vent is centrally located in the disposal area (see Figure 3) and vents LFG freely to the atmosphere.

The waste in Area 5 is located approximately 50 to 300 feet east of the western property line, extending north to the base of a draw that separates the landfill from the BNSF right-of-way (commonly referred to as the north drainage ditch) and bounded on the east by Area 6 and on the south by the central plateau. The north drainage ditch routes stormwater west around the landfill and was part of the original natural drainage. Based on an early topographic map for the landfill area (dated June 2, 1979), the natural surface elevation of the north drainage ditch was about 790 feet and sloped upward to the south to an elevation of approximately 830 feet on the central plateau.

The available information indicates that Area 5 was active from as early as 1978 through 1990. Historical maps and records suggest that Area 5 consists of four refuse-filled trenches (trenches 5a, 5b, 5c, and 5d). Recent information from the RI indicates that the MSW disposal area is larger than the maps describe. The historical maps and records suggest that each trench extends approximately 950 to 1,100 feet east to west. The four trenches were excavated side by side and extend about 450 feet south of the draw. Waste was first placed at the northern base of the hill along the draw. Trench profile drawings prepared for the 1980 Sanitary Landfill Permit indicate that trench 5a may have started as an excavation parallel and within the draw and that the planned depth of the trench was about 17 feet. As the trench was filled, another trench would have been excavated on the adjacent hillside (south side of trench) and the soils from the second trench would have been used to cover the active cell. By this method, the trenches would stair-step up the hillside to the south.

Mr. Prouty stated that when he became the landfill supervisor in May 1985, trench 5b was approximately two-thirds full. Reports indicate that trenches 5c and 5d were operated from 1986 through 1989; however, minor discrepancies in the actual duration of disposal are apparent in the records.

A dual-purpose lysimeter/gas vent was installed against the north wall of trench 5d during the trench construction. Mr. Prouty installed the gas vent and lysimeter and stated that the pipe was set on the trench bottom and provided an accurate measure of the bottom elevation of the trench. Historical literature, hand notes, and verification measurements collected by Mr. Dennis Rakestraw (landfill supervisor from 1997 to 2012) in 2005 indicate that the bottom elevation of the gas vent and presumably the corresponding bottom elevation of these two trenches are located at about 780 feet.

Mr. Prouty stated that in 1985 minimal soil cover (less than 1 foot) had been placed over the waste in trenches 5a and 5b; therefore, he placed a 5- to 8-foot-thick soil cover over the waste in 1985 and 1986. A temporary soil cover was placed over trenches 5c and 5d in 1988 and 1989 (City of Walla Walla 1988). Final cover material was placed over trenches 5c and 5d in 1994 consistent with the general closure and post-closure requirements (WAC 173-304-407). Exploration data from the RI indicate that the cover soil over Area 5 may range from 1.5 to greater than 14.5 feet thick. Most observations of the cover thickness exceeded 4 feet.

Mr. Prouty set stakes at the corners of each trench in March 1986. The trench corners and boundaries were provided in the 1988 Sudbury Road Landfill Utilization Plan (Dahl and Anderson-Perry. 1987); however, the boundaries do not correspond with the current surface morphology of the fill area, and MSW has been verified outside the drawn trench boundaries. A geophysical and test pit program was initiated during the RI to better define the waste limits shown on Figure 3.

Oral reports by Mr. Prouty and several written reports suggest that sections of trench 5a and possibly trench 5b may have been excavated near to or below the water table. Based on the planned profile, the northern Area 5 trenches were to be excavated 17 feet below the level of the draw. If excavated as designed, the bottom of trench 5a would be about 776 feet (NAVD 88) or approximately 16 feet above the elevation of the high water table recorded in March 2008. However, Mr. Prouty recollected that trenches 5a and 5b were being excavated 25 to 30 feet below the surface level of the draw and were being filled with uncompacted waste when he took over.

Mr. Prouty's recollections were verified during the RI. Seven borings were drilled though the northernmost trench to document the extent of the waste. The MSW layer in most of the borings ranged from 11 to 16 feet thick; however the MSW layer in SB-20 was 38.5 feet thick and extended 9.5 feet below the saturated zone observed in the boring. The base of the MSW layer in SB-19, SB-22, and SB-25 extended to within 1.5, 0.5, and 3 feet of the saturated zone observed in the borehole, respectively. The boring locations are shown on Figure 3. Borings drilled during the 2005 Independent RI just south of northernmost trench 5b (GP-6, B9RI, B10RI, B11RI, and B17RI) did not extend to groundwater, and at least 10 feet of separation was observed. The 2005 Independent RI exploration locations are shown on Figure 11.

1.4.2.4 Area 6

Area 6 is north-centrally located on the landfill parcel, adjacent to the east side of Area 5. Excavation of Area 6 began in late 1987, and deposition of MSW into the waste cell began as early as 1988. Area 6 was initially permitted and operated in accordance with Chapter 173-304 WAC regulations.

In September 1993, a Solid Waste Transition Permit (Chapter 173-351 WAC) was issued for Area 6 operations. In July 1997, use of Area 6 was granted a Full Permit for Municipal Solid Waste Landfilling for operation as an arid landfill in accordance with Chapter 173-351 WAC. Closure of Area 6 was completed in 2010 in accordance with the Chapter 173-351 WAC Operating Permit and the Revised Interim Action Plan (Schwyn 2010b).

Area 6 consists of three trenches extending roughly 1,400 feet north to south and 450 to 600 feet east to west. The northwestern half of the area abuts, and in some areas overlaps, Area 5; the southeast corner nearly touches Area 1. Area 7 abuts the east side of Area 6. The north edge of Area 6 is bounded by the north drainage ditch and the BNSF right-of-way.

From west to east, the Area 6 trenches are designated as trench 6a, 6, and 6b. The trench floor has a bottom elevation of 795 to 809 feet at the north end and is graded with an upward slope of 1 or 2 percent toward the south (Schwyn 2006). The Area 6 cell bottom is composed of compacted native silt without a leachate collector system. Six lysimeters were installed during the cell construction. Fluids were not detected in the lysimeters until 2005, when a small volume (several gallons) of fluid was sampled from one of the six lysimeter ports. Leachate has not been observed in the lysimeter sampling ports since that time.

In 2001 the City submitted an application for a vertical expansion permit to the WWCHD for Area 6. The application proposed upward expansion over the three trenches to a projected top elevation of 887 feet. The expansion permit was approved, and Area 6 reached its permitted maximum elevation in 2005. Waste disposal was transitioned into Area 7 during 2006. Limited additional waste was placed in Area 6 until 2008.

Full closure of Area 6 occurred in 2010 in accordance with the Operating Permit and Interim Action Plan. The closure consisted of an evapotranspiration (ET) cover that met the requirements of WAC 173-351-500(1)(b) for arid areas, a gas collector and treatment system, and surface water controls. The final cover system design was incorporated into the Area 6 Specifications and Plans (JUB 2010), which were reviewed by Ecology and approved by the WWCHD.

1.4.2.5 Area 7

In 1995, Area 6 and the initial design of the proposed lateral expansion into Area 7 were permitted as an arid design landfill in accordance with WAC 173-351-300(2)(b). Initially, Area 6 was expected to reach capacity in 2002, at which time operations would have been transferred into Area 7. In September 2001, the City submitted an application for a Solid Waste Permit renewal for the Site that included the lateral expansion into Area 7. In 2002, the agencies approved a vertical expansion of Area 6, which resulted in additional waste capacity and extended the life of the cell. In 2004, Ecology submitted a letter to the WWCHD that indicated the department could no longer support the expansion into Area 7 without a liner system. The decision was based upon the groundwater contamination detected in MW-15, which suggested that the existing unlined cell design without leachate collection may not be protective of groundwater. The November 2004 Permit Application for the Area 7 Lateral Expansion was subsequently not approved.

In 2005, Shaw/EMCON/OWT, on behalf of the City, submitted a revised permit modification for the lateral expansion into Area 7 (Shaw/EMCON/OWT 2005). The revised Area 7 landfill design included significant modifications to the original design, including a composite liner, a leachate collector and removal system (LCRS), and an LFG collector and control system. The Area 7 composite liner consisted of a 12-inch layer of soil with permeability less than 1 x 10^{-5} cm/sec, a geosynthetic clay liner (GCL), a 60-mil high-density polyethylene (HDPE) geomembrane, and a 250-mil bi-planer geocomposite LCRS with collection piping as needed to maintain a leachate head below 1 foot. A LFG collector and control system was not required by Federal New Source Performance Standards but was proposed as a proactive and appropriate means to control the potential impacts of volatile organic compounds (VOCs) on groundwater.

The City started excavating soil from the proposed area in 1996, using the excavated material for daily cover in Area 6. Waste disposal in Area 7 began in 2006. Area 7 is 17.3 acres and authorized to accept approximately 1,592,000 cubic yards of waste (Schwyn 2006). The bottom elevation of Area 7 is designed to range from 792 to 780 feet (Shaw/EMCON/OWT 2005). The active Area 7 leachate evaporation ponds are located on the north side of the BNSF right-of-way.

1.4.2.6 Asbestos Waste Area (Area 4)

WWCHD correspondence with the City dated July 24, 1985 (Schwyn 2006) indicated that the City had “been allowing the disposal of asbestos in the landfill under certain specific conditions for the past several years.” The correspondence goes on to state that the WWCHD recommends that the City adopt the new U.S. Environmental Protection Agency (USEPA) Asbestos Waste Management Guidance before accepting more asbestos for disposal in the landfill.

In accordance with the WWCHD recommendation, the City adopted the asbestos management guidance, and two asbestos waste cells were subsequently excavated at the Site. The oldest cell (Area 4a) is located between the western property line and Area 5, at the northwest corner of the landfill property (Figure 3). Mr. Prouty stated in 2005 (Schwyn 2006) that the first asbestos disposal cell consisted of several trenches excavated approximately 12 feet deep (bottom approximately level with the north drainage ditch at 793 feet). The west edge of the cell was cut 8 to 10 feet east of the fence so that a vehicle could pass by. Area 4a was small and filled very quickly due to the number of asbestos projects being conducted at that time. Mr. Prouty recalled that the cell was filled and covered by the end of 1985.

Area 4a was closed along with Area 5 in accordance with the closure and post-closure requirements for limited purpose landfills (Chapter 173-304 WAC).

The second asbestos trench (Area 4) located at the southwest corner of the landfill area was cut much bigger to accommodate the quantity of material being disposed of. The “Asbestos Waste Area” was operated from 1985 into 2004 in accordance with the Solid Waste Landfill General Facility Permit.

The asbestos waste trench extended approximately 860 feet north to south and was cut approximately 40 feet from the western property line. The trench was about 40 feet wide at its base, with nearly vertical sidewalls about 40 feet high. The trench was sloped to the south, and records indicate that the deepest point of the trench was 789.57 feet. Mr. Rakestraw indicated that approximately three lifts of asbestos were placed in the trench before its closure. Standard operating procedure was to cover the waste within 24 hours of disposal. “Extreme care was taken to not rupture any of the protective coating of the asbestos wrappings” (City of Walla Walla 1988). The asbestos waste area was closed in 2004, in accordance with the Chapter 173-304 WAC closure and post-closure criteria for limited purpose landfills. Asbestos wastes are now placed directly into Area 7.

1.4.2.7 Medical Waste Trench (Area 3)

Records indicate that before 1992 medical wastes generated by local medical facilities were either incinerated by the generator or transported out of the Walla Walla area for disposal. Walla Walla City Council documents indicate that the Site began accepting medical wastes on a 3-month trial basis on December 31, 1991. In March 1992, the City Council approved the continued collection and handling of medical waste at the Site. Medical wastes were accepted at the Site until 2004, when the trench was closed in accordance with the Chapter 173-304 WAC closure and post-closure requirements for limited purpose landfills.

During operation, the medical wastes were placed in a trench that ran parallel to the east side of the Asbestos Waste Area and was separated from it by a high soil berm. The trench measured approximately 880 feet long by 80 feet wide at its base. The deepest point of the trench was 788 feet (Schwyn 2006).

Several Site maps show an area labeled “Existing Covered Medical Waste” located east of the Medical Waste Trench. During the closure of the asbestos and medical waste areas in 2004, soil was removed from the area, and medical waste was not encountered. Based on these soil excavations, file documents, and aerial photographs reviewed during this RI, it is believed that the maps were incorrectly labeled.

1.4.2.8 Compost Area

In 2006, a temporary compost facility was constructed above the former asbestos and medical waste cells. A permanent facility that complied with Chapter 173-350 WAC was designed in 2007 and 2008. The compost facility was constructed and opened in 2009. The facility has an asphalt surface for working the compost. Stormwater is collected and diverted into a lined evaporation pond located on the southeast side of the compost area.

1.4.3 REGULATORY CRITERIA

The Site has been and continues to be operated in accordance with the applicable regulations as amended and current at the time. Development and permitting of the Site began in 1976, in accordance with Ecology's Regulation Relating to Minimum Functional Standards for Solid Waste Handling, Chapter 173-301 WAC (Ecology 1972). Conforming Permits were issued by the WWCHD annually under Chapter 173-301 WAC until the regulation was superseded by Chapter 173-304 WAC in 1985. All of Areas 1 and 2 and Area 5 trenches 5a and 5b were operated during the effective period of Chapter 173-301 WAC.

The Minimum Functional Standards for Solid Waste Handling (Chapter 173-304 WAC) was filed on October 28, 1985 (Ecology 1988), and the City made operational changes and prepared documents to comply with the new regulation. Area 5 trenches 5c and 5d and Area 6 operated from 1985 into 1993 in accordance with the Chapter 173-304 WAC regulatory criteria. Area 5 was also closed in accordance with Chapter 173-304 WAC closure and post closure requirements.

The operation of Area 6 was transitioned into the new operating standards of Chapter 173-351 WAC, Criteria for Municipal Solid Waste Landfills, which became effective on November 27, 1993 (Ecology 1993). A Solid Waste Transition Permit for the facility was issued on September 27, 1993, and on July 14, 1997, the WWCHD issued a Chapter 173-351 WAC Full Permit for Municipal Solid Waste Landfilling in Area 6. The closure of Area 6 in 2011 was also conducted in accordance with the requirements for arid areas [WAC 173-351-500(1)(b)].

All design and operations of Area 7 have been consistent with Chapter 173-351 WAC and the Municipal Solid Waste Landfilling Permit.

The asbestos and medical waste disposal trenches were operated as limited-purpose landfills in accordance with Chapter 173-304 WAC into 2004. The Solid Waste Handling Standards, Chapter 173-350 WAC, replaced Chapter 173-304 WAC and became effective on February 10, 2003. The City determined that it would not be economical to upgrade the asbestos and medical waste areas to meet the new standards, and, therefore, these two areas were closed in 2004, in accordance with the Chapter 173-304 WAC closure standards.

The compost facility was designed, constructed, and permitted in accordance with the Chapter 173-350 WAC standards.

1.4.4 WASTE COMPOSITION

Most of the waste disposed at the Site is mixed MSW that is transported to the Site by commercial and public garbage disposal service contractors from the City of Walla Walla and Walla Walla and Columbia Counties, which are predominantly rural counties with an agricultural economic base and little manufacturing or heavy industry. Permitted waste disposal at the Site has been limited to MSW, asbestos, and medical wastes. The Site has also provided special areas for disposing of animal carcasses. Hazardous substances have never knowingly been allowed into the landfill based on available information.

Appliances ("white goods") have historically been set aside for salvage and recycling. The appliances are stored (usually in the vicinity of Area 2) and retrieved by a salvage operation. When market conditions were not economical for recycling, or the appliances were not retrieved by the salvage operation within a reasonable time period, the appliances were disposed of in the active disposal area in use at that time, according to oral reports (Schwyn 2006).

Extensive City records indicate that measures to prevent the disposal of hazardous materials in the landfill were initiated during the early years of operation. Correspondence from Ecology and the WWCHD, as early as February 8, 1979, recommended that landfill operators screen loads to keep hazardous waste out of the landfill. Shortly thereafter, the City requested information about hazardous waste disposal practices from the WWCHD for incorporation into the landfill policy and procedure manual. In 1980, the City posted a notice at the scale house regarding the disposal of dangerous wastes.

Landfill records report several patron attempts to dispose of small quantities of hazardous waste in the landfill, suggesting that the landfill operators diligently tried to exclude the materials from the landfill. In 2005, Mr. Prouty stated that he was not aware of any large quantities of non-permitted materials being disposed of in the landfill but did remove unacceptable materials from the disposal area occasionally. Mr. Prouty also stated that he never allowed or observed the disposal of large quantities of potentially hazardous waste, such as lidded 55-gallon drums. He indicated that the established practice was to allow disposal of only empty, rinsed drums.

On June 3, 1986, the Dangerous Waste Regulation (Chapter 173-303 WAC) formally prohibited the disposal of certain hazardous wastes in MSW landfills. In 1993, the City constructed a Household Hazardous Waste Facility (HHWF) at the landfill to accept, recycle, and/or appropriately dispose of hazardous waste from noncommercial sources. The HHWF facility remains in operation and continues to prevent the disposal of hazardous materials in the landfill.

1.5 GROUNDWATER MONITORING

1.5.1 MONITORING WELL INSTALLATIONS

The City installed the first monitoring wells [MW-1a, Well #2 (also referred to as MW-2), and MW-3a] in November and December 1976 to monitor shallow groundwater downgradient of the landfill and provide background groundwater quality information. Well #2 was installed to greater depth for additional use as the landfill potable water supply well; however, in 1984 or 1985 landfill staff stopped using Well #2 as a potable water source and began using bottled water.

Since 1976, numerous additional wells have been installed to monitor upgradient and downgradient water quality beneath the landfill, sprayfarm, and sludge application areas. A summary of installation dates, well uses, casing sizes, screen intervals, and other information is provided in Table 1. Site well logs and driller's well reports are provided in Appendix A.

Some of the monitoring wells have been decommissioned or are no longer in use. MW-1a and MW-3a either went dry or had poor surface seals. These two wells were abandoned in 1986 and replaced with MW-1 and MW-3. Monitoring wells MW-1 and MW-3 had screens installed deep into the underlying aquifer and were replaced with MW-14 and MW-15 in 1999 and 2001, respectively, to better monitor the top of the first encountered water-bearing zone. Monitoring well MW-1 is currently unusable due to a pump stuck in the casing. MW-3 is still in usable condition. The location of MW-6 is unknown because the parking area of the landfill office was apparently constructed on top of the well.

Monitoring wells MW-4, MW-5, MW-7, MW-9, and MW-10 were originally installed to monitor the sprayfield and biosolids application areas; however, some of these wells have also been used to monitor upgradient groundwater quality for the landfill. MW-16 was installed in 2005 as part of the Independent RI to evaluate groundwater quality south of MW-15, downgradient of Area 5, and at the western property boundary. The Garver well was the original irrigation well installed on the property and is still used for irrigation, dust control, construction, and the compost facility. Well #2 is also used for nondomestic water purposes. The locations of the wells are shown on Figure 2.

The compliance groundwater monitoring system consists of three downgradient monitoring wells (MW-11, MW-14b, and MW-15) and one upgradient monitoring well (MW-12b). Monitoring wells MW-11 and MW-12 were installed in 1995 as part of the Chapter 173-351 WAC hydrogeologic study and were incorporated into the approved compliance monitoring program in 1995. MW-12 historically produced low quantities of water, and eventually the water table dropped below the screen section and water samples could not be obtained. In August 2008, MW-12b was drilled to a deeper depth near MW-12, which was decommissioned in accordance with state regulation. In June 2012, MW-14 was also decommissioned due to the decreasing water table and replaced with MW-14b, which was drilled to a deeper depth. The locations of the compliance wells are shown on Figures 2 and 3.

1.5.2 COMPLIANCE GROUNDWATER MONITORING PROGRAM

Monitoring began in 1976 after the installation of MW-1a, Well #2, and MW-3a. Initially, only groundwater elevations were measured so that the elevation of the landfill cell bottom could be designed to be above the water table. Collection of groundwater samples began the following year in August 1977 and continued on a monthly basis through July 1978. The sampling program was conducted at the request of Ecology to establish "baseline" groundwater quality before the landfill began operation. The groundwater samples were analyzed for pH, biological oxygen demand, chemical oxygen demand, chlorides, iron, total dissolved solids (TDS), total alkalinity, and total coliform bacteria.

Since July 1978, groundwater monitoring has been conducted on a quarterly schedule. Over time, the analytical parameters have been modified to address changes in the regulatory requirements for groundwater monitoring. Since September 1994, the landfill monitoring well samples have been analyzed for Appendix I and II detection monitoring constituents, per WAC 173-351-990. Numerous additional analyses were performed in 2002 and 2003 as part of an assessment monitoring program (Appendix III parameters). Dichlorodifluoromethane (Freon 12) was added to the analytical suite as a result of the assessment monitoring program. In June 2012, samples collected from downgradient compliance monitoring wells MW-11, MW-14b and MW-15 were analyzed for Appendix III assessment monitoring constituents, per WAC 173-351-990, and no new constituents were detected at concentrations greater than statistically significant background concentrations.

Currently, in accordance with the 2011 Operating Permit, monitoring wells MW-11, MW-12b, MW-14b, and MW-15 are sampled quarterly. The groundwater samples are analyzed for Appendix I and II detection monitoring constituents, per WAC 173-351-990, plus Freon 12, by an accredited laboratory in accordance with Chapter 173-50 WAC.

1.5.3 SUMMARY OF GROUNDWATER CONTAMINATION

Groundwater monitoring data collected since 1993 indicate the presence of groundwater contamination (primarily VOCs) in samples collected from monitoring wells located upgradient and downgradient of the sprayfarm and landfill areas. Since 2001, when MW-15 was installed, groundwater contamination with slightly different characteristics (VOCs with inorganic constituents) has been detected in downgradient monitoring well MW-15.

1.5.3.1 Area-wide Contamination

Groundwater monitoring data indicate that a number of VOCs [including chloroform, trichloroethene (TCE), and tetrachloroethene (PCE)] are present in upgradient wells on the eastern property boundary (over 1.4 miles east, and upgradient, of the landfill). The VOCs in groundwater have been present since at least 1993, when the City began monitoring for VOCs, and they persist in samples collected as recently as 2013. Similarly, slightly lower VOC concentrations have regularly been detected in the landfill monitoring wells and two domestic water supply wells (Small and Camp wells). The Small and Camp residences are located approximately ¾ mile west and northwest of the landfill, respectively.

In 1999, Ecology, under cooperative agreement with the USEPA, published a Contaminant Source Identification/Assessment (CSI/A) Report (Ecology 1999). The CSI/A indicated that the relatively high VOC contaminant concentrations observed both upgradient and downgradient of the landfill, and the persistence of the concentrations with time, implied that the presence of a large continuous source. Ecology identified the WSP, which is located just east (and upgradient) of the Site, as a potential source of the VOC contamination at the landfill, because similar VOCs have been used and potentially disposed of on the penitentiary property.

An RI was conducted on the WSP in 2010 and 2011, and an RI/FS Report was prepared in 2012 (Parametrix 2012). Data provided in the report indicate the presence of a VOCs in groundwater beneath the WSP. The VOCs and their concentrations in groundwater are similar to the area-wide contamination observed beneath the entire City property and in the samples from the Camp and Small domestic wells.

1.5.3.2 Localized Landfill Contamination

In July 2001, monitoring well MW-15 was installed in the northwest corner of the landfill to monitor the downgradient groundwater quality of the uppermost aquifer immediately downgradient of Area 5. VOCs [including TCE, PCE, trichlorofluoromethane (Freon 11), Freon 12, vinyl chloride, chloroethane, 1,1-dichloroethane, and *cis*-1,2-dichloroethane) and inorganic constituents (including calcium, sodium, bicarbonate/alkalinity, chloride, and TDS] were detected at higher concentrations in this well relative to the concentrations in other Site wells and the background concentrations. With the exception of chloride and TDS, all of these constituents have exceeded the site-specific Chapter 173-351 WAC compliance levels (prediction intervals) on at least two consecutive occasions. These exceedances prompted the RI/FS of the Site.

1.5.4 PRIOR GROUNDWATER STUDIES

Various initial groundwater studies of the landfill were conducted in the 1970s and 1980s to comply with the requirements of the landfill Operating Permit, but they shed little light on the nature of the area-wide or localized VOC contamination. Three later studies are more significant.

The first was a 1993 hydrogeologic investigation conducted to meet the requirements of WAC 173-351-490. The resulting Hydrogeologic Report provided the first extensive report of the geology, hydrogeology, and groundwater quality of the landfill (EMCON 1995).

The second was an assessment monitoring program that was initiated in September 2002 in accordance with WAC 173-351-440. The extensive testing requirements of the assessment monitoring program did not indicate the presence of other constituents in the landfill groundwater monitoring wells at concentrations greater than background concentrations, with exception of Freon 12. Freon 12 was subsequently added to the compliance monitoring program for the landfill.

The third was a recent study to characterize the MW-15 contamination and fulfill the requirements of WAC 173-351-440(6). A Work Plan was prepared in 2004 to guide the RI process (LAI 2004). An Independent RI was initiated in 2005 in general accordance with the 2004 RI Work Plan; however, the investigation was stalled in 2006 before all of the tasks had been completed because of a number of factors, including available funding and off-Site access. Relevant information from these previous studies was used to formulate the conceptual site model.

1.6 INTERIM ACTIONS

The detection of VOC and inorganic constituents in the MW-15 groundwater samples at concentrations greater than statistical background/upgradient concentrations in 2001 prompted the following interim actions:

- Redesign and construction of an alternative Area 6 closure; and
- Design and construction of stormwater controls on the north side of Area 5 and Area 6.

Each of these interim actions is described in the following subsections.

1.6.1 AREA 6 CLOSURE

The closure of Area 6 was performed as an interim action in 2010. Area 6 has no geosynthetic bottom liner or leachate collector system, and before 2010, it had no engineered or permitted top cover, LFG extraction and treatment system, or adequate surface water collection and control facilities. Therefore, on March 31, 2010, a Revised Interim Action Plan (Schwyn 2010b) was submitted to the agencies to address these landfill design features. The closure/interim action was approved by Ecology and constructed in 2010.

The interim action for the Area 6 closure consisted of the design and construction of (1) an ET cover that meets the requirements of WAC 173-351-500(1)(b) for arid areas, (2) an LFG collector and control system, and (3) a stormwater collector and conveyance system to divert water away from the active refuse disposal areas and the northern stormwater drainage area where percolating waters could potentially migrate into the Area 5 refuse. Details of the north stormwater drainage system are provided in the following section.

1.6.2 NORTH DRAINAGE STORMWATER CONTROLS

The drainage features of the north drainage ditch valley bottom have historically been modified to trap sediments and stormwater. This was accomplished by excavating depressions in the natural drainage channel along the northern boundary of Area 5. Stormwater formerly pooled in the depressions, where it either infiltrated and/or evaporated. Studies of Area 5 suggest that a possible former source of leachate generation could have been the infiltration of the pooled surface water in the north drainage area and subsequent southward migration in the underlying soils into the Area 5 refuse.

Construction of stormwater drainage controls in the drainage located on the north side of Area 5 was determined to be an important engineering control for minimizing a possible contaminant transport mechanism for the migration of waste constituents to groundwater. The interim action that was constructed in 2010 was designed to promote stormwater flow through the valley adjacent to Area 5 and minimize pooling, thereby reducing the quantity of surface water available for infiltration through the refuse. The engineering design features of the interim action included (1) a sedimentation basin, (2) filling of depressions excavated in the valley bottom and surface grading to slope the valley to the west along the natural drainage channel, (3) installation of a culvert under the western perimeter roadway to allow the stormwater to flow off-Site, and (4) installation of erosion control mats in the stormwater channel.

2.0 RI SCOPE AND METHODS

This section describes the investigations conducted in support of the RI. The RI scope-of-work was based on an evaluation of all existing data obtained during previous investigations and compliance monitoring data collected from the Site. These data were used to formulate a preliminary conceptual model of the Site, establish data gaps, and formulate a work plan to complete the RI. The RI scope-of-work is detailed in the RI Work Plan (Schwyn 2011) and consisted of the following tasks:

- A geophysical survey was conducted to assist in the delineation of the horizontal extent of the solid waste at Areas 1, 2, and 5.
- Sixty one test pits and 13 trenches were excavated for the following:
  - Evaluation of the soil cover thickness over Areas 1, 2 and 5;
  - Collection of samples from Area 5 for soil characteristic (geotechnical) analysis; and
  - Delineation of the horizontal extent of the solid waste at Areas 2 and 5.
- Ten soil borings were drilled through the waste in Areas 1, 2, and 5 to obtain information about the MSW, MSW thickness, subsurface lithology, depth to groundwater, and soil samples for laboratory analysis.
- Seventeen groundwater monitoring wells were installed to complement the existing groundwater monitoring system.
- Seven LFG monitoring wells were installed to complement the existing gas monitoring system.
- Five soil samples were collected beneath the MSW in Areas 1, 2, and 5 to analyze for VOCs and assess the soil quality in the vadose zone beneath the MSW.
- Groundwater samples were collected from 26 groundwater monitoring wells during eight monitoring events to characterize the groundwater quality upgradient and downgradient of the Site, beneath the landfill, and in 4 downgradient domestic water supply wells.
- An LFG barhole survey (nine barholes) was conducted to assess the potential for LFG occurrence and migration at Area 2.
- LFG monitoring was conducted during five events at 10 gas monitoring wells (3 existing and 7 newly installed gas wells) to assess seasonal variability of methane, carbon dioxide, and oxygen.
- LFG sampling for VOC analysis was conducted at nine gas monitoring wells to evaluate the potential impact of LFG on groundwater and indoor air intrusion at the HHWF.

Initial field studies were conducted in April and May 2012. The technical approach for each field program, including the sampling strategy, locations, methods, and procedures, were identified in, and conducted in accordance with, the SAP, QAPP and HASP that were included in the Work Plan.

Evaluation of the preliminary data obtained from the initial field studies identified several additional data gaps or questions in areas where the field program had not achieved the desired objectives. Additional field studies were conducted in August 2012 to achieve the Work Plan objectives. The inconclusive issues and additional scope of work are described in the Sudbury RI Data Gap Review Memorandum (Schwyn 2012).

The methods used in the field program to achieve the RI data collection objectives are described in the following subsections. The results of the studies are described in Section 3.

2.1 GEOPHYSICAL SURVEY

Zonge International (Zonge) completed a geophysical investigation to delineate the horizontal extent of the solid waste in Areas 1, 2, and 5 on April 24 to 26, and June 21, 2012. The horizontal extents of the buried debris were evaluated with the combined use of electromagnetic (EM) and magnetic (MAG) techniques. Location data were acquired simultaneously with the MAG and EM data with the use of a Trimble AG132 Differential Global Positioning System. Zonge processed and interpreted the field data and described the findings in a report, which is provided in Appendix B.

The results of the geophysical survey were inconclusive in terms of precisely defining the waste cell boundaries. The cover soil over Area 1 was greater than 17 feet thick and was judged to be too thick to make EM or MAG survey data useful. The precise limits of Area 2 and Area 5 were masked by the dispersion characteristics of the waste and past cover/excavation processes. The Area 2 and Area 5 results were similar to what was expected, but the degree of precision was inadequate to define the waste cell boundaries in critical areas such as the northern limits of Area 5 or the Area 2 boundary. This was identified as a data gap in the Sudbury RI Data Gap Review Memorandum, and additional test pit excavations were subsequently completed in critical areas to assess the waste boundary conditions.

2.2 TEST PIT EXCAVATIONS

The RI test pit program was conducted to accomplish the following:

- Collect samples for Area 5 soil characteristic (geotechnical) analysis;
- Evaluate the soil cover thickness over Areas 1, 2 and 5;
- Determine the lateral extent of the Area 2 MSW; and
- Determine the lateral extent of the MSW at the north side of Area 5.

A total of 28 test pits were excavated during the initial test pit program conducted on May 14 and 15, 2012. An additional 33 test pits were excavated in Area 2, and 13 trenches were excavated on the northern boundary of Area 5 on August 27, 2012, to fill data gaps presented by the imprecise geophysical survey results. All test pits were excavated with a Caterpillar 314C backhoe, operated by Braden and Nelson, Inc., under the observation of a Washington State Registered Hydrogeologist (LHG). Each test pit was excavated from the surface to the level of the first encountered MSW or the maximum reach of the backhoe (15 to 17 feet bgl). The test pits were backfilled with the excavated materials after the observations had been recorded. The general locations of the test pits are shown on Figure 3. Detailed locations for the Area 2 test pits, the recorded depth to MSW, and the lateral extent of the MSW are shown on Figure 12. Detailed locations for the Area 5 test pits, the recorded depth to MSW, and the northern extent of MSW are shown on Figure 13.

Five test pits (TP-24 through TP-28) were excavated in Area 1 on May 15, 2012. MSW was encountered in only one test pit, at a depth of 12 feet bgl. All other Area 1 excavations terminated at the maximum reach of the backhoe (17 feet) without encountering MSW.

On May 15, 2012, one test pit (TP-24) was excavated in Area 2 in an attempt to record the MSW thickness; however, the waste extended beyond the reach of the backhoe, and the excavation was terminated. Thirty-three additional test pits (TP-29 through TP-62) were excavated on August 27, 2012, to record the depth to MSW and the lateral extent of the waste. These excavations were completed to compensate for the imprecise limits of the waste determined during the geophysical survey.

On May 15, 2012, twenty-three test pits (TP-1 through TP-23) were excavated in Area 5 to record the thickness of the soil cover and collect select soil samples for geotechnical analysis. Thirteen additional trenches (B-1 through B-13) were excavated on August 27, 2012, to determine the northern extent of Area 5 waste. The trenches were cut in a north-south alignment, and the north edge of Area 5 was determined by marking the soil-MSW contact.

Select soil samples were collected from Area 5 test pits for soils characteristics analysis (geotechnical analysis and lithologic descriptions). Grab and Shelby tube samples were collected from test pits 8, 19, and 20 (Figure 13). Five grab samples were collected from each test pit at approximate 1-foot intervals and placed in plastic zip-lock bags for moisture content analysis. Relatively undisturbed samples were collected using 18-inch-long, 4-inch-diameter Shelby tubes, which were pushed into the soil from 6 to 24 inches and 24 to 42 inches bgl with the backhoe bucket. These samples were tested to determine moisture content, grain size (with hydrometer), Atterberg limits, and in-situ permeability.

One additional bulk sample was collected in Area 5 from TP-12 where the cover soils are thick and the cover soils are potentially available for borrow. This sample was tested to determine moisture content, grain size (with hydrometer), Atterberg limits, moisture/density relationship, and remolded permeability. This sample consisted of approximately 50 pounds of soil composited while the test pit excavation was advanced. The sample was placed and transported within a sealed 5-gallon bucket.

The soil samples were analyzed by HWA GeoSciences, Inc. (HWA) of Bothell, Washington. The geotechnical soils report is provided in Appendix C.

2.3 DRILLING PROGRAM

A drilling program was conducted to evaluate the soil, groundwater, and LFG characteristics in the vicinity of the landfill. Subsurface explorations included 10 soil borings, 17 groundwater monitoring wells, and 7 gas monitoring wells. The boring and well locations are shown on Figure 3. Drilling, boring decommissioning, and well construction were performed by Environmental West Exploration of Spokane, Washington, in accordance with the Washington State Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC). The borings were advanced under the observation of an LHG by means of sonic drilling methods with continuous cores for lithologic observation and select laboratory soil sample collection. Boring diameters were commensurate with the drilling objectives (i.e., soil boring, 2-inch-diameter monitoring well, 4-inch-diameter monitoring well, or 1-inch-diameter gas monitoring well). All samples were classified according to the Unified Soil Classification System, and lithologic descriptions were recorded on a field log along with information on MSW content and thickness, LFG odor, location of water-bearing strata, and well completion details. This information is summarized on the exploration logs provided in Appendix A.

All down-hole drilling equipment was decontaminated before use and between drilling locations in accordance with the SAP. Contaminated soil cuttings and other investigation-derived waste generated during the drilling were placed in drums and disposed of in the active cell (Area 7) of the landfill. Borings were backfilled to the surface with bentonite chips (3/8-inch minus) and hydrated with potable water as the casing was withdrawn. MW-14 was installed in 1999 and replaced with MW-14b during the RI because the water level had dropped to near the top of the pump. MW-14 was decommissioned by filling the casing from the bottom to the surface with bentonite.

2.3.1 SOIL BORINGS

During May 2012, five borings were drilled in Area 1 (GP-11), Area 2 (SB-24), and the northern trench in Area 5 (SB-20, SB-21, and SB-22). The boring program was conducted to obtain information about the waste thickness, subsurface lithology, and depth to groundwater and to collect soil samples for laboratory analysis. Five additional borings (SB-19, SB-22, SB-23, SB-25, and SB-26) were drilled in August 2012 through the northern trench in Area 5 to better define the vertical extent of MSW in the northern trench. The boring locations are shown on Figure 3.

2.3.2 GROUNDWATER MONITORING WELLS

During May 2012, 10 new groundwater monitoring wells were installed on the Site, and 6 additional groundwater monitoring wells were installed on private land adjacent to and hydraulically downgradient of the landfill. Two pairs of the off-Site wells (MW-21S, MW-21D, MW-22S, MW-22D) were completed with screens located to monitor the shallow and deeper horizons of the old gravel and clay aquifer. In August 2012, one additional groundwater monitoring well (MW-27) was installed along the north edge of Area 5 to better define the groundwater quality along the north side of Area 5. The monitoring well locations are shown on Figure 2.

The groundwater monitoring wells were constructed with a flush-threaded, 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) screen and riser pipe. The monitoring well screens for the shallow wells (installed across the water table) were 15 feet in length, with the screen section set into the first encountered gravel unit. The monitoring well screens for the deeper wells (MW-21D and MW-22D) were installed with a 5-foot screen section set approximately 25 feet below the accompanying shallow well screen. MW-15D was constructed for the purposes of groundwater monitoring and to conduct pumping tests. The well was constructed with a flush threaded, 4-inch-diameter Schedule 40 PVC screen and riser pipe. The 15-foot screen section was set approximately 34 feet below the water table. Each well was constructed with 0.010-inch machine-slotted PVC pipe, and a flush-threaded end cap was installed at the bottom of each screen. Number 10/20 washed, rounded sand was packed around the screens to a minimum of 2 feet above the screened section. The sandpack was capped with a bentonite seal to within 1.5 feet of the surface. Each monitoring well was completed with a flush or aboveground locking protective cover. Flush and aboveground completions were surrounded with three steel protective bollards.

Each groundwater monitoring well was developed by means of surging, bailing, and pumping techniques. Well development continued until the turbidity of the purge water was visibly low. All development water was contained and discharged into the landfill's lined leachate evaporation pond.

2.3.3 LANDFILL GAS MONITORING WELLS

Seven LFG monitoring wells were installed to complement the existing gas monitoring system (Figure 3). Each boring was advanced by means of sonic drilling equipment. Each gas well was constructed with ¾-inch diameter PVC casing with a 5-foot, 0.010-slot screen section installed in the boring. The screen sections were positioned at the following approximate locations:

- GW-7D: at the water table elevation 31 to 36 feet bgl;
- GW-7S, GW-8, and GW-9: 10 to 15 feet bgl;
- GW-10: 5 to 10 bgl;
- GW-11: centrally located in the MSW, 25 to 30 feet bgl; and
- GW-12: 26 to 31 feet bgl.

For each of the gas wells (except for GW-11), a filter pack was installed around each screen, extending from the bottom of the end cap to about 2 foot above the screen. GW-11 has a filter pack that also extends approximately 2 feet below the screen. The filter pack material consists of 3/8-inch commercially prepared and prewashed rounded free-flowing pea-gravel. The filter pack was capped with a bentonite seal to within 1.5 feet of the surface. Each gas well was completed with a flush or aboveground locking protective cover. All aboveground completions were surrounded with three steel protective bollards. Each gas well casing was capped with an expandable stop-cock plug and brass quick-connect air hose fitting.

2.4 SOIL SAMPLING

Select soil samples were collected from five soil borings (GW-11, SB-21, SB-23, SB-24, and SB-26) for laboratory analysis of VOCs. The sample intervals were selected to assess the soil quality in the vadose zone beneath the MSW. Five-gram soil samples were collected from the selected sample intervals in accordance with USEPA Method 5035A, Closed System Analysis for VOCs. The soil vials were labeled, logged onto a chain-of-custody form, placed in a chilled cooler, and transported to ALS Environmental, Inc. (ALS) in Kelso Washington via next day delivery service. The laboratory analytical reports are provided in Appendix D.

2.5 GROUNDWATER MONITORING

Groundwater samples were collected from the following wells for laboratory analysis (see Figure 2):

- Site wells: MW-11, MW-12b, MW-14b, MW-15, and MW-16;
- New wells: MW-15D, MW-17, MW-18, MW-19, MW-20, MW-21S, MW-21D, MW-22S, MW-22D, MW-23, MW-24, MW-25, MW-26, and MW-27;
- Upgradient wells: MW-5, MW-9, and MW-10; and
- Domestic wells: Small, Camp, Kinman, and Schmidt.

As part of the RI, eight groundwater monitoring events were conducted between June 2012 and February 2013. Each groundwater monitoring event was conducted between 30 and 45 days apart. The groundwater monitoring program included the measurement of depth to water in each monitoring well, the measurement of field parameters including pH, conductivity, and temperature, and the collection of groundwater samples for laboratory analysis. Depth to groundwater was not measured in the domestic water supply wells. Field measurements were recorded on Groundwater Sampling Data Sheets.

Groundwater samples were collected from each monitoring well with the use of dedicated Grundfos RediFlo2 groundwater sampling pumps. Domestic well groundwater samples were collected from the nearest available hose bib connecting to the existing pumping system. Samples collected for analysis of dissolved metals were field filtered and preserved. Each sample was labeled, logged on a chain-of-custody form, placed in a chilled cooler, and transported to ALS for analysis. The laboratory analytical reports are provided in Appendix D.

The Site well samples and samples from all of the new monitoring wells were analyzed for VOCs and the following conventional chemistry constituents: calcium, sodium, magnesium, potassium, sulfate, chloride, manganese, iron, ammonia, nitrate, alkalinity, total organic carbon (TOC), and TDS. Samples collected from the upgradient and domestic wells were analyzed for VOCs only. The following laboratory analytical methods were used:

- VOCs were analyzed by USEPA Method 8260, with vinyl chloride by USEPA Method 8260 SIM to reach a method reporting level (MRL) of 0.02 micrograms per liter (µg/L).
- Dissolved calcium, iron, manganese, magnesium, potassium, and sodium were analyzed by USEPA Method 6010C.
- Chloride, nitrate, and sulfate were analyzed by Standard Method (SM) 300.0.
- Alkalinity was analyzed by SM 2320B.
- Ammonia was analyzed by SM 4500.
- TOC was analyzed by USEPA Method 415.1.
- TDS was analyzed by SM 2540C.

During the first groundwater monitoring event (June 2012), groundwater samples collected from Site wells MW-11, MW-14b, and MW-15 were also analyzed for WAC 173-351-990 Appendix III parameters. The Appendix III analytical suite was initiated to determine if any additional parameters should be added to the subsequent RI sampling events. The following laboratory analytical methods were used for the Appendix III suite of parameters:

- Dissolved metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, tin, vanadium, and zinc) were analyzed by USEPA Method 6010C.
- Total mercury was analyzed by USEPA Method 7470A.
- Organochlorine pesticides were analyzed by USEPA Method 8081A.
- Polychlorinated biphenyls (PCBs) (also referred to as Aroclors) were analyzed by USEPA Method 8082.
- Organophosphorus compounds were analyzed by USEPA Method 8141A.
- Chlorinated herbicides were analyzed by USEPA Method 8151A.
- VOCs were analyzed by USEPA Method 8260C.
- Semivolatile organic compounds (SVOCs) were analyzed by USEPA Method 8270D.
- Total cyanide and sulfide were analyzed by SM 4500.

The analytical results for the Appendix III parameters did not indicate the presence of any new constituents, and the SAP for subsequent sampling events included no modifications to the standard suite of analyses implemented for the Site, upgradient, and domestic wells.

2.6 DATA VALIDATION

A Tier I data quality review was performed on all RI samples, including soil, vapor, and groundwater data resulting from soil and groundwater laboratory analysis performed by ALS and LFG analysis performed by Fremont Analytical of Seattle, Washington, and Air Toxics of Folsom, California. The analytical data were validated in accordance with the following:

- Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review (USEPA 2004); and
- CLP National Functional Guidelines for Organic Data Review (USEPA 2008).

The review encompassed data from two soil sampling events, two LFG sampling events, and eight groundwater sampling events that took place between May 2012 and February 2013. A total of 22 sample delivery groups (individual laboratory reports) were received from ALS: 3 for soil and 19 for groundwater. Two sample delivery groups (SDGs) were received for LFG: one from Fremont Analytical and one from Air Toxics. The following paragraphs describe two very limited data quality concerns noted in these sample delivery groups.

For the VOC analysis of soil sample “Dup” from SDG K1204954, the surrogate recovery of 4-bromofluorobenze was outside the control limits (88 to 127 percent) because it exceeded the upper control limit by 1 percent. Per the USEPA guidelines, only detected volatile target compounds were qualified. Specifically, for soil sample “Dup,” m,p-xylene was the only detected target compound and was qualified “J” (estimated). With the addition of this data qualifier, the VOC result from this sample was determined to be of acceptable quality for use as qualified.

For the “nitrate as nitrogen” analysis of groundwater in SDGs K1209358 and K1300254, the samples were received by the laboratory with a slight exceedance of the holding time to complete both sample check-in and analysis. The maximum holding time exceedance for SDG K1209358 was 9 hours; the maximum holding time exceedance for SDG K1300254 was 4 hours.

Therefore, the nitrate as nitrogen results for samples MW-12b, MW-14b, MW-16, MW-23, D-23, and MW-25 from SDG K1209358 and samples D-19, MW-22D and MW-22S from SDG K1300254 have been qualified “J” (estimated) due to analysis outside of the method holding times. With that qualified added, the Nitrate data for those samples was determined to be of acceptable quality for use as qualified.

For all the other media, analyses, and SDGs, the laboratory followed the specified analytical method and met USEPA CLP National Functional Guidelines. Accuracy was acceptable, as demonstrated by the matrix spike, laboratory control sample, or reference material percent recovery values. Precision was acceptable, as demonstrated by the matrix spike/matrix spike duplicate, laboratory control sample/laboratory control sample duplicate, or sample/sample duplicate relative percent differences. All of the RI data, as reported by the laboratory, except for the qualified data discussed in the previous paragraphs, were determined to be acceptable for use.

2.7 LANDFILL GAS MONITORING AND SAMPLING

2.7.1 MONITORING PROGRAM

The LFG investigative field activities discussed in the following four sections included the following:

- Barhole study in Area 2 to evaluate the potential for LFG occurrence and migration;
- Installation of seven gas monitoring wells;
- Monitoring of 10 gas wells, including 3 existing gas wells and 7 newly installed gas wells for LFG;
- Evaluation of Area 6 LFG extraction system; and
- Collection of LFG samples from nine gas monitoring wells for VOC analysis to evaluate the potential impact of LFG on groundwater and indoor air intrusion at the HHWF.

The LFG monitoring and sampling locations are shown on Figure 14.

2.7.2 AREA 2 BARHOLE MONITORING

A barhole-probe survey was conducted on May 8, 2012, by Herrera Environmental Consultants, Inc. (Herrera) in Area 2 of the landfill to evaluate the potential presence of LFG. Seven probes (BHSB-1 through BHSB-7) were spaced approximately 100 to 150 feet apart to provide coverage across the area. Two additional probes (BHSB-8 and BHSB-9) were placed in the center of Area 2 (Figure 15). After the more complete delineation of Area 2 by means of test pits during the second phase of work, one barhole location, BHSB-3, was determined to be outside the waste area.

A 1-inch-diameter steel casing with a 4-inch-long steel mesh screen was driven at each of the nine locations to a depth of 1 to 2 feet with a slide hammer. Polyethylene tubing was connected with an airtight seal to the screened zone within the casing, and the tubing was extended to the surface. A LandTec GEM 2000 Gas Analyzer was connected to the tubing, and the barhole probe was monitored for methane, carbon dioxide, oxygen, static pressure, and barometric pressure. A minimum of one probe volume of gas was evacuated before the measurements were recorded, and then the probe was purged until the methane, carbon dioxide, and oxygen measurements stabilized (varying by less than 10 percent over three consecutive measurements). Measurements were recorded at approximately each 1/4-tubing volume. The final recorded measurements included the stabilized percentages.

2.7.3 GAS SAMPLING PROCEDURES

Field testing was performed at two existing gas wells (GW-5 and GW-6) to establish baseline conditions in refuse areas where active LFG collection is not being performed, and at LFG well GW-3 to establish baseline conditions within the Area 6 refuse where active LFG collection is currently being performed (GW-2 and GW-4 could not be located in Area 6 for evaluation; reported as abandoned). Seven new LFG monitoring wells (GW-7S, GW-7D, GW-8, GW-9, GW-10, GW-11, and GW-12) were monitored at the northern, southern, eastern, and western perimeters of the landfill areas (Figure 14). The following parameters were monitored at each LFG well:

- Methane;
- Carbon dioxide;
- Oxygen;
- Gas pressure (well head pressure); and
- Barometric pressure.

Gas monitoring was performed in May, July, August, and November 2012 and February 2013 to assess seasonal variability. Methane, carbon dioxide, and oxygen concentrations were measured using a LandTec GEM 2000 during the first monitoring event and an Elkins Earthworks Envision Gas Analyzer during subsequent monitoring events. Each day, the instruments were calibrated according to manufacturers' instructions before the gas monitoring activities began. The gas wells were monitored by connecting the gas analyzer via silicone tubing and a water trap to the wellhead.

To ensure that representative measurements were collected, the gas wells were purged until the methane, carbon dioxide, and oxygen percentages stabilized. To provide an adequate purge rate, purging was conducted with the testing instrument [purge rate of 300 milliliters/minute (mL/min) for the GEM 2000 and 450 mL/min for the Elkins]. Purge times were calculated for each well based on the construction details.

Barometric pressures were obtained from atmospheric data collected at the Walla Walla Airport. Gas pressure was measured at the wellhead before each well was purged. The methane, carbon dioxide, and oxygen percentages were monitored every ¼ well volume purged from the respective gas well. It was assumed that the parameters stabilized when they varied by less than 10 percent for three consecutive measurements. The final recorded measurements were represented by the stabilized methane, carbon dioxide, and oxygen percentages.

Additionally, one round of gas samples was collected from gas wells GW-5, GW-6, GW-7S, GW-7D, GW-8, GW-9, GW-10, GW-11 and GW-12 for laboratory analysis of VOCs. The gas samples were collected in a specially prepared canister (Summa canister) and analyzed for VOCs by gas chromatography/mass spectrometry in accordance with USEPA Method TO-15. Laboratory-certified Summa canisters (6-liter volume), flow controllers, and Teflon tubing were acquired from the analytical laboratory for the collection of the gas samples.

Before sampling, each gas well was purged, as discussed above, until the methane, carbon dioxide, and oxygen percentages stabilized. The flow controller was then connected to the gas well, and a passive integrated sample was collected over a 1-hour period. The gas pressure of the Summa canister was recorded before, during, and after the collection of the gas sample. The gas sample was then transported to the laboratory under standard chain-of-custody procedures within the 14-day holding time. The laboratory analytical reports are provided in Appendix D.

2.7.4 AREA 6 LANDFILL GAS EXTRACTION SYSTEM EVALUATION

The evaluation of the Area 6 LFG extraction system was based on normal flare station operating parameters and observations of 11 existing Area 6 extraction wells, which were monitored for vacuum and flow rate with the use of an Elkins Earthworks Envision Gas Analyzer (Figure 14). The valve positions of the extraction wells were also noted. LFG and pressure conditions were observed at gas monitoring well GW-3; wells GW-2 and GW-4 could not be located and were reported as abandoned.

2.7.5 INDOOR AIR INTRUSION EVALUATION

Well GW-10 was installed near the HHWF foundation to measure LFG adjacent to the structure (Figure 14). Gas monitoring was performed as described in Section 2.7.3.

2.8 AQUIFER TESTING

Aquifer testing was conducted in accordance with the Work Plan. The goals of aquifer testing were to characterize the first encountered aquifer beneath the landfill and to assess the hydraulic connection between the hydrostratigraphic zones screened in MW-15D, MW-3, and MW-15. The aquifer testing consisted of four parts: a baseline water-level survey, step-discharge pumping tests, a 28-hour constant-discharge pumping test, and a water-level recovery test. The aquifer test implementation, results, and analysis are described in greater detail in Appendix E.

Constant-discharge aquifer testing was performed on September 26 and 27, 2012; MW-15D was used as the pumping well with a calculated average flow rate of 24.8 gallons per minute (gpm) over 28 hours. This rate was selected based on the results of step-discharge testing performed on MW-15D. Drawdown and recovery water level data were collected from pumping well MW-15D, and observation wells MW-3, MW-15, MW-18, and MW-27. All data were collected with automated pressure transducers, imported into Aqtesolv Professional 4.5 for analysis.

Drawdown data from three observation wells and recovery data from the pumping well were used to estimate the aquifer characteristics. The Cooper-Jacob straight-line solution (Cooper and Jacob 1946), the Theis (1935) method for confined conditions, extended by Hantush (1961) for partially penetrating wells, and other solutions were used to estimate the aquifer characteristics. Fluctuation in the ambient water levels due to unknown sources resulted in limitations in the suitability of the data from some observation wells for curve-matching techniques. The water levels in wells monitored for baseline conditions showed a daily pattern of fluctuation. These inflections were filtered out for wells with sufficient displacement.

2.9 SURVEY

All exploration points and new wells, and location specific topographic elevations were surveyed by a land surveyor licensed in the State of Washington. The horizontal datum that was used is North American Datum of 1983 (NAD 83), Washington State Plane Coordinate System, South Zone, US Survey Feet. The basis of position was established using a new holding National Geodetic Survey (NGS) control point “City of Walla Walla Control Sudbury,” installed at the security gate entrance of the Sudbury Road Landfill in September 2012. The vertical datum is the North American Vertical Datum of 1988 (NAVD 88) based on an NGS control point “City of Walla Walla Control Sudbury” elevation of 826.52 feet.

The top of the PVC casing of each groundwater monitoring well was surveyed for horizontal (plus or minus 1.0 foot) and vertical (plus or minus 0.01 foot) control. A small mark was placed on the well casing rim to indicate the surveyed point. The locations of soil borings, test pits, barholes, and gas wells were surveyed to horizontal (plus or minus 1.0 foot) and vertical ground level (plus or minus 0.1 foot) control.

Previous vertical elevation survey data (i.e., existing monitoring wells) were based on a Site-specific datum. These elevations were corrected by +2.57 feet to convert the elevations to NAVD 88. Attempts were made to correct and use NAVD 88 elevation data for all the reported elevations in the RI.

Area specific topographic survey was conducted in the vicinity of the compost facility and southern side of Area 5. These data were used for stormwater control and diversion planning.

3.0 RI FIELD INVESTIGATION FINDINGS

This section describes the data collected to close the data gaps identified in the Ecology-approved Work Plan as amended and characterize the nature and extent of contamination at the Site. The field studies were conducted to achieve the following objectives and fill the identified data gaps:

- To further develop an understanding of the hydrostratigraphy beneath the Site.
- To fill the following data gaps related to groundwater contamination:
  - Neither the off-Site, nor the source(s) of the VOC contamination in the MW-15 specific samples had been fully identified. In particular, it had not been established whether Area 5 or Area 6 was contributing to the contamination found at MW-15.
  - Neither the extent nor the source(s) of the Freon 11 and 12 contamination in the landfill monitoring wells had been fully characterized.
  - The source(s) of inorganic constituent contamination in the MW-15-specific samples had not been fully characterized.
  - The vertical extent of contamination within the aquifer had not been evaluated.
  - The impact of the upgradient area-wide contamination on the Site and domestic well groundwater had not been fully characterized.
  - The source(s) of the VOCs impacts observed in the Small and Camp wells had not been established.
- To fill the following data gaps related to the LFG:
  - The presence/absence or character of LFG in Areas 1 and 2;
  - The potential impact of the LFG on groundwater quality near Area 1 and Area 5;
  - The extent and pathways of the LFG migration (there was insufficient data on the presence/absence of LFG extending beyond the waste limits for Areas 1, 2, and 5);
  - The quality and flow rate of gas from the gas extraction system and the radius of influence of the Area 6 LFG extraction wells to determine the effectiveness of the Area 6 interim action; and
  - The presence/absence and quality of VOCs in LFG near the HHWF consistent with the vapor intrusion guidelines.
- To further develop an understanding of the lateral and vertical extents of the MSW and the soil cover thicknesses at Areas 1, 2, and 5.
- To evaluate the soil quality beneath the MSW.

3.1 DISPOSAL AREA CHARACTERIZATION

MSW disposal Areas 1, 2, and 5 were evaluated during the RI by means of a geophysical survey and test pit and soil boring programs to better understand the horizontal and vertical extent of the MSW and the thickness of the soil cover over the MSW. The geophysical survey was inconclusive in precisely defining the waste cell boundaries due to signal masking and dispersion caused by thick soil cover, scattered debris outside the main disposal areas, and surrounding area soil disturbance.

Therefore, the test pit and soil boring programs and historical data were used to better define the lateral and vertical extents of waste and the thickness of the oil cover over the waste.

3.1.1 AREA 1

The approximate limits of Area 1 are shown on Figure 3. The observed MSW and cover soil thicknesses are provided in Table 2.

Observations from four test pits and one soil boring indicated that the upper waste surface is covered by 11 to more than 17 feet of soil (mostly local silt with a thin surface gravel layer for vehicle travel). The cover thickness was not assessed (due to the terrain and subsurface utilities) on the southern slope or in the west corner of Area 1.

The MSW thickness observed during the installation of GW-11 extended from 11 to 48 feet bgl. Intermediate cover layers (silt zones up to 4 feet thick) were observed in the top 25 feet of waste; however, no intermediate cover was observed in the lower 21 feet of waste. Much of the MSW in Are 1 appeared to have been partially burned. Soil cuttings collected near the bottom of the waste contained newspaper fragments dated January 1979.

3.1.2 AREA 2

Thirty-four test pits and one soil boring were used to define the Area 2 waste boundary and the thicknesses of the MSW and the cover soils. The approximate limits of Area 2 are shown on Figure 12. The observed MSW and cover soil thicknesses are provided in Table 2.

The MSW cover soil consisted of silt common to the Site vicinity. The cover thickness ranged from 0.5 to 11 feet; however, the thickness in all but three test pits was 4 feet or less.

The observed MSW thickness in Area 2 was highly variable. The recorded thicknesses in the interior test pits (those not located near the area boundary) and boring SB-24 ranged from 1 to 27 feet. Some test pits were not able to penetrate zones of consolidated MSW, while others encountered soil with limited MSW. Several newspapers found near the bottom of the waste were dated March 1979.

3.1.3 AREA 5

RI information from 23 test pits, 13 trenches, and seven soil borings excavated on the northern boundary, along with soil borings and gas well installation data from previous investigations, was used to define the Area 5 waste boundaries and MSW and cover soil thicknesses. The MSW boundary evaluation focused on the north side of Area 5. The approximate limits of Area 5 based on the RI data are shown on Figure 13. The MSW and cover soil thicknesses observed during the RI are provided in Table 2.

The MSW cover soil consisted of silt common to the Site vicinity. The observed cover soil thickness ranged from 1.5 to 15.5 feet. Cover soil of approximately 10 feet or greater was observed over most of the area. Cover soil less than 5 feet thick was observed on the south side of Area 5 in four test pits (Figure 13). Shallow cover was also observed in TP-21/B-1 and B-2 at the northeastern boundary of Area 5 (3 and 4.5 feet, respectively); however, some of the cover soil in these areas was likely removed during the RI to create drilling pads.

Historical records indicate that the first disposal in Area 5 started as an excavation parallel and within the north drainage ditch. As the trench was filled, another trench would be excavated on the adjacent hillside (south side of trench), and the soils from the second trench would be used to cover the active cell. By this method, the trenches would stair-step up the hillside to the south. The RI findings suggest that this historical information is correct. Trench bottom elevations (base of MSW) were observed to be lower to the north and progressively higher to the south. Correspondingly, the separation between the base of the MSW and the groundwater table was less to the north relative to the separation to the south.

Borings drilled through the MSW at the northern extent of Area 5 indicated that the MSW thickness was about 11 to 16 feet thick in most borings. The separation between the base of the MSW and the groundwater table (based on February 2013 water table elevations) ranged from 7 to 21 feet. Boring SB-20 was an anomaly. The MSW thicknesses in SB-20 was 49.5 feet and extended approximately 11 feet beneath the groundwater table (based on February 2013 water table elevations).

A review of soil boring information and drilling information for gas wells GW-5 and GW-6 from the 2005 Independent RI (refer to Table 1 and the boring logs in Appendix A) indicates that as the explorations move south, the MSW zone thickens. The exploration data also indicate that the bottom elevation of the MSW rises, providing more separation from groundwater.

3.1.3.1 Area 5 Stormwater

Control of stormwater is important to prevent leachate generation. The general surface slopes in Area 5 promote stormwater drainage to the north and west. Drainage to the north is toward the north drainage ditch, where waters are directed off-Site as described in more detail in the following discussion of the north drainage ditch. Two linear road cuts located on the north slope of Area 5 likely impede stormwater flow and potentially promote infiltration. Drainage to the west reaches a shallow depression on the west side of Area 5, where stormwater is directed overland to the northwest (see the following description of the southwest area). No additional large depressions or areas where stormwater would pool were observed during the RI.

North Drainage Ditch

The north drainage ditch routes stormwater west along the north side of Area 5. The drainage features of the north drainage ditch valley bottom were historically modified by the creation of pits to trap sediments and stormwater. The practice was discontinued in 2005, and an interim action (described in Section 1.6) was conducted in 2010 to promote stormwater flow through the valley adjacent to Area 5 and minimize pooling, thereby reducing the quantity of surface water available for infiltration.

The location of the Area 5 boundary (Figure 13) and knowledge of where the stormwater pits had been located before 2005 indicate that the former stormwater pits were located within several feet (at most 20 feet) of the MSW. During the RI, the engineering controls implemented during the 2010 interim action were observed to be promoting drainage past Area 5. However, the constructed drainage pathway is filling with soil and vegetation, which were observed to be impeding water movement during the RI. It appears that the existing drainage ditch is approximately 30 to 40 feet from the MSW in Area 5.

Southwest Side of Area 5

Stormwater run-on occurs at the south side of Area 5, in the vicinity of the entrance to the compost facility. The stormwater flows from the entrance point over the west side of Area 5 toward the northwest corner of the Site. Observations during the RI indicated the presence of boggy areas on the surface of Area 5 and soil cover erosion during storm events in this area.

3.2 SOIL SAMPLE RESULTS

3.2.1 GEOTECHNICAL SOIL CHARACTERIZATION

Grab, bulk, and Shelby tube soil samples were collected from the Area 5 soil cover material to analyze the soil characteristics (geotechnical analysis and lithologic descriptions). The laboratory testing was conducted by HWA for future use during the FS in evaluating soil infiltration and ET capacities. The laboratory testing indicated that the soil is composed of silt with an average (geometric mean) permeability of 4.1×10^{-6} cm/sec. The soils report is provided in Appendix C.

3.2.2 SOIL ANALYTICAL RESULTS

During the RI, select soil samples were collected from soil borings GW-11, SB-21, SB-23, SB-24, and SB-26 for laboratory analysis of VOCs. The sample intervals were selected to assess the soil quality in the vadose zone beneath the MSW. The laboratory results are summarized in Table 3. The laboratory analytical reports (2012 data only) are provided in Appendix D.

The analytical results indicated the presence of low-concentration VOCs in all soil samples collected during the RI. Nine VOCs were detected in the sample from Area 1, whereas no more than three VOCs were detected in all the other samples. The results suggest the potential for downward migration of leachate or impacts from LFG.

Four soil samples were also collected from beneath the MSW during the 2005 Independent RI. The MRLs reported for the 2005 samples were several orders of magnitude higher than the MRLs reported during this RI. The analytical results from the 2005 sampling indicated no VOCs in any of the samples at concentrations equal to or greater than the MRL.

3.3 LANDFILL GAS INVESTIGATION

3.3.1 BARHOLE PROBE SURVEY

The barhole survey was conducted to determine the presence/absence and character of LFG in shallow soils across Area 2. The monitoring results are provided in Table 4, and the barhole locations are shown on Figure 15. The results indicated no methane concentrations in eight of the nine probes; a concentration of 0.1 percent methane was detected at location BHSB-7 to the northeast. The presence of dense silt around the probe screen prevented adequate air circulation at several locations, including BHSB-7 and BHSB-9, and the pump in the gas analyzer shut off after approximately one probe tubing volume had been purged. However, the detection of carbon dioxide indicates that air was entering the barhole screen from the surrounding formation and not short-circuiting to ground surface. The absence of methane detections during the barhole survey suggests that methane was not penetrating into the silt cover above the MSW.

3.3.2 LANDFILL GAS MONITORING

LFG monitoring was conducted at 10 new and existing gas wells:

- Gas well GW-3 represents baseline conditions within Area 6 refuse where LFG collection is currently being performed.
- Gas wells GW-5 and GW-6 represent baseline conditions in refuse areas where LFG collection is not being performed.
- Gas wells GW-7S and GW-7D were installed to evaluate the potential for contaminant transfer from LFG to groundwater and to represent conditions beyond the northwest corner of Area 5.
- Gas well GW-8 represents conditions beyond the northern junction of Areas 5 and 6.
- Gas well GW-9 represents conditions beyond the southeastern perimeter of Area 1.
- Gas well GW-10 was installed specifically to evaluate the potential for vapor intrusion into the HHWF.
- Gas well GW-11 represents conditions within Area 1 MSW.
- Gas well GW-12 represents conditions along the center of the western landfill perimeter.

3.3.2.1 Methane

The results of methane monitoring at the 10 gas wells are provided in Table 5. Wells completed in MSW in Area 1 (GW-11), Area 5 (GW-6), between Areas 5 and 6 (GW-5), and Area 6 (GW-3) exhibited high methane concentrations, ranging between 12.5 and 66.6 percent by volume. All of the other measurements indicated no methane at perimeter wells, except for two events at GW-7S (0.1 and

0.4 percent by volume) and one event at GW-10 (0.7 percent by volume). The perimeter well results indicate that LFG migration, if any, is insignificant beyond the landfill boundary.

3.3.2.2 Volatile Organic Compounds

Historical LFG sampling performed in 2006 at groundwater monitoring wells MW-15 and MW-16, positioned outside the western perimeter of Area 5, and in 2009 at LFG monitoring wells GW-5 and GW-6, positioned within Area 5 refuse, indicated the presence of many VOCs. In 2012, existing gas wells GW-5 and GW-6, as well as newly installed gas wells (GW-7S, GW-7D, GW-8, GW-9, GW-10, GW-11, and GW-12) were analyzed for VOCs. The analytical results indicated the presence of VOCs in LFG at some level in all samples collected during the RI. The laboratory analytical results are provided in Table 6.

Theoretical Landfill Gas Contribution to Groundwater

Groundwater may be contaminated by leachate and/or LFG as it passes through or beneath the landfill waste. To determine if LFG should be considered a contaminant transfer pathway to groundwater, Henry's Law equilibrium concentrations were calculated for VOCs identified in Site groundwater and measured in LFG at GW-5, GW-6, and GW-11 (wells screened in the Area 1 and 5 refuse). The following equation was used to calculate the theoretical equilibrium concentration of select VOCs detected in LFG associated with a concentration of 0.5 µg/L in groundwater:

$$Cw = Cg \div H(1{,}000 \text{ liters per cubic meter})$$

Where: Cw = VOC concentration in water (µg/L)

Cg = VOC concentration in gas (micrograms per cubic meter)

H = Henry's Law constant of VOC (dimensionless)

The theoretical concentrations of VOCs of interest in LFG associated with a minimum detectable concentration of 0.5 µg/L in groundwater are provided in the following table. The VOCs selected for evaluation included constituents that were detected in groundwater in either Site or background wells, or constituents whose concentration in LFG was high enough to create a potential detection in groundwater at 0.5 µg/L or greater.

Volatile Organic Compound	Henry's Law Constant* (dimensionless)	Calculated Equilibrium Concentration (µg/m³)	Perimeter Well Concentration Range (µg/m³)	Refuse Well Concentration Range (µg/m³)
1,1-Dichloroethene	0.635	317.5	ND	261–**480**
Chloroethane	0.275	137.5	ND	**194–785**
Chloroform	0.0794	39.7	ND	ND
cis-1,2-Dichloroethene	0.087	43.4	ND	**4,300–12,500**
trans-1,2-Dichloroethene	0.212	106	ND	**197–704**
Freon 11	2.17	1,085	ND–31	254–**2,930**
Freon 12	2.85	1,425	ND–1,200	950–**12,400**
Freon 114	63.7	31,850	ND–930	731–7,600
Toluene	0.124	62	ND–6.6	**10,900–19,900**
Trichloroethene	0.204	102	ND–10	**2,190–6,870**
Tetrachloroethene	0.331	165.5	ND–2,700	**3,100–17,000**
Vinyl chloride	0.75	375	ND	**830–3,560**

*Based on temperature of 10° Celsius, provided in Minnesota Pollution Control Agency Risk-based Guidance for the Vapor Intrusion Pathway Intrusion Screening Values for Vapor Intrusion Risk Evaluation table found at http://www.pca.state.mn.us/index.php/view-document.html?gid=3162.

Perimeter wells include GW-7S, GW-7D, GW-8, GW-9, GW-10, and GW-12.

Refuse wells include GW-5, GW-6, and GW-11.

Bold value indicates reported groundwater concentration that exceeds the calculated equilibrium concentration in landfill gas.

µg/m³ = micrograms per cubic meter.

ND = not detected at or above the method reporting level.

The analytical results indicate that a majority of the VOCs detected in groundwater theoretically could have been introduced through LFG in the MSW areas, based on the concentrations found at GW-5, GW-6, and/or GW-11. The LFG concentrations reported in the perimeter gas well samples are less than the threshold required to theoretically affect groundwater.

Landfill Gas Migration Potential

Gas samples collected from perimeter gas wells GW-8, GW-9, and GW-12 and interior gas well GW-10 located near the HHWF indicated the presence of up to seven VOCs reported at concentrations mostly near the MRLs. Reported concentrations of Freon 11, Freon 114, and PCE were greater than the MRLs but significantly less than the theoretical concentration required to affect groundwater based on the Henry's Law calculation. The low-concentration presence of VOCs in the perimeter wells indicates minor lateral migration of LFG at the landfill boundary, with limited, if any, potential to affect groundwater.

Four VOCs in LFG were detected at both GW-7S and GW-7D (1,1-dichloroethane, Freon 12, PCE, and toluene), a paired set of gas wells (shallow and deep) lying outside Area 5 and close to MW-15. Additionally, Freon 114 was detected in the shallow well. The VOC concentrations in the shallow well were approximately two orders of magnitude higher than the concentrations reported in the deeper well. The presence of high concentrations of Freon 114 and PCE at shallow well GW-7S suggests lateral migration from refuse through a shallow soil pathway; low concentrations of six VOCs detected in GW-7D indicates relatively minor lateral migration at depth.

3.3.3 AREA 6 LANDFILL GAS EXTRACTION SYSTEM EVALUATION

The evaluation of the Area 6 LFG extraction system consisted of observing the system setup and operating parameters, measuring LFG concentrations and flow characteristics at each of the 11 extraction wells (EW-1 through EW-11), and measuring LFG concentrations and pressure at observation well GW-3, located at the center of the system. The system measurements are summarized in the following table.

Extraction Well	CH_4 (ppmv)	CO_2 (ppmv)	O_2 (ppmv)	CH_4/CO_2	Balance (ppmv)	Flow (scfm)
1	46.30	36.80	0.00	1.30	16.90	8
2	45.90	36.80	0.00	1.20	17.30	18
3	44.80	37.90	0.00	1.40	17.30	20
4	45.10	35.90	0.10	1.30	18.80	6
5	51.60	38.90	0.00	1.30	9.30	24
6	52.60	30.60	0.00	1.30	8.00	28
7	29.10	33.50	0.00	0.80	37.40	8
8	45.00	37.10	0.00	1.20	17.90	10
9	20.80	27.20	0.00	0.80	52.00	7
10	41.70	35.90	0.00	1.20	22.30	15
11	45.90	38.70	NR	1.20	15.40	15

CH_4 = Methane
CO_2 = Carbon dioxide
NR = Not recorded
O_2 = Oxygen
Ppmv = Parts per million by volume
Scfm = Standard cubic feet per minute

The extraction wells are located approximately 200 feet apart across Area 6. Static pressure was measured at gas monitoring well GW-3 five times between May 2012 and February 2013 (Figure 14). Four of the five measurements showed generally positive pressures during extraction system operations, indicating a buildup of methane in the central portion of Area 6. After this testing, GW-3 was connected to the extraction system to induce negative pressure to withdraw the methane. Farther away, measurements at perimeter gas well GW-8, located approximately 200 feet northwest of the extraction system, indicated no detected methane and fluctuating positive and negative vacuum near zero over the monitoring period. Based on these results, it appears that the well radius of influence is approximately at or less than 100 feet, and the extraction system was not allowing LFG to migrate to the landfill boundary. Therefore, additional radius of influence testing at the perimeter wells did not appear to be warranted and was not conducted.

The methane concentrations measured in wells EW-7 and EW-9 were 29.1 and 20.8 (percent by volume), respectively, significantly less than the range of 41.7 to 52.6 detected in the other nine extraction wells. Despite an increase in the valve positions at these locations without an increase in oxygen, the methane concentrations consistently remained low, indicating that the valve positions at these wells were at the optimum extraction flow setting.

Based on the measured methane concentrations in the extraction wells, the system testing, and discussions with City operations staff, the system appears to be operating at an optimum extraction flow rate without the introduction of oxygen. Therefore, no further modifications to the system operation are recommended at this time.

3.3.4 Vapor Intrusion Evaluation

GW-10 was installed to evaluate the potential for LFG to affect indoor air quality at the HHWF. No methane was detected in four of the five measurements performed, and the one positive reading of 0.7 percent by volume was well below the 5 percent threshold established for further evaluation in the SAP. In addition, no VOC concentrations exceeded the draft Washington State Method C Soil Gas Screening Levels (Ecology 2009) that trigger the need for further analysis (see the following table). Based on these finding, no vapor intrusion modeling was performed.

	Freon 11 (µg/m³)	**Freon 12 (µg/m³)**	**Tetrachloroethene (µg/m³)**	**Toluene (µg/m³)**	**1,1,1-Trichloroethane (µg/m³)**	**m,p-Xylenes (µg/m³)**
Screening level*	7,000	1,800	42	49,000	48,000	1,000
GW-10	31	280	28	6.6	24	4.3

*Draft Washington State Method C Soil Gas Screening Levels (Ecology 2009)
µg/m³ = micrograms per cubic meter

3.4 AQUIFER CHARACTERIZATION

Drawdown data from three observation wells and recovery data from the pumping well were used to estimate the aquifer characteristics. The Cooper-Jacob straight-line solution (Cooper and Jacob 1946), the Theis (1935) method for confined conditions, extended by Hantush (1961) for partially penetrating wells, and other solutions were used to estimate the aquifer characteristics. Fluctuations in the ambient water levels resulted in limitations in terms of the suitability of the data from some observation wells for curve-matching techniques. Water levels in wells monitored for baseline conditions showed a daily pattern of fluctuation. These inflections were filtered out for wells with sufficient displacement. A detailed account of the testing and analysis and the results are provided in Appendix E.

A geometric mean of the results yields an overall estimated transmissivity in the aquifer of approximately 4,000 square feet per day (ft^2/day) in the vicinity of the test, and a hydraulic conductivity of approximately 1.4 x 10^{-2} cm/sec (40 feet per day). Using this hydraulic conductivity and an effective porosity of 0.3, the average groundwater flow velocity beneath the Site was calculated to be approximately 1.9 x 10^{-4} cm/sec (193 feet per year). The aquifer testing indicated a storativity of approximately 2 x 10^{-3}, which is at the higher end of the range for confined aquifers of this type and is consistent with semi-confined aquifer conditions.

The aquifer test results indicate hydraulic connectivity between the screened interval of MW-15D and hydrostratigraphic zones represented by monitoring well screens for the deeper monitoring well MW-3 and shallower monitoring wells MW-15, MW-18, and MW-27. Minimal recharge (leakage) from the overlying silt unit to the old gravel and clay aquifer was identified with the use of the Hantush-Jacob/Hantush solution for leakage into a confined aquifer (Hantush and Jacob 1955; Hantush 1964). The results indicate a hydraulic connection between the screened intervals of MW-15D and MW-3, which are located approximately 26 feet below the bottom of the MW-15D screened interval. Although both wells are assumed to be within the same gravel aquifer unit, the dampened response in MW-3 suggests a more complex local hydrostratigraphy at depth, such as the presence of one or more lower permeability layers within the gravel aquifer unit.

3.5 GROUNDWATER LEVELS, FLOW DIRECTION, AND RATE

Depth to groundwater was measured in each monitoring well (not domestic wells) during each monitoring event, and the respective elevation was calculated using NAVD 88. Three groundwater elevation contour maps were prepared using the elevation data from the monitoring events in June 2012, October 2012, and February 2013. The groundwater contours and projected groundwater flow direction from these three monitoring events are shown on Figures 7, 8, and 9, respectively. The inferred groundwater flow direction on all three figures is to the west and southwest, with an approximate horizontal gradient of 0.004 ft/ft beneath the landfill. A vertical downward gradient is indicated, based on the difference in water levels in MW-3 and MW-15 (752.30 and 756.56 feet, respectively, in February, 2013). Using a hydraulic conductivity of 1.4 x 10^{-2} cm/sec and an effective porosity of 0.3, the average horizontal groundwater flow velocity beneath the landfill was calculated to be approximately 1.9 x 10^{-4} cm/sec (193 feet per year).

Little water level fluctuation was observed during the monitoring period. Minor daily water level fluctuations were observed during the aquifer test baseline survey, and a longer term decline of the groundwater potentiometric surface is apparent. Data-logging pressure transducers deployed during the baseline aquifer test from July 12 through September 25, 2012, indicated daily water level fluctuations of approximately 0.2 to 0.4 foot. The water level fluctuations occurred in a highly consistent daily pattern and were attributed to the effects of earth tides. A review of water levels since 1997 indicates a steady decline in the vicinity of the landfill with as much as 10 feet of elevation loss in MW-12. The declining water level trends in the landfill compliance monitoring wells are shown on Figure 10. The declining water levels result in greater separation between the base of the MSW and groundwater, providing more protection of the groundwater from the impacts due to leachate.

3.6 GROUNDWATER QUALITY EVALUATION

The discussions in this section are based on an evaluation of the groundwater data collected during the RI (June 2012 through February 2013). The laboratory analytical results from the eight RI groundwater sampling events are summarized in Table 7, and the analytical reports are provided in Appendix D. The analytical results in Table 7 have been organized and evaluated by group of well data:

- Upgradient wells: MW-5, MW-9, MW-10, MW-12b, and MW-25;
- Site wells: MW-3, MW-11, MW-14b, MW-15D, MW-16, MW-17, MW-18, MW-23, MW-24, MW-26, and MW-27 (excludes MW-15);
- MW-15 (most contaminated Site well);
- Downgradient wells: MW-19, MW-20, MW-21S/D, MW-22S/D; and
- Domestic wells: Camp, Kinman, Schmidt, and Small.

VOCs were detected in groundwater samples from all of the wells except two of the domestic wells (Kinman well and Schmidt well). The most prevalent detected VOCs were PCE and TCE. The average concentrations detected during the RI are shown on Figure 16.

No exceedance of the proposed MTCA Method B cleanup levels for groundwater (see Section 4 for cleanup level justification) was reported for samples from any of the wells, except MW-15. Two VOCs in MW-15 (PCE and vinyl chloride) consistently exceeded the proposed MTCA Method B cleanup levels for groundwater during the RI sampling period.

No specific trends or MTCA exceedances were observed for the metals results, with the exception of manganese. Manganese concentrations of up to 1.27 milligrams per liter (mg/L), which exceeded the USEPA's secondary drinking water standard, were initially detected in the new wells;

however, the concentrations decreased with time (presumably due to better well development), and the highest concentrations were detected in the samples from upgradient well MW-25. The discussion of inorganic parameters is limited to leachate indicator constituents (calcium, chloride, potassium, sodium, sulfate, and TDS) reported in groundwater samples collected from the four wells located in alignment along the north drainage ditch (from upgradient to downgradient: MW-24, MW-23, MW-27, and MW-15).

Statistical VOC data for the RI samples including mean, standard deviation, standard error, median, lower and upper quartile, maximum and minimum concentrations, and percentage of detections are provided in Table 8. Statistical data for calcium, chloride, potassium, sodium, sulfate, and TDS for wells MW-24, MW-23, MW-27, to MW-15 are provided in Table 9. Box plot diagrams for the inorganic constituents and VOCs reported for these wells are provided in Appendix F.

3.6.1 AREA-WIDE GROUNDWATER QUALITY

3.6.1.1 Regional Groundwater Quality

Regionally, the groundwater in the vicinity of the landfill contains low concentrations of chloroform, PCE, and TCE. The groundwater analytical data included in the RI/FS Report for the WSP (Parametrix 2012) indicate the presence of these VOCs in groundwater beneath the WSP, which is upgradient of the Site. The VOCs and concentrations in groundwater at the Site are similar to the area-wide contamination observed beneath the entire City property and in samples from the Camp and Small domestic wells.

The average upgradient concentrations of chloroform, PCE, and TCE, based on the RI sample results, are 1.17, 0.64, and 1.69 μg/L, respectively. Similar VOC concentrations have regularly been detected in the landfill monitoring wells (see Tables 7 and 8) and two domestic water supply wells (Small and Camp wells).

3.6.1.2 Domestic Well Groundwater Quality

The groundwater results from the four domestic supply wells that were sampled indicated the presence of VOCs in two of the wells. The detected VOCs include chloroform (up to 0.67 μg/L), PCE (up to 1.5 μg/L), and TCE (up to 0.62 μg/L) in the samples from the Small well, and PCE (up to 0.88 μg/L) in the samples from the Camp well. VOCs were not detected in the samples collected from the Kinman and Schmidt wells. The maximum and mean concentrations in the samples from the Small and Camp wells compared to the concentrations in the upgradient well samples are shown in the following table.

	Upgradient Well		Small Well		Camp Well	
	Maximum (µg/L)	Mean (µg/L)	Maximum (µg/L)	Mean (µg/L)	Maximum (µg/L)	Mean (µg/L)
Chloroform	2.1	1.17	0.67	0.52	ND	ND
Tetrachloroethene	0.9	0.64	1.5	1.35	0.88	0.67
Trichloroethene	2	1.69	0.62	0.33	ND	ND

µg/L = micrograms per liter

ND = not detected at or above the method reporting level

The VOC concentrations and direction of groundwater flow suggest that the contamination detected in the Camp and Small domestic wells is the result of area-wide contamination, with limited, if any, contribution from the Site. VOCs that are unique to the Site, such as 1,1-dichloroethane, *cis*-1,2-dichloroethene, Freon 12, and vinyl chloride, have not been detected in the domestic well samples. The maximum and mean concentrations of chloroform and TCE reported in the samples from the Small and Camp wells, and the maximum and mean concentrations of PCE in the samples from the Camp well are all less than the respective concentrations in the upgradient well samples. The maximum and mean PCE concentrations in the samples from the Small well are slightly greater than the concentrations in the upgradient well samples; however, these comparisons are based on the recent RI data. Historical maximum PCE concentrations reported in MW-5 (7.1 µg/L on April 13, 1993) and MW-9 (4.1 µg/L on April 13, 1993) have been decreasing with time. Therefore, it is difficult to determine whether the slightly higher concentrations in the samples from the Small well are the result of landfill contribution or the tail end of the regional PCE plume.

The groundwater flow direction also influences the potential landfill impact on domestic well groundwater quality. The groundwater flow path from the Site (to the west and southwest) does not extend within the reach of the Camp well, which is located ¾ mile northwest of the landfill. The groundwater flow path from MW-15 could, however, intercept the Small well. Based on a groundwater flow rate of 193 feet per year, contaminants from the vicinity of MW-15 would take approximately 24 years to reach the Small well (assuming no retention factor).

3.6.2 MW-15 Groundwater Quality

MW-15 had the highest overall concentrations of VOCs reported for any of the wells monitored during the RI sampling period. Leachate indicator concentrations for alkalinity, calcium, potassium, sodium, sulfate, and TDS reported in the MW-15 samples were also greater than the concentrations in the other well samples. Concentrations of these constituents generally increase as groundwater moves past Area 5 (see the box plots in Appendix F). The maximum detected concentrations of VOCs and select inorganic constituents in the MW-15 samples compared with the maximum background concentrations during the RI are summarized in the following table.

Analyte	Maximum Concentration	Maximum Background Concentration
1,1-Dichloroethane (µg/L)	4.1	<0.5
Chloroethane (µg/L)	0.61	<0.5
cis-1,2-Dichloroethene (µg/L)	14.0	<0.5
Dichlorodifluoromethane (µg/L)	3.4	<0.5
Tetrachloroethene (µg/L)	6.8	0.64
Trichloroethene (µg/L)	2.2	2.0
Trichlorofluoromethane (µg/L)	0.63	<0.5
Vinyl chloride (µg/L)	1.2	<0.02
Calcium (mg/L)	163	109
Chloride (mg/L)	126	140
Potassium	8.83	7.9
Sodium (mg/L)	69.9	33.9
Sulfate (mg/L)	44.3	36.4
TDS (mg/L)	988	770

µg/L = micrograms per liter
mg/L = milligrams per liter
TDS = total dissolved solids

PCE, TCE, 1,1-dichloroethane, *cis*-1,2-dichloroethene, Freon 12, and vinyl chloride were reported in all the MW-15 samples, at concentrations greater the regional background concentrations. Concentrations of chloroethane (detected twice), toluene (detected once), and Freon 11 (detected three times) were also reported in the MW-15 samples.

Chloroethane and vinyl chloride were unique constituents that were reported only in the MW-15 samples. The compounds *cis*-1,2-dichloroethene and 1,1-dichloroethane were also reported in downgradient off-Site wells MW-19 and MW-20 (*cis*-1,2-dichloroethene only). These constituents are common breakdown products of PCE and TCE in anaerobic environments.

Freon 11 and Freon 12, which are commonly reported in the Site monitoring wells, are also commonly reported in MW-15 sample results. Regionally (area-wide) reported constituents that are also found in MW-15 include low concentrations of PCE and TCE. Chloroform, which is found regionally, has never been reported in MW-15, most likely due to anoxic groundwater conditions. It is likely that the PCE and TCE concentrations in MW-15 are in part due to the low regional (background) concentrations.

Time-series plots of the VOC detections in MW-15 since August 2001, provided in Appendix F, indicate that all of the VOCs detected in MW-15 are showing decreasing trends, with exception of *cis*-1,2-dichloroethene, which is a breakdown product and is observed to increase in concentration as the parent compounds decrease.

Inorganic constituents, including calcium, chloride, potassium, sodium, sulfate, and TDS in the MW-15 samples are generally greater than the respective concentrations in other wells. Elevated concentrations of these constituents can be indicators of leachate impact on groundwater quality. Monitoring wells MW-24, MW-23, MW-27, and MW-15 are generally located in line with the groundwater flow direction from upgradient to downgradient along the northern boundary of Area 5. Statistical data for calcium, chloride, potassium, sodium, sulfate, and TDS for wells MW-24, MW-23, MW-27 and MW-15 are provided in Table 9, and box plot diagrams are provided in Appendix F. These data generally indicate increasing concentrations as the groundwater travels downgradient past Area 5. Conversely, concentrations of chloroform, a chlorinated VOC that is stable in aerobic conditions, decrease from upgradient well MW-24 to less than the MRL in MW-15. These concentration trends suggest a leachate impact on groundwater in the vicinity of Area 5, an indication that is supported by the finding that some of the MSW in Area 5 is within the saturated zone.

3.6.3 LANDFILL WELL GROUNDWATER QUALITY, EXCLUDING MW-15

A review of the RI groundwater quality data for the other Site monitoring wells (excluding MW-15) indicates the common presence of chloroform, PCE, Freon 11, and Freon 12. Additionally, TCE was detected in five of the Site wells (MW-15D, MW-17, MW-23, MW-24, and MW-27), all located in the vicinity of Area 5.

The average chloroform concentrations in the Site wells ranged from 0.54 to 1.28 µg/L. The average chloroform concentrations in upgradient well MW-12b was 0.79 µg/L, with a combined upgradient well average of 1.17 µg/L. The chloroform concentrations detected in the landfill well samples, therefore, fall within the range of chloroform concentrations typical of the regional groundwater quality.

The average PCE concentrations in the Site wells ranged from 0.69 to 1.95 µg/L. The average PCE concentrations in upgradient well MW-12b was 0.93 µg/L, with a combined upgradient well average of 0.64 µg/L. The average PCE concentrations in most Site wells (see Table 8) are slightly greater than the average concentrations in MW-12b and upgradient wells (regional), indicating possible landfill contribution of PCE to groundwater. A time-trend plot of historical PCE concentrations in MW-11 (see Appendix F) suggests an increasing trend with time, although the highest detected concentration during the RI was 1.5 µg/L.

Freon 11 was reported in monitoring wells MW-16, MW-17, and MW-18, at concentrations up to 1.2 µg/L. Freon 12 was reported in all of the Site wells except MW-3, MW-15D, MW-17, and MW-24, at concentrations up to 1.0 µg/L. The Freon 11 and Freon 12 could indicate landfill impacts on groundwater via LFG (see the subsection "Theoretical LFG Contribution to Groundwater" in Section 3.3.2.2).

3.6.4 DOWNGRADIENT OFF-SITE WELL GROUNDWATER QUALITY

The shallow downgradient off-Site monitoring wells are MW-19, MW-20, MW-21S, and MW-22S. The downgradient off-Site monitoring wells with screens placed deeper in the aquifer are MW-21D and MW-22D. The analytical results indicate off-Site movement of VOCs in the shallow and deeper aquifer zones. Common VOCs detected in all downgradient well samples include chloroform (up to 0.91 µg/L) and PCE (up to 1.9 µg/L). The highest downgradient off-Site VOC concentrations are generally found in either MW-19 or MW-20. The VOCs detected in MW-19 and MW-20 are similar to those found in MW-15 and include PCE, TCE, 1,1-dichloroethane (MW-19 only), chloroform, *cis*-1,2-dichloroethene, Freon 11, and Freon 12. The concentrations of chloroform and TCE in the deep wells are slightly less than the regional concentrations; however, the concentrations of PCE (up to 1.2 µg/L) and Freon 11 (up to 0.89 µg/L) are greater than the regional background concentrations and possibly indicate landfill contribution of at least these two constituents. Freon 12 (up to 1.4 µg/L) is also found in all of the shallow downgradient wells, indicating off-Site movement of VOCs in the shallow aquifer

4.0 CONSTITUENTS OF CONCERN, PROPOSED DRAFT CLEANUP LEVELS, AND POINTS OF COMPLIANCE

A large number of environmental samples have been collected at the Site as part of the activities described in this report. In order to develop screening and draft cleanup levels, the existing data set was examined for the media of concern. The environmental media sampled at the Site were soil, LFG, and groundwater. However, soil and LFG are not considered media for which cleanup levels need to be established because the affected soil and LFG are within the permitted landfill boundaries, with little potential for human exposure. Groundwater, on the other hand, shows impacts downgradient of the MSW cells; therefore, cleanup levels must be established for groundwater. The following table indicates the analyte groups for which Site groundwater samples were tested historically for groundwater and when that testing was conducted.

	Remedial Investigation (2012–2013)		Appendix III Parameters (2002 and 2012)*			
Site samples	Conventional parameters	VOCs	SVOCs	Metals	PCBs	Pesticides/ herbicides

*Source: WAC 173-351-990, Appendix III, list of parameters

PCB = Polychlorinated biphenyl

SVOC = Semivolatile organic compound

VOC = Volatile organic compound

Table 7 summarizes all the RI groundwater sampling results for detected analytes to identify COCs for the Site. The steps for identifying the COCs were as follows:

- Step 1—identify detected chemicals by media.
- Step 2—develop screening levels for detected chemicals by media.
- Step 3—compare concentrations of detected chemicals to screening levels.

4.1 CHEMICALS IDENTIFIED IN GROUNDWATER

During the RI, groundwater samples were analyzed for the following chemical groups:

- Conventional parameters by various USEPA methods;
- VOCs by USEPA Method 8260C;
- SVOCs by USEPA Method 8270C;
- Pesticides/herbicides by USEPA Methods 8081A/8141A/8151A:
- PCBs by USEPA Method 8082; and
- Metals by various USEPA methods.

Groundwater has been collected regularly from monitoring wells at the Site for compliance monitoring purposes and a significant amount of data exist. These data are summarized in Appendix G.

Table 10 lists the constituents that were detected during the RI and their maximum detected concentrations. To be protective, all constituents detected in groundwater during the RI were retained for the development of groundwater screening levels regardless of their frequency of detection.

4.2 DRAFT CLEANUP LEVELS AND CONSTITUENTS OF CONCERN

4.2.1 GROUNDWATER SCREENING LEVELS AND CONSTITUENTS OF CONCERN

The following pathway was considered for the establishment of groundwater screening levels at the Site: protection of human health via drinking water as the highest beneficial use.

In developing screening levels for the Site, it is relevant to note that there are currently no complete exposure pathways from groundwater at the Site itself, because groundwater from the Site wells is only used for nonpotable purposes. There is a potential pathway of exposure for resident's downgradient of the landfill who currently use wells for domestic purposes, if contaminants from the Site were to migrate to these wells at levels exceeding applicable screening levels or drinking water standards. As described in Section 5.4 below, however, sampling at selected downgradient domestic wells has indicated detections of COCs consistently less than the screening levels and the National Primary Drinking Water Standard maximum contaminant levels.

Because the Site is not located within 2,000 feet of any perennial creeks or waterways, protection of surface water resources was not considered as a pathway for the establishment of groundwater screening levels.

4.2.1.1 Applicable Groundwater Screening Levels

Consistent with MTCA requirements in WAC 173-340-720(4) for selecting Method B groundwater cleanup levels, the following promulgated standards were used to identify concentrations that would be protective of human health via drinking water consumption and/or inhalation of vapors that are volatilized from water:

- Protection of human health via drinking water consumption: MTCA Method B groundwater cleanup levels; and
- Protection of human health via drinking water consumption: state and federal drinking water maximum contaminant levels (MCLs).

4.2.1.2 Groundwater Screening Levels

The most stringent screening levels for PCE and vinyl chloride in groundwater are listed in the following table. PCE and vinyl chloride were the only chemicals with concentrations that exceeded their respective screening levels at the Site. Where multiple criteria were available for a chemical, the lowest value was selected, consistent with MTCA [WAC 173-340-720 (4)(b)(i)]. The MTCA Method B cleanup level of 4 μg/L was selected as the screening level for TCE. The maximum detected TCE concentration is 2.2 μg/L, and TCE was therefore eliminated as a COC. All applicable screening levels are provided in Table 10. The following table is a summary of chemicals that were detected during the RI in groundwater samples at concentrations greater than the proposed screening levels and are, therefore, considered to be COCs at the Site. The highest concentrations were detected in monitoring well MW-15, with vinyl chloride detected in MW-15 only. The maximum and average concentrations of PCE in the groundwater samples collected from the Site wells were less than the screening levels in all the wells except MW-15.

Constituent of Concern	Screening Level (μg/L)	Maximum Detected Concentration (μg/L)
Tetrachloroethene	5	6.8
Vinyl chloride	0.029	1.2

μg/L = micrograms per liter

Chloroethane was detected during the RI. A cleanup level is not proposed for chloroethane because no applicable or relevant and appropriate requirements (ARARs) or MTCA cleanup levels are available. Chloroethane was also detected at a very low frequency at the Site (1 percent). Elimination of chemicals as COCs at a Site based on infrequent or anomalous detection is consistent with the COC screening approach described in USEPA Risk Assessment Guidance (USEPA 1989).

4.2.1.3 Proposed Draft Groundwater Cleanup Levels

Proposed draft groundwater cleanup levels have been developed for PCE and vinyl chloride based on the screening levels in the previous table. The rationale for cleanup level development is as follows:

- The cleanup level for PCE is based on the most stringent of the ARARs and is, therefore, equal to the screening level of 5 μg/L, as indicated in the following summary table.
- The cleanup level for vinyl chloride has been adjusted upward from the screening level of 0.029 μg/L. In accordance with WAC 173-340-720, groundwater cleanup levels for individual hazardous substances may be adjusted provided that in making these adjustments, (1) the cleanup level is at least as stringent as the most stringent concentration established under applicable state and federal laws (in this case, MCLs), and the cleanup level is at least as stringent as the concentrations that protect human health. A concentration is sufficiently protective if the hazard index does not exceed 1 and the total excess cancer risk does not exceed 1 in 100,000 (1×10^{-5}).

The proposed adjusted cleanup level for vinyl chloride is provided in the following table, along with the associated risk. The table indicates that this value, even with the upward adjustment, meets the intent of WAC 173-340-720. The value is less than the state and federal MCL of 2 μg/L and meets the risk requirements with a total excess cancer risk of 1.0×10^{-5} and a hazard index of 0.11 (including the risk posed by PCE). The values indicated in the following table are, therefore, proposed as draft groundwater cleanup levels for PCE and vinyl chloride.

Constituent of Concern	Draft Proposed Cleanup Level (µg/L)	Associated Risk Values	
		Excess Cancer Risk	**Hazard Quotient**
Tetrachloroethene	5.0	2.3×10^{-7}	0.1
Vinyl chloride	0.29	9.9×10^{-6}	0.01
	Total Risk	1.0×10^{-5}	0.11

µg/L = micrograms per liter

The average concentrations of PCE and TCE detected during the RI sampling event are shown on Figure 16. Although not a COC, TCE is included in the figure because it was detected so frequently at the Site. The PCE concentrations are compared to the proposed draft cleanup level for PCE. The figure indicates that while PCE has been detected Site-wide, it has been detected at concentrations exceeding the proposed cleanup level in only monitoring well MW-15. The extent of vinyl chloride is limited to MW-15, where it has been detected at concentrations exceeding its proposed cleanup level during all RI and historical sampling events.

4.3 POINTS OF COMPLIANCE

Points of compliance (locations where the cleanup levels must be achieved) are established for each affected medium at the Site. The media of concern, the COCs, the pathways of exposure, and the locations of the exceedances of the proposed cleanup levels were identified during the RI process and are summarized in Section 5, Conceptual Site Model. Groundwater is the only identified environmental medium of concern; therefore, the points of compliance are identified for groundwater only.

The standard point of compliance for groundwater under MTCA is "throughout the site from the uppermost level of the saturated zone extending vertically to the lowest depth which could potentially be affected by the site" [WAC 173-340-720(8)(b)]. However, for landfills, a conditional point of compliance is typically used that sets the point of compliance at the downgradient edge of the waste cells, or the landfill boundary, whichever is closer [WAC 173-340-720(8)(c)]. For this Site, the downgradient boundary coincides with the western edge of Area 5; therefore, the conditional point of compliance should be set along the western property boundary. Compliance may be monitored by a series of monitoring wells located as close as practical to this boundary; from north to south, the wells are MW-3, MW-15D, MW-15, MW-18, MW-16, and MW-14B.

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5.0 CONCEPTUAL SITE MODEL

This section describes the conceptual site model developed from the available information about the landfill as described in the preceding sections. According to MTCA, the goal of the conceptual site model is to identify the potential or suspected sources of hazardous substances, the types and concentrations of hazardous substances, the potentially contaminated media, and the potential exposure pathways and receptors. The conceptual site model provides the foundation for defining the objectives of the FS.

5.1 SUSPECTED SOURCES OF HAZARDOUS SUBSTANCES

Most of the waste disposed of at the Site is MSW transported to the Site by commercial and public garbage disposal service contractors from the City, as well as Walla Walla and Columbia Counties, which are predominantly rural counties with an agricultural economic base and little manufacturing or heavy industry. Permitted waste disposal at the Site has been limited to MSW, asbestos, and medical wastes. The Site has also provided special areas for animal carcass disposal. Hazardous substances have never knowingly been allowed into the landfill based on the available information.

Based on the RI data, the suspected sources of hazardous substances found in groundwater at the landfill include the following

- LFG;
- Direct disposal of MSW in groundwater; and
- Leachate.

LFG was observed in all MSW disposal areas during the RI. The elevated VOC concentrations in the LFG samples indicated high potential for LFG contaminants to migrate to groundwater. The VOCs in LFG are likely the primary contributor to the groundwater quality impacts observed at the landfill.

Direct disposal of MSW in groundwater appears to be limited to a small area located within the northern Area 5 disposal trench. VOC and inorganic constituent concentrations in groundwater do not increase significantly downgradient of the MSW in groundwater, and therefore the small area of deposition below the groundwater table is not considered a significant contaminant source. MSW occurrence below the water table was observed only in SB-20; however, wet soils were observed near the base of the MSW in several other borings in the vicinity of SB-20. The declining elevation of the regional groundwater table is beneficially providing greater separation of the MSW and groundwater with time and, therefore, should provide better protection from the migration of VOCs to groundwater.

The RI data indicate that leachate could be a contributing source based on the following:

- Conventional parameter concentrations in MW-15 exceed the background and upgradient well data.
- Low level VOCs were detected in soil samples collected beneath the MSW in Areas 1, 2, and 5. The low level VOCs observed in soil below the MSW are not considered a significant contaminant source to groundwater.
- Thin (less than 5 feet thick) landfill cover soils were observed above all of Area 2 and a small portion of Area 5.
- Stormwater drainage channels extend along the north side of Area 5, and stormwater run-on was observed in the southwestern portion of Area 5. Boggy areas and erosion channels were also observed in the southwestern portion of Area 5.

5.2 CONTAMINATED MEDIA

5.2.1 SOIL

Soil is not considered a medium of concern at the Site. No human exposure is possible because the contaminated soils were found beneath the permitted landfill cells at depths greater than 15 feet bgl, the areas of contamination are capped, and institutional controls [such as those described in WAC 173-340-440(1)(a)(b)(c) and (d)] are in effect for the landfill as a requirement of the Municipal Solid Waste Permit.

5.2.2 GROUNDWATER

5.2.2.1 Maximum Beneficial Use

The maximum beneficial use of groundwater is for drinking water purposes, so groundwater concentrations were compared to cleanup levels appropriate for drinking water use (refer to Table 10). PCE and vinyl chloride concentrations exceed applicable standards and were defined as the COCs for the Site (but constrained to only well MW-15 only). The maximum detected PCE concentration in groundwater is 6.8 µg/L, which is greater than the proposed cleanup level of 5.0 µg/L, and the maximum detected vinyl chloride concentration is 1.2 µg/L, which is greater than the proposed cleanup level of 0.29 µg/L based on the MTCA Method B approach but less than the state and federal drinking water standard of 2.0 µg/L.

5.2.2.2 Area-wide and Domestic Well Groundwater

Groundwater monitoring data have indicated the presence of low concentrations of chloroform, PCE, and TCE in groundwater extending from the eastern boundary of the City property (6,300 feet east and hydraulically upgradient of the landfill boundary) and as far west as the Small domestic supply well (4,600 feet west of the landfill boundary). None of the concentrations detected outside of the landfill boundary exceeded applicable cleanup levels. One or more of these three contaminants were also detected in samples from all of the wells tested during the RI, except the Schmidt and Kinman domestic supply wells. Based on the RI data, these contaminants observed upgradient of the landfill, and at least in part beneath and downgradient of the landfill originate from an upgradient source.

5.2.2.3 Localized Groundwater near MW-15

The contaminants detected in groundwater samples from MW-15 and off-Site wells downgradient of MW-15 are distinct from those detected in all the other Site and downgradient domestic wells in that they consist of a broader list of VOCs. The constituent list includes PCE, TCE, chloroethane, 1,1-dichloroethane, *cis*-1,2-dichloroethane, Freon 12, Freon 11, and vinyl chloride, but not chloroform. Concentrations of PCE and vinyl chloride in MW-15 exceeded the draft proposed cleanup levels. No other constituent in a downgradient off-Site well sample exceeded a screening level.

Inorganic constituents, including calcium, sodium, bicarbonate, chloride, alkalinity, and TDS, were also detected in groundwater samples from MW-15. The concentrations of these constituent concentrations do not exceed the screening levels but are possible indicators of landfill leachate impacts on groundwater in the vicinity of MW-15.

5.2.2.4 Landfill Area Groundwater

Common contaminants detected in groundwater monitored by the Site monitoring wells include chloroform, PCE, Freon 11, and Freon 12. TCE was also detected in five of the Site wells located in the vicinity of Area 5.

Average PCE concentrations in most Site wells are slightly higher than the average PCE concentrations detected in wells upgradient of the landfill, indicating possible landfill contribution of PCE to groundwater. The presence of Freon 11 and Freon 12 likely indicates landfill impacts on groundwater, as noted above. Based on these findings, the landfill is likely having an impact on groundwater; however, none of the detected constituents exceeded a screening level, and therefore groundwater in the landfill area (with the exception of MW-15) does not appear to be contaminated by concentrations greater than the proposed draft cleanup levels.

5.2.3 LANDFILL GAS

LFG is generated during the decomposition of refuse by anaerobic bacteria and the release of VOCs from the disposed waste products. The LFG studies conducted during the RI indicate that while off-Site methane migration has not occurred, the VOCs found in LFG at Areas 1 and 5 are at high enough concentrations to pose a risk of directly contaminating groundwater (cross-media pathway). Area 6 has an LFG collector system (active since 2010); Areas 1 and 5 do not. Soil vapor intrusion at the HHWF was not considered a significant concern.

5.2.4 STORMWATER

Stormwater itself is not considered a potentially contaminated medium because there are no pathways for stormwater at the Site to encounter hazardous materials before running off-Site. However, stormwater infiltration through or adjacent to the MSW and the subsequent generation and downward migration of leachate to groundwater has been identified as a possible cause of groundwater contamination. The leachate appears to be the primary source of conventional parameter impact to groundwater, while the VOC impacts from leachate appear to be minor. The areas of concern include the following:

- The north drainage ditch engineering controls implemented during the 2010 interim action promote drainage past Area 5. However, the constructed drainage pathway is filling with soil and vegetation, which is impeding water movement off-Site. It appears that the existing drainage ditch is approximately 30 to 40 feet from the MSW in Area 5.
- Stormwater run-on occurs at the southwest side of Area 5, in the vicinity of the entrance to the compost facility.
- Stormwater flow on the surface of Area 5 has caused erosion of the soil cover on the west side of Area 5.
- Two linear road cuts located on the north slope of Area 5 likely impede stormwater flow and potentially promote infiltration.
- The soil cover thickness over Area 2 may be insufficient to prevent infiltration of precipitation and stormwater.

5.3 FATE AND TRANSPORT

Chlorinated VOCs can be very persistent in the environment and can travel downgradient significant distances before attenuating. Attenuation can occur by direct adsorption of molecules to soil organic carbon, by biodegradation, or by simple dispersion of the molecules away from the core of the plume into surrounding groundwater as it travels downgradient. With biodegradation, the presence of biodegradation "daughter products" such as *cis*-1,2-dichloroethene and vinyl chloride (found in MW-15) suggests that biodegradation of the plume is significant and occurring in and near the source area. This is typical of plumes in anaerobic environments found in groundwater affected by landfill leachate or LFG, because the bacteria that are capable of biodegrading chlorinated compounds typically live in highly reducing anaerobic environments; however, once the chlorinated plume migrates beyond the limited area of anaerobic activity, little further degradation is expected to occur in the oxidizing environment found in downgradient groundwater.

Therefore, the primary fate and transport mechanism in downgradient groundwater is advective transport and dispersion of the contaminants downgradient until the contaminants eventually attenuate by dispersion or become firmly bound to soil organic matter in the aquifer. The growth or decay of the plume depends on the balance between groundwater flow and the amount of contaminant mass being replenished to the aquifer. If the source of the contamination can be controlled, the plume is expected to diminish in size as it is transported downgradient in groundwater. Alternatively, if the source mass is increased, the plume will grow in size, because it overwhelms the attenuation ability of the aquifer.

5.4 RECEPTORS/PATHWAYS OF EXPOSURE

Groundwater is the primary contaminated medium at this Site and its highest beneficial use is for drinking. Exceedances above the draft cleanup levels have been detected only at MW-15. Off-property migration of contaminants in groundwater has occurred, but not at concentrations that are causing exceedances of the draft cleanup levels in the nearest off-Site monitoring wells. Currently, there are no complete exposure pathways from groundwater at the Site itself, because groundwater from Site wells is not used for potable purposes.

Possible receptors of contaminants in groundwater are downgradient domestic well users. However, domestic well users are located over ¾ mile downgradient of the Site, and a review of VOC concentrations in their wells by the Washington State Department of Health in 2012 (WDOH 2012) indicated that the concentrations were safe for individuals who use the groundwater for drinking, showering, bathing, and cooking. VOC concentrations detected in two residential wells during the RI were consistently less than the screening levels and the National Primary Drinking Water Standard maximum contaminant levels. Therefore, the risk to domestic well groundwater users does not reach a level that requires action.

The LFG studies conducted during the RI indicate that off-Site methane migration and soil vapor intrusion into the HHWF and equipment building are not pathways of exposure.

5.4.1 TERRESTRIAL ECOLOGICAL EVALUATION EXCLUSION

A terrestrial ecological evaluation was not conducted for the Site, because all the contaminated soil and MSW in inactive cells is covered by a physical barrier (soil cover), and institutional controls [such as those described in WAC 173-340-440(1)(a)(b)(c) and (e)] are in effect for the landfill as a requirement of the Municipal Solid Waste Permit. Additionally, any possible soil contamination is expected to be greater than 15 feet bgl and would, therefore, also meet the standard point of compliance described in WAC 173-340-7490(4)(b). These conditions are sufficient to meet the exclusion criteria described in WAC 173-340-7491(1)(a), (b), or(c).

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6.0 REMEDIAL ACTION REQUIREMENTS

This section identifies the requirements that must be met for a remedial alternative to comply with MTCA. The landfill is composed of seven disposal areas (Areas 1 through 7) and covers approximately 125 acres of a larger 828.86-acre City-owned parcel that is zoned as “reserved” and used for various waste management purposes. All disposal areas have been closed except for Area 7. Area 7 is a lined cell with leachate controls operating in compliance with Chapter 173-351 WAC, is still actively accepting waste, and is not included in the FS.

6.1 MTCA CLEANUP REQUIREMENTS

In order to meet the requirements of MTCA, the selected remedy must be protective of human health and the environment. WAC 173-340-360(2)(a) specifies four threshold criteria that all cleanup actions must satisfy:

- Protect human health and the environment.
- Comply with cleanup standards (WAC 173-340-700 through 173-340-760).
- Comply with applicable local, state, and federal laws (WAC 173-340-710).
- Provide for compliance monitoring (WAC 173-340-410 and WAC 173-340-720 through 173-340-760).

In addition, WAC 173-340-360(2)(b) specifies three other criteria that alternatives must satisfy:

- Use permanent solutions to the maximum extent practicable.
- Provide for a reasonable restoration timeframe.
- Consider public concerns (WAC 173-340-600).

Because of the typical size and history of solid waste landfills, it is impracticable to treat solid waste or remove solid waste from a landfill as part of a cleanup action. MTCA allows containment for sites that contain large volumes of materials with relatively low levels of hazardous substances, like MSW landfills [refer to WAC 173-340-370(3)]. Further, MTCA uses the landfill closure requirements as the minimum requirements for landfill cleanup actions [refer to WAC 173-340-710(7)(c)].

Under MTCA, closed landfills are considered to be sites that have used “containment of hazardous substances” as the remedial action. Under WAC 173-340-740(6)(f), MTCA defines the expectation for containment sites as follows:

> *WAC 173-340-740(6)(f): The department recognizes that, for those cleanup actions selected under this chapter that involve containment of hazardous substances, the soil cleanup levels will typically not be met at the points of compliance specified in (b) through (e) of this subsection. In these cases, the cleanup action may be determined to comply with cleanup standards, provided:*

(i) The selected remedy is permanent to the maximum extent practicable using the procedures in WAC 173-340-360;

(ii) The cleanup action is protective of human health. The department may require a site-specific human health risk assessment conforming to the requirements of this chapter to demonstrate that the cleanup action is protective of human health;

(iii) The cleanup action is demonstrated to be protective of terrestrial ecological receptors under WAC 173-340-7490 through 173-340-7494;

(iv) Institutional controls are put in place under WAC 173-340-440 that prohibit or limit activities that could interfere with the long-term integrity of the containment system;

(v) Compliance monitoring under WAC 173-340-410 and periodic reviews under WAC 173-340-430 are designed to ensure the long-term integrity of the containment system; and

(vi) The types, levels, and amount of hazardous substances remaining on-site and the measures that will be used to prevent migration and contact with those substances are specified in the draft cleanup action plan.

For closed solid waste landfills (or closed solid waste landfill cells), Ecology allows containment to be part of the remedial action. It is unnecessary to evaluate removal actions or perform a disproportionate cost analysis (DCA) for removal, as otherwise required under WAC 173-340-360); however, the specific remedy selected for the landfill must demonstrate that the other elements of containment are met as defined by Sections (ii) through (iv) above.

6.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

In accordance with MTCA, all cleanup actions must comply with applicable state and federal laws [WAC 173-340-710(1)]. MTCA defines applicable state and federal laws to include legally applicable requirements and those requirements Ecology determines are relevant and appropriate requirements based on consideration of the criteria in WAC 173-340-710(4). Collectively, these requirements are referred to as ARARs. The potential ARARs for this project include the following:

- MTCA Cleanup Regulation (Chapter 173-340 WAC);
- Minimum Functional Standards for Solid Waste Handling (Chapter 173-304, WAC);
- Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC);
- Solid Waste Handling Standards (Chapter 173-350 WAC);
- Dangerous Waste Regulations (Chapter 173-303 WAC);
- State Environmental Policy Act (SEPA) Rules (Chapter 197-11 WAC);
- Safe Drinking Water Act, Primary Drinking Water Regulations [Code of Federal Regulations Title 40, Part 141 (40 CFR 141)]
- State Water Code and Water Rights (Chapters 173-150 and 173-154 WAC);
- Underground Injection Control Program (Chapter 173-218 WAC);

- State Water Pollution Control Act (Chapter 90.48 RCW);
- Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 RCW);
- Washington Clean Air Act (Chapter 70.94 WAC);
- General Regulations for Air Pollution Sources (Chapter 173-400 WAC);
- Operating Permit Regulation (Chapter 173-401 WAC);
- Occupational Safety and Health Act (29 CFR 1910.120);
- Washington Industrial Safety and Health Act (Chapter 49.17 RCW); and
- Accreditation of Environmental Laboratories (Chapter 173-50 WAC).

6.3 REDEVELOPMENT AND LAND USE GOALS

In order to meet the cleanup requirements identified above, it is important to identify whether there are any future redevelopment plans for the Site to ensure that the selected remedy meets the goals for the landfill in both its present state and future configurations.

The Sudbury Road Landfill covers approximately 125 acres of a larger 828.86-acre City-owned parcel that is zoned as “reserved” and used for various waste management purposes. Area 7 of the landfill is operating in compliance with a Chapter 173-351 WAC Solid Waste Permit. The total fill date for Area 7, cells 1 through 3, is projected to be in the year 2038, with available expansion areas to the north or east of the landfill.

Land use of the Site into the foreseeable future is designated for waste disposal purposes. After the closure of the landfill, an environmental covenant will be recorded on the landfill property and will meet at a minimum the requirements stipulated in WAC 173-351-500(1)(h).

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7.0 PRELIMINARY REMEDIAL ALTERNATIVES SCREENING

The RA Focusing Study (Schwyn 2013a) was prepared for the Site and submitted to Ecology on November 8, 2013, and subsequently approved by Ecology. As part of the RA Focusing Study, a list of potential cleanup action technologies was compiled on the basis of the nature and sources of the COCs identified for the Site, the environmental medium of concern (groundwater), and the potential exposure pathway (drinking water). Potentially applicable cleanup action technologies were screened against the criteria described in WAC 173-340-350(8)(b) and WAC 173-340-360(2)(a)(b). The RA Focusing Study provided the basis for the alternatives that are evaluated as part of this FS and was used as the baseline for the evaluation.

7.1 IDENTIFICATION OF REMEDIAL ACTION OBJECTIVES

The RAOs must address all of the affected media, and the recommended cleanup alternative must achieve all of the RAOs to be considered a viable cleanup action. Based on the RI findings, the only environmental medium that requires cleanup is groundwater. Exceedances of the proposed groundwater cleanup levels have been detected only at well MW-15, which is at the conditional point of compliance. Off-Site migration of contaminants in groundwater has occurred; however, there were no exceedances of the proposed cleanup levels in samples from the nearest off-Site monitoring and domestic wells. There are no complete exposure pathways from groundwater at the landfill itself, because groundwater from Site wells is only used for nonpotable purposes. The suspected sources of hazardous substances detected in groundwater at the landfill include contact of MSW with groundwater (localized and considered a minor source), landfill leachate, and LFG.

Protection of human health and the environment at the Site can be achieved through the fulfillment of the following RAOs:

- Protect groundwater resources by eliminating, reducing, or controlling the suspected sources of COCs (specifically PCE and vinyl chloride) detected in groundwater at the landfill.
- Prevent direct contact with landfill contents to protect human and terrestrial receptors;
- Control stormwater runoff, run-on, and erosion;
- Control contaminant leaching to groundwater by minimizing stormwater infiltration at the landfill;
- Control and treatment of LFG buildup; and
- Control and/or treatment of contaminated groundwater and/or leachate.

7.2 SCREENING CRITERIA

Three general criteria were established to screen the potential cleanup technologies identified for the Site. These criteria provide a basis for evaluating the minimum requirements and procedures for selecting cleanup actions described in WAC 173-340-360(2)(a)(b) and help form a basis for evaluating whether a potential cleanup technology, if implemented, would meet the baseline standards established for alternatives screening in WAC 173-340-350(8)(b).

- ***Technical Feasibility/Effectiveness***. The technical feasibility criterion relates to engineering factors associated with the ability of the technology to function effectively and achieve meaningful progress toward the RAOs, based on site-specific characteristics, including the nature and extent of the COCs, waste/source type and locations, site hydrogeology, and time required to achieve the proposed cleanup levels. The effectiveness criterion relates to the ability of the technology to achieve the RAOs.
- ***Implementability***. This criterion relates to administrative and field issues associated with the technology, including ARARs, construction schedule, constructability, access, monitoring, operation and maintenance, and community concerns.
- ***Cost***. Both relative cost and cost-effectiveness are considered for this criterion to ensure that the cost of the preferred remedial alternative is proportionate to the environmental benefit obtained. For this screening, knowledge of typical technology costs for prior projects and engineering judgment were used to determine the cost of a technology relative to that of other similar technologies.

7.3 EVALUATION OF CLEANUP ALTERNATIVES

As set forth in WAC 173-340-360, MTCA requires that cleanup alternatives be compared to a number of criteria to evaluate the adequacy of each alternative in achieving the intent of the regulations and to serve as a basis for comparing the relative merits of the developed cleanup alternatives. Consistent with MTCA, the alternatives were evaluated in terms of their compliance with threshold requirements, permanence, and restoration timeframe.

7.3.1 THRESHOLD REQUIREMENTS

As specified in WAC 173-340-360(2)(a), all cleanup actions must meet the following threshold requirements:

- Protection of human health and the environment;
- Compliance with cleanup levels specified under MTCA;
- Compliance with applicable state and federal laws; and
- Provisions for compliance monitoring.

7.3.2 REQUIREMENT FOR PERMANENT SOLUTION TO THE MAXIMUM EXTENT PRACTICABLE

WAC 173-340-200 defines a permanent solution as one in which cleanup levels can be met without the requirement for further action at the original site or any other site involved in the cleanup action, other than the approved disposal site for any residue from the treatment of hazardous substances. Ecology recognizes that permanent solutions may not be practicable for all sites. To determine whether a cleanup action is permanent to the "maximum extent practicable," MTCA requires the use of a DCA [WAC 173-340-360(3)(b)]. Evaluation of the practicability of a given alternative is a comparative evaluation of whether the incremental increase in cost associated with increasingly protective cleanup actions is substantial and disproportionate to the incremental increase in environmental benefit. In accordance with WAC 173-340-360(3)(f), the following criteria are used to evaluate and compare each technology when conducting a DCA:

- ***Overall protectiveness*** of human health and the environment, including the degree to which site risks are reduced, the risks during implementation, and the improvement of overall environmental quality;
- ***Long-term effectiveness,*** including the degree of certainty that the alternative will be successful, the long-term reliability, the magnitude of residual risk, and the effectiveness of controls required to manage treatment residues and remaining waste;
- ***Management of short-term risks,*** including the protection of human health and the environment during construction and implementation;
- ***Permanent reduction in toxicity, mobility, and volume of hazardous substances,*** including the reduction or elimination of hazardous substance releases and sources of releases;
- ***Implementability,*** including consideration of whether the alternative is technically possible; the availability of necessary off-site facilities, services, and materials; administrative and regulatory requirements; the scheduling, size, and complexity of construction; monitoring requirements; access for construction, operations, and monitoring; and integration with existing facility operations;
- ***Cleanup costs,*** including capital costs and operation and maintenance costs; and
- ***Consideration of public concerns,*** which will be addressed by the receipt of public comments related to the CAP.

In the DCA, cleanup alternatives are arranged from most to least permanent based on the criteria specified in WAC 173-340-360(3)(f). Costs are disproportionate to benefits if the incremental costs of the more permanent alternative exceed the incremental benefits achieved by the lower cost alternative [WAC 173-340-360(3)(e)(i)]. Alternatives that exhibit disproportionate costs are considered "impracticable." When the benefits of two alternatives are equivalent, MTCA specifies that Ecology select the least costly alternative [WAC 173-340-360(3)(e)(ii)(C)]. For closed solid waste landfills (or landfill cells), Ecology allows containment of wastes rather than removal as the primary component of the remedial action. As described in Section 6.1, it is therefore unnecessary to evaluate removal actions or perform a DCA for removal (as otherwise required under WAC 173-340-360).

7.3.3 REQUIREMENT FOR A REASONABLE RESTORATION TIMEFRAME

WAC 173-340-360(4)(b) specifies that the following factors be considered in establishing a "reasonable" timeframe:

- Potential risks to human health and the environment;
- Practicability of achieving a shorter restoration timeframe;
- Current use of the Site, surrounding areas, and associated resources that are, or may be, affected by releases from the Site;
- Potential future use of the Site, surrounding areas, and associated resources that are, or may be, affected by releases from the Site;
- Availability of alternative water supplies;
- Likely effectiveness and reliability of institutional controls;
- Ability to control and monitor migration of hazardous substances from the Site;
- Toxicity of the hazardous substances at the Site; and
- Natural processes that reduce concentrations of hazardous substances and have been documented to occur at the Site or under similar site conditions.

7.3.4 REQUIREMENT FOR CONSIDERATION OF PUBLIC CONCERNS

The draft final RI/FS Report will be issued for public comment to provide the public an opportunity to express any concerns. Those concerns will be considered by Ecology and, if appropriate, a responsiveness summary will be prepared and the RI/FS Report will be modified in response to the public concerns.

7.4 LANDFILL REMEDY COMPONENTS

This section generally describes the components of the landfill remedy, which are considered in more detail, and identifies their purpose and how they relate to the condition of a landfill. A review of the remedies is included in the evaluation of remedial alternatives for the landfill and incorporated into the detailed evaluation of alternatives described in Section 8.0.

7.4.1 LANDFILL CAP, INCLUDING STORMWATER CONTROLS

Implementing a landfill cap and managing stormwater at a landfill minimizes infiltration of waters into the landfill, minimizes the potential for contaminant leaching to groundwater, and prevents conveyed stormwater from coming into direct contact with landfill contents.

7.4.2 SOURCE AREA GROUNDWATER CONTROLS, INCLUDING LEACHATE CONTROLS

The amount of leachate entering groundwater must be limited or controlled at a landfill. For closed disposal areas, this can be accomplished by minimizing the amount of groundwater interacting with the solid waste by means of capping and stormwater controls.

7.4.3 LANDFILL GAS COLLECTION AND TREATMENT

An additional component of the remedy is ensuring that the LFG is addressed properly. This may be accomplished by a LFG collector and treatment system or monitoring to ensure that the LFG levels are safe. Various gas systems can meet this requirement and, similar to the landfill cap, the final design is based on the conditions of the LFG itself. The LFG system must be designed to capture the gas within a landfill and ensure that the gas does not migrate outside of the landfill boundary and is discharged safely. If necessary, the LFG controls may also include provisions for the protection of buildings, utility corridors, and other surface and subsurface structures to ensure that the LFG does not enter these structures and provides safety to human health and the environment.

7.4.4 INSTITUTIONAL CONTROLS TO SUPPLEMENT ENGINEERING CONTROLS

As part of the remedy for a landfill, institutional controls are typically implemented to ensure the integrity of the containment systems and the health and safety of the landfill users. Typical controls include long-term operation and maintenance plans, and activity and use restrictions and implementation procedures. The exact nature of the institutional controls is site-specific and depends on the selected remedy for the landfill cap, stormwater controls, and leachate controls. There are numerous methods of implementing the selected institutional controls, one of which is a restrictive covenant that outlines the controls on a landfill.

7.4.5 LONG-TERM MONITORING OF ENGINEERING CONTROLS

Long-term monitoring ensures that the engineering controls implemented for the landfill remain effective and have been designed properly. Stormwater monitoring is not required as part of the MTCA process for the landfill because the conveyed stormwater at the Site will not come into contact with the solid waste.

7.5 TECHNOLOGIES RETAINED IN REMEDIAL ALTERNATIVES FOCUSING STUDY

In addition to a review of the components of the remedy for a landfill, potentially applicable cleanup action technologies for the Site were evaluated as part of the RA Focusing Study (Schwyn 2013a). The technologies evaluated in the RA Focusing Study are described in Table 11. A brief description of the technologies is included in the following subsections for each retained alternative, along with the rationale for including (or excluding) them in the detailed evaluation of the alternatives for the Site, which is provided in Section 8.0. These technologies could be implemented in combination with other technologies or as stand-alone treatments in particular areas, depending on the Site conditions. Technologies that are not appropriate or not implementable for the Site or do not meet the remedial action requirements defined in Section 6.0 are shown as rejected in Table 11 and were, therefore, not evaluated further.

7.5.1 NO/LIMITED ACTION

The no-action alternative does not meet the RAOs defined in Section 7.3 and was not retained for further evaluation. A limited-action alternative would consist of keeping current conditions at the landfill (i.e., no additional source control or engineering controls), while implementing minimum requirements, such as institutional controls and long-term monitoring, as outlined in Chapter 173-304 WAC or Chapter 173-351 WAC. This alternative does not meet the RAOs defined in Section 7.3; therefore, it was not retained for further evaluation. However, both institutional controls and long-term monitoring are required under MTCA to ensure the long-term integrity of the containment system at the landfill.

7.5.2 MONITORED NATURAL ATTENUATION

Monitored natural attenuation (MNA) involves routine groundwater sampling and analysis to monitor the results of one or more naturally occurring physical, chemical, or biological processes that reduce the mass, toxicity, volume, or concentration of chemicals in site soils and/or groundwater. MNA is a mechanism by which COCs are reduced (often slowly) through natural means without other control, removal, treatment, or aquifer-modifying activities. These in-situ processes may include biodegradation; dispersion; dilution; sorption; volatilization; and chemical or biological stabilization, transformation, or destruction of contaminants. Groundwater monitoring data and fate and transport modeling are typically required to evaluate the effectiveness of MNA in terms of its protection of potential receptors, such as downgradient domestic water supply from groundwater wells.

MNA cannot typically be implemented as a sole remediation method while source areas (i.e., the landfill mass) remain. Source control (including removal and/or treatment of hazardous substances) must be conducted to the maximum extent practicable to prevent further groundwater contamination in order for MNA to conform with the expectations in MTCA [WAC 173-340-370(7)]. The use of MNA as a sole remediation method would be inconsistent with MTCA, and was not retained for further evaluation.

7.5.3 HYDRAULIC CONTAINMENT

Hydraulic containment involves pumping contaminated groundwater from the subsurface and treating the groundwater ex-situ before it is discharged. Pump and treat is the most common form of groundwater remediation at sites with plumes that have migrated off-site because it typically is very effective in stopping the migration of the plume. However, groundwater concentrations of all COCs are below Site cleanup levels, except for PCE and vinyl chloride at well MW-15, an on-Site well.

Downgradient groundwater in all other on-Site and off-Site wells currently meet the cleanup levels and will be monitored routinely to ensure that the groundwater conditions are improving over time and the COCs are not migrating off-site. The cost of hydraulic containment is disproportionate to the benefit that would be provided; therefore, this alternative was not retained for further evaluation.

7.5.4 SOURCE CONTROLS

Source controls at an MSW landfill typically consist of engineering controls that are put in place to minimize risks to human health and the environment associated with the containment of solid waste within the landfill.

7.5.4.1 Landfill Gas Extraction and Treatment

Many landfills require venting to prevent gas pressure buildup below the landfill cap and to prevent damage to the vegetative cover. LFG extraction (passive or active) is also necessary if the landfill produces excessive odors, if final use of the landfill will involve public access, if buildings may be adversely affected (inhalation or explosion hazards), or to comply with ARARs. Common LFG control technologies include the means to collect, convey, and treat gas to meet regulatory requirements and to mitigate odors or uncontrolled releases that may pose safety and health concerns. LFG control objectives are generally focused on off-site migration and/or on-site accumulation control. The VOC concentrations detected in LFG at the Site indicate that a significant potential for LFG contaminants to migrate to groundwater; therefore, this alternative was retained for further evaluation.

7.5.4.2 Leachate Controls, Including Capping

Landfill leachate is produced as a result of solid waste biodegradation and movement of water through the waste (via infiltration or groundwater flow). Leachate collector and treatment was not required as part of the closure of Areas 1, 2, 5, and 6 and was not deemed necessary because of limited rainfall. Also, groundwater is generally not in contact with solid waste at the landfill (with the exception of a small area within the northern Area 5 disposal trench). It is also infeasible to install a leachate collector and treatment system in the closed areas as a remedial alternative; therefore, this alternative was not retained for further evaluation. A leachate collector system was installed in Area 7 (refer to Section 1.4.2.5). Waste disposal in Area 7 of the landfill began in 2006, and Area 7 is still currently accepting MSW (and is not included in this FS).

The primary purpose of implementing leachate controls at the Site would be to minimize or eliminate the infiltration of water through the solid waste. This can be accomplished with stormwater controls and by the installation of a geosynthetic/multimedia cap, low-permeability or ET soil cover, or manipulation and/or reconstruction of the existing soil cover. Therefore, the landfill cap alternative was retained for further evaluation.

7.5.4.3 Stormwater Controls

Stormwater control is necessary at a landfill to direct and control stormwater runoff and run-on to minimize water infiltration into the landfill, which will reduce leachate production and minimize cap erosion. Stormwater surface controls at a landfill may include surface grading, stormwater channel construction, and/or run-on prevention. Existing stormwater controls are currently in place (refer to Section 1.6.2); however, some improvements could be made, and this alternative was therefore retained for further evaluation.

7.6 TECHNOLOGIES RETAINED FOR FURTHER EVALUATION

Based on the preliminary screening described in Section 7.5, along with a review of the components of the remedy for landfills described in Section 7.4, the following technologies, or combination of technologies, were retained for detailed evaluation:

- LFG extraction and destruction
  - Active control
  - Passive control
- Landfill cap
  - Geomembrane cap
  - ET cap
- Stormwater controls
  - Impervious runoff channel (north drainage ditch)
  - Re-grading areas to prevent Area 5 run-on
  - Piping run-on away from Area 5
  - Runoff control berms on Area 5

8.0 DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

8.1 LANDFILL GAS COLLECTION AND TREATMENT

The LFG studies conducted during the RI indicate that while off-Site LFG migration has not occurred, the VOCs found in LFG in Areas 1 and 5 are at high enough concentrations to pose a risk of contaminating groundwater (cross-media pathway). Area 6 has an LFG collector system (active since 2010). Areas 1 and 5 have no collector system; however, an open gas vent is present at Area 5. The location of the existing LFG system is shown on Figure 17. An evaluation of the existing LFG extraction system indicates that it is effectively controlling LFG in Area 6. Based on the RI findings, soil vapor intrusion into the HHWF is not considered a significant concern. Mitigating actions associated with LFG control should take current landfill regulations in WAC 173-351-200(4) into account, requiring gas control, monitoring and compliance with subsurface migration standards.

This section evaluates the LFG control component of the remedy that would be used to manage LFG. This section also identifies the design constraints for the LFG control systems and identifies the alternatives that may be used as part of the selected remedy for the landfill.

8.1.1 LANDFILL GAS CONTROL METHODS

This section presents the general technologies used to control LFG at landfills. LFG control methods typically rely on either a passive or active collector system. Convertible passive and active control systems are often considered to address potential changing conditions as the composition of LFG changes with time.

Common LFG control technologies include the means to collect, convey, and treat gas to meet the regulatory requirements and mitigate odors or uncontrolled releases that may pose safety and health concerns. The objectives of LFG control are generally focused on off-site migration and/or on-site accumulation. LFG control systems that address migration and accumulation can be categorized as active, passive, or a combination of both. The control objectives and strategies for the Site will focus on both off-site migration and on-site accumulation, considering both active and passive systems.

Off-site LFG migration is driven by a pressure gradient that develops over time between the gas-producing waste and the atmosphere. Gas can migrate through permeable soil, including a cover above or native material to the side or bottom. The rate of gas migration is determined by the magnitude of the pressure gradient, the type and permeability of the soils, and the geometry of the interface between the solid waste and the soil. Landfill cover systems can contribute to the pressure gradient by preventing LFG escape and causing lateral migration. If the gradient is interrupted by a vent to the atmosphere, the path of least resistance will be through the vent instead of the surrounding soils.

8.1.1.1 Passive Control

Passive venting of LFG to control off-site migration and on-site accumulation has been successfully demonstrated throughout the United States. The type of passive vent system used often depends on the depth of solid waste and the type of cover system. Shallow landfills, less than approximately 20 feet deep, can be vented by means of a horizontal trench and perforated pipe system. A deeper landfill may require the installation of vertical wells vented to the atmosphere to provide the necessary “break” in the LFG pressure gradient.

Effective control of on-site gas accumulation at landfill cells that have been closed for a long period or at low-volume and relatively shallow sites can usually be achieved by means of trenches or wells installed immediately below the landfill cover. Additionally, effective perimeter control of LFG migration can usually be achieved by means of simple passive ventilation trenches buried within the edge of the solid waste or native soil. Such passive vent systems consist of a slotted or perforated pipe buried within highly permeable backfill materials (i.e., drain rock). The trench depth depends on the thickness of the solid waste, such that the perforated pipe is placed at approximately one-half the solid waste depth. The burial depth can vary, depending on the native soil conditions or whether changes in the depth of the solid waste edge are required to accommodate a landfill cover system.

8.1.1.2 Convertible Control Systems

A well-designed, integrated landfill control system should ensure that LFG does not migrate beyond the property boundary or accumulate on-site, potentially affecting on-site facilities or groundwater. Converting to an active collector system is generally achieved by providing separate, discrete connections for individual trenches and wells from an unperforated header, allowing location-specific vacuum or venting control. Additionally, impermeable barriers are generally installed in perimeter venting trenches (at the edge of the waste) to allow them to be converted to active systems without inducing excess amounts of atmospheric air and creating a potential fire hazard. Barrier installation costs can be high when compared to the cost of gas venting trenches alone.

8.1.1.3 Active Control

Active LFG control systems are commonly used to extract LFG for destruction, cogeneration, and/or control of off-site migration. Such systems typically include vertical wells or deep horizontal trenches installed throughout the solid waste. The term “active” refers to the application of a vacuum to a gas ventilation system, usually by means of centrifugal blowers (i.e., exhausters) driven by electric motors. Instead of providing a passive “break” in the pressure gradient between the waste and the atmosphere, an active system “pulls” the gas out by applying a negative (vacuum) pressure at the collection points. The gas is then conveyed to a treatment system for destruction (e.g., flare system), adsorption (e.g., granular activated carbon), or it is vented to the atmosphere, depending on the concentrations of gas constituents.

The effectiveness of an active LFG collector system depends greatly on the design and operation of the system and on the methane generation capability of the landfill waste. An effective collector system should be designed and configured as follows:

- To handle the maximum LFG generation rate,
- With a sufficient radius of influence to effectively collect LFG from all areas of the landfill, and
- To monitor and adjust the operation of individual extraction wells and trenches.

Many configurations of wells and trenches, including perimeter systems and in-refuse network-type systems, have proven to be successful at controlling LFG and eliminating off-site migration at a wide variety of landfills. The Area 6 LFG collector system includes gas extraction wells and no trenches.

Landfill settlement is a concern for in-refuse horizontal collectors. Active control systems are balanced by adjusting the vacuum level applied to the perforated piping within the trench or well system. Typically, a radius of influence and appropriate vacuum level are estimated based on the soil permeability, site geometry, and collector design. Monitoring probes located within the vicinity of the LFG collectors can be used to adjust a control system until a proper radius of influence is achieved, without creating an excessive vacuum. Usually, an active system's applied vacuum is balanced to evacuate LFG within a defined area without pulling in air from above the surface or surrounding soil. Where excess atmospheric air (oxygen-rich air) is pulled into the solid waste, either inadvertently or by design, the collector system must be monitored and controlled to avoid potential fires.

8.1.2 LANDFILL GAS CONTROL FEATURES

Design features generally applicable to a variety of passive venting or active collector systems are briefly described in the following subsections.

8.1.2.1 Passive Collector Trench System

A full perimeter passive collector trench system may average approximately 6 feet in depth. A backhoe or small track hoe could excavate the trench to a minimum width of 2 feet. The geotextile, bedding/backfill, pipeline, and appurtenances would then be installed within the trench. It would be necessary to adhere to Occupational Safety and Health Administration (OSHA) guidelines for work in hazardous locations (i.e., protective clothing and ambient air monitoring).

Riser vents for passive collection pipelines are typically 4-inch-diameter HDPE pipes that are tied into main horizontal collectors. It is not necessary to include valves on the risers because the system maintains near-atmospheric pressures. Depending on the site conditions, risers typically extend a minimum of 6 feet above grade and terminate in a bird screen or rain cap. Cleanouts are spaced at

300-foot intervals, depending on the horizontal trench layout. Cleanouts consist of angled (45 degrees) 4-inch-diameter HDPE risers for the insertion of a vacuum or flushing wand and hose.

8.1.2.2 Active Collector Trench System

An active perimeter collector trench system would be similar to the passive trench system; however, it may include an impermeable barrier to minimize air intrusion at the waste boundary. Active collector trenches that are not installed at the waste boundary would not include an impermeable barrier. The perimeter perforated piping would be connected to a solid header or manifold with valve stations to allow discrete control of trench segments. Active collection trenches would be installed to a depth of 7 to 8 feet.

For an active collector system, a separate HDPE solid pipe header, buried below grade, would be installed to provide vacuum to key points in the perforated collector pipeline, based on the perimeter collector length. Control valves with flow monitoring ports, installed in hand holes on a lateral that connects the vacuum header to the perforated collector, would allow adjustment of suction pressure to various points in the system. The suction header, control valves, and laterals would also be necessary to balance the applied vacuum to the entire perimeter system, as required.

An active system requires vacuum pressure supplied by single-stage, explosion-proof centrifugal blowers/exhausters. Typically located on a concrete pad, the system includes header piping, a condensate collector (i.e., water knockout), isolation valves, and blower/vent pipes. A weatherproof control panel and power supply also would be required. To reduce noise and/or screen the exhauster equipment from view, a small ventilated enclosure may be supplied.

8.1.2.3 Active Extraction Well System

An extraction well system is similar to an active collector trench system, except the trenches are replaced with wells. The wells would generally be constructed to extend down to seasonal low groundwater or the bottom of the MSW. Wells are typically 6-inch-diameter HDPE, with a deeper screened zone (bottom 5 to 10 feet of the well) sized for collection when combined with a cover system with collector trenches. When a below-cover trench system is not used, wells are either screened throughout the solid waste depth or partitioned to maximize the radius of influence with a surface plug to minimize short-circuiting. Based on the age and type of waste, wells are typically installed on a 200-foot grid; however, the actual spacing depends on the type of cover system, extent of waste, proximity to buildings, and proximity to perimeter trenches.

Area 6 has an ET cover system and 11 extraction wells with 4-inch-diameter HDPE screened sections extending through the entire refuse thickness (ranging between 10 and 60 feet). The wells were installed at distances ranging from approximately 90 to 155 feet apart based on preliminary extraction tests.

8.1.2.4 Venting Well System

Venting wells are typically 6-inch-diameter HDPE with a screened zone throughout the solid waste depth. They are vented to a manifold or directly to the atmosphere. Based on the age and type of waste, wells would be installed on a 50-foot grid, depending on the type of cover system, extent of waste, proximity to buildings, and proximity to perimeter trenches.

8.1.3 LANDFILL GAS TREATMENT SYSTEMS

LFG treatment systems generally require active gas collection, although vent-mounted flares and odor control canisters have been developed for passive collector systems. Treatment options are limited in areas that produce low concentrations of methane and non-methane organic compounds (NMOCs). Moreover, a perimeter active collector system may cause atmospheric air to be drawn in, further diluting LFG contaminants. Methane measured over a 9-month period ranged from 12.5 to 19.7 percent in an Area 1 gas monitoring well (GW-11) and 51.5 to 66.6 percent in two Area 5 gas monitoring wells (GW-5 and GW-6), allowing for a wide range of treatment technology applications, including flare systems. No gas well has been installed in Area 2; therefore, no methane measurements directly associated with the waste have been made.

Most active LFG control systems that do not recover energy terminate in a combustion flare. Flares have been shown to effectively combust all the methane while destroying at least 98 percent of the NMOCs and odorous sulfur compounds typically found in LFG; however, landfill sites that have been closed for many years and exhibit low gas generation and declining methane concentrations frequently do not produce gas with sufficient energy content to sustain combustion. The minimum methane concentration required for continuous flaring is approximately 20 percent by volume, depending on atmospheric conditions; however, flares typically are designed to operate at a 50 percent methane feed. The use of an auxiliary fuel, such as natural gas or propane, can ensure continuous combustion with low-energy LFG, but this practice is expensive and usually avoided. Typically, older landfills with minimal LFG generation also exhibit very low concentrations of NMOCs and sulfur compounds. In these cases, it is often the practice to vent an LFG exhauster directly to the atmosphere. Periodic exhaust monitoring is then used to ensure that acceptable levels of NMOC and methane emissions are maintained.

Flare systems can have enclosed or open flames, be stationary or portable, be designed for low methane content and low gas flow, and be powered by standard power sources or by solar-charged batteries. The existing Site flare, set up in Area 1 to treat LFG extracted and conveyed from Area 6, is a 4-foot-diameter, 40-foot-tall John Zink Enclosed ZTOF Biogas system. The system is controlled by a programmable logic controller that receives and transmits signals associated with operating conditions. If an unacceptable operating condition occurs, the control system discontinues the flow of gas or adjusts the operating parameters to address the problem. Control of the flare includes an initial purge cycle, an automatic ignition sequence, and fail-safe controls. A self-checking flame scanner monitors the pilot flame or main flame, and integrated shut-down features prevent equipment damage. The system includes three thermocouples at varying heights designed for LFG destruction at flow rates ranging from 150 to 350 standard cubic feet per minute (SCFM), assuming 50 percent methane content. The system currently is operating at 159 SCFM; the blower is rated to a maximum of 380 SCFM.

The existing flare has the capacity for an additional 191 SCFM. Potential contributions from Areas 1, 2, and 5 are estimated at 7, 3, and 108 SCFM, respectively, totaling 118 SCFM. These contributions are based on a proportional distribution associated with current maximum estimates of MSW deposited as follows:

- **Area 1** – 60,000 cubic yards estimated on the basis of gas well and test pit logs and the historical reported trench dimensions (700 feet long, 90 feet wide, and 25 feet deep);
- **Area 2** – 35,000 cubic yards estimated on the basis of soil boring and test pit logs and topographic information (200-foot-diameter cylinder, 30 feet deep); and
- **Area 5** – 900,000 cubic yards estimated on the basis of the cross section and reported historical trench dimensions (1,100 feet long, 450 feet wide, and 50 feet deep).

The Area 6 volume of 1,326,327 cubic yards was estimated for design of the Area 6 interim action, on the basis of waste disposal records (S&W 2009).

Because a proven treatment system and infrastructure with adequate capacity are already present on the site, no other active treatment options will be considered for use. As the landfill continues to age and methane production diminishes, other treatment options that work in tandem with, or eventually replace, the existing system may become applicable.

Venting involves collecting LFG at a particular point through a vertical well or across a network of wells that are joined by a manifold. Active venting requires applying a vacuum to the collector system; passive venting allows the natural buildup of pressure in the landfill to expel gas through the vent pipe. Venting relies on the dilution of toxic chemicals in the atmosphere, the concentrations of which are measured at the property boundary. The viability of venting is determined by evaluating the concentrations of toxic air pollutants (TAPs) at the discharge point to establish baseline conditions and then modeling expected conditions at benchmark locations (i.e., at the source, fence line, and maximum impact distance). Landfill emissions must meet small quantity emission rate (SQER) loading limits, based on TAP concentrations, at downgradient compliance locations. Whereas the existing flare has been permitted for use at the landfill, venting would require additional permitting, based on modeling results.

8.1.4 LANDFILL GAS CONTROL SYSTEM EVALUATION AND CONFIGURATION

The LFG control technologies appropriate for Areas 1, 2, and 5 are described in Table 12. A detailed discussion of the LFG control alternatives, as well as no action, for each area is provided in the following subsections. The RAOs relate to a reduction in contaminant volume, toxicity, and mobility. Mobility considerations are related specifically to the potential for transfer of VOCs from LFG to groundwater; there is no evidence that methane is migrating laterally beyond the landfill boundary.

8.1.4.1 Area 1

No Action

The no action option provides a baseline for comparison with other technologies. This option involves no processes, and no further construction would be necessary. The methane content should remain relatively stable in the short term, with LFG continuing to provide a potential source for groundwater contamination. The no action option would be ineffective at reducing the volume, toxicity, or mobility of LFG, and it would not meet the RAOs in a timely manner or provide additional protection against groundwater degradation.

Venting Well System

Considering the age, distribution, and density of refuse at Area 1, multiple vent wells would effectively reduce the volume and mobility of LFG over time. The vent well spacing would be determined on the basis of LFG measurements collected after the first well installation. The concentrations of four TAPs measured at gas well GW-11 significantly exceed the ambient source impact levels (ASILs) used for screening purposes, indicating that venting potentially would not be possible for Area 1 (additional testing would be required, along with modeling to estimate contaminant loading at the points of compliance, in support of the permit negotiations). If allowable, the buildup of LFG would decrease over time, resulting in volume and mobility decreases; however, the timeframe for meeting these RAOs is unknown. Reduction of toxicity would not be achieved. The effectiveness at reducing VOC concentrations in groundwater would be evaluated by comparing the long-term monitoring results at MW-11 and MW-25. The timeframe for meeting the RAOs is unknown.

Active Collector Trench

An active collector trench would consist of a trench surrounding and extending down to the refuse. Based on observations in test pits and gas well GW-11, the cover thickness ranges from 11 to 17 feet bgl. Trench systems typically cannot effectively capture LFG deeper than 20 feet. With refuse extending to 48 feet bgl in GW-11, a trench system would not be effective for this area.

Extraction Well System

Gas well GW-11 is located immediately adjacent to the flare system used to treat gas collected from Area 6. Methane concentrations in GW-11 ranged from 12.5 to 19.7 percent during monitoring performed from May 2012 to February 2013. The refuse extends approximately 48 feet bgl at GW-11, but the bottom depth of the refuse is unknown, based on four test pits completed to the northeast. A cost-effective option would be to install one extraction well at the TP-25 location, approximately 140 feet northeast of GW-11, and a second extraction well in the vicinity of GW-11. Both would be connected to the flare system for LFG destruction. This option would meet the RAOs in a timely manner and the existing flare has capacity to receive the LFG.

8.1.4.2 Area 2

No Action

The no action option provides a baseline for comparison with other technologies. This option involves no processes, and no further construction would be necessary. Based on a barhole survey (see Section 3.3.1), methane was detected in only one of nine test points, at a concentration of 0.1 percent, indicating negligible LFG migration through the existing cover material. Methane was detected once during six monitoring periods extending from May to February 2013, at a concentration of 0.7 percent in gas well GW-10, located approximately 140 feet to the northeast. It is unclear whether LFG from Area 2 is contributing to groundwater contamination. During monitoring performed for the RI, the same three VOCs were detected in groundwater from upgradient well MW-11 and downgradient well MW-14B.

The soil cover thicknesses range from 0.5 to 11 feet, overlying MSW with variable thicknesses ranging from 0.5 feet near the edge of the area to a maximum of 27 feet in the center. It has reportedly been over 30 years since this area has accepted MSW, which was placed on the surface and not compacted.

LFG generation rates would continue to decrease over time in this area, due to natural biodegradation, indicating that the volume and toxicity of LFG would continue to decrease under the no action option. However, considering that LFG may be contributing to groundwater contamination, reduction of mobility would not be achieved.

Venting Well System

Considering the age, distribution, and density of refuse at Area 2, one to four vent wells would effectively reduce the volume and mobility of LFG (toxicity would not be addressed). The vent well spacing would be determined on the basis of LFG measurements collected after the first well installation. No VOC data are available for Area 2; therefore, it is unknown whether modeling would be required or whether contaminant loading might exceed the SQER loading limits (additional testing would be required to support the permit negotiations with Ecology according to Chapter 173-460 WAC, Controls for New Sources of Toxic Air Pollutants). If allowable, the buildup of LFG would decrease over time, resulting in volume and mobility decreases; however, the timeframe for meeting these RAOs is unknown. Reduction of toxicity would not be achieved.

Active Collector Trench

Area 2 is semi-circular, with an approximate circumference of 1,000 feet. Based on observations in test pits, the cover thickness ranges from 0.5 to 11 feet. An active collector trench would be installed to surround the waste and extend into the refuse. Perforated collection piping would be laid within the trench, surrounded by bedding material and covered with a low-permeability seal. A lateral pipe would be connected to the Area 6 header system by Area 5. This option would meet the RAOs in a timely manner.

Extraction Well System

Area 2 is approximately 400 feet in diameter. Based on an MSW thickness of 27 feet in the center of this area and the limited extent of refuse, one extraction well would be adequate to reduce the volume, toxicity, and mobility of LFG. A lateral pipe would be connected to the Area 6 header system by Area 5, and ultimately to the flare system for LFG destruction. This option would meet the RAOs in a timely manner and the existing flare has capacity to receive the LFG..

8.1.4.3 Area 5

No Action

The no action option provides a baseline for comparison with other technologies. This option involves no processes, and no further construction would be necessary. Methane readings at gas wells GW-5 and GW-6 exceeded 50 percent during monitoring every other month from May 2012 to February 2013. The wells also exhibited positive pressure consistently over this period. LFG from Area 5 appears to be contributing to groundwater contamination, based on the VOC sampling discussed in Section 3.3.2.2. These findings indicate that no action is not a viable option for Area 5.

Venting Well System

Considering the size of Area 5 and the methane concentrations measured at GW-5 and GW-6, a vent well system does not appear to be a viable option for Area 5. Similar to Area 1, concentrations of four TAPs measured at both gas wells significantly exceed the ASILs, indicating that venting may not be possible on the basis of TAPs loading.

Active Collector Trench System

Based on soil borings completed in this area during the RI, the bottom of the MSW is 48 to 50 feet bgl in some areas. Typically trench systems are not effective when MSW extends below 20 feet. Considering the size of this area and the depth of the MSW, an active collector trench system would not be an appropriate option.

Extraction Well System

The conditions at Area 5 are similar to those at Area 6, including the size, waste volume and distribution, and methane concentrations. Area 5 would be suitable for an extraction well system comparable to the system operating at Area 6. The Area 6 conveyance system was constructed with two expansion tees on the header installed along the Area 5 border, allowing a direct hookup. Assuming an area of influence with a radius of 150 feet extending from each well, seven extraction wells would be sufficient to remove gas from Area 5. The wells would be screened through the waste, ranging in depth from approximately 10 to 50 feet. The existing flare is currently operating at approximately 45 percent flow capacity, leaving what appears to be adequate room for the estimated additional LFG from Area 5.

The extraction well system would be effective at reducing the volume, toxicity, and mobility of LFG. Its effectiveness at reducing VOC concentrations in groundwater would be evaluated by comparing the long-term monitoring results at MW-15 and upgradient wells. The extraction well system would meet the RAOs in a timely manner (refer to Section 9.4 for restoration time frame).

8.1.5 COMPLIANCE WITH MTCA REQUIREMENTS AND ARARS

The LFG control component of the remedy described in this section complies with the MTCA requirements for a selected remedy and applicable ARARs defined in Section 6.3. A description of how the MTCA requirements are met is included in Section 9.0.

8.2 LANDFILL CAP

This section evaluates the landfill cap components of the remedy, which will be used to minimize the infiltration of stormwater.

8.2.1 AREAS CONSIDERED FOR LANDFILL CAP

The RI identified portions of the existing soil cover in Areas 2 and 5 that are relatively thin and/or experiencing significant erosion. The cover thickness identified in test pits in Area 2 ranged from 6 inches to 11 feet (Table 2). The vast majority of the test pits at Area 2 indicate that the existing soil cover is less than 5 feet thick (Figure 12). These thin areas of cover provide opportunity for stormwater to infiltrate directly into the waste; therefore, the approximately 3-acre Area 2 is being considered for a new cover.

The cover thickness identified in test pits in Area 5 ranged from 1.5 to 15 feet (Table 2). The vast majority of the test pits indicate that the soil cover is more than 5 feet thick (Figure 13). Therefore, the soil cover is much thicker than the soil cover at Area 2. However, it appears that the cover soil placed on the south end of Area 5 has migrated down to the toe of the slope onto the north face of Area 5, leaving behind the thin cover layer on the top of Area 5. During the RI, many deep ruts in the cover due to runoff were identified. Several depressions are present along the north face of Area 5, along the access roads that bisect Area 5; these ditches tend to intercept any sheet runoff before it can flow into the north drainage ditch. Therefore, regrading of the approximately 13-acre Area 5, as well as a new cover, is being considered.

Two types of cover systems were evaluated: a conventional Resource Conservation and Recovery Act (RCRA) Subtitle C barrier cover and an ET cover.

8.2.2 CONVENTIONAL COVER WITH GEOMEMBRANE

Final cover systems for landfills typically are multicomponent cover systems consisting of the following layers, from bottom to top: (1) hydraulic barrier layer (composite layer with geomembrane overlying compacted soil or GCL, (2) drainage layer (geosynthetic drainage material), (3) protective layer (native soils), and (4) erosion control layer (topsoil).

One option for a typical landfill cover involves the following layers, from bottom to top (1) an 18-inch thickness of compacted soil, (2) a geomembrane, (3) a geonet for drainage, (4) a 24-inch thickness of soil for protection (hydraulic barrier), and (5) a 6-inch thickness of soil with vegetation. Because the fine-grained soils at the Site are relatively difficult to compact to the degree required for a hydraulic barrier (1 x 10^{-5} cm/sec), the hydraulic barrier layer should consist of a GCL rather than a 24-inch thickness of compacted soil. This is a fairly typical final cover for a landfill and is the base barrier that was used in the development of Area 7.

The advantage of a conventional barrier cover is that a physical barrier is constructed to prevent stormwater from infiltrating the waste. It is also a standard design than can be applied to many different landfill sites.

There are several disadvantages to a conventional barrier cover. They are expensive to construct and maintain. The functionality is limited to the integrity of the geomembrane cover, which can leak. The geomembrane covers have a finite lifespan. Flexibility with gas collector system is limited, because any excavations after the cover is installed could compromise the integrity of the cover system.

8.2.3 EVAPOTRANSPIRATION COVER

There are several alternative covers for landfills. One alternative that takes advantage of the arid climate and fine-grained soils native to Walla Walla is an ET cover, which works with the forces of nature rather than attempting to control them. In this type of cover system, a layer of fine-grained soil is covered by native grasses, and it contains no barrier layers. The ET cover uses two natural processes to control infiltration into the waste: (1) the fine grained soils with a high water holding capacity provide a natural water reservoir, and (2) natural evaporation from the soil and plant transpiration (ET) empty the soil water reservoir. The thickness of the ET cover depends on the annual water balance for the specific site. It is an inexpensive, practical, easily maintained, and self-renewing biological system. The ET cover would remain effective over extended time periods, perhaps centuries.

There are several advantages to the ET cover. Because it is a natural and self-renewing system, it is less prone to failure and has a longer life than conventional cover systems. It is also easily repaired. Typically, the construction cost and long-term maintenance costs associated with an ET cover are less relative to those of conventional cover systems. Finally, there are also more options for gas control because drilling and installation of gas wells or piping does not threaten the integrity of the cover.

The disadvantages associated with the ET cover include a need for site-specific designs because the climate, soil, plant cover, and site requirements are unique for each site. It also requires a significant amount of adequate soil nearby in order to be cost effective.

The ET cover was successfully used in the closure of Area 6 in 2010 and provided a substantial saving in project costs relative to those of a conventional cover system. The ET cover on Area 6 has been functioning quite well since 2010; there is no noticeable erosion, and the vegetation layer appears healthy.

8.2.4 COMPLIANCE WITH MTCA REQUIREMENTS AND ARARS

The landfill cap component of the remedy described in this section complies with the MTCA requirements for a selected remedy and applicable ARARs defined in Section 6.3. A description of how the MTCA requirements are met is included in Section 9.0.

8.3 STORMWATER CONTROLS

Stormwater itself is not considered a contaminated medium. However, stormwater infiltration through or adjacent to the MSW and the subsequent generation and downward migration of leachate to groundwater has been identified as a possible cause of groundwater contamination.

As part of the Area 6 closure in 2010, several stormwater improvements were constructed. Runoff control berms were constructed on Area 6, sedimentation ponds were constructed north and south of Area 6, and an erosion control mat was constructed along the north drainage ditch. The runoff control berms have been working well by providing a stormwater travel path that has not eroded the landfill cap. The sedimentation ponds also appear to be functioning well. Some concerns related to stormwater infiltration in portions of Areas 2 and 5, and the north drainage ditch are described below.

8.3.1 STORMWATER AREAS OF CONCERN

The RI results indicate the following areas of concern related to stormwater at the Site:

- The erosion control mat along the north drainage ditch is filling with soil and vegetation, which is impeding water movement off-Site.
- Stormwater flow on the surface of Area 5 has caused erosion of the soil cover on the southwest and west sides of Area 5.
- Stormwater run-on occurs at the southwest side of Area 5, in the vicinity of the entrance to the compost facility.
- Two linear road cuts located on the north slope of Area 5 likely impede stormwater flow and potentially promote infiltration.
- The soil cover thickness over Area 2 may be insufficient to prevent the infiltration of precipitation and stormwater.

The primary goal of the stormwater controls related to the landfill is to maintain a separation between the landfill contents and stormwater that is collected and conveyed in the stormwater system.

Three stormwater alternatives for the north drainage ditch and two options for controlling stormwater run-on at the southwest corner of Area 5 are evaluated below to improve stormwater flow. As previously discussed, the landfill cap on Areas 2 and 5 will be graded to thicken the cover and encourage stormwater flow away from the landfill and into the north and south drainages.

8.3.2 NORTH DRAINAGE DITCH

The existing north drainage ditch was constructed in 2010 as an interim remedial measure to stop surface water from infiltrating the MSW in Area 5. The north drainage ditch has a triangular cross section that is lined with an erosion control mat. The erosion control mat was designed to allow vegetation to grow through the fabric, allowing the native grasses to assist in holding the mat in place and prevent soil erosion. Currently, the erosion control mat remains visible in only a few locations where the grass has not completely grown over the mat. A visual inspection of the soil and vegetation in the north drainage ditch indicates that the channel is functioning as designed, although sediments are collecting in the ditch.

Although sufficient for erosion protection, the existing sediment and vegetation in the channel have the potential to encourage infiltration and possible long-term overflow into the Area 5 MSW. The north drainage ditch could be further improved by the construction of a water-impermeable layer to encourage all collected run-on and runoff to pass off-Site with no infiltration. Three protection alternatives were evaluated:

1. Cast-in-place concrete channel,
2. Cable-blocks, and
3. Precast concrete channel.

8.3.2.1 Alternative 1: Cast-In-Place Concrete Channel

The first alternative is to line the north drainage ditch with cast-in-place concrete as the primary barrier to infiltration along with a geomembrane liner that would be provided beneath the concrete channel for secondary protection. Figure 18a, Plate 1, illustrates a cross-sectional view of this alternative. The slope of the new channel would be the same as that of the existing channel (0.7%). Lining the channel with concrete would provide a smoother channel surface, which would result in higher flow velocities. The average channel velocity (during a 25-year storm) would change from 2.3 ft/sec to 4.7 ft/sec. These higher velocities would allow more sediment to be conveyed through the channel instead of being deposited in the channel, thus making the channel self-cleaning.

Based upon typical soil particle sizes found at the Sudbury Landfill, a minimum velocity of 1.2 ft/sec is recommended to prevent sedimentation in the channel. Calculated water velocity in the proposed concrete-lined north drainage ditch during a storm event with a 2-year recurrence interval is approximately 1 ft/sec. During a 10-year storm, velocities are expected to be approximately 3 ft/sec.

Therefore, typical annual rainfall events many not have the velocity required to completely scour the channel, but larger storm events will.

Although the channel will be self-cleaning, a box-shaped channel would also provide ability to be manually cleaned because it could be custom-sized to the width of the City's skid steer. Therefore, the cross section would be modified from triangular to rectangular, allowing the base of the channel to be mechanically cleaned out by the City's compact rubber-tired skid steer, if needed.

A portion of stormwater runoff from Area 5 flows to the north via sheet flow into the north drainage ditch. In an effort to encourage this sheet flow runoff to find its way into the channel and not undermine the vertical concrete walls, a strip of geomembrane liner would bolt to the top of the concrete channel as shown in Plate 1 of Figure 18a. Moreover, in order to prevent soil erosion, construction of a soil erosion mat along the south side of the channel is proposed.

8.3.2.2 Alternative 2: Cable-Block Channel

The second alternative is to line the north drainage ditch with geomembrane as the primary layer with a layer of concrete cable-blocks on top for mechanical protection. Figure 18a, Plate 2, illustrates a typical concrete cable-block. The footprint of each block is about 1 square foot. Multiple blocks are interconnected with steel cables that run through the blocks. Figure 18a, Plate 3, illustrates a cross-sectional view of this alternative. The geomembrane is sandwiched between geotextile fabrics to protect the geomembrane from abrasion.

The width of the channel allows the City's compact rubber-tired skid steer to clean out the channel when needed. The cable-blocks allow for a relatively easy installation of mechanical protection, because the blocks form a mat that can be lifted and placed into position. The ridges on the blocks, however, are not ideal for mechanically cleaning the channel. The bucket on the skid steer has the potential of knocking or chipping out pieces of block. This alternative would not have the self-cleaning abilities of Alternative 1.

8.3.2.3 Alternative 3: Precast Concrete Channel

Figure 18a, Plate 4, illustrates a cross-sectional view of the north drainage ditch with a precast concrete channel. This is essentially the same as Alternative 1 with a pre-cast channel instead of a cast in place channel. Pea gravel is placed between the geomembrane and the concrete channel to protect the geomembrane and allow compacted placement of the concrete channel.

The advantages of the rectangular cross-sectional dimensions are noted in the discussion of Alternative 1 (cast-in-place concrete channel), although a precast concrete channel would likely not be custom sized to the exact width of the proposed cleaning equipment. From a infiltration potential prospective, the channel is equal to the cast-in-place channel. Use of precast concrete allows relatively easy placement of the concrete channel because sections of the channel can be moved and set into place. Care is needed during placement so that the channel segments line up flush horizontally and vertically and the joints are grouted watertight.

8.3.3 AREA 5 STORMWATER EROSION

Erosion of the Area 5 soil cover is occurring at the southwest and west sides of Area 5. The stormwater is generated by two sources:

1. General surface drainage off of Area 5 (stormwater runoff); and
2. Stormwater run-on from pervious surfaces located between the north and eastern side of the compost area and south of Area 5.

Rutting and soil erosion of the Area 5 soil cover has occurred where these sources of runoff and run-on combine then flow northwest across the western edge of Area 5 to the north drainage ditch.

8.3.3.1 Area 5 Stormwater Run-off

An erosion control berm is proposed to facilitate the movement of Area 5 stormwater runoff, address the rutting and soil erosion concerns on the southwest and west sides of Area 5, and impede run-on (more substantial run-on prevention measures are addressed in the following section). Erosion control berms are V-shaped channels that are lined with a mat specifically designed to prevent soil erosion. Soil erosion control berms were used on the Area 6 cap and are functioning well. Figure 18a, Plate 5, illustrates a cross section of the proposed erosion control berm in Area 5.

The erosion control berm would extend along the entire southern boundary and west side of Area 5 in order to convey stormwater runoff from Area 5 to the north drainage ditch, as shown on Figure 18a, Plate 6. The total length of the berm would be about 1,500 feet, and it would have a maximum 4 percent slope.

8.3.3.2 Area 5 Stormwater Run-on

Stormwater generated in a relatively small area between the south side of Area 5 and the north and northeast sides of the compost pad currently collects at the southwest corner of Area 5 and then flows north to the north drainage ditch. Although an erosion control berm could address the rutting and soil erosion concerns on the southwest side of Area 5, no amount of run-on onto Area 5 should be allowed. Therefore, the stormwater generated between Area 5 and the compost facility must be diverted away from Area 5. One reasonable place to direct the runoff from this small area is south into the existing compost facility lagoon.

The compost facility lagoon was designed to retain leachate from a 25-year, 24-hour rainfall event. The proposed stormwater diversion would increase the pervious surface drainage basin for the lagoon by approximately 20%, and stormwater calculations indicate the potential for an additional 2.8-

inch rise in the water elevation in the compost lagoon from a 25-year, 24-hour rainfall event. Therefore, the typical storm event will not impose a burden on the lagoon. Additionally, the leachate collection sumps are monitored daily as part of the Leachate Management Plan. Draw-off locations are provided in the leachate collection sumps to allow trucks to remove leachate as necessary to be used for dust control or to be hauled to the other landfill leachate collection pond. The daily monitoring and ability to pump water from the lagoon mitigate any effects that an anomalous storm event could have on pond sizing.

Two options that would direct the stormwater run-on waters into the compost facility lagoon include:

1. Re-grading the area to the north and east of the compost facility to route the runoff from this area onto the compost pad and into the compost lagoon, and
2. Construction of a catch basin and pipeline to route the runoff directly to the compost facility lagoon.

Option 1: Regrading

Stormwater runoff generated between the compost facility and Area 5 could be controlled by adding soil to construct an elevated berm north of the existing compost facility entrance road, and resloping the grade so that stormwater flows south onto the compost pad and into the compost lagoon. This would require:

- Construction of an elevated berm, adding up to six feet of soil on the north side of the existing compost facility entrance road, to provide a grade to the south. The elevated berm would cover a portion of Area 5 which currently has very thin cover and requires additional fill. Therefore, the additional fill would accomplish two components of the remedial action.
- Reconstructing and raising the grade of approximately 200 linear feet (LF) of the existing compost facility access road.
- Elimination of the culvert that directs stormwater north under the existing roadway and regrading the drainage east of the compost facility to the south and west back onto the compost pad.
- Construction of a new culvert under the new roadway, to direct stormwater generated south of Area 5, south into the regraded valley east of the compost facility.

Figure 18b, Plate 7 depicts the proposed extents of fill for the grading alternative.

Option 2: Culvert and Pipe

Instead of re-grading the valley east of the compost pad, a subsurface pipe could be used to convey stormwater runoff directly to the compost facility lagoon.

This option would require:

- Elimination of the existing culvert that directs stormwater north under the existing roadway.
- Construction of a new culvert to direct stormwater generated south of Area 5 to the south side of the road.

- Construction of a catch basin and sediment retention sump on the south side of the compost facility entrance road. The sediment retention sump would need to be cleaned out periodically using mechanical equipment available at the composting facility.
- Construction of approximately 500 LF of 12-inch diameter pipe extending from the catch basin to the compost lagoon. This would require cutting open the liner and installing a new pipe penetration boot as is typical on all pipe penetrations through geomembrane liners.

This alternative is depicted as Plate 8 on Figure 18b.

8.3.4 Re-Grading Areas 2 & 5

As previously mentioned, two linear road cuts located on the north slope of Area 5 likely impede stormwater flow and potentially promote infiltration. Moreover, runoff channels are present in several locations on Area 5, which likely have led to reduced cover thickness in those areas as well as infiltration. Re-grading of Area 5 will be necessary to eliminate these road cuts and provide a uniform slope down towards the north drainage ditch. The grading of Area 5 will create smooth and rolling hills in order to promote sheet flow for runoff and minimize drainage channels. All runoff will be directed to flow via sheet flow towards either the north drainage ditch or the runoff control berm.

Area 2 was also noted as having areas where the cover is very thin. Re-grading this area will increase the cover thickness and minimize the ability for stormwater to infiltrate into the waste.

Costs for these two improvements are incorporated in the landfill cap systems described in Section 8.2.

8.3.5 Compliance with MTCA Requirements and ARARs

The stormwater control component of the remedy described in this section complies with the MTCA requirements for a selected remedy and applicable ARARs defined in Section 6.3. A description of how the MTCA requirements are met is included in Section 9.0.

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9.0 PREFERRED REMEDIAL ALTERNATIVE

The preferred remedial alternative for the Site consists of containment (capping) of the solid waste with measures to prevent or control its impact on surrounding environmental media, such as capture of LFG and controls on stormwater to prevent leachate generation. It also includes provisions for long-term monitoring and institutional controls.

As described previously, MTCA defines specific requirements for a selected remedy to be protective of human health and the environment and identifies criteria that must be met by each alternative. In addition, landfill regulations guide the selection of other requirements that must be satisfied for a landfill to be closed in a fashion that reduces or prevents the release of solid waste constituents, leachate, and LFG, to the ground, groundwater, surface water, and the atmosphere. The regulations also require that a landfill continue operation and maintenance of the selected remedy and ongoing monitoring of the various media at the landfill.

9.1 DESCRIPTION OF PREFERRED REMEDIAL ALTERNATIVE

The components of the selected remedy (the preferred alternative) include the following:

- Landfill cap improvement using an ET cover over Areas 2 and 5, including grading design including grading design to facilitate drainage.
- Stormwater controls:
  - Cast-in-place concrete channel for the north drainage ditch;
  - Erosion control berm for Area 5 runoff; and
  - Diversion of run-on from the southwest side of Area 5 to the compost lagoon.
- Active LFG extraction and destruction in Areas 1, 2, and 5.
- Long-term monitoring of:
  - Groundwater;
  - LFG;
  - Landfill cap; and
  - Stormwater controls.
- Institutional controls.

The components of the preferred alternative are discussed in the following subsections, along with a summary of how the preferred alternative meets the MTCA cleanup action requirements.

9.1.1 LANDFILL CAP

The recommended final cover alternative for both Area 2 and Area 5 is the ET cover. Because it is a natural and self-renewing system, an ET cover is less prone to failure, has a longer life than conventional cover systems, and is easier to repair. There is a significantly lower construction cost and lower long-term maintenance costs associated with an ET cover compared to conventional cover systems.

Finally, there are also more options for gas control because drilling and installation of gas wells or piping does not threaten the integrity of the cover.

An ET cover was the final cover selection for the Area 6 closure in 2010; therefore, a site-specific design has already been completed. As described in a January 2010 memorandum prepared by HWA. (provided in Appendix H), a 4.8-foot-thick layer of native soils loosely compacted in 24-inch lifts at 85 percent of maximum compaction was the design solution for the Area 6 cover. The top foot of the cover incorporated Class B biosolids from the Walla Walla Wastewater Treatment Plant as well as compost from the compost facility at the Site to create an organic topsoil layer in which dry land vegetation would thrive. Follow-up inspections indicate that the Area 6 cover is performing well. Therefore, the same ET cover could be used at Areas 2 and 5.

Although the ET cover design was previously approved by Ecology for the Area 6 closure, Ecology may require the completion of another site-specific design based on the proposed stockpile source for the cover. If another site-specific design is required, it is anticipated that the design would be similar to that described in the HWA memorandum.

To meet the requirements of the ET cover functionality and address overall site drainage, including potential infiltration via the road cuts on the north side of Area 5, a grading design will also need to be completed. Because Area 2 has an existing thin soil cover, it is anticipated that the entire 4.8-foot-thick ET cover will have to be hauled in from a nearby stockpile site. However, the relatively deep layer of soil on portions of Area 5 could potentially be moved to the upper end of Area 5 and possibly to Area 2 also. The suitability of the existing Area 5 soil cover, required compaction (or loosening and scarification) efforts, and installation methodology would be described in the design document.

A grading permit may be required by the City for this work. The planning-level cost estimate for the recommended final cover system is $1,130,000, as detailed in Appendix I. The cost estimate assumes that the entire 4.8-foot-thick cover for Areas 2 and 5 would be hauled in from a stockpile site located at the landfill.

9.1.2 STORMWATER CONTROLS

The preferred alternative includes the following stormwater controls:

- Construction of a cast-in-place concrete channel in the north drainage ditch to promote surface water discharge off-Site.
- Construction of an erosion control berm to facilitate the movement of Area 5 stormwater runoff and to repair erosion features in the Area 5 cover.
- Surface elevation regrading to prevent stormwater run-on to Area 5.
- Regrading of Areas 2 and 5 performed during the placement of the ET covers described in Section 9.9.1

The stormwater controls included in the preferred alternative for each of these areas are summarized in the following subsections.

9.1.2.1 North Drainage Ditch

A cast-in-place concrete channel was selected for the improvement of the north drainage ditch. A geomembrane layer would provide secondary protection underneath the concrete channel. The concrete cast-in-place channel will promote a "scouring" velocity that is designed to flush sediments from the ditch flow line.

Although the ditch is designed to be self-cleaning, the City may wish to occasionally remove sediment and wind-blown debris. Therefore, the cross-sectional shape of the ditch would be rectangular. This would allow the City's compact rubber-tired skid steer to be driven within the ditch. The proposed cast-in-place concrete channel design includes reinforced concrete and a pea gravel base to provide the structural support needed for the skid steer (Figure 18a, Plate 1).

The cast-in-place concrete channel is designed to allow sheet runoff from Area 5 to enter into the ditch. The proposed design includes a strip of geomembrane that is bolted to the top of the concrete channel and covered with an erosion control mat on the south side of the ditch to prevent undermining and rutting as the sheet flow enters the channel (Figure 18a, Plate 1).

The planning-level cost estimate for the north drainage ditch improvements including design and construction is $303,000, as detailed in Appendix I.

9.1.2.2 Area 5 Stormwater Run-off

An erosion control berm is proposed to facilitate the movement of Area 5 surface drainage, address the rutting and soil erosion concerns on the southwest and west sides of Area 5, and impede run-on. The erosion control berm would consist of a V-shaped channel lined with an erosion control mat. The erosion control berm would extend along the entire southern boundary and west side of Area 5 to convey stormwater runoff from Area 5 to the north drainage ditch, as shown on Figure 18a, Plate 6. The total length of the berm would be about 1,500 feet, and it would have a maximum 4 percent slope.

The planning-level cost estimate for the Area 5 runoff control berm including design and construction is $41,500, as detailed in Appendix I.

9.1.2.3 Area 5 Stormwater Run-on

The selected alternative for run-on prevention at the southwest side of Area 5 includes the construction of an elevated berm north of the compost facility to prohibit stormwater generated south of Area 5 to flow north, and regrading the surface soil in the valley east of the compost facility to divert stormwater south and west onto the compost pad, and ultimately into the compost facility lagoon (refer to Figure 18b, Plate 7). The alternative requires the reconstruction of approximately 200 LF of the existing compost access road in order to raise the grade of the road and prevent runoff from flowing north. The additional stormwater from a 25-year, 24-hour rainfall event diverted into the compost facility lagoon is calculated to cause a 2.8-inch rise in the water level within the lagoon, which is not expected to burden the lagoon during typical storm events. Additionally, the daily monitoring and ability to pump water from the lagoon mitigates any effects that an anomalous storm event could have on pond sizing.

The planning level cost estimate for the Area 5 run-on elimination including design and construction is $100,500, as detailed in Appendix I. The pipeline alternative is less expensive at $75,000; however, periodic sediment removal by mechanical means would be required, pipelines are subject to plugging, and cutting open the lagoon liner for a new pipe penetration introduces risk of damaging the existing liner. Moreover, construction of the elevated berm to the north of the compost facility (the preferred alternative) will also provide the needed additional cover thickness on Area 5.

9.1.3 LANDFILL GAS CONTROLS

LFG controls must be sufficient to prevent LFG from impacting groundwater, protect human health from toxic gases, prevent explosion hazards, and to demonstrate that LFG is not migrating off-site at unacceptable levels. Monitoring has shown that LFG is present only within the boundaries of the Site. The existing LFG flare system is currently operating at approximately 45 percent flow capacity, leaving adequate capacity for the estimated additional LFG from Areas 1, 2, and 5.

9.1.3.1 Area 1

The extraction well system hooked to existing Area 6 gas treatment system was selected for controlling the Area 1 LFG. It would entail the installation of two extraction wells and connection of the wells to the existing header at the flare station. The LFG is of low quality at this location, but if the extraction rate is monitored and the optimum flow rate is determined during initial testing and operation, two extraction wells should effectively prevent the buildup of LFG and reduce the migration of VOCs to groundwater.

The planning-level cost estimate of the extraction well system is $55,000, as detailed in Appendix I.

9.1.3.2 Area 2

The extraction well system hooked to existing Area 6 gas treatment system was selected for controlling LFG in Area 2. Considering the small size of this area, one extraction well should effectively reduce the volume, toxicity, and mobility of LFG. An active collector trench would also be an effective option, but the construction cost would be excessive, making the extraction well system the preferred option. The planning-level cost estimates for the construction of these two options are $74,500 for extraction well and $276,000 for the trench system, as detailed in Appendix I.

9.1.3.3 Area 5

The extraction well system hooked to existing Area 6 gas treatment system was selected for controlling LFG in Area 5. MSW is buried too deep to effectively implement a trench system. Based on the methane concentrations in wells GW-5 and GW-6, which are greater than those measured in the 11 extraction wells in Area 6, an extraction system would prevent vertical migration of LFG and reduce the LFG contribution to groundwater contamination.

The proposed locations of seven extraction wells with a radius of 150 feet, comparable to the spacing of the extraction wells in Area 6, are shown on Figure 17. The wells would be screened throughout the depth of MSW and linked by a header system, which would be connected to the Area 6 header expansion tee located near the east side of Area 5. During the extraction well installation the existing Area 5 gas vent would be decommissioned to prevent short-circuiting of the LFG to surface or intake of surface air. Vent decommissioning would be accomplished by filling the vent from bottom to top with concrete

The planning-level cost estimate for the extraction well system is approximately $196,500, as detailed in Appendix I.

9.2 LONG-TERM MONITORING

To ensure that the components of the preferred alternative are implemented efficiently and are operating properly, long-term monitoring of the various components must be implemented. The following subsections describe the monitoring requirements for the landfill to ensure that the remedy is effective and provides long-term protection of human health and the environment. The current landfill monitoring plans will be modified as described, and the modified Compliance Monitoring Plan will be included as an appendix of the Engineering Design Report, in accordance with the MTCA compliance monitoring requirements.

9.2.1 GROUNDWATER

The goal of groundwater monitoring is to confirm that the landfill remedy is performing adequately and that the engineering controls are working and to document that PCE and vinyl chloride concentrations in groundwater are stable or decreasing. Both on-site and downgradient off-Site groundwater will be monitored. The contaminant concentrations in downgradient off-Site groundwater currently meet the cleanup levels; therefore, the groundwater will be monitored to ensure that the conditions are stable or improving over time. On-site monitoring will be conducted to monitor changes in groundwater quality after implementation of the preferred alternative. Periodic monitoring for a broader spectrum of constituents other than VOCs will be conducted to ensure that changes in the environmental conditions do not cause release of other contaminants that could adversely affect groundwater.

As discussed previously, monitoring wells MW-11, MW-12b, MW-14b, and MW-15 are currently being sampled quarterly in accordance with the Solid Waste Operating Permit. The groundwater samples are analyzed for Appendix I and II detection monitoring constituents, per WAC 173-351-990, plus Freon 12, in accordance with Chapter 173-50 WAC. Specific details of the groundwater monitoring are included in the Revised Compliance Monitoring Plan (Schwyn 2013b). In addition to the routine landfill compliance sampling, groundwater samples will also be collected quarterly from downgradient monitoring wells MW-19 and MW-20 and annually from the Small and Camp wells for VOC analysis. Additionally, groundwater samples will be collected annually from MW-11, MW-12b, MW-14b, and MW-15 and analyzed for Appendix III parameters, per WAC 173-351-990. The locations of the wells are shown on Figure 2.

The original groundwater monitoring plan and SAP for the Site was included in the Hydrogeologic Report (EMCON 1995), and the SAP was subsequently approved during the permitting process required by Chapter 175-351 WAC. Since the SAP approval, several permit modifications have been made (in 1999, 2001, 2007, 2012, and 2013) and approved by the WWCHD. It is anticipated that the existing monitoring plans will be modified during the design process to account for the additional monitoring discussed in this section.

The groundwater monitoring results will be reported quarterly, with annual summary reports, and the findings will be reviewed at least every 5 years during 5-year MTCA review process. Modifications to the monitoring locations, analyses, or frequency will be documented at that time. Long-term monitoring of off-site groundwater is expected to occur for a minimum period of 5 years, or at least 2 years after the cleanup levels for groundwater are achieved.

9.2.2 LANDFILL GAS

Typically, LFG collector systems require two types of monitoring: operational and performance. The locations of the gas wells, the frequency of monitoring, and the specific monitoring requirements will be defined in an Operations, Maintenance, and Monitoring Plan to be included as part of the LFG system design report.

To optimize the control system, operational monitoring will be required during system startup. Ongoing monitoring will be required, based on the system response after full build-out, to ensure that the LFG control system is operating effectively.

Performance monitoring will likely be required at the landfill perimeter using existing gas monitoring wells. Performance of the control systems will likely be based on not exceeding the methane lower explosive limit at the Site boundary and diminishing VOC concentrations in groundwater monitoring wells located downgradient of Areas 1 and 5.

Mitigating actions associated with LFG control must also take current landfill regulations [WAC 173-351-200(4)] into account, requiring monitoring and compliance with gas control standards.

9.2.3 LANDFILL COVER

Annual landfill cover inspection, maintenance and repair procedures will be conducted to preserve the intended function of the ET covers. The following cover conditions will be observed and documented:

- Appearance and condition of the vegetation;
- Vegetation stress or death due to LFG;
- Deposition of eroded soil at the toe of steep slopes;
- Soil erosion;
- Rills or cracks in the cover;
- Changes in the surface slope and settlement of waste;
- Intrusion by humans or animals;
- Holes of any kind that allow surface runoff to enter the MSW directly;
- Wildlife trails created on the cover; and
- Damage by vehicles or maintenance machines.

Maintenance and repairs will be conducted on an as-needed basis to maintain the integrity of the ET covers. Long term care will continue until a registered professional engineer certifies to the WWCHD and Ecology that post closure activities are no longer needed.

9.2.4 STORMWATER CONTROLS

Currently, stormwater monitoring is not conducted at the Site. Previously, the landfill operated under the Statewide General Industrial Stormwater Permit; however, follow-up inspections by Ecology confirmed the relative lack of runoff at the landfill, and the permit was consequentially terminated by Ecology. It is suggested however that routine visual inspections and maintenance be conducted to ensure functionality of the stormwater control system.

Inspection and maintenance will be conducted on annual schedule. Inspections should document disturbances that result in erosion, settlement, ponded stormwater, and blockage of ditch flow lines. Maintenance will be conducted on an as needed basis.

9.3 INSTITUTIONAL CONTROLS

In accordance with WAC 173-340-440, MTCA requires that institutional controls such as environmental covenants be imposed on contaminated property whenever the remedial action conducted will result in remaining hazardous substances in soil, groundwater, or other media at concentrations that exceed the applicable cleanup levels, or when Ecology determines that such controls "are required to assure the continued protection of human health and the environment or the integrity of the interim or cleanup action." An environmental covenant is also required on the deed to meet the requirements stipulated in WAC 173-351-500(1)(h). The covenant will also describe with specificity the activity or limitations that prohibit uses and activities that:

- Threaten the integrity of any cover, waste containment, stormwater control, gas, leachate, public access control, or environmental monitoring systems;
- May interfere with the operation and maintenance, monitoring, or other measures necessary to ensure the integrity of the landfill and continued protection of human health and the environment; and
- May result in the release of solid waste constituents or otherwise exacerbate exposures.

The purpose of an environmental covenant is to prohibit activities that may interfere with a cleanup action, operation and maintenance, or monitoring or activities that may result in the release of a hazardous substance that was contained as a part of the cleanup action. Environmental covenants must be recorded in order to provide adjoining property owners, future purchasers, and tenants, as well as the general public, notice of the restrictions on use of the property. Property owners are also required to notify Ecology prior to any lease or sale of the restricted property.

To ensure that the selected components of the preferred alternative are operated efficiently and continue to be operated and maintained properly, an environmental covenant will be used as a legal measure to provide a clear record of the responsibilities and restrictions for the landfill. The environmental covenant will also ensure that the remedial action remains protective of human health and the environment and that the required landfill maintenance and monitoring are performed as necessary, in coordination with Ecology. The environmental covenant will be developed as part of the process associated with the Draft CAP and will be implemented for the landfill portion of the City-owned parcel.

9.4 RESTORATION TIME FRAME

Criteria for establishing whether a cleanup action provides for a reasonable restoration time frame are described in WAC 173-340-360(4)(b). The preferred remedial alternative for the Site consists of containment (capping) of the solid waste with measures to prevent or control its impact on surrounding environmental media, including capture of LFG and controls on stormwater to prevent leachate generation. It also includes provisions for long-term monitoring and institutional controls. Because containment of the MSW is the primary source control, long-term LFG removal and treatment will be necessary until VOC generation diminishes during the MSW degradation process.

The VOCs in LFG are likely the primary contributor to the groundwater quality impacts observed at the landfill. Based on empirical data from other sites, such as the Pasco Landfill (GSI 2014), COC concentrations in groundwater at the CPOC is expected to decline immediately after LFG system startup. At the Pasco Landfill, PCE concentrations similar to those observed at the Sudbury Landfill dropped to non-detectable concentrations within several months of system startup.

A conservative conceptual timeframe to meet the RAOs is 6.2 years based on the following assumptions:

- The primary component of the groundwater contamination observed in MW-15 is from Area 5 with the overriding influence on groundwater quality emanating from the LFG contaminant to groundwater pathway;
- When the LFG system is turned on the vapor pressure at the capillary fringe will be reduced and the LFG to groundwater pathway will be eliminated;
- A particle of contamination traveling from the upgradient side of Area 5 (east side) to MW-15 will travel at 193 ft/yr through the 1,190 ft distance; and
- Vinyl chloride is the degradation product of the PCE in groundwater and will be eliminated as the PCE source diminishes.

9.5 ESTIMATED COSTS

9.5.1 ESTIMATED COST OF PREFERRED ALTERNATIVE

The components of the preferred alternative and the estimated cost for each component, including field construction and construction oversight costs, are as follows:

- ET cover in Areas 2 and 5: $1,130,000;
- Cast-in-place concrete panels to improve the north drainage ditch: $303,000;
- Stormwater runoff erosion control berm construction along the south and west sides of Area 5: $41,500;
- Area 5 stormwater run-on prevention facilities: $100,500; and
- LFG extraction well systems in Areas 1, 2, and 5: $326,500.

The total estimated cost for construction of the preferred alternative is $1,901,500. These costs are conceptual and subject to change after completion of the engineering design. The cost for administrative and Ecology oversight related to the preparation of the Draft CAP, formal agreements, and Engineering Design Report; contractor bidding; construction closeout; annual agency interaction; and 5-year reviews for a 10-year post-construction period is estimated at an additional $400,000, as detailed in Appendix I. The total estimated cost for the preferred alternative is $2,301,500.

9.5.2 ESTIMATED LONG-TERM MONITORING COSTS

The estimated planning-level cost estimates for third-party long-term monitoring based on a 10-year post-construction monitoring and restoration period are the following:

- Groundwater monitoring and reporting: $537,000, which includes off-site lease agreements for two properties and off-site well decommissioning for six off-site wells;

- LFG field monitoring (no laboratory analysis) and reporting: $170,000; and
- Landfill cover and stormwater system monitoring with minor maintenance: $50,000, assuming these systems will be monitored and maintained according to the normal landfill closure monitoring requirements after the 10-year remedial action period.

The total estimated cost for long-term monitoring is $757,000, as detailed in Appendix I.

9.5.3 TOTAL ESTIMATED COST

The total estimated cost for construction, administration, and monitoring of the preferred alternative for a 10-year period is $3,058,500.

9.6 ATTAINMENT OF REMEDIAL ACTION OBJECTIVES

The remedy was evaluated for its compliance with MTCA cleanup goals, including those for containment remedies. As described in the following subsections, the proposed preferred alternative meets the requirements of MTCA and achieves the RAOs established for the Site.

9.6.1 COMPLIANCE WITH MTCA REQUIREMENTS

Certain minimum requirements must be met for a selected remedy to comply with the requirements of MTCA. This section discusses how the preferred alternative meets these requirements.

9.6.1.1 Threshold Requirements

The threshold criteria identified in WAC 173-340-360(2)(a) that must be met by the selected remedy and the reasons that the preferred alternative meets them are as follows:

- **Protect human health and the environment.** The landfill cap will prevent direct contact with solid waste by people, plants, and terrestrial receptors. The landfill cap and stormwater controls will decrease the amount of generated leachate by limiting the infiltration of stormwater. The stormwater controls will ensure that stormwater will not come in contact with solid waste. The LFG extraction well systems for Areas 1, 2, and 5 will collect VOCs entrained in the LFG and route them through the flare system for destruction, limiting the source of VOCs and minimizing the LFG to groundwater cross-media-contaminant pathway. Source control actions, such as the LFG system, are expected to further improve groundwater conditions. The monitoring and maintenance requirements combined with the environmental covenant will ensure that the cap, stormwater controls and LFG system are maintained over time. The proposed presumptive remedy protects human health and the environment and meets the expectations for the protection of terrestrial receptors in Chapter 173-340 WAC.
- **Comply with cleanup standards (WAC 173-340-700 through 173-340-760).** The landfill cap will allow soil with COC concentrations greater than the cleanup levels to be left in place as long as the requirements for a containment remedy are met. The COC concentrations in groundwater will comply with the proposed MTCA Method B cleanup levels at the point of compliance at the edge of the waste. All COC concentrations in groundwater are already in compliance, with the exception of PCE and vinyl chloride at well MW-15. The concentrations in downgradient off-Site groundwater currently meet the cleanup levels and will be monitored routinely to ensure that the groundwater conditions

are improving over time and the COCs are not migrating off-site. The LFG controls will control cross-media contamination of groundwater by VOCs. The presence of LFG will continue indefinitely as long a methane is being produced, and LFG control will be integrated into the overall management of the landfill operations.

- **Comply with applicable local, state, and federal laws (WAC 173-340-710).** The designed landfill cap, in conjunction with the proposed stormwater infrastructure, will ensure compliance with the requirements of WAC 173-340-710(7)(c). The LFG control requirements apply to the specific landfill regulations, as outlined in Section 6.3 (ARARs). The other components of the preferred alternative are consistent with the applicable regulations.
- **Provide for compliance monitoring (WAC 173-340-410 and WAC 173-340-720 through 173-340-760).** Compliance monitoring of LFG and groundwater will be conducted, as described in Section 9.2.

WAC 173-340-360(2)(b) specifies three additional criteria that must be satisfied by the preferred alternative. The following list indicates how the preferred alternative satisfies the criteria:

- **Use permanent solutions to the maximum extent practicable.** The preferred alternative is permanent to the maximum extent practicable for closed solid waste cells. The landfill cap will prevent direct contact by potential receptors and stormwater controls will limit infiltration. Monitoring and maintenance requirements, along with an environmental covenant, will ensure that the containment remedy will remain protective over time.
- **Provide for a reasonable restoration timeframe.** An ET cover is already in place over Area 6 and is functioning as designed. The ET cover for Areas 2 and 5 will be constructed within 1 to 2 years after Ecology approves the design, a reasonable timeframe. The implementation of the LFG control systems will occur concurrently with the construction of the landfill cap. A reduction in COC concentrations in groundwater is expected within several months after the LFG system startup. The COC concentrations in groundwater are expected to be in compliance within a reasonable timeframe, likely within 6.2 years or less after the LFG collection efforts begin.
- **Consider public concerns (WAC 173-340-600).** The preferred alternative will be submitted to Ecology and eventually described in a CAP produced by Ecology, which will be issued for public review.

9.6.1.2 Requirements for Containment Systems

Several additional elements of WAC 173-340-740(6)(f) identify the requirements of a containment remedial action and allow soil and solid waste with concentrations greater than the soil cleanup levels to remain in place. The preferred alternative meets these requirements in the following ways:

- **Institutional controls are in place.** An environmental covenant will be established to ensure that the components of the preferred alternative, including the landfill cap, maintenance and monitoring of the LFG control systems, and groundwater monitoring, are implemented. The landfill is fenced, and maintenance and monitoring of the LFG control systems in Areas 1, 2, and 5 will be performed. There are currently four domestic water supply wells in the vicinity of the landfill, the closest being ¾ mile away. These supply wells have been tested, and VOCs that are present are likely a result of area-wide aquifer contamination (refer to Section 3.6.1.2). It is against Washington State regulation to install a drinking water well within 1,000 feet of a landfill.

- **Compliance monitoring and periodic reviews are designed to ensure long-term integrity of the system.** Monitoring of the LFG control systems will be implemented and included in the Operations, Maintenance, and Monitoring Plans for the LFG control systems installed in Areas 1, 2, and 5. Likewise, groundwater will continue to be monitored until it is fully in compliance with the cleanup levels, at which point groundwater monitoring will continue in accordance with the Solid Waste Permit for the Site.
- **Types, levels, and amounts of hazardous substances remaining on-site and the description of the measures used to prevent migration and contact are specified in the CAP.** The material remaining within Areas 1, 2, and 5 is MSW containing low concentrations of hazardous substances. A Final CAP produced by Ecology will acknowledge these areas as previously closed solid waste landfill cells and identify the components of the containment remedy.

9.6.1.3 Compliance with ARARs

The preferred alternative complies with the following chemical-, location, and action-specific ARARs under WAC 173-340-710.

9.6.1.4 Chemical-specific ARARs

The preferred alternative is predicted to attain concentration-based cleanup levels developed under MTCA for the COCs in groundwater at the Site. Refer to Section 4.0 for a detailed discussion of how the cleanup levels were identified.

9.6.1.5 Location-specific ARARs

No location-specific ARARs that apply to the preferred alternative have been identified.

9.6.1.6 Action-specific ARARs

Action-specific ARARs are requirements that define acceptable management practices and are usually specific to certain kinds of activities that occur or are specific to the technologies that are used during the implementation of cleanup actions. The preferred alternative will comply with the requirements discussed in the following subsections.

Landfill Standards

The preferred alternative will comply with the standards for landfill closure requirements as identified in Chapters 173-304 and 173-351 WAC. Containment of landfill waste is relied on as the remedy for landfills, and, therefore, landfill capping (including stormwater controls) and LFG controls are remedies to comply with the landfill standards and to address contaminated groundwater at the Site. Institutional controls will also be implemented to augment the engineering controls and to protect human health and the environment. Long-term monitoring will be performed to ensure that the components of the preferred remedy are operating as intended.

Federal, State, and Local Air Quality Protection Programs

Regulations promulgated under the federal Clean Air Act (United States Code, Title 42, Section 7401) and the Washington State Clean Air Act (Chapter 70.94 RCW) govern the release of airborne contaminants from point and nonpoint sources. These requirements apply to the Site because the preferred alternative will extract and destroy LFG, which may require permitting. Additionally, any construction activities associated with the preferred alternative will need to meet all federal, state, and local air quality requirements for controlling fugitive dust and other emissions.

Federal and State Worker Safety Regulations

The safety of workers implementing remedies at hazardous waste sites are covered by the following regulations:

- Health and Safety for Hazardous Waste Operations and Emergency Response (HAZWOPER), Chapter 296-62 WAC; and Health and Safety, 29 CFR 1901.120;
- Occupational Safety and Health Act; and
- Washington Industrial Safety and Health Act (WISHA), Chapter 296-62 WAC, Chapter 296-155 WAC, and Chapter 49.1 RCW.

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10.0 DRAFT CLEANUP ACTION PLAN

Ecology is responsible for the cleanup action selection and the completion of the cleanup action plan (CAP). The CAP sets forth requirements that the cleanup must meet to achieve the cleanup standards and cleanup action objectives for the Site. As described in WAC 173-340-380(1)(a) the CAP shall include:

- A general description of the selected cleanup action developed in accordance with WAC 173-340-350 through 173-340-390.
- A summary of the rationale for selecting the proposed alternative.
- A brief summary of other cleanup action alternatives evaluated in the remedial investigation/feasibility study (RI/FS).
- Cleanup standards for each hazardous substance and for each medium of concern at the site.
- The schedule for implementation of the cleanup action plan.
- Institutional controls required as part of the cleanup action.
- Applicable state and federal laws for the cleanup action.
- A preliminary determination by the department that the cleanup action will comply with WAC 173-340-360.
- Where the cleanup action involves on-site containment, specification of the types, levels, and amounts of hazardous substances remaining on site and the measures that will be used to prevent migration and contact with those substances.

Text and figures for Ecology's use in the preparation of a draft CAP, based on the preferred alternative described in this RI/FS, are provided in Appendix J.

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11.0 REFERENCES

City of Walla Walla. 1977. *Engineering Report, City of Walla Walla Sanitary Landfill with Application for Disposal Site Permit and SEPA Documents.* March 18.

———. 1988. *City of Walla Walla, Sudbury Road Landfill Operating Plan*. June 20.

Cooper, H.H. and C.E. Jacob. 1946. A generalized graphical method for evaluating formation constants and summarizing well field history. *American Geophysical Union Transactions*, vol. 27, pp. 526-534.

Dahl, Norman & Associates (Dahl) and Anderson-Perry & Associates, Inc.(Anderson-Perry). 1987. *Final Report, Sudbury Road Landfill Utilization Plan for City of Walla Walla*. December.

EMCON. 1995. *Hydrogeologic Report*, *Sudbury Road Landfill, Walla Walla County, Washington*. June.

GSI Water Solutions, Inc. 2014. Pasco Landfill – Zone E VOC Occurrence and Alternative Source Assessment. Prepared for Weyerhaeuser NR Company. 2014.

Hantush, M.S. 1961. Drawdown Around a Partially Penetrating Well and Aquifer Tests on Partially Penetrating Wells. *Jour. of the Hyd. Div.*, *Proc. of the Am. Soc. of Civil Eng*., vol. 87, no. HY4, pp. 83-98 and HY5, pp. 171-194.

Hantush, M.S. and C.E. Jacob. 1955. *Non*-Steady Radial Flow in an Infinite Leaky Aquifer. *American Geophysical Union Transactions*, vol. 36, no. 1, pp. 95-100.

J-U-B Engineers, Inc. (JUB). 2010. *Specifications and Plans, Area 6 Closure, Sudbury Road Landfill*. Prepared by J-U-B Engineers, Kennewick, Washington for the City of Walla Walla. January.

Landau Associates, Inc. (LAI). 2004. *Remedial Investigation Work Plan, Sudbury Road Landfill, Walla Walla, Washington.* Prepared for the City of Walla Walla. April 22.

Newcomb, R.C. 1965. *Groundwater and Ground-Water Resources of the Walla Walla River Basin, Washington-Oregon*. Water Supply Bulletin 21. State of Washington, Division of Water Resources.

Parametrix. 2012. *Final Remedial Investigation and Feasibility Study (RI/FS) Report, Washington State Penitentiary, Walla Walla, Washington*. Prepared for Washington State Department of Corrections. November.

Schwyn Environmental Services, LLC (Schwyn). 2013a. *Remedial Alternatives Focusing Study, Sudbury Road Landfill, Walla Walla, Washington*. Prepared for the City of Walla Walla. November 8.

———. 2013b. *Revised Compliance Monitoring Plan, City of Walla Walla Sudbury Road Landfill.* Letter to Kevin Tureman, R.S., Walla Walla County Health Department. June 28.

———. 2012. *Memorandum: Sudbury RI – Data Gap Review.* To Frank Nicholson, P.E., City of Walla Walla. August 6.

———. 2011. *Data Summary and Remedial Investigation Work Plan, Sudbury Road Landfill, Walla Walla, Washington.* With accompanying Sampling and Analysis Plan, Quality Assurance Project Plan, and Health and Safety Plan. Prepared by Schwyn for the City of Walla Walla. 28 December.

———. 2010a. *Area 5 Landfill Gas Probe Installation and Sampling Report for the Sudbury Road Landfill, Walla Walla, Washington.* Prepared by Schwyn for the City of Walla Walla. January 22.

———. 2010b. *Revised Interim Action Plan, Sudbury Road Remedial Action, Walla Walla, Washington.* Prepared by Schwyn for the City of Walla Walla, Solid Waste Division. March 31.

———. 2006. *Sudbury Road Landfill Historical Study Report, Walla Walla, Washington.* Prepared by Schwyn for the City of Walla Walla, Solid Waste Division . January 17.

Shannon & Wilson (S&W). 2009. *Sudbury Road Landfill Notice of Construction Permit Application.* Prepared by S&W for the City of Walla Walla, Washington. October 22.

Shaw/EMCON/OWT, Inc. 2005. *Solid Waste Permit Modification for Lateral Expansion of Sudbury Road Landfill in Compliance with WAC 173-351*. Prepared for the City of Walla Walla. May.

Theis, C.V. 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage. *American Geophysical Union Transactions*, vol. 16, pp. 519–524.

U.S. Environmental Protection Agency (USEPA). 2008. *USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review*. EPA-540/R-99/008. October.

———. 2004. *USEPA National Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. OSWER 9240.1-45, EPA 540-R-04-004. Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, D.C. October.

———. 1991. *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites.* OSWER Directive 9355.3-11. EPA 540/P-91/001. February.

———. 1989. *Risk Assessment Guidance for Superfund.* Volume 1, *Human Health Evaluation Manual (Part A).* Interim Final. EPA/540/1-89/002. Office of Emergency and Remedial Response, Washington, D.C. Available at: http://www.epa.gov/oswer/riskassessment/ragsa/index.htm. December.

———. 1981. *Presumptive Remedy for CERCLA Municipal Landfill Sites Directive*. OSWER Directive 9355.3-11.

Walla Walla Union Bulletin. 1978. New city landfill on Sudbury Road opens Monday. Whitman College Penrose Library. On microfiche. July 9.

Washington State Department of Ecology (Ecology). 2012a. Email Correspondence Re: Sudbury Data Gap Review. To Frank Nicholson, Craig Schwyn, Melissa K. Warner, and Diane Singer. From Marni Solheim. August 9.

———. 2012b. *Sudbury Road Landfill – December 28, 2011, Data Summary and RI Work Plan (Including SAP/QAPP and HSP) and Independent Remedial Investigation Methods*. Letter to Frank Nicholson, City of Walla Walla Public Works, from Marni Solheim, Senior Regulatory & Facilities Specialist, Eastern Regional Office. January 6.

———. 2009. *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action.* Washington State Department of Ecology, Toxics Cleanup Program. Publication Number 09-09-047. Draft. October 2009.

———. 2007. *Washington Administrative Code*. Chapter 173-340, Model Toxics Control Act Cleanup Regulation. Compiled by Ecology's Toxics Cleanup Program. Publication No. 94-06. November.

———. 1999. *Sudbury Road Landfill Site, Contaminant Source Identification/Assessment Report.* Prepared under a Site Assessment Cooperative Agreement between the Washington State Department of Ecology and the U.S. Environmental Protection Agency. June.

———. 1993. *Washington Administrative Code*. Chapter 173-351, Criteria for Municipal Solid Waste Landfills. October.

———. 1990. *Washington Administrative Code*. Chapter 173-200, Water Quality Standards for Ground Waters of the State of Washington. December.

———. 1988. *Washington Administrative Code*. Chapter 173-304, Minimum Functional Standards for Solid Waste Handling. October.

———. 1972. *Washington Administrative Code*. Chapter 175-301, Regulation Relating to Minimum Functional Standards for Solid Waste Handling. Adopted October 24, 1972; effective November 27, 1972.

Washington State Department of Health (WDOH). 2012. *Private Well Volatile Organic Compound Exposure Near Sudbury Road, Walla Walla, Walla Walla County, Washington.* Letter Health Consultation prepared by the WDOH under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. July 18.

TABLE 1
WELL CONSTRUCTION SUMMARY
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

		Well Elevation		Depth	Casing		Screen Depth		Screen Elevation	
	Date	Ground	TOC	**Drilled**	**Diameter**	**Screen**	Top	Bottom	Top	Bottom
Well	**Drilled**	(Ft Above MSL)		(Ft-BGL)	(Inches)	**Type**	(Ft-BGL)		(Ft Above MSL)	
MW-1	8/26/1986	788.57	791.45	121	2	0.01 slot S.S.	108	118	680.6	670.6
MW-2	12/1/1976	802.57		155	5	Perforated Steel	80	155	722.6	647.6
MW-3	9/18/1986	788.37	791.35	121	2	0.01 slot S.S.	108	118	680.4	670.4
MW-4	8/1/1983	802.97	806.48	71	5	Perforated Steel	51	71	752.0	732.0
MW-5	9/8/1983	822.97	826.44	82	5	Perforated Steel	62	82	761.0	741.0
MW-9	9/20/1991	901.27	904.01	210	5	0.01 slot PVC	63	83	838.3	818.3
MW-10	12/27/1993	869.97	872.38	47	2	0.01 slot PVC	29.4	44.7	840.6	825.3
MW-11	2/10/1995	794.38	797.55	41	2	0.01 slot PVC	25.5	40.5	768.9	753.9
MW-12	2/9/1995	826.07	828.90	62	2	0.01 slot PVC	46.5	61.5	779.6	764.6
MW-12b	8/28/2008	827.94	830.73	80.5	2	0.01 slot PVC	60	80	767.9	747.9
MW-14	8/12/1999	833.07	835.80	82	2	0.01 slot PVC	66	82	767.1	751.1
MW-14b	5/23/2012	832.43	834.89	107	2	0.01 slot PVC	91.6	106.6	740.8	725.8
MW-15	7/17/2001	790.02	792.61	46.5	2	0.01 slot PVC	28	43	762.0	747.0
MW-15D	5/23/2012	789.64	792.04	87	4	0.01 slot PVC	68	83	721.6	706.6
MW-16	8/31/2005	813.72	816.32	69	2	0.01 slot PVC	54	69	759.7	744.7
MW-17	5/12/2012	844.75	847.01	97	2	0.01 slot PVC	79.6	94.6	765.1	750.1
MW-18	5/20/2012	807.52	810.11	63	2	0.01 slot PVC	47.1	62.1	760.4	745.4
MW-19	5/20/2012	814.83	814.30	77	2	0.01 slot PVC	59.6	74.6	755.2	740.2
MW-20	5/15/2012	789.51	791.83	57	2	0.01 slot PVC	41.6	56.6	747.9	732.9
MW-21S	5/12/2012	794.84	794.27	58	2	0.01 slot PVC	39.6	54.6	755.2	740.2
MW-21D	5/13/2012	796.59	796.04	83	2	0.01 slot PVC	75.6	80.6	721.0	716.0
MW-22S	5/13/2012	813.91	813.26	82	2	0.01 slot PVC	65.6	80.6	748.3	733.3
MW-22D	5/14/2012	814.29	813.60	112	2	0.01 slot PVC	105.6	110.6	708.7	703.7
MW-23	5/21/2012	794.05	796.49	52	2	0.01 slot PVC	36.6	51.6	757.5	742.5
MW-24	5/22/2012	796.85	799.30	47	2	0.01 slot PVC	26.6	41.6	770.3	755.3
MW-25	5/22/2012	793.00	795.44	42	2	0.01 slot PVC	25.6	40.6	767.4	752.4
MW-26	5/9-10/2012	832.63	834.91	92	2	0.01 slot PVC	76.6	91.6	756.0	741.0
MW-27	8/29/2012	791.98	794.50	52	2	0.01 slot PVC	41.6	51.6	750.4	740.4
GW-5	8/6/2009	843.67	847.00	48.5	0.5	0.03 slot Sch 80 PVC	25	30	818.7	813.7
GW-6	8/6/2009	800.87		39	0.5	0.03 slot Sch 80 PVC	20	25	780.9	775.9
GW-7S	5/7/2012	789.10	791.68	17	0.75	0.01 slot PVC	12	17	777.1	772.1
GW-7D	5/7/2012	789.45	792.10	37	0.75	0.01 slot PVC	31.1	36.3	758.4	753.2
GW-8	5/7/2012	805.91	808.58	15	0.75	0.01 slot PVC	10	15	795.9	790.9
GW-9	5/7/2012	792.97	795.77	15	0.75	0.01 slot PVC	10	15	783.0	778.0
GW-10	5/7/2012	796.23	795.62	10	0.75	0.01 slot PVC	5	10	791.2	786.2
GW-11	5/8/2012	831.73	834.53	57	0.75	0.01 slot PVC	25	30	806.7	801.7
GW-12	5/7/2012	822.34	824.86	31	0.75	0.01 slot PVC	26	31	796.3	791.3
Garver	12/8/1967	89.57		1227	10	?	?	?		

Notes:

TOC = Top of casing

Ft Above MSL = Feet above mean sea level (NAVD 88)

Ft-BGL = Feet below ground level

S.S. = Stainless steel

TABLE 2
COVER AND MSW THICKNESS SUMMARY
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Location	Ground Elevation (Ft MSL)	Cover Thickness (Ft)	Depth to MSW (Ft BGL)	MSW Bottom (Ft BGL)	MSW Thickness (Ft)	MSW Base Elevation (Ft MSL)	Water Table *(Ft MSL)	MSW - Water Table Separation *(Ft)
Area 1								
GW-11	831.7	11	11	48	37	783.7	760	24
TP-25	833.8	12	12	ND	ND	ND	ND	ND
TP-26	834.4	>16.5	ND	ND	ND	ND	ND	ND
TP-27	834.5	>17	ND	ND	ND	ND	ND	ND
TP-28	836.4	>17	ND	ND	ND	ND	ND	ND
Area 2								
TP-24	812.0	3	3	>10	ND	ND	ND	ND
SB-24	812.0	3	3	30	27	782.0	759	23
TP-29	820.6	NA	none to 12'	NA	Likely none	ND	ND	ND
TP-30	820.1	NA	none to 15'	NA	Likely none	ND	ND	ND
TP-31	817.0	NA	none to 16'	NA	Likely none	ND	ND	ND
TP-32	813.4	NA	none to 16'	NA	Likely none	ND	ND	ND
TP-33	811.5	NA	none to 15'	NA	Likely none	ND	ND	ND
TP-34	810.3	NA	none to 15'	NA	Likely none	ND	ND	ND
TP-35	813.0	11	11	>14	ND	ND	ND	ND
TP-36	815.6	6	6	9	3	806.6	759	48
TP-37	816.6	3	3	4	1	812.6	759	54
TP-38	818.1	3	3	3.5	0.5	814.6	759	56
TP-39	820.4	NA	none to 16'	NA	Likely none	ND	ND	ND
TP-40	816.3	2.5	2.5	5	2.5	811.3	759	52
TP-41	814.9	2.5	2.5	8	5.5	806.9	759	48
TP-42	813.6	3	3	>3	ND	ND	ND	ND
TP-43	812.5	5	5	>5	ND	ND	ND	ND
TP-44	809.1	6	6	>9	ND	ND	ND	ND
TP-45	804.6	1.5	1.5	2	0.5	802.6	759	44
TP-46	804.9	2	2	3	1	801.9	759	43
TP-47	801.7	4	4	>9	ND	ND	ND	ND
TP-48	796.4	0.5	0.5	2	1.5	794.4	759	35
TP-49	794.7	0.5	0.5	9	8.5	785.7	759	27
TP-50	796.2	3	3	4	1	792.2	759	33
TP-51	794.7	1.5	1.5	>7	>5.5	ND	ND	ND
TP-52	793.8	2	2	>5	>3	ND	ND	ND
TP-53	793.4	2.5	2.5	6	4	787.4	759	28
TP-54	785.2	NA	NSQ to 4'	4	NSQ	ND	ND	ND
TP-55	782.0	3	3	5	2	777.0	759	18
TP-56	785.1	2	2	3	1	782.1	759	23
TP-57	794.1	NA	none to 16'	NA	Likely none	ND	ND	ND
TP-58	806.1	NA	none to 10'	NA	Likely none	ND	ND	ND
TP-59	804.1	4	4	5	1	799.1	759	40
TP-60	804.3	2	2	7	5	797.3	759	38
TP-61	810.1	2	2	8	6	802.1	759	43
TP-62	811.8	5	5	5.5	0.5	806.3	759	47

TABLE 2
COVER AND MSW THICKNESS SUMMARY
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Location	Ground Elevation (Ft MSL)	Cover Thickness (Ft)	Depth to MSW (Ft BGL)	MSW Bottom (Ft BGL)	MSW Thickness (Ft)	MSW Base Elevation (Ft MSL)	Water Table *(Ft MSL)	MSW - Water Table Separation *(Ft)
Area 5								
TP-1	847.3	13.0	13.0	ND	ND	ND	ND	ND
TP-2	842.7	4.0	4.0	ND	ND	ND	ND	ND
TP-3	836.9	4.0	4.0	ND	ND	ND	ND	ND
TP-4	828.6	1.5	1.5	ND	ND	ND	ND	ND
TP-5	816.8	3.3	3.3	ND	ND	ND	ND	ND
TP-6	815.3	10.0	10.0	ND	ND	ND	ND	ND
TP-7	837.6	14.0	14.0	ND	ND	ND	ND	ND
TP-8	845.2	13.5	13.5	ND	ND	ND	ND	ND
TP-9	843.3	14.0	14.0	ND	ND	ND	ND	ND
TP-10	837.9	15.5	15.5	ND	ND	ND	ND	ND
TP-11	839.8	14.5	14.5	ND	ND	ND	ND	ND
TP-12	837.5	15.0	15.0	ND	ND	ND	ND	ND
TP-13	836.1	11.5	11.5	ND	ND	ND	ND	ND
TP-14	829.5	5.5	5.5	ND	ND	ND	ND	ND
TP-15	818.0	9.5	9.5	ND	ND	ND	ND	ND
TP-16	804.2	10.5	10.5	ND	ND	ND	ND	ND
TP-17	808.5	10.5	10.5	ND	ND	ND	ND	ND
TP-18	*820	>14.5	ND	ND	ND	ND	ND	ND
TP-19	*825	11	11	ND	ND	ND	ND	ND
TP-20	804.6	10.5	10.5	ND	ND	ND	ND	ND
TP-21	797.7	3.0	3.0	5.0	2.0	792.7	760.4	32
TP-22	795.1	5.5	5.5	ND	ND	ND	ND	ND
TP-23	802.4	5.5	5.5	ND	ND	ND	ND	ND
B-1/TP-21	797.0	3.0	3.0	ND	ND	ND	ND	ND
B-2	796.7	4.5	4.5	ND	ND	ND	ND	ND
B-3	796.7	6.0	6.0	ND	ND	ND	ND	ND
B-4	794.9	9.0	9.0	ND	ND	ND	ND	ND
B-5/TP-22	795.3	5.5	5.5	ND	ND	ND	ND	ND
B-6	793.3	7.0	7.0	ND	ND	ND	ND	ND
B-7	792.7	6.0	6.0	ND	ND	ND	ND	ND
B-8	793.1	7.0	7.0	ND	ND	ND	ND	ND
B-9	792.8	8.0	8.0	ND	ND	ND	ND	ND
B-10	792.1	9.0	9.0	ND	ND	ND	ND	ND
B-11	791.9	8.0	8.0	ND	ND	ND	ND	ND
B-12	792.2	11.0	11.0	ND	ND	ND	ND	ND
B-13	792.9	7.0	7.0	ND	ND	ND	ND	ND
SB-19	793.4	12.0	12.0	28.0	16.0	765.4	758.1	7
SB-20	797.6	11.0	11.0	49.5	38.5	748.1	759.2	-11
SB-21	798.7	3.0	3.0	17.0	14.0	781.7	760.4	21
SB-22	794.8	13.0	13.0	29.5	16.5	765.3	758.6	7
SB-23	796.0	9.0	9.0	25.5	16.5	770.5	758.9	12
SB-25	798.3	13.0	13.0	27.5	14.5	770.8	759.5	11
SB-26	800.0	11.5	11.5	23.0	11.5	777.0	759.9	17

TABLE 2
COVER AND MSW THICKNESS SUMMARY
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Location	Ground Elevation (Ft MSL)	Cover Thickness (Ft)	Depth to MSW (Ft BGL)	MSW Bottom (Ft BGL)	MSW Thickness (Ft)	MSW Base Elevation (Ft MSL)	Water Table *(Ft MSL)	MSW - Water Table Separation *(Ft)
Area 5 (Continued)								
B9RI	800.8	3.0	3.0	33.0	30.0	767.8	758.0	10
B10RI	*802	11.0	11.0	31.0	20.0	771.0	758.9	12
B11RI	*808	21.0	21.0	33.0	12.0	775.0	759.9	15
B12RI	*822	16.5	16.5	41.0	24.5	781.0	759.5	22
B14RI	*842	10.0	10.0	48.0	38.0	794.0	760.2	34
B17RI	*820	10.0	10.0	40.0	30.0	780.0	758.7	21
B18RI	*825	8.0	8.0	21.0	13.0	804.0	758.0	46
GW-5	843.7	13.0	13.0	36.5	23.5	807.2	760.2	47
GW-6	800.9	3.0	3.0	32.5	29.5	768.4	758.0	10

Notes:
Ft MSL = Feet above mean sea level (NAVD 88)
Ft BGL = Feet below ground level
Water table elevation based on February 2013 depth to water measurements
NA = Not applicable
ND = Not Determined
NSQ = nonsignificant quantity (scattered debris in soil)
* = Estimated

TABLE 3
SOIL ANALYTICAL DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Exploration	Date Sampled	1,1-Dichloroethane (µg/kg)	Acetone (µg/kg)	Carbon disulfide (µg/kg)	cis-1,2-Dichloroethene (µg/kg)	Methyl ethyl ketone (µg/kg)	Methyl iso butyl ketone (µg/kg)	Methylene chloride (µg/kg)	Tetrachloroethene (µg/kg)	Toluene (µg/kg)	Trichloroethene (µg/kg)	Xylene (meta & para) (µg/kg)
GW11@56'	5/8/2012	8.8	6,500	6.7	5.6 U	16,000	53	170	5.6 U	9	5.8	8.5
SB24@32'	5/21/2012	5.5 U	22 U	5.5 U	11	22 U	22 U	18	7.1	5.5 U	5.5 U	7.8
SB-24 Dup	5/21/2012	4.7 U	19 U	4.7 U	15	19 U	19 U	22	10	4.7 U	4.7 U	11 J
SB21@27'	5/22/2012	5 U	20 U	5 U	22	20 U	20 U	11	5.9	5 U	5 U	5 U
SB-23-29.5-30	8/28/2012	5.1	19 U	4.8 U	50	19 U	19 U	9.5 U	4.8 U	4.8 U	4.8 U	4.8 U
SB-26-28.5-29	8/29/2012	5 U	20 U	5 U	14	20 U	20 U	9.9 U	5.3	5 U	5 U	5 U
GP-3-21.5-22	7/6/2005	100 U	1000 U	100 U	100 U	1000 U	1000 U	1000 U	30.0 U	100 U	30.0 U	400 U
GP-4-18-18.5	7/6/2005	100 U	1000 U	100 U	100 U	1000 U	1000 U	1000 U	30.0 U	100 U	30.0 U	400 U
GP-6-15-15.5	7/6/2005	100 U	1000 U	100 U	100 U	1000 U	1000 U	1000 U	30.0 U	100 U	30.0 U	400 U
B-9RI-35'	8/29/2005	100 U	1000 U	100 U	100 U	1000 U	1000 U	1000 U	30.0 U	100 U	30.0 U	400 U
B-10RI-34'	8/30/2005	100 U	1000 U	100 U	100 U	1000 U	1000 U	1000 U	30.0 U	100 U	30.0 U	400 U
B-11RI-34'	8/30/2005	100 U	1000 U	100 U	100 U	1000 U	1000 U	1000 U	30.0 U	100 U	30.0 U	400 U
B-12RI-44'	8/30/2005	100 U	1000 U	100 U	100 U	1000 U	1000 U	1000 U	30.0 U	100 U	30.0 U	400 U

Notes

Only volatile organic compounds detected on a regular basis in the landfill area groundwater are presented on table.

U = analyte not detected at or above the indicated laboratory reporting level.

J = analyte detected, numeric result is considered an estimate.

µg/kg = micrograms per kilogram.

TABLE 4
BARHOLE MONITORING RESULTS
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Gas Well Identification	Date of Measurement	Bottom of Barhole (ft bgs)	Barometric Pressure (inches Hg)	Well Head Pressure (inches H20)	Methane (% volume)	Carbon Dioxide (% volume)	Oxygen (% volume)
SBBH-1	5/8/2012	2	29.09	2.8	0	0.2	21
SBBH-2	5/8/2012	2	29.11	2.9	0	0.8	19.4
SBBH-3	5/8/2012	2	29.1	3.03	0	2.6	18.4
SBBH-4	5/8/2012	2	29.14	0.01	0	8.2	11.6
SBBH-5	5/8/2012	2	29.15	0.07	0	1	20
SBBH-6	5/8/2012	2	29.13	0.09	0	0.7	19.7
SBBH-7[1]	5/8/2012	2	29.12	0.19	0.1	0.6	18.8
SBBH-8	5/8/2012	1	29.11	0.09	0	0.5	19.5
SBBH-9[2]	5/8/2012	2	29.1	-0.03	0	0	20.1

Notes:
1 Readings did not stabilize. GEM 2000 shut down after 44 seconds due to tight silt formation.
2 Readings did not stabilize. GEM 2000 shut down after 25 seconds due to tight silt formation.
Hg = mercury
bgs = below ground surface

TABLE 5
GAS WELL MONITORING RESULTS
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Gas Well Identification	Date of Measurement	Barometric Pressure (inches Hg)	Well Head Pressure (inches H20)	Methane (% volume)	Carbon Dioxide (% volume)	Oxygen (% volume)
GW-3	5/14/2012	29.09	1.34	59.9	39.6	0
GW-3	7/11/2012	30.00	1.41	57.3	42.8	0
GW-3	9/27/2012	30.06	3.01	59.8	40.2	0
GW-3	11/29/2012	29.70	4.15	58.5	40.9	0
GW-3	2/14/2013	30.50	-0.1	59.5	40.1	0
GW-5	5/10/2012	29.38	0.26	66.6	55.6	0
GW-5	5/13/2012	29.18	0	65.6	36.1	0
GW-5	7/11/2012	30.00	0.44	61.3	36.7	0
GW-5	9/26/2012	30.01	0.18	54.9	34.9	0
GW-5	11/29/2012	29.70	1.16	62.4	37.3	0
GW-5	2/14/2013	30.49	-0.49	62.1	37.2	0
GW-6	5/9/2012	29.21	0.38	55.3	33.8	0
GW-6	7/11/2012	30.00	0.3	53.8	33.9	0
GW-6	9/26/2012	30.01	0.53	63	37.0	0
GW-6	11/29/2012	29.71	0.66	52.4	35.4	0
GW-6	2/14/2013	30.49	-0.31	51.5	32.2	0.3
GW-7S	5/9/2012	29.22	0.12	0	19.3	0
GW-7S	5/11/2012	29.35	0.04	0	16.6	2.4
GW-7S	7/11/2012	30.00	0.06	0.4	19.3	0
GW-7S	9/26/2012	30.01	-0.13	0	19.6	1.3
GW-7S	11/29/2012	29.71	NR	0.1	18.9	0
GW-7S	2/14/2013	30.49	0.01	0	13.6	6.5
GW-7D	5/9/2012	29.17	0.08	0	0.2	21.5
GW-7D	5/11/2012	29.41	0.02	0	0.9	19.8
GW-7D	7/11/2012	30.00	0.02	0	0	22.7
GW-7D	9/26/2012	30.01	-0.16	0	0	22.5
GW-7D	11/29/2012	29.71	0.03	0	0.1	21.8
GW-7D	2/14/2013	30.49	0.01	0	0	NR[1]
GW-8	5/9/2012	29.16	0	0	1.9	18.9
GW-8	5/11/2012	29.40	0	0	1.5	18
GW-8	7/11/2012	30.00	0.02	0	1.1	19
GW-8	9/26/2012	30.01	-0.17	0	0.6	21.2
GW-8	11/29/2012	29.69	0.03	0	0.5	20.6
GW-8	2/14/2013	30.50	-0.01	0	0.5	NR[1]
GW-9	5/9/2012	29.16	0.03	0	1.9	19.4
GW-9	5/11/2012	29.34	0	0	1.9	17.9
GW-9	7/11/2012	30.00	NR	0	1.4	17.3
GW-9	9/26/2012	30.02	NR	0	1.8	18.9
GW-9	11/29/2012	29.70	0.01	0	1.5	19.6
GW-9	2/14/2013	30.50	0	0	1.0	NR[1]
GW-10	5/9/2012	29.22	0.26	0	5.6	12.1
GW-10	5/13/2012	29.32	0.03	0.7	6.8	11.3
GW-10	7/11/2012	30.00	0.35	0	7.6	8.7
GW-10	9/27/2012	30.06	0.52	0	8.3	8
GW-10	11/29/2012	29.70	0.18	0	7.7	8.7
GW-10	2/14/2013	30.50	-0.16	0	6.2	8.9

TABLE 5
GAS WELL MONITORING RESULTS
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Gas Well Identification	Date of Measurement	Barometric Pressure (inches Hg)	Well Head Pressure (inches H20)	Methane (% volume)	Carbon Dioxide (% volume)	Oxygen (% volume)
GW-11	5/8/2012	29.09	0.62	19.7	20.4	0
GW-11	5/11/2012	29.36	0.26	13.5	17.8	0
GW-11	7/11/2012	30.00	0.13	12.5	18.8	0
GW-11	9/26/2012	30.02	NR	15.5	20.1	0
GW-11	11/29/2012	29.69	0.5	16.4	21.0	0
GW-11	2/14/2013	30.49	-0.2	14.2	20.6	0.2
GW-12	5/9/2012	29.18	0.18	0	1.3	19.5
GW-12	5/11/2012	29.35	0.16	0	2.3	17.2
GW-12	7/11/2012	30.00	0.14	0	0.9	19.4
GW-12	9/26/2012	30.00	-0.06	0	1.1	19.2
GW-12	11/29/2012	29.71	0.22	0	1.2	18.3
GW-12	2/14/2013	30.49	-0.17	0	1.1	NR[1]

Notes:
1 Oxgen sensor malfunction
Hg – mercury.
NR – not reported

TABLE 6
LANDFILL GAS VOC DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Sample Location	MW-15	MW-16	GW-5	GW-6	GW-05	GW-06	GW-07D	GW-07S	GW-08	GW-09	GW-10	GW-11	GW-12
Sample Date	**8/9/2006**	**8/9/2006**	**9/12/2009**	**9/12/2009**	**5/13/2012**	**5/9/2012**	**5/11/2012**	**5/11/2012**	**5/11/2012**	**5/11/2012**	**5/13/2012**	**5/11/2012**	**5/11/2012**
EPA TO-15 Analyte	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**	**(µg/m^3)**
1,1,1-Trichloroethane	6.7 U	5.0 U	430 U	130 U	0.623 U	134	5.2 U	6.8 U	5.2 U	5.2 U	24	0.623 U	5.2 U
1,1-Dichloroethane	99	5.0 U	430 U	470	55	1790	3.8 U	7.9	3.9 U	3.9 U	3.8 U	3250	3.9 U
1,1-Dichloroethene	8.8	5.0 U	430 U	220	480	261	3.8 U	5 U	3.8 U	3.8 U	3.7 U	374	3.8 U
1,2,4-Trichlorobenzene	130 U	130 U	430 U	130 U	9.5	1.15 U	28 U	37 U	28 U	28 U	28 U	1.15 U	28 U
1,2,4-Trimethylbenzene	--	--	970	420	1160	892	5.7	6.2 U	5.8	4.7 U	4.6 U	1180	4.9
1,2-Dichlorobenzene	6.7 U	5.0 U	430 U	130 U	0.925 U	19.2	5.7 U	7.5 U	5.7 U	5.7 U	5.6 U	5.77	5.7 U
1,2-Dichloroethane	6.7 U	5.0 U	430 U	130 U	22.7	88.1	3.8 U	5.1 U	3.9 U	3.9 U	3.8 U	95.2	3.9 U
1,2-Dichloropropane	12	5.0 U	430 U	130 U	45.8	194	4.4 U	5.8 U	4.4 U	4.4 U	4.3 U	199	4.4 U
1,3,5-Trimethylbenzene	--	--	450	230	699	426	4.7 U	6.2 U	4.7 U	4.7 U	4.6 U	618	4.7 U
1,4-Dichlorobenzene	6.7 U	5.0 U	430 U	130 U	46.2	258	5.7 U	7.5 U	5.7 U	5.7 U	5.6 U	187	5.7 U
2-Hexanone	6.7 U	5.0 U	430 U	130 U	0.757 U	804	16 U	20 U	16 U	16 U	15 U	1.74 U	16 U
4-Ethyltoluene	--	--	430 U	220	680	619	4.7 U	6.2 U	4.7 U	4.7 U	4.6 U	981	4.7 U
Acetone	45 M	37	4,300 U	1,300 U	1360	772	22 U	30 U	23 U	23 U	22 U	849	23 U
Acrolein	--	--	430 U	130 U	1.49 U	1.49 U	--	--	--	--	--	49.6	--
Benzene	6.7 U	5.0 U	940	1,700	1490	1740	3 U	4 U	3 U	3 U	3 U	1220	3 U
Bromodichloromethane	6.7 U	5.0 U	430 U	130 U	1.35 U	136	6.4 U	8.4 U	6.4 U	6.4 U	6.3 U	1.35 U	6.4 U
Bromoform	6.7 U	5.0 U	430 U	130 U	0.867 U	0.867 U	9.8 U	13 U	9.9 U	9.9 U	9.7 U	0.867 U	9.9 U
Carbon disulfide	20	15	430 U	130 U	86.2	62.3	12 U	16 U	12 U	12 U	12 U	0.467 U	12 U
Chlorobenzene	6.7 U	5.0 U	430 U	130 U	768	0.497 U	4.4 U	5.8 U	4.4 U	4.4 U	4.3 U	0.497 U	4.4 U
Chloroethane	36	5.0 U	430 U	970	236	785	10 U	13 U	10 U	10 U	9.9 U	194	10 U
Chloromethane	6.7 U	5.0 U	430 U	150	99.5	61.8	20 U	26 U	20 U	20 U	19 U	91.2	20 U
cis-1,2-Dichloroethene	65	5.0 U	11,000	19,000	10200	12500	3.8 U	5 U	3.8 U	3.8 U	3.7 U	4300	3.8 U
Cyclohexane	--	--	1,600	5,300	1100	1490	3.3 U	4.3 U	3.3 U	3.3 U	3.2 U	2510	3.3 U
Dichlorodifluoromethane (Freon12)	650 M	150	430 U	7,900	950	5980	12	1200	180	420	280	12400	4.7 U
Ethyl acetate	--	--	870 U	1,200	902	606	--	--	--	--	--	503	--
Ethylbenzene	6.7 U	6.5	6,400	3,900	8550	4290	4.1 U	5.4 U	4.1 U	4.1 U	4.1 U	5670	4.1 U
Freon 114	--	--	430 U	1,600	731	1490	6.6 U	930	37	150	59	7600	6.7 U
iso-Propanol	--	--	5,100	1,300	1020	76.7	9.3 U	12 U	9.4 U	9.4 U	9.2 U	400	9.4 U
4-Methyl-2-pentanone (MIBK)	6.7 U	5.0 U	920	1,100	2990	0.971 U	3.9 U	5.1 U	3.9 U	3.9 U	3.8 U	0.971 U	3.9 U
Methyl methacrylate	--	--	870 U	260 U	0.76 U	28.8	--	--	--	--	--	10.5	--
Methylene chloride	55	46	1,100	2,300	1270	0.848 U	33 U	44 U	33 U	33 U	33 U	0.848 U	33 U
Methyl-Tert-Butyl Ether	6.7 U	5.0 U	430 U	130 U	19.6	46.1	3.4 U	4.5 U	3.4 U	3.4 U	3.4 U	30	3.4 U
Naphthalene	130 U	130 U	430 U	130 U	493	56.2	--	--	--	--	--	0.898 U	--
n-Heptane	--	--	8,800	14,000	10900	7510	3.9 U	5.1 U	3.9 U	3.9 U	3.8 U	10400	3.9 U
n-Hexane	--	--	1,900	5,800	3120	4800	3.3 U	4.4 U	3.4 U	3.4 U	3.3 U	9490	3.4 U
Propene	--	--	430 U	13,000	2660	3880	--	--	--	--	--	21500	--

TABLE 6
LANDFILL GAS VOC DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Sample Location	MW-15	MW-16	GW-5	GW-6	GW-05	GW-06	GW-07D	GW-07S	GW-08	GW-09	GW-10	GW-11	GW-12
Sample Date	**8/9/2006**	**8/9/2006**	**9/12/2009**	**9/12/2009**	**5/13/2012**	**5/9/2012**	**5/11/2012**	**5/11/2012**	**5/11/2012**	**5/11/2012**	**5/13/2012**	**5/11/2012**	**5/11/2012**
EPA TO-15 Analyte	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**	**(µg/m³)**
Styrene	12	14	430 U	230	645	436	4 U	5.3 U	4.1 U	4.1 U	4 U	793	4.1 U
Tetrachloroethene	550	5.0 U	4,000	9,900	3100	17000	14	2700	6.5 U	200	28	9110	6.5 U
Tetrahydrofuran	--	--	790	580	2840	592	2.8 U	3.7 U	2.8 U	2.8 U	2.8 U	1900	2.8 U
Toluene	28	23	52,000	26,000	10900	19900	5.6	4.7 U	6	3.6 J	6.6	17200	6.4
trans-1,2-Dichloroethene	6.7 U	5.0 U	430 U	260	197	624	3.8 U	5 U	3.8 U	3.8 U	3.7 U	704	3.8 U
trans-1,3-Dichloropropene	6.7 U	5.0 U	430 U	130 U	1.67 U	1.67 U	4.3 U	5.7 U	4.3 U	4.3 U	4.3 U	1.67 U	4.3 U
Trichloroethene	190	20	2,000	3,200	2190	6870	5.1 U	10	5.1 U	5.1 U	5 U	6250	5.1 U
Trichlorofluoromethane (Freon 11)	6.7 U	16	430 U	160	254	544	5.3 U	7 U	14	16	31	2930	5.4 U
Vinyl acetate	6.7 U	5.0 U	4,300 U	1,300 U	54.1 J	88.4 J	--	--	--	--	--	150 J	--
Vinyl chloride	220	5.0 U	430 U	2,200	830	1660	2.4 U	3.2 U	2.4 U	2.4 U	2.4 U	3560	2.4 U
Xylene (meta & para)	24	23	15,000	8,200	8390	5400	6.3	5.4 U	5.3	4.1 U	4.3	5400	5
Xylene (ortho)	8.0	6.1	3,300	2,400	4920	3080	4.1 U	5.4 U	4.1 U	4.1 U	4.1 U	3050	4.1 U

Notes:
Only detected analytes in one or more of the samples are reported on table.
U = Compound was analyzed for, but not detected above the laboratory reporting limit.
J = analyte detected, numeric result is considered an estimate.
-- = No result for particular analyte.

TABLE 7
GROUNDWATER ANALYTICAL DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

	Nitrate (mg/L)	Calcium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Manganese (mg/L)	Ammonia (total as nitrogen) (mg/L)	Total Organic Carbon (mg/L)	Total Dissolved Solids (mg/L)	1,1-Dichloroethane (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	cis-1,2-Dichloroethene (µg/L)	Dichlorodifluoromethane (Freon 12) (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (Freon 11) (µg/L)	Vinyl chloride (µg/L)	Vinyl chloride by SIM (µg/L)
MW-03																								
6/8/2012	9.8	105	17.5	138	49.5	7.1	30.9	243	0.02 U	0.005 U	0.05 U	0.51	633	0.5 U	0.5 U	0.55	0.5 U	0.5 U	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/11/2012	10.5	110	16.8	138	50.1	7.19	32.7	300	0.02 U	0.005 U	0.05 U	0.5 U	745	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.89	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/14/2012	10.1	103	16.2	135	45.1	6.79	31.8	253	0.02 U	0.005 U	0.05 U	0.55	783	0.5 U	0.5 U	0.66	0.5 U	0.5 U	1.0	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/19/2012	10.1	105	16.7	144	48	6.89	35.1	253	0.01 U	0.002 U	0.05 U	0.57	667	0.5 U	0.5 U	0.51	0.5 U	0.5 U	0.86	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/25/2012	10.0	108	16.7	137	48.5	7.01	32.5	249	0.02 U	0.005 U	0.05 U	0.53	643	0.5 U	0.5 U	0.56	0.5 U	0.5 U	0.94	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/27/2012	11.8	103	17	136	48.5	7.2	32.5	242	0.02 U	0.005 U	0.05 U	0.5 U	572	0.5 U	0.5 U	0.57	0.5 U	0.5 U	0.95	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/8/2013	10.2	106	17.3	136	48.5	7.09	31.9	252	0.02 U	0.005 U	0.05 U	0.69	613	0.5 U	0.5 U	0.58	0.5 U	0.5 U	0.89	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/11/2013	9.8	106	17.7	130	49.4	7.25	30.7	258	0.02 U	0.005 U	0.05 U	0.57	553	0.5 U	0.5 U	0.68	0.5 U	0.5 U	0.92	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
MW-05																								
6/5/2012														0.5 U	0.5 U	0.57	0.5 U	0.5 U	0.77	0.5 U	1.7	0.5 U	0.5 U	0.02 U
7/11/2012														0.5 U	0.5 U	0.54	0.5 U	0.5 U	0.65	0.5 U	1.7	0.5 U	0.5 U	0.02 U
8/15/2012														0.5 U	0.5 U	0.67	0.5 U	0.5 U	0.71	0.5 U	2.0	0.5 U	0.5 U	0.02 U
8/15/2012 (Dup)														0.5 U	0.5 U	0.7	0.5 U	0.5 U	0.66	0.5 U	2.1	0.5 U	0.5 U	0.02 U
9/18/2012														0.5 U	0.5 U	0.57	0.5 U	0.5 U	0.64	0.5 U	1.8	0.5 U	0.5 U	0.02 U
10/22/2012														0.5 U	0.5 U	0.68	0.5 U	0.5 U	0.79	0.5 U	1.9	0.5 U	0.5 U	0.02 U
11/27/2012														0.5 U	0.5 U	0.74	0.5 U	0.5 U	0.76	0.5 U	1.9	0.5 U	0.5 U	0.02 U
1/8/2013														0.5 U	0.5 U	0.6	0.5 U	0.5 U	0.63	0.5 U	1.7	0.5 U	0.5 U	0.02 U
2/13/2013														0.5 U	0.5 U	0.71	0.5 U	0.5 U	0.64	0.5 U	1.9	0.5 U	0.5 U	0.02 U
MW-09																								
6/5/2012														0.5 U	0.5 U	0.81	0.5 U	0.5 U	0.54	0.5 U	1.4	0.5 U	0.5 U	0.02 U
7/10/2012														0.5 U	0.5 U	1.0	0.5 U	0.5 U	0.62	0.5 U	1.7	0.5 U	0.5 U	0.02 U
8/15/2012														0.5 U	0.5 U	1.0	0.5 U	0.5 U	0.64	0.5 U	1.7	0.5 U	0.5 U	0.02 U
9/18/2012														0.5 U	0.5 U	0.83	0.5 U	0.5 U	0.54	0.5 U	1.4	0.5 U	0.5 U	0.02 U
10/22/2012														0.5 U	0.5 U	0.99	0.5 U	0.5 U	0.62	0.5 U	1.6	0.5 U	0.5 U	0.02 U
11/27/2012														0.5 U	0.5 U	1.0	0.5 U	0.5 U	0.54	0.5 U	1.7	0.5 U	0.5 U	0.02 U
1/8/2013														0.5 U	0.5 U	0.82	0.5 U	0.5 U	0.52	0.5 U	1.3	0.5 U	0.5 U	0.02 U
2/13/2013														0.5 U	0.5 U	1.1	0.5 U	0.5 U	0.57	0.5 U	1.6	0.5 U	0.5 U	0.02 U
MW-10																								
6/5/2012														0.5 U	0.5 U	1.6	0.5 U	0.5 U	0.68	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/10/2012														0.5 U	0.5 U	2.1	0.5 U	0.5 U	0.72	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/15/2012														0.5 U	0.5 U	2.0	0.5 U	0.5 U	0.72	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/18/2012														0.5 U	0.5 U	1.6	0.5 U	0.5 U	0.59	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/22/2012														0.5 U	0.5 U	2.0	0.5 U	0.5 U	0.72	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/27/2012														0.5 U	0.5 U	2.1	0.5 U	0.5 U	0.68	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/8/2013														0.5 U	0.5 U	1.7	0.5 U	0.5 U	0.59	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/13/2013														0.5 U	0.5 U	2.1	0.5 U	0.5 U	0.71	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U

TABLE 7
GROUNDWATER ANALYTICAL DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

	Nitrate (mg/L)	Calcium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Manganese (mg/L)	Ammonia (total as nitrogen) (mg/L)	Total Organic Carbon (mg/L)	Total Dissolved Solids (mg/L)	1,1-Dichloroethane (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	cis-1,2-Dichloroethene (µg/L)	Dichlorodifluoromethane (Freon 12) (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (Freon 11) (µg/L)	Vinyl chloride (µg/L)	Vinyl chloride by SIM (µg/L)
MW-11																								
6/6/2012	8.0	89.4	36.7	85	35.4	8.01	27.6	267	0.02 U	0.005 U	0.051	0.66	583	0.5 U	0.5 U	1.1	0.5 U	0.56	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/9/2012	8.0	88.6	36.3	85.5	34.5	7.7	27.8	271	0.02 U	0.005 U	0.05 U	0.6	493	0.5 U	0.5 U	1.1	0.5 U	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/14/2012	7.9	85.5	35.2	85.1	31.6	7.38	27.5	271	0.02 U	0.005 U	0.05 U	0.63	577	0.5 U	0.5 U	1.4	0.5 U	0.55	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/18/2012	8.0	85	35.9	88	34.4	7.86	30.5	268	0.02 U	0.005 U	0.05 U	0.63	583	0.5 U	0.5 U	1.2	0.5 U	0.5 U	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/23/2012	8.0	87.4	36.1	83.9	34.7	7.89	28.1	273	0.02 U	0.005 U	0.05 U	0.56	572	0.5 U	0.5 U	1.4	0.5 U	0.51	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/28/2012	9.7	89.2	37	87.4	35.6	8.04	27.8	263	0.02 U	0.005 U	0.05 U	0.5 U	580	0.5 U	0.5 U	1.4	0.5 U	0.56	1.5	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/9/2013	8.0	87.8	34.6	83.7	33	7.43	28.1	275	0.02 U	0.005 U	0.05 U	0.64	548	0.5 U	0.5 U	1.2	0.5 U	0.5 U	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/13/2013	10.1	89.6	37.4	86.2	35.3	8.13	30.2	273	0.02 U	0.005 U	0.05 U	0.53	544	0.5 U	0.5 U	1.4	0.5 U	0.63	1.4	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
MW-12b																								
6/8/2012	9.6	108	30	139	48.1	7.46	32.2	276	0.093	0.005 U	0.05 U	0.56	720	0.5 U	0.5 U	0.93	0.5 U	0.5 U	0.84	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/12/2012	9.9	108	29.4	138	47.6	7.44	33.9	311	0.02 U	0.005 U	0.05 U	0.5 U	770	0.5 U	0.5 U	0.79	0.5 U	0.5 U	0.74	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/13/2012	9.4	103	28.3	135	44.7	7.19	32.6	282	0.02 U	0.005 U	0.05 U	0.58	620	0.5 U	0.5 U	1.0	0.5 U	0.5 U	0.79	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/17/2012	9.4 J	102	29.1	140	46.7	7.48	36.2	271	0.0307	0.005 U	0.05 U	0.63	699	0.5 U	0.5 U	0.83	0.5 U	0.5 U	0.68	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/22/2012	9.4	103	28.6	133	46.6	7.66	32.7	278	0.02 U	0.005 U	0.05 U	0.7	664	0.5 U	0.5 U	1.0	0.5 U	0.5 U	0.82	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/27/2012	11.3	106	29.9	133	48.7	7.76	32.6	274	0.02 U	0.005 U	0.05 U	0.5 U	556	0.5 U	0.5 U	1.0	0.5 U	0.5 U	0.77	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/9/2013	9.5	109	29.3	136	45.2	7.15	34.9	279	0.02 U	0.005 U	0.05 U	0.68	680	0.5 U	0.5 U	0.91	0.5 U	0.5 U	0.74	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/12/2013	11.6	107	30.7	133	48.9	7.9	36.4	284	0.02 U	0.005 U	0.05 U	0.57	612	0.5 U	0.5 U	0.96	0.5 U	0.5 U	0.9	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
MW-14b																								
6/7/2012	8.3	121	17.3	143	48	7.41	37.4	280	0.02 U	0.0453	0.05 U	0.65	711	0.5 U	0.5 U	1.1	0.5 U	0.56	0.67	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/11/2012	9.0	122	17.4	147	49.2	7.44	39.9	318	0.02 U	0.0459	0.05 U	0.5 U	723	0.5 U	0.5 U	0.78	0.5 U	0.56	0.68	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/13/2012	8.7	117	17.1	141	45.9	7.2	37.3	285	0.02 U	0.0165	0.05 U	0.54	680	0.5 U	0.5 U	1.1	0.5 U	0.61	0.85	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/17/2012	8.7 J	116	17.4	147	48.7	7.56	41	286	0.02 U	0.0054	0.05 U	0.58	677	0.5 U	0.5 U	0.85	0.5 U	0.5 U	0.72	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/23/2012	8.7	119	17.7	141	49.6	7.62	38.4	289	0.02 U	0.005 U	0.05 U	0.51	688	0.5 U	0.5 U	1.1	0.5 U	0.61	0.92	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/28/2012	10.5	122	18	142	50.3	7.68	48.7	283	0.02 U	0.005 U	0.05 U	0.57	675	0.5 U	0.5 U	0.98	0.5 U	0.67	0.91	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/9/2013	8.8	121	17.2	142	48	7.23	37.4	293	0.02 U	0.005 U	0.05 U	0.57	679	0.5 U	0.5 U	0.84	0.5 U	0.54	0.67	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/12/2013	10.9	123	18	141	49.5	7.62	40.1	290	0.02 U	0.005 U	0.05 U	0.59	599	0.5 U	0.5 U	0.98	0.5 U	0.71	1.0	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/12/2013 (Dup)	10.8	122	18.5	141	50.8	7.79	40.3	291	0.02 U	0.005 U	0.05 U	0.69	611	0.5 U	0.5 U	1.0	0.5 U	0.72	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
MW-15																								
6/6/2012	6.9	152	54.1	126	48.5	8.3	37.9	491	0.02 U	0.0363	0.05 U	1.38	988	3.1	0.5 U	0.5 U	9.1	2.8	5	0.59	1.6	0.63	0.67	0.78
6/6/2012 (Dup)	6.9	151	52.3	127	48.5	8.23	38	484	0.02 U	0.0361	0.05 U	1.29	953	3	0.5 U	0.5 U	9	2.9	4.8	0.5 U	1.6	0.65	0.62	0.79
7/12/2012	6.2	160	69.7	117	48.5	8.32	41.3	620	0.02 U	0.046	0.05 U	1.15	917	3.8	0.5 U	0.5 U	12	2.2	5.5	0.5 U	1.9	0.5 U	0.92	1.0
8/13/2012	6.6	150	61.1	121	44.5	7.94	38.7	507	0.02 U	0.0428	0.05 U	1.22	845	3.7	0.61	0.5 U	11	2.7	5.1	0.5 U	2.0	0.63	0.7	0.7
9/19/2012	6.1	162	68.2	120	48.1	8.19	44.1	553	0.01 U	0.0496	0.05 U	1.25	884	3.9	0.5 U	0.5 U	12	1.9	5.3	0.5 U	1.8	0.5 U	0.87	1.2
10/23/2012	6.2	157	66.5	117	49.9	8.66	40.8	539	0.02 U	0.0523	0.05 U	1.12	879	4	0.5 U	0.5 U	13	2.2	5.7	0.5 U	2.0	0.5 U	0.88	1.1
11/28/2012	8.4	155	60.5	121	48.7	8.33	39.4	485	0.02 U	0.0474	0.05 U	1.06	857	4.1	0.5 U	0.5 U	12	2.7	5.5	0.5 U	2.2	0.58	0.82	0.76
11/28/2012 (Dup)	8.1	157	64.5	123	49.6	8.52	38.6	505	0.02 U	0.0459	0.05 U	1.13	856	4.1	0.58	0.5 U	12	2.8	5.5	0.5 U	2.1	0.68	0.8	0.94
1/8/2013	6.2	162	66.7	117	48.6	8.33	40.5	544	0.02 U	0.0533	0.05 U	1.38	833	3.9	0.5 U	0.5 U	13	2.9	5.4	0.5 U	1.9	0.5 U	0.84	0.87
2/12/2013	7.8	163	69.9	119	50.4	8.83	44.3	533	0.02 U	0.0486	0.05 U	1.3	859	3.9	0.5 U	0.5 U	14	3.4	6.8	0.5 U	2.2	0.5 U	0.78	0.68

TABLE 7
GROUNDWATER ANALYTICAL DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

	Nitrate (mg/L)	Calcium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Manganese (mg/L)	Ammonia (total as nitrogen) (mg/L)	Total Organic Carbon (mg/L)	Total Dissolved Solids (mg/L)	1,1-Dichloroethane (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	cis-1,2-Dichloroethene (µg/L)	Dichlorodifluoromethane (Freon 12) (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (Freon 11) (µg/L)	Vinyl chloride (µg/L)	Vinyl chloride by SIM (µg/L)
MW-15D																								
6/8/2012	10.7	115	19.6	136	52	7.56	30.5	281	0.02 U	0.0158	0.066	0.61	597	0.5 U	0.5 U	0.68	0.5 U	0.5 U	1.1	0.5 U	0.51	0.5 U	0.5 U	0.02 U
7/11/2012	11.0	115	18.9	135	50.8	7.42	31.6	318	0.02 U	0.0084	0.05 U	0.5 U	731	0.5 U	0.5 U	0.54	0.5 U	0.5 U	0.89	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/13/2012	10.5	108	18.4	131	47.1	7.08	30.1	288	0.02 U	0.005 U	0.05 U	0.52	620	0.5 U	0.5 U	0.7	0.5 U	0.5 U	1.0	0.5 U	0.64	0.5 U	0.5 U	0.02 U
9/19/2012	10.7	117	19.1	138	50.3	7.33	33.3	289	0.0137	0.002 U	0.05 U	0.5 U	628	0.5 U	0.5 U	0.62	0.5 U	0.5 U	0.94	0.5 U	0.53	0.5 U	0.5 U	0.02 U
10/25/2012	10.6	118	18.7	133	50.9	7.47	31	283	0.02 U	0.005 U	0.05 U	0.5 U	651	0.5 U	0.5 U	0.7	0.5 U	0.5 U	0.91	0.5 U	0.58	0.5 U	0.5 U	0.02 U
11/27/2012	12.4	113	18.8	131	50.2	7.64	30.8	283	0.02 U	0.005 U	0.05 U	0.55	691	0.5 U	0.5 U	0.73	0.5 U	0.5 U	1.1	0.5 U	0.69	0.5 U	0.5 U	0.02 U
1/8/2013	10.8	113	18.4	131	48.7	7.15	30.6	299	0.02 U	0.005 U	0.05 U	0.78	645	0.5 U	0.5 U	0.62	0.5 U	0.5 U	0.87	0.5 U	0.52	0.5 U	0.5 U	0.02 U
2/11/2013	10.4	113	19.8	124	51.5	7.68	29.4	326	0.02 U	0.005 U	0.05 U	0.64	621	0.5 U	0.5 U	0.75	0.5 U	0.5 U	1.0	0.5 U	0.58	0.5 U	0.5 U	0.02 U
MW-16																								
6/8/2012	8.7	120	22.5	145	51.3	7.33	34.8	289	0.02 U	0.005 U	0.05 U	0.5 U	712	0.5 U	0.5 U	0.62	0.5 U	0.62	0.82	0.5 U	0.5 U	0.84	0.5 U	0.02 U
7/12/2012	8.9	116	20.6	146	48.3	6.87	36.1	312	0.02 U	0.005 U	0.05 U	0.5 U	771	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.68	0.5 U	0.5 U	0.69	0.5 U	0.02 U
8/14/2012	8.4	111	19.9	140	44.3	6.64	36.1	274	0.02 U	0.005 U	0.05 U	0.56	764	0.5 U	0.5 U	0.61	0.5 U	0.58	0.73	0.5 U	0.5 U	0.96	0.5 U	0.02 U
9/17/2012	8.4 J	110	20.4	146	47.5	6.95	37.7	278	0.02 U	0.005 U	0.05 U	0.69	687	0.5 U	0.5 U	0.54	0.5 U	0.5 U	0.64	0.5 U	0.5 U	0.64	0.5 U	0.02 U
10/22/2012	8.5	113	20.9	142	49	7.25	35.7	280	0.02 U	0.005 U	0.05 U	0.57	687	0.5 U	0.5 U	0.59	0.5 U	0.5	0.68	0.5 U	0.5 U	0.68	0.5 U	0.02 U
11/27/2012	10.3	115	20.5	145	48.6	7.26	35.7	275	0.02 U	0.005 U	0.05 U	0.61	753	0.5 U	0.5 U	0.61	0.5 U	0.69	0.71	0.5 U	0.5 U	0.94	0.5 U	0.02 U
1/9/2013	8.7	117	21	143	48.8	7.09	35.3	282	0.02 U	0.005 U	0.098	0.53	648	0.5 U	0.5 U	0.57	0.5 U	0.54	0.63	0.5 U	0.5 U	0.75	0.5 U	0.02 U
2/13/2013	8.4	116	21.4	138	50.6	7.28	34.2	282	0.02 U	0.005 U	0.05 U	0.5 U	608	0.5 U	0.5 U	0.7	0.5 U	0.58	0.66	0.5 U	0.5 U	0.94	0.5 U	0.02 U
MW-17																								
6/7/2012	10.1	113	29.1	141	47.7	8	29	299	0.02 U	0.0649	0.05 U	0.75	669	0.5 U	0.5 U	0.66	0.5 U	0.5 U	0.77	0.5 U	0.5 U	0.63	0.5 U	0.02 U
7/9/2012	10.4	114	30.3	139	49.8	8.07	29.8	297	0.0282	0.0271	0.05 U	0.67	698	0.5 U	0.5 U	0.5	0.5 U	0.5 U	1.3	0.5 U	0.5 U	0.68	0.5 U	0.02 U
8/13/2012	9.9	107	28.6	136	45.6	7.62	28.9	292	0.02 U	0.0146	0.05 U	0.66	625	0.5 U	0.5 U	0.66	0.5 U	0.5 U	1.8	0.5 U	0.58	1.0	0.5 U	0.02 U
9/17/2012	9.9	107	28.8	142	47.2	7.83	31.2	297	0.02 U	0.0117	0.05 U	0.73	676	0.5 U	0.5 U	0.54	0.5 U	0.5 U	1.8	0.5 U	0.57	0.66	0.5 U	0.02 U
10/22/2012	10.0	111	29.6	136	48.5	8.07	29.5	299	0.02 U	0.0087	0.05 U	0.58	700	0.5 U	0.5 U	0.66	0.5 U	0.5 U	2.5	0.5 U	0.7	0.72	0.5 U	0.02 U
11/26/2012	11.9	112	29.1	135	48.3	7.99	29	298	0.02 U	0.0055	0.05 U	0.79	657	0.5 U	0.5 U	0.66	0.5 U	0.5 U	2.6	0.5 U	0.63	0.73	0.5 U	0.02 U
1/9/2013	10.1	113	29.5	135	47.9	7.87	29.4	306	0.02 U	0.0058	0.05 U	0.67	661	0.5 U	0.5 U	0.62	0.5 U	0.5 U	2.4	0.5 U	0.59	0.66	0.5 U	0.02 U
2/13/2013	10.0	112	30.1	131	49.7	8.05	28.8	306	0.02 U	0.0068	0.05 U	0.78	623	0.5 U	0.5 U	0.73	0.5 U	0.5 U	2.4	0.5 U	0.64	0.85	0.5 U	0.02 U
MW-18																								
6/7/2012	9.5	121	28.4	157	51.2	8.17	32.8	315	0.02 U	0.0175	0.05 U	0.59	764	0.5 U	0.5 U	0.68	0.5 U	0.58	1.0	0.5 U	0.5 U	0.93	0.5 U	0.02 U
7/11/2012	9.7	123	29.1	153	52.4	8.16	33.2	337	0.02 U	0.0094	0.05 U	0.5 U	837	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.97	0.5 U	0.5 U	0.89	0.5 U	0.02 U
8/13/2012	9.4	119	28.5	152	49.2	7.87	32.5	321	0.02 U	0.005 U	0.05 U	0.58	740	0.5 U	0.5 U	0.65	0.5 U	0.61	1.1	0.5 U	0.5 U	1.2	0.5 U	0.02 U
8/13/2012 (Dup)	9.3	117	29.3	151	50.7	8.07	32.7	316	0.02 U	0.005 U	0.05 U	0.57	647	0.5 U	0.5 U	0.67	0.5 U	0.63	1.1	0.5 U	0.5 U	1.2	0.5 U	0.02 U
9/19/2012	9.6	123	28.7	161	51.4	8.01	36.6	317	0.01 U	0.002 U	0.05 U	0.5 U	671	0.5 U	0.5 U	0.58	0.5 U	0.5 U	0.99	0.5 U	0.5 U	0.82	0.5 U	0.02 U
10/22/2012	9.5	120	29.5	152	53.2	8.47	33.3	316	0.02 U	0.005 U	0.05 U	0.59	755	0.5 U	0.5 U	0.65	0.5 U	0.54	1.2	0.5 U	0.5 U	0.96	0.5 U	0.02 U
11/26/2012	11.2	123	29.7	152	54.2	8.49	33.5	312	0.02 U	0.005 U	0.05 U	0.63	773	0.5 U	0.5 U	0.64	0.5 U	0.6	1.2	0.5 U	0.5 U	1.1	0.5 U	0.02 U
11/26/2012 (Dup)	11.3	121	29.1	151	53.2	8.29	33.6	316	0.02 U	0.005 U	0.05 U	0.64	693	0.5 U	0.5 U	0.64	0.5 U	0.66	1.2	0.5 U	0.5 U	1.1	0.5 U	0.02 U
1/9/2013	9.7	125	29.6	152	52.7	8.25	33.4	328	0.02 U	0.005 U	0.077	0.55	721	0.5 U	0.5 U	0.57	0.5 U	0.51	0.99	0.5 U	0.5 U	0.93	0.5 U	0.02 U
2/12/2013	9.4	125	30.8	145	54.1	8.59	32.3	336	0.02 U	0.005 U	0.05 U	0.62	704	0.5 U	0.5 U	0.7	0.5 U	0.58	1.1	0.5 U	0.5 U	1.1	0.5 U	0.02 U

TABLE 7
GROUNDWATER ANALYTICAL DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

	Nitrate (mg/L)	Calcium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Manganese (mg/L)	Ammonia (total as nitrogen) (mg/L)	Total Organic Carbon (mg/L)	Total Dissolved Solids (mg/L)	1,1-Dichloroethane (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	cis-1,2-Dichloroethene (µg/L)	Dichlorodifluoromethane (Freon 12) (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (Freon 11) (µg/L)	Vinyl chloride (µg/L)	Vinyl chloride by SIM (µg/L)
MW-19																								
6/6/2012	9.1	128	21.3	129	53.4	7.71	39.4	332	0.0225	0.0098	0.05 U	0.71	745	0.92	0.5 U	0.52	9	1.4	1.8	0.5 U	1.3	0.5 U	0.5 U	0.02 U
7/11/2012	10.0	127	21.1	138	52.5	7.39	43.2	387	0.02 U	0.005 U	0.05 U	0.5 U	790	0.94	0.5 U	0.5	9.5	1.2	1.6	0.5 U	1.3	0.5 U	0.5 U	0.02 U
7/11/2012 (Dup)	9.8	126	21.2	134	52.9	7.39	42.3	375	0.02 U	0.005 U	0.05 U	0.51	759	0.91	0.5 U	0.5 U	9.3	1.2	1.6	0.5 U	1.2	0.5 U	0.5 U	0.02 U
8/15/2012	9.3	108	24.8	128	41	7.23	40.3	326	0.02 U	0.005 U	0.05 U	0.67	732	1.1	0.5 U	0.64	9.7	1.3	1.8	0.5 U	1.4	0.5 U	0.5 U	0.02 U
9/19/2012	9.2	121	21	132	49.6	7.45	43.3	328	0.0209	0.0139	0.05 U	0.54	724	0.9	0.5 U	0.5 U	7.8	0.51	1.2	0.5 U	1.1	0.5 U	0.5 U	0.02 U
10/25/2012	9.4	132	19.1	129	48.2	6.76	41.1	326	0.02 U	0.005 U	0.05 U	0.5 U	700	0.99	0.5 U	0.61	9.5	1.1	1.8	0.5 U	1.4	0.5 U	0.5 U	0.02 U
10/25/2012 (Dup)	9.4	131	19.1	130	48.1	6.74	41.1	329	0.02 U	0.005 U	0.05 U	0.5 U	700	0.98	0.5 U	0.65	9.3	1.1	1.8	0.5 U	1.4	0.5 U	0.5 U	0.02 U
11/26/2012	11.2	125	21.4	130	52.8	7.55	40.1	320	0.02 U	0.005 U	0.05 U	0.66	760	1.1	0.5 U	0.64	9.6	1.4	1.9	0.5 U	1.4	0.5 U	0.5 U	0.02 U
1/8/2013	9.4	126	21.1	126	50.8	7.26	39.9	335	0.02 U	0.005 U	0.05 U	0.72	720	0.97	0.5 U	0.56	8.7	1.2	1.7	0.5 U	1.3	0.5 U	0.5 U	0.02 U
1/8/2013 (Dup)	9.5 J	128	21.5	129	52.1	7.44	40.5	339	0.02 U	0.005 U	0.054	0.69	659	0.94	0.5 U	0.6	8.8	1.2	1.7	0.5 U	1.4	0.5 U	0.5 U	0.02 U
2/11/2013	9.4	127	22.4	125	53.7	7.74	39.3	342	0.02 U	0.005 U	0.05 U	0.79	672	1	0.5 U	0.65	8.8	1.2	1.8	0.5 U	1.3	0.5 U	0.5 U	0.02 U
MW-20																								
6/8/2012	9.7	124	28	150	53.1	8.25	32.5	299	0.02 U	0.255	0.05 U	0.71	816	0.5 U	0.5 U	0.59	0.5 U	0.62	1.2	0.5 U	0.5 U	0.85	0.5 U	0.02 U
7/12/2012	10.3	122	27.1	152	51.5	7.98	33.9	348	0.02 U	0.111	0.05 U	0.5 U	822	0.5 U	0.5 U	0.5 U	0.59	0.51	1.0	0.5 U	0.5 U	0.68	0.5 U	0.02 U
8/15/2012	10.0	124	21.6	149	50.1	7.45	33	305	0.02 U	0.005 U	0.05 U	0.62	754	0.5 U	0.5 U	0.69	0.55	0.61	1.2	0.5 U	0.51	1.1	0.5 U	0.02 U
9/19/2012	10.3	121	26.8	157	51.1	7.84	36.2	314	0.01 U	0.0082	0.05 U	0.5 U	607	0.5 U	0.5 U	0.52	0.51	0.5 U	1.1	0.5 U	0.50 U	0.66	0.5 U	0.02 U
10/22/2012	10.0	123	27.3	145	52.9	8.14	33.4	315	0.02 U	0.0078	0.05 U	0.59	708	0.5 U	0.5 U	0.63	0.59	0.55	1.2	0.5 U	0.50 U	0.73	0.5 U	0.02 U
11/26/2012	12.2	122	27.2	148	52.9	8.12	33.3	311	0.02 U	0.0058	0.05 U	0.83	780	0.5 U	0.5 U	0.61	0.59	0.59	1.2	0.5 U	0.50 U	0.72	0.5 U	0.02 U
1/8/2013	10.3	122	27	148	51.3	7.92	33.3	318	0.02 U	0.005 U	0.05 U	0.66	741	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.92	0.5 U	0.50 U	0.66	0.5 U	0.02 U
2/11/2013	10.0	123	28	141	52.8	8.23	32.3	325	0.02 U	0.005 U	0.05 U	0.68	683	0.5 U	0.5 U	0.65	0.53	0.5 U	1.2	0.5 U	0.50 U	0.83	0.5 U	0.02 U
MW-21D																								
6/6/2012	10.4	119	19.2	150	53.9	7.73	31.2	295	0.02 U	0.0081	0.05 U	0.71	704	0.5 U	0.5 U	0.54	0.5 U	0.5 U	0.89	0.5 U	0.5 U	0.53	0.5 U	0.02 U
7/10/2012	10.7	122	19.3	151	54.3	7.73	31.7	297	0.02 U	0.005 U	0.05 U	0.77	655	0.5 U	0.5 U	0.55	0.5 U	0.5 U	0.9	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/14/2012	10.3	115	19.4	147	50	7.51	30.9	291	0.02 U	0.005 U	0.05 U	0.51	721	0.5 U	0.5 U	0.89	0.5 U	0.5 U	1.2	0.5 U	0.54	0.76	0.5 U	0.02 U
9/18/2012	10.4	114	18.9	155	52.1	7.53	34.2	294	0.02 U	0.005 U	0.05 U	0.69	713	0.5 U	0.5 U	0.58	0.5 U	0.5 U	0.92	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/24/2012	10.4	126	17.7	150	50.5	7.13	31.8	294	0.02 U	0.005 U	0.05 U	0.5 U	732	0.5 U	0.5 U	0.7	0.5 U	0.5 U	1.0	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/26/2012	12.3	118	19.4	149	53.6	7.8	31.2	299	0.02 U	0.005 U	0.05 U	0.65	744	0.5 U	0.5 U	0.68	0.5 U	0.5 U	0.94	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/8/2013	10.4	119	19.3	147	52.6	7.56	30.9	304	0.02 U	0.005 U	0.05 U	0.65	684	0.5 U	0.5 U	0.64	0.5 U	0.5 U	0.9	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/12/2013	10.3	120	20.1	144	54.1	7.91	30.7	308	0.02 U	0.005 U	0.05 U	0.64	608	0.5 U	0.5 U	0.73	0.5 U	0.5 U	0.94	0.5 U	0.5 U	0.56	0.5 U	0.02 U
MW-21S																								
6/6/2012	9.1	116	25.4	141	49.3	7.93	32.5	300	0.02 U	0.159	0.05 U	0.85	693	0.5 U	0.5 U	0.5 U	0.5 U	0.6	0.84	0.5 U	0.5 U	0.93	0.5 U	0.02 U
7/10/2012	9.9	118	25.3	143	49.6	7.73	33.9	308	0.02 U	0.106	0.05 U	0.55	621	0.5 U	0.5 U	0.51	0.5 U	0.51	0.8	0.5 U	0.5 U	0.84	0.5 U	0.02 U
8/14/2012	9.6	114	26.1	139	46.6	7.68	32.4	297	0.02 U	0.076	0.05 U	0.64	715	0.5 U	0.5 U	0.63	0.5 U	0.64	0.88	0.5 U	0.5 U	1.2	0.5 U	0.02 U
9/18/2012	9.6	111	25.1	146	48.2	7.65	35.7	297	0.02 U	0.062	0.05 U	0.64	749	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.85	0.5 U	0.5 U	0.76	0.5 U	0.02 U
10/24/2012	9.9	123	23.7	140	46.7	7.22	33.4	302	0.02 U	0.0332	0.05 U	0.5 U	675	0.5 U	0.5 U	0.63	0.5 U	0.53	0.95	0.5 U	0.5 U	0.82	0.5 U	0.02 U
11/26/2012	11.8	116	25.5	139	49.2	7.87	32.5	302	0.02 U	0.0229	0.05 U	0.66	696	0.5 U	0.5 U	0.6	0.5 U	0.54	0.91	0.5 U	0.5 U	0.84	0.5 U	0.02 U
1/8/2013	10.0	119	25	137	47.8	7.47	31.8	303	0.02 U	0.016	0.05 U	0.62	701	0.5 U	0.5 U	0.54	0.5 U	0.5 U	0.8	0.5 U	0.5 U	0.84	0.5 U	0.02 U
2/12/2013	9.9	118	26.3	135	49.6	7.85	31.9	308	0.02 U	0.0105	0.05 U	0.63	613	0.5 U	0.5 U	0.68	0.5 U	0.54	0.92	0.5 U	0.5 U	1.0	0.5 U	0.02 U

TABLE 7
GROUNDWATER ANALYTICAL DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

	Nitrate (mg/L)	Calcium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Manganese (mg/L)	Ammonia (total as nitrogen) (mg/L)	Total Organic Carbon (mg/L)	Total Dissolved Solids (mg/L)	1,1-Dichloroethane (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	cis-1,2-Dichloroethene (µg/L)	Dichlorodifluoromethane (Freon 12) (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (Freon 11) (µg/L)	Vinyl chloride (µg/L)	Vinyl chloride by SIM (µg/L)
MW-22D																								
6/6/2012	10.0	121	19.2	157	54.5	7.98	32.4	290	0.02 U	0.236	0.05 U	0.73	697	0.5 U	0.5 U	0.55	0.5 U	0.5 U	0.83	0.5 U	0.5 U	0.64	0.5 U	0.02 U
7/10/2012	10.4	120	18.8	155	53.9	7.64	32.9	305	0.02 U	0.141	0.05 U	0.53	714	0.5 U	0.5 U	0.56	0.5 U	0.5 U	0.87	0.5 U	0.5 U	0.57	0.5 U	0.02 U
8/14/2012	10.1	117	18.4	154	49.3	7.39	32.5	300	0.02 U	0.101	0.05 U	0.5	768	0.5 U	0.5 U	0.91	0.5 U	0.5 U	1.2	0.5 U	0.54	0.89	0.5 U	0.02 U
9/20/2012	10.3	124	19.2	162	53.9	7.58	35.9	297	0.01 U	0.105	0.05 U	0.5 U	657	0.5 U	0.5 U	0.56	0.5 U	0.5 U	0.78	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/24/2012	10.2	128	18.1	155	52.9	7.42	33.1	292	0.02 U	0.0393	0.06	0.5 U	725	0.5 U	0.5 U	0.64	0.5 U	0.5 U	0.92	0.5 U	0.5 U	0.56	0.5 U	0.02 U
11/26/2012	12.1	118	19.1	152	54.8	7.66	32.5	293	0.02 U	0.0119	0.05 U	0.64	695	0.5 U	0.5 U	0.66	0.5 U	0.5 U	1.0	0.5 U	0.5 U	0.55	0.5 U	0.02 U
1/8/2013	10.4 J	124	18.8	154	53	7.54	33	305	0.02 U	0.0115	0.05 U	0.71	728	0.5 U	0.5 U	0.54	0.5 U	0.5 U	0.78	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/12/2013	10.1	121	19.7	148	54.6	7.83	31.9	313	0.02 U	0.0089	0.05 U	0.64	671	0.5 U	0.5 U	0.74	0.5 U	0.5 U	0.95	0.5 U	0.5 U	0.67	0.5 U	0.02 U
MW-22S																								
6/6/2012	9.2	122	25.5	156	52.8	8.08	33.8	309	0.02 U	0.0155	0.05 U	0.74	779	0.5 U	0.5 U	0.57	0.5 U	0.68	0.97	0.5 U	0.5 U	0.98	0.5 U	0.02 U
7/10/2012	9.4	123	25.8	154	53.4	7.97	34.5	314	0.02 U	0.0104	0.05 U	0.71	686	0.5 U	0.5 U	0.58	0.5 U	0.59	0.88	0.5 U	0.5 U	0.87	0.5 U	0.02 U
8/14/2012	9.2	118	25.4	153	49.1	7.8	33.6	309	0.02 U	0.005 U	0.05 U	0.55	744	0.5 U	0.5 U	0.7	0.5 U	0.66	0.89	0.5 U	0.5 U	1.2	0.5 U	0.02 U
9/20/2012	9.3	122	24.6	162	50.3	7.48	37.4	309	0.01 U	0.003	0.05 U	0.5 U	660	0.5 U	0.5 U	0.57	0.5 U	0.5	0.84	0.5 U	0.5 U	0.74	0.5 U	0.02 U
10/24/2012	9.2	129	25.6	153	54.1	8.08	34.3	300	0.02 U	0.005 U	0.052	0.5 U	727	0.5 U	0.5 U	0.7	0.5 U	0.56	1.0	0.5 U	0.5 U	0.86	0.5 U	0.02 U
11/26/2012	10.9	122	25.9	153	51	8.61	33.9	308	0.02 U	0.005 U	0.05 U	0.65	748	0.5 U	0.5 U	0.67	0.5 U	0.61	0.96	0.5 U	0.5 U	0.84	0.5 U	0.02 U
1/8/2013	9.4 J	122	25.8	154	52.3	7.96	34.5	318	0.02 U	0.005 U	0.077	0.69	697	0.5 U	0.5 U	0.6	0.5 U	0.5	0.83	0.5 U	0.5 U	0.81	0.5 U	0.02 U
2/12/2013	9.1	121	27.1	147	54.5	8.37	33.2	328	0.02 U	0.005 U	0.05 U	0.65	636	0.5 U	0.5 U	0.7	0.5 U	0.62	1.0	0.5 U	0.5 U	0.98	0.5 U	0.02 U
MW-23																								
6/7/2012	10.2	109	25.4	124	44.5	7.65	31	281	0.02 U	0.0253	0.05 U	0.73	736	0.5 U	0.5 U	0.66	0.5 U	1.0	0.85	0.5 U	0.63	0.5 U	0.5 U	0.02 U
7/9/2012	10.5	113	26	122	46.6	7.75	31.7	290	0.02 U	0.0083	0.05 U	0.56	601	0.5 U	0.5 U	0.55	0.5 U	0.79	1.1	0.5 U	0.66	0.5 U	0.5 U	0.02 U
8/15/2012	10.2	99.2	26.1	120	41.5	7.41	30.3	284	0.02 U	0.0125	0.05 U	0.59	689	0.5 U	0.5 U	0.68	0.5 U	0.97	1.0	0.5 U	0.73	0.5 U	0.5 U	0.02 U
9/17/2012	10.2 J	106	25.3	125	44.9	7.49	33.2	291	0.0234	0.005 U	0.05 U	0.63	705	0.5 U	0.5 U	0.55	0.5 U	0.67	0.97	0.5 U	0.69	0.5 U	0.5 U	0.02 U
9/17/2012 (Dup)	10.2 J	104	24.8	124	44	7.38	33.4	292	0.02 U	0.005 U	0.05 U	0.67	677	0.5 U	0.5 U	0.55	0.5 U	0.67	1.0	0.5 U	0.66	0.5 U	0.5 U	0.02 U
10/22/2012	10.3	109	26.3	121	46.6	7.82	31.6	292	0.02 U	0.005 U	0.05 U	0.61	656	0.5 U	0.5 U	0.66	0.5 U	0.78	1.2	0.5 U	0.73	0.5 U	0.5 U	0.02 U
11/27/2012	12.1	112	26.8	121	48.1	7.88	31.2	291	0.02 U	0.005 U	0.05 U	0.63	636	0.5 U	0.5 U	0.63	0.5 U	0.93	1.2	0.5 U	0.82	0.5 U	0.5 U	0.02 U
1/9/2013	10.3	112	25.5	118	44.9	7.51	30.5	293	0.02 U	0.005 U	0.05 U	0.64	644	0.5 U	0.5 U	0.59	0.5 U	0.77	1.0	0.5 U	0.71	0.5 U	0.5 U	0.02 U
2/11/2013	10.6	110	25.6	98.8	44.9	7.5	30	304	0.02 U	0.005 U	0.05 U	0.72	596	0.5 U	0.5 U	0.65	0.5 U	0.7	1.1	0.5 U	0.7	0.5 U	0.5 U	0.02 U
MW-24																								
6/7/2012	9.0	100	25.9	101	41.9	7.54	29.6	285	0.02 U	0.146	0.05 U	0.74	600	0.5 U	0.5 U	0.76	0.5 U	0.5 U	0.78	0.5 U	0.7	0.5 U	0.5 U	0.02 U
7/9/2012	10.5	101	25.6	103	43.1	7.39	30.8	279	0.02 U	0.04	0.05 U	0.63	594	0.5 U	0.5 U	0.57	0.5 U	0.5 U	0.89	0.5 U	0.66	0.5 U	0.5 U	0.02 U
8/15/2012	10.3	117	27.5	101	49.6	7.97	30	280	0.02 U	0.0501	0.05 U	0.63	592	0.5 U	0.5 U	0.83	0.5 U	0.5 U	1.1	0.5 U	0.89	0.5 U	0.5 U	0.02 U
9/17/2012	10.2	96	24.8	104	42	7.32	32.5	281	0.02 U	0.0065	0.05 U	0.68	647	0.5 U	0.5 U	0.65	0.5 U	0.5 U	1.1	0.5 U	0.75	0.5 U	0.5 U	0.02 U
10/22/2012	10.5	96.6	25.4	101	42.9	7.59	30.8	279	0.02 U	0.0056	0.05 U	0.68	576	0.5 U	0.5 U	0.71	0.5 U	0.5 U	1.2	0.5 U	0.77	0.5 U	0.5 U	0.02 U
11/27/2012	12.4	101	25.4	103	43.5	7.56	30.6	280	0.02 U	0.005 U	0.05 U	0.6	621	0.5 U	0.5 U	0.77	0.5 U	0.5 U	1.3	0.5 U	0.82	0.5 U	0.5 U	0.02 U
1/9/2013	10.6	102	24.8	99.6	42	7.22	30.2	286	0.02 U	0.005 U	0.093	0.8	595	0.5 U	0.5 U	0.73	0.5 U	0.5 U	1.4	0.5 U	0.84	0.5 U	0.5 U	0.02 U
1/9/2013 (Dup)	10.6	104	24.6	100	41.8	7.16	30.4	284	0.02 U	0.0054	0.071	0.68	564	0.5 U	0.5 U	0.74	0.5 U	0.5 U	1.3	0.5 U	0.81	0.5 U	0.5 U	0.02 U
2/11/2013	10.1	103	25.2	115	42.4	7.27	30	292	0.02 U	0.005 U	0.05 U	0.66	563	0.5 U	0.5 U	0.71	0.5 U	0.5 U	1.2	0.5 U	0.81	0.5 U	0.5 U	0.02 U

TABLE 7
GROUNDWATER ANALYTICAL DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

	Nitrate (mg/L)	Calcium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Manganese (mg/L)	Ammonia (total as nitrogen) (mg/L)	Total Organic Carbon (mg/L)	Total Dissolved Solids (mg/L)	1,1-Dichloroethane (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	cis-1,2-Dichloroethene (µg/L)	Dichlorodifluoromethane (Freon 12) (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (Freon 11) (µg/L)	Vinyl chloride (µg/L)	Vinyl chloride by SIM (µg/L)
MW-25																								
6/8/2012	7.5	75.1	33.9	60.3	27.6	7.8	24.2	224	0.124	1.17	0.05 U	0.68	521	0.5 U	0.5 U	1.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/9/2012	9.0	76	32.6	61.8	28	7.37	25.3	230	0.02 U	0.624	0.05 U	0.54	469	0.5 U	0.5 U	1.2	0.5 U	0.5 U	0.51	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/13/2012	9.0	73.2	31	61.5	26.1	7.19	24.8	225	0.02 U	0.671	0.05 U	0.56	452	0.5 U	0.5 U	1.7	0.5 U	0.5 U	0.64	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/17/2012	9.6 J	71.8	30.4	64.1	26.9	7.13	26.9	224	0.0211	0.0939	0.05 U	0.59	477	0.5 U	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/22/2012	10.1	76	31.7	61.9	28.5	7.56	25.7	226	0.02 U	0.021	0.05 U	0.56	468	0.5 U	0.5 U	1.5	0.5 U	0.5 U	0.57	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/27/2012	11.8	75.6	31	66	28	7.39	25.7	221	0.02 U	0.0143	0.05 U	0.5 U	484	0.5 U	0.5 U	1.5	0.5 U	0.5 U	0.55	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/9/2013	10.2	77.9	30.3	62	27.5	7.1	25.6	227	0.02 U	0.006	0.074	0.56	472	0.5 U	0.5 U	1.4	0.5 U	0.5 U	0.51	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/13/2013	10.8	80.2	33	60.9	30.4	7.81	25.2	228	0.02 U	0.0058	0.05 U	0.53	459	0.5 U	0.5 U	1.6	0.5 U	0.5 U	0.53	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
MW-26																								
6/8/2012	8.2	110	36.1	110	43	8.31	29.3	304	0.02 U	0.0103	0.05 U	0.5 U	664	0.5 U	0.5 U	1.1	0.5 U	0.63	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/9/2012	8.4	107	35.6	108	42.5	8.5	30.4	317	0.02 U	0.0055	0.05 U	0.5	596	0.5 U	0.5 U	0.88	0.5 U	0.51	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/13/2012	8.1	100	34.2	103	39.3	8.17	29.2	309	0.02 U	0.005 U	0.05 U	0.55	598	0.5 U	0.5 U	1.1	0.5 U	0.67	1.3	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/17/2012	8.0	98.5	33.3	104	39.5	8.14	31.1	305	0.02 U	0.005 U	0.05 U	0.59	613	0.5 U	0.5 U	0.98	0.5 U	0.52	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/17/2012 (Dup)	8.0	98.1	33.5	105	39.8	8.27	31.3	313	0.02 U	0.005 U	0.05 U	0.58	656	0.5 U	0.5 U	0.97	0.5 U	0.52	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/22/2012	8.1	98.9	34	101	40.4	8.42	29.1	309	0.02 U	0.005 U	0.05 U	0.56	603	0.5 U	0.5 U	1.2	0.5 U	0.56	1.3	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/27/2012	9.7	103	34.4	102	41.3	8.46	29.2	307	0.02 U	0.005 U	0.05 U	0.53	661	0.5 U	0.5 U	1.2	0.5 U	0.69	1.3	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/9/2013	8.1	102	33.5	98.6	39.3	8	28.5	310	0.02 U	0.005 U	0.05 U	0.59	523	0.5 U	0.5 U	1.1	0.5 U	0.59	1.0	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/13/2013	8.0	103	35.2	93.9	41.9	8.65	27.9	310	0.02 U	0.005 U	0.05 U	0.54	624	0.5 U	0.5 U	1.4	0.5 U	0.7	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
MW-27																								
9/17/2012	10.2	105	25.8	131	45.1	7.55	32.5	287	0.02 U	0.005 U	0.05 U	0.66	665	0.5 U	0.5 U	0.51	0.5 U	0.5 U	0.91	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/22/2012	10.2	109	27	126	47.2	7.72	30.7	292	0.02 U	0.005 U	0.05 U	0.61	673	0.5 U	0.5 U	0.61	0.5 U	0.5 U	1.0	0.5 U	0.53	0.5 U	0.5 U	0.02 U
10/22/2012 (Dup)	10.2	108	26.6	127	46.6	7.68	30.6	291	0.02 U	0.005 U	0.05 U	0.6	653	0.5 U	0.5 U	0.59	0.5 U	0.5 U	1.1	0.5 U	0.51	0.5 U	0.5 U	0.02 U
11/27/2012	12.2	110	26.8	128	47.4	7.83	30.5	286	0.02 U	0.005 U	0.05 U	0.6	725	0.5 U	0.5 U	0.61	0.5 U	0.53	1.1	0.5 U	0.57	0.5 U	0.5 U	0.02 U
1/8/2013	10.4	111	24.5	126	42.6	6.96	30.3	296	0.02 U	0.005 U	0.051	0.66	660	0.5 U	0.5 U	0.6	0.5 U	0.5 U	0.93	0.5 U	0.52	0.5 U	0.5 U	0.02 U
2/11/2013	10.2	111	27.8	122	47.7	7.93	29.5	295	0.02 U	0.005 U	0.05 U	0.72	671	0.5 U	0.5 U	0.61	0.5 U	0.5 U	0.96	0.5 U	0.52	0.5 U	0.5 U	0.02 U
2/11/2013 (Dup)	10.1	114	28.1	121	48.4	8.09	29.1	306	0.02 U	0.005 U	0.05 U	0.86	519	0.5 U	0.5 U	0.59	0.5 U	0.5 U	0.97	0.5 U	0.5	0.5 U	0.5 U	0.02 U
Camp Ranch																								
6/6/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.86	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
6/6/2012 (Dup)														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.81	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/10/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.88	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/14/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.78	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/18/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.73	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/25/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.86	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/28/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/7/2013														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/13/2013														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.53	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U

TABLE 7
GROUNDWATER ANALYTICAL DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

	Nitrate (mg/L)	Calcium (mg/L)	Sodium (mg/L)	Chloride (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Manganese (mg/L)	Ammonia (total as nitrogen) (mg/L)	Total Organic Carbon (mg/L)	Total Dissolved Solids (mg/L)	1,1-Dichloroethane (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	cis-1,2-Dichloroethene (µg/L)	Dichlorodifluoromethane (Freon 12) (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (Freon 11) (µg/L)	Vinyl chloride (µg/L)	Vinyl chloride by SIM (µg/L)
Kinman Ranch																								
6/6/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/10/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/14/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/18/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/25/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/28/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/7/2013														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/13/2013														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
Schmidt																								
6/6/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/10/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/14/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/18/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/25/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/28/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
1/7/2013														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/13/2013														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
Small Ranch																								
6/6/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.4	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
7/10/2012														0.5 U	0.5 U	0.57	0.5 U	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.5 U	
7/10/2012 (Dup)														0.5 U	0.5 U	0.61	0.5 U	0.5 U	1.4	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
8/14/2012														0.5 U	0.5 U	0.61	0.5 U	0.5 U	1.3	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
9/18/2012														0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
10/25/2012														0.5 U	0.5 U	0.6	0.5 U	0.5 U	1.4	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
11/28/2012														0.5 U	0.5 U	0.66	0.5 U	0.5 U	1.5	0.5 U	0.62	0.5 U	0.5 U	0.02 U
1/7/2013														0.5 U	0.5 U	0.56	0.5 U	0.5 U	1.4	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U
2/13/2013														0.5 U	0.5 U	0.67	0.5 U	0.5 U	1.4	0.5 U	0.51	0.5 U	0.5 U	0.02 U

Notes:
Only VOC analytes detected during the RIFS sampling are presented on table.
Blank space indicates no analysis for that particular analyte.
J = analyte detected, numeric result is considered an estimate.
U = analyte not detected at or above the indicated laboratory reporting level.
µg/L = micrograms per liter.
mg/L = milligrams per liter.

TABLE 8
STATISTICAL SUMMARY OF GROUNDWATER VOC DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Constituent Name	Well	N	Mean	Standard Deviation	Median	Min.	Max.	% Non-Detects
Upgradient Wells: MW-5, MW-9, MW-10, MW-12b, and MW-25								
Chloroform (ug/L)	MW-05	8	0.64	0.07	0.64	0.54	0.74	0
Chloroform (ug/L)	MW-09	8	0.94	0.11	1.00	0.81	1.10	0
Chloroform (ug/L)	MW-10	8	1.90	0.23	2.00	1.60	2.10	0
Chloroform (ug/L)	MW-12b	8	0.93	0.08	0.95	0.79	1.00	0
Chloroform (ug/L)	MW-25	8	1.43	0.18	1.45	1.20	1.70	0
Constituent Statistics		**5**	**1.17**	**0.06**	**1.00**	**0.54**	**2.10**	
Tetrachloroethene (ug/L)	MW-05	8	0.70	0.07	0.68	0.63	0.79	0
Tetrachloroethene (ug/L)	MW-09	8	0.57	0.05	0.56	0.52	0.64	0
Tetrachloroethene (ug/L)	MW-10	8	0.68	0.06	0.70	0.59	0.72	0
Tetrachloroethene (ug/L)	MW-12b	8	0.79	0.07	0.78	0.68	0.90	0
Tetrachloroethene (ug/L)	MW-25	8	0.48	0.15	0.52	0.25	0.64	25
Constituent Statistics		**5**	**0.64**	**0.04**	**0.68**	**0.25**	**0.90**	
Trichloroethene (ug/L)	MW-05	8	1.83	0.12	1.85	1.70	2.00	0
Trichloroethene (ug/L)	MW-09	8	1.55	0.16	1.60	1.30	1.70	0
Constituent Statistics		**2**	**1.69**	**0.02**	**1.73**	**1.30**	**2.00**	
MW-15								
1,1-Dichloroethane (ug/L)	MW-15	8	3.80	0.31	3.90	3.10	4.10	0
Chloroethane (ug/L)	MW-15	8	0.30	0.13	0.25	0.25	0.61	87.5
Chloroform (ug/L)	MW-15	8	ND	--	ND	ND	<0.5	100
cis-1,2-Dichloroethene (ug/L)	MW-15	8	12.01	1.48	12.00	9.10	14.00	0
Dichlorodifluoromethane (ug/L)	MW-15	8	2.60	0.48	2.70	1.90	3.40	0
Tetrachloroethene (ug/L)	MW-15	8	5.54	0.56	5.45	5.00	6.80	0
Trichloroethene (ug/L)	MW-15	8	1.95	0.20	1.95	1.60	2.20	0
Trichlorofluoromethane (ug/L)	MW-15	8	0.39	0.19	0.25	0.25	0.63	62.5
Vinyl chloride (ug/L)	MW-15	8	0.91	0.18	0.85	0.70	1.20	0
Site Wells: MW-3, MW-11, MW-14b, MW-16, MW-17, MW-18, MW-23, MW-24, MW-26 and MW-27								
Chloroform (ug/L)	MW03	8	0.55	0.13	0.57	0.25	0.68	12.5
Chloroform (ug/L)	MW-11	8	1.28	0.14	1.30	1.10	1.40	0
Chloroform (ug/L)	MW-14b	8	0.97	0.13	0.98	0.78	1.10	0
Chloroform (ug/L)	MW-15D	8	0.67	0.07	0.69	0.54	0.75	0
Chloroform (ug/L)	MW-16	8	0.56	0.13	0.60	0.25	0.70	12.5
Chloroform (ug/L)	MW-17	8	0.63	0.07	0.66	0.50	0.73	0
Chloroform (ug/L)	MW-18	8	0.62	0.07	0.65	0.50	0.70	0
Chloroform (ug/L)	MW-23	8	0.62	0.05	0.64	0.55	0.68	0
Chloroform (ug/L)	MW-24	8	0.72	0.08	0.72	0.57	0.83	0
Chloroform (ug/L)	MW-26	8	1.12	0.16	1.10	0.88	1.40	0
Chloroform (ug/L)	MW-27	5	0.59	0.04	0.61	0.51	0.61	0
Constituent Statistics		**11**	**0.76**	**0.04**	**0.66**	**0.25**	**1.40**	
Dichlorodifluoromethane (ug/L)	MW-11	8	0.45	0.16	0.53	0.25	0.63	37.5
Dichlorodifluoromethane (ug/L)	MW-14b	8	0.56	0.14	0.59	0.25	0.71	12.5
Dichlorodifluoromethane (ug/L)	MW-16	8	0.53	0.13	0.56	0.25	0.69	12.5
Dichlorodifluoromethane (ug/L)	MW-18	8	0.49	0.15	0.56	0.25	0.61	25
Dichlorodifluoromethane (ug/L)	MW-23	8	0.83	0.12	0.79	0.67	1.00	0
Dichlorodifluoromethane (ug/L)	MW-26	8	0.61	0.08	0.61	0.51	0.70	0
Dichlorodifluoromethane (ug/L)	MW-27	5	0.31	0.13	0.25	0.25	0.53	80
Constituent Statistics		**7**	**0.54**	**0.03**	**0.56**	**0.25**	**1.00**	
Tetrachloroethene (ug/L)	MW03	8	0.94	0.08	0.93	0.86	1.10	0
Tetrachloroethene (ug/L)	MW-11	8	1.23	0.15	1.20	1.10	1.50	0
Tetrachloroethene (ug/L)	MW-14b	8	0.80	0.13	0.79	0.67	1.00	0
Tetrachloroethene (ug/L)	MW-15D	8	0.98	0.09	0.97	0.87	1.10	0
Tetrachloroethene (ug/L)	MW-16	8	0.69	0.06	0.68	0.63	0.82	0
Tetrachloroethene (ug/L)	MW-17	8	1.95	0.65	2.10	0.77	2.60	0

TABLE 8
STATISTICAL SUMMARY OF GROUNDWATER VOC DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Constituent Name	Well	N	Mean	Standard Deviation	Median	Min.	Max.	% Non-Detects
Tetrachloroethene (ug/L)	MW-18	8	1.07	0.10	1.05	0.97	1.20	0
Tetrachloroethene (ug/L)	MW-23	8	1.05	0.12	1.05	0.85	1.20	0
Tetrachloroethene (ug/L)	MW-24	8	1.12	0.20	1.15	0.78	1.40	0
Tetrachloroethene (ug/L)	MW-26	8	1.20	0.11	1.20	1.00	1.30	0
Tetrachloroethene (ug/L)	MW-27	5	0.98	0.08	0.96	0.91	1.10	0
Constituent Statistics		**11**	**1.09**	**0.16**	**1.05**	**0.63**	**2.60**	
Trichloroethene (ug/L)	MW-15D	8	0.54	0.13	0.56	0.25	0.69	12.5
Trichloroethene (ug/L)	MW-17	8	0.53	0.18	0.59	0.25	0.70	25
Trichloroethene (ug/L)	MW-23	8	0.71	0.06	0.71	0.63	0.82	0
Trichloroethene (ug/L)	MW-24	8	0.78	0.08	0.79	0.66	0.89	0
Trichloroethene (ug/L)	MW-27	5	0.48	0.13	0.52	0.25	0.57	20
Constituent Statistics		**5**	**0.61**	**0.04**	**0.59**	**0.25**	**0.89**	
Trichlorofluoromethane (ug/L)	MW-16	8	0.81	0.13	0.80	0.64	0.96	0
Trichlorofluoromethane (ug/L)	MW-17	8	0.74	0.12	0.70	0.63	1.00	0
Trichlorofluoromethane (ug/L)	MW-18	8	0.99	0.13	0.95	0.82	1.20	0
Constituent Statistics		**3**	**0.85**	**0.00**	**0.80**	**0.63**	**1.20**	
Downgradient Wells: MW-19, MW-20, MW-21S/D, MW-22S/D								
1,1-Dichloroethane (ug/L)	MW-19	8	0.99	0.08	0.98	0.90	1.10	0
Chloroform (ug/L)	MW-19	8	0.55	0.13	0.59	0.25	0.65	12.5
Chloroform (ug/L)	MW-20	8	0.56	0.14	0.60	0.25	0.69	12.5
Chloroform (ug/L)	MW-21D	8	0.66	0.12	0.66	0.54	0.89	0
Chloroform (ug/L)	MW-21S	8	0.54	0.13	0.57	0.25	0.68	12.5
Chloroform (ug/L)	MW-22D	8	0.65	0.13	0.60	0.54	0.91	0
Chloroform (ug/L)	MW-22S	8	0.64	0.06	0.64	0.57	0.70	0
Constituent Statistics		**6**	**0.60**	**0.03**	**0.60**	**0.25**	**0.91**	
cis-1,2-Dichloroethene (ug/L)	MW-19	8	9.08	0.64	9.25	7.80	9.70	0
cis-1,2-Dichloroethene (ug/L)	MW-20	8	0.48	0.15	0.54	0.25	0.59	25
Constituent Statistics		**2**	**4.78**	**0.25**	**4.90**	**0.25**	**9.70**	
Dichlorodifluoromethane (ug/L)	MW-19	8	1.16	0.28	1.20	0.51	1.40	0
Dichlorodifluoromethane (ug/L)	MW-20	8	0.45	0.17	0.53	0.25	0.62	37.5
Dichlorodifluoromethane (ug/L)	MW-21S	8	0.48	0.15	0.54	0.25	0.64	25
Dichlorodifluoromethane (ug/L)	MW-22S	8	0.59	0.07	0.60	0.50	0.68	0
Constituent Statistics		**4**	**0.67**	**0.08**	**0.57**	**0.25**	**1.40**	
Tetrachloroethene (ug/L)	MW-19	8	1.70	0.22	1.80	1.20	1.90	0
Tetrachloroethene (ug/L)	MW-20	8	1.13	0.11	1.20	0.92	1.20	0
Tetrachloroethene (ug/L)	MW-21D	8	0.96	0.10	0.93	0.89	1.20	0
Tetrachloroethene (ug/L)	MW-21S	8	0.87	0.06	0.87	0.80	0.95	0
Tetrachloroethene (ug/L)	MW-22D	8	0.92	0.14	0.90	0.78	1.20	0
Tetrachloroethene (ug/L)	MW-22S	8	0.92	0.07	0.93	0.83	1.00	0
Constituent Statistics		**6**	**1.08**	**0.05**	**0.93**	**0.78**	**1.90**	
Trichloroethene (ug/L)	MW-19	8	1.31	0.10	1.30	1.10	1.40	0
Trichloroethene (ug/L)	MW-20	8	0.28	0.09	0.25	0.25	0.51	87.5
Trichloroethene (ug/L)	MW-21D	8	0.29	0.10	0.25	0.25	0.54	87.5
Trichloroethene (ug/L)	MW-22D	8	0.29	0.10	0.25	0.25	0.54	87.5
Constituent Statistics		**4**	**0.54**	**0.00**	**0.25**	**0.25**	**1.40**	
Trichlorofluoromethane (ug/L)	MW-20	8	0.78	0.15	0.73	0.66	1.10	0
Trichlorofluoromethane (ug/L)	MW-21D	8	0.39	0.20	0.25	0.25	0.76	62.5
Trichlorofluoromethane (ug/L)	MW-21S	8	0.90	0.14	0.84	0.76	1.20	0
Trichlorofluoromethane (ug/L)	MW-22D	8	0.55	0.21	0.57	0.25	0.89	25
Trichlorofluoromethane (ug/L)	MW-22S	8	0.91	0.14	0.87	0.74	1.20	0
Constituent Statistics		**5**	**0.71**	**0.03**	**0.73**	**0.25**	**1.20**	

TABLE 8
STATISTICAL SUMMARY OF GROUNDWATER VOC DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Constituent Name	Well	N	Mean	Standard Deviation	Median	Min.	Max.	% Non-Detects
Domestic Wells Camp & Small								
Chloroform (ug/L)	Small	8	0.52	0.17	0.59	0.25	0.67	25
Tetrachloroethene (ug/L)	Small	8	1.35	0.11	1.40	1.20	1.50	0
Trichloroethene (ug/L)	Small	8	0.33	0.15	0.25	0.25	0.62	75
Tetrachloroethene (ug/L)	Camp	8	0.67	0.23	0.76	0.25	0.88	12.5

Notes:
Statistics based on remedial investigation data collected from June 2012 through February 2013.
Table summary only includes constituents with detected concentrations.
Vinyl chloride was only reported in MW-15. Vinyl chloride statistics are not provided for other wells.
Statistics calculated with Sanitas for Groundwater V9.3.
N = number of samples (sample population).

TABLE 9
STATISTICAL SUMMARY OF SELECT NORTH DRAINAGE GROUNDWATER DATA
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Constituent Name	Well	N	Mean	Standard Deviation	Median	Lower Quartile	Upper Quartile	Min.	Max.
Wells Ordered From Upgradient (East) to Downgradient (West)									
Chloroform (ug/L)	MW-24	8	0.72	0.08	0.72	0.68	0.77	0.57	0.83
Chloroform (ug/L)	MW-23	8	0.62	0.05	0.64	0.57	0.66	0.55	0.68
Chloroform (ug/L)	MW-27	5	0.59	0.04	0.61	0.56	0.61	0.51	0.61
Chloroform (ug/L)	MW-15	8	ND	ND	ND	ND	ND	ND	<0.5
Calcium (mg/L)	MW24	8	102.1	6.52	101.0	98.3	102.5	96.0	117.0
Calcium (mg/L)	MW23	8	108.8	4.47	109.5	107.5	112.0	99.2	113.0
Calcium (mg/L)	MW27	5	109.2	2.49	110.0	107.0	111.0	105.0	111.0
Calcium (mg/L)	MW15	8	157.6	4.93	158.5	153.5	162.0	150.0	163.0
Chloride (mg/L)	MW24	8	103.5	4.88	102.0	101.0	103.5	99.6	115.0
Chloride (mg/L)	MW23	8	118.7	8.35	121.0	119.0	123.0	98.8	125.0
Chloride (mg/L)	MW27	5	126.6	3.29	126.0	124.0	129.5	122.0	131.0
Chloride (mg/L)	MW15	8	119.80	3.06	119.5	117.0	121.0	117.0	126.0
Potassium (mg/L)	MW24	8	7.48	0.24	7.47	7.30	7.58	7.22	7.97
Potassium (mg/L)	MW23	8	7.63	0.17	7.58	7.50	7.79	7.41	7.88
Potassium (mg/L)	MW27	5	7.60	0.38	7.72	7.26	7.88	6.96	7.93
Potassium (mg/L)	MW15	8	8.36	0.27	8.33	8.25	8.50	7.94	8.83
Sodium (mg/L)	MW24	8	25.6	0.86	25.4	25.0	25.8	24.8	27.5
Sodium (mg/L)	MW23	8	25.9	0.52	25.8	25.5	26.2	25.3	26.8
Sodium (mg/L)	MW27	5	26.4	1.27	26.8	25.2	27.4	24.5	27.8
Sodium (mg/L)	MW15	8	64.6	5.53	66.6	60.8	69.0	54.1	69.9
Sulfate (mg/L)	MW24	8	30.6	0.89	30.4	30.0	30.8	29.6	32.5
Sulfate (mg/L)	MW23	8	31.2	1.01	31.1	30.4	31.7	30.0	33.2
Sulfate (mg/L)	MW27	5	30.7	1.11	30.5	29.9	31.6	29.5	32.5
Sulfate (mg/L)	MW15	8	40.9	2.34	40.7	39.1	42.7	37.9	44.3
Total Dissolved Solids (mg/L)	MW24	8	598.50	25.92	595	584	611	563	647
Total Dissolved Solids (mg/L)	MW23	8	657.90	49.33	650	619	697	596	736
Total Dissolved Solids (mg/L)	MW27	5	678.80	26.33	671	663	699	660	725
Total Dissolved Solids (mg/L)	MW15	8	882.80	49.85	869	851	901	833	988

Notes:
Statistics based on remedial investigation data collected from June 2012 through February 2013.
Statistics calculated with Sanitas for Groundwater V9.3.
N = number of samples (sample population).
ND = not detected at or above the method reporting level.

TABLE 10
PROPOSED CLEANUP LEVELS FOR GROUNDWATER BASED ON PROTECTION OF DRINKING WATER CONSUMPTION
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

Analyte	Unit	MTCA Method B Groundwater Cleanup Level		Federal Maximum Contaminant Level	WA State Maximum Contaminant Level	EPA Lifetime Health Advisory[1]	Unadjusted Screening Level - Minimum of Applicable SLs	Maximum Detected Value (RI Data 2012-2013)	Proposed Adjusted Cleanup Level[2]	Cancer Risk	Hazard Quotient
		Carcinogen	Non-Carcinogen								
Conventionals											
Alkalinity	mg/L	--	--	--	--	--	--	620	--	--	--
Ammonia (total as nitrogen)	mg/L	--	--	--	--	30	30	0.098	--	--	--
Chloride	mg/L	--	--	--	--	--	--	162	--	--	--
Nitrate	mg/L	--	--	10000	10000	--	10000	12.4	--	--	--
Sulfate	mg/L	--	--	--	--	--	--	48.7	--	--	--
Sulfide	mg/L	--	--	--	--	--	--		--	--	--
Metals											
Calcium	mg/L	--	--	--	--	--	--	163	--	--	--
Iron	mg/L	--	11	--	--	--	11	0.124	--	--	--
Magnesium	mg/L	--	--	--	--	--	--	54.8	--	--	--
Manganese[3]	mg/L	--	2.24	--	--	0.3	0.3	1.17	--	--	--
Potassium	mg/L	--	--	--	--	--	--	8.83	--	--	--
Sodium	mg/L	--	--	--	--	--	--	69.9	--	--	--
VOCs											
1,1-Dichloroethane	µg/L	--	1600	--	--	--	1600	4.1	--	--	--
Chloroethane[3]	µg/L	--	--	--	--	--	--	0.61	--		
Chloroform	µg/L	--	80	80	80	--	80	2.1	--	--	--
cis-1,2-Dichloroethene	µg/L	--	16	70	70	--	16	14	--	--	--
Dichlorodifluoromethane	µg/L	--	--	--	--	1000	1000	3.4	--	--	--
Tetrachloroethene	µg/L	21	48	5	5	--	5	**6.8**	**5**	2.4E-07	0.10
Toluene	µg/L	--	640	1000	1000		640	0.59	--	--	--
Trichloroethene (TCE)[4]	µg/L	0.54	4	5	5	--	4	2.2	--	--	--
Trichlorofluoromethane	µg/L	--	2400	--	--	--	2400	1.2	--	--	--
Vinyl chloride (VC)	µg/L	0.029	24	2	2	--	0.029	**1.2**	**0.29**	9.9E-06	0.008
									Total	1.0E-05	0.11

Notes:

Bold values exceeds applicable screening levels.

1 EPA Lifetime Health Advisory levels are non-enforceable standards. The values have been included here where no other standard exists for comparative purposes only. http://water.epa.gov/drink/standards/hascience.cfm

2 Per WAC 173-340-720(7), groundwater cleanup levels for individual hazardous substances may be adjusted provided that the hazard index does not exceed one (1) and the total excess cancer risk does not exceed one in one hundred thousand (1 x 10-5). Risk calculations using Equations 720-1 and 720-2 of WAC 173-340-720 have been completed to determine cleanup level adjustments that meet these while still meeting cancer risk and hazard quotient requirements. The cleanup level for VC has therefore been adjusted upward.

3 A cleanup level is not proposed for chloroethane, because no ARARs or MTCA cleanup levels are available. Additionally, chloroethane is not retained as a COC due to its low detection frequency at the Site (1%) per USEPA's Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (EPA, 1989).

4 Per Ecology guidance published in September 2012 (Ecology 2012c), the MTCA Method B cleanup level for TCE in groundwater is 4 µg/L, based on a downward adjustment of the state and federal MCL of 5 µg/L per WAC 173-340-720(7)(b). Therefore, this MTCA Method B non-carcinogenic cleanup level was selected as the screening level for TCE rather than the minimum screening level of 0.54 µg/L.

TABLE 11
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
Sudbury Landfill Remedial Investigation/ Feasibility Study
City of Walla Walla, Washington

General Response Action	Implemented by	Remedial Technology	Description	Technical Feasibility/ Effectiveness	Implementability	Cost	Retained/ Rejected
Groundwater Cleanup Action Objective: Protect groundwater by reducing or controlling migration of contaminant-bearing groundwater.							
No Action	No Action	None	No activities taken to address groundwater beyond current compliance monitoring activities.	Does not achieve CAOs.	High	Low	**Retained.** Retained for baseline comparison purposes.
Limited Action	Institutional Controls	Land Use Restrictions	Land use restrictions are measures undertaken to limit or prohibit activities that may interfere with the integrity of a cleanup action or result in exposure to hazardous substances at a site.	This control could be effective for the Site because it could restrict the use of groundwater or the construction of structures in the contaminated areas. It does not directly address contamination removal or treatment.	This can be an acceptable method for preventing human contact with hazardous media and institutional controls are commonly in effect at landfill sites. It can be difficult to implement on private property due to potential public resistance, and the necessary cooperation of multiple agencies and local governments.	Low	**Retained.** Retained for evaluation in combination with other response actions.
	Long-Term Monitoring	Groundwater Monitoring	Periodic monitoring of groundwater is conducted to assess changes in groundwater quality that might be attributed to contaminant leaching, migration, natural attenuation processes, or active remediation.	Long-term monitoring can be an effective method for evaluating chemical changes in groundwater and is likely feasible at the Site. It does not directly address contamination removal or treatment.	This is an established and accepted technology. An adequate groundwater monitoring system is available at the Site.	Low to moderate	**Retained.** Retained for evaluation in combination with other response actions.
In-Situ Treatment	Physical/ Chemical Treatment	Air Sparging	Injected air strips volatiles from the groundwater. VOCs which partition into the rising air are collected by a vacuum extraction system installed in the unsaturated zone. Oxygen may enhance biodegradation.	Air sparging can be an effective technology for removing VOCs; however, the mass transfer efficiency decreases for VOCs at very low concentrations such as those reported at the Site. The effectiveness of this technology can be affected by very small changes in soil permeability/heterogeneity, which can lead to localized treatment around the sparge points or leave areas untreated. Oxygen added to the contaminated groundwater can enhance aerobic biodegradation of contaminants below and above the water table, but may have adverse effects on anaerobic degradation.	This is an established and accepted technology. It may be difficult to implement at the Site due to subsurface conditions, fine-grained horizons, matrix of the gravel aquifer, and Site geology. Pilot testing would likely be needed to evaluate the use of air sparging at the Site before proceeding with full-scale remedial action using this technology. A performance monitoring program would be required to assess the effectiveness of this technology. This approach has low O&M requirements.	Low to moderate	**Rejected**. Rejected due to low concentrations of VOCs in groundwater and heterogeneous soil profile.
		In-well Air Stripping	Compressed air is injected at depth in a double cased well with an upper and lower screen. The injected air lifts the water in the well and causes it to flow out the upper screen, wile groundwater enters the well through the lower screen. VOCs are partially stripped through the air-lift process. Vapors are drawn off by a vacuum extraction system and treated. The discharge of water from the upper screen and intake of water through the lower screen establishes an in-situ hydraulic circulation cell through which groundwater is repeatedly circulated and treated.	In-well air stripping may be technically feasible at the Site; however, in-well air strippers are most effective at sites that contain high concentrations of dissolved contaminants. Effective installations require a well-defined contaminant plume and well-placed screens to prevent the spread of contamination. The treatment effectiveness can also be limited by the groundwater flow regime around the well and can be limited by the pumping capacity and resulting radius of influence.	Pilot scale system testing would likely be required to determine whether the technology is implementable at the Site. Air sparging or pump and treat technologies would likely provide greater assurance of success.	Moderate	**Rejected**. Other technologies would likely provide greater assurance of success.

TABLE 11
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
Sudbury Landfill Remedial Investigation/ Feasibility Study
City of Walla Walla, Washington

General Response Action	Implemented by	Remedial Technology	Description	Technical Feasibility/ Effectiveness	Implementability	Cost	Retained/ Rejected
In-Situ Treatment (continued)	Physical/ Chemical Treatment (continued)	Chemical Oxidation	Injection of oxidizing agents such as ozone, hydrogen peroxide, or permanganate to rapidly destroy organic compounds.	Chemical oxidation can be an effective technology for removing VOCs from groundwater. The effectiveness of this technology can be limited by low permeability soils and rapid groundwater flow, both of which are present at the Site. Chemical oxidation can interfere with anaerobic degradation processes and can potentially mobilize metals. A treatability study and reaction transport model are typically required to assess feasibility.	This is an established and accepted technology. It may be difficult to implement at the Site due to the heterogeneous soil profile. Proper and uniform distribution of oxidant can be difficult in heterogeneous materials. A pilot testing and performance monitoring program would be required to assess the effectiveness of this technology. This approach has high O&M requirements.	Medium to high	**Rejected**. Rejected due to heterogeneous soil profile.
	Chemical Treatment	Permeable Reactive Barrier (PRB), with or without Funnel and Gate.	Installation of an engineered subsurface treatment zone across the flow path of a dissolved contaminant plume. As groundwater passes through the zone, it is treated in-situ by reactive media. Often used in conjunction with impermeable wall sections (funnels) to force groundwater to flow through the permeable sections containing the reactive media.	PRBs can be an effective method for the reductive dechlorination of chlorinated constituents; however, PRBs can lose permeability with age and can affect groundwater flow vectors. A PRB could increase the downward gradient in the Site aquifer if the barrier is not tied into an underlying low permeability soil zone.	Potentially implementable as a partially penetrating barrier to a depth of 50 ft. Construction of a deeper barrier is not considered feasible. May need other technologies to funnel the contaminants through the PRB (funnel and gate system).	High	**Rejected**. Full-scale barrier along property boundary considered infeasible. Would require prohibitive periodic replacement of reactive material.
	Biological Treatment	Enhanced Anaerobic Biodegradation	Enhance biodegradation accelerates the natural biodegradation process by providing nutrients, electron acceptors, and/or microorganisms to degrade (metabolize) organic contaminants in groundwater. Typical enhancements include oxygen, nitrates, or solid phase peroxide products such as an oxygen releasing compound (ORC).	Enhanced biodegradation can be an effective technology for removing VOCs from groundwater. Its effectiveness can be limited by the spacing of injection points and the heterogeneity of the subsurface materials. Under anaerobic conditions, contaminants may be degraded to a product that is more hazardous than the original contaminant. For example, trichloroethene frequently biodegrades to the persistent and more toxic vinyl chloride.	This is an established and accepted technology. It would likely be difficult to implement at the Site due to the heterogeneity of the subsurface soil. Pilot testing and microcosm testing would likely be needed to evaluate the use of enhanced biodegradation at the Site before proceeding with full-scale remedial action using this technology. This approach has high O&M requirements to ensure continued effectiveness of the contact technologies.	Moderate to high	**Rejected**. Effectiveness limited by heterogeneity of the subsurface materials. Possibility of increasing vinyl chloride concentrations in groundwater. Pilot testing costs.
	Biological, Chemical, and Physical Treatment	Monitored Natural Attenuation	Reliance on one or more physical, chemical, or biological processes that reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These in-situ processes include biodegradation; dispersion; dilution; sorption; volatilization; and chemical or biological stabilization, transformation, or destruction of contaminants. Typically requires source control and long-term monitoring to verify performance.	MNA is an accepted technology that has been implemented at numerous sites across the country. It can be easy to implement because little to no aggressive action is required. A long-term groundwater monitoring system would be required to verify the effectiveness of this approach. Institutional controls may be required.	Preliminary groundwater quality data suggest that natural biodegradation is already occurring locally at the Site as evidenced by increased vinyl chloride and cis-1,2-dichloroethene concentrations at MW-15. MNA is readily implemented using the existing monitoring well system, or with additional wells, and/or additional geochemical testing. This approach has low O&M requirements with moderate monitoring requirements.	Low to moderate	**Retained.** Retained for evaluation in combination with other response actions.

TABLE 11
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
Sudbury Landfill Remedial Investigation/ Feasibility Study
City of Walla Walla, Washington

General Response Action	Implemented by	Remedial Technology	Description	Technical Feasibility/ Effectiveness	Implementability	Cost	Retained/ Rejected
Containment	Vertical Barriers	Slurry Wall/Sheet Piles/Grout Curtains	A subsurface vertical wall constructed with impermeable material such as low permeability trench fill (slurry), sheet piles, or grout curtains. The wall is often keyed into a low permeability natural base, such as clay or competent bedrock.	This can be an effective technology for preventing horizontal migration of contaminants. However, the barrier can affect groundwater flow vectors and may not retain the contaminants if the barrier is not tied into a low permeability soil horizon. It provides containment only; it does not treat groundwater or provide source removal. Because no active treatment is occurring, additional remedial action may be required to control contaminant concentrations. Degradation of the slurry wall may occur over time.	Potentially implementable at the Site as a partially penetrating barrier to a depth of 50 feet. Construction of a deeper barrier is not considered feasible. May need other remedial technologies to treat contaminants. May increase the downward gradient in the aquifer, and contaminated groundwater may naturally flow around the barrier.	Moderate to high	**Rejected.** No base formation to tie barrier wall into.
	Hydraulic Containment	Pumping	Uses groundwater pumping to form a hydraulic barrier and control off-site migration of contaminants. May require groundwater treatment before discharge	This can be an effective technology for preventing contaminant migration, and is commonly coupled with an ex-situ treatment technology. Capture zone modeling would likely be necessary to design a system to adequately prevent contaminant migration.	This is a common and accepted technology. Limitations can include long duration to meet cleanup goals and rebound (pumping depresses the groundwater level, leaving residuals sorbed to the soil, and after the groundwater level returns to its normal level, contaminants sorbed onto soil become dissolved.) This approach has high O&M requirements.	Moderate to high	**Retained.** Retained as a contingent technology to control offsite migration, not as a primary treatment of MW-15 groundwater.
Ex-Situ Treatment of Extracted Groundwater	Physical Treatment	Air Stripping	Transfer of VOCs from the aqueous phase to the vapor phase by bringing the groundwater into contact with air, typically in a counter current manner using packed towers or bubble tray aerators.	Air stripping can be an effective technology for removing moderate to high VOC concentrations from groundwater; however, the mass transfer efficiency can decrease for VOCs at very low concentrations such as those reported at the Site. It can be effective for removing miscible compounds such as vinyl chloride. Air strippers transfer the VOCs from groundwater to air and do not destroy contaminants. Additional waste streams are generated that may require treatment.	This is a common, well-established, and accepted technology. Small systems for point-of-use treatment are available. Off-gas treatment by activated carbon adsorption or catalytic oxidation may be added. This approach has average O&M requirements.	Moderate	**Rejected.** Inefficient at removing low concentrations of VOCs.
		Carbon Adsorption	Removal of dissolved VOCs from groundwater by adsorption onto granular activated carbon (GAC).	GAC can be an effective technology for removing most VOCs; however, its effectiveness can be limited for water-soluble compounds such as dichloroethane. GAC has a short-term duration, especially for high concentrations and would require a high frequency of operation and maintenance. This process requires transport and disposal or regeneration of spent carbon.	This is a common, well-established, and accepted technology that could be implementable. This approach has high O&M requirements including monitoring of influent and effluent stream, replacement of carbon, and backwashing.	Medium to high	**Retained.** Retained for evaluation in combination with hydraulic containment.

TABLE 11
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
Sudbury Landfill Remedial Investigation/ Feasibility Study
City of Walla Walla, Washington

General Response Action	Implemented by	Remedial Technology	Description	Technical Feasibility/ Effectiveness	Implementability	Cost	Retained/ Rejected
Ex-Situ Treatment of Extracted Groundwater (continued)	Physical Treatment (continued)	Evaporation Pond	An evaporation pond is used to remove VOCs from extracted groundwater by means of natural biological, physical, and chemical processes.	An evaporation pond can effectively remove VOCs from extracted groundwater in warm, dry climates. The system can cause the direct release of contaminants to the atmosphere and emission control is generally not feasible. A large amount of space and storage capacity for winter months is required. The extraction rate and volume for full-time groundwater extraction would be required to size the pond and determine ultimate feasibility.	Evaporation ponds are not commonly used for treatment of contaminated groundwater. The climate is acceptable for evaporation, and land for pond construction is likely available at the Site. There are potential regulatory issues related to volatilization to the atmosphere. This approach has moderate to high construction costs and low O&M requirements.	Low to moderate	**Retained.** Retained for evaluation in combination with hydraulic containment.
		Sprinkler Irrigation	The process uses pressure to force water contaminated with VOCs through a sprinkler irrigation system. The pressure change transfers the contaminants from the dissolved phase to the vapor phase.	Sprinkler irrigation can be an effective technology for treating low-concentration VOCs in groundwater. It is used primarily to treat contaminants that readily transfer from the dissolved phase to the vapor phase. The system causes the direct release of contaminants to the atmosphere and emission control is not feasible.	Sprinkler irrigation technology could be implemented at the Site. There are potential regulatory issues related to volatilization to the atmosphere. There is a potential for direct release of contaminants to soil. Sprinkler irrigation could potentially be coupled with evaporation pond treatment. This approach has low O&M requirements.	Low to moderate	**Retained.** Retained for evaluation in combination with hydraulic containment.
Source Control Cleanup Action Objective: Protect groundwater by reducing or controlling the source of VOC contaminants available to groundwater.							
Source Removal	MSW Removal	Excavation of MSW from Area 2 and from beneath the Water Table in Area 5, with Disposal in a Permitted Landfill (Area 7)	Excavation and disposal in a permitted landfill is used to remove the contaminant source (MSW) from the environment.	Excavation and removal of MSW is impractical in most cases due to the health hazards, construction difficulties, and high cost. Removal of the MSW from Area 2 is likely feasible if proper health and safety controls are applied; however, the volume of waste that would require excavation and transport would be impractical. Removal of MSW from beneath the water table in Area 5 is not considered feasible without extensive shoring of MSW and soil. Excavation of the MSW from beneath the water table would likely only be effective in removing a small portion of the contaminant source.	Excavation and removal of MSW is not commonly implemented, except when MSW materials have high toxicity or present an elevated hazard to human health or the environment. The Sudbury Landfill remedial investigation did not indicate that the MSW mass in Area 2 or the MSW beneath the water table in Area 5 present a high toxicity source or large component of the overall contamination. It likely could not be implemented for MSW at depth or beneath the water table. It possibly could be implemented at Area 2, however, the MSW removal has disproportionate cost compared to other technologies.	High	**Rejected:** Rejected based on disproportionate cost and virtual infeasibility to excavate MSW from below water table.
Landfill Gas Control	Landfill Gas Extraction and Destruction	Landfill Gas Extraction and Destruction	Landfill gas is extracted using a an extraction well and vacuum-blower system. The extracted gas is destroyed using a flare system.	Landfill gas extraction and treatment is technically feasible and is currently being implemented for Area 6. It has been shown to be effective as a source control technique, and may reduce the VOC contaminants in gas that are available to partition to groundwater.	Landfill gas extraction and treatment is currently being conducted at Area 6, and the system could be expanded to other disposal areas at the Site. The existing gas treatment system is capable of accepting gas from other areas of the Site.	Moderate	**Retained.** Retained as an expansion of the existing system.
Leachate Control	MSW Cover	Low Permeability or Evapotranspiration Soil Cover	Low permeability soil or evapotranspiration soil cap installed over MSW areas to limit infiltration/recharge and leaching of contaminants into groundwater.	This can be an effective technology that forms a barrier between the contaminated media and the surface, restricts the infiltration of surface water, and limits the generation of leachate. A soil cover provides containment only; it does not treat groundwater.	This common landfill technology can be straightforward to implement and can meet requirements of Chapter 173-351 WAC. Previous studies at the Sudbury Landfill have found that low permeability soil used as an evapotranspiration cover can be effective at the Site. Low permeability soil is available on the Site.	Low to moderate	**Retained.** This technology has shown to be effective at the site.

TABLE 11
INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
Sudbury Landfill Remedial Investigation/ Feasibility Study
City of Walla Walla, Washington

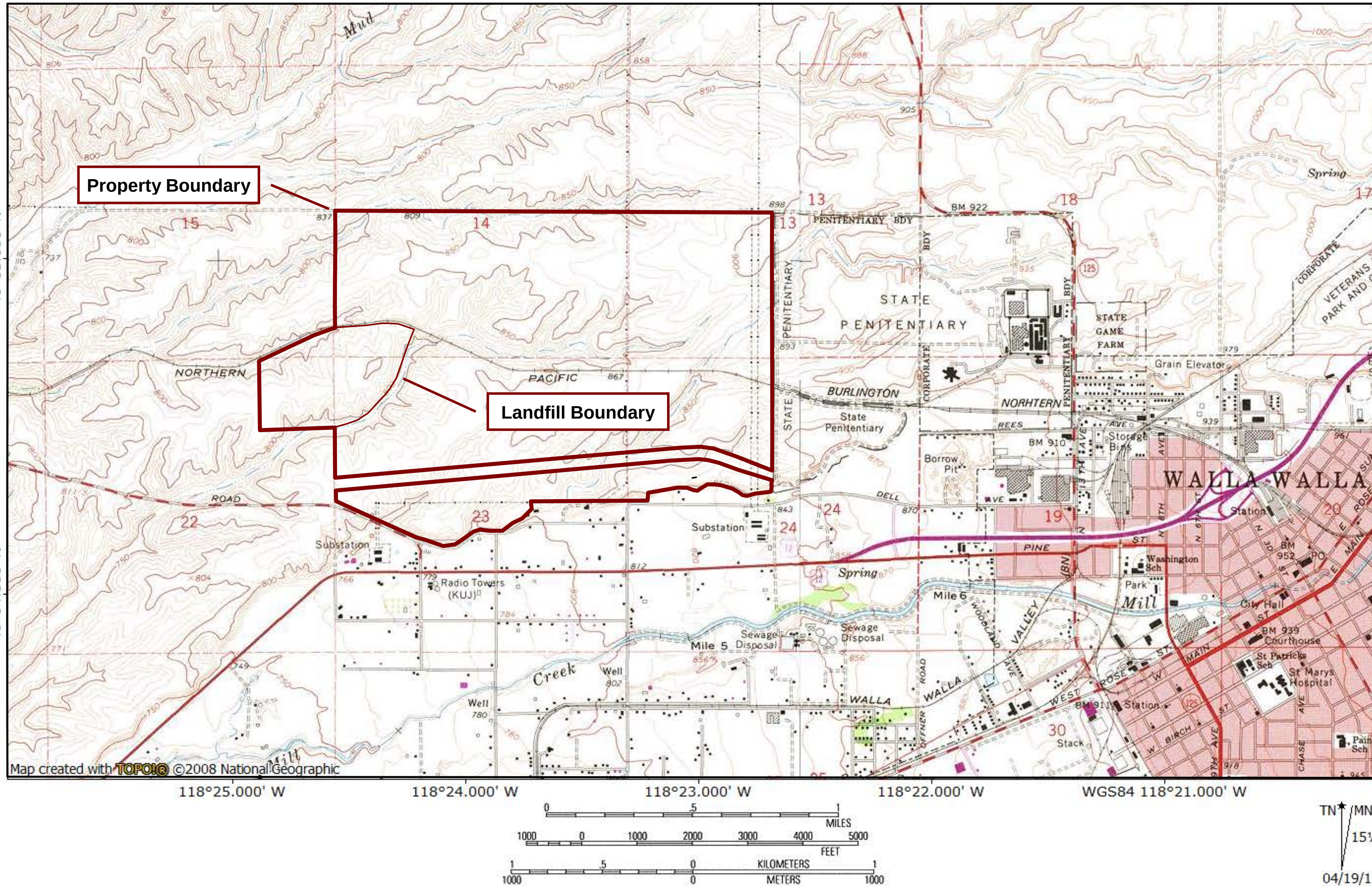
General Response Action	Implemented by	Remedial Technology	Description	Technical Feasibility/ Effectiveness	Implementability	Cost	Retained/ Rejected
Leachate Control (continued)	MSW Cover (continued)	Geosynthetic/ Multimedia Cap	Geosynthetic/Multimedia cap installed over MSW areas to limit infiltration/recharge and leaching of contaminants into groundwater.	This can be an effective technology that forms a barrier between the contaminated media and the surface, restricts the infiltration of surface water, and limits the generation of leachate. A cap provides containment only; it does not treat groundwater.	This common landfill technology can be straightforward to implement and can meet the requirements of Chapter 173-351 WAC.	Moderate to high	**Retained.** Retained as a contingent cover design.
		Reconstruction of Existing Area 5 Soil Cover	Manipulation of existing low-permeability soil cover on Area 5 to promote drainage and limit infiltration/recharge and leaching of contaminants into groundwater.	Reconstruction and/or manipulation of the existing Area 5 soil cover may be technically feasible, and could be effective in the minimizing the generation of leachate. Studies at the Sudbury Landfill have found that sufficient low permeability soil may cover the MSW, but the undulating surface may retain surface water and promote infiltration. This technology would enhance the effectiveness of existing cover systems.	This common landfill technology is likely easy to implement, could enhance the effectiveness of the existing cover system over Area 5, and can meet the requirements of Chapter 173-351 WAC.	Low	**Retained.** This technology would enhance the effectiveness of existing cover systems.
	Stormwater Controls	Surface Grading, Construction of Stormwater Channels, and Run-on Prevention.	Stormwater controls are implemented at landfills to prevent erosion, and stormwater run-on, pooling, and infiltration.	Construction of stormwater controls can be an effective method of preventing erosion, run-on, pooling, and infiltration, and are a requirement of the Solid Waste Permit and Chapter 173-351 WAC.	Stormwater controls are commonly implemented at landfills to prevent erosion, infiltration, and the generation of leachate. Interim measures have been implemented at the Site.	Low	**Retained.** Stormwater controls have been implemented at the Site and can be effective at minimizing leachate generation.

Notes:
CAO = Cleanup action objective
MSW = Municipal solid waste
O&M = Operations and maintenance
PRB = Permeable-reactive barrier
VOC = Volatile organic compound
WAC = Washington Administrative Code

TABLE 12
LANDFILL GAS CONTROL TECHNOLOGIES
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

LFG Control Technology	Advantages	Disadvantages	Applicability to Areas 1, 2, and 5
Cap/cover System	Simple Low maintenance	Moderate cost Needs to work in concert with LFG system	High
Passive trench venting	Low cost Minimal O&M Convertible to active system Compatible with multiple systems Effective at waste extents Works well with impermeable cover systems Works well with semi permeable covers over subsurface collection layers (i.e., crushed rock under asphalt pavement)	Limited radius of influence within landfill MSW may extend too deep in Areas 1 and 5 for trenches.	Low - Areas 1 and 5 Moderate - Area 2
Perimeter barriers	Controls migration at waste extents	Moderate to high cost MSW may extend too deep in Areas 1 and 5 for trenches.	Low - Areas 1 and 5 Moderate - Area 2
Extraction wells	Discrete zone control Compatible with multiple systems May be connected to existing header and flare system	Moderate maintenance required Moderate cost Limited radius of influence	High
Active collection trenches	Discrete zone control Compatible with multiple systems	Moderate maintenance required Moderate cost Limited radius of influence MSW may extend too deep in Areas 1 and 5 for trenches.	Low - Areas 1 and 5 Moderate - Area 2

Notes:
LFG = Landfill gas
MSW = Municipal solid waste
O&M = Operations and maintenance

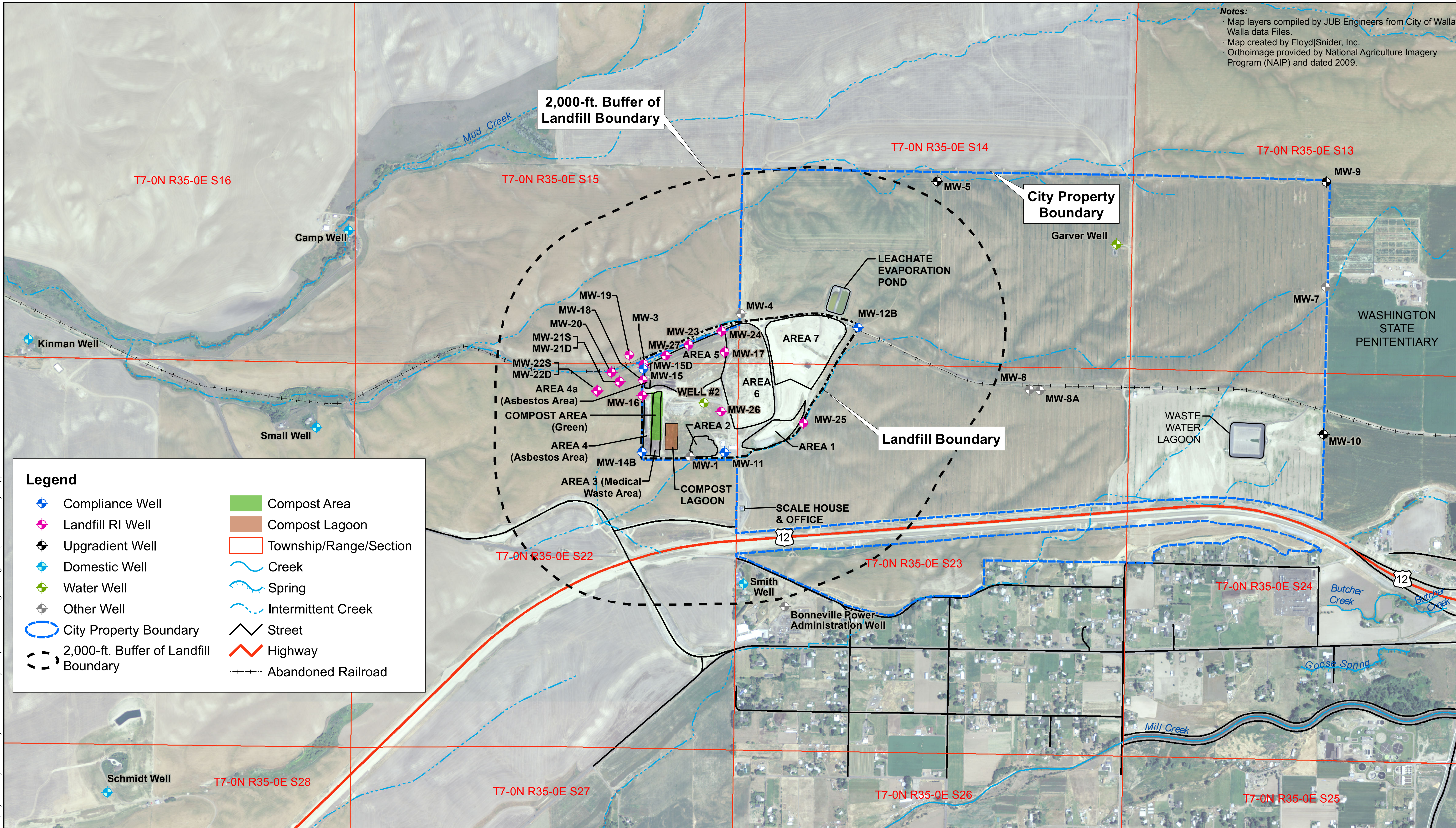


Schwyn Environmental Services

Sudbury Road Landfill
Walla Walla, Washington

Site Location

Figure 1



Schwyn Environmental Services

0 500 1,000 2,000

Scale in Feet

1:15,000

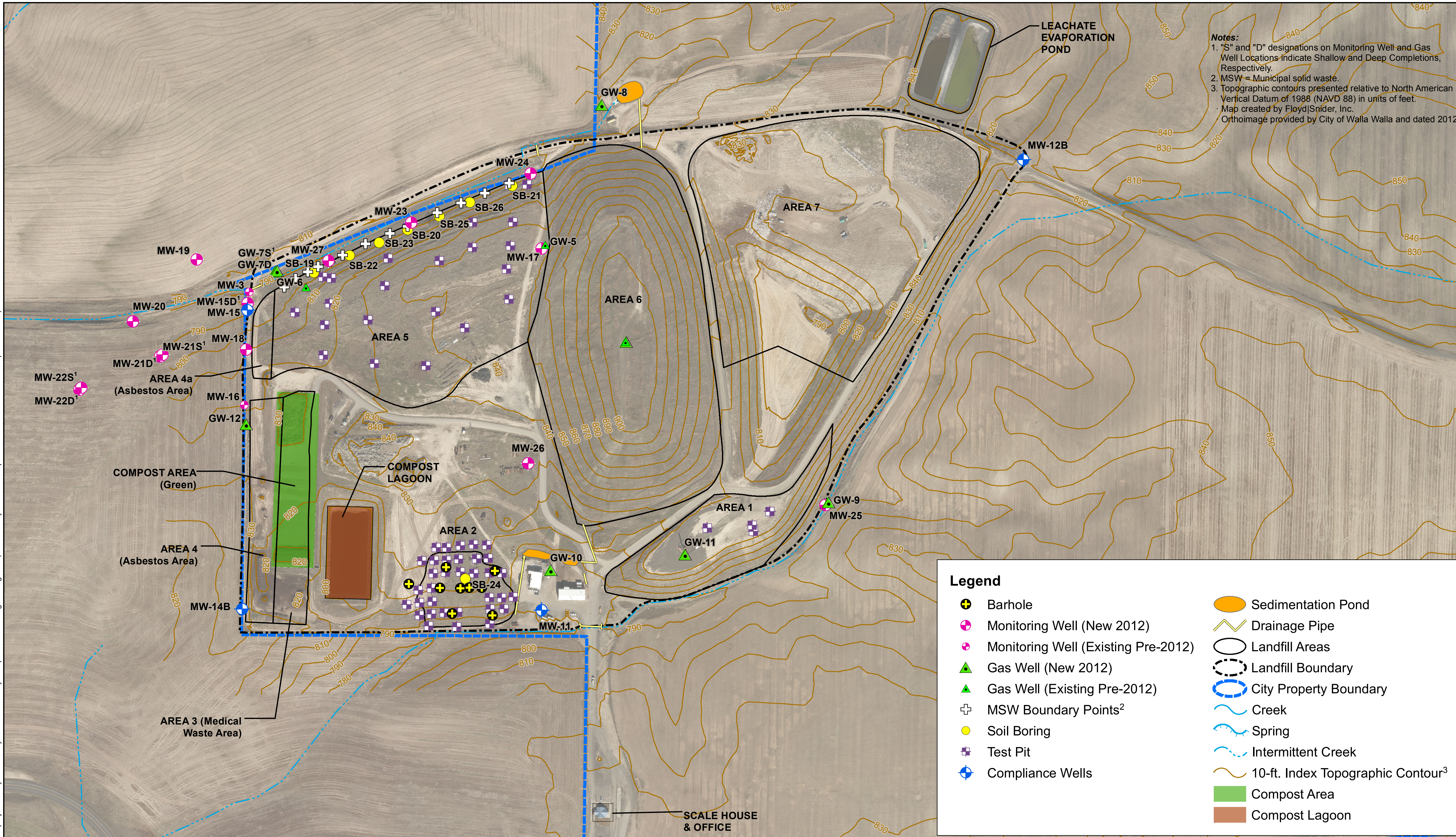
N

Sudbury Road Landfill
Walla Walla, Washington

Vicinity Map

Figure 2

F:\projects\Schwyn-Sudbury\GIS\MXD\Schwyn Request\2013 RI Figures\Figure 2 (Landfill Vicinity Map).mxd 3/18/2014



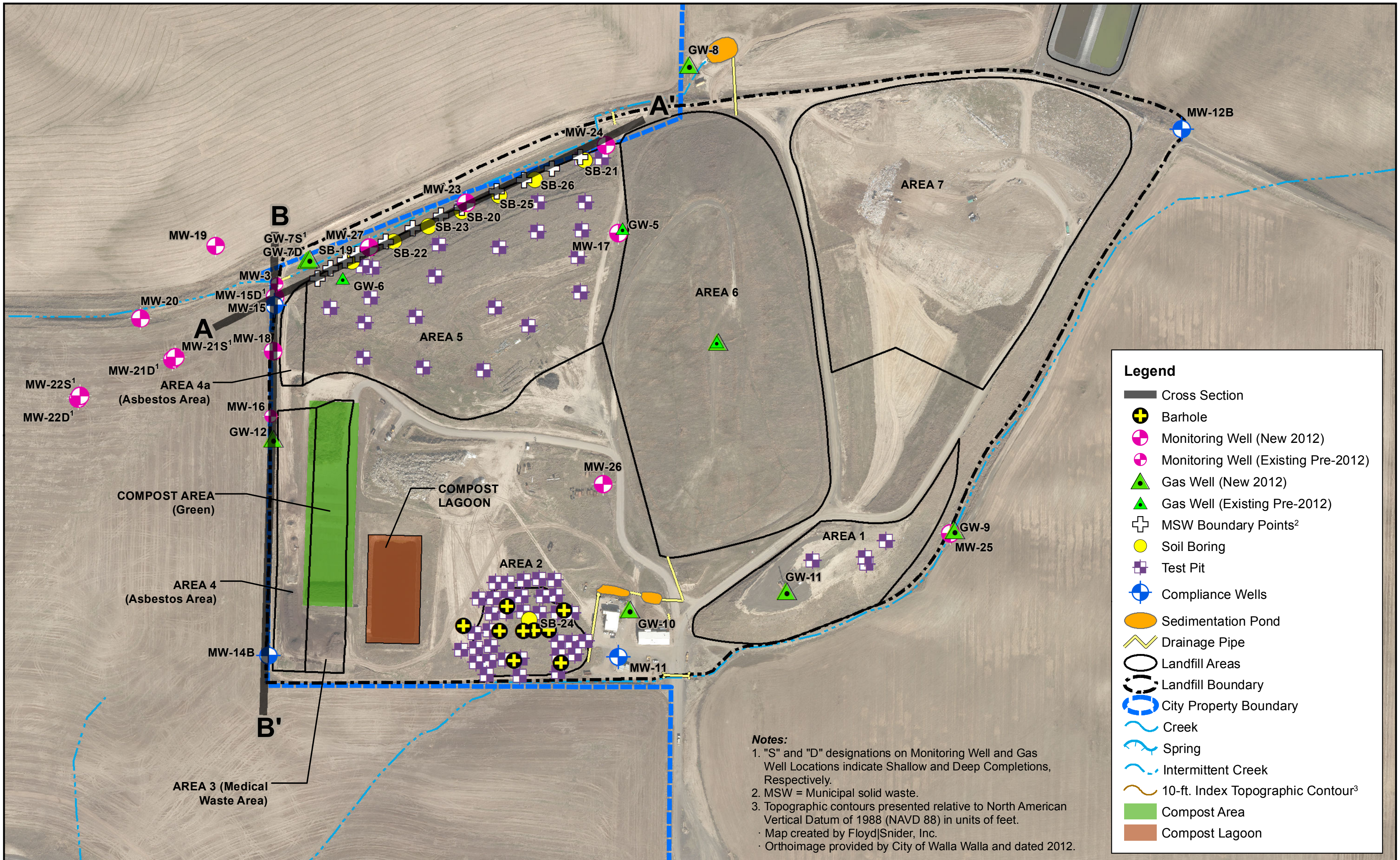
F:\projects\Schwyn-Sudbury\GIS\MXD\Schwyn Request\2013 RI Figures\Figure 3 (2012 Surveyed As-built Exploration Locations and 2012 Topo and Aerial).mxd 3/18/2014

Schwyn Environmental Services

Sudbury Road Landfill
Walla Walla, Washington

Remedial Investigation Exploration Locations

Figure 3



F:\projects\Schwyn-Sudbury\GIS\MXD\Schwyn Request\2013 RI Figures\Figure 4 (Location of Geologic Cross-Section).mxd 3/18/2014

Schwyn Environmental Services

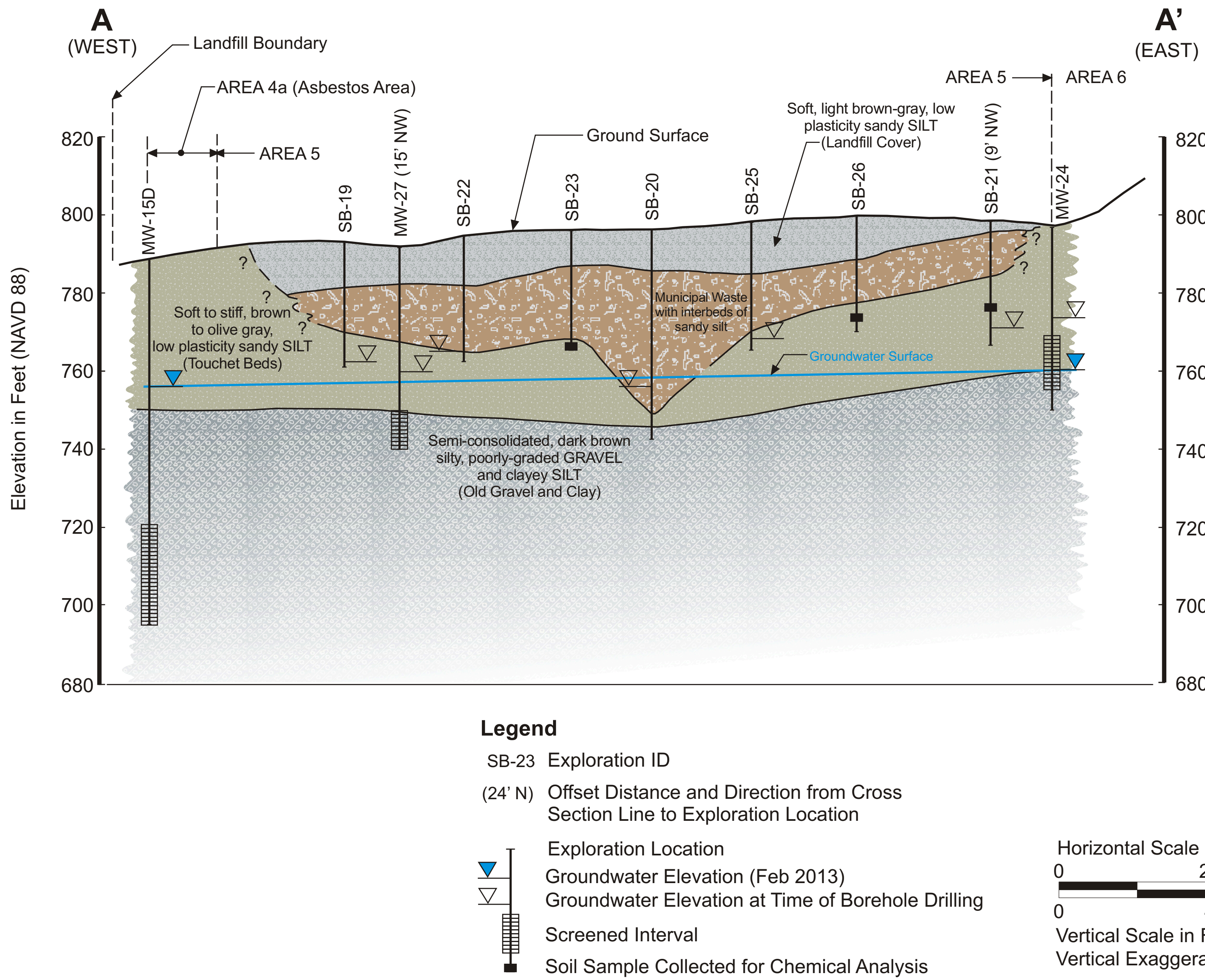
0 175 350 700
Scale in Feet

N

Sudbury Road Landfill
Walla Walla, Washington

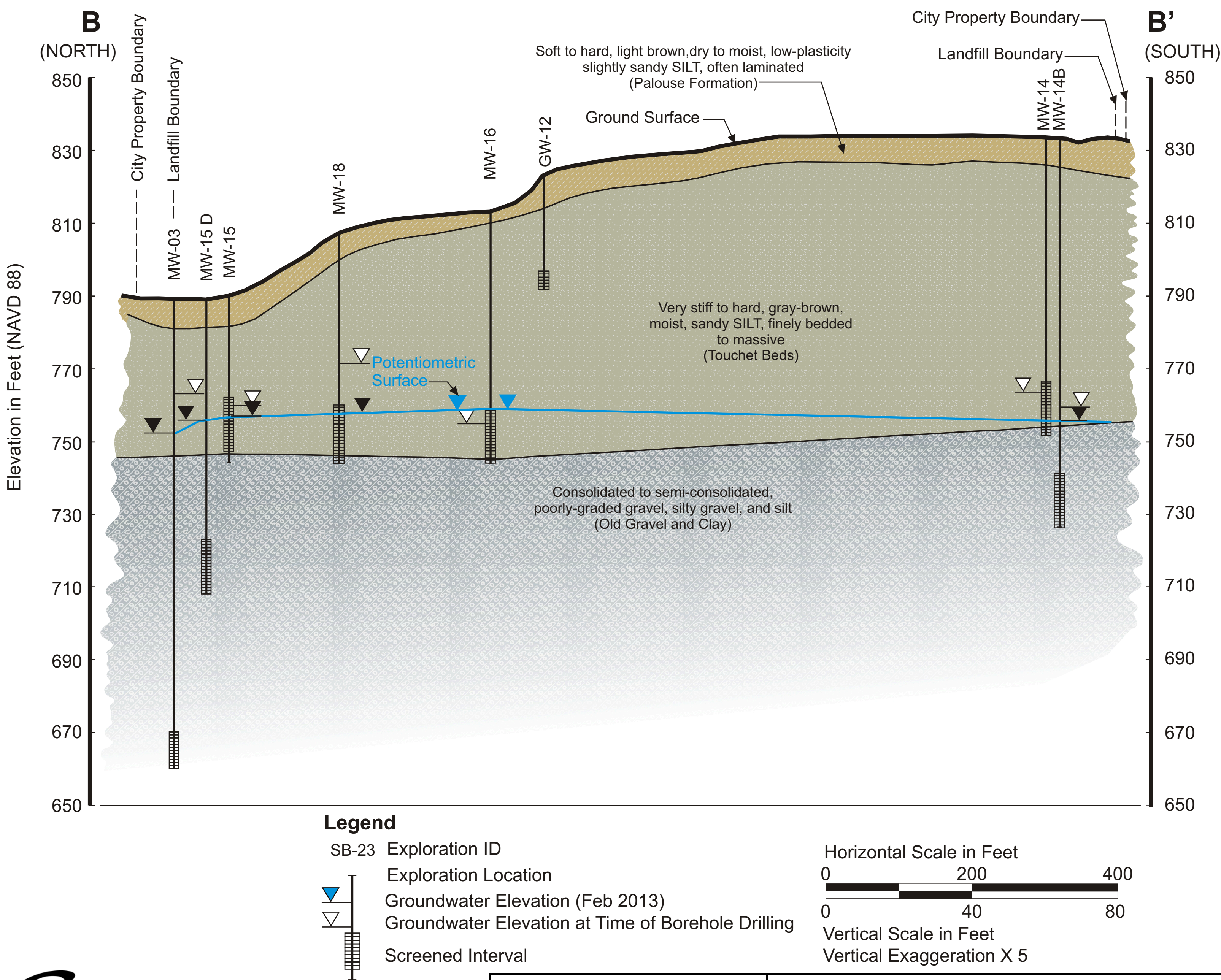
Location of Geologic Cross-Sections

Figure
4



Schwyn Environmental Services

Sudbury Landfill Remedial Investigation Walla Walla, Washington	**Geologic Cross Section A-A'**	Figure 5



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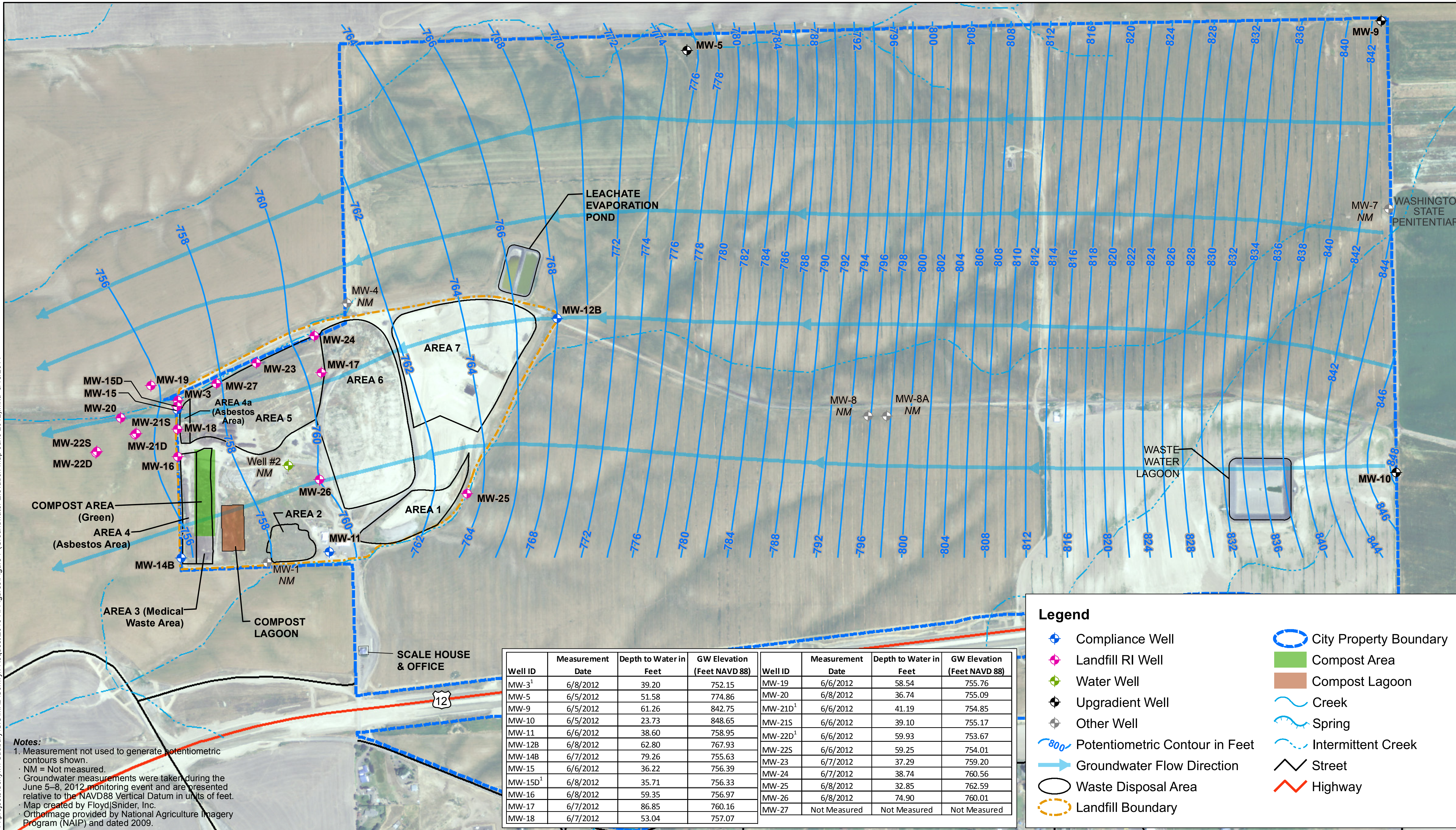
Sudbury Landfill
Remedial Investigation
Walla Walla, Washington

Geologic Cross Section B-B'

Figure
6



Well ID	Measurement Date	Depth to Water in Feet	GW Elevation (Feet NAVD 88)
MW-3[1]	6/8/2012	39.20	752.15
MW-5	6/5/2012	51.58	774.86
MW-9	6/5/2012	61.26	842.75
MW-10	6/5/2012	23.73	848.65
MW-11	6/6/2012	38.60	758.95
MW-12B	6/8/2012	62.80	767.93
MW-14B	6/7/2012	79.26	755.63
MW-15	6/6/2012	36.22	756.39
MW-15D[1]	6/8/2012	35.71	756.33
MW-16	6/8/2012	59.35	756.97
MW-17	6/7/2012	86.85	760.16
MW-18	6/7/2012	53.04	757.07

Well ID	Measurement Date	Depth to Water in Feet	GW Elevation (Feet NAVD 88)
MW-19	6/6/2012	58.54	755.76
MW-20	6/8/2012	36.74	755.09
MW-21D[1]	6/6/2012	41.19	754.85
MW-21S	6/6/2012	39.10	755.17
MW-22D[1]	6/6/2012	59.93	753.67
MW-22S	6/6/2012	59.25	754.01
MW-23	6/7/2012	37.29	759.20
MW-24	6/7/2012	38.74	760.56
MW-25	6/8/2012	32.85	762.59
MW-26	6/8/2012	74.90	760.01
MW-27	Not Measured	Not Measured	Not Measured

Notes:
1. Measurement not used to generate potentiometric contours shown.
- NM = Not measured.
- Groundwater measurements were taken during the June 5–8, 2012 monitoring event and are presented relative to the NAVD88 Vertical Datum in units of feet.
- Map created by Floyd|Snider, Inc.
- Orthoimage provided by National Agriculture Imagery Program (NAIP) and dated 2009.

F:\projects\Schywn-Sudbury\GIS\MXD\Schwyn Request\2013 RI Figures\Figure 7 (Groundwater Elevation Map June 2012).mxd 3/18/2014

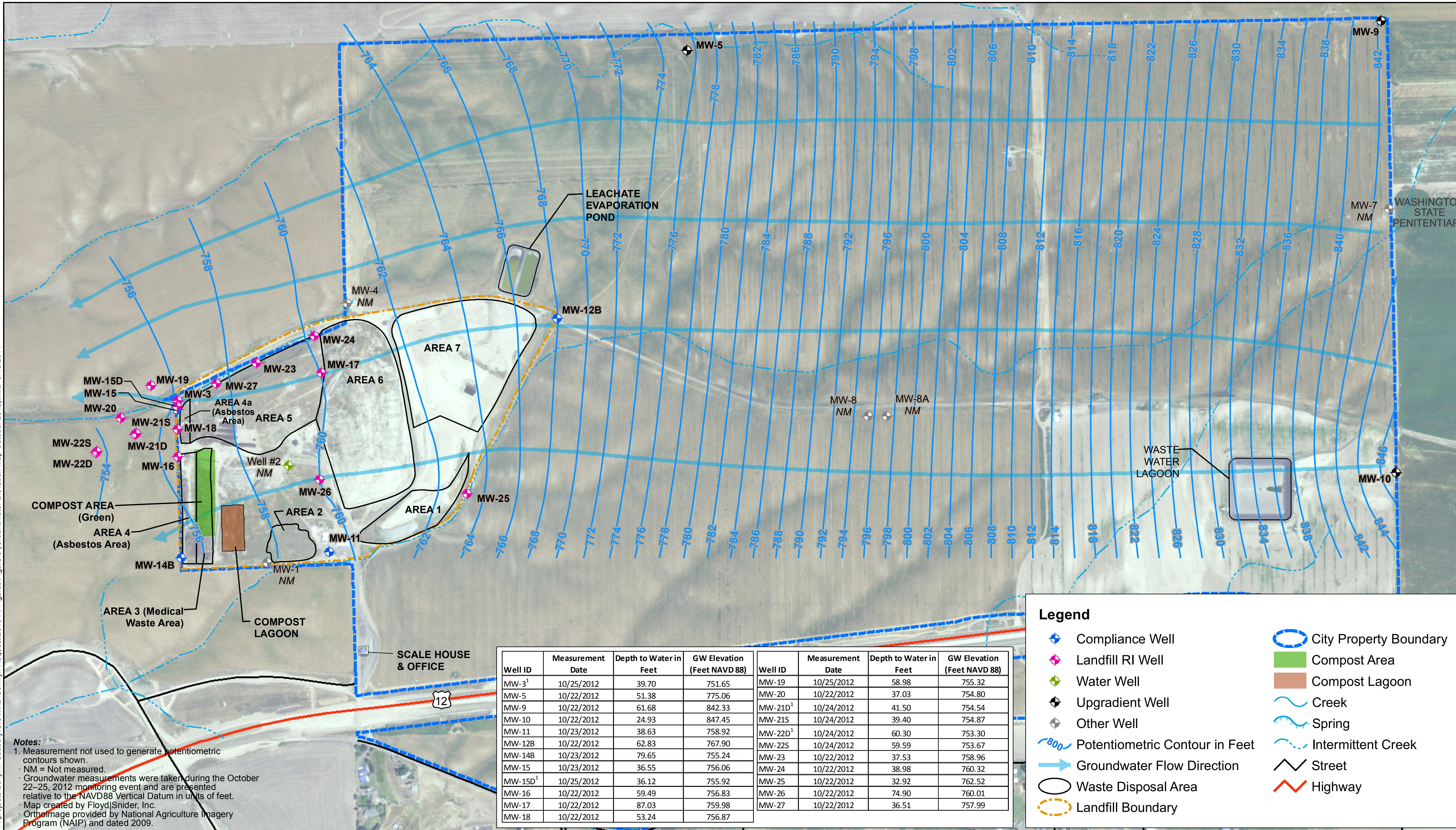
Schwyn Environmental Services

0 350 700 1,400
Scale in Feet
1:8,400
N

Sudbury Road Landfill
Walla Walla, Washington

Groundwater Elevation Map
June 2012

Figure
7



Well ID	Measurement Date	Depth to Water in Feet	GW Elevation (Feet NAVD 88)
MW-3[1]	10/25/2012	39.70	751.65
MW-5	10/22/2012	51.38	775.06
MW-9	10/22/2012	61.68	842.33
MW-10	10/22/2012	24.93	847.45
MW-11	10/23/2012	38.63	758.92
MW-12B	10/22/2012	62.83	767.90
MW-14B	10/23/2012	79.65	755.24
MW-15	10/23/2012	36.55	756.06
MW-15D[1]	10/25/2012	36.12	755.92
MW-16	10/22/2012	59.49	756.83
MW-17	10/22/2012	87.03	759.98
MW-18	10/22/2012	53.24	756.87

Well ID	Measurement Date	Depth to Water in Feet	GW Elevation (Feet NAVD 88)
MW-19	10/25/2012	58.98	755.32
MW-20	10/22/2012	37.03	754.80
MW-21D[1]	10/24/2012	41.50	754.54
MW-21S	10/24/2012	39.40	754.87
MW-22D[1]	10/24/2012	60.30	753.30
MW-22S	10/24/2012	59.59	753.67
MW-23	10/22/2012	37.53	758.96
MW-24	10/22/2012	38.98	760.32
MW-25	10/22/2012	32.92	762.52
MW-26	10/22/2012	74.90	760.01
MW-27	10/22/2012	36.51	757.99

Notes:

1. Measurement not used to generate potentiometric contours shown.

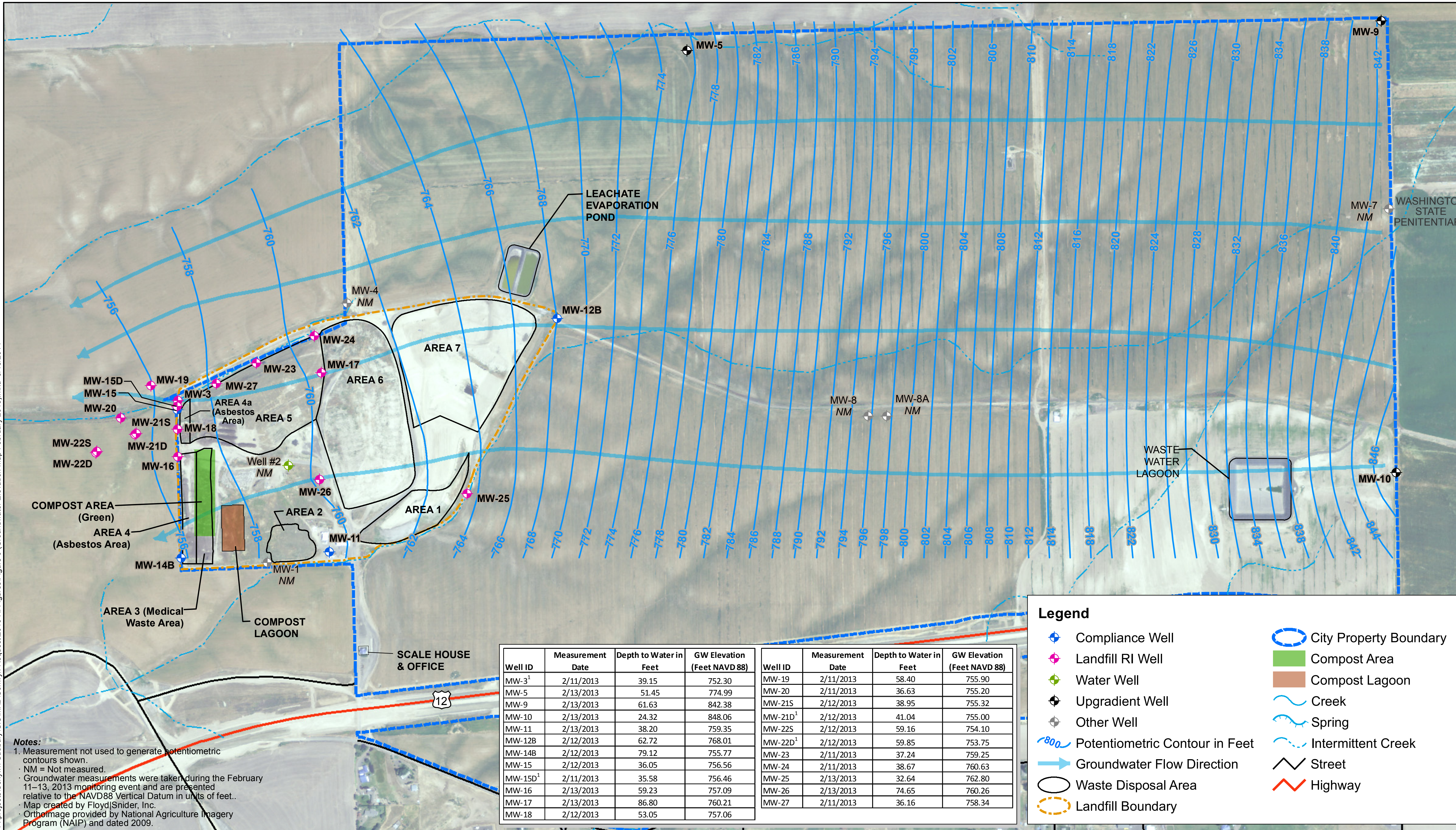
- NM = Not measured.
- Groundwater measurements were taken during the October 22–25, 2012 monitoring event and are presented relative to the NAVD88 Vertical Datum in units of feet.
- Map created by Floyd|Snider, Inc.
- Orthoimage provided by National Agriculture Imagery Program (NAIP) and dated 2009.

Schwyn Environmental Services

Sudbury Road Landfill
Walla Walla, Washington

Groundwater Elevation Map
October 2012

Figure
8



Well ID	Measurement Date	Depth to Water in Feet	GW Elevation (Feet NAVD 88)
MW-3[1]	2/11/2013	39.15	752.30
MW-5	2/13/2013	51.45	774.99
MW-9	2/13/2013	61.63	842.38
MW-10	2/13/2013	24.32	848.06
MW-11	2/13/2013	38.20	759.35
MW-12B	2/12/2013	62.72	768.01
MW-14B	2/12/2013	79.12	755.77
MW-15	2/12/2013	36.05	756.56
MW-15D[1]	2/11/2013	35.58	756.46
MW-16	2/13/2013	59.23	757.09
MW-17	2/13/2013	86.80	760.21
MW-18	2/12/2013	53.05	757.06

Well ID	Measurement Date	Depth to Water in Feet	GW Elevation (Feet NAVD 88)
MW-19	2/11/2013	58.40	755.90
MW-20	2/11/2013	36.63	755.20
MW-21S	2/12/2013	38.95	755.32
MW-21D[1]	2/12/2013	41.04	755.00
MW-22S	2/12/2013	59.16	754.10
MW-22D[1]	2/12/2013	59.85	753.75
MW-23	2/11/2013	37.24	759.25
MW-24	2/11/2013	38.67	760.63
MW-25	2/13/2013	32.64	762.80
MW-26	2/13/2013	74.65	760.26
MW-27	2/11/2013	36.16	758.34

Notes:

1. Measurement not used to generate potentiometric contours shown.

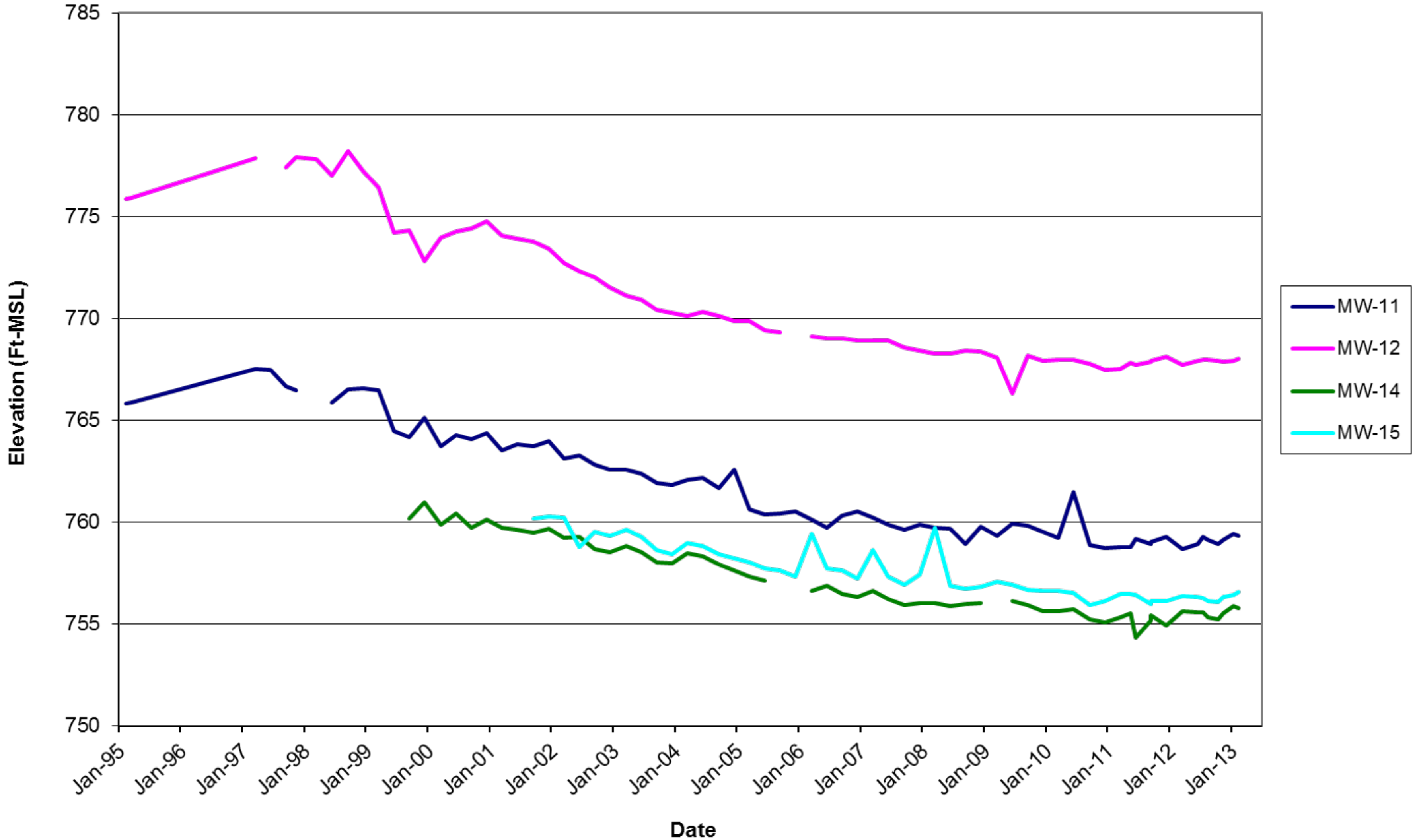
· NM = Not measured.
· Groundwater measurements were taken during the February 11–13, 2013 monitoring event and are presented relative to the NAVD88 Vertical Datum in units of feet..
· Map created by Floyd|Snider, Inc.
· Orthoimage provided by National Agriculture Imagery Program (NAIP) and dated 2009.

Schwyn Environmental Services

Sudbury Road Landfill
Walla Walla, Washington

Groundwater Elevation Map
February 2013

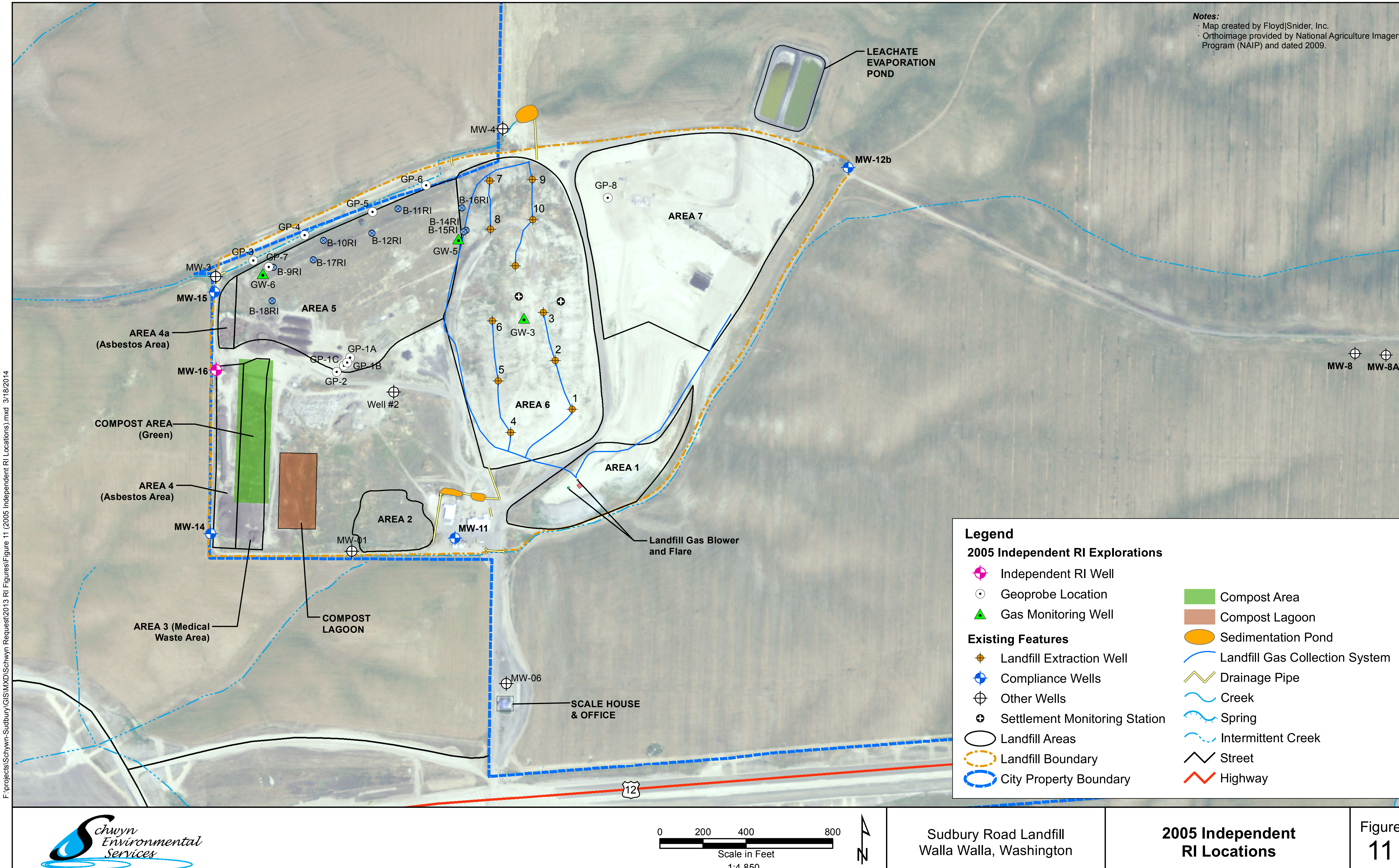
Figure
9



Note: All elevations corrected to NAVD 88

Schwyn Environmental Services

Sudbury Landfill Walla Walla, Washington	**Groundwater Elevation Trend**	Figure 10

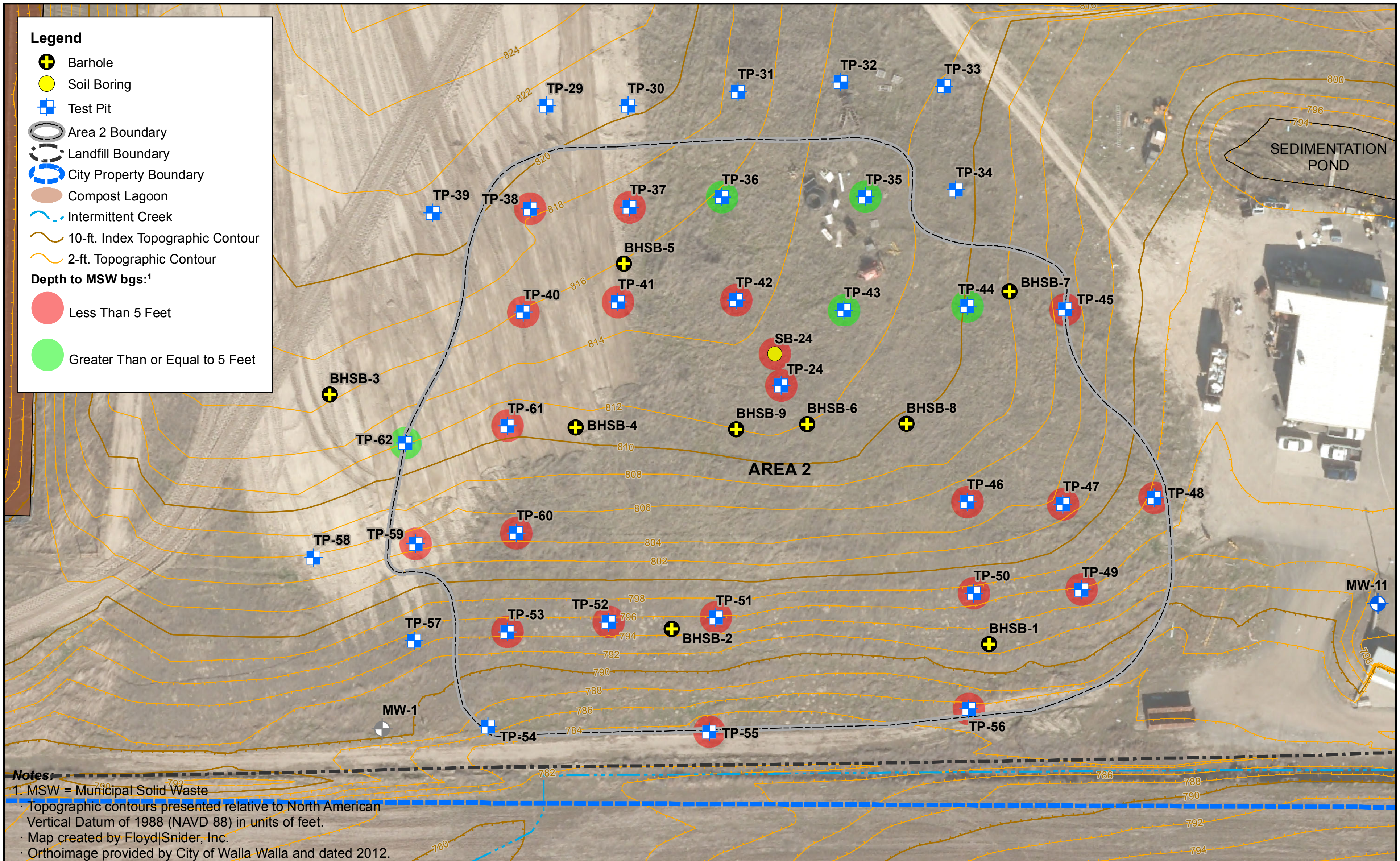


Schwyn Environmental Services

Sudbury Road Landfill
Walla Walla, Washington

2005 Independent RI Locations

Figure 11



Schwyn Environmental Services

0 25 50 100

Scale in Feet

1:800

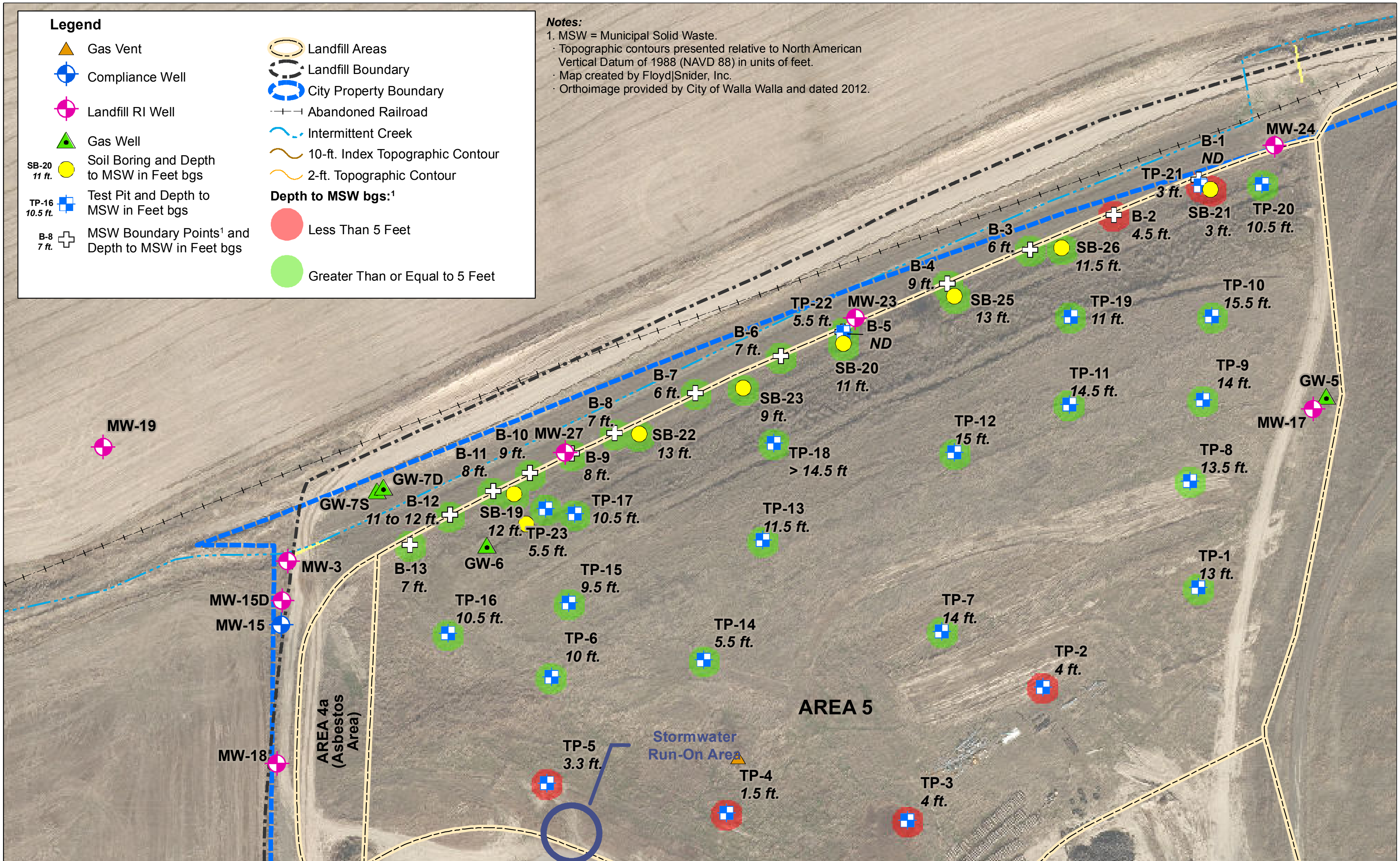
N

Sudbury Road Landfill
Walla Walla, Washington

Area 2 Explorations

Figure
12

F:\projects\Schwyn-Sudbury\GIS\MXD\Schwyn Request\2013 RI Figures\Figure 12 (Area 2 Explorations) 8.5x11.mxd 3/18/2014



Schwyn Environmental Services

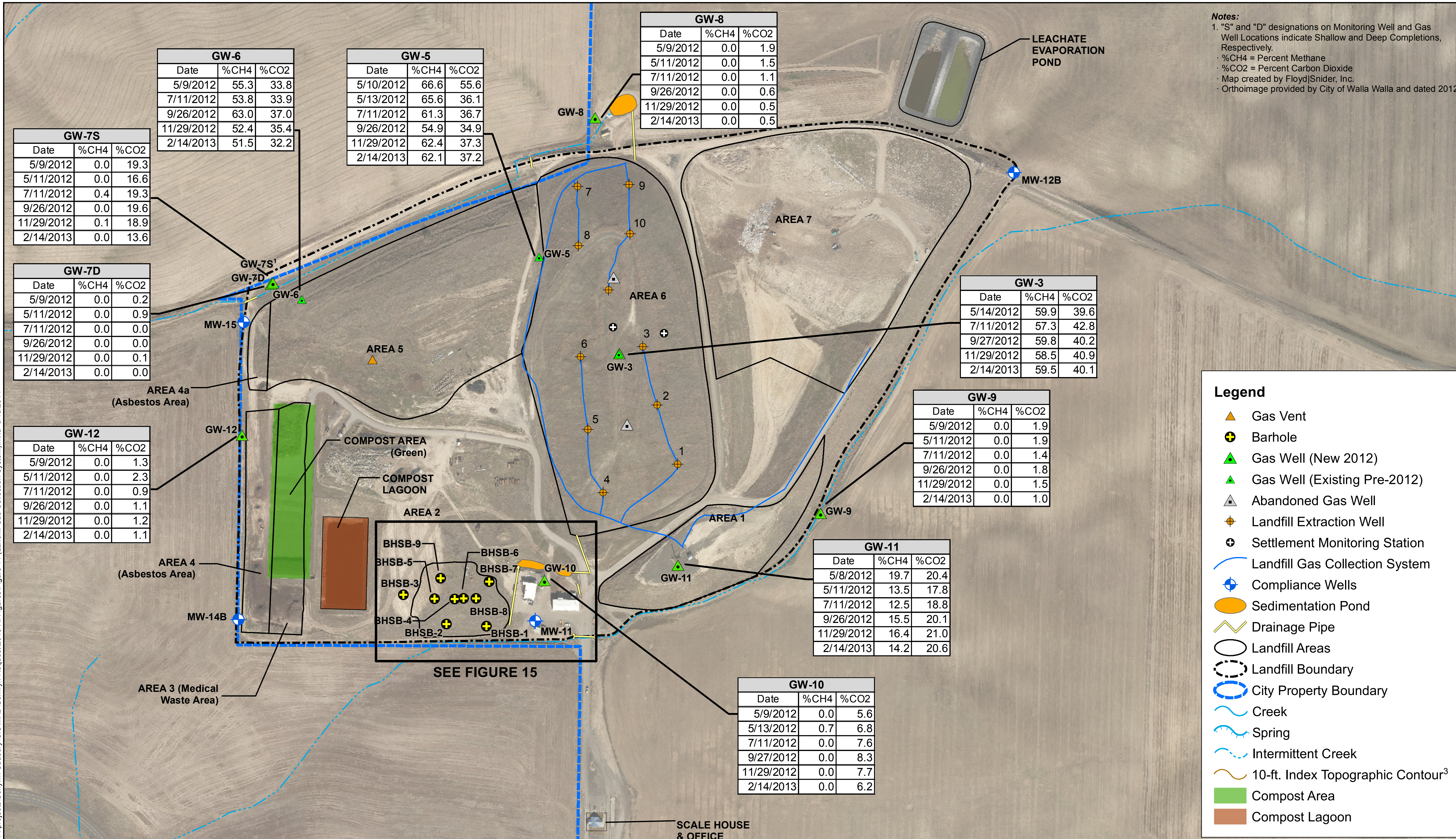
0 50 100 200
Scale in Feet
1:1,800

N

Sudbury Road Landfill
Walla Walla, Washington

Area 5 Explorations

Figure
13



Notes:
1. "S" and "D" designations on Monitoring Well and Gas Well Locations indicate Shallow and Deep Completions, Respectively.
· %CH4 = Percent Methane
· %CO2 = Percent Carbon Dioxide
· Map created by Floyd|Snider, Inc.
· Orthoimage provided by City of Walla Walla and dated 2012.

GW-8

Date	%CH4	%CO2
5/9/2012	0.0	1.9
5/11/2012	0.0	1.5
7/11/2012	0.0	1.1
9/26/2012	0.0	0.6
11/29/2012	0.0	0.5
2/14/2013	0.0	0.5

GW-6

Date	%CH4	%CO2
5/9/2012	55.3	33.8
7/11/2012	53.8	33.9
9/26/2012	63.0	37.0
11/29/2012	52.4	35.4
2/14/2013	51.5	32.2

GW-5

Date	%CH4	%CO2
5/10/2012	66.6	55.6
5/13/2012	65.6	36.1
7/11/2012	61.3	36.7
9/26/2012	54.9	34.9
11/29/2012	62.4	37.3
2/14/2013	62.1	37.2

GW-7S

Date	%CH4	%CO2
5/9/2012	0.0	19.3
5/11/2012	0.0	16.6
7/11/2012	0.4	19.3
9/26/2012	0.0	19.6
11/29/2012	0.1	18.9
2/14/2013	0.0	13.6

GW-7D

Date	%CH4	%CO2
5/9/2012	0.0	0.2
5/11/2012	0.0	0.9
7/11/2012	0.0	0.0
9/26/2012	0.0	0.0
11/29/2012	0.0	0.1
2/14/2013	0.0	0.0

GW-3

Date	%CH4	%CO2
5/14/2012	59.9	39.6
7/11/2012	57.3	42.8
9/27/2012	59.8	40.2
11/29/2012	58.5	40.9
2/14/2013	59.5	40.1

GW-9

Date	%CH4	%CO2
5/9/2012	0.0	1.9
5/11/2012	0.0	1.9
7/11/2012	0.0	1.4
9/26/2012	0.0	1.8
11/29/2012	0.0	1.5
2/14/2013	0.0	1.0

GW-12

Date	%CH4	%CO2
5/9/2012	0.0	1.3
5/11/2012	0.0	2.3
7/11/2012	0.0	0.9
9/26/2012	0.0	1.1
11/29/2012	0.0	1.2
2/14/2013	0.0	1.1

GW-11

Date	%CH4	%CO2
5/8/2012	19.7	20.4
5/11/2012	13.5	17.8
7/11/2012	12.5	18.8
9/26/2012	15.5	20.1
11/29/2012	16.4	21.0
2/14/2013	14.2	20.6

GW-10

Date	%CH4	%CO2
5/9/2012	0.0	5.6
5/13/2012	0.7	6.8
7/11/2012	0.0	7.6
9/27/2012	0.0	8.3
11/29/2012	0.0	7.7
2/14/2013	0.0	6.2

Legend

- Gas Vent
- Barhole
- Gas Well (New 2012)
- Gas Well (Existing Pre-2012)
- Abandoned Gas Well
- Landfill Extraction Well
- Settlement Monitoring Station
- Landfill Gas Collection System
- Compliance Wells
- Sedimentation Pond
- Drainage Pipe
- Landfill Areas
- Landfill Boundary
- City Property Boundary
- Creek
- Spring
- Intermittent Creek
- 10-ft. Index Topographic Contour[3]
- Compost Area
- Compost Lagoon

F:\projects\Schwyn-Sudbury\GIS\MXD\Schwyn Request\2013 RI Figures\Figure 14 (Landfill Gas Collection System).mxd 6/13/2014

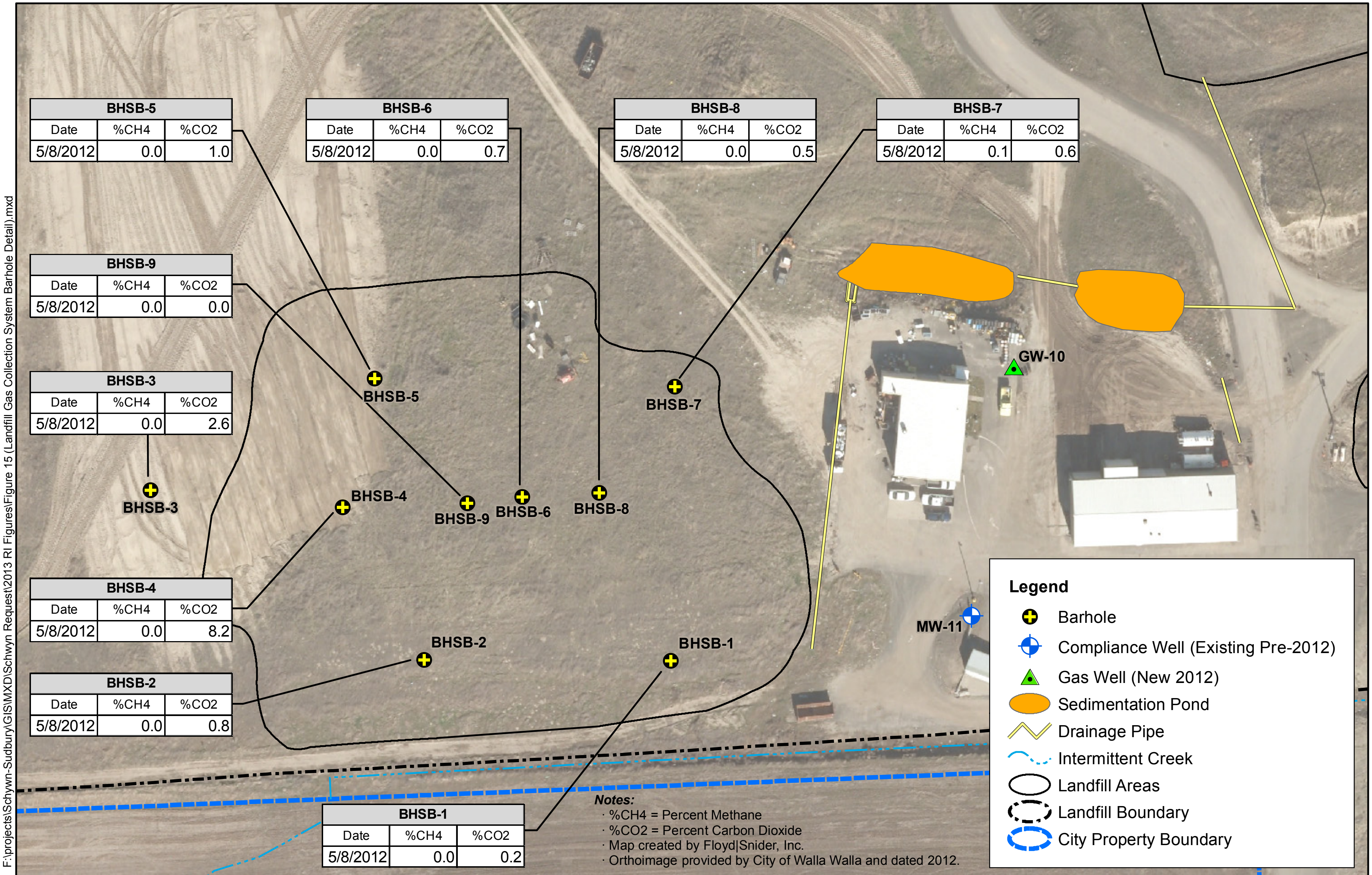
Schwyn Environmental Services

Sudbury Road Landfill
Walla Walla, Washington

Landfill Gas Monitoring Results

Figure
14

F:\projects\Schywn-Sudbury\GIS\MXD\Schwyn Request\2013 RI Figures\Figure 15 (Landfill Gas Collection System Barhole Detail).mxd



BHSB-5		
Date	%CH4	%CO2
5/8/2012	0.0	1.0

BHSB-6		
Date	%CH4	%CO2
5/8/2012	0.0	0.7

BHSB-8		
Date	%CH4	%CO2
5/8/2012	0.0	0.5

BHSB-7		
Date	%CH4	%CO2
5/8/2012	0.1	0.6

BHSB-9		
Date	%CH4	%CO2
5/8/2012	0.0	0.0

BHSB-3		
Date	%CH4	%CO2
5/8/2012	0.0	2.6

BHSB-4		
Date	%CH4	%CO2
5/8/2012	0.0	8.2

BHSB-2		
Date	%CH4	%CO2
5/8/2012	0.0	0.8

BHSB-1		
Date	%CH4	%CO2
5/8/2012	0.0	0.2

Notes:
· %CH4 = Percent Methane
· %CO2 = Percent Carbon Dioxide
· Map created by Floyd|Snider, Inc.
· Orthoimage provided by City of Walla Walla and dated 2012.

Schwyn Environmental Services

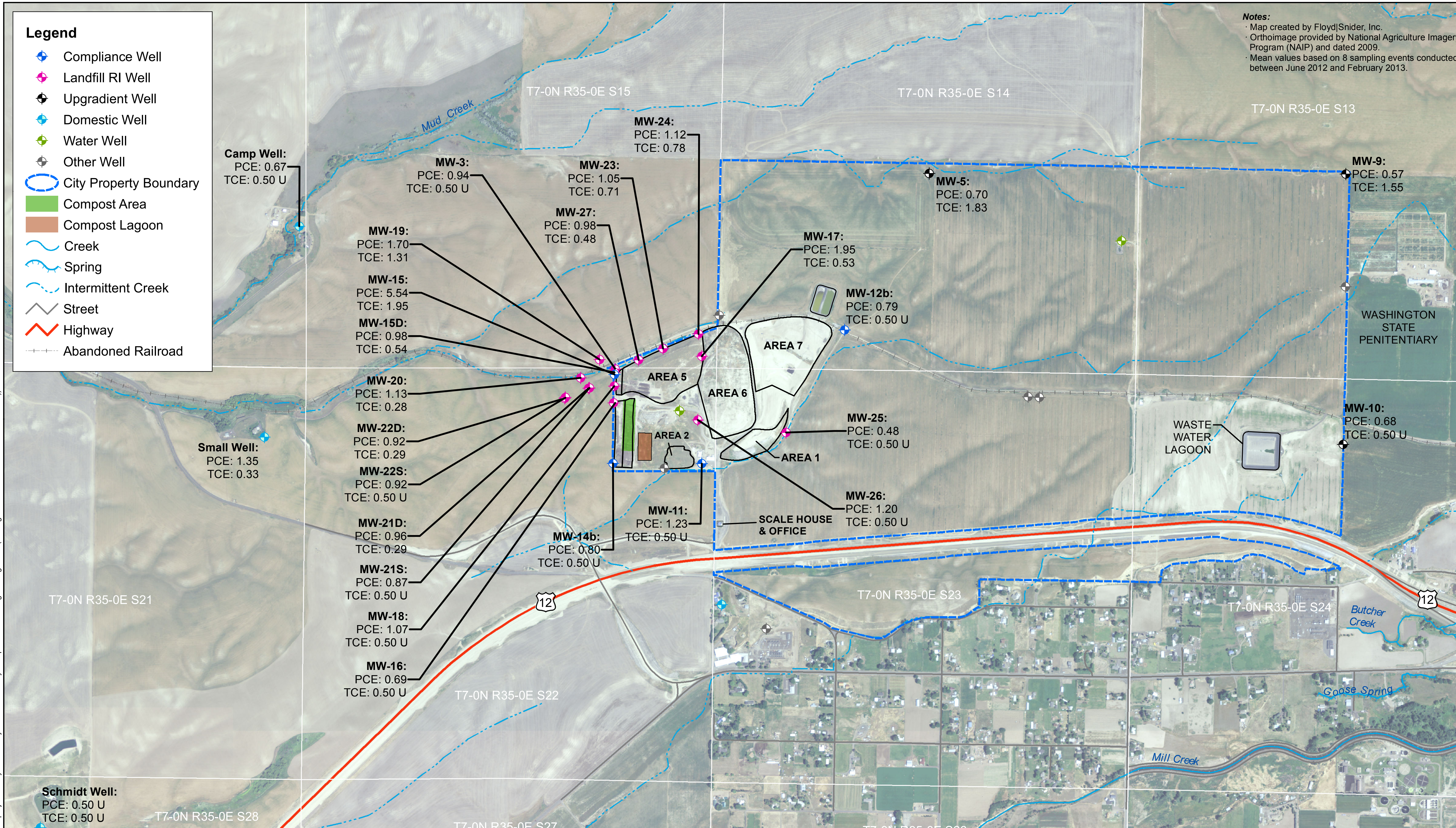
0 25 50 100
Scale in Feet

N

Sudbury Road Landfill
Walla Walla, Washington

Landfill Gas Monitoring Results (Barhole Detail)

Figure 15



F:\projects\Schwyn-Sudbury\GIS\MXD\Schwyn Request\2013 RI Figures\Figure 16 (Average RI Concentration of TCE and PCE).mxd 3/18/2014

Schwyn Environmental Services

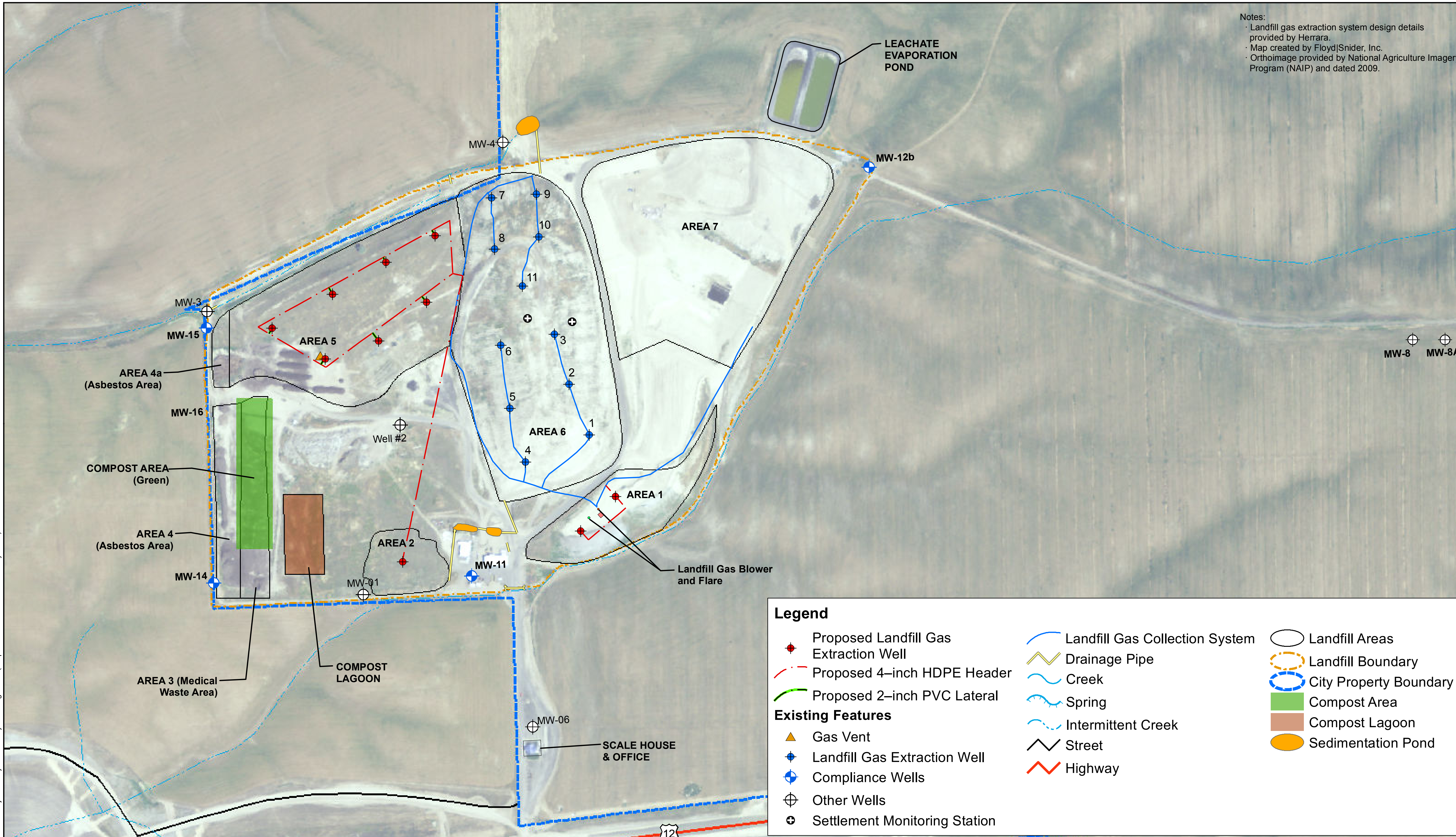
0 500 1,000 2,000
Scale in Feet
1:14,000

N

Sudbury Road Landfill
Walla Walla, Washington

Average RI Concentration of TCE and PCE (µg/L)

Figure 16



Schwyn Environmental Services

0 200 400 800
Scale in Feet
1:4,850

N

Sudbury Road Landfill
Walla Walla, Washington

Proposed Landfill Gas Extraction Well Systems Areas 1, 2, and 5

Figure 17

I:\GIS\Projects\Schwyn-Sudbury\MXD\Figure 17 (Proposed LFG Extraction Well Systems).mxd 5/14/2014

North Drainage Ditch Alternatives

Plate 1: Alternative 1 - Cast–In–Place Concrete Channel

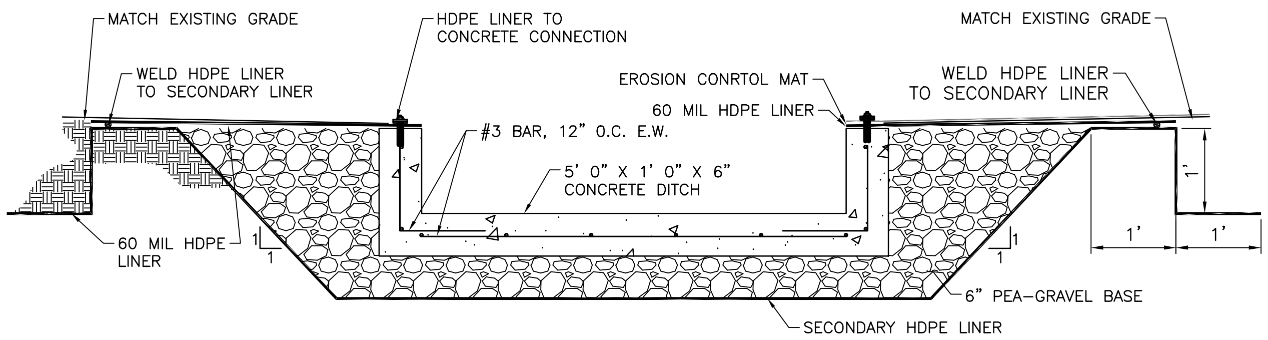


Plate 2: Alternative 2 - Concrete Cable–Block (from Contech ArmorFlex)

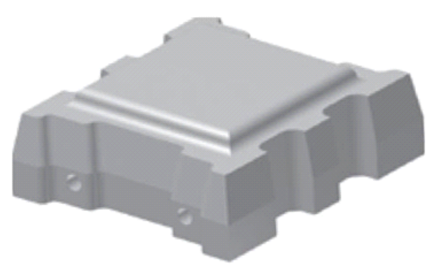


Plate 3: Alternative 2 - Cable–Block Channel Cross–Section

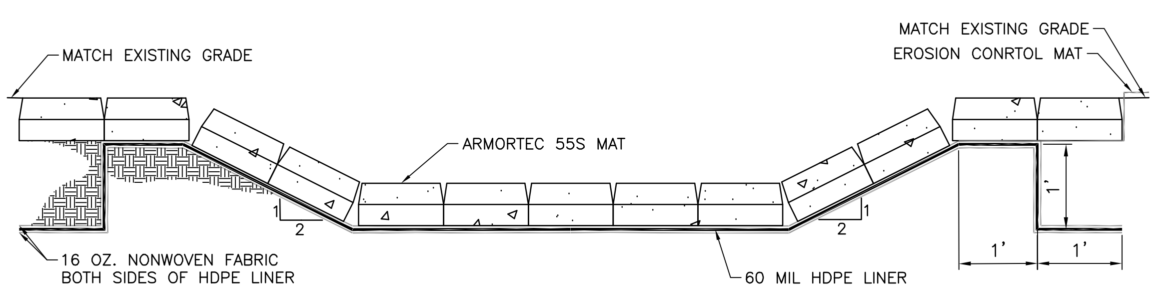
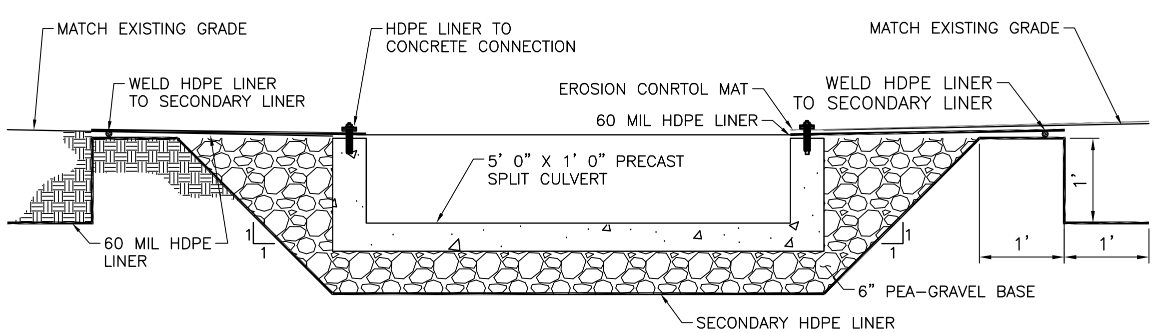


Plate 4: Alternative 3 - Pre–cast Concrete Channel



Area 5 Erosion Control Berm

Plate 5: Erosion Control Berm–Typical Section

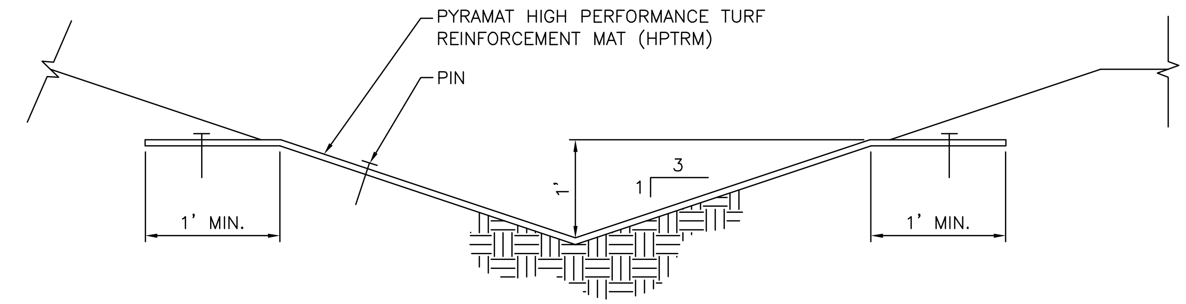
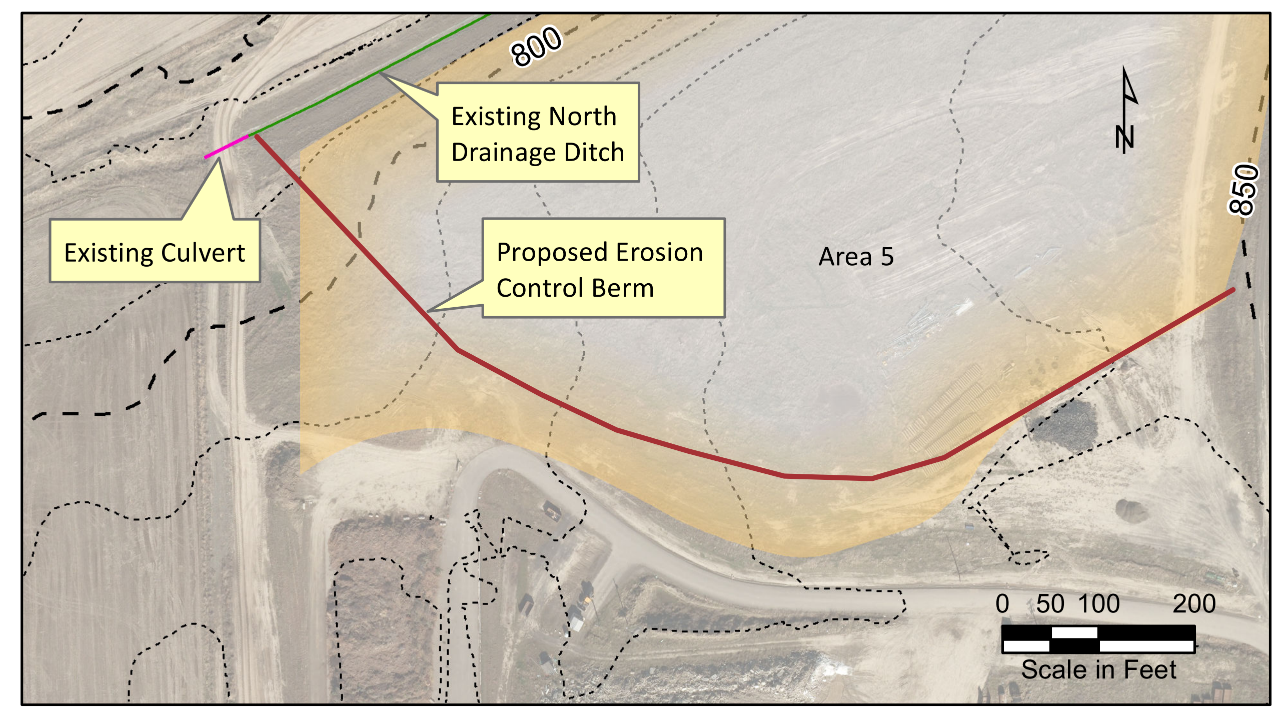


Plate 6: Area 5 Erosion Control Berm–Plan View



I:\GIS\Projects\Schywn-Sudbury\SVG\Figure 18a (Stormwater Control Alternatives Plates 1-6).svg 7/24/2014

Schwyn Environmental Services

Notes:
· Design elements provided by J-U-B Engineers, Inc.
· Map created by Floyd|Snider, Inc.
· Orthoimage provided by National Agriculture Imagery Program (NAIP) and dated 2009.

Sudbury Road Landfill
Walla Walla, Washington

Stormwater Control Alternatives Plates 1–6

Figure 18a

Area 5: Stormwater Run-On

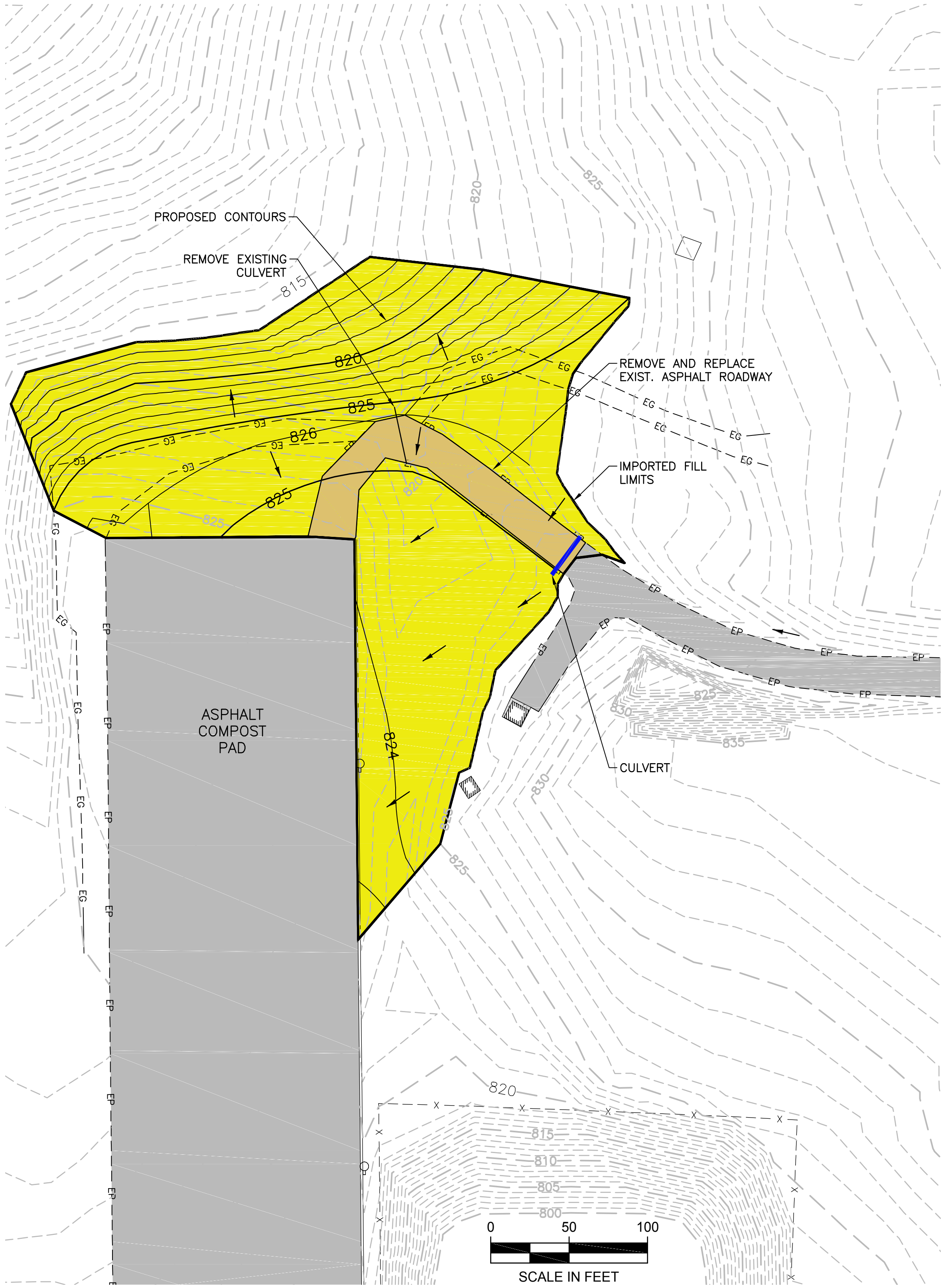


Plate 7 - Area 5 Run-On Alternative 1

Plate 8 – Area 5 Run-On Alternative 2

I:\GIS\Projects\Schywn-Sudbury\SVG\Figure 18b (Stormwater Control Alternatives Plates 7-8)_allVec.svg 7/18/2014

Schwyn Environmental Services

Notes:
- Design elements provided by J-U-B Engineers, Inc.
- Map created by Floyd|Snider, Inc.

Sudbury Road Landfill
Walla Walla, Washington

Stormwater Control Alternatives Plates 7–8

Figure 18b

APPENDIX A

Boring and Well Construction Logs

Schwyn Environmental Services

APPENDIX A

Remedial Investigation Logs

Log of Exploration

Schwyn Environmental Services

Boring ID: SB-19

Drill Date: 8/28/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 32 ft.
Groundwater (ft BGL): 29.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 793.41 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278724
Longitude/Easting: 2169799

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Core 0-7			0–12	ML	ML: Light brownish gray Sandy SILT, fine sand with trace clay, some roots, soft, low plasticity, dry. [Fill] @ 3.75 ft.: damp.	Bentonite Chips
Core 7-12					@ 10 ft.: very dark gray.	
Core 12-17			12–23.5	MSW	MSW: Municipal Solid Waste composed of plastic, paper, fabric, newspapers, metal cans, and wood. Strong odor with gas eminating from hole while drilling.	
Core 17-22					@ 17 ft.: 6" layer of gray silt. @18 ft.: metal wire blocks core barrel.	
Core 22-27					@ 22 ft.: metal, plastic, paper, wood fragemnts, and cardboard. Strong odor.	
			23.5–27.5	ML	ML: Greenish gray Sandy SILT, fine sand with trace clay, soft to medium stiff, low plasticity, moist to wet, moderate odor.	
Core 27-32			27.5–28	MSW	MSW: 6" layer of MSW	
			28–32	ML	ML: Greenish gray Sandy SILT, fine sand with trace clay, soft to medium stiff, low plasticity, moist to wet, moderate odor. @ 28.5 ft.: mottling. @ 29 ft.: wet	

Notes:
ft BGL = feet below ground level
USCS = Unified Soil Classification System
▽ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: SB-20

Drill Date: 5/21/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 54.5 ft.
Groundwater (ft BGL): 40

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 797.63 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278901
Longitude/Easting: 2170146

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Core 0-6.5			0–11	ML	ML: Light olive brown Sandy SILT, with fine sand, soft, low plasticity, dry to damp. [Fill]	
Core 6.5-9.5						
Core 9.5-19.5			11–35	MSW	MSW: Municipal Solid Waste composed of cardboard, fabric, wire, metal, paper, and plastic underlain by ~1 foot of dark stained silt. MSW appears to have been burned.	
Core 19.5-29.5					@ 24 ft.: newspaper dated March 1980. @ 24.5 ft.: dark gray silt layer (6"), dark brown, damp.	Bentonite Chips
Core 29.5-39.5					@ 30 ft.: metal plastic, twigs, intermixed with dark gray silt layers.	

Notes:
ft BGL = feet below ground level
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: SB-20

Drill Date: 5/21/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 54.5 ft.
Groundwater (ft BGL): 40

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 797.63 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278901
Longitude/Easting: 2170146

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			35–39		MSW, cont.	
Core 39.5-44.5			40–44		@ 39.5 ft.: 6" layer of wood and silt. @ 40 ft.: 12" layer of silt. @ 41 ft.: 6" layer of metal, plastic, cardboard, twigs and wood debris. Appears burned. @41.5 to 49.5 ft.: Silt intermixed with small amounts of MSW (glass and metal).	
Core 44.5-49.5			45–49			
Core 49.5-54.5			50–51		ML: Dark brown SILT with wire intermixed. [Fill]	
			52–54		GM: Dark brown Silty GRAVEL with sand and cobbles, fine to coarse sub-angular to sub-rounded basalt gravel, well graded, loose, moderate plasticity fines, wet. Reddish staining at interface of overlying silt.	

Notes:
ft BGL = feet below ground level
USCS = Unified Soil Classification System
▽ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: SB-21

Drill Date: 5/22/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 32 ft.
Groundwater (ft BGL): 29 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 798.68 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 279084
Longitude/Easting: 2170534

Remarks: Soil Sample (SB21 @ 27') collected for laboratory analysis.

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Core 0-7			0–3	ML	ML: Dark brown Sandy SILT, fine sand, soft to medium stiff, low plasticity, dry to damp. [Fill] @ 2 ft.: gray.	
Core 7-12 Core 12-17			3–17	MSW	MSW: Municipal Solid Waste composed of compacted plastic, tires, wood, cardboard, glass, and paper. Waste appears burned. @ 8.5 ft.: 6" layer of gray silt. @ 12 ft.: leather, newspaper dated July 1980, fabric, tires, and plastic. @14 ft.: 4" layer of silt.	Bentonite Chips
Core 17-22 Core 22-27 Core 27-32			17–32	ML	ML: Gray Sandy SILT, fine sand, soft, low plasticity, dry. @ 19 ft.: light brownish gray. @ 22 ft.: olive brown to light browninsh gray. @ 23.5 ft.: light yellowish brown @ 24 ft.: damp @ 27 ft.: moist. @ 29 ft.: wet.	

Notes:
ft BGL = feet below ground level
USCS = Unified Soil Classification System
∇ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: SB-22

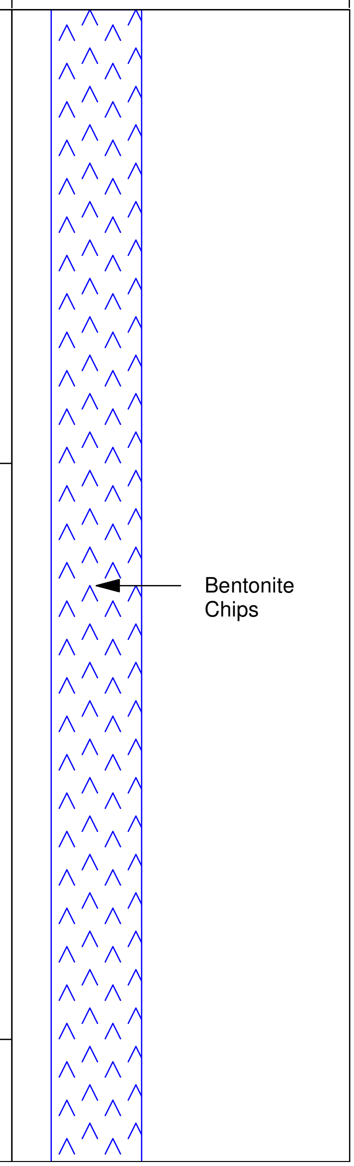
Drill Date: 8/28/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 33 ft.
Groundwater (ft BGL): 30 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 794.79 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278794
Longitude/Easting: 2169931

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-8			0		ML: Brown Sandy SILT, fine sand with trace clay, soft, low plasticity, dry to damp. [Fill]
			4		@ 4 ft.: damp.
Core 8-13			8		@ 8 ft.: very dark gray.
			9		@ 9 ft.: gley mottling.
			10		@ 10.25 ft.: wood fragment (section of plywood).
Core 13-18			13		MSW: Municipal Solid Waste composed of plastic bags, paper, wood and cardboard.
Core 18-23			18		@ 18 ft.: paper, yarn, plastic, wood, wood debris, metal, and wire.
Core 23-28			23		@ 23 ft.: glass, plastic, paper, wood, a book, and metal.
Core 28-33			29		ML: Dark olive gray Sandy SILT, fine sand with trace clay, mottling, soft to medium stiff, low plasticity, moist to wet.
			30		@ 30 ft.: wet.

Well Construction Detail



Notes:
ft BGL = feet below ground level
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Boring ID: SB-23

Drill Date: 8/28/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 30.5 ft.
Groundwater (ft BGL): NA

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 795.98 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278848
Longitude/Easting: 2170041

Remarks: Soil sample (SB-23 29.5-30) collected for laboratory analysis.

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Core 0-9			0–9	ML	ML: Yellowish brown Sandy SILT, fine sand with trace clay, soft, low plasticity, dry to damp. [Fill] @ 2.5 ft.: dark gray.	Bentonite Chips
Core 9-14			9–14	MSW	MSW: Municipal Solid Waste composed of plastic, paper, wood, cardboard, grass clippings, fabric, and metal wire. @ 11.5 ft.: 6" silt layer. @ 12 ft.: yellow and white material, 1 cm. thick layer, powdery.	
Core 14-19			14–19	MSW	@ 14 ft.: wire blocked drilling shoe.	
Core 19-24			19–24	MSW	@ 19 ft.: wire (significant quantity), rubber tire fragment, ceramic, metal, and plastic bags.	
Core 24-29			24–29	MSW / ML	@ 24 ft.: carpet, wood, and plastic. ML: Dark greenish gray Sandy SILT, fine sand, low to moderate plasticity, damp. @ 27 ft.: dark yellowish brown.	
SS 29-30.5		19/6" 36/6" 39/6"	29–30.5	ML	@ 30 ft.: moist.	

Notes:
ft BGL = feet below ground level
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: SB-24

Drill Date: 5/21/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 37 ft.
Groundwater (ft BGL): None

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 812.04 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 277592
Longitude/Easting: 2170421

Remarks: Soil Sample (SB24 @ 32' and duplicate) collected for laboratory analysis.

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Core 0-7			0–3	ML	ML: Dark yellowish brown Sandy SILT, fine sand, soft, low plasticity, damp. [Fill] @ 3 ft.: dark yellowish gray.	Bentonite Chips
			3–30	MSW	MSW: Municipal Solid Waste composed of cardboard, wood, plywood, twigs, plastic bags, brick, and porcelain fragments.	
Core 7-17					@ 7.5 ft.: 6" thick layer of dark gray to black silt.	
Core 17-27					@ 18 ft.: bike frames, grass clippings, wood boards, plastic bags, and cardboard.	
Core 27-37					@ 28 ft.: wood, grass clippings, plastic, window blind, and carpet.	
			30–37	ML	ML: Dark yellowish brown Sandy SILT, fine sand, soft, low plasticity, damp.	

Notes:
ft BGL = feet below ground level
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: SB-25

Drill Date: 8/28/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 34 ft.
Groundwater (ft BGL): 30.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 798.26 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278957
Longitude/Easting: 2170264

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Core 0-9			0–13	ML	ML: Brown Sandy SILT, fine sand with trace clay, soft, low plasticity, dry to damp. [Fill] @ 3.5 ft.: very dark gray.	Bentonite Chips
Core 9-14					@ 9.5 ft.: 4" layer of plywood and debris.	
Core 14-19			13–27.5	MSW	MSW: Municipal Solid Waste composed of plastic bags, paper, cardboard, and metal wire. Strong odor. Newspaper dated 1979.	
Core 19-24					@ 19 ft.: plastic bags, cardboard, metal wire, bricks, and wood fragements.	
Core 24-29					@ 24 ft.: cardboard, wire, wood, plastic bags, colored glass, and styrofoam.	
Core 29-34			27.5–34	ML	ML: Greenish gray Sandy SILT, fine sand with trace clay, soft to medium stiff, low to moderate plasticity, moist to wet. @ 30.5 ft.: wet, caliche mottling. @ 31 ft.: brown.	

Notes:
ft BGL = feet below ground level
USCS = Unified Soil Classification System
▽ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: SB-26

Drill Date: 8/29/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 29.5 ft.
Groundwater (ft BGL): NA

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 800.02 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 279015
Longitude/Easting: 2170377

Remarks: Soil sample (SB-26 28.5-29) collected for laboratory analysis.

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Core 0-8			0–8	ML	ML: Brown Sandy SILT, fine sand with trace clay, soft, low plasticity, dry to damp. Small roots in upper 3 ft. [Fill]	Bentonite Chips
Core 8-13			8–11.5	ML	@ 8.5 ft.: dark greenish gray.	
Core 13-18			11.5–23	MSW	MSW: Municipal Solid Waste composed of plastic debris, plastic bags, plywood, styrofoam, and cardboard. Moderate odor. @ 12 ft.: appears burned. @ 15 ft.: fabric and wood fragments.	
Core 18-23					@ 18 ft.: grass clippings, plastic, foam, wood, and plywood.	
Core 23-28			23–29.5	ML	ML: Greenish gray Sandy SILT, fine sand with trace clay, soft to medium stiff, non- to low plasticity, damp to moist.	
SS 28-29.5		18/6" 25/6" 36/6"				

Notes:
ft BGL = feet below ground level
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-14b

Unique Well ID: BCE 345

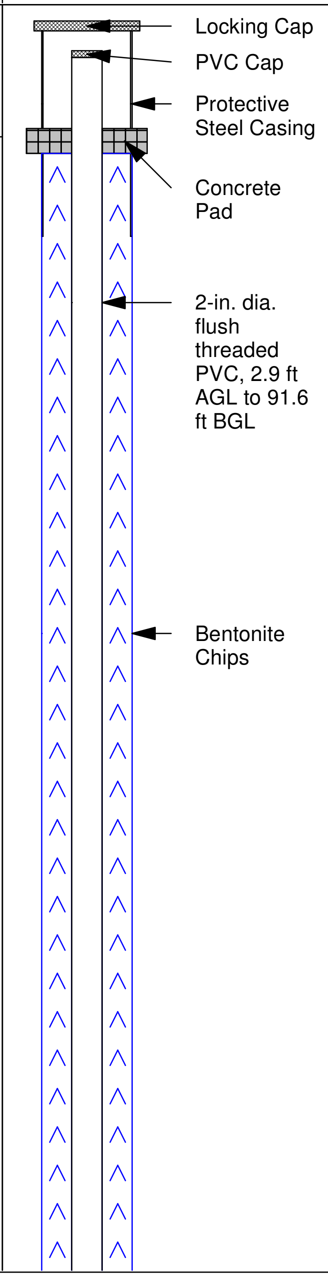
Drill Date: 5/23/2012
Logged By: C. Schwyn/E. Ramirez
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 107 ft.
Groundwater (ft BGL): 73 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 832.43 ft. (NAVD 88)
Casing Elevation: 834.89 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 277440
Longitude/Easting: 2169585

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0–7	ML	ML: Brown SILT, trace sand and clay, low plasticity, blocky structure, loose, dry.
Core 7-17			7–17	ML	@ 7 ft.: laminated (1/4 -1/8" thick), dry to moist.
Core 17-27			17–27	ML	@ 17 ft.: moist.
Core 27-37			27–34	ML	@ 27 ft.: dry - powdery.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-14b

Unique Well ID: BCE 345

Drill Date: 5/23/2012
Logged By: C. Schwyn/E. Ramirez
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 107 ft.
Groundwater (ft BGL): 73 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 832.43 ft. (NAVD 88)
Casing Elevation: 834.89 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 277440
Longitude/Easting: 2169585

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			35		ML: SILT, cont.	
Core 37-47			37			
			44		@ 44-45 ft.: some fine sand, dry to moist.	Bentonite Chips
Core 47-57			47		@ 47-52 ft.: very stiff.	
			55		@ 55 ft.: whitish caliche mottling.	
Core 57-67			57			
Core 67-77			67			
			68		@ 68 ft.: whitish caliche mottling.	
			72		@ 72 ft.: very moist.	

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing

USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-14b

Unique Well ID: BCE 345

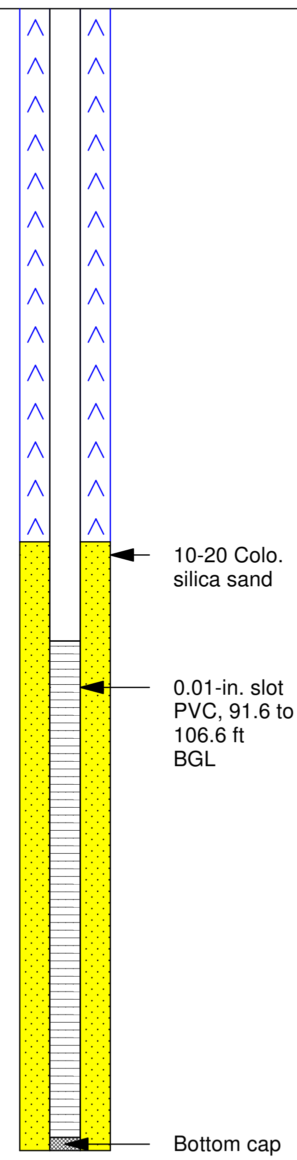
Drill Date: 5/23/2012
Logged By: C. Schwyn/E. Ramirez
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 107 ft.
Groundwater (ft BGL): 73 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 832.43 ft. (NAVD 88)
Casing Elevation: 834.89 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 277440
Longitude/Easting: 2169585

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			73	ML	ML: SILT. cont. @ 73 ft.: wet.
			75	ML	@ 75-77 ft.: moist.
Core 77-87			78.5	ML	@ 78.5 ft.: brown to dark brown.
			81	ML	@ 81 ft.: moist.
			83	ML	@ 83 ft.: 12" zone of heavy caliche mottling.
Core 87-97			87	ML	@ 87 ft.: 6" thick fine to medium sand lens.
			91	ML	@ 91 ft.: iron oxide mottling, increasing downward.
Core 97-107			98	GM	GM: Dark brown Silty GRAVEL with cobbles, loose to moderately dense, well graded, fine to coarse sub-angular to sub-rounded sand, basalt gravel and cobbles, moist.
			100	GM	appears dry at 100 ft and wet at 101 ft.
			103	GM	@ 103 ft.: 8" silty sand lens, immediately above 2" zone of heavy iron oxide cementation.
			107		

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▽ = denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-15D

Unique Well ID: BCE 338

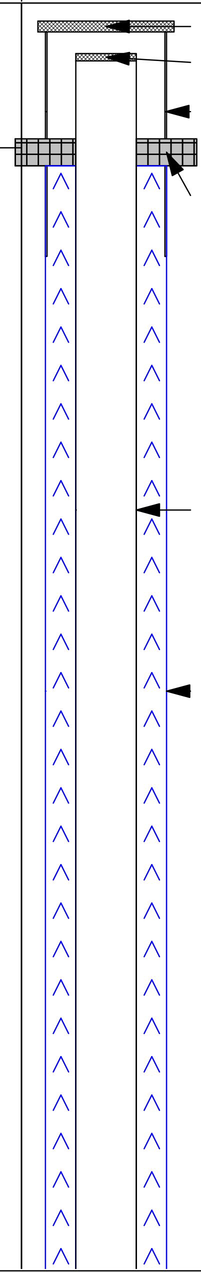
Drill Date: 5/23/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 8.75-in
Boring Depth (ft BGL): 87 ft.
Groundwater (ft BGL): 30 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 789.64 ft. (NAVD 88)
Casing Elevation: 792.04 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278598
Longitude/Easting: 2169554

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0	ML	ML: Very dark grayish brown SILT, trace fine sand, soft to medium stiff, low plasticity, damp.
Core 7-17			7.5–8.5		@ 7.5 to 17 ft.: sandy silt. @ 8.5 ft.: dark brown.
Core 17-27			21–24		@ 21 ft.: sandy silt. @ 23 ft.: 4" sandy lens. @ 24 ft.: moist.
Core 27-37			30		@ 30 ft.: wet.

Well Construction Detail



Locking Cap
PVC Cap
Protective Steel Casing
Concrete Pad
4-in. dia. flush threaded PVC, 2.4 ft AGL to 68 ft BGL
Bentonite Chips

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-15D

Unique Well ID: BCE 338

Drill Date: 5/23/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 8.75-in
Boring Depth (ft BGL): 87 ft.
Groundwater (ft BGL): 30 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 789.64 ft. (NAVD 88)
Casing Elevation: 792.04 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278598
Longitude/Easting: 2169554

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			31–40	ML	ML: SILT, cont.	4-in. dia. flush threaded PVC, 2.4 ft AGL to 68 ft BGL
Core 37-47			40–59	GM	GM: Dark yellowish brown Silty GRAVEL with cobbles, medium dense, well graded, fine to coarse sub-angular to sub-rounded sand, basalt gravel and cobbles, wet. @ 42 ft.: 8" sandy lens.	
Core 47-57						
Core 57-67			59–60		@ 59 ft.: dark brown.	
			60–63	ML	ML: Dark brown Sandy SILT, fine to medium sand, soft, low plasticity, wet. @ 62 ft.: 6" sandy lens.	
			63–66	GM	GM: Dark grayish brown Silty GRAVEL with cobbles, loose, well graded, fine to coarse, angular to sub-angular sand, basalt gravel and cobbles, wet.	

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-15D

Unique Well ID: BCE 338

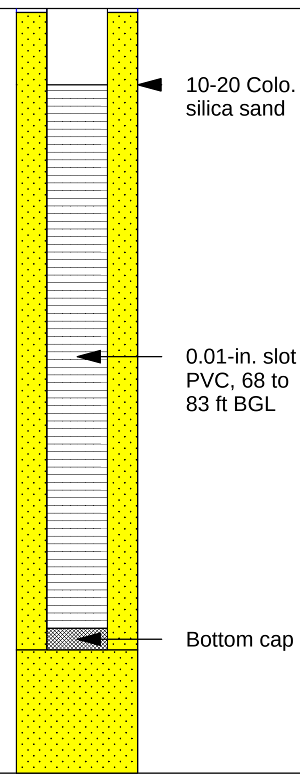
Drill Date: 5/23/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 8.75-in
Boring Depth (ft BGL): 87 ft.
Groundwater (ft BGL): 30 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 789.64 ft. (NAVD 88)
Casing Elevation: 792.04 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278598
Longitude/Easting: 2169554

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 67-77			67	GM	GM: Silty GRAVEL, Cont.
			73		@ 73 ft.: dry.
			75		@ 75 ft.: moist.
Core 77-82			77		
Core 82-87			82		
			83.5		@ 83.5 ft.: 12" silt layer.
			85		@ 85 ft.: decreasing moisture, mosit to damp.
			86		@ 86 ft.: dry.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-17
Unique Well ID: BBH 612

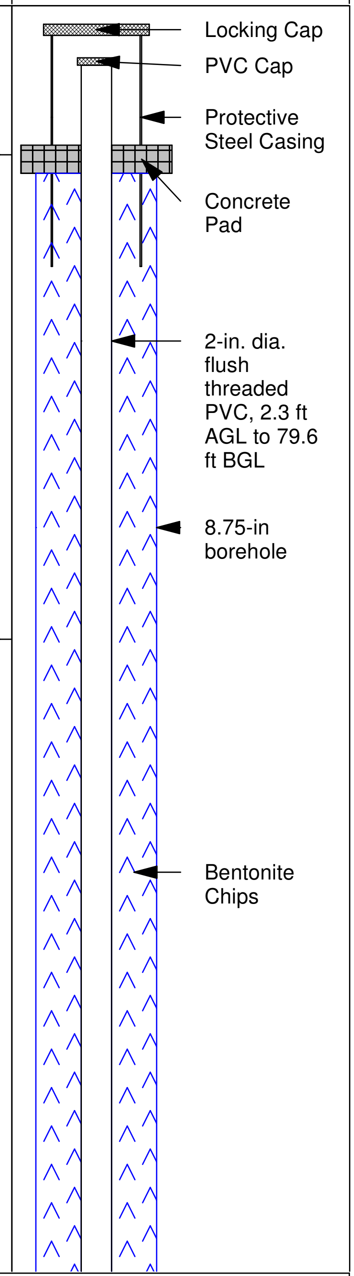
Drill Date: 5/11/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 8.75-in to 38 ft. 6.75-in to 97 ft.
Boring Depth (ft BGL): 97 ft.
Groundwater (ft BGL): 76 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 844.75 ft. (NAVD 88)
Casing Elevation: 847.01 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278853
Longitude/Easting: 2170655

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0	ML	ML: Dark yellowish brown Sandy SILT, fine sand and trace clay, soft, low plasticity, damp.
Core 7-17			9		@ 9 ft.: olive gray.
			13	MSW	MSW: Municipal Solid Waste mixed with soil, moderate to high compaction, strong odor. @ 13 to 15 ft.: Highly compact plastic, paper, wood, carpet.
Core 17-27			17		@ 17 ft.: Moderately compact soil, paper, wood, metal,and fabric intebedded with soil.
			22		@ 22 ft.: Newspapers, plastic metal.
			24		@ 24 ft.: Uncompacted soil.
Core 27-37			27		@ 27 ft.: Fabric, with dark staining.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-17

Unique Well ID: BBH 612

Drill Date: 5/11/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 8.75-in to 38 ft. 6.75-in to 97 ft.
Boring Depth (ft BGL): 97 ft.
Groundwater (ft BGL): 76 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 844.75 ft. (NAVD 88)
Casing Elevation: 847.01 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278853
Longitude/Easting: 2170655

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			30–37		MSW: Municipal Solid Waste, cont.	
Core 37-47			37		@ 37 ft.: Loosely compacted plastic, paper, wood, asphalt, concrete, and aggregates.	2-in. dia. flush threaded PVC, 2.3 ft AGL to 79.6 ft BGL
			45			6.75-in borehole
Core 47-57			47		@ 47 ft.: Wood, tire, rounded cobbles, gravel, paper, plastic, newpaper and grass. Newspaper dated 1984.	
			56		ML: Very pale orange Sandy SILT, fine to medium sand, soft to firm, low plasticity, damp. Some metal and debris intermixed with the soil. @ 57.5 ft.: dark yellow brown.	
Core 57-67			57–64			Bentonite Chips

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-17

Unique Well ID: BBH 612

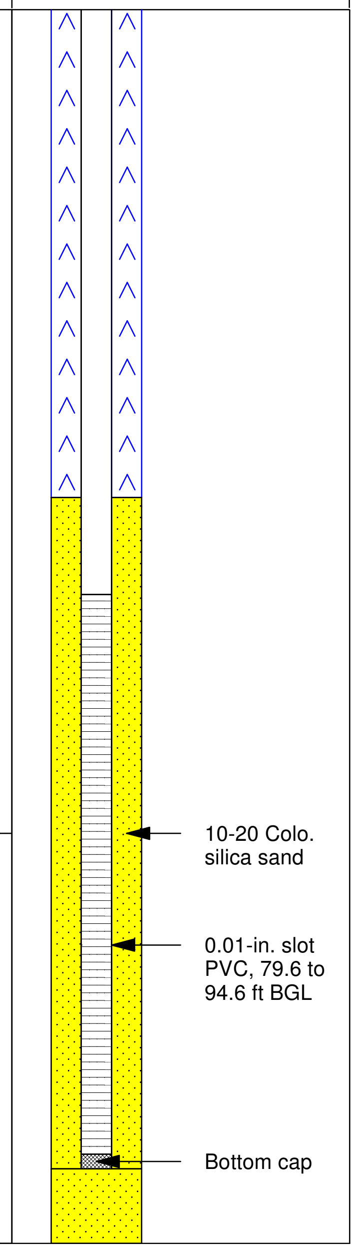
Drill Date: 5/11/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 8.75-in to 38 ft. 6.75-in to 97 ft.
Boring Depth (ft BGL): 97 ft.
Groundwater (ft BGL): 76 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 844.75 ft. (NAVD 88)
Casing Elevation: 847.01 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278853
Longitude/Easting: 2170655

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			64–67	ML	ML: SILT, cont.
Core 67-77			67		@ 67 ft.: moist.
			72		@ 72 ft.: caliche mottling.
			73		@ 73 ft.: wet.
Core 77-87			80		@ 80 to 83 ft.: caliche mottling.
			86	GM	GM: Moderate brown Silty GRAVEL with cobbles, sand and clay, medium dense, well graded, fine to coarse sub-angular to well-rounded sand, gravel and cobbles, fines exhibit moderate plasticity, wet.
Core 87-97			95		@ 95 ft.: 6" sandy lens.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-18

Unique Well ID: BCE 343

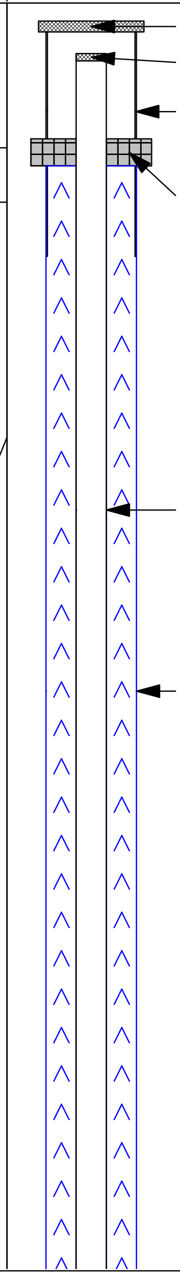
Drill Date: 5/20/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 63 ft.
Groundwater (ft BGL): 35.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 807.52 ft. (NAVD 88)
Casing Elevation: 810.11 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278422
Longitude/Easting: 2169556

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-8			0		Fill: Crushed glass with some soil.
			1.5		ML: Very dark grayish brown Sandy SILT, soft to medium stiff, low plasticity, damp. [Fill]
Core 8-18			8		@ 8 ft.: 2" lens of white material, possible asbestos.
					ML: Brown Sandy SILT, trace fine sand and clay, soft, low plasticity, damp.
			12.5		@ 12.5 ft.: stiff.
Core 18-28					
			23.5		@ 23.5 ft.: 6" sandy lens.
Core 28-38			29		@ 29 ft.: moist.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-18

Unique Well ID: BCE 343

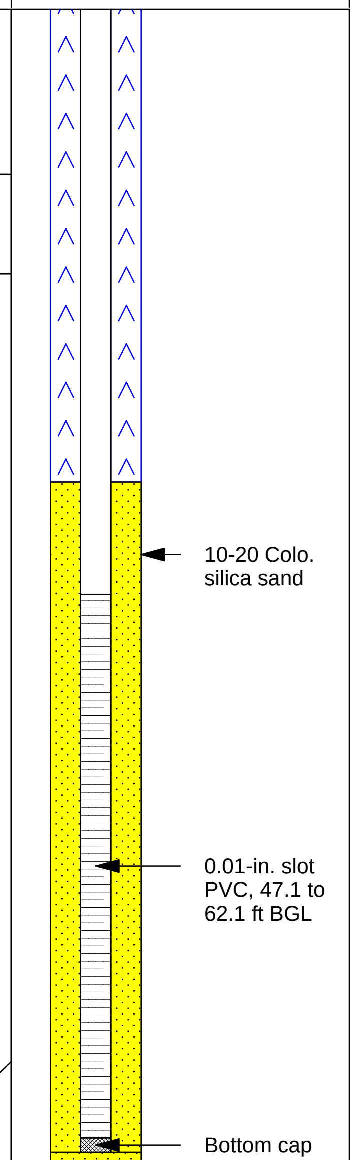
Drill Date: 5/20/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 63 ft.
Groundwater (ft BGL): 35.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 807.52 ft. (NAVD 88)
Casing Elevation: 810.11 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278422
Longitude/Easting: 2169556

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			31–35.5	ML	ML: SILT, cont.
			35.5–38.3	CL	CL: Yellowish Brown Silty CLAY, medium stiff, high plasticity, wet.
			38.3–60	ML	ML: Brown Sandy SILT, trace fine sand and clay, soft, medium to high plasticity, caliche mottling, wet.
			44		@ 44 ft.: dark yellowish brown, low plasticity fines.
Core 48-58			48		@ 48 ft.: brown.
			56		@ 56 ft.: moist, increased caliche mottling.
Core 58-63			58		@ 58 ft.: dark brown, with grayish brown caliche mottling.
			59		@ 59 ft.: 12" sandy lens.
			60–63	GM	GM: Dark brown Silty GRAVEL with cobbles, medium dense, well graded, fine to coarse sub-angular to sub-rounded sand, basalt gravel and cobbles (some fractured), rust staining and mottling, wet.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-19

Unique Well ID: BBH 611

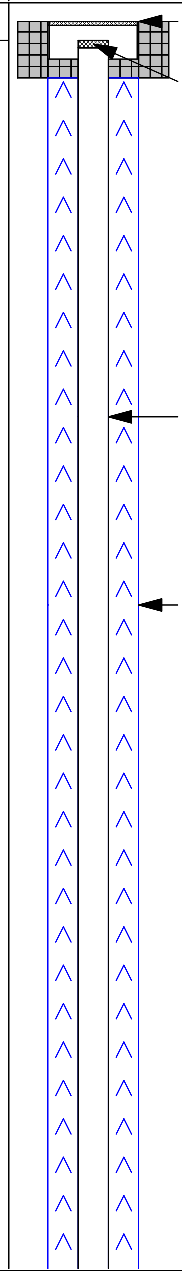
Drill Date: 5/20/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 77 ft.
Groundwater (ft BGL): 55.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 814.83 ft. (NAVD 88)
Casing Elevation: 814.30 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278754
Longitude/Easting: 2169354

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0	ML	ML: Brown Sandy SILT, soft, low plasticity, dry.
Core 7-17			10		@ 10 ft.: damp.
			12.5		@12.5 ft.: 6" fine sand lens.
Core 17-27			19		@19 ft.: 6" fine sand lens.
			25.5		@ 25.5 ft.: 12" fine sand lens.
Core 27-37					

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-19

Unique Well ID: BBH 611

Drill Date: 5/20/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 77 ft.
Groundwater (ft BGL): 55.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 814.83 ft. (NAVD 88)
Casing Elevation: 814.30 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278754
Longitude/Easting: 2169354

Remarks:

SAMPLE TYPE / ID	DEPTH FT BGS	Sample Description	Well Construction Detail
	33	ML: SILT, cont.	
Core 37-47	38	@38 ft.: 8" fine sand lens.	
	39	@ 39 ft.: moist.	
	45	@ 45 ft.: dark yellowish brown mottling.	
Core 47-57	48	@ 48 to 52.5 ft.: white caliche mottling.	
	54	@ 54 ft.: grayish brown, some white caliche with occasional rust staining.	
	55.5	@ 55.5 ft.: wet.	
Core 57-67	58		10-20 Colo. silica sand
	60	@60 ft.: sporadic rust staining.	
	64	@ 64 ft.: olive brown.	

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
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Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-19

Unique Well ID: BBH 611

Drill Date: 5/20/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 77 ft.
Groundwater (ft BGL): 55.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 814.83 ft. (NAVD 88)
Casing Elevation: 814.30 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278754
Longitude/Easting: 2169354

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Core 67-77			67		ML: SILT, cont.	0.01-in. slot PVC, 59.6 to 74.6 ft BGL
			68–69		SM: Brown Silty SAND, fine to medium, angular to subrounded sand, loose, poorly graded, wet.	
			70–74		GM: Dark brown Silty GRAVEL with sand and cobbles, fine to coarse sub-angular to well-rounded basalt gravel, well graded, moderately dense, low plasticity fines, wet.	
			75–77		@ 74.5 ft.: 6" sandy gravel lens with sand primarily composed of coarse basalt.	Bottom cap

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-20

Unique Well ID: BCE 337

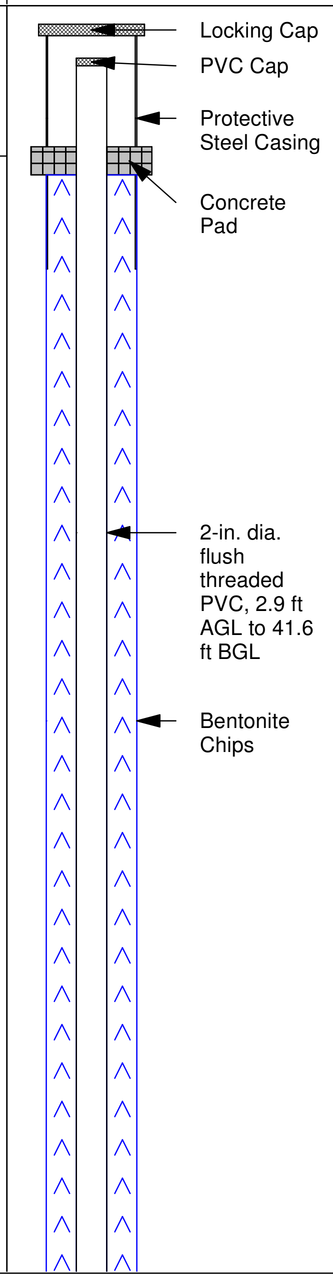
Drill Date: 5/15/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 57 ft.
Groundwater (ft BGL): 32 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 789.51 ft. (NAVD 88)
Casing Elevation: 791.83 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278509
Longitude/Easting: 2169123

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0	ML	ML: Dark yellowish brown Sandy SILT, trace sand and clay, soft, low plasticity, dry.
Core 7-17			9		@ 9 ft.: damp.
			14.5		@ 14.5 ft.: 4" sandy lens.
Core 17-27					
Core 27-37			27		@ 27 ft.: moist.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-20

Unique Well ID: BCE 337

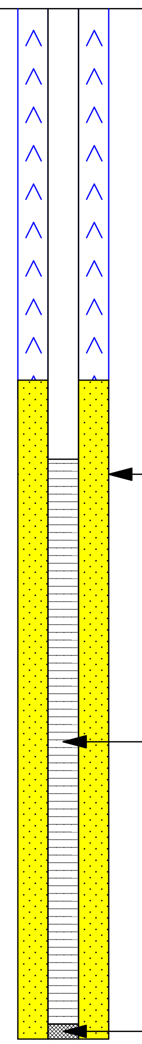
Drill Date: 5/15/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 57 ft.
Groundwater (ft BGL): 32 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 789.51 ft. (NAVD 88)
Casing Elevation: 791.83 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278509
Longitude/Easting: 2169123

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			30–32	ML	ML: SILT, cont.
			32		@ 32 ft.: wet.
Core 37-47			41–42	SM	SM: Brown Silty SAND, poorly graded, loose, wet.
			42–43	ML	ML: Brown Sandy SILT, medium dense, moderate plasticity, some mottling, wet.
			43–45	GM	GM: Olive brown Silty GRAVEL with sand and cobbles, fine to coarse sub-angular to well-rounded basalt sand, gravel, and cobbles, well graded, loose, wet.
			45–48.5	SM	SM: Dark yellowish brown Silty SAND, fine to medium sand, poorly graded, loose to moderately dense, wet. @ 47 ft.: dark brown. @ 47.5 ft. clean sand (SP), trace fines, felsic and mafic grains.
Core 47-57			48.5–57	GM	GM: Dark brown Silty GRAVEL with sand and cobbles, fine to coarse sub-angular to well-rounded basalt sand, gravel and cobbles, well graded, loose, fines have moderate plasticity, wet.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-21D

Unique Well ID: BCE 342

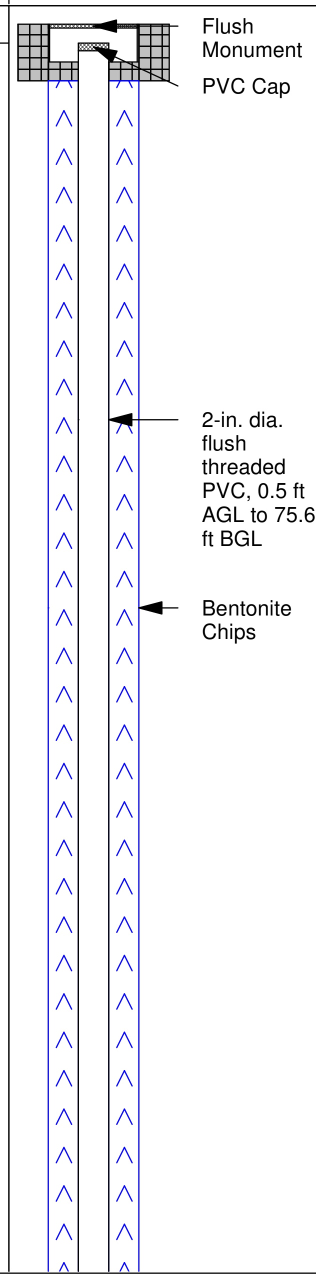
Drill Date: 5/13/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 83 ft.
Groundwater (ft BGL): 40 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 796.59 ft. (NAVD 88)
Casing Elevation: 796.04 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278381
Longitude/Easting: 2169232

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-8			0		ML: Brown to dark brown Sandy SILT, trace sand and clay, loose, low plasticity, dry.
Core 8-18			8		
			11		@ 11 ft.: 12" fine sand lens.
			13		@13 ft.: 6" fine sand lens.
Core 18-28			18		
			21		@ 21 ft.: moist.
Core 28-38			28		

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-21D

Unique Well ID: BCE 342

Drill Date: 5/13/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 83 ft.
Groundwater (ft BGL): 40 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 796.59 ft. (NAVD 88)
Casing Elevation: 796.04 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278381
Longitude/Easting: 2169232

Remarks:

SAMPLE TYPE / ID	DEPTH FT BGS	Sample Description
	33	ML: SILT, cont.
	37	@ 37 ft.: mottling.
Core 38-48	40	@ 40 ft.: wet.
Core 48-58	49	GC: Olive brown Clayey GRAVEL with sand and cobbles, fine to coarse sub-rounded to rounded basalt gravel, moderate grading, moderate to high plasticity fines, wet.
	53	GM: Dark brown Silty GRAVEL with sand and cobbles, fine to coarse sub-angular to well-rounded basalt gravel, loose, well graded, moderate plasticity fines, wet.
Core 58-68	59	@ 59 ft.: dark reddish brown.
	65	@ 65 to 68 ft.: strong brown above very dark gray mottling.

Column headings: SAMPLE TYPE / ID; DRIVE / RECOVERY; BLOW COUNT; DEPTH FT BGS; USCS SYMBOL; Sample Description; Well Construction Detail

Depth scale: 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
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Log of Exploration

Monitoring Well ID: MW-21D

Unique Well ID: BCE 342

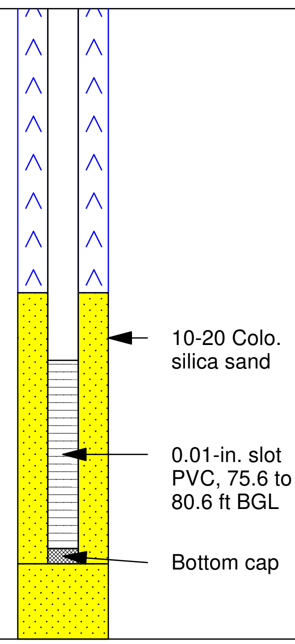
Drill Date: 5/13/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 83 ft.
Groundwater (ft BGL): 40 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 796.59 ft. (NAVD 88)
Casing Elevation: 796.04 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278381
Longitude/Easting: 2169232

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			67		
Core 68-78			68		GM: GRAVEL, cont. @ 68 ft.: moisture decreases to damp to moist.
			69		
			70		
			71		
			72		
			73		
			74		
			75		
			76		
			77		@ 77 ft.: moisture decreases to dry.
Core 78-83			78		@ 78 ft.: wet.
			79		
			80		
			81		
			82		@ 82 ft.: increasing fines.
			83		

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-21S

Unique Well ID: BCE 341

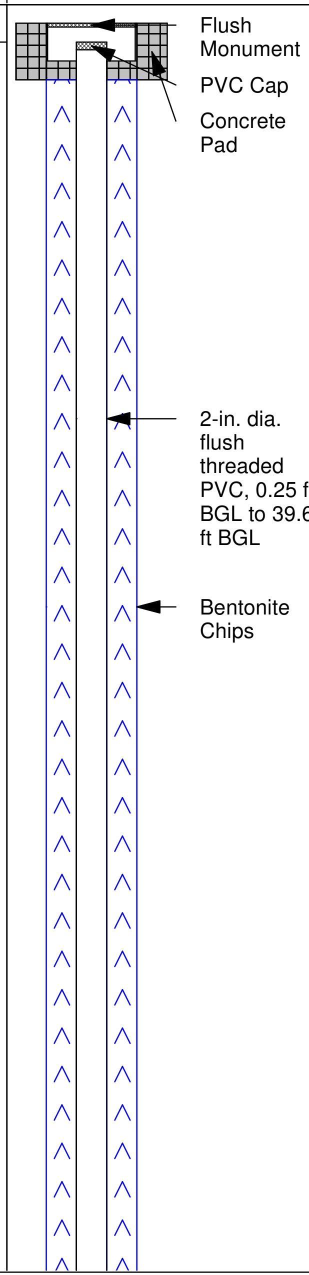
Drill Date: 5/12/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 58 ft.
Groundwater (ft BGL): 37 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 794.84 ft. (NAVD 88)
Casing Elevation: 794.27 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278388
Longitude/Easting: 2169241

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-8			0		ML: Dark grayish brown Sandy SILT, soft, low plasticity, dry.
Core 8-18			8		
			11		@ 11 ft.: 12" fine sand lens.
			14		@14 ft.: 6" fine sand lens.
Core 18-28			18		
			24		@ 24 ft.: moist.
			27		@ 27 ft.: medium plasticity.
Core 28-38			28		

Well Construction Detail



Notes:
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ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-21S

Unique Well ID: BCE 341

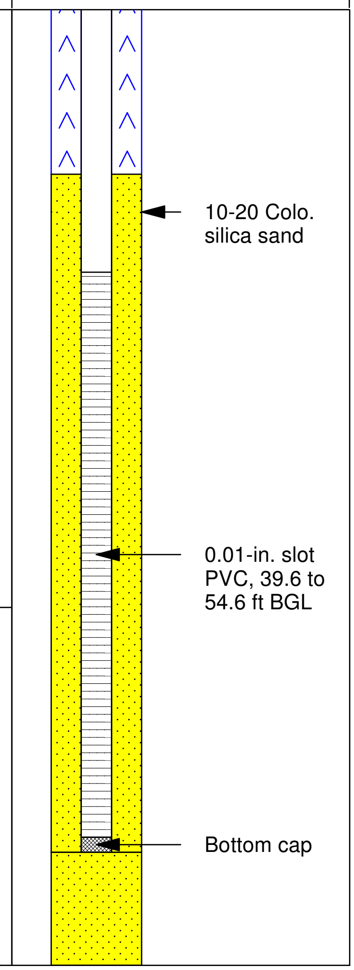
Drill Date: 5/12/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 58 ft.
Groundwater (ft BGL): 37 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 794.84 ft. (NAVD 88)
Casing Elevation: 794.27 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278388
Longitude/Easting: 2169241

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			33–37	ML	ML: SILT, cont.
Core 38-48			37–40	ML	@ 37 ft.: wet.
			40–48	ML	@ 40 ft.: mottling.
Core 48-58			48–58	GM	GM: Olive brown Silty GRAVEL with sand and cobbles, fine to coarse angular to sub-rounded basalt gravel, loose, well graded, low to high plasticity fines, wet.

Well Construction Detail



Notes:
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Log of Exploration

Monitoring Well ID: MW-22D

Unique Well ID: BCE 340

Schwyn Environmental Services

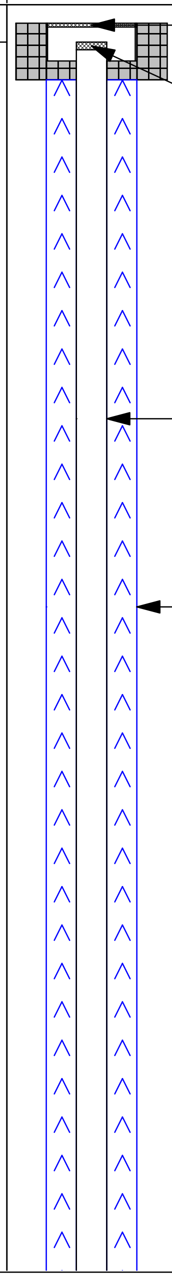
Drill Date: 5/14/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 112 ft.
Groundwater (ft BGL): 45 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 814.29 ft. (NAVD 88)
Casing Elevation: 813.60 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278242
Longitude/Easting: 2168933

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0	ML	ML: Brown Sandy SILT, soft, low plasticity, dry.
			5		@ 5 ft.: 6" caliche mottling.
Core 7-11			8		@ 8 ft.: 8" fine sand lens.
			10		@10 ft.: 12" fine sand lens.
Core 11-15			11		
Core 15-17			15		@15 ft.: 6" fine sand lens.
Core 17-27			17		
			19		@19-22 ft.: fine sand content increases.
			24		@ 24 ft.: 8" fine sand lens.
Core 27-37			27		

Well Construction Detail



Notes:
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Log of Exploration

Monitoring Well ID: MW-22D

Unique Well ID: BCE 340

Drill Date: 5/14/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 112 ft.
Groundwater (ft BGL): 45 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 814.29 ft. (NAVD 88)
Casing Elevation: 813.60 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278242
Longitude/Easting: 2168933

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			33	ML	ML: SILT, cont.	
Core 37-47			37			
			45 ▽		@ 45 ft.: wet.	
Core 47-57			47			
			52		@ 52 ft.: brown/dark brown.	Bentonite Chips
Core 57-67			57			
			58	SM	SM: Dark brown Silty SAND, angular basalt sand, loose, moderate grading, wet. @ 58 to 58.5 ft.: caliche mottling .	
			61	ML	ML: Dark yellowish brown Sandy SILT, medium stiff, low plasticity, wet.	
			66			

Notes:
ft BGL = feet below ground level
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USCS = Unified Soil Classification System
▽ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-22D

Unique Well ID: BCE 340

Drill Date: 5/14/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 112 ft.
Groundwater (ft BGL): 45 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 814.29 ft. (NAVD 88)
Casing Elevation: 813.60 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278242
Longitude/Easting: 2168933

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Core 67-77			67–76	ML	ML: SILT, cont.	
					@ 71 to 76 ft.: fining of unit downward from Dark brown Clayey SILT to Silty CLAY, medium stiff, moderate to high plasticity, mottling in lower ft.	
Core 77-87			76–99	GM	GM: Dark brown Silty GRAVEL with sand and cobbles, fine to coarse sub-angular to well-rounded basalt gravel, well graded, loose, moderate plasticity fines, wet.	
					@ 82 ft.: dark yellowish brown with dark brown mottling.	
Core 87-97					@ 87 ft.: brown/dark brown.	
					@ 94 ft.: dark reddish brown.	
Core 97-107					@ 97 ft.: dark brown, fines increase.	

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-22D

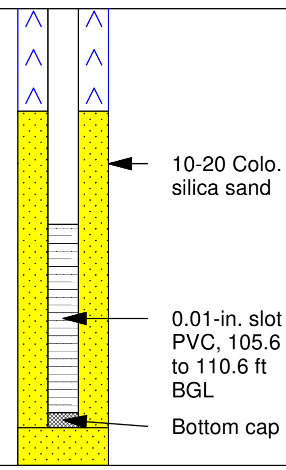
Unique Well ID: BCE 340

Drill Date: 5/14/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 112 ft.
Groundwater (ft BGL): 45 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 814.29 ft. (NAVD 88)
Casing Elevation: 813.60 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278242
Longitude/Easting: 2168933

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			100			
			101			
			102		GM: GRAVEL, cont.	
			103			
			104		@ 103 ft.: dark yellowish brown, with 6" silty clay lens.	
			105			
			106			
Core 107-112			107			
			108			
			109			
			110			
			111			
			112			



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-22S

Unique Well ID: BCE 339

Drill Date: 5/13/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 82 ft.
Groundwater (ft BGL): 45 ft.

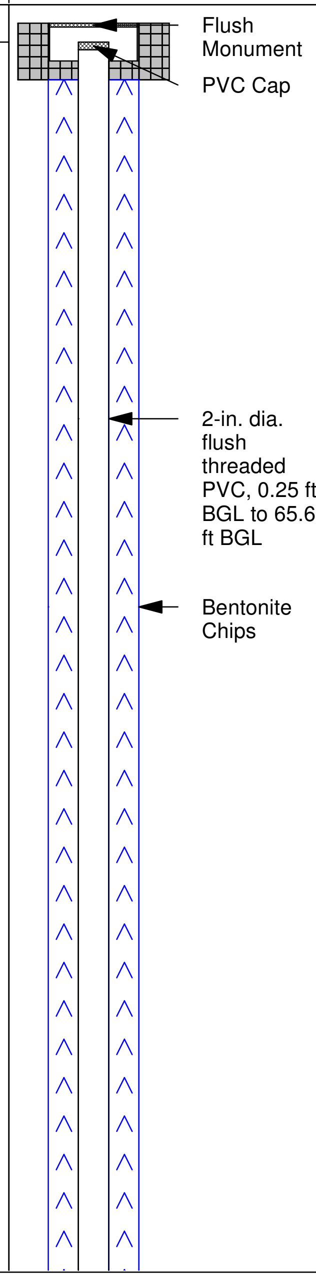
Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 813.91 ft. MSL
Casing Elevation: 813.26 ft. MSL
Coordinate System: NAD/NAVD 88
Latitude/Northing: 278250
Longitude/Easting: 2168939

Remarks: Warm, light breeze

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0	ML	ML: Brown Sandy SILT,soft, low plasticity, dry to damp.
Core 7-17			8		@ 8 ft.: 12" fine sand lens.
			10		@10 ft.: 6"' fine sand lens.
Core 17-27			20		@20 ft.: 8" fine sand lens.
Core 27-37					

Depth scale: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-22S

Unique Well ID: BCE 339

Drill Date: 5/13/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 82 ft.
Groundwater (ft BGL): 45 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 813.91 ft. MSL
Casing Elevation: 813.26 ft. MSL
Coordinate System: NAD/NAVD 88
Latitude/Northing: 278250
Longitude/Easting: 2168939

Remarks: Warm, light breeze

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			33		ML: SILT, cont.	
			34			
			35			
			36			
Core 37-47			37			
			38		@ 38 ft.: olive brown, moist.	
			39			
			40			
			41			
			42			
			43		@ 43 ft.: dark grayish brown.	
			44			
			45		@ 45 ft.: wet.	
			46			
Core 47-57			47		@ 47.5 ft.: olive brown.	
			48			
			49			
			50			
			51			
			52		@ 52 ft.: brown/dark brown.	
			53			
			54			
			55			
			56			
Core 57-67			57			
			58			
			59		@ 59 to 61 ft.: mottling.	
			60			
			61			
			62			
			63			
			64			
			65			
			66			

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-22S

Unique Well ID: BCE 339

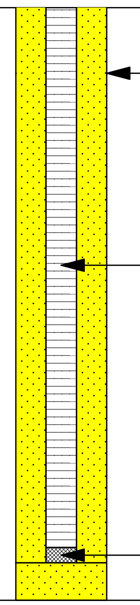
Drill Date: 5/13/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 82 ft.
Groundwater (ft BGL): 45 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 813.91 ft. MSL
Casing Elevation: 813.26 ft. MSL
Coordinate System: NAD/NAVD 88
Latitude/Northing: 278250
Longitude/Easting: 2168939

Remarks: Warm, light breeze

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 67-77			67–69.5	SM	SM: Dark brown Silty SAND, angular basalt sand, loose, moderate grading, wet.
			69.5–75	ML	ML: Dark brown Sandy SILT, medium stiff, low plasticity, wet. @ 73.5 ft.: dark brown/brown.
Core 77-82			75–79	CL	CL: Fining of unit downward from Olive brown Clayey SILT to Silty CLAY, moderate to high plasticity, mottling at 78 to 79 ft.
			79–82	GM	GM: Dark brown Silty GRAVEL with sand and cobbles, fine to coarse sub-angular to well-rounded basalt gravel, loose, well graded, moderate plasticity fines, wet.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-23

Unique Well ID: BBH 613

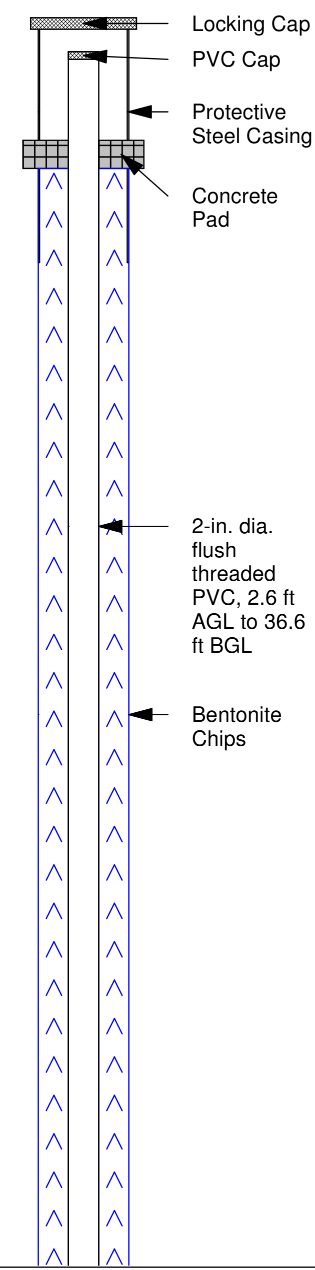
Drill Date: 5/21/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 52 ft.
Groundwater (ft BGL): 32

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 794.05 ft. (NAVD 88)
Casing Elevation: 796.49 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278929
Longitude/Easting: 2170158

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-3			0	ML	ML: Grayish brown Sandy SILT, fine sand with trace clay, soft, low plasticity, roots in upper 1.5 ft., dry.
Core 3-7			3.5		@ 3.5 ft.: color transitions from dark brown to light yellowish brown to very dark grayish brown
Core 7-17			7		@ 7 ft.: brown.
Core 17-27			17		@ 17 ft.: caliche mottling.
Core 27-37			27		

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-23

Unique Well ID: BBH 613

Drill Date: 5/21/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 52 ft.
Groundwater (ft BGL): 32

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 794.05 ft. (NAVD 88)
Casing Elevation: 796.49 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278929
Longitude/Easting: 2170158

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			30–31		ML: Silt, cont.	
			32		@ 32 ft.: grayish brown, 1 cm layer of solid caliche, wet.	
			34		@ 34 ft.: dark brown.	10-20 Colo. silica sand
Core 37-47			37		@ 37 ft.: hematite staining, periodic cobble and coarse gravel embedded in silt.	
			40		@ 40 ft.: very dark grayish brown.	
			42		@ 42 ft.: brown.	
			44		SP: Dark reddish brown clean SAND, subangular, basalt, wet.	0.01-in. slot PVC, 36.6 to 51.6 ft BGL
Core 47-52			45–52		GM: Dark brown Silty GRAVEL and cobbles with silty matrix, fine to coarse sub-angular to well-rounded basalt gravel, well graded, moderate plasticity fines, wet.	Bottom cap

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▽ = denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-24
Unique Well ID: BBH 615

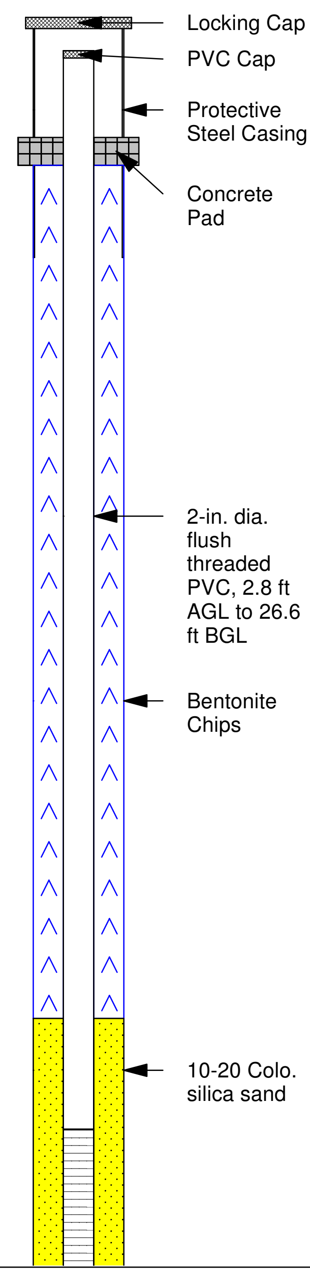
Drill Date: 5/22/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 47 ft.
Groundwater (ft BGL): 26.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 796.85 ft. (NAVD 88)
Casing Elevation: 799.30 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 279135
Longitude/Easting: 2170601

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0	ML	ML: Dark grayish brown Sandy SILT, fine sand with trace clay, soft to medium stiff, low plasticity, roots in upper 1 ft., damp to moist.
			3		@ 3 ft.: very dark grayish brown.
Core 7-9			7		@ 7 ft.: brown, dry to damp.
Core 9-12			9		
Core 12-17			12		
Core 17-27			17		@ 17 ft.: dark grayish brown, moist.
			26.5		@ 26.5 ft.: wet.
Core 27-37			27		

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-24

Unique Well ID: BBH 615

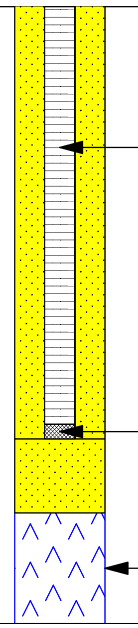
Drill Date: 5/22/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 47 ft.
Groundwater (ft BGL): 26.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 796.85 ft. (NAVD 88)
Casing Elevation: 799.30 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 279135
Longitude/Easting: 2170601

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			31–36		ML: SILT, cont.
Core 37-47			36–47		GM: Dark brown Silty GRAVEL with cobbles in a silty matrix, fine to coarse sub-angular to well-rounded basalt gravel, well graded, moderate plasticity fines, wet.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-25

Unique Well ID: BCE 348

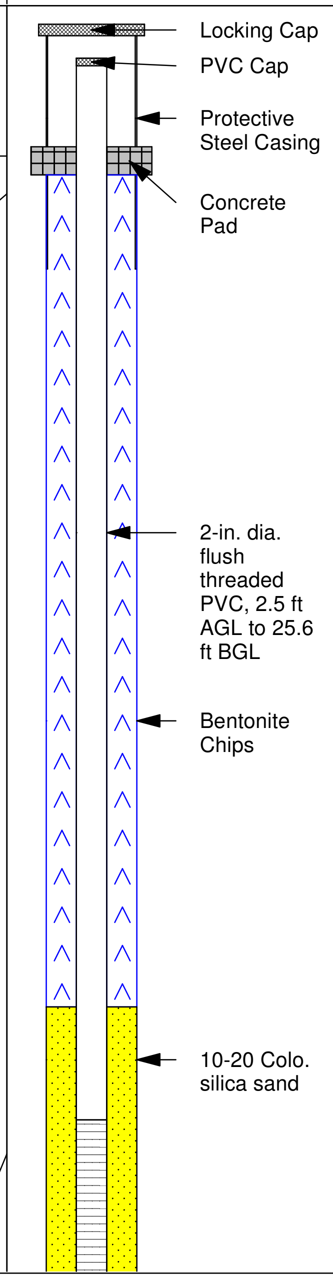
Drill Date: 5/22/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 42 ft.
Groundwater (ft BGL): 26 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 793.00 ft. (NAVD 88)
Casing Elevation: 795.44 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 277931
Longitude/Easting: 2171770

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0		Fill: sand and gravel with silt (road base).
			1		ML: Very dark grayish brown Sandy SILT, fine sand with trace clay, soft to medium stiff, low plasticity, damp.
Core 7-17			7		@ 7 ft.: dark grayish brown, moist.
			12		@ 12 ft.: hematite mottling and staining.
Core 17-27			17		@ 17 ft.: brown.
			26		@ 26 ft.: wet.
Core 27-37			27		GM: Dark brown Sandy GRAVEL with cobbles in a silty matrix, fine to coarse sub-angular to well-rounded basalt gravel, loose, well graded, moderate plasticity fines, wet.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-25

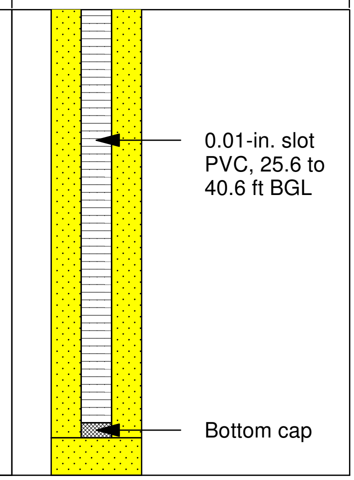
Unique Well ID: BCE 348

Drill Date: 5/22/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 42 ft.
Groundwater (ft BGL): 26 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 793.00 ft. (NAVD 88)
Casing Elevation: 795.44 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 277931
Longitude/Easting: 2171770

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Core 37-42			30–42		GM: GRAVEL, cont.	



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-26

Unique Well ID: BCE 336

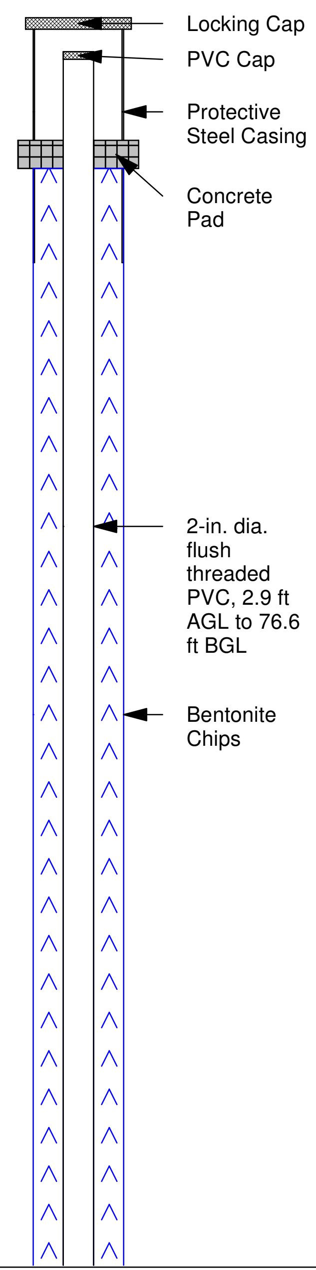
Drill Date: 5/9/2012
Logged By: C. Schwyn/E. Ramirez
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 92 ft.
Groundwater (ft BGL): 75 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 832.63 ft. (NAVD 88)
Casing Elevation: 834.91 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278040
Longitude/Easting: 2170640

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0	ML	ML: Brown SILT, trace sand and clay, soft, low plasticity, dry to damp.
Core 7-17			9		@ 9 ft.: 12" zone of very fine sand.
Core 17-27			20		@ 20 ft.: 12" zone of very fine sand.
Core 27-37					

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-26

Unique Well ID: BCE 336

Drill Date: 5/9/2012
Logged By: C. Schwyn/E. Ramirez
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 92 ft.
Groundwater (ft BGL): 75 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 832.63 ft. (NAVD 88)
Casing Elevation: 834.91 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278040
Longitude/Easting: 2170640

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			30		ML: SILT, cont.	
Core 37-47			37			Bentonite Chips
Core 47-57			47			
Core 57-67			57		@ 57 ft.: white caliche with yellow brown mottling.	
			60		@ 60 ft.: appears wet.	
			63			

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-26

Unique Well ID: BCE 336

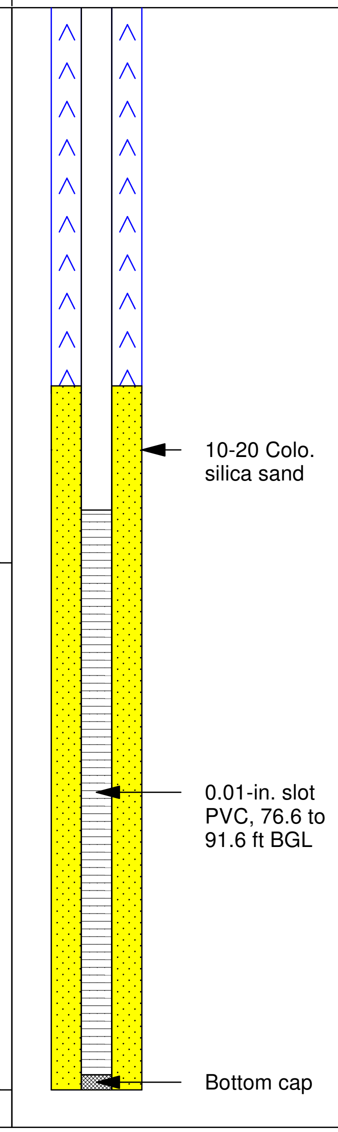
Drill Date: 5/9/2012
Logged By: C. Schwyn/E. Ramirez
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 92 ft.
Groundwater (ft BGL): 75 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 832.63 ft. (NAVD 88)
Casing Elevation: 834.91 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278040
Longitude/Easting: 2170640

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			64–65	ML	ML: SILT, cont.
Core 67-77			72		@ 72 ft.: damp-moist.
			73.5		@ 73.5 ft.: caliche mottling.
Core 77-87			78	GM	GM: Dark yellowish brown Sandy GRAVEL with cobbles in a silty matrix, fine to coarse sub-angular to well-rounded basalt gravel, well graded, wet.
Core 87-92			92		

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-27

Unique Well ID: BHP200

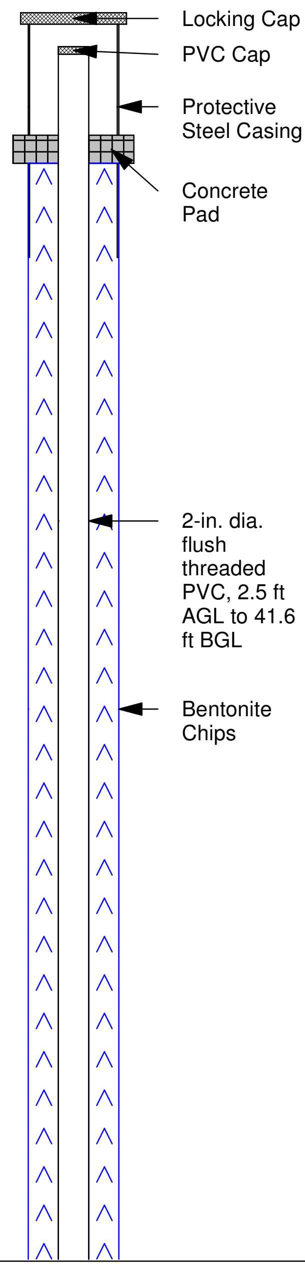
Drill Date: 8/28/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 52 ft.
Groundwater (ft BGL): 31 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 791.98 ft. (NAVD 88)
Casing Elevation: 794.50 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278771
Longitude/Easting: 2169852

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-4			0	ML	ML: Light brownish gray Sandy SILT, fine sand with trace clay, soft, low plasticity, dry.
Core 4-7			5.5		@ 5.5 ft.: very dark gray.
Core 7-17			7		@ 7 ft.: damp to moist.
Core 17-27			21.5		@ 21.5 ft.: 8" fine sand lens.
Core 27-37			27.25		@ 27.25 ft.: 12" black medium sand lens.
			28.25		@28.25 ft.: olive gray, mottled.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-27

Unique Well ID: BHP200

Drill Date: 8/28/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 52 ft.
Groundwater (ft BGL): 31 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 791.98 ft. (NAVD 88)
Casing Elevation: 794.50 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278771
Longitude/Easting: 2169852

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			30–31	ML	ML: Silt, cont.
			31	ML	@ 31 ft.: brown, wet.
			32–33	ML	@ 32-33 ft.: caliche mottling.
			34.5	ML	@ 34.5 ft.: 6" medium sand lens.
Core 37-47			38–42.5	ML	@ 38-42.5 ft.: reddish mottling.
			43–45	GM	GM: Brown Silty GRAVEL, trace clay to coarse sub-rounded gravel, moderately graded, medium dense, wet. @ 43.5 ft.: 6" reddish mottled silt lens. @ 44.5 ft.: gravel size decreases to smaller sub-angular to sub-rounded coarse gravel.
			45–47.5	SP	SP: Dark reddish brown SAND, subangular, poorly graded, loose, wet.
Core 47-52			47.5–52	GM	GM: Dark reddish brown Sandy GRAVEL, trace fines, angular coarse sand to sub-rounded fine to coarse gravel, moderately graded, loose, wet. With depth, the gravel size fraction increases as the sand fraction decreases.

Depth scale: 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53

Well Construction Detail

10-20 Colo. silica sand

0.01-in. slot PVC, 41.6 to 51.6 ft BGL

Bottom cap

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Gas Well ID: GW-7D

Unique Well ID: BBH 614

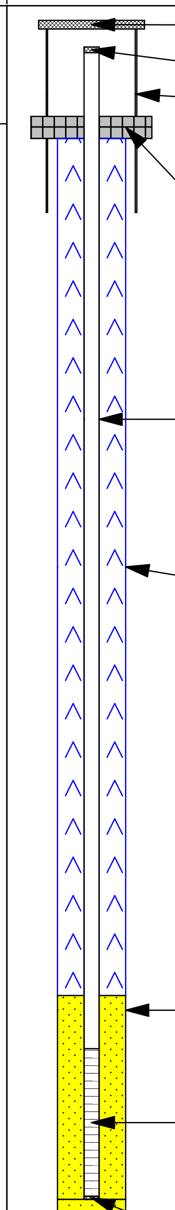
Drill Date: 5/7/2012
Logged By: B. Carpenter (Herrera)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 4.25-in
Boring Depth (ft BGL): 37 ft.
Groundwater (ft BGL): 32 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 789.45 ft. (NAVD 88)
Casing Elevation: 792.10 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278725
Longitude/Easting: 2169657

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0–7	ML	ML: Brown Sandy SILT, trace sand and clay, low plasticity, root tubes and oganic material present, damp.
Core 7-14			7–14	ML	@ 12 ft.: caliche lens. @ 13 ft.: blocky structure, dry.
Core 14-17			14–17	ML	@ 16 ft.: stiff, laminated loess with basalt flakes.
Core 17-27			17–27	ML	ML: SILT, cont. @ 24 ft.: black mottling. @ 25.5 ft.: 6" caliche zone.
Core 27-37			27–37	ML	@ 29.5 ft.: 12" caliche zone. @ 32 ft.: gray brown, wet. 6" caliche zone. @ 36 ft.: gray brown with redddish brown mottling.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▽ = denotes groundwater table

Log of Exploration

Gas Well ID: GW-7S

Unique Well ID: BBH 610

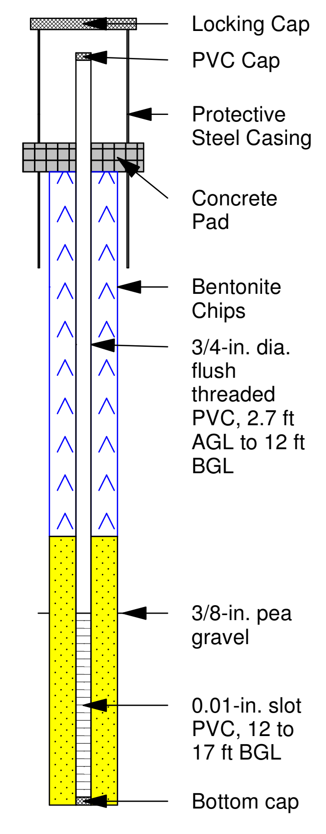
Drill Date: 5/7/2012
Logged By: B. Carpenter (Herrera)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 4.25-in
Boring Depth (ft BGL): 17 ft.
Groundwater (ft BGL): None

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 789.10 ft. (NAVD 88)
Casing Elevation: 791.68 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278720
Longitude/Easting: 2169650

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0	ML	ML: Brown Sandy SILT, trace sand and clay, low plasticity, root tubes and organic material present, moist.
			6		@ 6 ft.: blocky structure, dry.
Core 7-12			7		
			11		@ 11 ft.: caliche lens, stiff, dry.
Core 12-17			12		

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Gas Well ID: GW-8

Unique Well ID: BCE 336

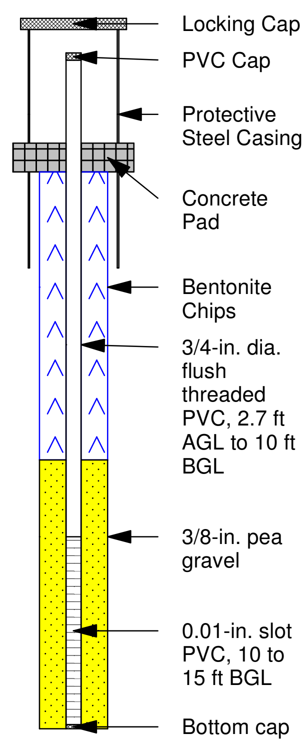
Drill Date: 5/7/2012
Logged By: B. Carpenter (Herrera)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 4.25-in
Boring Depth (ft BGL): 15 ft.
Groundwater (ft BGL): None

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 805.91 ft. (NAVD 88)
Casing Elevation: 808.58 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 279406
Longitude/Easting: 2170855

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-6			0–6	ML	ML: Brown Sandy SILT, trace sand and clay, low plasticity, moist.
Core 6-12			6–12	ML	@ 5 ft.: blocky structure.
Core 12-15			12–15	ML	@ 11 ft.: laminated.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Gas Well ID: GW-9

Unique Well ID: BCE 347

Drill Date: 5/7/2012
Logged By: B. Carpenter (Herrera)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 4.25-in
Boring Depth (ft BGL): 15 ft.
Groundwater (ft BGL): None

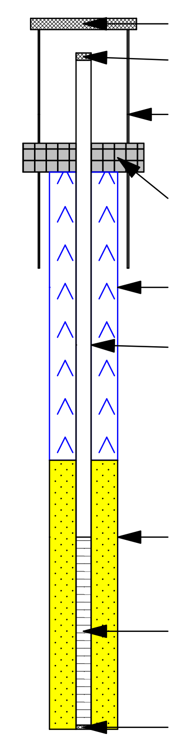
Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 792.97 ft. (NAVD 88)
Casing Elevation: 795.77 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 277941
Longitude/Easting: 2171779

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0		ML: Dark brown Sandy SILT, trace sand and clay, low plasticity, moist.
Core 7-15			8		@ 8 ft.: blocky structure, dry.

Depth scale: -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Gas Well ID: GW-10

Unique Well ID: BCE 346

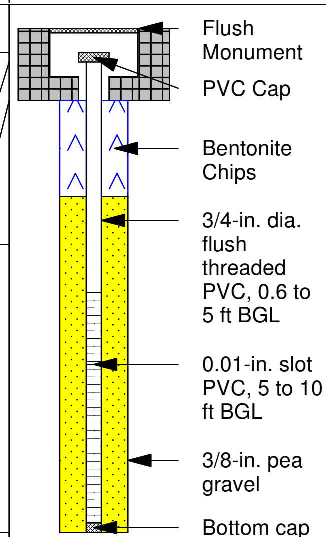
Drill Date: 5/7/2012
Logged By: B. Carpenter (Herrera)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 4.25-in
Boring Depth (ft BGL): 10 ft.
Groundwater (ft BGL): None

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 796.23 ft. (NAVD 88)
Casing Elevation: 795.62 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 277639
Longitude/Easting: 2170741

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Cutter			0–1		Asphalt
			1–2		Fill: Crushed rock
Core 2-5			2–4		Fill: Silty Sandy GRAVEL with cobbles.
			4–5		ML: Light brown SILT, trace sand, moist.
Core 5-8			5–8		
Core 8-10			8–10		

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Gas Well ID: GW-11

Unique Well ID: BCE 350

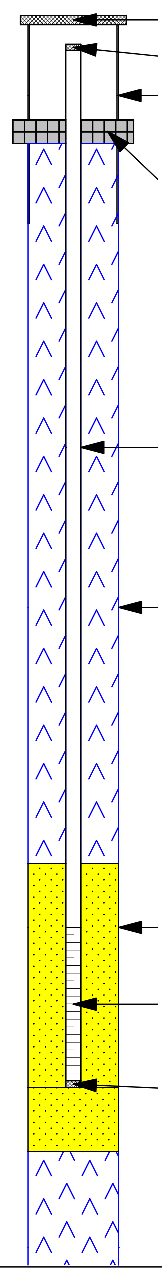
Drill Date: 5/8/2012
Logged By: B. Carpenter (Herrera)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 57 ft.
Groundwater (ft BGL): None

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 831.73 ft. (NAVD 88)
Casing Elevation: 834.53 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 277720
Longitude/Easting: 2171246

Remarks: Soil Sample (GW-11 @ 56') collected for laboratory analysis.

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7					Fill: Crushed Rock
					ML: Dark brown Sandy SILT, moist. [Fill]
Core 7-12					MSW: Municipal Solid Waste composed primarily of plastic, paper, and metal, with layers of brown to black silt.
Core 12-15					ML: Light brown SILT, dry. [Fill]
Core 15-17					MSW: Municipal Solid Waste.
Core 17-22					ML: Brown SILT, dry. [Fill]
Core 22-27					MSW: Municipal Solid Waste composed of refuse, woodwaste, plastic, and paper. MSW appears burned.
					ML: Brown SILT, dry. [Fill]
Core 27-37					MSW: Municipal Solid Waste composed of refuse, woodwaste, plastic, cardboard, wire, glass, and paper, with layers of brown to black silt. MSW appears burned in some zones.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Gas Well ID: GW-11
Unique Well ID: BCE 350

Drill Date: 5/8/2012
Logged By: B. Carpenter (Herrera)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 57 ft.
Groundwater (ft BGL): None

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 831.73 ft. (NAVD 88)
Casing Elevation: 834.53 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 277720
Longitude/Easting: 2171246

Remarks: Soil Sample (GW-11 @ 56') collected for laboratory analysis.

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			36		Municipal Solid Waste, cont.	
Core 37-47			37–45			Bentonite Chips
			46–47		@ 46 ft.: newspaper and documents dated between January 7 and 24, 1979.	
Core 47-57			48–49		ML: Brown SILT, root tubes and organic material present.	
			50–55		@ 50 ft.: blocky structure.	
			56–57		@ 56 ft.: soil sample collected for VOC analysis (GW11@56').	

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Gas Well ID: GW-12

Unique Well ID: BCE 344

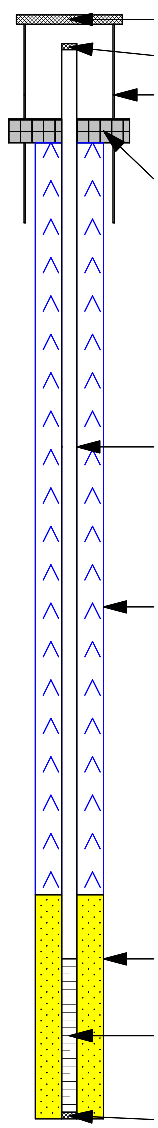
Drill Date: 5/7/2012
Logged By: B. Carpenter (Herrera)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 4.25-in
Boring Depth (ft BGL): 31 ft.
Groundwater (ft BGL): None

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 822.34 ft. (NAVD 88)
Casing Elevation: 824.86 ft. (NAVD 88)
Coordinate System: NAD 83 SP, WA South
Latitude/Northing: 278140
Longitude/Easting: 2169566

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-5			0–5	ML	ML: Dark brown Sandy SILT, trace sand and clay, low plasticity, moist.
Core 5-12			5–12	ML	@ 8-9 ft.: animal bones and hair, piece of plastic, dry.
Core 12-14			12–14	ML	@ 12 ft.: dense, wind blown laminations [loess].
Core 14-19			14–19	ML	
Core 19-26			19–26	ML	ML: SILT, cont.
Core 26-31			26–31	ML	

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COURSE GRAINED SOILS More than 50% retained on No. 200 sieve	**GRAVEL** More than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND More than 50% of coarse fraction retained on No. 4 sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% passes No. 200 sieve	**SILT AND CLAY** liquid limit less than 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY liquid limit more than 50	INORGANIC	MH	HIGH-PLASTICITY SILT, ELASTIC SILT
			CH	HIGH-PLASTICITY CLAY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

Notes:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488.
2. Where laboratory index testing has been conducted, soil classification is based on ASTM D2487.
3. USCS group symbols correspond to the symbols used by the Unified Soil Classification System and ASTM Classification methods.

APPENDIX A

Historical Logs

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

MW-1

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ....

Permit No. ....

(1) **OWNER:** Name City of Walla Walla Address Box 478

(2) **LOCATION OF WELL:** County Walla Walla — SW ¼ NE ¼ Sec 22 T 7 N., R 35 E W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 1
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 2" inches.
Drilled 121 ft. Depth of completed well 121' ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 2 " Diam. from +2 ft. to 118 ft.
Threaded ☒ ...." Diam. from .... ft. to .... ft.
Welded ☐ ...." Diam. from .... ft. to .... ft.

Perforations: Yes ☐ No ☒
Type of perforator used ....
SIZE of perforations .... in. by .... in.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type 316 Model No. ....
Diam. 2 Slot size .010 from 108 ft. to 118 ft.
Diam. .... Slot size .... from .... ft. to .... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ....
Gravel placed from .... ft. to .... ft.

Surface seal: Yes ☒ No ☐ To what depth? .... ft.
Material used in seal ....
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? .... Depth of strata ....
Method of sealing strata off ....

(7) PUMP: Manufacturer's Name ....
Type: .... H.P. ....

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 23' ft. below top of well Date 10-22-86
Artesian pressure .... lbs. per square inch Date ....
Artesian water is controlled by .... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 12 gal./min. with 1 ft. drawdown after 1 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0.00	23'				
.00	24'				
.01	23'				

Date of test 9-8-86
Bailer test .... gal./min. with .... ft. drawdown after .... hrs.
Artesian flow .... g.p.m. Date ....
Temperature of water 54 Was a chemical analysis made? Yes ☐ No ☒

10/29/86

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Topsoil	0	23
Sand + Brown Clay	23	42
Sand	42	48
Brown Clay + Gravel	48	73
Brown Clay	73	79
Brown Clay + Gravel	79	87
Brown Clay	87	92
Brown Clay + Gravel	92	97
Gravel - water	97	121

7 Sacks Filter Sand 10-20 From 121 To 90 FT

Pumped in 15 Sacks Vol Clay From 90 To 6'

1 FT of Sand 6' To 5'

Put in 6 Sacks Portland Cem From 5' To Ground Level

Work started 8-27 19 86. Completed 9-18 19 86

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Harding Drilling Co (Person, firm, or corporation) (Type or print)

Address Rt 3 Box 67 Walla Walla, W

[Signed] Mike Harding (Well Driller)

License No. 173 Date 10-28, 19 86

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

MW-1A - ABANDONED

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ....

Permit No. ....

(1) OWNER: Name Walla Walla City Land Fill Address

LOCATION OF WELL: County Walla Walla SEE BELOW ¼ Sec. T. N., R. W.M.

Bearing and distance from section or subdivision corner NE¼ NE¼ NE¼ Sec 22

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) #1
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 5 inches.
Drilled 65 ft. Depth of completed well 65 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 5" Diam. from 0 ft. to 65 ft.
Threaded ☐ ......" Diam. from ...... ft. to ...... ft.
125# PVC Welded ☒ ......" Diam. from ...... ft. to ...... ft.

Perforations: Yes ☒ No ☐
Type of perforator used Machine
SIZE of perforations 1/2 in. by 3 in.
...... perforations from ...... ft. to ...... ft.
40 perforations from 25 ft. to 65 ft.
...... perforations from ...... ft. to ...... ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type ...... Model No. ......
Diam. ...... Slot size ...... from ...... ft. to ...... ft.
Diam. ...... Slot size ...... from ...... ft. to ...... ft.

Gravel packed: Yes ☒ No ☐ Size of gravel: 3/4-1 1/4
Gravel placed from 25 ft. to 65 ft.

Surface seal: Yes ☒ No ☐ To what depth? 25 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ...... Depth of strata ......
Method of sealing strata off ......

(7) PUMP: Manufacturer's Name None
Type: ...... H.P. ......

(8) WATER LEVELS: Land-surface elevation above mean sea level...... ft.
Static level 27 ft. below top of well Date Nov 21-76
Artesian pressure ...... lbs. per square inch Date ......
Artesian water is controlled by ...... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: ...... gal./min. with ...... ft. drawdown after ...... hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ......
Bailer test 4 gal./min. with 35 ft. drawdown after 1/2 hrs.
Artesian flow ...... g.p.m. Date ......
Temperature of water 58 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG: T7N R35E

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Top soil + Brown clay	0	35
Brown clay with Fine Sand Some water	35	36
Clay Brown	36	38
Gravel - Cement - Brown	38	49
Clay - Brown	49	53
Gravel - Cement - Brown	53	65

W. W. Land Fill #1

BEGIN AT THE NORTHEAST CORNER OF SECTION 22 IN TOWNSHIP 7 NORTH, RANGE 35 EAST OF THE WILLAMETTE MERIDIAN AND RUNNING THENCE SOUTHERLY ALONG THE EAST LINE OF SAID SECTION 22, A DISTANCE OF 533 FEET; THENCE WESTERLY AT RIGHT ANGLES TO THE EAST LINE OF SAID SECTION 22, A DISTANCE OF 471 FEET TO THE SITE OF TEST WELL #1

RECEIVED
JAN 11 1977
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started Nov 15 1976. Completed Nov 22 1976

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Lowell W. Marlatt (Person, firm, or corporation) (Type or print)

Address Rt# 2 Box 111 Milton Freewater Or

[Signed] Lowell W. Marlatt (Well Driller)

License No. C-81 Date Dec 16, 1976

(USE ADDITIONAL SHEETS IF NECESSARY)

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON Well-2

Application No.

Permit No.

(1) OWNER: Name Walla Walla City Address

(2) LOCATION OF WELL: County ¼ SE ¼ Sec SEE BELOW T. N., R. W.
Bearing and distance from section or subdivision corner SE¼ NE¼ NE¼ Sec 22 T7N R35

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☑ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) #2
New well ☐ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 5 inches.
Drilled 155 ft. Depth of completed well 155 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 5" Diam. from 0 ft. to 155 ft.
Threaded ☐ " Diam. from ft. to ft.
125# PVC Welded ☑ " Diam. from ft. to ft.

Perforations: Yes ☑ No ☐
Type of perforator used Machine
SIZE of perforations 1/2 in. by 3 in.
perforations from ft. to ft.
80 perforations from 80 ft. to 155 ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☑
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☑ No ☐ Size of gravel: 3/4 x 1¼
Gravel placed from 30 ft. to 155 ft.

Surface seal: Yes ☑ No ☐ To what depth? 30 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name None
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level 75 ft. below top of well Date Dec. 14-76
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☑ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 50 gal./min. with 30 ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water 59 Was a chemical analysis made? Yes ☐ No ☑

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Top soil & clay - Brown	0	57
Clay - Tan	57	79
Gravel Cement - Brown	79	95
Clay - Brown	95	97
Gravel Cement - Brown	97	106
Gravel Med - Some water	106	115
Gravel Cement - Brown	115	120
Clay - Brown	120	122
Gravel Cement - Brown	122	124
Clay - Brown	124	127
Gravel Water bearing	127	155

BEGIN AT THE NORTHEAST CORNER OF SECTION 22 IN TOWNSHIP 7 NORTH. RANGE 35 EAST OF THE WILLAMETTE MERIDIAN AND RUNNING THENCE SOUTHERLY ALONG THE EAST LINE OF SAID SECTION 22, A DISTANCE OF 1270 FEET, THE WESTERLY AT RIGHT ANGLES TO THE EAST LINE OF SAID SECTION 22, A DISTANCE OF 150 FEET TO THE SITE OF TEST WELL #2

Work started Dec 1 1976 Completed Dec 15 1976

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Lowell W. Marlatt (Person, firm, or corporation) (Type or print)

Address RT. #2 Box 111 Milton Freewater

[Signed] Lowell W. Marlatt (Well Driller)

License No. C-81 Date Dec 16, 1976

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

MW-3

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ....

Permit No. ....

OWNER: Name City of Walla Walla Address Box 478

(2) **LOCATION OF WELL:** County Walla Walla — NW ¼ NE ¼ Sec 22 T 7 N., R. 35 W.M.

Bearing and distance from section or subdivision corner

(3) **PROPOSED USE:** Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☒ Other ☐

(4) **TYPE OF WORK:** Owner's number of well (if more than one) 3

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) **DIMENSIONS:** Diameter of well .... inches.
Drilled .... ft. Depth of completed well .... ft.

(6) **CONSTRUCTION DETAILS:**

Casing installed: 2 " Diam. from +2 ft. to 118 ft.
Threaded ☒ .... " Diam. from .... ft. to .... ft.
Welded ☐ .... " Diam. from .... ft. to .... ft.

Perforations: Yes ☐ No ☒
Type of perforator used ....
SIZE of perforations .... in. by .... in.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type 316 Model No. ....
Diam. 2 Slot size .010 from 108 ft. to 118 ft.
Diam. .... Slot size .... from .... ft. to .... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ....
Gravel placed from .... ft. to .... ft.

Surface seal: Yes ☒ No ☐ To what depth? .... ft.
Material used in seal ....
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? .... Depth of strata ....
Method of sealing strata off ....

(7) **PUMP:** Manufacturer's Name ....
Type: .... H.P. ....

(8) **WATER LEVELS:** Land-surface elevation above mean sea level .... ft.
Static level 26' ft. below top of well Date 10-22-86
Artesian pressure .... lbs. per square inch Date ....
Artesian water is controlled by .... (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 10 gal./min. with 2 ft. drawdown after 1 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
00	28	:01	26		

Date of test 10-1-86
Bailer test .... gal./min. with .... ft. drawdown after .... hrs.
Artesian flow .... g.p.m. Date ....
Temperature of water 54 Was a chemical analysis made? Yes ☐ No ☒

10/29/86

(10) **WELL LOG:**

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Topsoil	0	23
Brown Clay + Sand	23	42
Sand	42	59
Brown Clay	59	61
Sand + Gravel	61	74
Brown Clay + Gravel	74	96
Brown Clay	96	101
Gravel - Water	101	121

Put in 8 Sacks 10-20 Filter Sand From 121' To 90'

Pumped in 13 Sacks Vol Clay From 90 To 16'

Put in Sand From 16' To 10'

Put in 9 Sacks Portland Cem From 10' To Ground Level

Work started 9-18 1986 Completed 10-21 1986

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME HARDING DRILLING Co (Person, firm, or corporation) (Type or print)

Address RT 3 Box 67 Walla Walla Wa.

[Signed] Mike Harding (Well Driller)

License No. 173 Date 10-29, 1986

MW - 3A

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ....

Permit No. ....

(1) OWNER: Name Walla Walla City Address

LOCATION OF WELL: County Walla Walla - SEE BELOW Sec. T 7 N., R 35 W.M.

Bearing and distance from section or subdivision corner NW 1/4 NE 1/4 NE 1/4 Sec 22

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☑ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 3

New well ☐ Deepened ☐ Reconditioned ☐

Method: Dug ☐ Bored ☐ Cable ☑ Driven ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 5 inches.
Drilled 85 ft. Depth of completed well 80 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 5 " Diam. from 0 ft. to 80 ft.
Threaded ☐ ...." Diam. from ...... ft. to ...... ft.
125# PVC Welded ☑ ...." Diam. from ...... ft. to ...... ft.

Perforations: Yes ☑ No ☐
Type of perforator used Machine
SIZE of perforations 1/2 in. by 3 in.
...... perforations from ...... ft. to ...... ft.
52 perforations from 25 ft. to 80 ft.
...... perforations from ...... ft. to ...... ft.

Screens: Yes ☐ No ☑
Manufacturer's Name
Type ...... Model No.
Diam. ...... Slot size ...... from ...... ft. to ...... ft.
Diam. ...... Slot size ...... from ...... ft. to ...... ft.

Gravel packed: Yes ☑ No ☐ Size of gravel: 1/4 - 1 1/4
Gravel placed from 25 ft. to 86 ft.

Surface seal: Yes ☑ No ☐ To what depth? 25 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? ...... Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name None
Type: ...... H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level.... ft.
Static level 28 ft. below top of well Date Nov 21-76
Artesian pressure ...... lbs. per square inch Date
Artesian water is controlled by ...... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☑ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
" " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 25 gal./min. with 40 ft. drawdown after 1 hrs.
Artesian flow ...... g.p.m. Date
Temperature of water 58 Was a chemical analysis made? Yes ☐ No ☑

(10) WELL LOG: T 7 N R 35

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Top soil & clay Brown	0	20
Gravel in Brown clay	20	21
Clay - Brown	21	29
Clay - Tan	29	34
Gravel Brown ~~[illegible]~~	34	62
Clay - Brown	62	64
Gravel some water 62'		
Casing 80-86	64	86

BEGIN AT THE NORTHWEST CORNER OF THE NORTHEAST QUARTER OF THE NORTHEAST QUARTER OF SECTION [22] TOWNSHIP 7 NORTH RANGE 35, EAST OF THE WILLAMETTE MERIDIAN AND RUNNING THENCE SOUTHERLY ALONG THE WEST LINE OF SAID NORTHEAST QUARTER OF THE NORTHEAST QUARTER OF SAID SECTION 22, A DISTANCE OF 100 FEET; THE EASTERLY AT RIGHT ANGLES TO SAID WEST LINE OF THE NORTHEAST QUARTER OF THE NORTHEAST QUARTER OF SAID SECTION 22, A DISTANCE OF 50 FEET TO THE SITE OF TEST WELL #3

Work started Nov 14 1976 Completed Nov 21 1976

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Lowell W. Marlatt (Person, firm, or corporation) (Type or print)

Address Rt 2 Box 111 Milton Freewater

[Signed] Lowell W. Marlatt (Well Driller)

License No. C-81 Date Dec 16, 1976

1/12/77

(USE ADDITIONAL SHEETS IF NECESSARY)

MW-4

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ....

Permit No. ....

(1) OWNER: Name CITY OF WALLA WALLA Address C/o Public Works Department P. O. Box 478, Walla Walla, WA 99362

(2) LOCATION OF WELL: County Walla Walla — SW ¼ SW ¼ Sec. 14 T. 7 N., R. 35 E.W.M.

Bearing and distance from section or subdivision corner SW of Sec. 14 – N16°E 1000 FT. (approx.)

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 82 ft. Depth of completed well 82 ft.

(6) CONSTRUCTION DETAILS:

Plastic Casing installed: 5" Diam. from 0 ft. to 82 ft.
Threaded ☐ ......" Diam. from ...... ft. to ...... ft.
Welded ☐ ......" Diam. from ...... ft. to ...... ft.

Perforations: Yes ☒ No ☐
Type of perforator used DRILL
SIZE of perforations 1/4 in. by 6" centers
160 perforations from 62 ft. to 82 ft.
...... perforations from ...... ft. to ...... ft.
...... perforations from ...... ft. to ...... ft.

Screens: Yes ☐ No ☒
Manufacturer's Name ......
Type ...... Model No. ......
Diam. ...... Slot size ...... from ...... ft. to ...... ft.
Diam. ...... Slot size ...... from ...... ft. to ...... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ......
Gravel placed from ...... ft. to ...... ft.

Surface seal: Yes ☒ No ☐ To what depth? 35 ft.
Material used in seal PORTLAND Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ...... Depth of strata ......
Method of sealing strata off ......

(7) PUMP: Manufacturer's Name ......
Type: ...... H.P. ......

(8) WATER LEVELS: Land-surface elevation above mean sea level 810 ft.
Static level 41 ft. below top of well Date 9-14-83
Artesian pressure ...... lbs. per square inch Date ......
Artesian water is controlled by ...... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? ......
Yield: ...... gal./min. with ...... ft. drawdown after ...... hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ......
Bailer test ...... gal./min. with ...... ft. drawdown after ...... hrs.
Artesian flow ...... g.p.m. Date ......
Temperature of water ...... Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Topsoil	0	23
Gravel	23	25
Brown Clay + Gravel	25	38
Sand	35	63
Gravel - water	63	82

RECEIVED
OCT 24 1983
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started 9-8 1983 Completed 9-15 1983

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME HARDING DRILLING Co. (Person, firm, or corporation) (Type or print)

Address RT 3 So 3RD Walla Walla WA

[Signed] Mike Harding (Well Driller)

License No. 173 Date 9-19 1983

13/E4/55

(USE ADDITIONAL SHEETS IF NECESSARY)

MW-5

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No.

Permit No.

(1) OWNER: Name CITY OF WALLA WALLA Address C/o Public Works Department P. O. Box 478, Walla Walla, WA 99362

(2) LOCATION OF WELL: County Walla Walla — NW ¼ SE ¼ Sec. 14 T. 7 N., R. 35E W.M.

Bearing and distance from section or subdivision corner SW of Sec. 14 - N.55°E 4100 FT (approx.)

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 71 ft. Depth of completed well 71 ft.

(6) CONSTRUCTION DETAILS:

Plastic Casing installed: 5" Diam. from 0 ft. to 71 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☐ " Diam. from ft. to ft.

Perforations: Yes ☒ No ☐
Type of perforator used DRILL
SIZE of perforations 1/2 in. by 6 centers in.
160 perforations from 51 ft. to 71 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 40 ft.
Material used in seal PORTLAND Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 310 ft.
Static level 32 ft. below top of well Date 8-5-83
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Topsoil	0	41
Gravel	41	56
Brown Clay & Gravel - water	56	71

RECEIVED
OCT 24 1983
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started 8-1 1983 Completed 8-6 1983

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME HARDING Drilling Co. (Person, firm, or corporation) (Type or print)

Address RT 3 So 3RD Walla Walla Wa.

[Signed] Mike Harding (Well Driller)

License No. 173 Date 9-19, 1983

10/24/83

(USE ADDITIONAL SHEETS IF NECESSARY)

MW-6

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ....

Permit No. ....

(1) OWNER: Name City of Walla Walla Address Box 478

(2) LOCATION OF WELL: County Walla Walla SW ¼ NW ¼ Sec 23 T 7 N., R 35 W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 6

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 2 inches.
Drilled 151 ft. Depth of completed well 151 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 2" Diam. from T 2 ft. to 148 ft.
Threaded ☒ ....." Diam. from ..... ft. to ..... ft.
Welded ☐ ....." Diam. from ..... ft. to ..... ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations ..... in. by ..... in.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type 316 Model No.
Diam. 2 Slot size .010 from 138 ft. to 148 ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes ☒ No ☐ To what depth? ..... ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ..... Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: ..... H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ..... ft.
Static level 63 ft. below top of well Date 10-22-86
Artesian pressure ..... lbs. per square inch Date
Artesian water is controlled by ..... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 8 gal./min. with 2 ft. drawdown after 1 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
00	65	01	63		

Date of test 8-26-86
Bailer test ..... gal./min. with ..... ft. drawdown after ..... hrs.
Artesian flow ..... g.p.m. Date
Temperature of water 53 Was a chemical analysis made? Yes ☐ No ☒

10/29/86

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Topsoil	0	20
Sand + Brown Clay	20	25
Brown Clay	25	77
Sand + Gravel	77	83
Sand	83	95
Brown Clay + Gravel - wat	95	143
Gravel - water	143	151

7 Sacks 10-20 Filter Sand From 151' To 122'

Pumped in 15 Sacks Vol Clay From 122 To 16'

Sand From 16 To 10'

Put in 12 Sacks Cement Fro. 10' To Ground Level

Work started 8-18 1986 Completed 9-18 1986

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Harding Drilling Co (Person, firm, or corporation) (Type or print)

Address Rt 3 Box 67 Walla Walla W.

[Signed] Mike Harding (Well Driller)

License No. 173 Date 10-24, 1986

MW-7

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ......
Permit No. ......

(1) **OWNER:** Name City of Walla Walla Address Box 478

(2) **LOCATION OF WELL:** County Walla Walla SE ¼ SW ¼ Sec 13 T 7 N., R 35 W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 7
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 2 inches.
Drilled 181 ft. Depth of completed well 181 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 2" Diam. from 2 ft. to 178 ft.
Threaded ☐ ...." Diam. from .... ft. to .... ft.
Welded ☐ ...." Diam. from .... ft. to .... ft.

Perforations: Yes ☐ No ☒
Type of perforator used ....
SIZE of perforations .... in. by .... in.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type 304 Model No. ....
Diam. 2 Slot size .010 from 168 ft. to 178 ft.
Diam. .... Slot size .... from .... ft. to .... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ....
Gravel placed from .... ft. to .... ft.

Surface seal: Yes ☒ No ☐ To what depth? .... ft.
Material used in seal ....
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? .... Depth of strata ....
Method of sealing strata off ....

(7) PUMP: Manufacturer's Name ....
Type: .... H.P. ....

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 39 ft. below top of well Date 10-22-86
Artesian pressure .... lbs. per square inch Date ....
Artesian water is controlled by .... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 10 gal./min. with 3 ft. drawdown after 1 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
00	42	01	39		

Date of test 10-13-86
Bailer test .... gal./min. with .... ft. drawdown after .... hrs.
Artesian flow .... g.p.m. Date ....
Temperature of water 53 Was a chemical analysis made? Yes ☐ No ☒

10/29/86 [illegible]

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Topsoil	0	28
Brown Clay	28	40
Brown Clay + Gravel	40	45
Sand	45	68
Sand + Brown Clay	68	79
Brown Clay	79	145
Gravel + a little Brown Clay	145	160
Gravel - water	160	181

7 Sack 10-20 Filter Sand From 181 To 148

Pumped in 15 Sack Vol Clay Fr. 148 To 16'

Put in Sand From 16' To 10'

Put in 9 Sacks Portland Cem To Ground Level

Work started 10-1 1986 Completed 10-21 1986

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Harding Drilling Co (Person, firm, or corporation) (Type or print)

Address RT 3 Box 67 Walla Walla Wn

[Signed] Mike Harding (Well Driller)

License No. 173 Date 10-28 1986

MW-8

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. ______

Water Right Permit No. ______

(1) OWNER: Name City of Walla Walla Address Box 478

(2) LOCATION OF WELL: County Walla Walla NW ¼ NE ¼ Sec 22 T 7N N., R 35 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) ______

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater ☐ Industrial ☒ Test Well ☐ Municipal ☐ Other

(4) TYPE OF WORK: Owner's number of well (if more than one) 12
☐ Abandoned ☒ New well ☐ Deepened ☐ Reconditioned
Method: ☐ Dug ☒ Cable ☐ Rotary ☐ Bored ☐ Driven ☐ Jetted

(5) DIMENSIONS: Diameter of well 10" inches.
Drilled 220 feet. Depth of completed well 130 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 5" Diam. from 130 ft. to +2 ft.
☐ Welded ______" Diam. from ______ ft. to ______ ft.
☐ Liner installed ______" Diam. from ______ ft. to ______ ft.
☒ Threaded

Perforations: Yes ☐ No ☒
Type of perforator used ______
SIZE of perforations ______ in. by ______ in.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type PVC Sch 40 Model No. 1A-98
Diam. 5" Slot size .020 from 90 ft. to 105 ft.
Diam. 5" Slot size .020 from 115 ft. to 130 ft.

Gravel packed: Yes ☒ No ☐ Size of gravel 1/4 To 3/4
Gravel placed from 220 ft. to 130 ft.

Surface seal: Yes ☒ No ☐ To what depth? 75' ft.
Material used in seal Bentonite and Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ______ Depth of strata ______
Method of sealing strata off ______

(7) PUMP: Manufacturer's Name ______
Type: ______ H.P. ______

(8) WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level 59 ft. below top of well Date 10-24
Artesian pressure ______ lbs. per square inch Date ______
Artesian water is controlled by ______ (Cap, valve, etc.))

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 26 gal./min. with 66 ft. drawdown after 4 hrs.
[redacted] " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0:00	125				
:03	95				
:08	59				

Date of test 12-5-89

Bailer test ______ gal./min. with ______ ft. drawdown after ______ hrs.
Airtest ______ gal./min. with stem set at ______ ft. for ______ hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water 52° Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Topsoil	0	21
Silt	21	52
Med-Gravel + Sand	52	58
Med-Gravel	58	63
Med-Gravel + Brown Clay	63	76
Med-Gravel (water)	76	84
Med-Gravel + Brown Clay	84	121
Brown Clay	121	124
Med Gravel (water)	124	132
Brown Clay	132	134
Med-Gravel + Brown Clay	134	168
Brown Clay + Small Gravel	168	175
Med Gravel + Brown Clay	175	178
Brown Clay	178	220

10/20 Filter Sand Around 5" Screens From 130' To 75'

From 75' To 13' - Filled with EnviroPl.

From 13' To 10' - Sand Cushion

From 10' To 0' - Neat Cement

RECEIVED
DEC 28 1989
DEPARTMENT OF ECOLOGY
SPOKANE REGIONAL OFFICE

Work started 10-10 1989 Completed 12-7 1989

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME HARDING DRILLING Co. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address Rt 8 Box 140 Walla Walla Wa.

(Signed) Mike Harding (WELL DRILLER) License No. 173

Contractor's Registration No. HARDIDC132NC Date 12-11 1989

(USE ADDITIONAL SHEETS IF NECESSARY)

8A

MW-8A

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 055642

77/6

Water Right Permit No.

(1) OWNER: Name City of Walla Walla Address Box 478 Walla Walla

(2) LOCATION OF WELL: County Walla Walla SW ¼ SW ¼ Sec 35 T. 7 N., R. 14 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) Walla Walla Land Fill

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☒ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 2 inches.
Drilled 95 feet. Depth of completed well 84 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: ______" Diam. from ______ ft. to ______ ft.
Welded ☐ ______" Diam. from ______ ft. to ______ ft.
Liner installed ☐
Threaded ☒ 2" Diam. from +2 ft. to 63 ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations ______ in. by ______ in.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Stainless Steel Model No 316L
Diam. 2 Slot size .010 from 63 ft. to 28 ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes ☒ No ☐ To what depth? 61 ft.
Material used in seal Cement Vol-Clay
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ______ Depth of strata ______
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: ______ H.P. ______

(8) WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level 62 ft. below top of well Date 11-18-91
Artesian pressure ______ lbs. per square inch Date
Artesian water is controlled by ______ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 15 gal./min. with 3 ft. drawdown after 1 hrs.
Airtest ______ gal./min. with stem set at ______ ft. for ______ hrs.
Artesian flow ______ g.p.m. Date 11-18-91
Temperature of water 57° Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Topsoil	0	21
Silt	21	52
Gravel + Sand	52	58
Gravel - water	58	63
Gravel + Brown Clay	63	76
Gravel - water	76	84
Gravel + Brown Clay	84	95
Vol-Clay From 95 To 84'		
10/20 Filter Sand 84' To 61'		
Vol-Clay From 61' To 10'		
Neat Cement From 10' To 0'		

Work started 10-30, 1991 Completed 11-18, 1991

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Harding Drilling Co. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address Rt 8 Box 106 Walla Walla, W.

(Signed) Mike Harding (WELL DRILLER) License No. 173

Contractor's Registration No. HARDIDC H132KK Date 11-20, 1991

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329- 3

e copy card   Well #9 MW-9

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 055647

Water Right Permit No. ______

(1) OWNER: Name City of Walla Walla   Address Box 478 Walla Walla

(2) LOCATION OF WELL: County Walla Walla   NE ¼ NE ¼ Sec 33 T 7 N., R 35 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) Walla Walla Landfill

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater   Industrial ☐ Test Well ☒   Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 9

Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐   Method: Dug ☐ Cable ☒ Rotary ☐ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10 inches.
Drilled 210 feet. Depth of completed well 83 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 10" Diam. from +1 ft. to 73 ft.
Welded ☐ 5" Diam. from +2 ft. to 83 ft.
Liner installed ☐
Threaded ☐ ___" Diam. from ___ ft. to ___ ft.

Perforations: Yes ☐ No ☒
Type of perforator used ______
SIZE of perforations ___ in. by ___ in.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.
___ perforations from ___ ft. to ___ ft.

Screens: Yes ☐ No ☒
Manufacturer's Name Johnson
Type PVC-Type [illegible]   Model No. ___
Diam. 5" Slot size .010 from 63 ft. to 83 ft.
Diam. ___ Slot size ___ from ___ ft. to ___ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel ___
Gravel placed from ___ ft. to ___ ft.

Surface seal: Yes ☒ No ☐ To what depth? 61 ft.
Material used in seal Vol-Clay [illegible]
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ___ Depth of strata ___
Method of sealing strata off ___

(7) PUMP: Manufacturer's Name Grundfos
Type: Sub. H.P. ½

(8) WATER LEVELS: Land-surface elevation above mean sea level ___ ft.
Static level 65 ft. below top of well Date 10-29-91
Artesian pressure ___ lbs. per square inch Date ___
Artesian water is controlled by ___ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? ___
Yield: ___ gal./min. with ___ ft. drawdown after ___ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ___
Bailer test 15 gal./min. with 5 ft. drawdown after 1 hrs.
Airtest ___ gal./min. with stem set at ___ ft. for ___ hrs.
Artesian flow ___ g.p.m. Date 10-25-91
Temperature of water 54 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Topsoil - Br. clay	0	35
Br. clay	35	47
medium gravel Br. clay	47	55
Sm. gravel Br. clay	55	66
Br. clay	66	68
Sm gravel Br clay water	68	75
Sm gravel Blue clay	75	83
Sm gravel Brown clay	83	102
Brown-Red clay sm gravel	102	119
Sm gravel Brown clay	119	140
Brown-Red clay-sm gravel	140	182
Fine silt & sand light Br clay	182	188
Fine sand light Br clay w/yellow	188	210
Blue clay	210	211

Vol-Clay From 211 To 85
10/20 Filter Sand Around 5" PVC
Screen From 85 To 61
Vol-Clay From 61' To 10'
Neat Cement 10' To 0

Back filled to 83'

Work started 9-20, 1991 Completed Oct 29, 1991

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Harding Drilling Co (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address Rt 8 Box 106 Walla Walla Wa 99
(Signed) Gerald L Harding (WELL DRILLER) License No 1698
Contractor's Registration No. HARDIDC#132NC Date 11-25, 1991

(USE ADDITIONAL SHEETS IF NECESSARY)

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

MW-10

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 0760?
UNIQUE WELL I.D. # AAM
Water Right Permit No. ____

(1) OWNER: Name City of Walla Walla Address ____

(2) LOCATION OF WELL: County Walla Walla — NW 1/4 ____ 1/4 Sec 12 T. 7N N., R.?

(2a) STREET ADDRESS OF WELL (or nearest address) farmers field

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☒ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) MW-10
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☐ Rotary ☐ Bored ☒ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 47 feet. Depth of completed well 45.6 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 2" Diam. from T 3 ft. to 30.6 ft.
Welded ☐ ____" Diam. from ____ ft. to ____ ft.
Liner installed ☐ ____" Diam. from ____ ft. to ____ ft.
Threaded ☒

Perforations: Yes ☐ No ☒
Type of perforator used ____
SIZE of perforations ____ in. by ____ in.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type PVC Sch 40 Model No. ____
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☒ No ☐ Size of gravel 10-20 Sand
Gravel placed from 32 ft. to 47 ft.

Surface seal: Yes ☒ No ☐ To what depth? 30 ft.
Material used in seal Bentonite Chips
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ____ Depth of strata ____
Method of sealing strata off ____

(7) PUMP: Manufacturer's Name N/A
Type: ____ H.P. ____

(8) WATER LEVELS: Land-surface elevation above mean sea level ____ ft.
Static level ____ ft. below top of well Date ____
Artesian pressure ____ lbs. per square inch Date ____
Artesian water is controlled by ____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? ____
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ____
Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.
Airtest ____ gal./min. with stem set at ____ ft. for ____ hrs.
Artesian flow ____ g.p.m. Date ____
Temperature of water ____ Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTI[ON]

Formation: Describe by color, character, size of material and structure, and show thickne[ss] and the kind and nature of the material in each stratum penetrated, with at least one e[ntry for each] change of information.

MW # 10 MATERIAL	FROM
Soft moist silt	0
Hard silt trace of gravel	25
Silt moist med brown	30.6
Hard silt trace of basalt,	40
Gravel fine to course	
saturated	
Perched water	25

Work Started 12-27-93, 19. Completed 12-27-93

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this we[ll, and its] compliance with all Washington well construction standards. Materials [used and] the information reported above are true to my best knowledge and belief.

NAME Environmental West Exp. I. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address ____
(Signed) [signature] (WELL DRILLER) License No. 18
Contractor's Registration No. ENVIRWE101PP Date 12-27

(USE ADDITIONAL SHEETS IF NECESSARY)

TOTAL P.02

LOG OF EXPLORATORY BORING

PROJECT NAME	Stokely USA, Inc.	BORING NO.	10
LOCATION	Walla Walla, Washington	PAGE	1 OF 3
DRILLED BY	Environmental West Exploration	GROUND ELEV.	
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	47.00'
LOGGED BY	Craig Schwyn	DATE COMPLETED	12/27/93

SAMPLING METHOD AND NUMBER	PID (in ppm)	BLOWS PER 6-INCHES	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	LITHOLOGIC COLUMN	WELL DETAILS	LITHOLOGIC DESCRIPTION
				0				0 to 27.0 feet: SILT (ML), grayish brown, trace fine to medium sand, low plasticity, damp.
		5-11-15		5				@ 5.0 feet: no sand, mottled white, 1/8-inch laminations.
		8-7-8		10				@ 10.0 feet: light olive brown, trace angular fine sand.
		3-5-6		15				@ 14.5 to 14.8 feet: lense with some medium to fine sand.
		4-4-4		20				

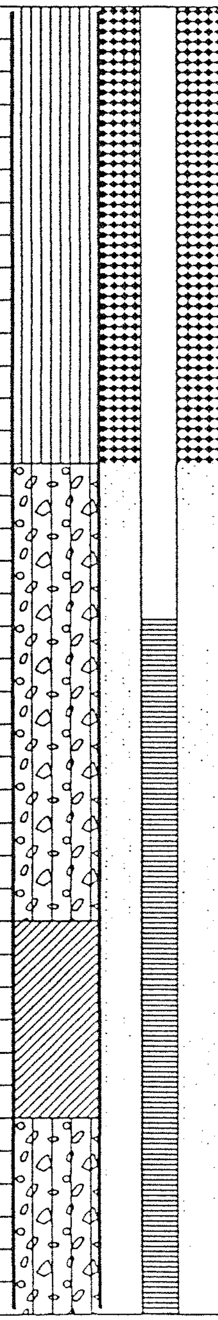
REMARKS

EMCON Northwest, Inc.

LOG OF EXPLORATORY BORING

PROJECT NAME	Stokely USA, Inc.	BORING NO.	10
LOCATION	Walla Walla, Washington	PAGE	2 OF 3
DRILLED BY	Environmental West Exploration	GROUND ELEV.	
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	47.00'
LOGGED BY	Craig Schwyn	DATE COMPLETED	12/27/93

SAMPLING METHOD AND NUMBER	PID (in ppm)	BLOWS PER 6-INCHES	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	LITHOLOGIC COLUMN	WELL DETAILS	LITHOLOGIC DESCRIPTION
								0 to 27.0 feet: SILT (ML), continued.
		5-7-30	2-7-22					
				25				@ 25.0 feet: trace sand, mottled brown and reddish brown, saturated.
								27.0 to 34.0 feet: SILTY GRAVEL (GM), reddish brown, little fine to coarse sand with some silt. Angular basalt gravel up to 1 1/2-inch diameter.
		33-38-50						
				30				
		1-1-1						34.0 to 37.0 feet: GRAVELLY SILT (CL), silt with some gravel, very soft.
				35				
								37.0 to 47.0 feet: SILTY GRAVEL (GM), reddish brown, little fine to coarse sand, angular basalt gravel, very hard drilling.
				40				



REMARKS

EMCON Northwest, Inc.

LOG OF EXPLORATORY BORING

PROJECT NAME	Stokely USA, Inc.	BORING NO.	10
LOCATION	Walla Walla, Washington	PAGE	3 OF 3
DRILLED BY	Environmental West Exploration	GROUND ELEV.	
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	47.00'
LOGGED BY	Craig Schwyn	DATE COMPLETED	12/27/93

SAMPLING METHOD AND NUMBER	PID (in ppm)	BLOWS PER 6-INCHES	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	LITHOLOGIC COLUMN	WELL DETAILS	LITHOLOGIC DESCRIPTION
								37.0 to 47.0 feet: SILTY GRAVEL (GM), continued.
				45				
								@ 47.0 feet: no sample attempt: hard gravel.
								Total depth drilled = 47.0 feet.
				50				
				55				
				60				

WELL COMPLETION DETAILS:
+2.3 to 29.4 feet: 2-inch-diameter, flush-threaded, schedule 40 PVC blank riser pipe.
29.4 to 44.7 feet: 2-inch-diameter, flush-threaded, schedule 40 PVC well screen with 0.010-inch machined slots and a 2-inch-diameter threaded end cap.
+3.0 to 3.0 feet: 6-inch-diameter, locking steel riser pipe.

+0.4 to 2.0 feet: Concrete.
2.0 to 27.0 feet: Bentonite chips hydrated with potable water.
27.0 to 47.0 feet: 10 - 20 Colorado Silica Sand.

REMARKS

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 17772
UNIQUE WELL I.D. # ABJ 926
Water Right Permit No. ______

(1) OWNER: Name City of Walla Walla Address P.O. Box 478 Walla Walla, WA 99362

(2) LOCATION OF WELL: County Walla Walla — NE 1/4 NE 1/4 Sec 22 T. 7N N., R 35E W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) Walla Walla, landfill

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☒ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (If more than one) MW# 11
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☐ Rotary ☐ Bored ☒ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 41 feet. Depth of completed well 41 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 2" Diam. from +3 ft. to 26 ft.
Welded ☐ ______" Diam. from ______ ft. to ______ ft.
Liner installed ☐
Threaded ☒ ______" Diam. from ______ ft. to ______ ft.

Perforations: Yes ☐ No ☒
Type of perforator used ______
SIZE of perforations ______ in. by ______ in.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type PVC Sch40 Model No. ______
Diam. 2" Slot size .010 from 26 ft. to 41 ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes ☒ No ☐ Size of gravel 10/20 Sand
Gravel placed from 23 ft. to 41 ft.

Surface seal: Yes ☒ No ☐ To what depth? 23 ft.
Material used in seal Bentonite Chips
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ______ Depth of strata ______
Method of sealing strata off ______

(7) PUMP: Manufacturer's Name N/A
Type: ______ H.P. ______

(8) WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level ______ ft. below top of well Date ______
Artesian pressure ______ lbs. per square inch Date ______
Artesian water is controlled by ______ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? ______
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
" " " "
" " " "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ______
Bailer test ______ gal./min. with ______ ft. drawdown after ______ hrs.
Airtest ______ gal./min. with stem set at ______ ft. for ______ hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water ______ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MW# 11 MATERIAL	FROM	TO
silt, dark brown saturated at 29 ft.	0	41

Work Started 2-10, 1995 Completed 2-10, 1995

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Environmental West Exploration (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address P.O. Box 11095, Spokane WA
(Signed) Dan Claassen (WELL DRILLER) License No. 1827

Contractor's Registration No. ENVIROEW011PP Date 2-11, 1995

(USE ADDITIONAL SHEETS IF NECESSARY)

LOG OF EXPLORATORY BORING

PROJECT NAME	Walla Walla, Washington	BORING NO.	MW-11
LOCATION	Sudbury Road Landfill	PAGE	1 OF 2
DRILLED BY	Environmental West	GROUND ELEV.	791.65'
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	41.00'
LOGGED BY	John Latta	DATE COMPLETED	02/10/95

SAMPLING METHOD AND NUMBER	GROUND WATER LEVELS	BLOWS PER 6 INCHES	DEPTH IN FEET
SS		14-16-30	5
SS		12-20-29	10
SS		4-5-8	15
SS		2-4-8	20
SS		6-14-24	25
SS	∇ 2/10/95 29.50'	4-6-11	30
SS		9-15-23	35
			40

LITHOLOGIC DESCRIPTION

0 to 14.0 feet: SILT (ML), dark olive gray, stiff, damp. Mottled appearance. Roots. Micaceous. (FILL)

14.0 to 41.5 feet: SILT (ML), light brownish gray, a few percent fine to medium sand, soft, damp. (ALLUVIUM)

@ 15.0 feet: roots.

@ 25.0 feet: light orange gray locally due to mottled iron oxide staining, stiff.

@ 30.0 feet: wet, mottled iron oxide stain.

@ 35.0 feet: mottled iron oxide stain, micaceous, wet.

REMARKS

(1) Washington Department of Ecology Unique Well No. ABJ 926. (2) SS = Split-spoon sampler driven by a 140-pound hammer with a 30-inch drop. Split-spoon is 2-1/2 I.D. unless otherwise noted. (3) Consistency of fines based upon blow counts.

EMCON

LOG OF EXPLORATORY BORING

PROJECT NAME	Walla Walla, Washington	BORING NO.	MW-11
LOCATION	Sudbury Road Landfill	PAGE	2 OF 2
DRILLED BY	Environmental West	GROUND ELEV.	791.65'
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	41.00'
LOGGED BY	John Latta	DATE COMPLETED	02/10/95

SAMPLING METHOD AND NUMBER	GROUND WATER LEVELS	BLOWS PER 6 INCHES	DEPTH IN FEET	SAMPLES	BORING DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
SS		11-30-50/5"					**14.0 to 41.5 feet: SILT (ML)**, continued. @ 40.0 feet: orange gray to light brownish gray, very stiff to hard, wet, mottled iron oxide stain.
							Total depth drilled = 41.0 feet. Total depth sampled = 41.5 feet.
			45				
							WELL COMPLETION DETAILS:
							0 to 25.5 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC blank riser pipe.
			50				25.5 to 40.5 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC well screen with 0.010-inch machined slots (screened 26.0 to 40.0 feet).
							40.5 to 41.0 feet: 2-inch-diameter threaded end cap.
			55				0 to 1.0 foot: Concrete.
							1.0 to 23.0 feet: Bentonite chips hydrated with potable water.
			60				23.0 to 41.0 feet: 10 - 20 Colorado Silica Sand.
			65				
			70				
			75				
			80				

REMARKS

(1) Washington Department of Ecology Unique Well No. ABJ 926. (2) SS = Split-spoon sampler driven by a 140-pound hammer with a 30-inch drop. Split-spoon is 2-1/2 I.D. unless otherwise noted. (3) Consistency of fines based upon blow counts.

EMCON

LOG OF EXPLORATORY BORI Decommissioned August 28, 2008

PROJECT NAME	Walla Walla, Washington	BORING NO.	MW-12
LOCATION	Sudbury Road Landfill	PAGE	1 OF 2
DRILLED BY	Environmental West	GROUND ELEV.	823.53'
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	62.00'
LOGGED BY	John Latta	DATE COMPLETED	02/10/95

SAMPLING METHOD AND NUMBER	GROUND WATER LEVELS	BLOWS PER 6 INCHES	DEPTH IN FEET
SS		2-4-6	5
SS		9-13-17	10
SS		9-20-20	15
SS		14-20-25	20
SS		7-26-40	25
SS		29-50/5"	30
SS		36-33-39	35
			40

SAMPLES | BORING DETAILS | LITHOLOGIC COLUMN

LITHOLOGIC DESCRIPTION

0 to 17.0 feet: SILT (ML), light brownish gray with a trace of fine to medium sand, stiff, damp. Bedded and laminated locally. Micaceous.

17.0 to 23.0 feet: CLAYEY SILT (ML/CL), light brownish gray to brown, silt with a little to few percent clay, very stiff, damp. Laminated and bedded.

23.0 to 45.0 feet: SILT (ML), light brownish gray to brown, hard, damp.

@ 30.0 feet: 1/2-inch-thick vertical clastic dike filled with fine to medium sand.

REMARKS

(1) Washington Department of Ecology Unique Well No. ABJ 927. (2) SS = Split-spoon sampler driven by a 140-pound hammer with a 30-inch drop. Split-spoon is 2-1/2 I.D. unless otherwise noted. (3) Consistency of fines based upon blow counts.

EMCON

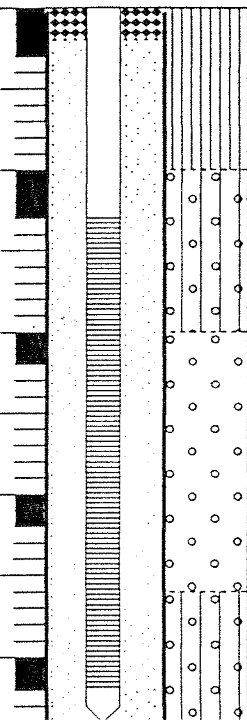
LOG OF EXPLORATORY BORING

Decommissioned August 28, 2008

PROJECT NAME	**Walla Walla, Washington**	BORING NO.	**MW-12**
LOCATION	**Sudbury Road Landfill**	PAGE	**2 OF 2**
DRILLED BY	**Environmental West**	GROUND ELEV.	**823.53'**
DRILL METHOD	**Hollow Stem Auger**	TOTAL DEPTH	**62.00'**
LOGGED BY	**John Latta**	DATE COMPLETED	**02/10/95**

SAMPLING METHOD AND NUMBER	GROUND WATER LEVELS	BLOWS PER 6 INCHES	DEPTH IN FEET
SS		14-30-50/3"	
3" SS		8-23-50	45
3" SS	▽ 2/10/95 50.75'	40-50/5"	50
3" SS		9/1'-50/4"	55
3" SS		6/1"-50/2"	60
			65
			70
			75
			80

SAMPLES / BORING DETAILS / LITHOLOGIC COLUMN



LITHOLOGIC DESCRIPTION

23.0 to 45.0 feet: SILT (ML), continued.
@ 40.0 feet: mottled appearance due to caliche.

45.0 to 50.0 feet: SILTY GRAVEL (GP-GM), brown, medium to coarse subrounded basaltic gravel and some silt, hard, wet.

50.0 to 58.0 feet: GRAVEL (GP), dark brownish gray, coarse to medium subrounded basaltic gravel, a few percent fine subrounded basaltic gravel, a few percent coarse to fine sand, and a trace silt, hard drilling, wet to moist.

58.0 to 62.0 feet: SILTY SANDY GRAVEL (GP-GM), brown, fine subrounded basaltic gravel with a few percent of medium to coarse; subrounded basaltic gravel, some coarse to medium sand, some fine sand and some silt, hard drilling, wet.

Total depth drilled = 62.0 feet.
Total depth sampled = 62.0 feet.

WELL COMPLETION DETAILS:

0 to 46.5 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC blank riser pipe.
46.5 to 61.5 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC well screen with 0.010-inch machined slots (screened 47.0 to 61.0 feet).
61.5 to 62.0 feet: 2-inch-diameter threaded end cap.

0 to 41.0 feet: Bentonite chips hydrated with potable water.
41.0 to 62.0 feet: 10 - 20 Colorado Silica Sand.

REMARKS

(1) Washington Department of Ecology Unique Well No. ABJ 927. (2) SS = Split-spoon sampler driven by a 140-pound hammer with a 30-inch drop. Split-spoon is 2-1/2 I.D. unless otherwise noted. (3) Consistency of fines based upon blow counts.

EMCON

Decommissioned August 28, 2008 MW-12

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. R 17774
UNIQUE WELL I.D. # ABJ 927
Water Right Permit No. ______

(1) OWNER: Name City of Walla Walla Address P.O. Box 478 Walla Walla, WA 99362

(2) LOCATION OF WELL: County Walla Walla SE 1/4 SW 1/4 Sec 14 T. 7 N., R 36E W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) Walla Walla land fill

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater Industrial ☐ Test Well ☒ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (If more than one) MW #12
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☐ Rotary ☐ Bored ☒ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 62 feet. Depth of completed well 62 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 2" Diam. from +3 ft. to 47 ft.
Welded ☐ ______" Diam. from ______ ft. to ______ ft.
Liner installed ☐ ______" Diam. from ______ ft. to ______ ft.
Threaded ☒

Perforations: Yes ☐ No ☒
Type of perforator used ______
SIZE of perforations ______ in. by ______ in.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type PVC Sch 40 Model No. ______
Diam. 2" Slot size .010 from 47 ft. to 62 ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes ☒ No ☐ Size of gravel 10/20 sand
Gravel placed from 41 ft. to 62 ft.

Surface seal: Yes ☒ No ☐ To what depth? 41 ft.
Material used in seal Bentonite chips
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? ______ Depth of strata ______
Method of sealing strata off ______

(7) PUMP: Manufacturer's Name N/A
Type: ______ H.P. ______

(8) WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level ______ ft. below top of well Date ______
Artesian pressure ______ lbs. per square inch Date ______
Artesian water is controlled by ______ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? ______
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ______
Bailer test ______ gal./min. with ______ ft. drawdown after ______ hrs.
Airtest ______ gal./min. with stem set at ______ ft. for ______ hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water ______ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MW #12 MATERIAL	FROM	TO
silt, light brown, dry	0	20
clayey silt, brown	20	25
silt, dark brown dry	25	45
silty gravel, cobbles, some fine sand.	45	62
saturated at 50 ft.		

Work Started 2-9, 19 95 Completed 2-10, 19 95

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Environmental West Exploration (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address P.O. Box 11095, Spokane WA
(Signed) Dan Classen (WELL DRILLER) License No. 1827
Contractor's Registration No. ENVIRWE101PP Date 2-11, 19 95

(USE ADDITIONAL SHEETS IF NECESSARY)

Garver Well

Appli. 8758
Per. 8090

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
DIVISION OF WATER RESOURCES

WELL LOG

Record by Driller

Source Driller's Record

Location: State of WASHINGTON

County Walla Walla

Area

Map

NE ¼ SW ¼ sec 14 T 7 N., R 35E. E. W.

Diagram of Section

Drilling Co. Moore & Anderson

Address P. O. Box 1228- Walla Walla, Washington

Method of Drilling cable Date November 30 19 67

Owner Richard Garver

Address P. O. Box 1002 Walla Walla, Washington

Land surface, datum ft. above below

SWL: 150' Date Dec. 8, 19 67 Dims.: 12x10"x 1227

CORRELATION	MATERIAL	From (feet)	To (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	Irrigation		
	Clay and soil	0	29
	Clay w/coarse sand & some gravel, brn	3	32
	Clay, brown, some gravel	11	43
	Clay, brown	28	71
	Clay and gravel	3	74
	Gravel	14	88
	Clay & gravel	5	93
	Gravel (water to drill with at 116')	57	150
	Gravel with clay	10	160
	Gravel (Static level 100')	19	179
	Gravel & clay	18	197
	Gravel	13	210
	Clay & Gravel, sticky brown	6	216
	Clay, gray	4	220

Turn up

Sheet ___ of ___ sheets

Garver Well

WELL LOG.—Continued No........../..........-..........

Correlation	Material	From (feet)	To (feet)
	Depth forward		
	Clay, greenish gray	68	288
	Clay, blue	21	309
	Clay, dark blue	25	334
	Clay, dark, green	38	372
	Clay, lighter green with some hard shale	10	382
	Clay, dark green	28	410
	Shale, dark gray, hard	2	412
	Rock & Gravel, broken with some clay	10	422
	Shale, brwon	10	432
	Gravel, with some clay	13	445
	Clay, brown	14	459
	Clay, brown, sticky	3	462
	Clay, brown	35	497
	Clay, blue	25	522
	Shale, blue	10	532
	Blackrock	8	540
	Rock, gray	10	550
	Soapstone, yellow-white, red-dish brn.	6	556
	Rock, reddish brown, harder	4	560
	Rock, gray, hard	57	617
	Rock, dark gray	23	640
	Rock, dark gray, softer	10	650
	Rock, black w/some blue, broken soapstone (Static level 200')	13	663
	Rock, black	23	686
	Rock, black w/ grn shale	33	719
	Shale, brown	2	721
	Rock, black	9	730
	Rock, blck w/blue soapstone	27	757
	Rock, black(Static level 173')	24	781

Garver Well

STATE OF WASHINGTON
DEPARTMENT OF CONSERVATION
DIVISION OF WATER RESOURCES

WELL LOG

Record by..........

Source..........

Location: State of WASHINGTON

County..........

Area..........

Map..........

......1/4 ......1/4 sec......T......N., R...... E. W.

Diagram of Section

Drilling Co...........

Address..........

Method of Drilling.......... Date.........., 19......

Owner..........

Address..........

Land surface, datum..........ft. above below

SWL:.......... Date.........., 19...... Dims.:..........

Correlation	Material	From (feet)	To (feet)
	(Transcribe driller's terminology literally but paraphrase as necessary, in parentheses. If material water-bearing, so state and record static level if reported. Give depths in feet below land-surface datum unless otherwise indicated. Correlate with stratigraphic column, if feasible. Following log of materials, list all casings, perforations, screens, etc.)		
	Rock, black, harder	15	796
	Rock, black, softer	33	829
	Rock, gray, softer	36	865
	Rock, gray, hard	11	876
	Rock, black	176	1052
	Rock, gray	9	1061
	Rock, black(Water at 1077')	137	1198
	Changed to 10" hole at 1100'		
	Static level 169' hole at 1131'		
	Static level 162' hole at 1136'		
	Static level 159' hole at 1151'		
	Static level 157' hole at 1170'		
	Rock, gray	2	1200
	Rock, black (Static level 155')	18	1218
	Rock, gray " " 154'	9	1227
	After pumping Static level was	at 150'	

Turn up

Sheet......of......sheets

Log of Exploration

Exploration No. **MW-12b**

Project: City of Walla Walla Sudbury Road Landfill Monitoring Well MW-12 Replacement

Start Date: 8/28/2008
Finish Date: 8/29/2008
Weather Conditions: Clear, Warm
Geologist: Craig Schwyn
Driller: Environmental West Exp.
Method: 6-in dia. TUBEX

Well Construction
Ground El: 825.37 PVC Casing El: 828.26 Datum: NAVD 88
Total Depth (BGL): 80.5 ft
Completion: 6-in. dia. locking steel monument with concrete surface pad
Seal (BGL): Bentonite chips 1.5 to 58 ft
Sandpack (BGL): Colo. silica sand (6 ft 10/20 & 16.5 ft 20/40) 58 to 80.5 ft.
Casing: 2-in. dia. flush threaded PVC +2.8 to 60.0 ft BGL
Screen: 0.01-in. slot PVC 60 to 80 ft BGL, with 4 in. bottom cap

Water Level Information

Date:	8/28/08	8/29/08
Time:	3:00	1:40
Depth to Water (ft BGL):	59.7	
Depth to Water (ft BTOC):		62.20

Sample Number	Sample Interval Top / Bot	Blows per 6-inch Interval	Sampler Type	Depth (feet)	USCS Symbol	Sample Description	Comments Drilling Action
	0		Grab	0	**ML**	Light brown **Silt**, trace sand, low plasticity, laminated, soft, dry.	
				1			
				2			
				3			
				4			
	5		Drill Chips	5			
				6			
				7			
				8			
	9.5 / 11	10 / 12 / 11	1.5-in SPT	9		Damp	
				10			
				11			
				12			
				13			
				14			
	15		Drill Chips	15			
				16			
				17			
				18			
	19.5 / 21	7 / 10 / 14	1.5-in SPT	19		Moist	
				20			

Schwyn Environmental Services

Log of Exploration

Exploration No. **MW-12b**

Sheet 2 of 5

Project: City of Walla Walla Sudbury Road Landfill Monitoring Well MW-12 Replacement

Sample Number	Sample Interval Top/Bot	Blows per 6-inch Interval	Sampler Type	Depth (feet)	USCS Symbol	**Sample Description**	Comments Drilling Action
				21	**ML**	Light brown **Silt** (continued) trace sand, low plasticity, laminated, stiff, moist.	
				22			
				23			
				24			
	25		Drill Chips	25			
				26			
				27			
				28			
				29			
	29.5 / 31	12 / 16 / 17	1.5-in SPT	30			
				31			
				32			
				33			
				34			
	35		Drill Chips	35			
				36			
				37			
				38			
				39		Clayey silt, whitish mottling, moderate plasticity.	
	39.5 / 41	8 / 12 / 16	1.5-in SPT	40			
				41			
				42			
				43			
				44			
	45		Drill Chips	45			

Log of Exploration

Project: City of Walla Walla Sudbury Road Landfill Monitoring Well MW-12 Replacement

Sample Number	Sample Interval Top / Bot	Blows per 6-inch Interval	Sampler Type	Depth (feet)	USCS Symbol	Sample Description	Comments Drilling Action
				46	ML	Light brown **Silt** (continued) trace sand, low plasticity, laminated, stiff, moist.	
				47			
				48			Drilling slows @ 48'
	49.5 / 50	100 / 8"	1.5-in SPT	49–50	GM	Brown silty **Gravel** with sand, 0.5 - 1" sub-rounded basalt gravel, up to 40% clay/silt matrix, very dense, moist.	
				51–54			
	55		Drill Chips	55		Dark brown, sandy Gravel with little silt.	
				56–58			
	59.5 / 61	9 / 16 / 25	1.5-in SPT	59–60	SM	Dark reddish brown fine **Sand** with little silt, dense, wet. @ 60.5: Whitish brown Silt with some fine sand.	∇ ATD Water @ 59.7' BGL
				61	GM	Grayish brown gravely **Sand** with silt. Sub-rounded gravel up to 1/2 inch, very dense, wet.	Interlayered wet and moist zones from 60 to 72 ft.
				62–63			
	64.5 / 65	100 / 6"	1.5-in SPT	64–65		Dark brown fine **Gravel** with silty sand matrix, sub-angular gravel, approx. 40% silty sand matrix, very dense, wet.	
				66–68			
	69.5 / 71	6 / 8 / 15	1.5-in SPT	69–70	ML	Reddish brown **Silt** with clay and little fine to medium sand, with clay and little fine to medium sand, hematite red staining,	

Project: City of Walla Walla Sudbury Road Landfill Monitoring Well MW-12 Replacement

Sample Number	Sample Interval Top / Bot	Blows per 6-inch Interval	Sampler Type	Depth (feet)	USCS Symbol	Sample Description	Comments Drilling Action
				71–72	ML	Reddish brown **Silt** (continued) with clay and little fine to medium sand, hematite red staining, very stiff, moist to wet.	
				72–73			Drilling slows
	74.5 / 75	100 / 5"	1.5-in SPT	74–75	GM	Grayish brown **Gravel** with little silty sand, sub-rounded basaltic gravel up to 1.5 inches, very dense, wet.	
				76			Producing substantial water
	79.5 / 80	100 / 7"	1.5-in SPT	79–80		Approximate 30% silt sand matrix	Water @ 59.7' BGL

Boring terminated at 80.5 ft

Notes:
1. Lithologic descriptions and stratigraphic contacts are based on field interpretations and are approximate.
2. Refer to "Soil Classification and Key" figure for explanation of graphics and symbols.
3. BGL = below ground level
4. BTOC = blow top of casing
5. ATD = at time of drilling

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COURSE GRAINED SOILS More than 50% retained on No. 200 sieve	**GRAVEL** More than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND More than 50% of coarse fraction retained on No. 4 sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% passes No. 200 sieve	**SILT AND CLAY** liquid limit less than 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY liquid limit more than 50	INORGANIC	MH	HIGH-PLASTICITY SILT, ELASTIC SILT
			CH	HIGH-PLASTICITY CLAY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

Notes:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488.
2. Where laboratory index testing has been conducted, soil classification is based on ASTM D2487.
3. USCS group symbols correspond to the symbols used by the Unified Soil Classification System and ASTM Classification methods.

Schwyn Environmental Services

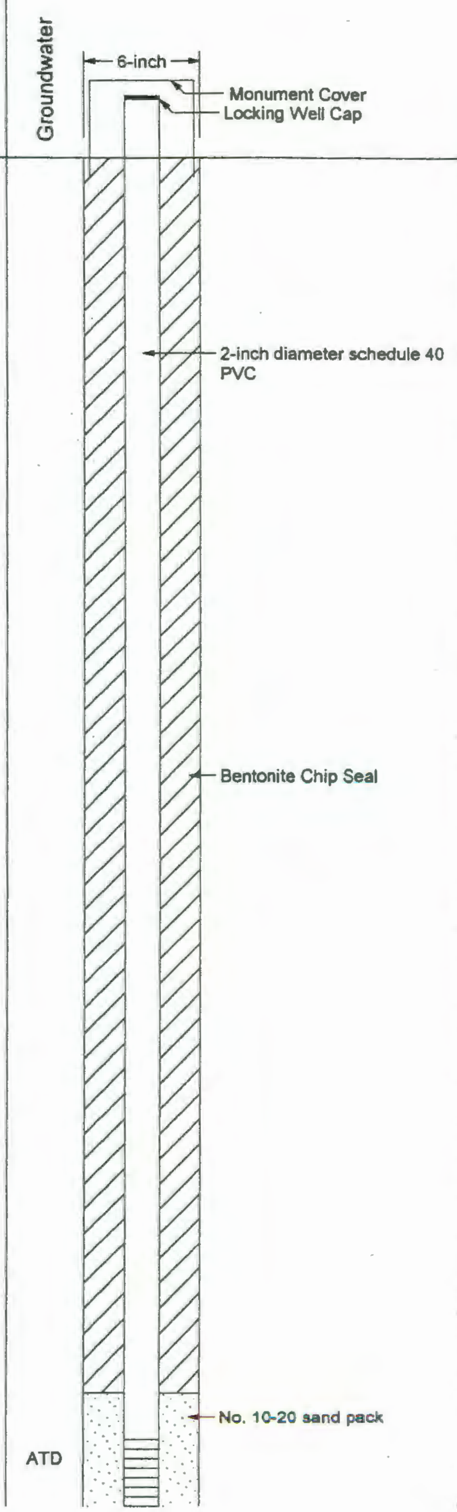
Soil Classification and Key

MW-14 Decommissioned May 8, 2012

SAMPLE DATA / SOIL PROFILE / WELL DETAIL

Drilling Method: Hollow-stem Auger
Ground Elevation (ft): 831 (MSL)
Drilled By: Environmental West

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Soil Description
0					ML	**Brown SILT.** Silt with trace clay. Low plasicity. Very stiff. Damp.
	1	b2	22			
10	2	b2	27			
	3	b2	41			
20	4	b2	33			
						Light brown silt with trace subangular fine sand. Low plasticity. Very stiff. Wet.
	5	b2	42			
30	6	b2	45			
	7	b2	53			
40	8	b2	36			
	9	b2	45			
50	10	b2	38			
	11	b2	33			Moisture increasing.
60	12	b2	23			
	13	b2	NA			
70						



Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Log of Boring and Well MW-14

MW-14

Decommissioned May 8, 2012

SAMPLE DATA					SOIL PROFILE			WELL DETAIL	
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): 831 (MSL) Drilled By: Environmental West	Groundwater	
70	14	b2	35			ML	Silt with clay, and fine to medium angular sand. Capillary fringe. Wet.		2-inch diameter schedule 40 PVC screen (0.010-inch slot size) with No. 10-20 sand pack
	15	b2	22						
80						GM	**SILTY GRAVEL with sand.** Based on drilling action.		Threaded end cap.

Boring Completed 08/12/99
Total Depth of Boring = 82.0 ft.

Well Completed 08/12/99
Elevation at Top of Protective Casing = 833.46 ft.
Elevation at Top of Well Casing = 833.23 ft.
Total Depth of Well = 82 ft.

90

100

110

120

130

140

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Log of Boring and Well MW-14

MW-15

SAMPLE DATA | SOIL PROFILE | GROUNDWATER

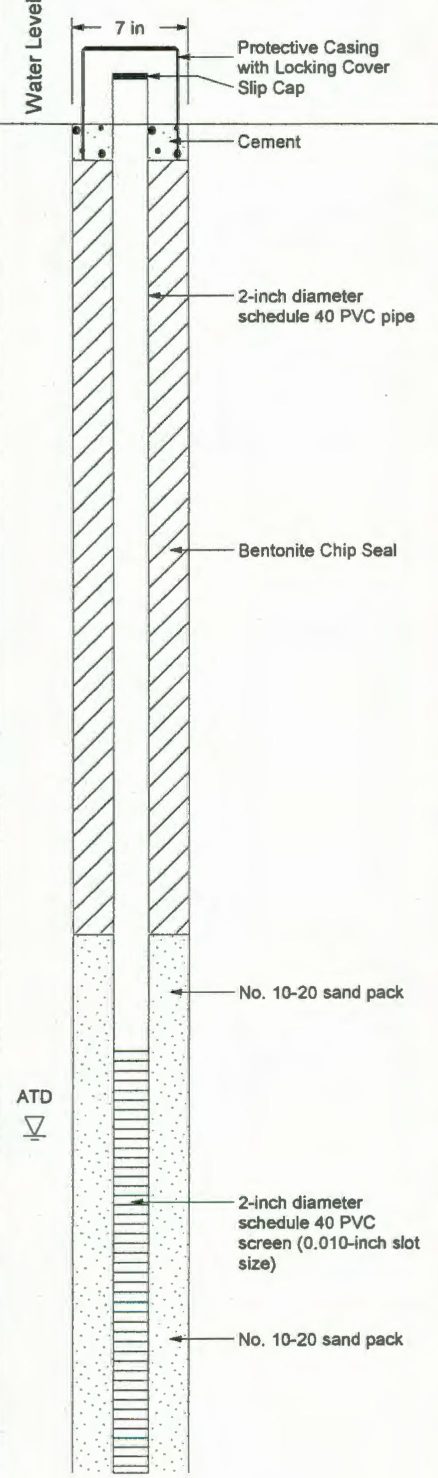
Drilling Method: TUBEX Air Rotary

Ground Elevation (ft): 787.0 (MSL)

Drilled By: Environmental West

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Description	Water Level
0						ML ML	Brown SILT. Low plasticity. moist.	
5								
10	D-1	b2	21			ML	Brown SILT. Low plasticity. Very stiff, moist.	
15								
20	D-2	b2	36			ML	Brown SILT. Low plasticity. Very stiff, moist.	
25								
30	D-3	b2	50/4"			ML	Brown SILT interbedded with 1/4-inch lenses of fine, basalt sand. Subangular. Hard, very moist to wet.	ATD ▽
35	D-4	b2	85			ML	Brown SILT. Hard, moist.	
40								

Well Detail



Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

MW-15

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Soil Profile	Water Level	Well Detail
						Drilling Method: TUBEX Air Rotary Ground Elevation (ft): 787.0 (MSL) Drilled By: Environmental West		
40	D-5	b2	66		ML	Brown SILT with trace of sand and 1-inch rounded gravel. Hard, wet.		
					ML GW			Threaded end cap.
45	D-6	b2	50/5"			Brown sandy GRAVEL with silt. Surounded. Very dense, wet.		

Boring Completed 07/17/01
Total Depth of Boring = 46.5 ft.

Well Completed 07/17/01
Total Depth of Well = 43.0 ft.

50

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80

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL[1]	TYPICAL DESCRIPTIONS[2][3]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to the symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM) for a sand or gravel indicate a soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50%	- "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50%	- "very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30%	- "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15%	- "with gravel," "with sand," "with silt," etc.
	≤ 5%	- "trace gravel," "trace sand," "trace silt," etc., or not noted.

Drilling and Sampling Key

SAMPLE NUMBER & INTERVAL

- Sample Identification Number
- Recovery Depth Interval
- 1 — Sample Depth Interval
- Portion of Sample Retained for Archive or Analysis

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Other - See text if applicable

Groundwater

▽ ATD — Approximate water elevation at time of drilling (ATD) or on date noted. Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.

Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Landau Associates

Sudbury Road Landfill
Walla Walla, Washington

Soil Classification System and Key

Figure A-1

Log of Exploration

Monitoring Well ID: MW-16

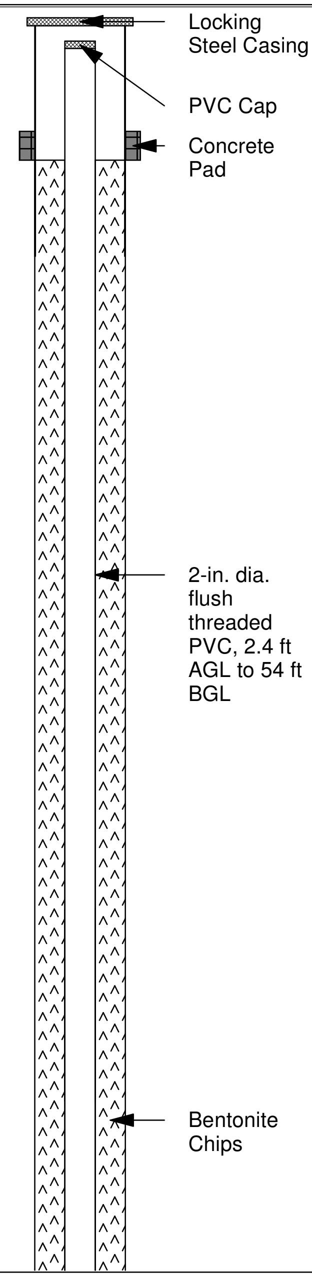
Drill Date: 8/31/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: 6" Tubex
Sample Method: Grab/2.4" SS
Boring Diameter: 6.5-in
Boring Depth (ft BGS): 69 ft.
Groundwater (ft BTOC): 58.02

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Surf Elev. & Datum: 810.9 ft. MSL
Casing Elevation: 813.39 ft. MSL
Coordinate System: NAD 83
Latitude/Northing: 278,211.43
Longitude/Easting: 2,169,578.97

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Grab			0		ML: Brown Silt, trace sand and clay, low plasticity, damp.
Drill Chips					
Drill Chips					
Drill Chips					
Drill Chips					
Drill Chips					

Well Construction Detail

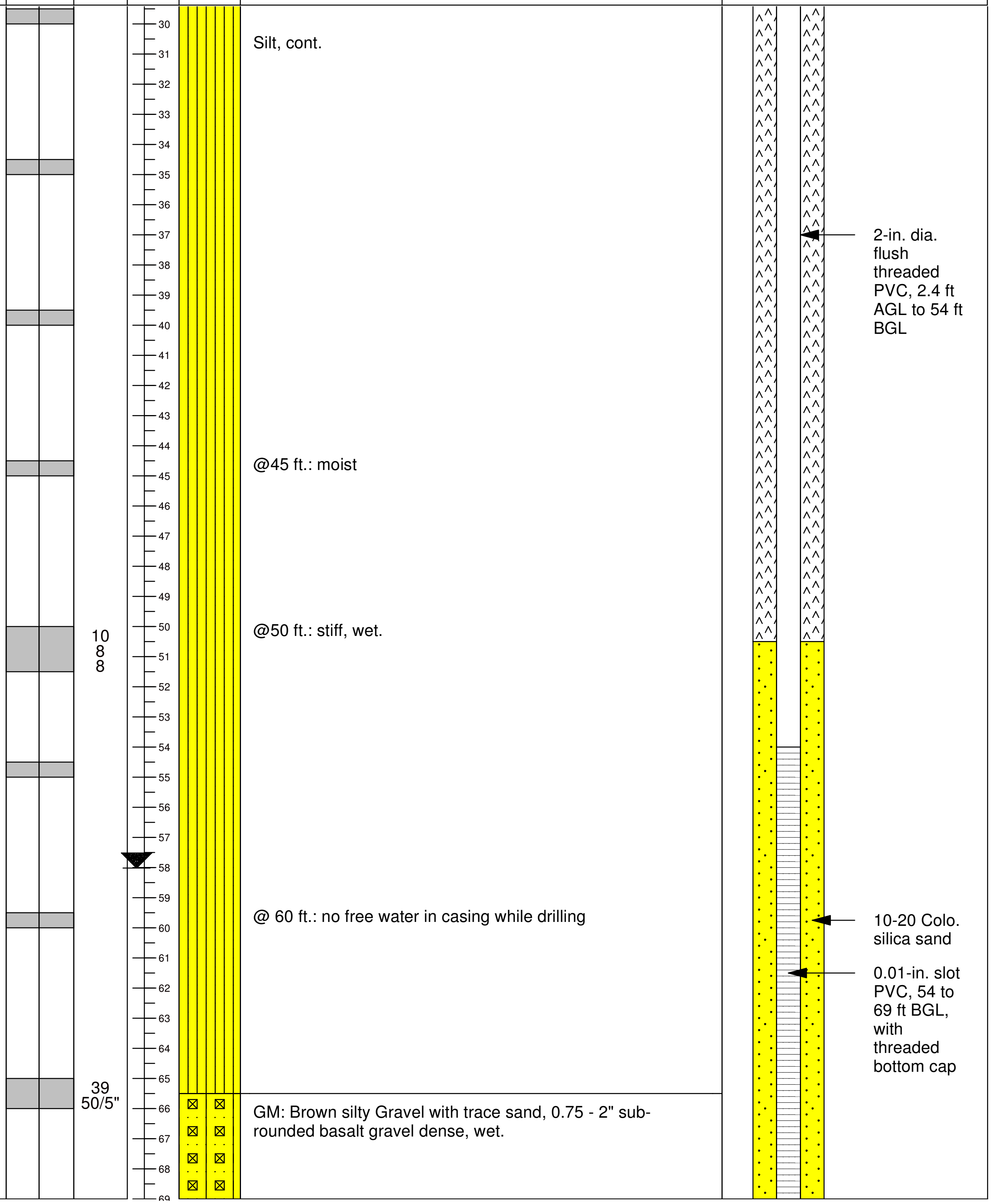


Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Monitoring Well ID: MW-16

SAMPLE TYPE / ID	BLOW COUNT	DEPTH FT BGS	Sample Description
Drill Chips		30	Silt, cont.
Drill Chips		35	
Drill Chips		40	
Drill Chips		45	@45 ft.: moist
2.4-in SS	10 8 8	50	@50 ft.: stiff, wet.
Drill Chips		55	
Drill Chips		60	@ 60 ft.: no free water in casing while drilling
2.4-in SS	39 50/5"	65	GM: Brown silty Gravel with trace sand, 0.75 - 2" sub-rounded basalt gravel dense, wet.

Column headings: SAMPLE TYPE / ID; DRIVE / RECOVERY; BLOW COUNT; DEPTH FT BGS; USCS SYMBOL; Sample Description; Well Construction Detail



Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

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Log of Exploration

Exploration No. GW-5

Sheet 1 of 3

Start Date: 8/6/2009	**Landfill Gas Well Completion** Surface Elevation: 841.05 ft MSL
Finish Date: 8/6/2009	Total Boring Depth (BGL): 48.5 ft Total Casing Depth (BTOC): 32.80 ft
Weather Conditions: Warm, Windy	Completion: Locking steel above ground monument with concrete surface pad
Geologist: Craig Schwyn	Seal (BGL): Bentonite chips, 2 to 18.3 ft and 35 to 48.5 ft
Drilling Method: 6-in dia. Sonic	Gravel pack (BGL): 5/8-minus rounded gravel, 18.3 to 35 ft
Sample Method: 4-in. dia. Core	Casing: 1/2-in. dia. flush threaded Sch. 80 PVC, +2.80 to 25 ft BGL
Operator: Enviro. West Exp.	Screen (BGL): 0.03-in. slot Sch. 80 PVC, 25 to 30 ft BGL, with bottom cap

Project: Walla Walla Sudbury Road Landfill Onsite RI

Sample Number	Sample Interval Top / Bot	Blow Counts / 6-in.	Sampler Type	Depth (feet)	USCS Symbol	Sample Description	Comments Drilling Action
	0 / 7		4-in Core	1	ML	Grayish brown **Silt**, trace sand, low plasticity, soft, dry. 2 ft recovery, saturated with drilling water	
				2			
				3			
				4			
				5			
				6			
	7 / 17		4-in Core	7			
				8			
				9			
				10			
				11			
				12			
				13		**Municipal Solid Waste**. Medium dense MSW consisting of fabric, wood, paper, & yard waste, with 6" thick layers of silt interspersed.	
				14			
				15			
				16			
	17 / 27		4-in Core	17		@ 17 to 20 ft: engine parts, metal, wire, and soil.	
				18			
				19			

Total Depth: 48.5 ft. Continued [X]

Log of Exploration

Exploration No. **GW-5**

Project: Walla Walla Sudbury Road Landfill Onsite RI

Start Date: 8/6/2009
Finish Date: 8/7/2009
Geologist: Craig Schwyn
Drilling Method: 6-in dia. Sonic
Sample Method: 4-in. dia. Core
Surface Elevation: 841.05 ft MSL

Sample Number	Sample Interval Top / Bot	Blow Counts / 6-in.	Sampler Type	Depth (feet)	USCS Symbol	Sample Description	Comments Drilling Action
				20		**Municipal Solid Waste** (cont.) @ 20 to 22 ft: gray silt, moist, compact.	
				21			
				22		@ 22 to 27 ft: black, wood, tires, and decomposed MSW.	
				23			
				24			
				25			
				26			
	27 / 37		4-in Core	27		@ 27 to 30 ft: black, paper, wood, and decomposed MSW.	
				28			
				29			
				30		@ 30 to 31 ft: silt.	
				31		@ 31 to 36 ft: glass, rock, and paper.	
				32			
				33			
				34			
				35		@ 35.5 to 36.5 ft: disturbed silt.	
				36	ML	Grayish brown Silt, with little clay and fine sand, stiff, low plasticity, moist. Some bedding structure observed in the silt with medium to coarse sand.	
	37 / 47		4-in Core	37			
				38			
				39			

Total Depth: 48.5 ft.

Continued X

Log of Exploration

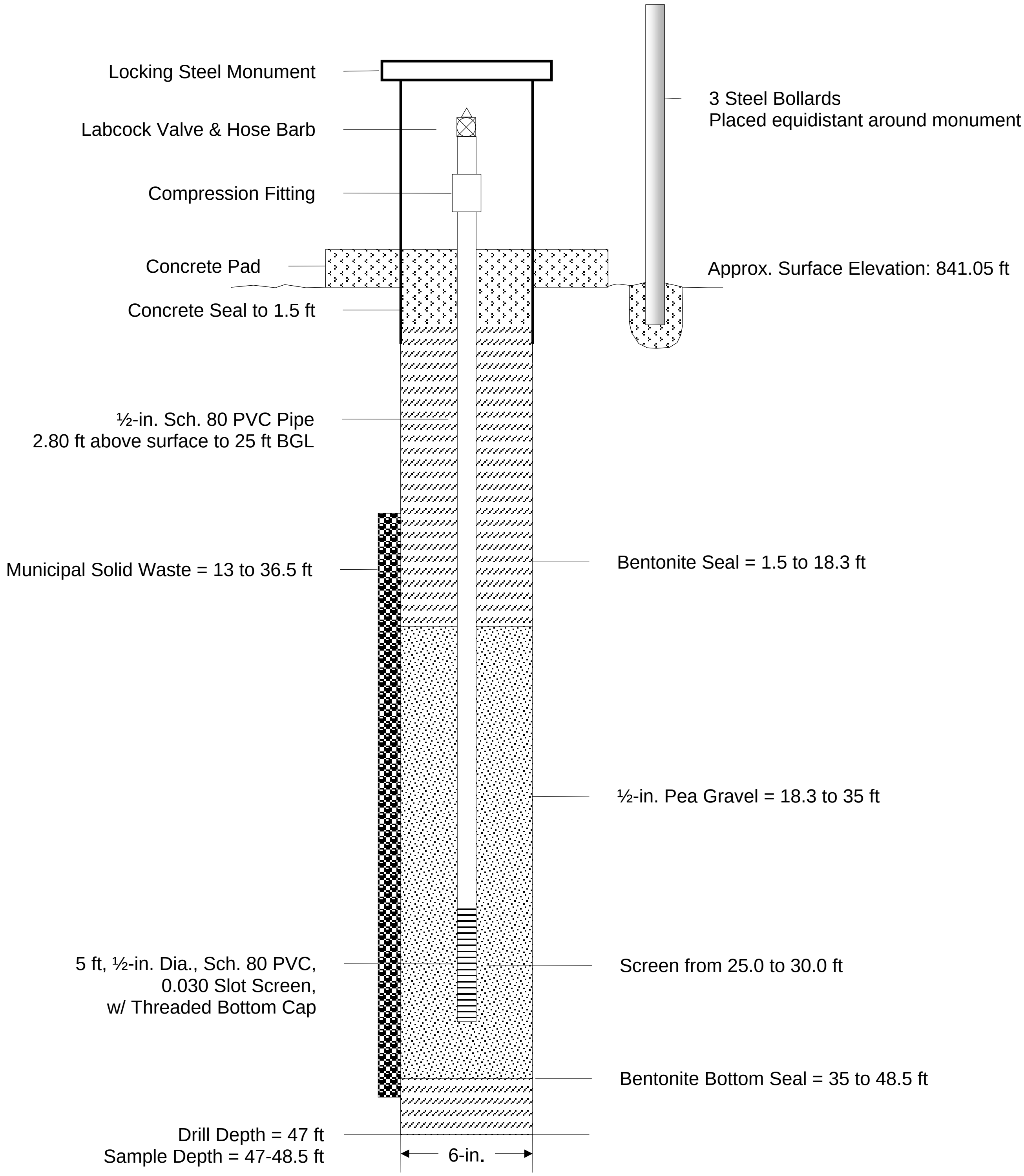
Project: Walla Walla Sudbury Road Landfill Onsite RI

Start Date: 8/6/2009
Finish Date: 8/7/2009
Geologist: Craig Schwyn
Drilling Method: 6-in dia. Sonic
Sample Method: 4-in. dia. Core
Surface Elevation: 841.05 ft MSL

Sample Number	Sample Interval Top / Bot	Blow Counts / 6-in.	Sampler Type	Depth (feet)	USCS Symbol	Sample Description	Comments Drilling Action
				40	ML	**Grey brown Silt,** with little clay and sand, stiff, low plasticity, moist.	
				41			
				42		@ 42 ft: Light brown	
				43			
				44			
				45			
				46			
S-1a	47	23	3-in	47		Light brown Silt with medium to coarse subangular basaltic sand,	
S-1b	48.5	33	SS			interspersed with layers of brown, very dense, silt; moist.	
S-1c		51		48	SM	Grades to very fine Sand with silt and medium to coarse sand.	

Boring drilled to 47 feet and sampled to 48.5 feet.
Gas well constructed in boring to 30 ft BGL.

Notes:
1. Lithologic descriptions and stratigraphic contacts are based on field interpretations and are approximate.
2. Refer to "Soil Classification and Key" figure for explanation of graphics and symbols.
3. BGL = below ground level
4. AGL = above ground level
5. TOC = top of casing
6. BTOC = below top of casing
7. SS = Split Spoon Sampler (2.42 -in. I.D.)
8. SPT = Standard Penetration Test Sampler (1.5 -in. I.D.)



Not To Scale

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GW-5 **Landfill Gas Probe Detail**	Figure A1

Log of Exploration

Exploration No. **GW-6**

Sheet 1 of 2

Start Date: 8/6/2009 Finish Date: 8/7/2009 Weather Conditions: Warm, Windy Geologist: Craig Schwyn Drilling Method: 6-in dia. Sonic Sample Method: 4-in. dia. Core Operator: Enviro. West Exp.	**Landfill Gas Well Completion** Surface Elevation: 798.25 ft MSL Total Boring Depth (BGL): 39 ft Total Casing Depth (BTOC): 27.48 ft Completion: Locking steel above ground monument with concrete surface pad Seal (BGL): Bentonite chips, 1.5 to 13 ft and 30 to 39 ft Gravel pack (BGL): 5/8-minus rounded gravel, 13 to 30 ft Casing: 1/2-in. dia. flush threaded Sch. 80 PVC, +2.48 to 20 ft BGL Screen (BGL): 0.03-in. slot Sch. 80 PVC, 20 to 25 ft BGL, with bottom cap

Project: Walla Walla Sudbury Road Landfill Onsite RI

Sample Number	Sample Interval Top / Bot	Blow Counts / 6-in.	Sampler Type	Depth (feet)	USCS Symbol	Sample Description	Comments Drilling Action
	0 / 7		4-in Core	1	ML	Grayish brown **Silt**, trace sand, low plasticity, soft, dry. (Landfill Cover)	
				2			
				3			
				4		**Municipal Solid Waste** @ about 3 to 5 ft. Medium dense MSW consisting of wood, yard waste, with 6" thick layers of silt interspersed. Plug of paper @ 7 ft is dated 8/10/1980	
				5			
				6			
	7 / 17		4-in Core	7		@ 7 to 11 ft: 4 ft recovery Silt, paper, glass, and kitchen rubbish.	
				8			
				9			
				10			
				11			
				12			
				13			
				14			
				15			
				16			
	17 / 27		4-in Core	17		@ 17 to 27 ft: tires, paper, cardboard, carpet pads, wood, MSW interspersed with layers of silt. Material with sales prediction date of 1979.	Rapid drilling
				18			
				19			

Total Depth: 39 ft. Continued [X]

Schwyn Environmental Services

Log of Exploration

Exploration No. **GW-6**

Sheet 2 of 2

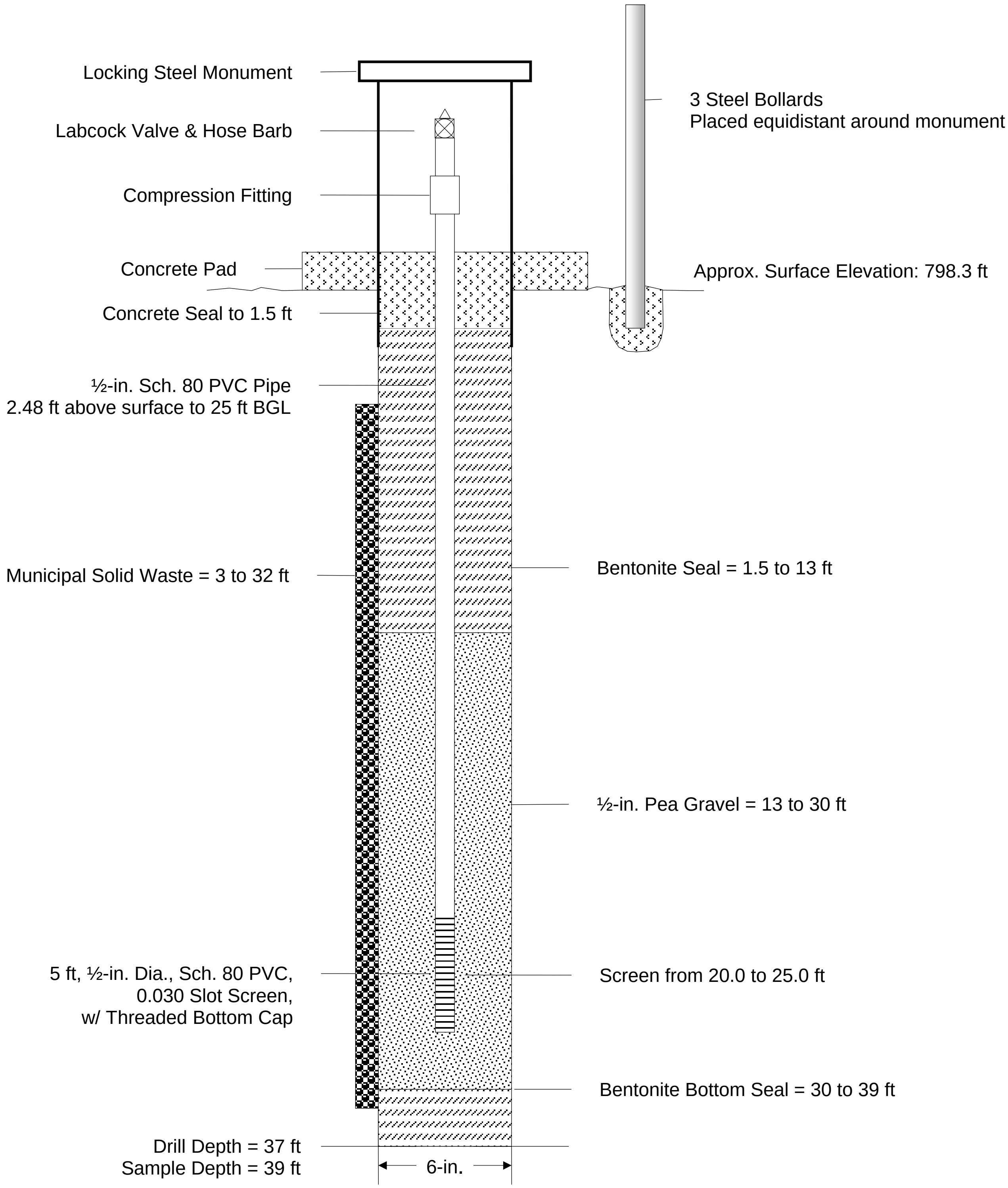
Project: Walla Walla Sudbury Road Landfill Onsite RI

Start Date: 8/6/2009
Finish Date: 8/7/2009
Geologist: Craig Schwyn
Drilling Method: 6-in dia. Sonic
Sample Method: 4-in. dia. Core
Surface Elevation: 798.25 ft MSL

Sample Number	Sample Interval Top / Bot	Blow Counts / 6-in.	Sampler Type	Depth (feet)	USCS Symbol	Sample Description	Comments Drilling Action
				20		**Municipal Solid Waste** (cont.)	
				21			
				22			
				23			
				24			
				25			
				26			
	27 / 37		4-in Core	27		@ 27 to 32 ft: black, paper, wood, metal, and decomposed MSW. Newspaper dated October 1979.	
				28			
				29			
				30			
				31			
				32	ML	Olive brown **Silt**, with trace clay and little fine sand, dense low plasticity, very moist.	
				33			
				34			
				35			
				36		@ 36 to 37 ft: Olive brown Silt, with little clay and fine to medium grained sand lenses up to 1/2-in. thick, firm, very moist.	
S-1a S-1b S-1c S-1d	37 / 39	7 9 12 15	3-in SS	37		@ 37 to 39 ft: Olive Silt, with trace clay and some fine to medium grained sand, mottled, low plasticity, wet.	
				38			

Boring drilled to 37 feet and sampled to 39 feet.
Gas well constructed in boring to 25 ft BGL.

Notes:
1. Lithologic descriptions and stratigraphic contacts are based on field interpretations and are approximate.
2. Refer to "Soil Classification and Key" figure for explanation of graphics and symbols.
3. BGL = below ground level
4. AGL = above ground level
5. TOC = top of casing
6. BTOC = below top of casing
7. SS = Split Spoon Sampler (2.42 -in. I.D.)
8. SPT = Standard Penetration Test Sampler (1.5 -in. I.D.)



Not To Scale

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GW-6
Landfill Gas Probe Detail

Figure
A2

Log of Exploration

Schwyn Environmental Services

Boring ID: GP-1a

Drill Date: 7/5/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: Geoprobe
Sample Method: 2.125" macro-core
Boring Diameter: 2.125"
Boring Depth (ft BGS): 14 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 834 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,296.29
Longitude/Easting: 2,170,203.40

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			0–3	ML	ML: brown Silt, trace sand, low plasticity, soft, dry.	Bentonite Chips
core			3–14	MW	MW: Municipal Solid Waste with 1.5 ft thick layers of silt, damp.	
core						
core			14		@ 14 ft. Refusal in municipal solid waste.	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: GP-1b

Drill Date: 7/5/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: Geoprobe
Sample Method: 2.125" macro-core
Boring Diameter: 2.125"
Boring Depth (ft BGS): 6 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 834 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,266.63
Longitude/Easting: 2, 170, 193.10

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			0–3.5	ML	ML: Brown Silt, trace sand, low plasticity, soft, dry.	Bentonite Chips
core			3.5–6	MW	MW: Municipal Solid Waste with silt, damp. @6 ft: Refusal in municipal solid waste.	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Log of Exploration

Boring ID: GP-1c

Drill Date: 7/5/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: Geoprobe
Sample Method: 2.125" macro-core
Boring Diameter: 2.125"
Boring Depth (ft BGS): 7 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 833 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,256.33
Longitude/Easting: 2,170,178.66

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			0–3	ML	ML: Brown Silt, trace fine sand, low plasticity, soft, dry.	Bentonite Chips
core			3–7	MW	MW: Municipal Solid Waste with 1.5 ft thick layers of silt, damp. @7 ft: Refusal in municipal solid waste.	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Boring ID: GP-2

Drill Date: 7/8/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: Geoprobe
Sample Method: 2.125" macro-core
Boring Diameter: 2.125"
Boring Depth (ft BGS): 52 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 831 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,227.90
Longitude/Easting: 2,170,142.79

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			0		ML: Light brown Silt, trace sand, low plasticity, soft, dry.	
			1		@ 1 ft: grey brown, laminated, stiff	
core			4		@ 4 ft: brown	
			7		@ 7 ft: damp.	
core			8		@ 8-12 ft: layered damp and dry silts.	
core			12		@12-30 ft: layered sandly silt and clayey silt.	
core			16			
core			20			
core			24		@ 24-27.5 ft: clayey Silt, massive structure, damp.	
			26			Bentonite Chips
core			27.5		@27.5 ft: Silt.	
core			31		@ 31-34 ft: layered (6-inch lenses) clayey silt, silt, and fine sandy silt. Clayey silts damp. Sandy silts dry.	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Boring ID: GP-2

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			33		Brown Silt (continued), damp to dry.	
core			34			@ 34 ft: Hole sloughing
			35			
			36			
			37			
Drv Pt			38		@38 ft: Drive solid point due to slit sloughing into hole and filling core barrel.	
			39			
			40			
			41			
			42			
core			43			
			44			
			45			
core			46			
			47			
			48		SM: Silty fine Sand, loose, dry.	
core			49		ML: Brown clayey Silt, blocky structure, firm, damp.	
			50			
			51			
			52			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: GP-3

Drill Date: 7/6/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: Geoprobe
Sample Method: 2.125" macro-core
Boring Diameter: 2.125"
Boring Depth (ft BGS): 39 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 787 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,716.05
Longitude/Easting: 2,169,730.66

Remarks: Groundwater sample collected from screened section set 36-39 BGS.

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			0	ML	ML: Light brown Silt, trace sand, soft, dry.	
			2		@ 2 ft: grey brown	
core			4			
			7		@ 7-8 ft: trace medium sand, subangular.	
core			8			
core			12		@ 12 ft: damp.	
core			16			
			18		@ 18-20 ft: little medium to coarse sand.	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Schwyn Environmental Services

Boring ID: GP-3

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			20			Bentonite Chips
GP3 21.5-22			21–22		@ 21 ft: Grey brown clayey Silt, blocky structure, wet. @ 21.5-22 ft: collect soil sample for analysis	
core			24			@ 24 ft: Check water level. Not sufficient quantity for sampling.
			25		SM: Brown silty fine Sand, damp	
core			26–27		ML: Brown clayey Silt, laminated structure @ 27 -28.5 ft: little fine to medium sand.	
			28		SM: Brown silty Sand with clay, fine to coarse angular sand, trace gravel, damp to wet.	@ 29 ft: Hard
core			30–31		ML: Brown clayey Silt with sand and silty Sand with clay.	
Wtr. smplr GP-3			35		@ 35 ft: drive water sampler to 39 ft, pull back 3 ft to expose 3 ft of stainless steel screen. Collect groundwater sample.	@ 37 ft: Hard

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: GP-4

Drill Date: 7/6/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: Geoprobe
Sample Method: 2.125" macro-core
Boring Diameter: 2.125"
Boring Depth (ft BGS): 34 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 788 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,841.80
Longitude/Easting: 2,169,959.43

Remarks: Groundwater sample collected from screen section set 30-34 ft. BGS

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			0	ML	ML: Grey brown Silt, trace sand, low plasticity, soft, dry.	
core			4		@ 4 ft: brown, trace clay, laminated	
core			8			
core			12		@ 12 ft: reddish brown	
core			16			
			17			Bentonite Chips
GP-4 18-18.5			18		@ 18-18.5 ft soil sample collected.	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Schwyn Environmental Services

Boring ID: GP-4

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			20			
core			24		@ 24-25.5 ft: clayey Silt.	
core			27.5		@ 27.5 ft: drive water sampler to 34 ft, pull back 4 ft to expose 4 ft of stainless steel screen. Collect groundwater sample.	
Wtr Smplr						
GP-4						

Depth scale: 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Boring ID: GP-5

Drill Date: 7/6/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: Geoprobe
Sample Method: 2.125" macro-core
Boring Diameter: 2.125"
Boring Depth (ft BGS): 36 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 790 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278.968.22
Longitude/Easting: 2,170,208.23

Remarks: Groundwater sample collected from screen section set 33-36 ft BGS

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			0		ML: Grey brown Silt, trace fine sand and clay, low plasticity, soft, damp. Sandy silts laminated, dry, periodic root tubes.Clayey silts blocky, damp.	
			3		@ 3 ft: brown, dry	
core			4			
core			8			
core			12		@ 12 ft: dark reddish brown, moisture increasing.	
core			16			
			17			Bentonite Chips
			19		@ 19 ft: increasing clay content.	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Schwyn Environmental Services

Boring ID: GP-5

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			20			
			21		@ 21-23 ft: saturated.	
			22			
			23		@ 23 ft: whitish brown clayey silt with calcite cementation, nodules, and thin (2 mm) lenses, very stiff, damp.	
Wtr Sampler			24			No sample collected.
			25		@ 24 ft: drive water sampler to 30 ft, pull back 4 ft to expose 4 ft of stainless steel screen. Dry. Pull back 1 ft to 25 ft. Dry.	
			26			
			27			
			28		Reddish brown clayey silt, blocky structure, damp to wet.	
			29			
core			30			
			31			
			32			
Wtr Smplr GP-5			33		@ 32 ft: drive water sampler to 36 ft, pull back 3 ft to expose 3 ft of stainless steel screen. Collect groundwater sample.	
			34			
			35			
			36			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: GP-6

Drill Date: 7/7/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: Geoprobe
Sample Method: 2.125" macro-core
Boring Diameter: 2.125"
Boring Depth (ft BGS): 35 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 791 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 279,108.41
Longitude/Easting: 2,170,513.94

Remarks: Groundwater sample collected from screen section set 32-35 ft. BGS

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			0		ML: Light brown Silt, trace clay and fine sand, low plasticity, soft, dry. Sandy silts laminated, dry, periodic root tubes. Clayey silts blocky, damp.	
			1			
			2			
			3			
core			4			
			5			
			6		@ 6 ft: damp.	
			7			
core			8		@ 8 to 10 ft: little sand, clay increasing with depth.	
			9			
			10		@ 10 to 15 ft: little clay, very stiff.	
			11			
core			12			
			13			
			14			
GP-6 15-15.5			15		@ 15 ft: trace clay, laminated, firm, methane odor. @ 15-15.5 ft: collect soil sample for analysis.	
core			16			
			17			Bentonite Chips
			18			
			19			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Boring ID: GP-6

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			20			
core			24		@ 24.5 -27.5 ft: little fine to medium sand, wet.	
			27		@ 27.5 to 28.5 ft: whitish brown clayey Silt with calcite cementation, nodules, and thin (2 mm) lenses, very stiff, damp.	
core			28		@ 28.5 to 30 ft: sandy Silt with calcite, wet.	
			30		@ 30 ft: clayey Silt with calcite, damp.	
Wtr Smplr GP-6			31		31 ft: drive water sampler to 35 ft, pull back 3 ft to expose 3 ft of stainless steel screen. Collect groundwater sample.	

Depth scale: 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Log of Exploration

Boring ID: GP-7

Drill Date: 7/7/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: Geoprobe
Sample Method: 2.125" macro-core
Boring Diameter: 2.125"
Boring Depth (ft BGS): 17 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 799 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,687.45
Longitude/Easting: 2,169,801.15

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			0	ML	ML: Brown Silt, trace fine sand , low plasticity, soft, dry.	Bentonite Chips
core			4			
			6	MW	MW: Municipal Solid Waste with 1.5 ft thick layers of silt, damp.	
core			8			
core			12			
core			16		@ 17 ft: Refusal in municipal solid waste.	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: GP-8

Drill Date: 7/7/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: Geoprobe
Sample Method: 2.125" macro-core
Boring Diameter: 2.125"
Boring Depth (ft BGS): 36.4 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 803 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 279,078.75
Longitude/Easting: 2,171,351.86

Remarks: Groundwater sample collected from screen set 32.4-36.4 ft. BGS

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			0		ML: Brown Silt, trace fine sand, low plasticity, soft, damp. Sandy silts laminated, dry, periodic root tubes. Clayey silts blocky, damp.	
core			4			
core			8			
core			11		@ 11 ft: whitish brown, calcite cementation, nodules, and thin lenses (2 mm), very stiff, dry.	
core			15			
			17.5			Bentonite Chips
core			19			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Schwyn Environmental Services

Boring ID: GP-8

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
core			20–24			
			24–25		@ 24.5 to 25 ft: wet. Calcitic Silt above and below are damp.	
core			26			
			27		SM: @ 27 ft: Olive brown silty fine Sand, wet.	
			29		ML: Light olive brown calcitic clayey Silt, blocky structure, very stiff, damp.	
core			30			
			31		@ 31 ft: Medium brown sandy Silt, wet.	
Wtr Smplr GP-8			34		@ 34 ft: brown sandy Silt with red mottling and coarse basaltic gravel.	
			36		@ 36 ft: Refusal. Total Depth of soil core @ 36 ft: drive water sampler to 36.4 ft, pull back 4 ft to expose 4 ft of stainless steel screen within borehole. Collect groundwater sample.	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: B-9RI

Drill Date: 8/29/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: 6-in. dia. TUBEX
Sample Method: Grab/1.5-in SPT
Boring Diameter: 6.5"
Boring Depth (ft BGS): 53 ft.
Groundwater (ft BTOC): 43.2

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 798 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,698.49
Longitude/Easting: 2,169,820.80

Remarks: Installed and sampled temporary well screened from 48-53 ft. Purged 2.5 gal. of groundwater and collected VOC samples. Remove casing and bentonite boring to surface.

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Grab			0	ML	ML: Light brown Silt, trace sand, low plasticity, soft, dry.	Bentonite Chips
Drill Chips			2.5			
Drill Chips			4.5			
			3	MW	MW: Municipal Solid Waste with silt, damp.	
Drill Chips			9.5			
Drill Chips			14.5			
Drill Chips			19.5			
Drill Chips			24.5			
Drill Chips			29.5			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Schwyn Environmental Services

Boring ID: B-9RI

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			33		ML: Olive grey Silt, damp.	
1.5-in SPT B935		8 20 17	35		Dark grey Silt with little clay and sand, stiff, landfill gas odor, moist, @35.5 ft up to 1.5 " dia. basalt gravel.	
Drill Chips			39		Brown Silt , very damp.	
Drill Chips			45		@ 45 ft: brown clayey silt	
			48		@ 48-53 ft: collect water sample	
Drill Chips			50			
Drill Chips			52		GM: Brownish fine Gravel with sand and silt, wet.	

Depth scale: 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: B-10RI

Drill Date: 8/30/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: 6-in. dia. TUBEX
Sample Method: Grab/2.4-in SS
Boring Diameter: 6.5-in
Boring Depth (ft BGS): 35
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 800 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,833.60
Longitude/Easting: 2,170,046.97

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Grab			0	ML	ML: Light brown Silt, trace sand, low plasticity, soft, dry.	Bentonite Chips
Drill Chips			5	ML		
Drill Chips			10	ML		
			11	MW	MW: Municipal Solid Waste with silt, damp.	
Drill Chips			15	MW		

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Boring ID: B-10RI

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Drill Chips			20			
			21			
			22			
			23			
			24			
Drill Chips			25			
			26			
			27			
			28			
			29			
Drill Chips			30			
			31			
			32		ML: Olive grey Silt, damp.	
			33			
2.4-in SS B1034		4 4 6	34		ML: Brown Silt with trace medium rounded sand, some vertical root tubes and stringers of calcite, wet.	
			35			

Log of Exploration

Boring ID: B-11RI

Drill Date: 8/30/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: 6-in. dia. TUBEX
Sample Method: Grab/2.4" SS
Boring Diameter: 6.5
Boring Depth (ft BGS): 35.5
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 806 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,995.06
Longitude/Easting: 2,170385.77

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Grab			0		ML: Light brown Silt, trace sand, low plasticity, soft, dry.	Bentonite Chips
Drill Chips			5			
Drill Chips			10			
Drill Chips			15		@ 15 ft: grey	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Boring ID: B-11RI

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Drill Chips			20			
			21		MW: Municipal Solid Waste with silt, damp.	
Drill Chips			25			
Drill Chips			30			
			33		SM: Olive grey silty Sand, damp.	
2.4-in SS B1134		9 17 13	34		SM: Grey fine to medium Sand with some silt, loose, damp.	
			35		ML: Brown sandy Silt with trace fine gravel, stiff, blocky structure,	

Log of Exploration

Boring ID: B-12RI

Drill Date: 8/30/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: 6-in. dia. TUBEX
Sample Method: Grab/2.4-in SS
Boring Diameter: 6.5
Boring Depth (ft BGS): 48.5
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 820 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,876.57
Longitude/Easting: 2,170, 269.11

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Grab			0	ML	ML: Light brown Silt, trace sand, low plasticity, soft, dry.	Bentonite Chips
Drill Chips			5			
Drill Chips			10			
Drill Chips			15			
			16.5	MW	MW: Municipal Solid Waste, dry to damp.	
Drill Chips			20			
Drill Chips			25			
Drill Chips			30			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Boring ID: B-12RI

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Drill Chips			33–41		MW: Municipal Solid Waste (cont.)	
Drill Chips						
			41–48		ML: Brown Silt	
2.4-in SS B1244		7 11 14			ML: Brown Silt, trace sand and clay, iron mottling, 0.25-in., laminations, stiff, damp.	
					Snap casing, boring terminated at 48.5'	

Depth scale: 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: B-14RI

Drill Date: 8/30/2005
Logged By: Craig Schwyn
Drilled By: Environmental West. Exp.
Drill Type: 6-in. diam. TUBEX
Sample Method: Drill Chips
Boring Diameter: 6.5-in
Boring Depth (ft BGS): 53.5
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 840 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,909.90
Longitude/Easting: 2,170,703.74

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Grab			0	ML	ML: Light brown Silt, trace sand, low plasticity, soft, dry.	
Drill Chips			5			
Drill Chips			10	MW	MW: Municipal Solid Waste with silt, damp.	
Drill Chips			15			
Drill Chips			20			
Drill Chips			25			
			27			Bentonite Chips
Drill Chips			30			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Schwyn Environmental Services

Boring ID: B-14RI

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			33			
Drill Chips			34		MW: Municipal Solid Waste (cont.)	
			35			
			36			
			37			
			38			
Drill Chips			39			
			40			
			41			
			42			
			43			
Drill Chips			44			
			45			
			46			
			47			
			48		ML: Brown Silt	
Drill Chips			49			
			50			
			51			
			52			
			53			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: B-15RI

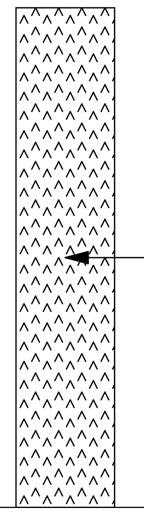
Drill Date: 8/31/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: 6-in. dia. TUBEX
Sample Method: Drill Chips
Boring Diameter: 6.5-in
Boring Depth (ft BGS): 13 ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 840 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,902.61
Longitude/Easting: 2,170,693.33

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Grab			0	ML	ML: Light brown Silt, trace sand, low plasticity, soft, dry.
Drill Chips			4.5		
Drill Chips			9.5		
Drill Chips			11	MW	MW: Municipal Solid Waste with silt, damp.
			13		

Well Construction Detail



Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Log of Exploration

Boring ID: B-16RI

Drill Date: 8/31/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: 6-in. dia. TUBEX
Sample Method: Drill Chips
Boring Diameter: 6.5-in
Boring Depth (ft BGS): 15 Ft.
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 828 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 279,012.25
Longitude/Easting: 2,170,679.78

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Grab			0	ML	ML: Light brown Silt, trace sand, low plasticity, soft, dry.	Bentonite Chips
Drill Chips			3–5	MW	MW: Municipal Solid Waste with silt, damp.	
Drill Chips			10			
Drill Chips			15			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Log of Exploration

Boring ID: B-17RI

Schwyn Environmental Services

Drill Date: 9/1/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: 6-in. dia. TUBEX
Sample Method: Drill Chips
Boring Diameter: 6.5-in
Boring Depth (ft BGS): 68
Groundwater (ft BTOC): 59.4

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 818 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,742.20
Longitude/Easting: 2,170,004.00

Remarks: Installed and sampled temporary well screened from 63-68 ft.
Purge 16 gal. and collect VOC sample with Grundfos pump. Remove casing and bentonite boring to surface.

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Grab			0	ML	ML: Light brown Silt, trace sand, low plasticity, soft, dry.	
Drill Chips			4.5			
Drill Chips			9.5			
			10	MW	MW: Municipal Solid Waste with silt, damp.	
Drill Chips			14.5			
Drill Chips			19.5			
Drill Chips			24.5			
Drill Chips			29.5			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Boring ID: B-17RI

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			33			
			34			Bentonite Chips
Drill Chips			35			
			36			
			37			
			38			
			39			
Drill Chips			40	ML	ML: Grey Silt, low plasticity, damp.	
			41			
			42			
			43			
			44			
Drill Chips			45		@ 45 ft: Brown, trace clay, damp	
			46			
			47			
			48			
			49			
Drill Chips			50			
			51			
			52			
			53			
			54		@ 54 ft: clayey, moist to wet.	
Drill Chips			55			
			56			
			57			
			58			
			59			
Drill Chips			60			
			61			
			62			
			63		@63-68 ft: collect water sample	
			64		@ 64.5 ft: Brown sandy Silt, with clay, moist.	
Drill Chips			65			
Drill Chips			66	GM	GM: Brown silty Gravel, wet.	
			67			
			68			

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▼ = denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Boring ID: B-18RI

Drill Date: 9/1/2005
Logged By: Craig Schwyn
Drilled By: Environmental West Exp.
Drill Type: 6-in. dia. TUBEX
Sample Method: 2.4-in SS
Boring Diameter: 6.5-in
Boring Depth (ft BGS): 31.5
Groundwater (ft BTOC):

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road, Walla Walla, WA
Ground Surf Elev. & Datum: 840 ft. MSL (Topo Map)
Casing Elevation:
Coordinate System: NAD 83
Latitude/Northing: 278,543.76
Longitude/Easting: 2,169,823.27

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
Grab			0	ML	ML: Light brown Silt, trace sand, low plasticity, soft, dry.	Bentonite Chips
Drill Chips			5	ML		
Drill Chips			8–10	MW	MW: Municipal Solid Waste with silt, dry	
Drill Chips			15	MW		
Drill Chips			20	MW		
			21	ML	ML: Brown Silt, low plasticity, damp.	
Drill Chips			25	ML		
2.4-in SS B1830		7 9 8	30–31.5	ML	Brown Silt, trace clay, laminated, stiff, damp.	

Notes:
ft BGS = feet below ground surface
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

APPENDIX B

Geophysical Study Report

Schwyn Environmental Services

Zonge International, Inc.
Parkside Business Center, Bldg. 1-B
3866 SW Nimbus Avenue
Beaverton, OR 97008

July 18, 2012
Zonge Ref. 12069

Craig C. Schwyn, L.Hg.
Schwyn Environmental Services
4621 South Custer Court
Spokane, WA 99223

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Dear Mr. Schwyn;

Zonge International has completed a geophysical investigation at the Sudbury Road Landfill located west of Walla Walla, Washington. The Sudbury Road Landfill has historically been used for the disposal of a wide variety of debris and waste. The objective of this survey was to delineate the horizontal extent of disposal areas in closed cells, defined as Areas 1, 2, and 5, at the landfill.

GEOPHYSICAL SURVEY

Figure 1 shows the location of Areas 1, 2, and 5 within the greater extent of the landfill property. The size of each area is 6, 1.5, and 15-acres respectively. The geophysical investigation utilized both electromagnetic and magnetic methods in order to define subsurface conductivity and magnetic response, both properties being influenced by the type and quantity of material buried at the site. Fieldwork was completed by a Senior Geophysicist and Geophysical Technician with Zonge International on April 24-26 and June 21, 2012.

Fundamentals of each geophysical technique and their application to the delineation of buried materials are described in a technical note included as Appendix B, *Geophysical Detection of Buried Objects.*

EM31 Data Acquisition:

Electromagnetic data were acquired using a Geonics EM31 terrain conductivity meter. Both quadrature-phase (apparent conductivity) and in-phase data were recorded. The EM31 was run in the “continuous” sampling mode, recording the EM response at 0.1 second intervals (approximately 0.6 feet) using a nominal line spacing of 20 feet.

Instrument problems with the EM31 precluded data collection in April after Area 5 was completed. During the June deployment additional EM31 data were acquired in Area 2. Soils overlying Area 1 were judged to be too thick to make EM31 data useful.

Magnetic Data Acquisition:

The MAG survey was conducted using a Geometrics G858G cesium magnetometer/ gradiometer. As with the EM, this instrument was run in the "continuous" sampling mode, recording the magnetic field at 0.1 second intervals (approximately 0.6 feet) using a nominal line spacing of 20 feet.

GPS Navigation

Location data were acquired simultaneously with the MAG and EM31 data using a Trimble AG132 Differential Global Positioning System (DGPS). That system provides visual feedback to the operator to assure that he is "on line" and that the survey area is covered uniformly. This system is a real time differential GPS system using the Omnistar satellite subscription service or a Coast Guard beacon for the differential correction. The GPS system has "sub-meter" accuracy; hence positions are generally good to ±1-2 feet, but may be off by 2-3 feet.

Data Processing

MAG and EM data were processed using the GeoSoft OASISmontaj™ data processing and analysis software. Magnetic data are presented in Appendix A as the Magnetic Analytic Signal, the Total Magnetic Field, and the Vertical Magnetic Gradient. The Analytic Signal is our preferred presentation because it reduces the bipolar nature of the response and centers the anomaly over the "source" object.

RESULTS AND INTERPRETATION

Data coverage of this survey is shown on Figure 1, *Site Exploration Plan*. Figures 2, 3, and 4 are *Geophysical Interpretation Summary* plots for Areas 1, 2, and 5 respectively. Those figures include the interpreted limits of buried landfill materials. Data plots are included in Appendix A.

The magnetic response over debris is typically chaotic, with numerous highs and lows of varying dimensions. The magnetic analytic signal is our preferred presentation of the magnetic data as it removes the bipolar (plus and minus) nature of the anomalies and centers the anomaly over the source. Areas with a chaotic MAG response are shown with a magenta diagonal hatch in Figures 2 - 4.

The EM31 response over debris is also chaotic in nature, with both highs and lows associated with each anomalous zone. The EM31 quadrature-phase response is a measure of terrain conductivity, and is reported in units of conductivity, millisiemen/meter (mS/m). Areas showing high apparent conductivity are indicative of extensive conductive debris.

The high apparent conductivities can also be indicative of a higher clay content in the cap materials overlying the debris and/or conductive interstitial water.

Area 1

Figure 2 is a *Geophysical Interpretation Summary* for Area 1. Magnetic data plots are included in Appendix as Figures A1-A3. The interpretation shows a large area on top of the raised cell which we have labeled *thick cover over debris*. Over this area there is a diffuse magnetic response, indicative of debris at a depth of greater than 10-15 feet. A large linear magnetic anomaly was observed trending to the north-east which we have labeled *linear "pipe-like" mag anomaly* on Figure 2. The MAG response on the south-east facing slope indicated scattered shallow and surface debris. Debris was more prevalent on the lower portion of the slope. Surface materials on the west, and the gas processing facility produced a strong magnetic response precluding any further interpretation in those areas.

No EM31 data were acquired over Area 1. The anticipated thick soil cover over debris greatly reduces the utility of EM31 data in this area.

Area 2

Figure 3 is a *Geophysical Interpretation Summary* for Area 2. Magnetic and EM data plots are included in Appendix A as Figures A4-A8. The interpretation shows a large area of *shallow scattered debris*, based mostly on the magnetic gradient data. Within that zone a smaller area, which we have interpreted as the limits of landfill debris, showed a stronger magnetic response as well as a distinct conductivity high.

Area 5

Figure 4 is a *Geophysical Interpretation Summary* for Area 5. Magnetic and EM data plots are included in Appendix A as Figures A9-A13. This large area appears more complex than the other areas, with possible disposal trenches and areas of thick cover. The figures include locations of some of the test pits excavated by Schwyn following the geophysical survey. Test pit locations were not necessarily based on the geophysical data.

The magnetic response over most of the site is interpreted as *deeper debris fill*. On the eastern portion of the site there is some indication of linear trenches. On the south central portion of the site the stronger magnetic response is interpreted as higher concentrations of shallow debris.

Background EM31 apparent conductivity was 20-35 millisiemen per meter (mS/m). In Figure 4, we have outlined two different levels of elevated and high conductivity. Areas with conductivities in excess of 100 mS/m are shown on the south and south-west portions of the site. This high conductivity is interpreted as due to high concentrations of debris. Alternative interpretations would be higher clay content in the cap materials and/or more conductive interstitial water (often associated with household debris).

Areas with elevated apparent conductivities in excess of 55 mS/m but less than 100 mS/m (shown with a dashed hatch) are indicative of 1) debris at a greater depth, i.e., under a thicker cover, or 2) a different character to the debris with less soluble, conductive materials.

Toward the eastern portions of Area 5 there are fingers and/or islands where the apparent conductivity is less than 55 mS/m. Those fingers in the EM data tend to coincide with areas of background magnetic field. These may be 1) areas between trenches or cells, 2) areas of yet deeper burial, or 3) differences in the nature of the fill materials.

CONCLUSIONS

The geophysical data displayed several levels of response, indicating differing character to the fill materials and/or differing thickness of cover over the fill. While we have attempted to put meaningful interpretations to the differing geophysical responses additional ground truth information may be necessary to refine those interpretations. The geophysical data are most useful in delineating boundaries of the fill and transitions within the fill.

CLOSURE

Zonge International has performed this work in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No warranty, express or implied, beyond exercise of reasonable care and professional diligence, is made. This report is intended for use only in accordance with the purposes of the study described within.

Geophysical surveys performed as part of this survey may or may not successfully detect or delineate any or all subsurface objects or features present. Locations, depths and scale of buried objects or subsurface features mapped as a result of this survey are a result of geophysical interpretation only, and should be considered as confirmed, actual, or accurate only where recovered by excavation or drilling.

We appreciate the opportunity to perform this geophysical investigation. Should you require further information concerning the field investigation, or this report, please contact us at your convenience.

Sincerely,

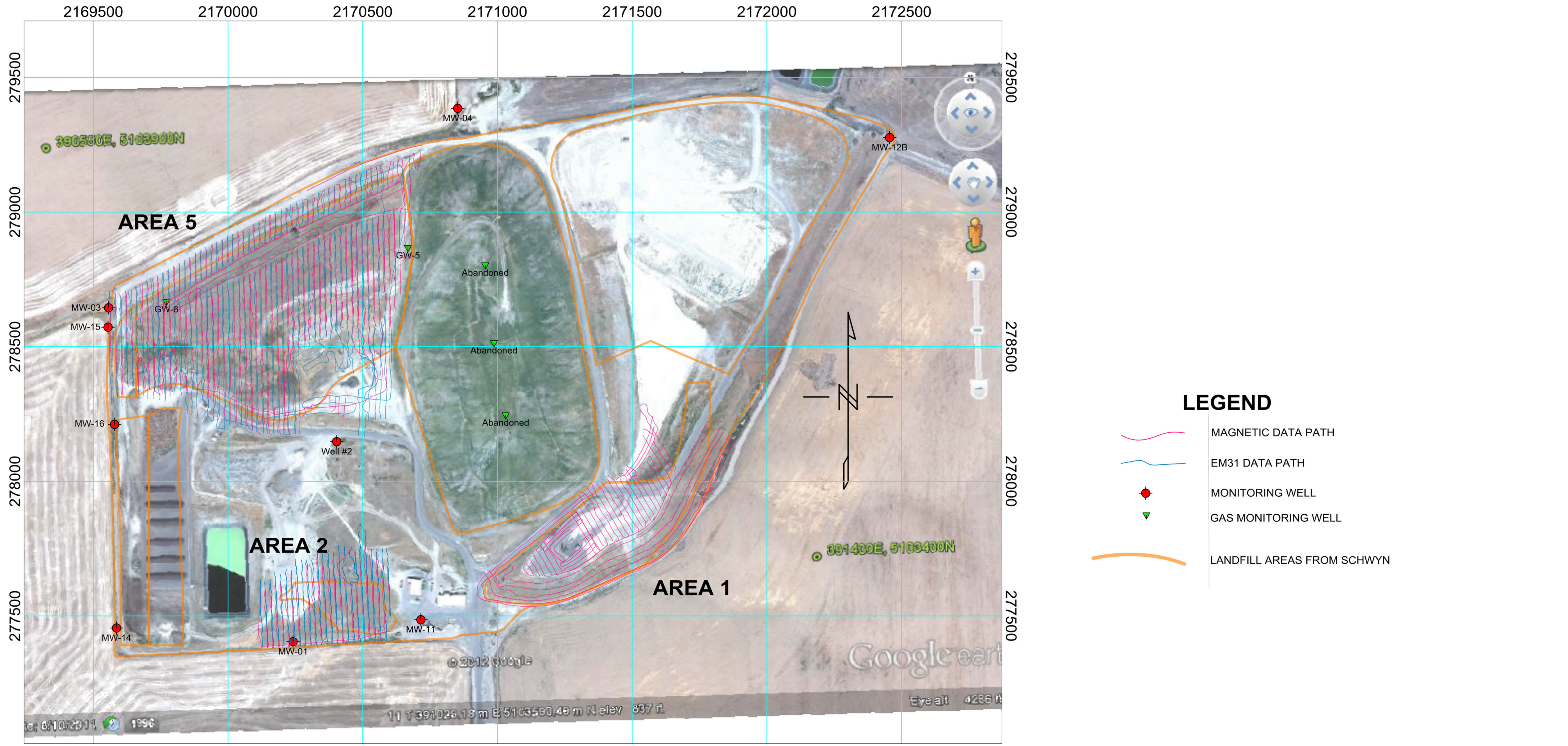
Zonge International, Inc.

Rowland B. French, L.G.
Senior Geophysicist

LIST OF FIGURES

LIST OF APPENDICIES

File: Zonge-Walla Walla landfill rpt01.doc
Zonge Project: 12069



BACKGROUND IMAGE FROM GOOGLE EARTH
IMAGERY DATE: 8/10/2011

FIGURE 1

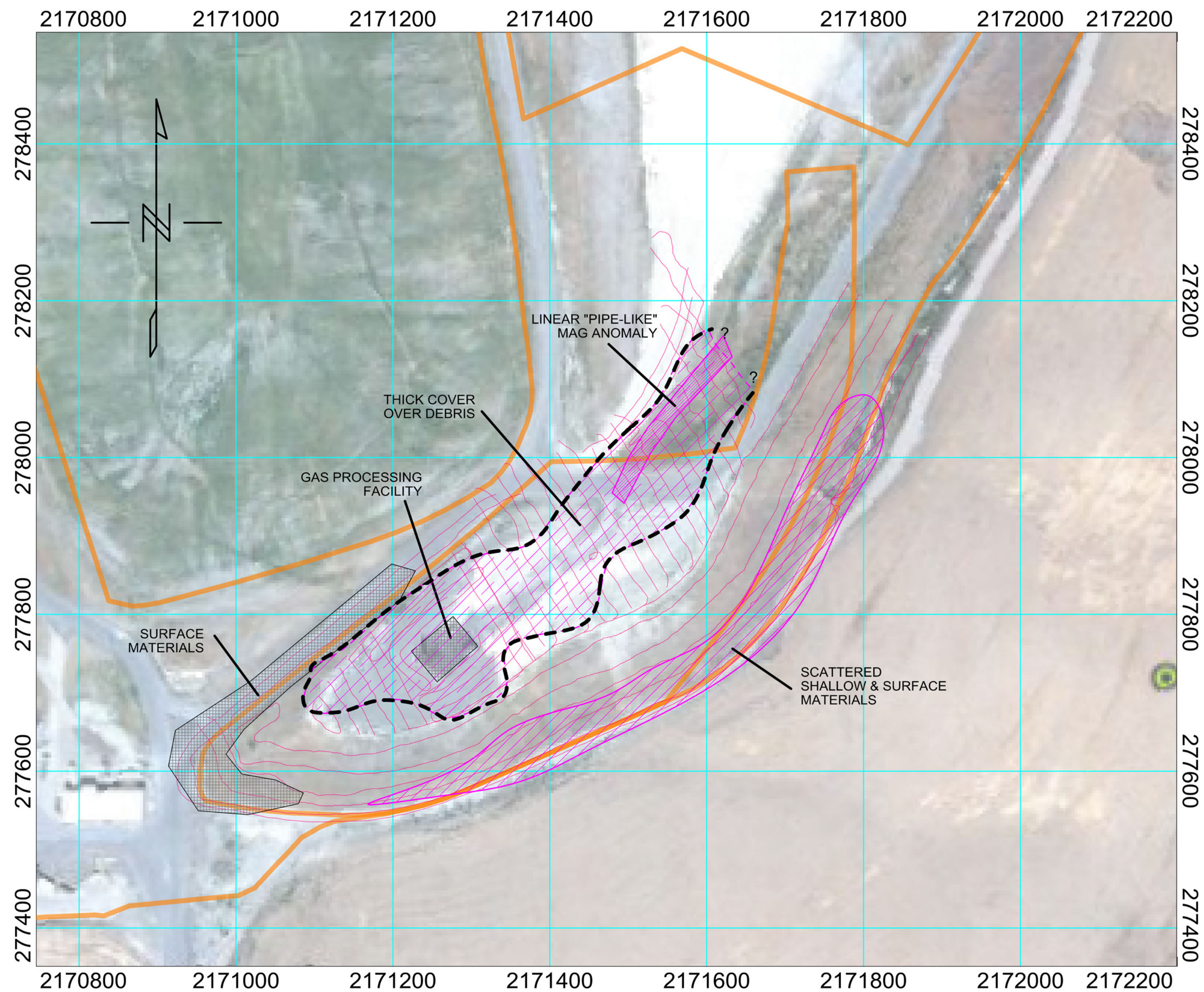
Prepared by: Zonge TRUSTED GEOPHYSICS.

Prepared for: Schwyn Environmental Services

SITE EXPLORATION PLAN

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

REVISION: B-18-JUL-12
DATE: APRIL 2012
FILE: Area1.map
ZONGE PROJECT 12069



LEGEND

MAGNETIC DATA PATH

INTERPRETED LIMITS OF LANDFILL DEBRIS

MAG INTERPRETATION

SHALLOW & SURFACE DEBRIS

DEEPER DEBRIS FILL

MONITORING WELL

GAS MONITORING WELL

LANDFILL AREAS FROM SCHWYN

Scale 1:2400

100 0 100 200 300 400 500

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

Prepared by:

Zonge TRUSTED GEOPHYSICS.

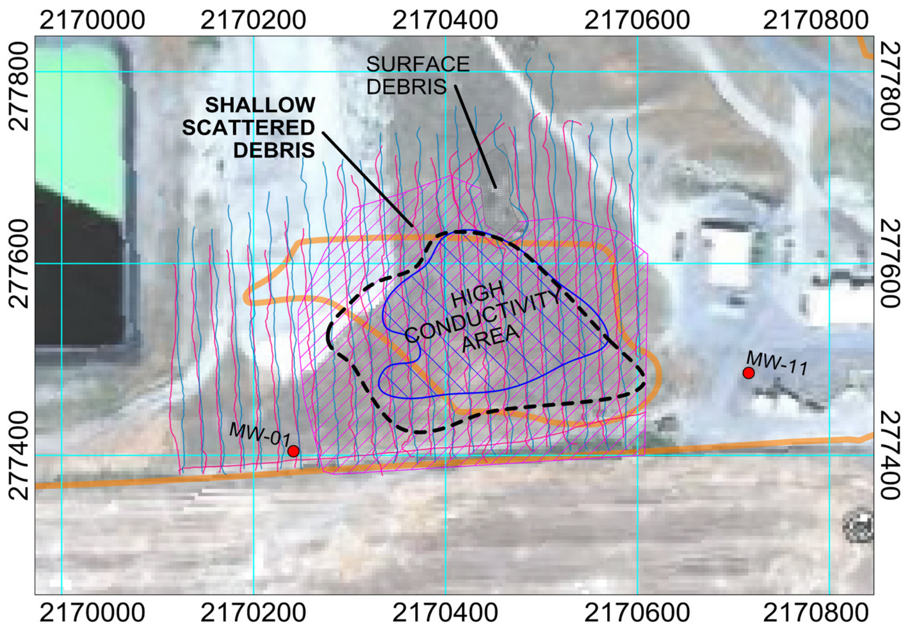
Prepared for:

Schwyn Environmental Services

FIGURE 2

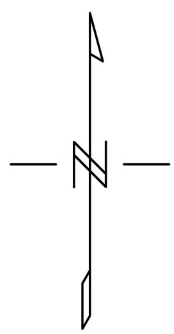
GEOPHYSICAL INTERPRETATION SUMMARY AREA 1

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington



LEGEND

- MAGNETIC DATA PATH
- EM31 DATA PATH
- INTERPRETED LIMITS OF LANDFILL DEBRIS
- MAG INTERPRETATION (SHALLOW SCATTERED DEBRIS)
- EM INTERPRETATION
- MONITORING WELL
- LANDFILL AREAS FROM SCHWYN



Scale 1:2400

100 0 100

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

FIGURE 3

GEOPHYSICAL INTERPRETATION SUMMARY AREA 2

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Prepared by: Zonge TRUSTED GEOPHYSICS.

Prepared for: Schwyn Environmental Services

REVISION: B-19-JUL-12

DATE: APRIL 2012

FILE: Area2.map

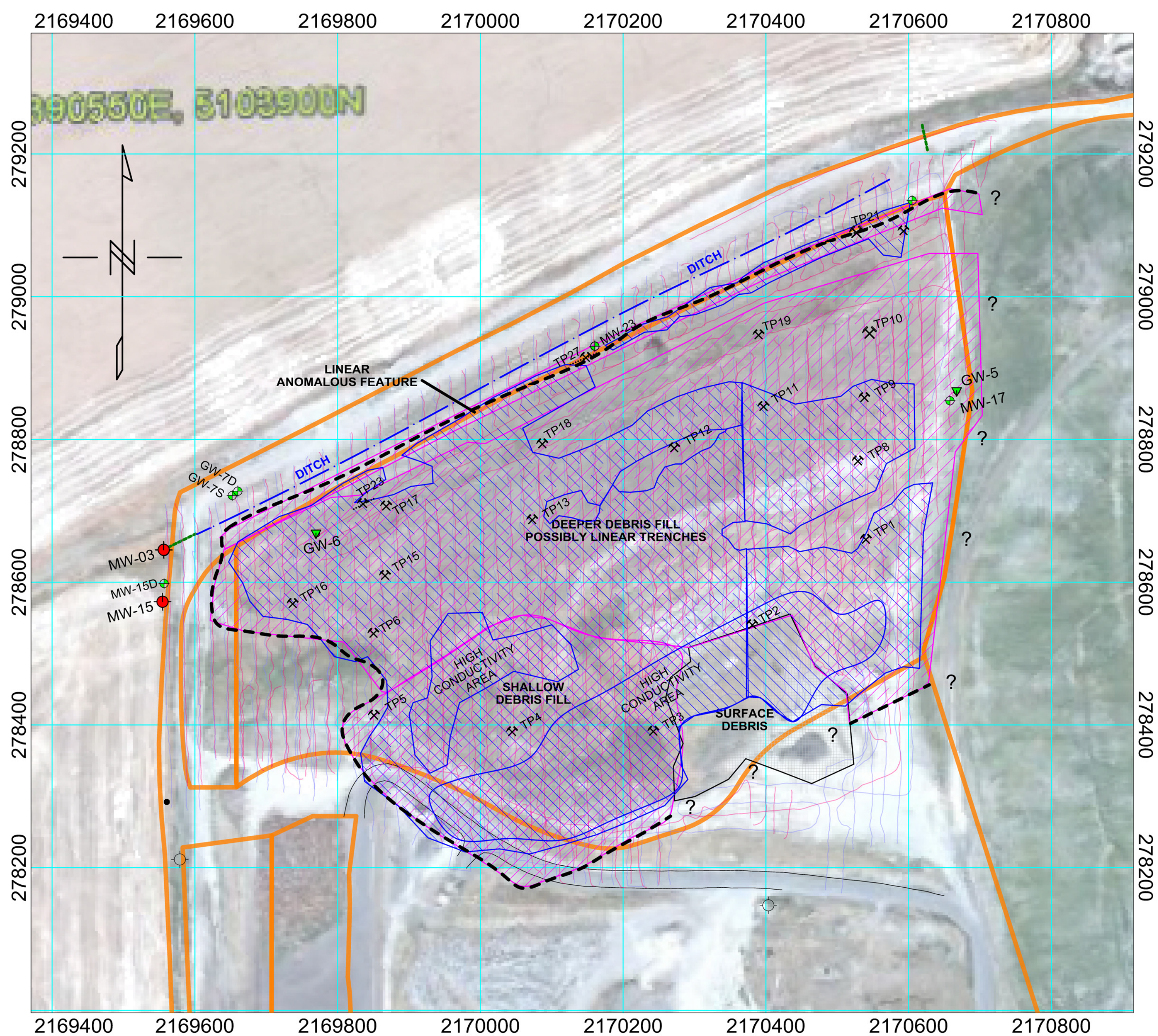
ZONGE PROJECT 12069

REVISION: B-19-JUL-12

DATE: APRIL 2012

FILE: Area5.map

ZONGE PROJECT 12069



LEGEND

MAGNETIC DATA PATH

EM31 DATA PATH

INTERPRETED LIMITS OF LANDFILL DEBRIS

MAG INTERPRETATION

SHALLOW DEBRIS FILL

DEEPER DEBRIS FILL

EM INTERPRETATION

HIGH CONDUCTIVITY AREA (>100 mS/m)

ELEVATED CONDUCTIVITY AREAS (>55 mS/m)

MONITORING WELL

GAS MONITORING WELL

TP1 TEST PIT (SCHWYN 2012)

MONITORING WELL (SCHWYN 2012)

LANDFILL AREAS FROM SCHWYN

Scale 1:2400

100 0 100 200 300 400 500

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

Prepared by:

Zonge TRUSTED GEOPHYSICS.

Prepared for:

Schwyn Environmental Services

FIGURE 4

GEOPHYSICAL INTERPRETATION SUMMARY AREA 5 - DATA PLOT

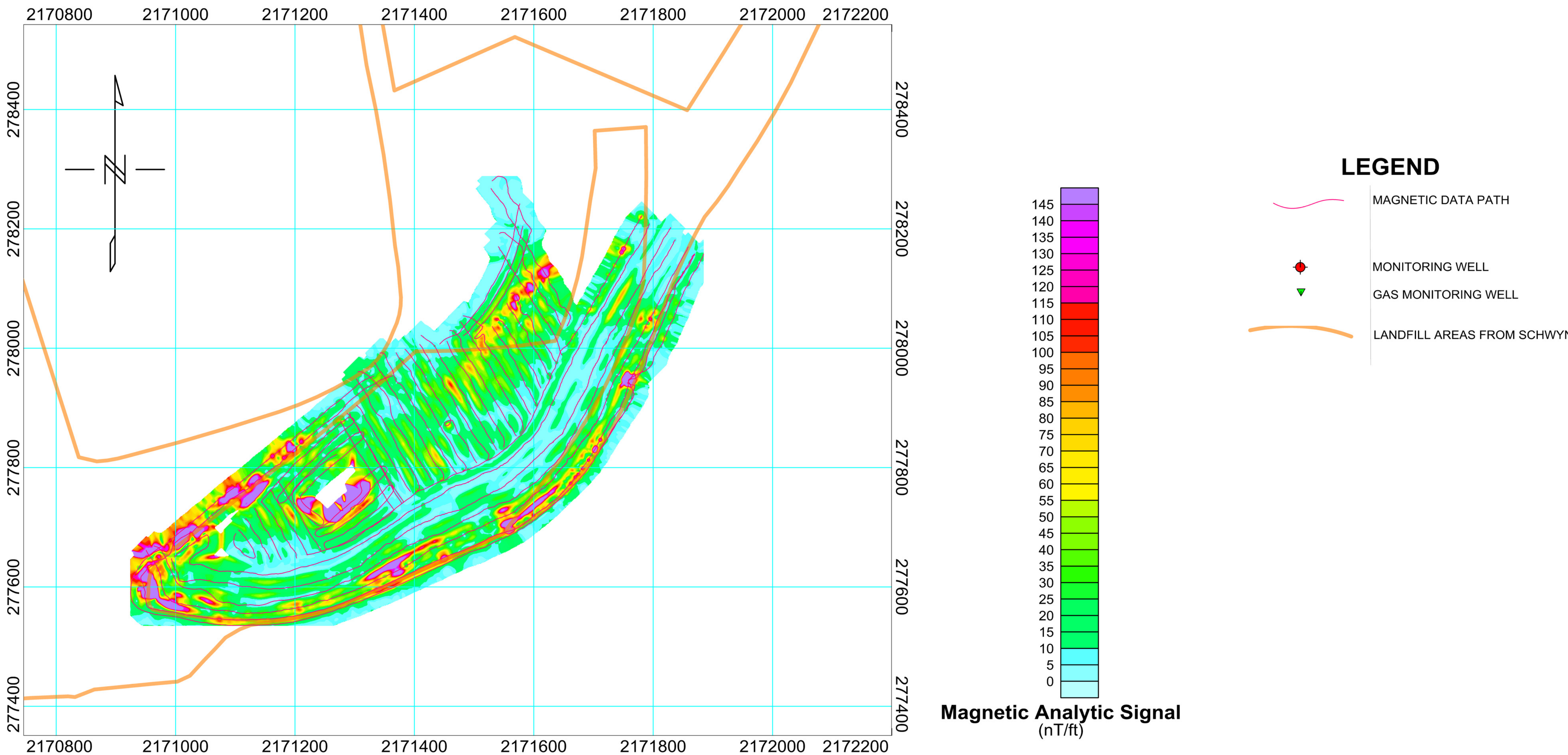
Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Geophysical Investigation

Sudbury Road Landfill

Walla Walla, Washington

APPENDIX A – DATA PLOTS



REVISION: B-18-JUL-12

DATE: APRIL 2012

FILE: Area1_AnSig.map

ZONGE PROJECT 12069

Scale 1:2400

100 0 100 200 300 400 500

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

Prepared by:

Zonge
TRUSTED GEOPHYSICS.

FIGURE A1

MAGNETIC ANALYTIC SIGNAL AREA 1 - DATA PLOT

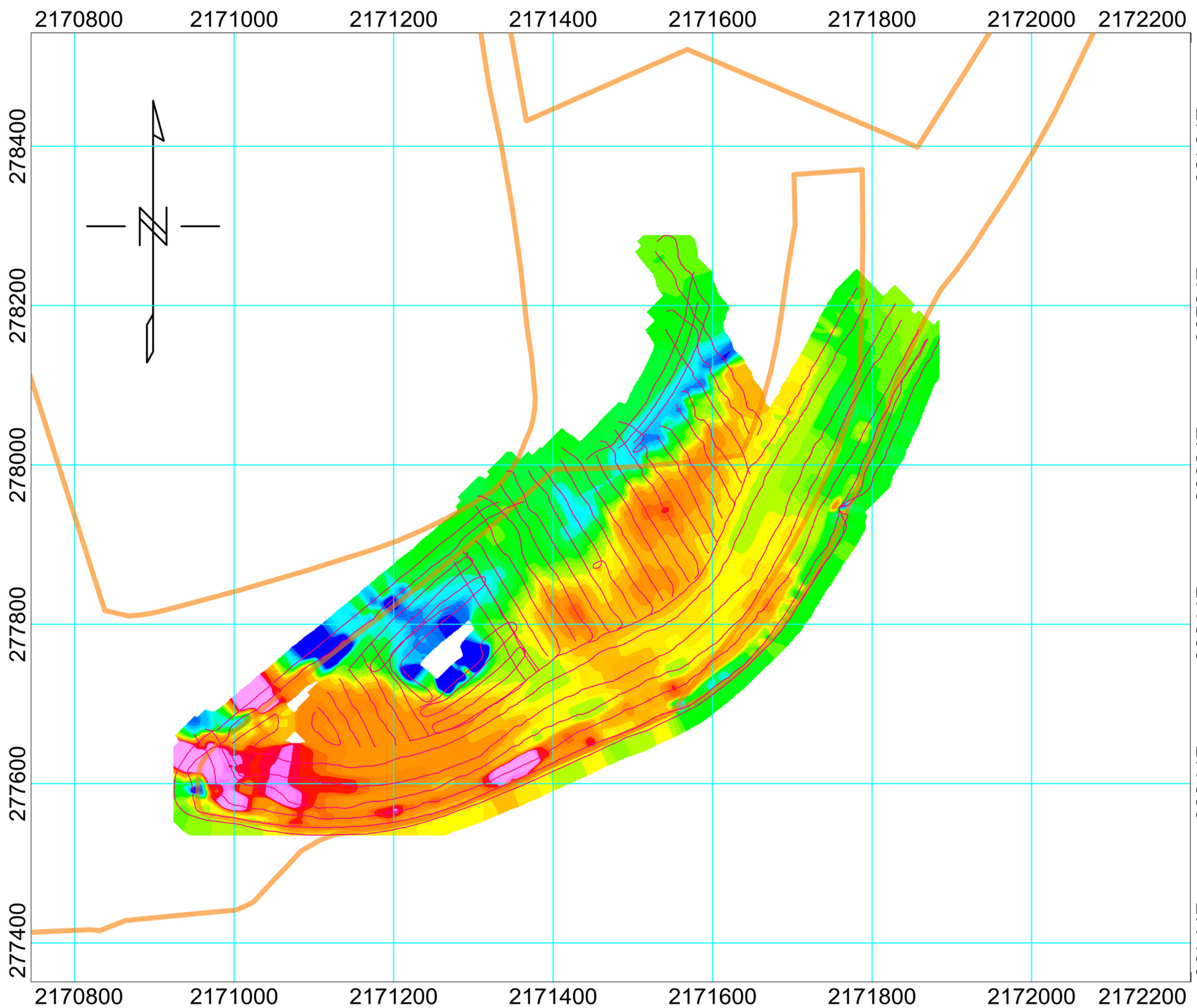
Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

REVISION: B-18-JUL-12

DATE: APRIL 2012

FILE: Area1_Top.map

ZONGE PROJECT 12069



LEGEND

MAGNETIC DATA PATH

MONITORING WELL

GAS MONITORING WELL

LANDFILL AREAS FROM SCHWYN

55100
55000
54900
54800
54700
54600
54500
54400
54300
54200
54100
54000
53900
53800
53700
53600
53500
53400
53300
53200
53100
53000
52900
52800
52700
52600
52500

Total Magnetic Field
(nT)

Scale 1:2400

100 0 100 200 300 400 500

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

Prepared by:

Zonge
TRUSTED GEOPHYSICS.

FIGURE A2

TOTAL MAGNETIC FIELD AREA 1 - DATA PLOT

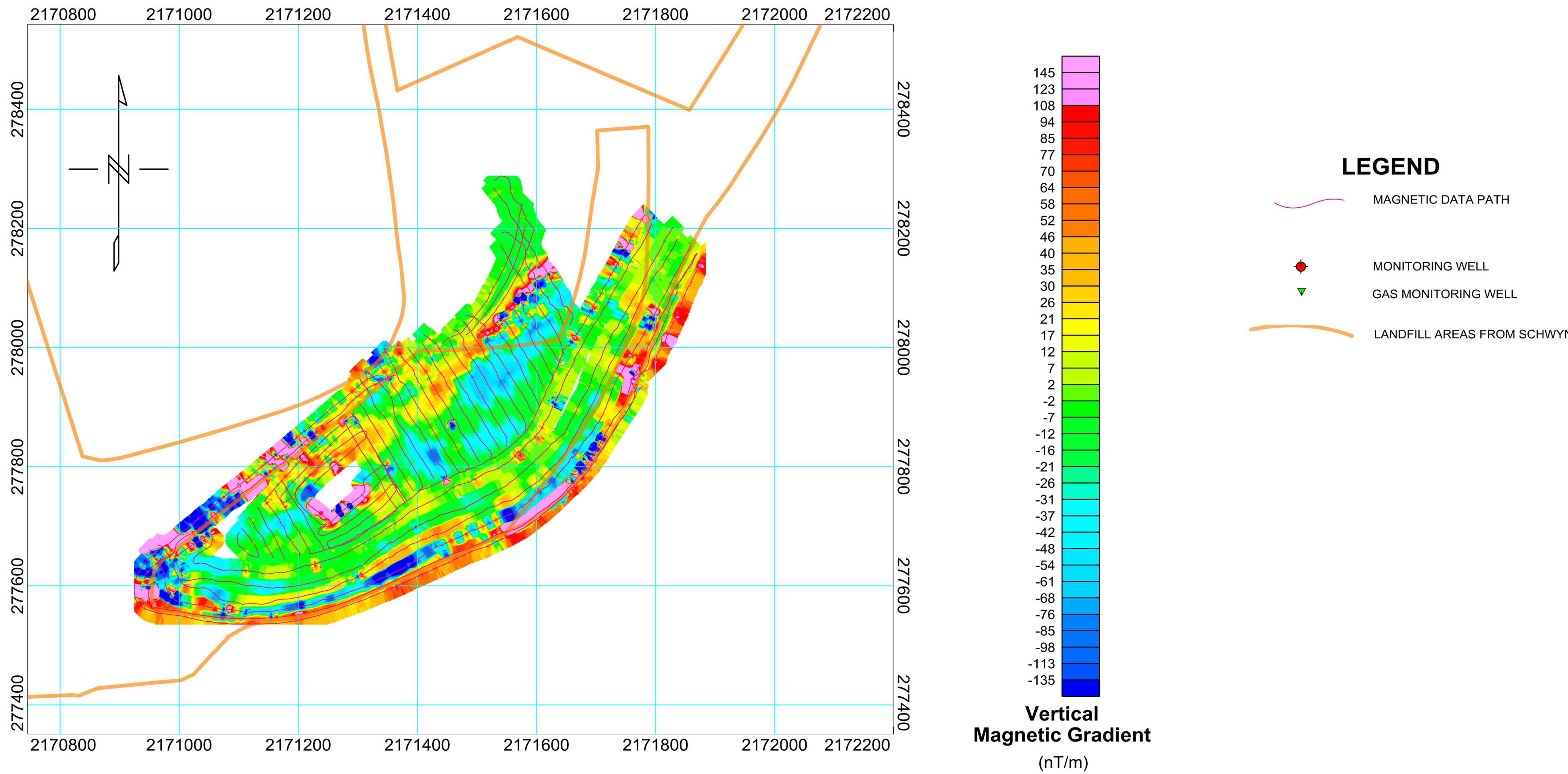
Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

REVISION: B-18-JUL-12

DATE: APRIL 2012

FILE: Area1_VGrad.map

ZONGE PROJECT 12069



Scale 1:2400

100 0 100 200 300 400 500

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

FIGURE A3

VERTICAL MAGNETIC GRADIENT AREA 1 - DATA PLOT

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Prepared by:

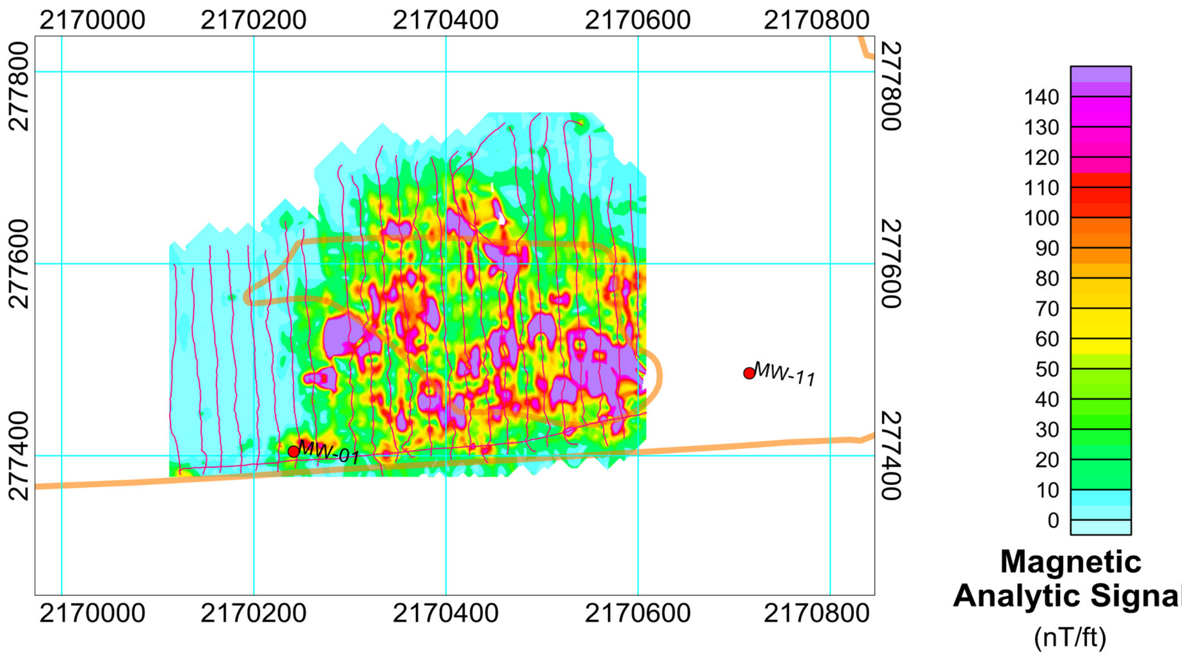
Zonge
TRUSTED GEOPHYSICS.

REVISION: B-18-JUL-12

DATE: APRIL 2012

FILE: Area2_AnSig.map

ZONGE PROJECT 12069



LEGEND

MAGNETIC DATA PATH

MONITORING WELL

LANDFILL AREAS FROM SCHWYN

Scale 1:2400

100 0 100

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

FIGURE A4

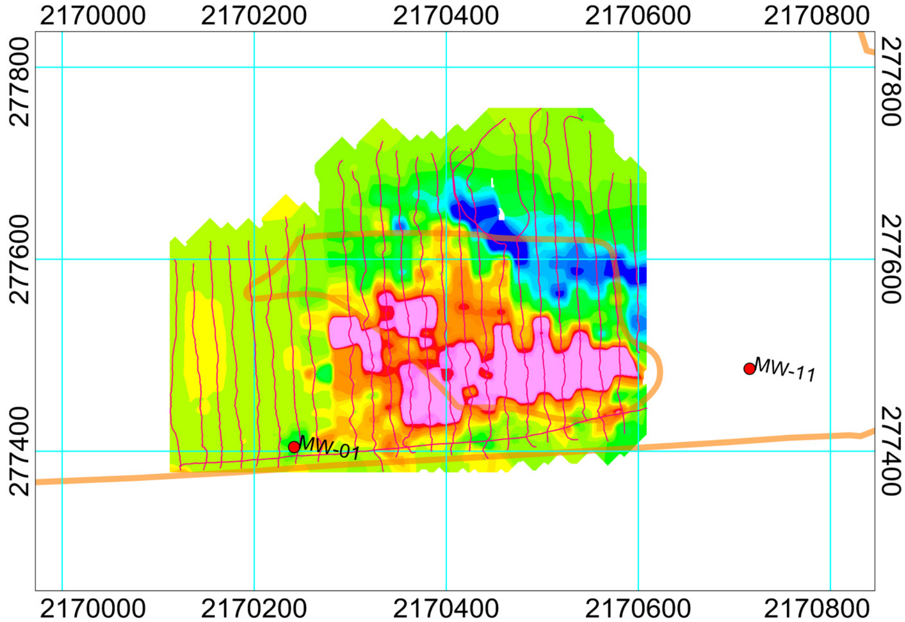
MAGNETIC ANALYTIC SIGNAL AREA 2 - DATA PLOT

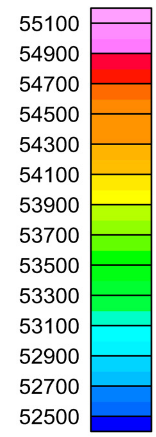
Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Prepared by:

Zonge

TRUSTED GEOPHYSICS.





Total Magnetic Field
(nT)

LEGEND

MAGNETIC DATA PATH

MONITORING WELL

LANDFILL AREAS FROM SCHWYN

Scale 1:2400

100 0 100

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

FIGURE A5

TOTAL MAGNETIC FIELD AREA 2 - DATA PLOT

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Prepared by:

Zonge
TRUSTED GEOPHYSICS.

REVISION: B=18-JUL-12

DATE: APRIL 2012

FILE: Area2_Top.map

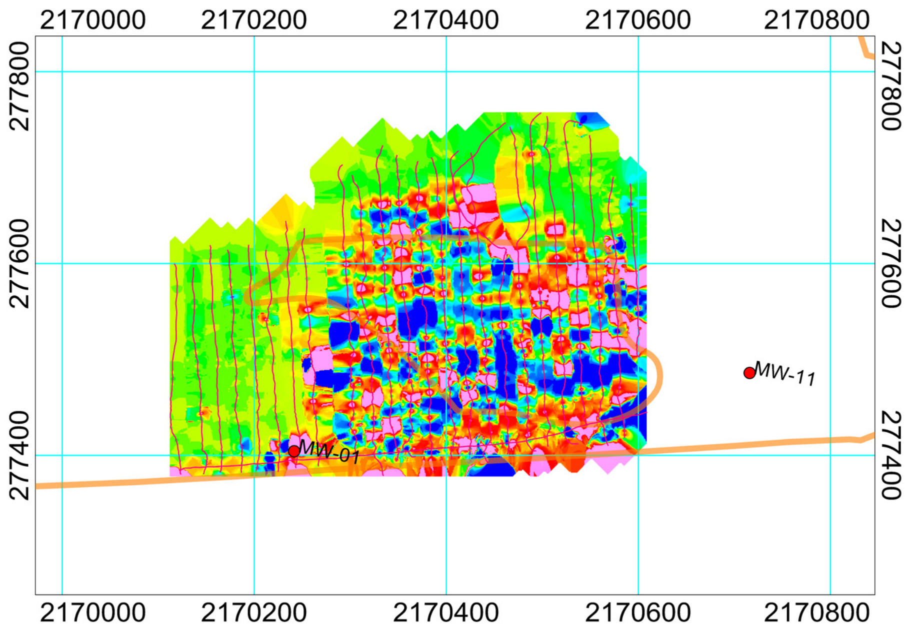
ZONGE PROJECT 12069

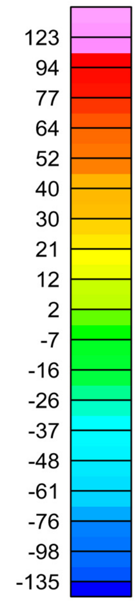
REVISION: B-18-JUL-12

DATE: APRIL 2012

FILE: Area2.map

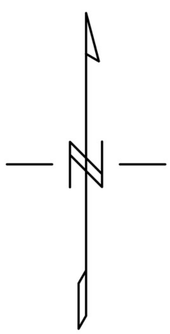
ZONGE PROJECT 12069





Vertical Magnetic Gradient

(nT/m)



LEGEND

MAGNETIC DATA PATH

MONITORING WELL

LANDFILL AREAS FROM SCHWYN

Scale 1:2400

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

FIGURE A6

VERTICAL MAGNETIC GRADIENT
AREA 2 - DATA PLOT

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Prepared by:

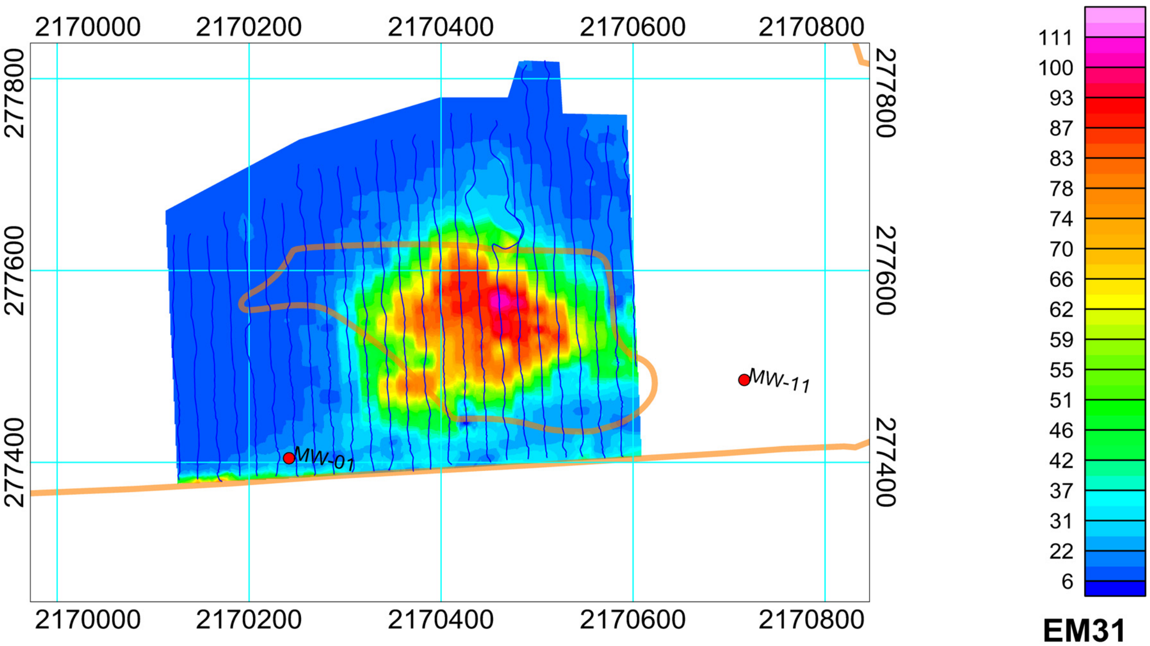
Zonge
TRUSTED GEOPHYSICS.

REVISION: A-18-JUL-12

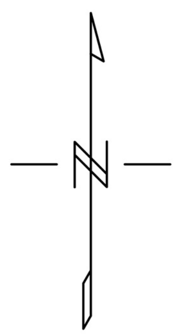
DATE: APRIL 2012

FILE: Area2_EM31-Q.map

ZONGE PROJECT 12069



EM31
Apparent Conductivity
(mS/m)



LEGEND

EM31 DATA PATH

MONITORING WELL

LANDFILL AREAS FROM SCHWYN

Scale 1:2400

100 0 100

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

FIGURE A7

EM31 APPARENT CONDUCTIVITY
AREA 2 - DATA PLOT

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Prepared by:

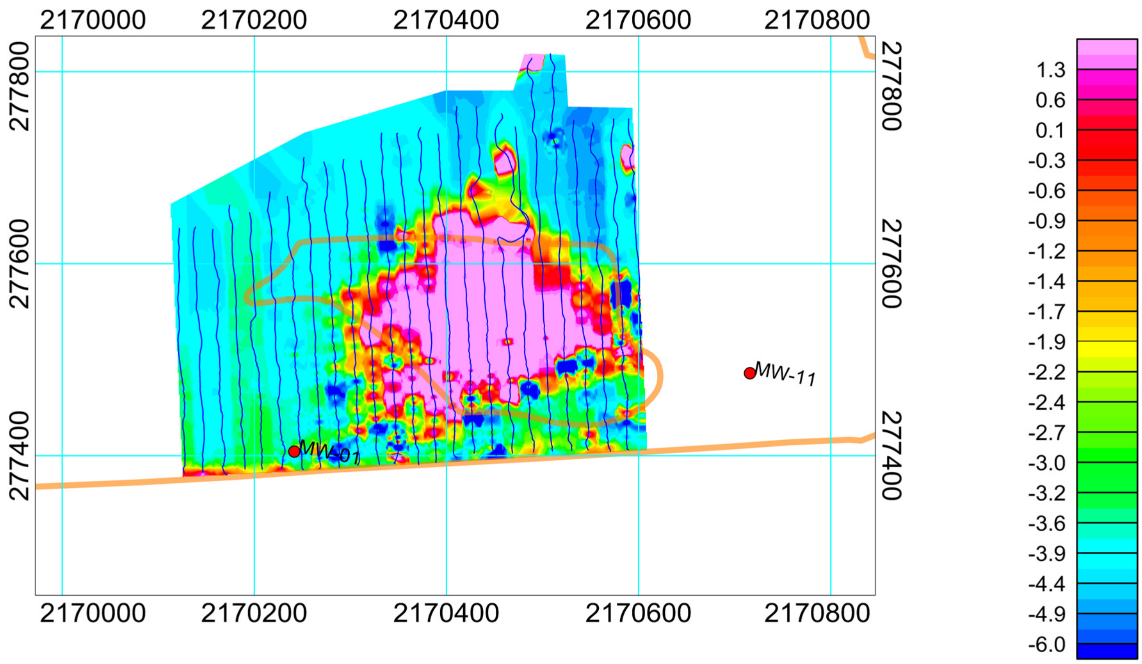
Zonge
TRUSTED GEOPHYSICS.

REVISION: B-18-JUL-12

DATE: APRIL 2012

FILE: Area2_EM31-I.map

ZONGE PROJECT 12069



EM31
In-Phase Response
(mS/m)

LEGEND

EM31 DATA PATH

MONITORING WELL

LANDFILL AREAS FROM SCHWYN

Scale 1:2400

100 0 100

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

FIGURE A8

EM31 IN-PHASE RESPONSE
AREA 2 - DATA PLOT

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Prepared by:

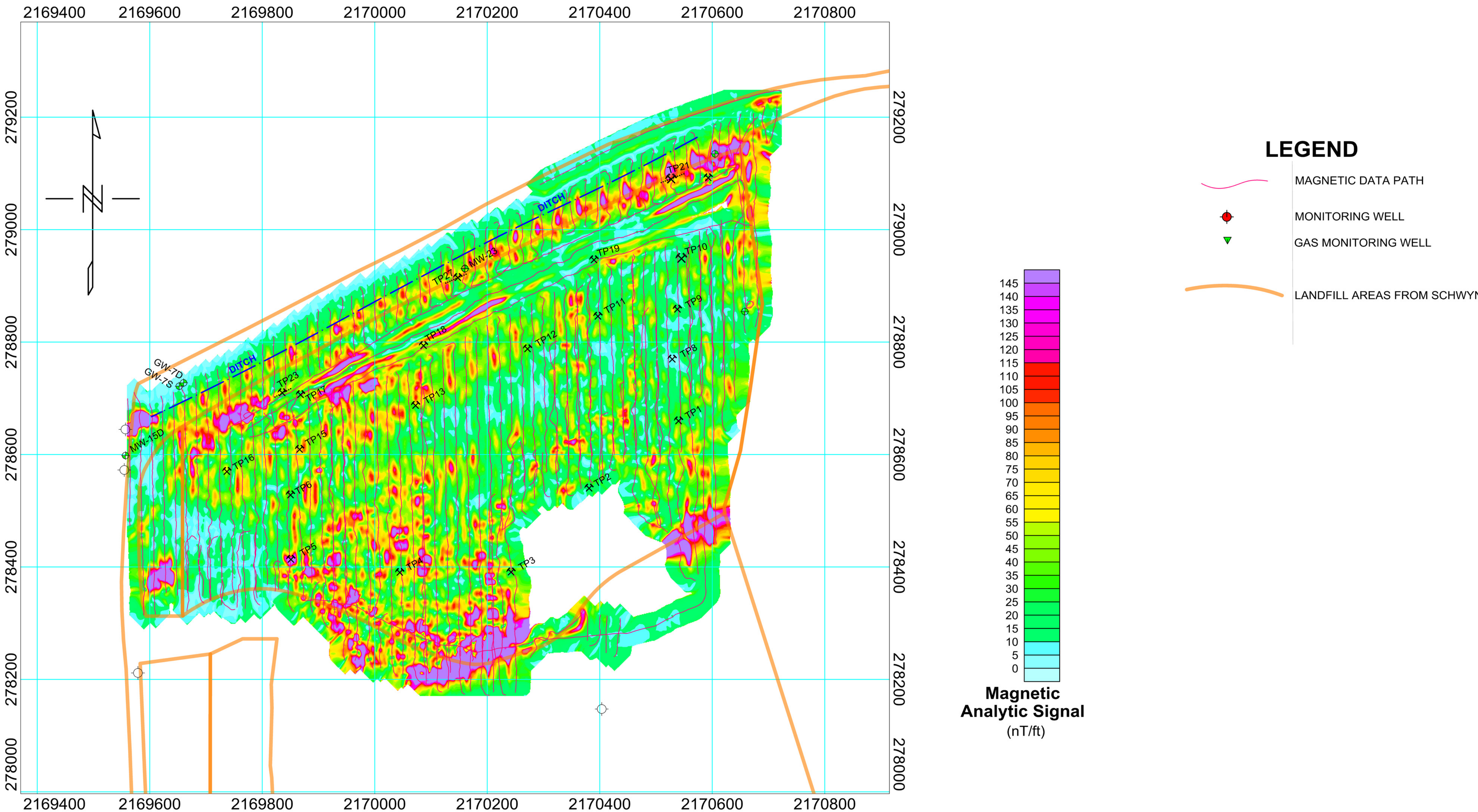
Zonge
TRUSTED GEOPHYSICS.

REVISION: B-18-JUL-12

DATE: APRIL 2012

FILE: Area5.map

ZONGE PROJECT 12069



Scale 1:2400

100 0 100 200 300 400 500

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

FIGURE A9

MAGNETIC ANALYTIC SIGNAL AREA 5 - DATA PLOT

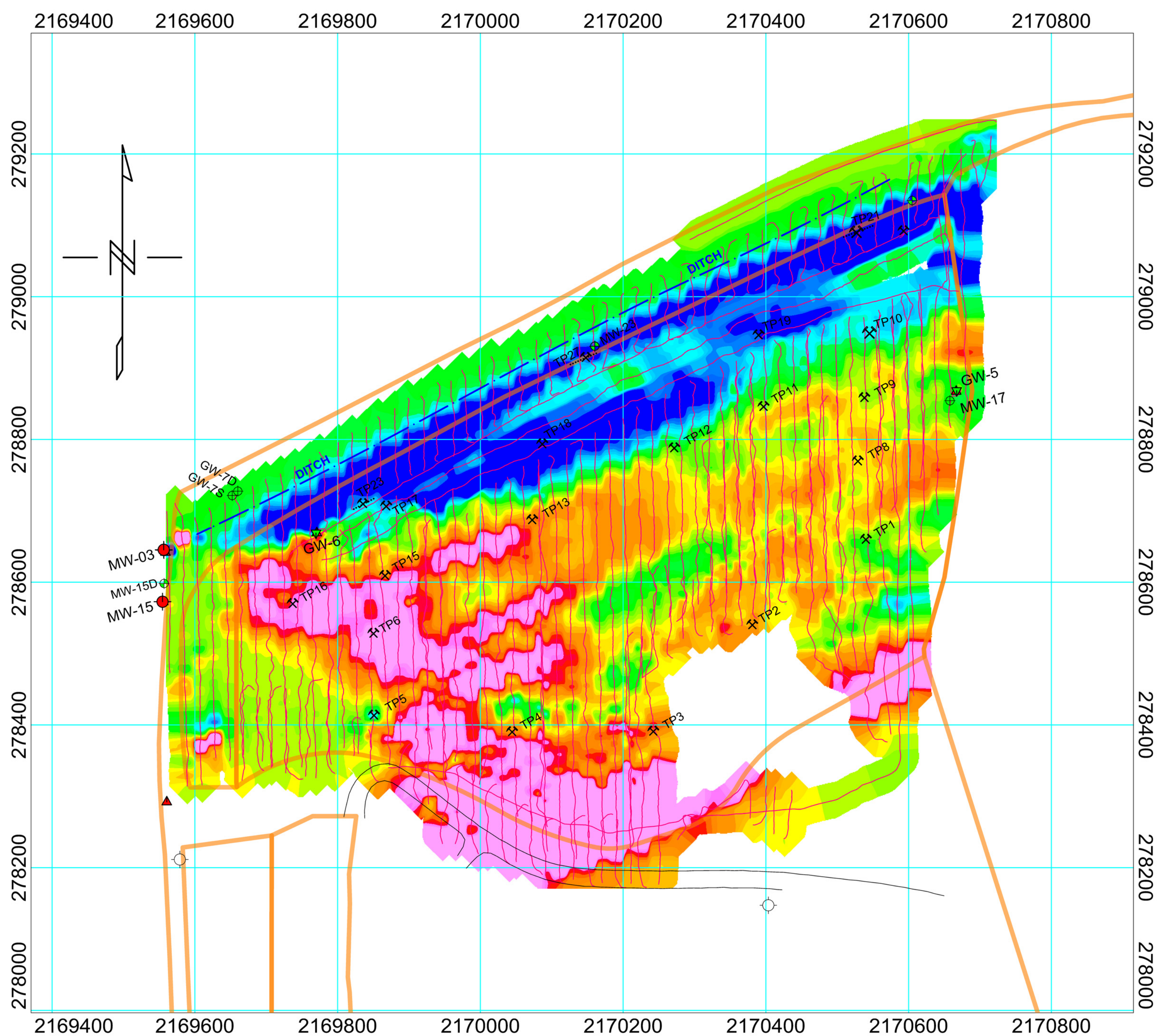
Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Prepared by:

Zonge

TRUSTED GEOPHYSICS.

REVISION: B-18-JUL-12
DATE: APRIL 2012
FILE: Area5_Top.map
ZONGE PROJECT 12069



LEGEND

- MAGNETIC DATA PATH
- MONITORING WELL
- GAS MONITORING WELL
- LANDFILL AREAS FROM SCHWYN

55100
55000
54900
54800
54700
54600
54500
54400
54300
54200
54100
54000
53900
53800
53700
53600
53500
53400
53300
53200
53100
53000
52900
52800
52700
52600
52500

Total Magnetic Field
(nT)

Scale 1:2400

100 0 100 200 300 400 500

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

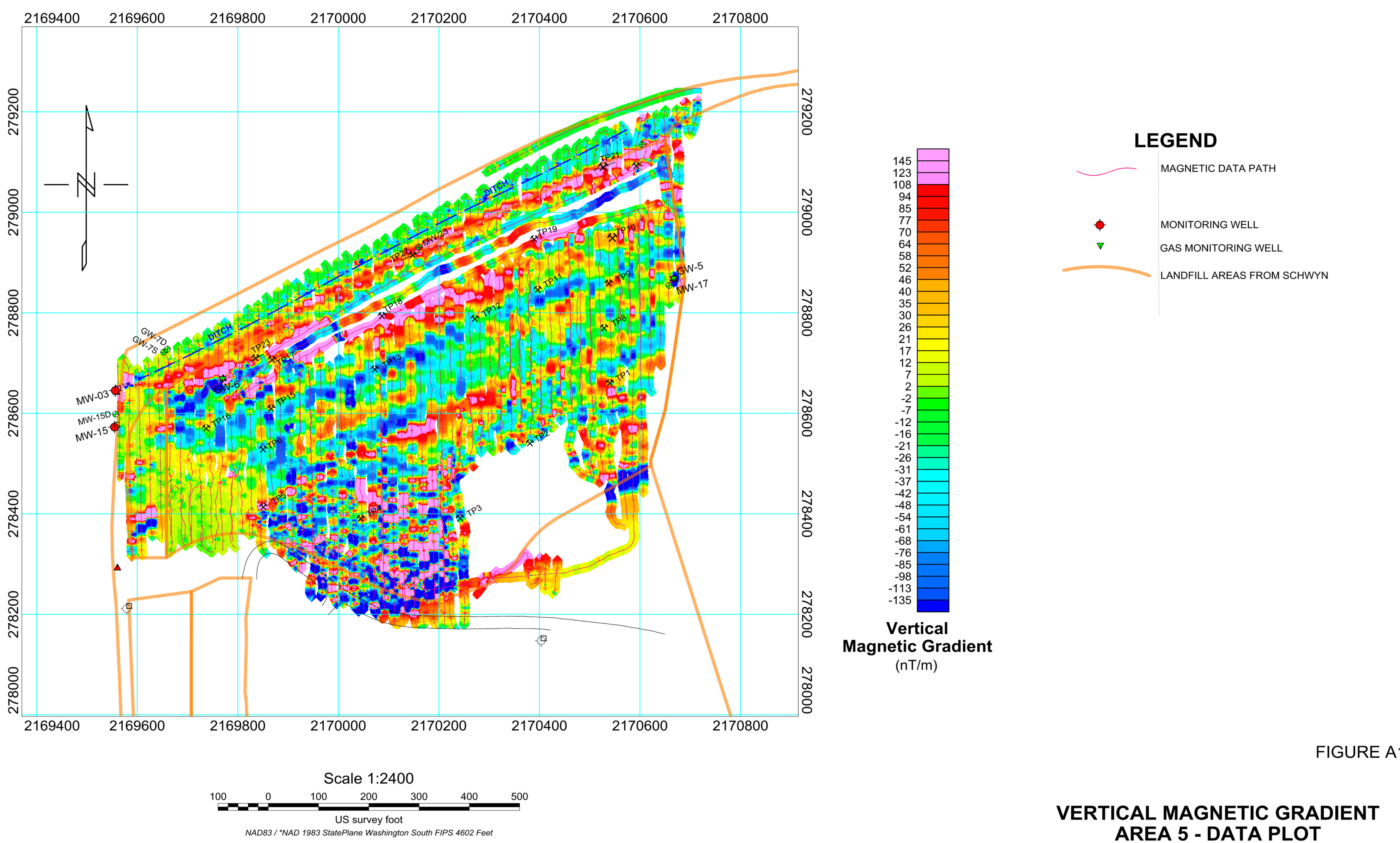
Prepared by:

Zonge TRUSTED GEOPHYSICS.

FIGURE A10

TOTAL MAGNETIC FIELD
AREA 5 - DATA PLOT

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington



REVISION: B-18-JUL-12

DATE: APRIL 2012

FILE: Area5.map

ZONGE PROJECT 12069

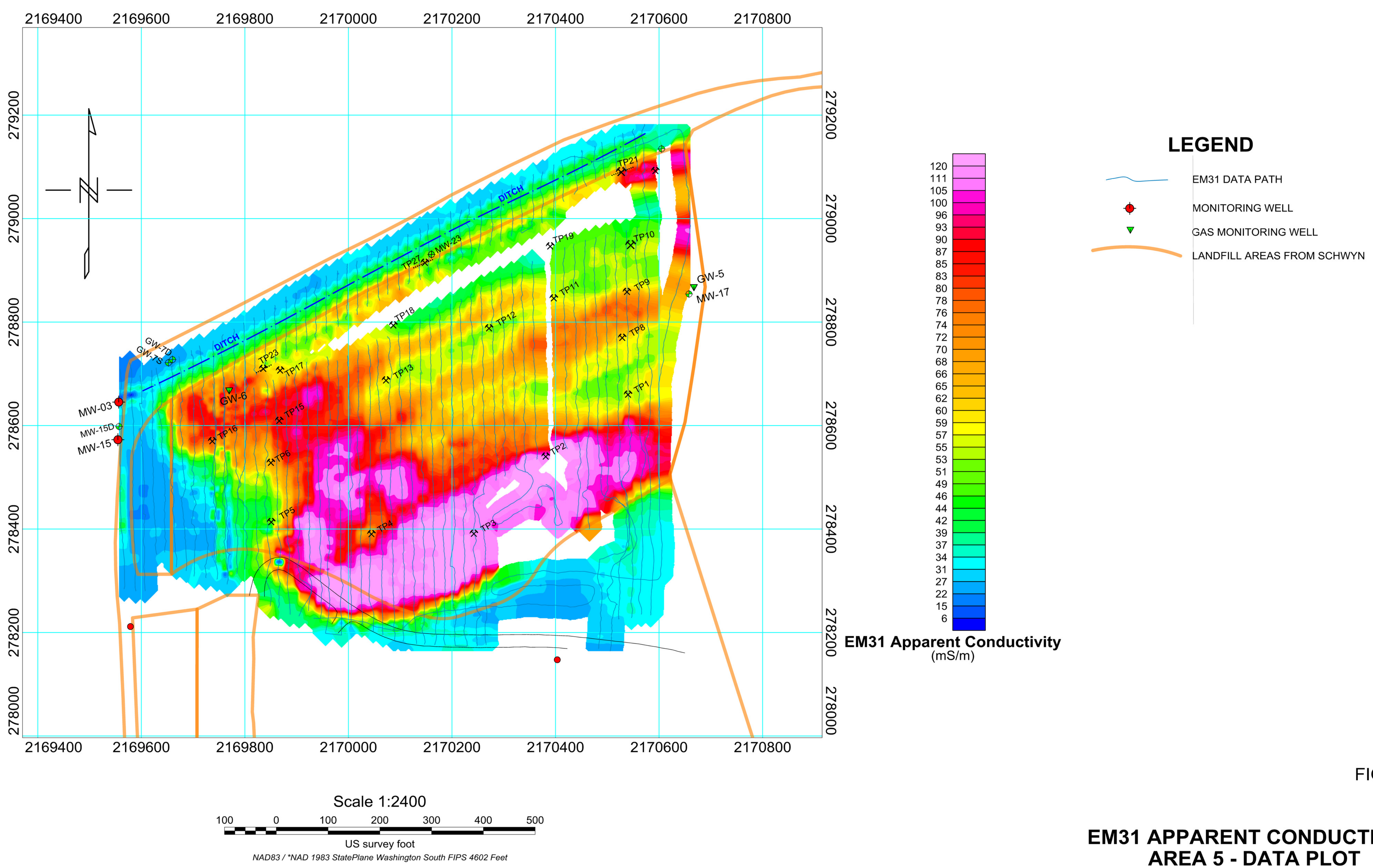
Prepared by:

Zonge TRUSTED GEOPHYSICS.

FIGURE A11

VERTICAL MAGNETIC GRADIENT
AREA 5 - DATA PLOT

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington



REVISION: B-18-JUL-12

DATE: APRIL 2012

FILE: Area5.map

ZONGE PROJECT 12069

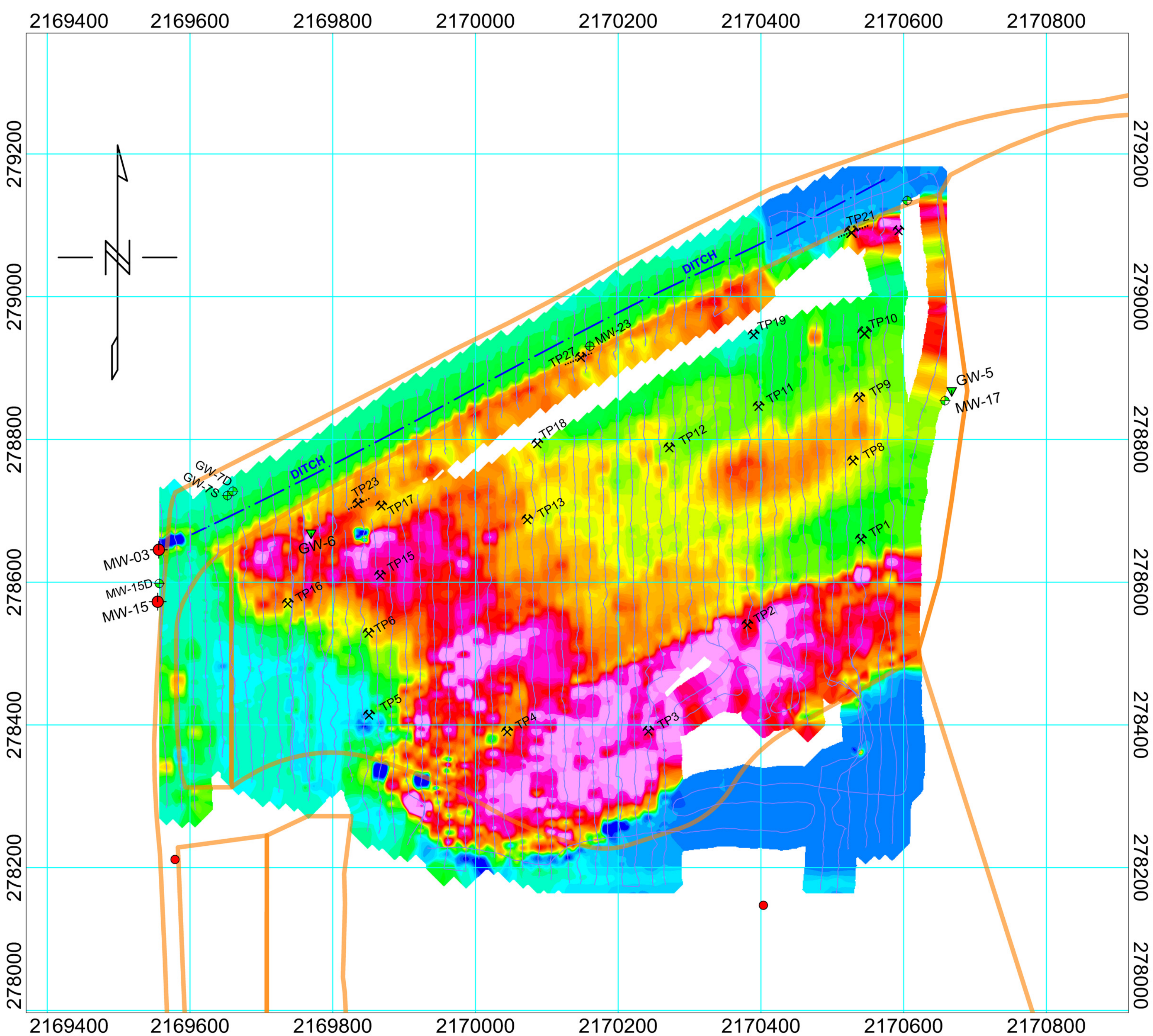
Prepared by:

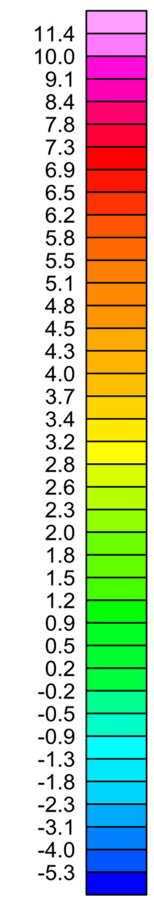
Zonge
TRUSTED GEOPHYSICS.

FIGURE A12

EM31 APPARENT CONDUCTIVITY
AREA 5 - DATA PLOT

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington





EM31
In-Phase Response
(ppt)

LEGEND

EM31 DATA PATH

MONITORING WELL

GAS MONITORING WELL

LANDFILL AREAS FROM SCHWYN

Scale 1:2400

100 0 100 200 300 400 500

US survey foot

*NAD83 / *NAD 1983 StatePlane Washington South FIPS 4602 Feet*

REVISION: B-18-JUL-12

DATE: APRIL 2012

FILE: Area5.map

ZONGE PROJECT 12069

Prepared by:

Zonge TRUSTED GEOPHYSICS.

FIGURE A13

EM31 IN-PHASE RESPONSE
AREA 5 - DATA PLOT

Geophysical Investigation
Sudbury Road Landfill
Walla Walla, Washington

Geophysical Investigation

Sudbury Road Landfill

Walla Walla, Washington

APPENDIX B

Technical Note

GEOPHYSICAL DETECTION OF BURIED OBJECTS

GEOPHYSICAL DETECTION OF BURIED OBJECTS

Photo 1-EM61

Photo 2-GPR

INTRODUCTION

Several geophysical techniques are used for locating buried objects such as underground storage tanks, pipes, utilities, drums and other debris. These techniques are used routinely, and are often recommended or required by state agencies, funding institutions and/or the EPA, particularly on sites where underground burial of steel drums or other debris may have occurred or where underground storage tanks are suspected.

Geophysics is generally used in the early reconnaissance phase of these investigations as a guide to sampling, excavation and/or placement of monitoring wells. In this paper we describe three of the most common geophysical techniques, electromagnetics (EM), magnetics (MAG) and ground penetrating radar (GPR).

Photo 3-Magnetometer

Photo 4-EM31

Zonge International, Inc.
8366 SW Nimbus Ave., Beaverton, OR 97008
(503) 992-6723 Fax: (503) 746-7094
www.zonge.com • ZongeOR@zonge.com

UTILITY OF GEOPHYSICS:

First, a few words about "geophysics" as used for environmental and geotechnical engineering applications. Surface geophysical techniques probe subsurface materials (soils and rock) using surface instruments. This is done by measuring physical signals which have interacted with the earth materials. These signals may be electrical, magnetic, acoustic (seismic) or electromagnetic.

Surface geophysics offers several advantages over other exploration techniques:

1) Surface geophysical methods are ***"non-intrusive"*** in that they do not disturb the ground surface, or stir up any contaminants which might be in the soil.

2) Geophysical methods ***measure earth properties over a large volume***. Whereas drilling only samples the earth at the point of the borehole, the measured geophysical response is affected by earth materials several feet, or tens of feet, away from the instrument sensor. This allows broad areas to be effectively "screened" with a series of surface measurements.

3) Most geophysical equipment used in environmental and geotechnical applications ***can be hand carried***. Geophysical surveys do not require vehicular access, but only a walking path, clear of brush and obstacles.

4) Geophysical surveys are relatively ***inexpensive*** and can be performed quickly.

TYPICAL OBJECTIVES:

Geophysics may be used in either a reconnaissance mode, or in a detailed survey mode. In the reconnaissance mode, geophysics is used to "screen" large areas to determine the presence or absence of buried objects. In more detailed surveys, the location and extent of the object is mapped in greater detail. This facilitates the efficient excavation of tanks or debris, aids the effective placement of monitoring wells, or improves the design of a sampling program.

The techniques discussed here are also useful for objectives other than identifying buried objects. Electromagnetic induction (EM) is especially useful in mapping changes in soil (e.g. sand or gravel channels), mapping clay aquitards, and mapping contaminant leachate plumes in groundwater. GPR can be used to map shallow stratigraphy or to map zones of disturbed soils.

GEOPHYSICAL METHODS:

Three geophysical methods are commonly used in the search for buried objects: 1) electromagnetic induction (EM), 2) magnetics (MAG), and 3) ground penetrating radar (GPR). EM and magnetics are complementary methods, most effective in the reconnaissance mode but also useful for more detailed work. GPR is most effective for detailed work, but may also be used in reconnaissance surveys.

Electromagnetic Methods:

The electromagnetic induction (EM) technique measures the electrical conductivity of the earth by inducing a time varying electric current in the earth. This is shown schematically in Figure 1. The EM technique was developed to measure natural soil conductivity to aid in identifying soil types and to measure rock conductivity in order to identify zones of conductive mineralization.

Man-made metallic objects are generally orders of magnitude more conductive than natural soils. Thus, the electric currents induced in the ground by EM instruments will be dramatically affected by the presence of any man made metallic object. Examples include pipes, tanks, cables, concrete reinforcing steel, or steel drums. By looking for anomalous signals which cannot be attributed to natural soils, buried metallic objects can readily be identified.

Frequency-domain EM – EM31

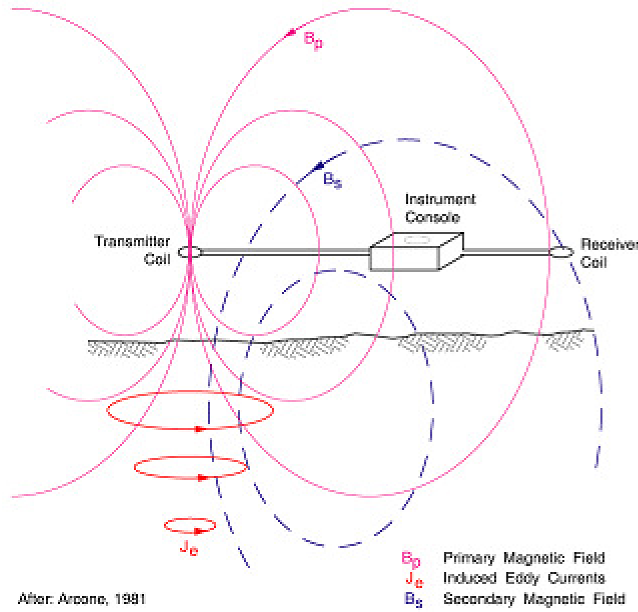
Frequency-domain EM systems transmit a sinusoidal waveform at a fixed frequency, or at multiple frequencies. The resulting secondary magnetic field may be phase shifted, depending on the nature of the target. Both the in-phase component (in phase with the primary magnetic field) and the quadrature phase component (shifted 90° from the primary field) can be measured to provide the phase shift information.

The Geonics EM31 is a common frequency domain EM instrument, often used for buried object detection. The cover photo 4 shows the EM31 in a field situation. Figure 1 is a schematic showing the principles of operation. A transmitter coil is in one end of the boom and a receiver coil in the other end. Depth of investigation for the EM-31 is generally 10-15 feet, but it may detect large metal objects at a somewhat greater distance. The instrument can quickly cover a wide area, mapping anomalous areas (metallic object locations) as well as changes in the soil character.

Figure 2 shows some sample data over a disposal site where 55 gallon steel drums had been dumped in a field and then covered with soil. The noisy and/or negative "apparent" conductivity is a clear indicator of metallic objects. The EM31 also records an "in-phase response" which aids in identifying metallic conductors. Data in Figure 2 indicate the zone of burial covers most of the northwest expanse of the site.

FIGURE 1

PRINCIPLES OF ELECTROMAGNETIC INDUCTION



Time-domain EM – EM61

Time-domain EM systems transmit a magnetic pulse, with a duration in the order of tens of microseconds (µs). That magnetic pulse induces electric currents in the ground as well as in any metallic object which is buried (or on the surface) within its range of influence. Currents induced in metallic conductors decay at a much slower rate than currents induced in the ground. Hence, metallic conductors can be easily identified.

The EM61-MK2a (cover photo 1) is a time-domain metal detector manufactured by Geonics, Ltd., of Toronto, Canada. The EM61-MK2a instrument consists of two horizontal air cored coils, 1.0 meter by 0.5 meters in size. The bottom coil acts as a receiver and transmitter and the top coil as a receiver. The instrument weighs about 75 lbs. and is pulled by one operator.

The Geonics EM61-MK2a has 4 time gates, to measure the rate of decay of the signal, and two receiver coils, to measure the field gradient. The rate of decay is dependant on the size, shape, and orientation of the metallic object. Generally, the EM61 is used to estimate gross target parameters, but can be used for more detailed discrimination of targets, particularly in identifying unexploded ordnance (UXO) materials.

The two receiver coils are very helpful in the differentiating between near surface objects and deeper objects. Since the amplitude of the response is highly dependent on the distance between the coil assembly and target, small near surface targets often produce a response orders of magnitude larger than targets having greater size at deeper depths. This masking effect from the near surface materials

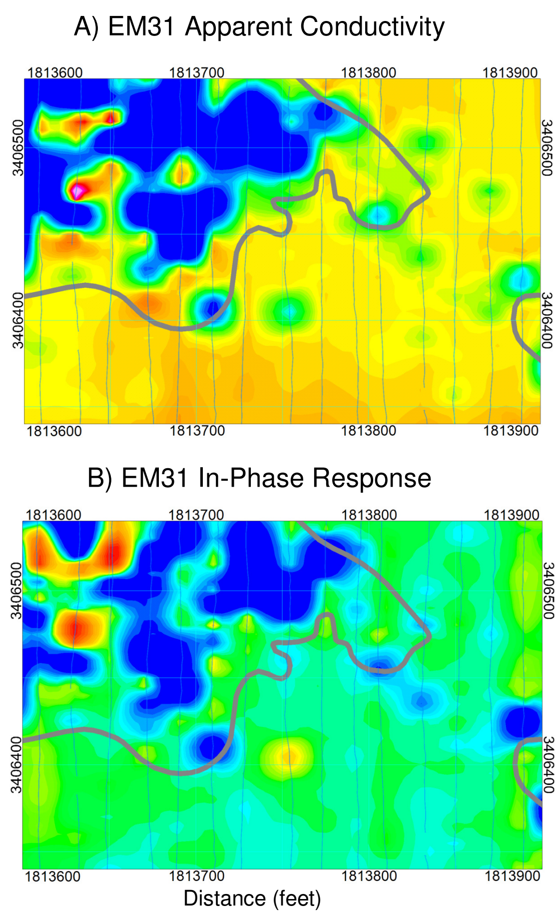
Geophysical Detection Of Buried Objects

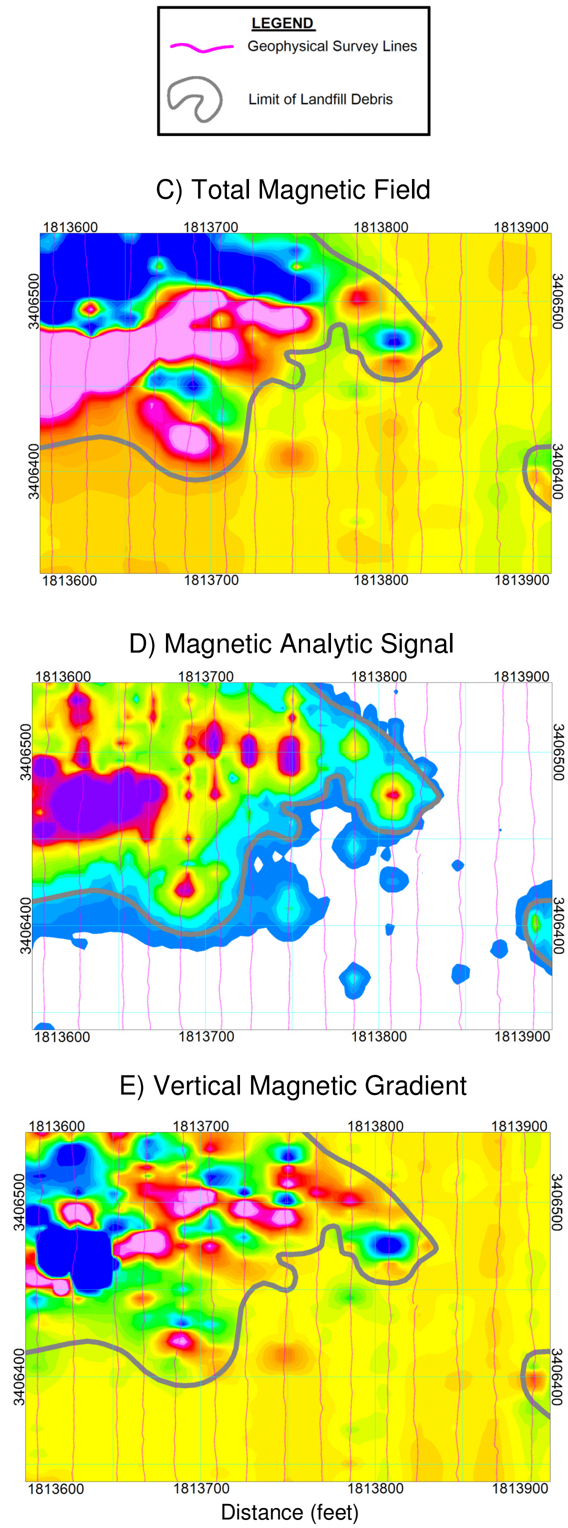
is drastically reduced by processing output of the two coils, essentially subtracting a portion of the bottom coil response from the top coil response. This is referred to as the differential mode or the differential signal.

Figure 3 shows some sample data over a 55 gallon steel drum partially buried, essentially flush with the surface of the ground. The response from the top and bottom coils is indicative of a substantial metallic presence. The relatively weak differential response is indicative of a shallow target.

FIGURE 2

EM31 & MAGNETIC GRIDS

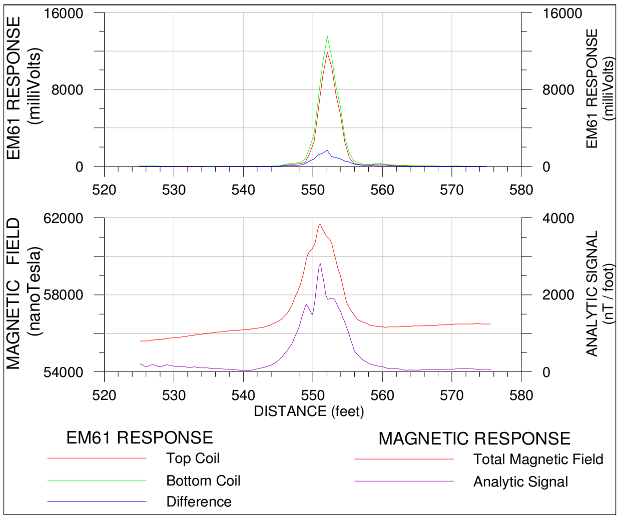




Geophysical Detection Of Buried Objects

FIGURE 3

EM61 & MAGNETIC PROFILES OVER PARTIALLY BURIED 55 GALLON DRUM



Magnetic Methods:

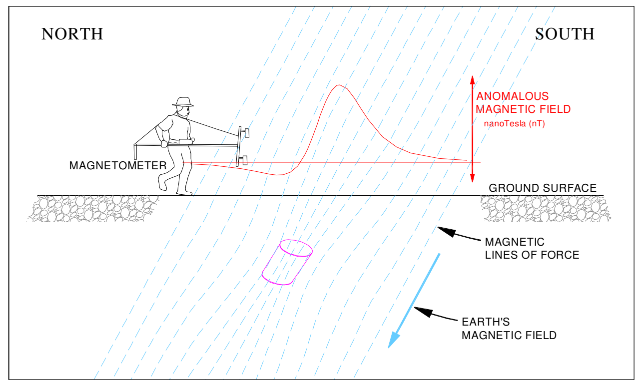
Magnetic methods measure disturbances in the earth's natural magnetic field. These disturbances are caused by magnetic materials, either magnetic rocks, or man made objects containing iron or steel. This is shown schematically in Figure 4. Most soils have negligible magnetization (both induced and remnant). Thus, most magnetic disturbances from shallow sources can be attributed to iron or steel objects which have been placed there by man's activities.

Magnetometers used for buried object detection usually measure the gradient of the magnetic field. This is done by measuring the difference between the magnetic field at two sensors separated vertically by two or three feet. This configuration is more sensitive to nearby disturbances, and is less effected by disturbances caused by distant objects or shallow bedrock.

Photo 3 on the cover shows a magnetometer/gradiometer. This instrument can also cover wide areas quickly, providing complementary data to EM. Figure 2 includes total magnetic field data, gradiometer data, and magnetic analytic signal data over the barrel disposal area. The large deviations in both total field and gradient are indicative of steel objects in close proximity.

FIGURE 4

PRINCIPLES OF MAGNETIC EXPLORATION



Ground Penetrating Radar:

Ground penetrating radar (GPR), like other radar techniques, sends out an electromagnetic pulse (radio wave or microwave) which is reflected off a "target" and returns to the receiver. GPR operates at lower frequencies (80-1500 MHz) than other radar to obtain better penetration in the earth materials. The antenna is pulled slowly along the ground surface to produce a continuous subsurface profile.

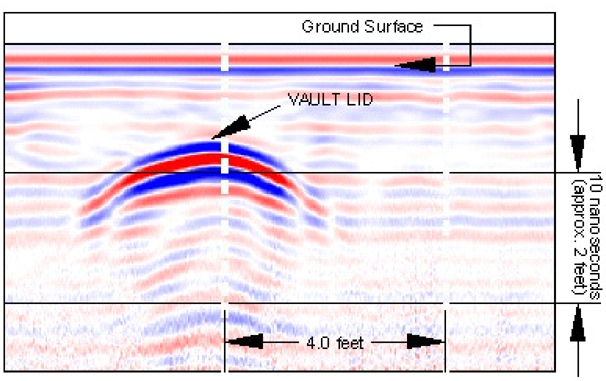
Photo 2 on the cover shows a GPR unit in operation. The 400 MHz antenna shown is being pushed in its cart. The control and recording unit is carried on the cart enabling one person operation.

Figure 5 is an example GPR profile over a shallow vault. The vertical scale is a time scale, giving the time for the radar pulse to travel down to the reflector and return to the receiver. Knowing the pulse velocity in the soils, we can convert this to depth. The horizontal scale corresponds to distance along the surface. Fiducial time marks on the record are placed at four foot intervals. The vault lid reflector shown appears as a hyperbola on the record. The vault lid produces a strong reflection with a characteristic ringing of the electronics, which appears as a dark red or blue band below the first arrival from the vault lid.

GPR is a tool for looking at selected areas in detail. Its continuous subsurface profiles give a graphic portrayal of subsurface conditions, and often provide an excellent means of accurately locating pipes and tanks. However, the GPR depth of exploration is strongly dependent on soil conductivity and subsurface conditions. In dry, sandy soils useful data may be obtained from depths down to 15 feet, whereas in conductive clay soils, typical of the Willamette valley, investigation depth is often limited to 2 or 3 feet.

FIGURE 5

SAMPLE GPR PROFILE



DISCUSSION:

As we have stressed, EM and magnetics are effective in screening large areas quickly to identify areas where buried objects may be present. Often these techniques can provide a rough estimate of the size and depth of the object causing the anomalous readings.

The choice of frequency domain EM (i.e. EM31) versus time-domain EM (i.e. EM61) depends on the objectives and the site. The EM61 is very effective at identifying small pieces of metal (e.g. unexploded ordnance), and offers some depth and discrimination capability. It is also less sensitive to cultural noise (e.g. buildings, vehicles, etc.) than the EM31. The EM61 can often resolve anomalies which are close together, where the EM31 does not. However, the EM61 requires a tight line spacing, typically 1 meter, to assure the area is covered. Also, the wheeled cart is difficult or impossible to operate on some sites (the EM61 can also be carried on a shoulder harness but is very awkward).

The EM31 is favored over the EM61 on more open sites where the objective is to locate underground tanks, drums, or collections of debris. The broader sphere of influence of the EM31 allows it to be run on a coarser line spacing, typically 5-20 feet depending on the target.

A major limitation of both EM and MAG is their sensitivity to cultural noise. Buildings, fences, metallic surface debris, and vehicles all create cultural noise. The EM and magnetic instruments respond to any metallic objects, whether buried or in plain view above ground. Thus, areas within 20 to 40 feet of buildings, vehicles or pipelines will be masked by the strong response from those objects. EM and magnetics will not be able to definitively identify other buried objects within that masked zone.

GPR on the other hand is fairly immune to those forms of cultural noise. The radar signal is confined to a broad beam, spreading at roughly a 45° angle, beneath the antenna. Most antennas are well shielded with little upward propagation of the pulse. Thus GPR can be run next to buildings, fences and parked vehicles. GPR may be run inside buildings and even over reinforced concrete.

Because the GPR beam is directional, it does not have the same utility as a reconnaissance tool as the EM and MAG techniques. Whereas the latter techniques would readily detect a large tank 10 or 20 feet off the survey line, GPR would not detect the tank unless the survey line passed directly over it.

CONCLUSIONS

No geophysical technique should be used without some form of "ground truth" provided by drilling, excavation, or some other form of sampling. The geophysical signature of an underground storage tank may be very similar to that of a buried automobile. However, geophysics can eliminate random drilling or extensive excavation when searching for underground tanks or other materials.

To conclude, EM, magnetic, and GPR methods are effective, complimentary techniques used in the detection and delineation of subsurface metallic objects. The choice of technique or techniques depends very much on both site conditions and the survey objective.

FURTHER READING:

Benson, R.C., Glaccum, R.A., and Noel, M.R., 1982, Geophysical techniques for sensing buried wastes and waste migration: Report prepared by TECHNOS, Inc. for EPA, Advanced Monitoring Systems Division, Las Vegas, pp.235.

Evans, R.B., 1982, Currently available geophysical methods for use in hazardous waste site investigations: from Risk Assessment at Hazardous Waste Sites, ACS symposium series No.204, p.93-115.

French, R.B., Williams, T.R., and Foster, A.R., 1988, Geophysical surveys at a superfund site, Western Processing, Washington: Proc. of SAGEEP, March 1988, Golden, Colorado, p.747-753.

McNeill, J.D., 1990, Use of electromagnetic methods for groundwater studies: in Geotechnical and Environmental Geophysics, ed.: S.H.Ward, SEG, IG#5, p.191:218.

Romig, Phillip, 1992, Engineering and Environmental Geophysics Get Top Billing at SAGEEP.: The Leading Edge Vol. 11, No. 11, P.36-37.

DISCUSSION OF GEOPHYSICAL TECHNIQUES

GEOPHYSICAL DETECTION OF BURIED OBJECTS

Zonge International, Inc.
8366 SW Nimbus Avenue
Beaverton, OR 97008
www.zonge.com
Phone: (503) 992-6723

FILE: B-B_TECH.pub
REVISION: 23-SEP-2010

APPENDIX C

Geotechnical Soils Report

Schwyn Environmental Services

HWA GeoSciences Inc.
Geotechnical & Pavement Engineering • Hydrogeology • Geoenvironmental • Planning & Permitting • Inspection & Testing

June 15, 2012
HWA Project No. 2012-054-23

Schwyn Environmental Services
4621 South Custer Court
Spokane, Washington 99223

Attention: Mr. Craig Schwyn, L.H.G.

Subject: **Materials Laboratory Report**
Sudbury Remedial Investigation
Geotechnical Laboratory Testing Program
Sudbury Road Landfill
Walla Walla, Washington

Dear Mr. Schwyn;

As requested, HWA GeoSciences Inc. (HWA) performed laboratory testing for the subject project. Herein we present the results of our laboratory analyses, which are summarized on the attached Figures. The laboratory testing program was performed in general accordance with your instructions and appropriate ASTM Standards as outlined below.

Sample Information: The subject samples were delivered to our laboratory on May 21st, 2012 by FED-EX delivery. Upon receipt, the samples were logged-in and a roster was prepared as shown on Table 1 presented at the end of this report. The samples were delivered in small Ziploc bags or Shelby tubes.

Moisture Content of Soil: The moisture content of the soil sample (percent by dry mass) was determined in general accordance with ASTM D 2216. The results are shown on Figure 1.

Particle Size Analysis of Soils: Selected samples were tested to determine the particle size distribution in general accordance with ASTM D422, using both sieve and hydrometer analysis. The results are summarized on the attached Particle Size Analysis reports shown on Figures 2 and 3, which also provide information regarding the classification of the sample and the moisture content at the time of testing.

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits): Selected samples were tested using method ASTM D4318, multi-point method. The results are reported on the attached Liquid Limit, Plastic Limit, and Plasticity Index reports shown on Figure 4.

Laboratory Compaction Characteristics of Soil (Proctor Test): One bulk sample was tested using method ASTM D698 (Standard Proctor) Method B.

21312 30th Drive SE
Suite 110
Bothell, WA 98021.7010
Tel: 425.774.0106
Fax: 425.774.2714
www.hwageo.com

The test was performed on the portion of the sample passing 3/8", as required by the test procedure. The test results are summarized on the attached Laboratory Compaction Characteristics of Soil report shown on Figure 5.

HYDRAULIC CONDUCTIVITY OF SOIL (FLEXI-WALL TRIAXIAL CHAMBER METHOD): The hydraulic conductivity (also commonly referred to as coefficient of permeability) of selected samples was measured in general accordance with method ASTM D5084. One sample was re-molded at approximately 2% over optimum moisture content within a 4-inch Proctor mold to about 95 percent of the materials maximum Proctor density as determined in the laboratory per ASTM D 698 as detailed in Table 2 below.

TABLE 2 PERMEABILITY TEST SAMPLE RE-MOLDING PARAMETERS

SAMPLE DESIGNATION	UCS	MOISTURE CONTENT	DRY UNIT WEIGHT	RELATIVE COMPACTION
TP-12 Bulk	**ML**	**17.0%**	**100.9 pcf**	**95.8%**

Three other samples, extracted from Shelby tubes were also tested. For each sample, test specimen dimensions and weight were recorded prior to placement within a flexible membrane within a triaxial pressure chamber. An effective confining pressure of 3.0 psi was applied to simulate near-surface ground conditions. Saturation was induced by subjecting the test specimen to a flow gradient ranging from 2.9 to 12.8 generated by a back-pressure differential of 2 psi and testing was conducted until inflow was approximately equal to outflow and the hydraulic conductivity was essentially steady. The test results are presented in detail on Figures 6 through 9.

CLOSURE: Experience has shown that laboratory test values for soil and other natural materials vary with each representative sample. As such, HWA has no knowledge as to the extent and quantity of material the tested sample may represent. HWA also makes no warranty as to how representative either the sample tested or the test results obtained are to actual field conditions. It is a well established fact that sampling methods present varying degrees of disturbance or variance that affect sample representativeness.

No copy should be made of this report except in its entirety.

We appreciate the opportunity to provide laboratory testing services on this project. Should you have any questions or comments, or if we may be of further service, please call.

Sincerely,

HWA GEOSCIENCES INC.

Steven E. Greene, L.G., L.E.G.
Vice-President

Ashley Crane
Laboratory Supervisor

SEG:AC:seg

Attachments:

Figure 1	Summary of Material Properties
Figures 2 – 3	Particle-Size Analysis of Soils
Figure 4	Liquid Limits, Plastic Limit and Plasticity Index of Soils
Figure 5	Laboratory Compaction Characteristics of Soils
Figures 6 – 9	Hydraulic Conductivity of Soils

Table 1 Sudbury Remedial Investigation – Sample Inventory

Exploration	Depth Interval	Sample Type	Moisture Content	Particle Size w/Hydro	Atterberg Limits	Proctor (ASTM D 698)	Permeability Triaxial
TP-8	6 – 24"	Shelby Tube	Best Sample	Best Sample	Best Sample		Best Sample
TP-8	24 – 42"	Shelby Tube					
TP-19	6 – 24"	Shelby Tube	Best Sample	Best Sample	Best Sample		Best Sample
TP-19	24 – 42"	Shelby Tube					
TP-20	6 – 24"	Shelby Tube	Best Sample	Best Sample	Best Sample		Best Sample
TP-20	24 – 42"	Shelby Tube					
TP-12		Bulk	X	X	X	X	X
TP-8	1	Ziploc Bag	X				
TP-8	2	Ziploc Bag	X				
TP-8	3	Ziploc Bag	X				
TP-8	4	Ziploc Bag	X				
TP-8	5	Ziploc Bag	X				
TP-19	1	Ziploc Bag	X				
TP-19	2	Ziploc Bag	X				
TP-19	3	Ziploc Bag	X				
TP-19	4	Ziploc Bag	X				
TP-19	5	Ziploc Bag	X				
TP-20	1	Ziploc Bag	X				
TP-20	2	Ziploc Bag	X				
TP-20	3	Ziploc Bag	X				
TP-20	4	Ziploc Bag	X				
TP-20	5	Ziploc Bag	X				

X-Test Requested

EXPLORATION DESIGNATION	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	MOISTURE CONTENT (%)	MAXIMUM DRY DENSITY	OPTIMUM MOISTURE CONTENT	ATTERBERG LIMITS (%) LL	PL	PI	% GRAVEL	% SAND	% SILT	% CLAY	ASTM SOIL CLASSIFICATION	SAMPLE DESCRIPTION
TP-08	1		14.0										ML	Light yellowish brown, SILT
TP-08	2		14.1										ML	Light olive brown, SILT
TP-08	3		15.1										ML	Olive brown, SILT
TP-08	4		15.2										ML	Light olive brown, SILT
TP-08	5		15.6										ML	Light olive brown, SILT
TP-08 (ST)	2	3.5	14.7			NP	NP	NP		22.2	73.0	4.7	ML	Olive brown, SILT with sand
TP-12	0		9.5	105.3	16.7	24	23	1	0.1	12.0	81.5	6.3	ML	Light olive brown, SILT
TP-19	1		14.1										ML	Light olive brown, SILT
TP-19	2		14.1										ML	Light olive brown, SILT
TP-19	3		7.6										ML	Light yellowish brown, SILT
TP-19	4		8.6										ML	Light yellowish brown, SILT
TP-19	5		9.6										ML	Light yellowish brown, SILT
TP-19 (ST)	2	3.5	13.9			27	23	4		13.3	84.6	2.1	ML	Olive brown, SILT
TP-20	1		18.7										ML	Olive brown, SILT
TP-20	2		18.4										ML	Olive brown, SILT
TP-20	3		15.5										ML	Olive brown, SILT
TP-20	4		13.9										ML	Olive brown, SILT
TP-20	5		15.3										ML	Olive brown, SILT
TP-20 (ST)	0.5	2.0	20.6			32	27	5		12.2	81.4	6.3	ML	Olive brown, SILT

Notes:
1. This table summarizes information presented elsewhere in the report and should be used in conjunction with the report text, other graphs and tables, and the exploration logs.
2. The classification of soils in this table is based on ASTM D2487 and D2488 as applicable.

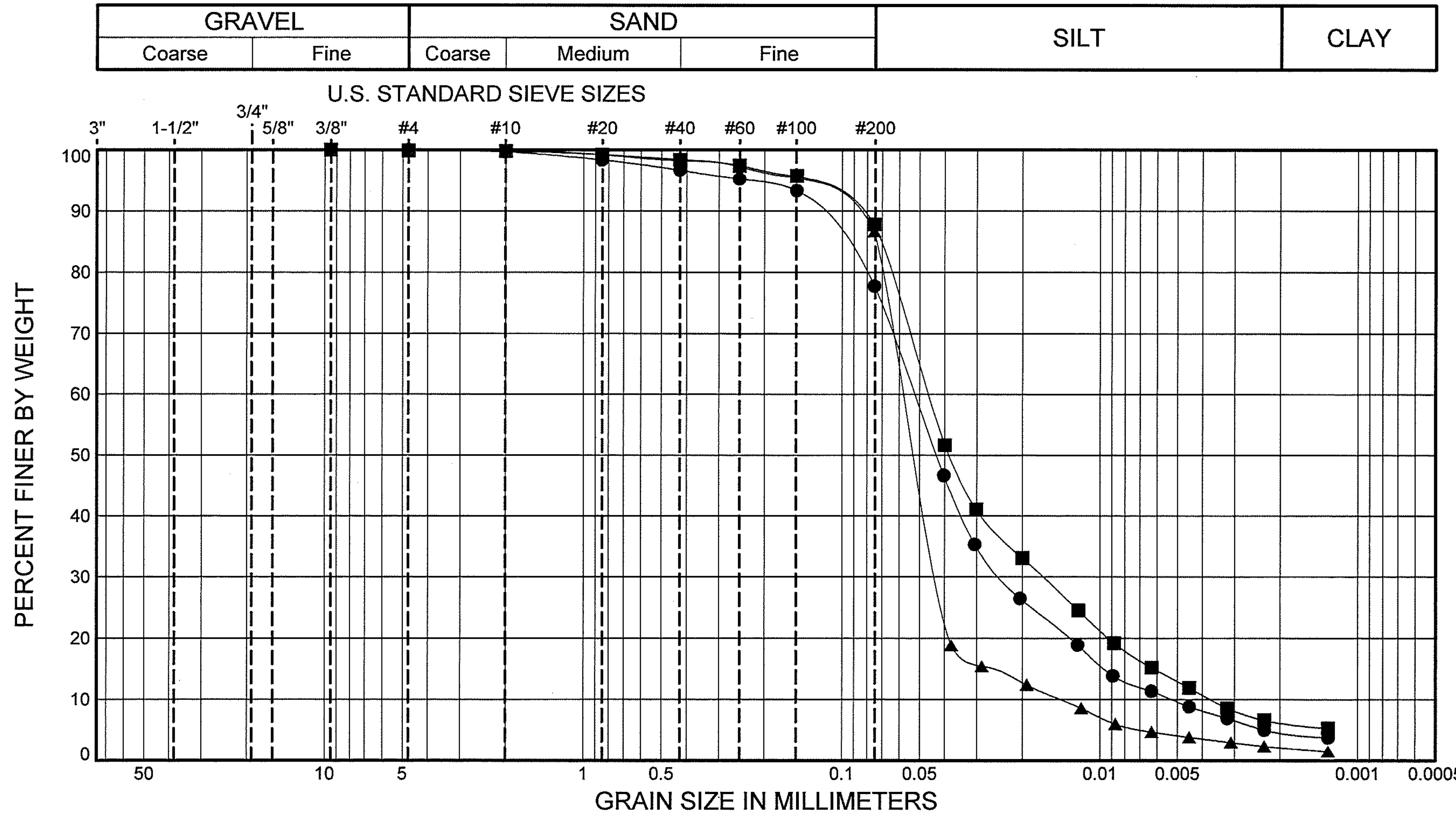
HWA GEOSCIENCES INC.

Sudbury Road LF Remedial Investigation
Walla Walla, Washington

SUMMARY OF MATERIAL PROPERTIES

PAGE: 1 of 1

PROJECT NO.: 2012-054 FIGURE: 1



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	TP-08 (ST)		2.0 - 3.5	(ML) Olive brown, SILT with sand	15	NP	NP	NP	0.0	22.2	77.8
■	TP-12	Bulk		(ML) Light olive brown, SILT	10	24	23	1	0.1	12.0	87.8
▲	TP-19 (ST)		2.0 - 3.5	(ML) Olive brown, SILT	14	27	23	4	0.0	13.3	86.7

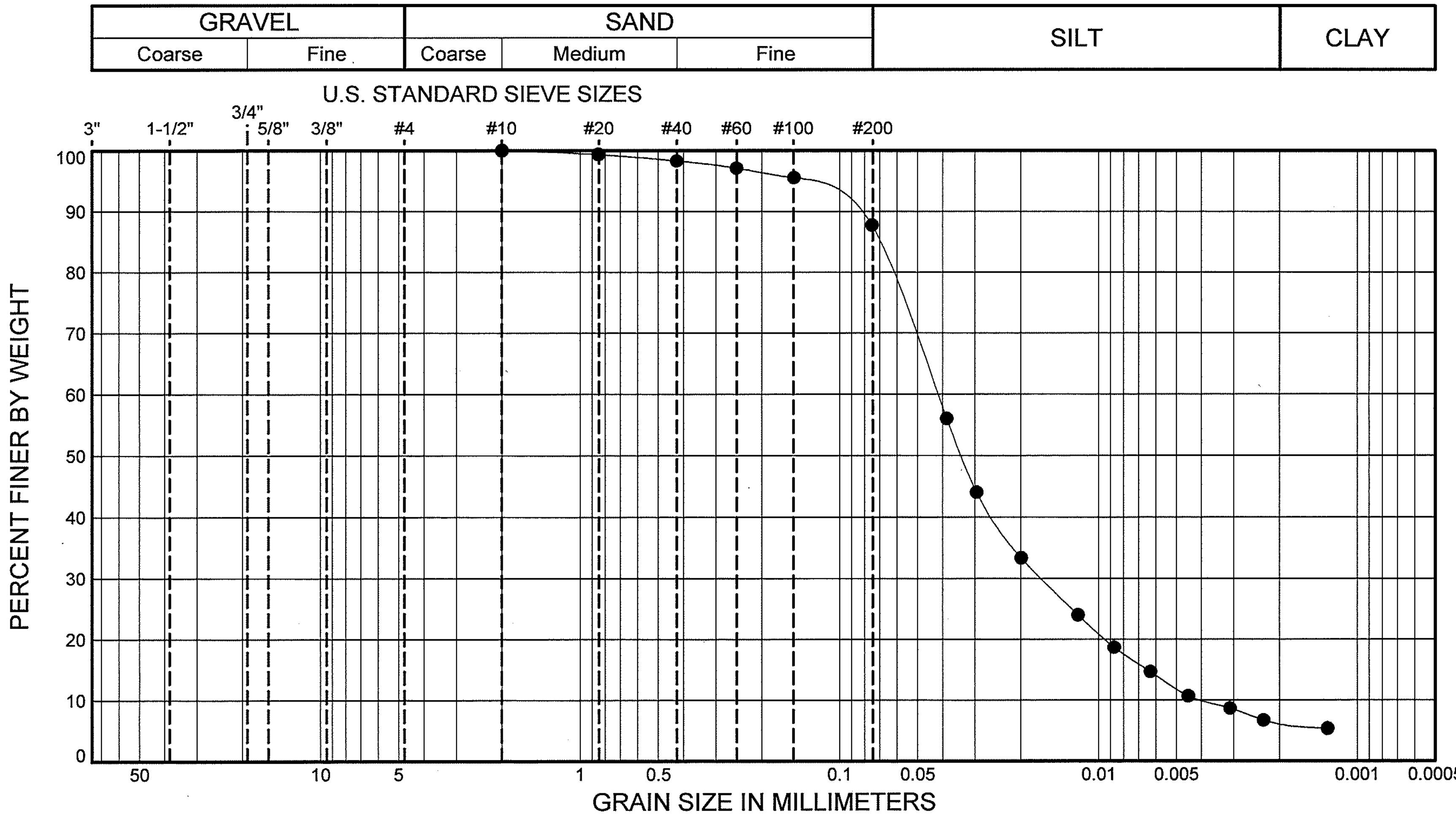
HWA GEOSCIENCES INC.

Sudbury Road LF Remedial Investigation
Walla Walla, Washington

PARTICLE-SIZE ANALYSIS OF SOILS METHOD ASTM D422

PROJECT NO.: 2012-054 FIGURE: 2

HWAGRSZ 2012-054.GPJ 6/15/12



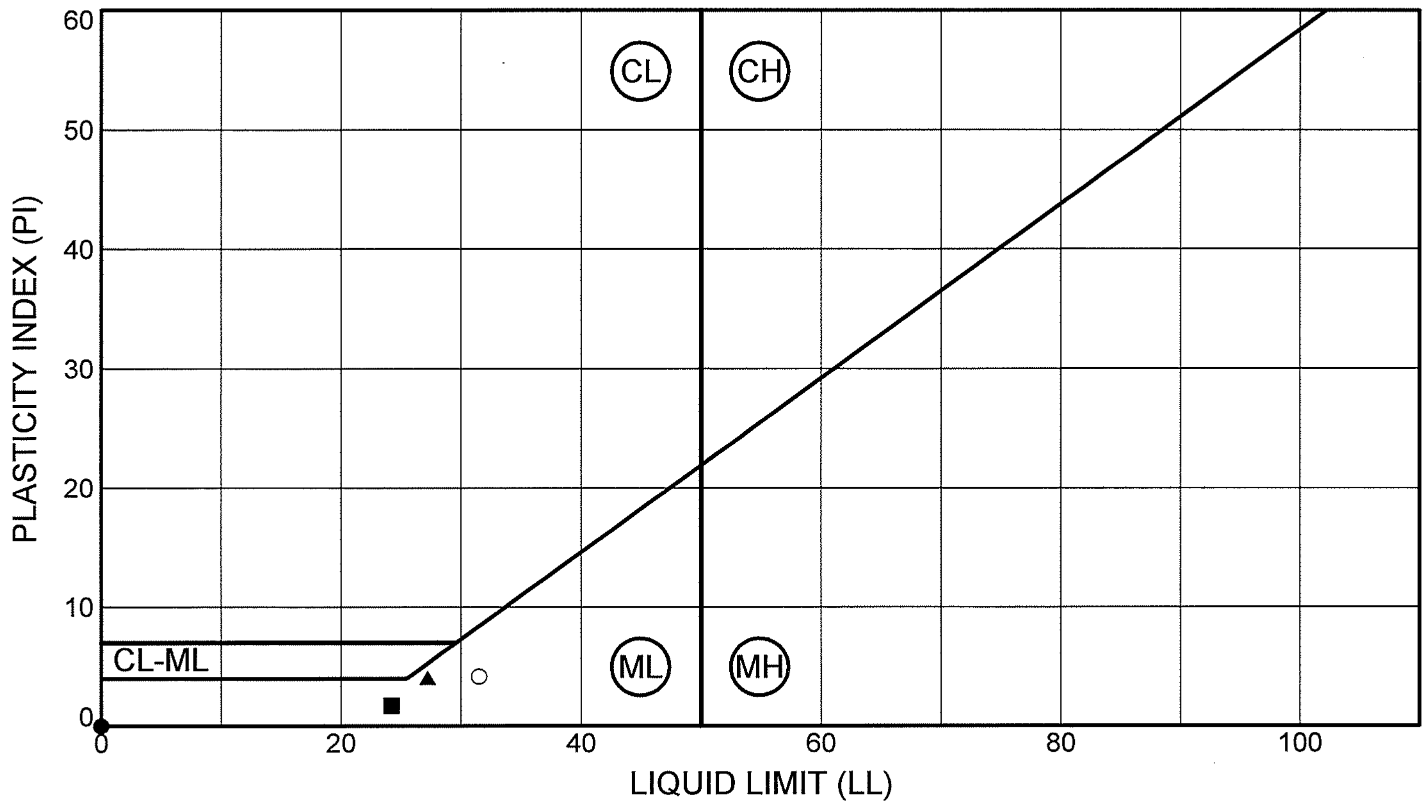
SYMBOL	SAMPLE	DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	TP-20 (ST)	0.5 - 2.0	(ML) Olive brown, SILT	21	32	27	5	0.0	12.2	87.8

HWA GEOSCIENCES INC.

Sudbury Road LF Remedial Investigation
Walla Walla, Washington

PARTICLE-SIZE ANALYSIS OF SOILS METHOD ASTM D422

PROJECT NO.: 2012-054 FIGURE: 3



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION	% MC	LL	PL	PI	% Fines
●	TP-08 (ST)		2.0 - 3.5	(ML) Olive brown, SILT with sand	15	NP	NP	NP	77.8
■	TP-12	Bulk		(ML) Light olive brown, SILT	10	24	23	1	87.8
▲	TP-19 (ST)		2.0 - 3.5	(ML) Olive brown, SILT	14	27	23	4	86.7
○	TP-20 (ST)		0.5 - 2.0	(ML) Olive brown, SILT	21	32	27	5	87.8

HWA GEOSCIENCES INC.

Sudbury Road LF Remedial Investigation
Walla Walla, Washington

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS METHOD ASTM D4318

PROJECT NO.: 2012-054 FIGURE: 4

LABORATORY COMPACTION CHARACTERISTICS OF SOIL

HWA GEOSCIENCES INC.

CLIENT: *Schwyn Environmental Services*

PROJECT: *Sudbury Landfill Remedial Investigation*

SAMPLE ID: *TP-12, Bulk*

PROJECT NO: *2012-054*

Sampled By: *Client*

Tested By: *AC*

Date Sampled:

Date Received: *5/21/2012*

Date Tested: *5/24/2012*

MATERIAL TYPE OR DESCRIPTION:
Light olive brown, SILT (ML)

MATERIAL SOURCE, SAMPLE LOCATION AND DEPTH:
TP-12, Bulk Sample

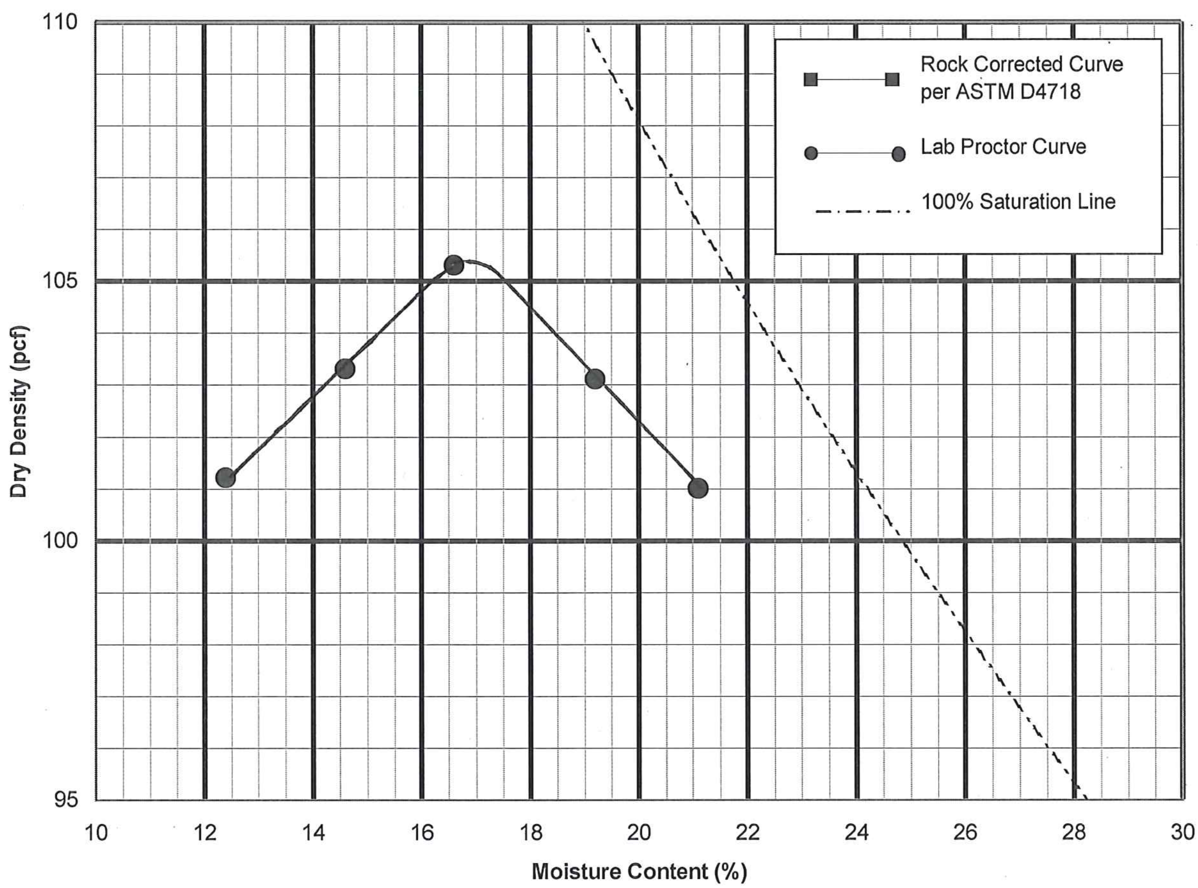
Designation: [X] ASTM D 698 [ ] ASTM D 1557 Natural Moisture Content: *11.9* %

Method: [ ] A [X] B [ ] C Oversize: *0* % retained on: *3/8* in.

Preparation: [ ] Dry [X] Moist Rammer: [X] Auto [ ] Manual Assumed S.G.: *2.65*

Test Data

Dry Density (pcf)	101.2	103.3	105.3	103.1	101.0
Moisture Content (%)	12.4	14.6	16.6	19.2	21.1



Data Summary*	
Percent Oversize	<5%
Max. Dry Density (pcf)*	105.3
Optimum Moisture (%)*	16.7

Test Values At Other Oversize Percentages

0.0%	5.0%	10.0%	15.0%	20.0%	25.0%	30.0%
105.3	107.2	109.3	111.4	113.6	115.8	118.2
16.7	15.9	15.1	14.3	13.6	12.8	12.0

* values corrected for oversize material per ASTM D4718, using assumed Specific Gravity shown and oversize moisture content of 1%

Reviewed By:

FIGURE 5

Hydraulic Conductivity (a.k.a. Permeability) Test Report

Method ASTM D 5084

HWA GEOSCIENCES INC.

Project	Sudbury RI
Client	0
Project number	2012-054
Date	5/30/2012
Technician	HB
Sample point	TP-12 Remolded Bulk Sample
Sample number	0
Sample depth	6"-24"
Sample description	Olive brown, SILT (ML)

Assumed Specific Gravity	2.65		
Initial Sample Area (cm2)	40.94	Final Sample Area (cm2)	41.13
Initial Sample Length (cm)	12.20	Final Sample Length (cm)	12.67
Initial Sample Volume (cc)	499.5	Final Sample Volume (cc)	521.1
Initial moisture (%)	17.0	Final moisture (%)	25.0
Initial wet unit wt. (pcf)	118.1	Final wet unit weight (pcf)	119.5
Initial dry unit wt. (pcf)	100.9	Final dry unit weight (pcf)	95.5
Initial void ratio	0.638	Final void ratio	0.731
Initial porosity	0.390	Final porosity	0.422
Initial saturation (%)	70.7	Final saturation (%)	90.8

Run No.	Hydraulic Conductivity (cm/s)	Running Average of 4 Readings (cm/s)	Maximum % Deviation from Average (should be less than 25%)	Flow Ratio (0.75 to 1.25 required)	Effective Confining Stress (psi)
1	5.7E-06	n.a.		0.99	3
2	5.6E-06	n.a.		0.99	3
3	6.6E-06	n.a.		1.00	3
Final	6.0E-06	**6.0E-06**	9.9%	0.99	3

Other Information
Maximum Gradient 12.1
Minimum Gradient 2.9
Max. Back Pressure (psi) 17.0
Min. Back Pressure (psi) 16.0

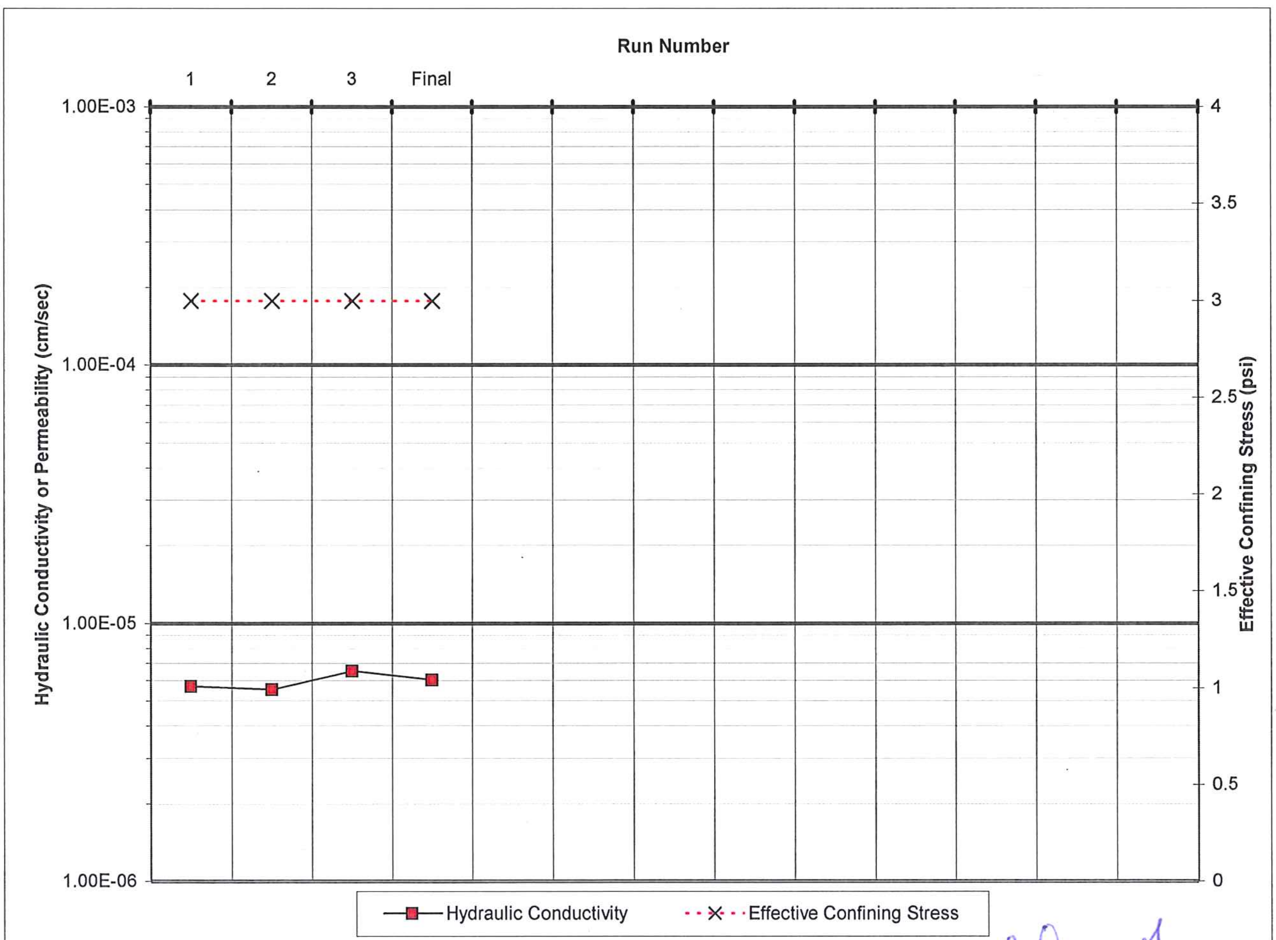


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FIGURE: 6

Hydraulic Conductivity (a.k.a. Permeability) Test Report

Method ASTM D 5084

HWA GEOSCIENCES INC.

Project	Sudbury RI	Assumed Specific Gravity	2.65		
Client	0	Initial Sample Area (cm2)	39.63	Final Sample Area (cm2)	39.63
Project number	2012-054	Initial Sample Length (cm)	12.65	Final Sample Length (cm)	12.65
Date	5/23/2012	Initial Sample Volume (cc)	501.2	Final Sample Volume (cc)	501.2
Technician	JH	Initial moisture (%)	14.7	Final moisture (%)	21.9
Sample point	TP-8	Initial wet unit wt. (pcf)	118.0	Final wet unit weight (pcf)	124.9
Sample number	0	Initial dry unit wt. (pcf)	102.8	Final dry unit weight (pcf)	102.4
Sample depth	24"-48"	Initial void ratio	0.608	Final void ratio	0.614
Sample description	Olive brown, SILT with sand (ML)	Initial porosity	0.378	Final porosity	0.381
		Initial saturation (%)	64.1	Final saturation (%)	94.5

Run No.	Hydraulic Conductivity (cm/s)	Running Average of 4 Readings (cm/s)	Maximum % Deviation from Average (should be less than 25%)	Flow Ratio (0.75 to 1.25 required)	Effective Confining Stress (psi)
1	5.1E-06	n.a.		0.94	3
2	5.1E-06	n.a.		0.94	3
3	5.8E-06	n.a.		1.00	3
4	5.5E-06	5.4E-06	7.0%	0.96	3
Final	5.6E-06	**5.5E-06**	6.5%	1.00	3

Other Information
Maximum Gradient 12.1
Minimum Gradient 8.5
Max. Back Pressure (psi) 16.0
Min. Back Pressure (psi) 16.0

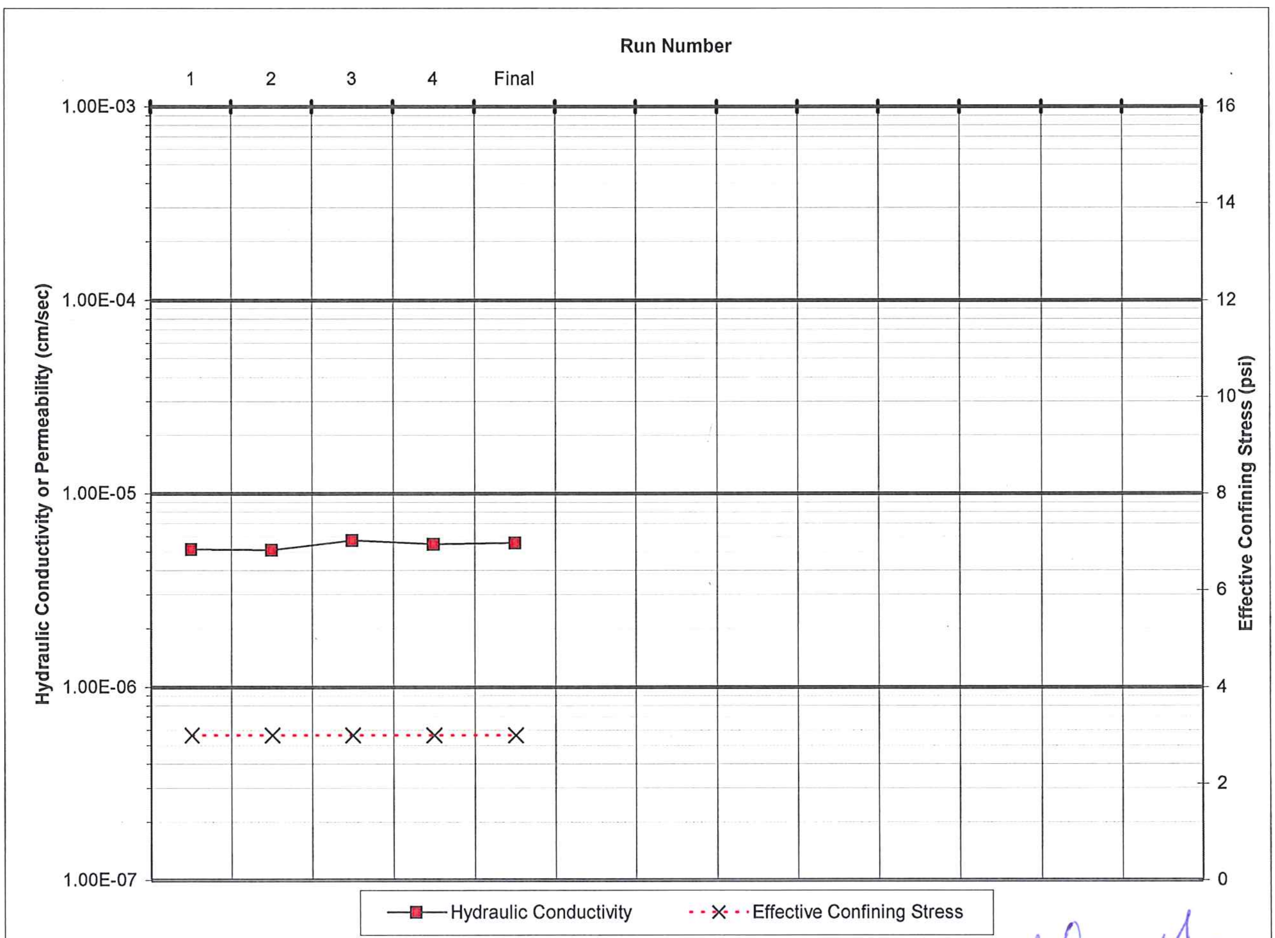

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FIGURE: 7

Hydraulic Conductivity (a.k.a. Permeability) Test Report

Method ASTM D 5084

HWA GEOSCIENCES INC.

Project	Sudbury RI
Client	0
Project number	2012-054
Date	5/23/2012
Technician	AC
Sample point	TP-19
Sample number	0
Sample depth	24"-48"
Sample description	Olive brown, SILT (ML)

Assumed Specific Gravity	2.65		
Initial Sample Area (cm2)	40.17	Final Sample Area (cm2)	41.22
Initial Sample Length (cm)	12.09	Final Sample Length (cm)	11.89
Initial Sample Volume (cc)	485.8	Final Sample Volume (cc)	489.9
Initial moisture (%)	13.9	Final moisture (%)	29.9
Initial wet unit wt. (pcf)	97.4	Final wet unit weight (pcf)	110.2
Initial dry unit wt. (pcf)	85.5	Final dry unit weight (pcf)	84.8
Initial void ratio	0.933	Final void ratio	0.949
Initial porosity	0.483	Final porosity	0.487
Initial saturation (%)	39.4	Final saturation (%)	83.3

Run No.	Hydraulic Conductivity (cm/s)	Running Average of 4 Readings (cm/s)	Maximum % Deviation from Average (should be less than 25%)	Flow Ratio (0.75 to 1.25 required)	Effective Confining Stress (psi)
1	4.6E-05	n.a.		0.90	3
2	3.9E-05	n.a.		1.00	3
3	4.3E-05	n.a.		1.00	3
4	4.0E-05	4.2E-05	9.1%	1.00	3
#DIV/0!	4.3E-05	4.1E-05	4.4%	1.00	3
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	3
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	3
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	3
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	3
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	3

Other Information
Maximum Gradient
12.8
Minimum Gradient
10.2
Max. Back Pressure (psi)
16.0
Min. Back Pressure (psi)
16.0

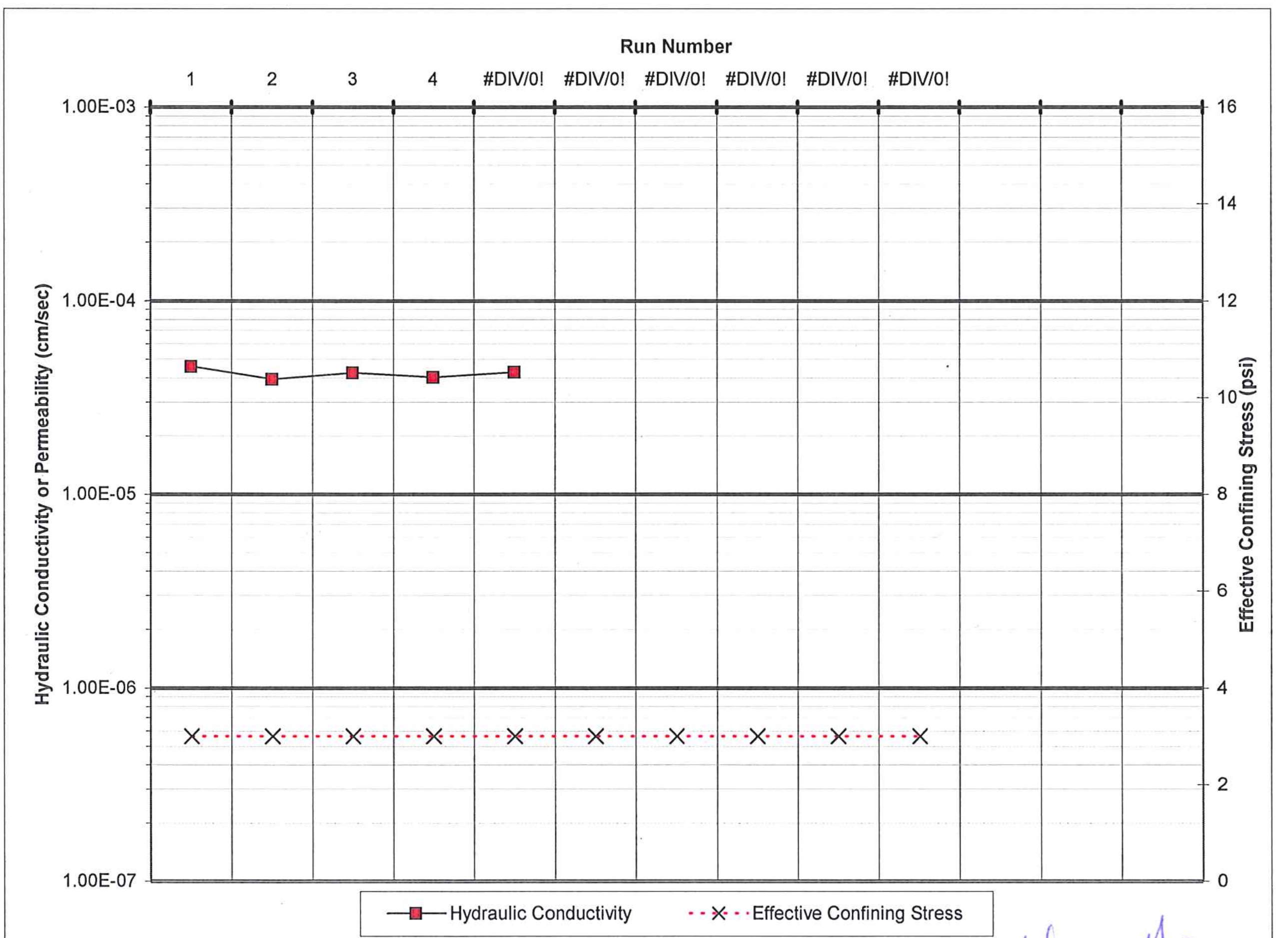

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FIGURE: 8

Hydraulic Conductivity (a.k.a. Permeability) Test Report

Method ASTM D 5084

HWA GEOSCIENCES INC.

Project	Sudbury RI
Client	0
Project number	2012-054
Date	5/24/2012
Technician	JH
Sample point	TP-20
Sample number	0
Sample depth	6"-24"
Sample description	Olive brown, SILT (ML)

Assumed Specific Gravity	2.65		
Initial Sample Area (cm2)	40.39	Final Sample Area (cm2)	40.12
Initial Sample Length (cm)	14.94	Final Sample Length (cm)	14.83
Initial Sample Volume (cc)	603.6	Final Sample Volume (cc)	595.2
Initial moisture (%)	20.6	Final moisture (%)	34.5
Initial wet unit wt. (pcf)	105.0	Final wet unit weight (pcf)	116.4
Initial dry unit wt. (pcf)	87.1	Final dry unit weight (pcf)	86.5
Initial void ratio	0.898	Final void ratio	0.911
Initial porosity	0.473	Final porosity	0.477
Initial saturation (%)	60.7	Final saturation (%)	100.4

Run No.	Hydraulic Conductivity (cm/s)	Running Average of 4 Readings (cm/s)	Maximum % Deviation from Average (should be less than 25%)	Flow Ratio (0.75 to 1.25 required)	Effective Confining Stress (psi)
1	3.6E-05	n.a.		0.98	3
2	2.4E-06	n.a.		0.98	3
3	1.6E-06	n.a.		0.97	3
4	1.7E-06	1.1E-05	245.9%	1.00	3
Final	2.5E-06	**2.1E-06**	23.2%	0.95	3

Other Information
Maximum Gradient
10.5
Minimum Gradient
4.3
Max. Back Pressure (psi)
17.0
Min. Back Pressure (psi)
16.0

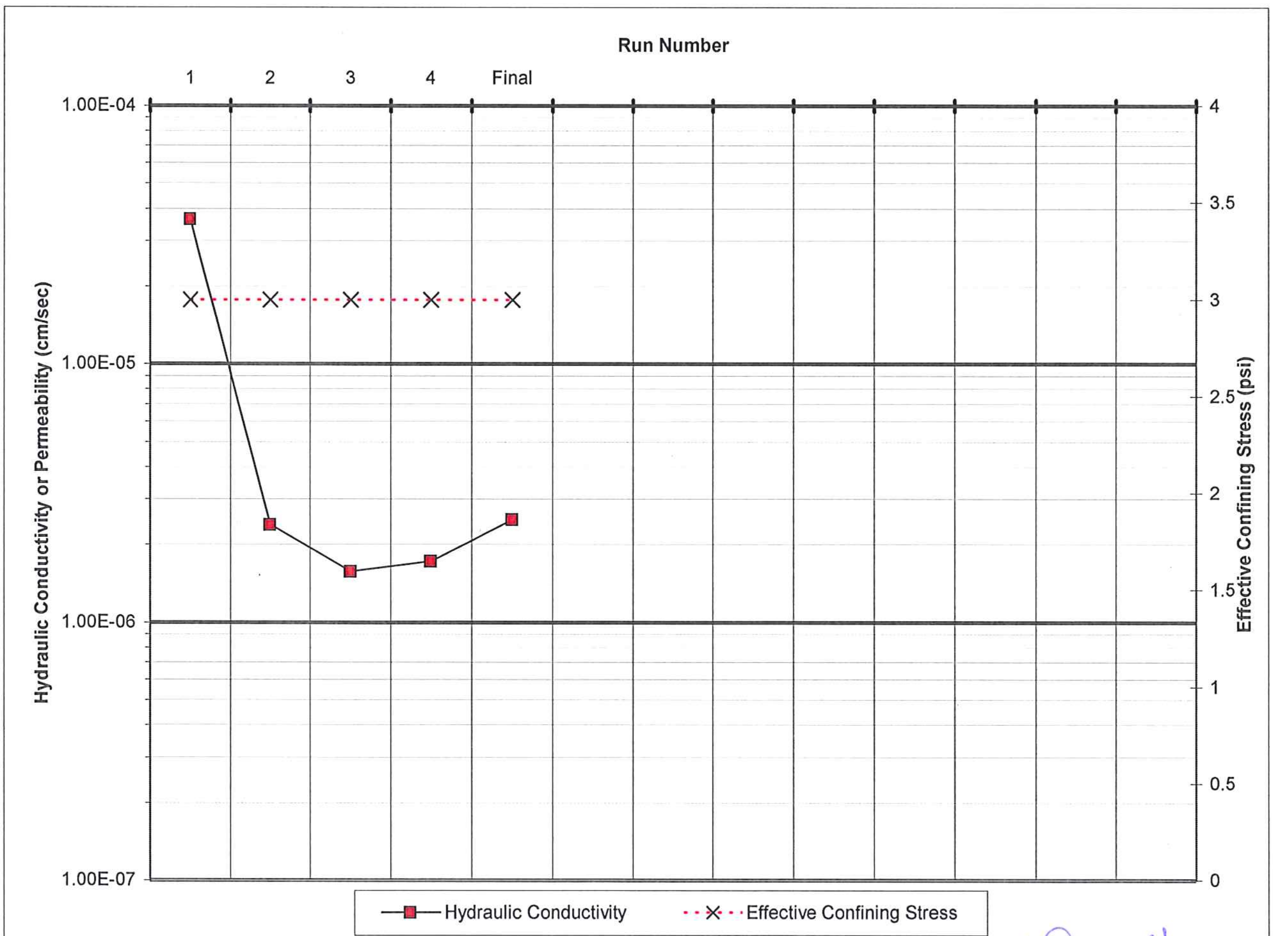

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FIGURE: 9

APPENDIX D

Laboratory Analytical Reports Provided on CD

Schwyn Environmental Services

APPENDIX E

Aquifer Test Report

Sudbury Road Landfill

Aquifer Test Report

Prepared for

Schwyn Environmental Services
2621 South Custer Ct.
Spokane, Washington 98223

Prepared by

FLOYD | SNIDER

601 Union Street
Suite 600
Seattle, Washington 98101

March 2013

State of Washington
Hydrogeologist
2624
Licensed Geologist
BRETT BEAULIEU
3/19/13

LIMITATIONS

This report has been prepared for the exclusive use of Schwyn Environmental Services*;* their authorized agents, and regulatory agencies. It has been prepared following the described methods and information available at the time of the work. No other party should use this report for any purpose other than that originally intended, unless Floyd|Snider agrees in advance to such reliance in writing. The information contained herein should not be utilized for any purpose or project except the one originally intended. Under no circumstances shall this document be altered, updated, or revised without written authorization of Floyd|Snider.

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Abbreviations/Acronyms

Acronym/ Abbreviation	Definition
bgs	Below ground surface
gpm	Gallons per minute
Landfill	Sudbury Road Landfill
NAVD88	North American Vertical Datum of 1988
psi	Pounds per square inch
RI/FS	Remedial Investigation/Feasibility Study
Work Plan	Data Summary and Remedial Investigation Work Plan

1.0 Introduction

This aquifer test report has been prepared as part of remedial investigation/feasibility study (RI/FS) activities at the Sudbury Road Landfill (Landfill) in accordance with the Data Summary and Remedial Investigation Work Plan (Work Plan; Schwyn Environmental 2011). In this report, field activities are summarized and the results of hydrogeologic field testing and analysis are presented. This hydrogeologic information is intended to be used to characterize the first encountered aquifer beneath the Landfill and to assess the hydraulic connection between the hydrostratigraphic zones screened in MW-15D, MW-3, and MW-15.

2.0 Summary of Field Activities

Aquifer test field activities were carried out in accordance with the Work Plan. Aquifer testing consisted of four parts: baseline water-level survey, step discharge pumping tests, 24-hour constant-discharge pumping test, and water-level recovery test. Relevant details of these field activities are summarized in this section.

Monitoring well locations for the pumping well and observation wells used in aquifer testing are illustrated on Figure 2.1. Monitoring well logs are included as Appendix A.

2.1 BASELINE WATER LEVEL SURVEY

Data-logging pressure transducers were deployed in MW-15D, MW-3, and MW-15 to collect baseline water level data from July 12 through September 25, 2012. A data-logging barometric pressure transducer was deployed concurrently for barometric compensation of water level pressure data. Barometrically compensated water level trends for these three monitoring wells are presented for an approximate 10 week period in Figure 2.2 and for an approximate 2-week period in Figure 2.3. No long-term antecedent data were collected for observation wells MW-18 or MW-27. Water level measurements in MW-15 were adjusted by 0.47 foot to reflect movement of the pressure transducer on August 15, 2012.

Water levels generally fluctuated in each of these three wells by approximately 0.2 to 0.4 foot during the monitoring period. Water levels in MW-3 and MW-15 exhibited a slight decreasing trend in July, on the order of approximately 0.1 to 0.2 foot, but stabilized in August and remained stable through the start of aquifer testing in late September. No long-term antecedent trends in water levels were identified that are relevant for aquifer test analysis.

Water levels in all three wells fluctuated in a highly consistent daily pattern, as illustrated in Figure 2.3. The timing of the daily fluctuation is consistent with the effects of Earth tides, which cause diurnal fluctuations in aquifer head, resulting in higher water levels coincident with the period between moonrise and moonset (Ferris et al. 1962). In the days preceding aquifer testing, moonrise in the vicinity occurred at approximately 2 p.m., moon transit occurred at approximately 7 p.m., and moonset occurred at approximately 12 a.m. This period corresponds to the recurring daily peak in water levels in the three wells. The magnitude of the daily fluctuation is approximately 0.1 foot or less, which is substantial enough to result in identifiable inflections of time-displacement curves for drawdown in observation wells (refer to Section 3.1 below).

2.1 STEP DISCHARGE TESTING

Step discharge testing was performed on MW-15D on September 25, 2012 to estimate the maximum sustainable yield rate suitable for 24-hour constant-discharge testing. Pumping rates were monitored in gallons per minute (gpm) throughout step discharge testing. MW-15D was pumped at approximately 16.5 gpm for 10 minutes, at approximately 20.5 gpm for 30 minutes, approximately 25 gpm for 40 minutes, and approximately 30 gpm for 87 minutes. The results of step drawdown testing are summarized in the table below.

MW-15D Approximate Pumping Rate (gallons per minute)	Duration (minutes)	Maximum Drawdown (feet)
16.5	10	10.2
20.5	30	16.95
25	40	27.35
30	87	40.15

The static water level prior to step discharge testing in MW-15D was 36.15 feet from the top of casing. At 30 gpm, with 40.15 feet of displacement, the water level was drawn down to 76.3 feet below the top of well casing, which is below the top of the well screen and within a few feet of the top of the pump. Based on these results, the maximum pumping rate MW-15D was capable of sustaining for a 24-hour test was estimated to be approximately 25 gpm.

2.2 AQUIFER TESTING

On September 26, 2012, constant-discharge aquifer testing was performed using MW-15D as the pumping well in accordance with the procedures detailed in the Work Plan. Aquifer testing was intended to produce a significant stress on the aquifer within the vicinity of the pumping well to provide estimated aquifer characteristics and information about hydraulic connections between the hydrostratigraphic zones screened in MW-3, MW-15, and the pumping well MW-15D.

2.2.1 Test Setup

The following procedures and equipment were used to perform the constant-discharge aquifer test:

- A Grundfos of Redi-flo 4 25E3 electric submersible pump was installed in MW-15D and was controlled via a Grundfos CU300 controller unit. The pump was suspended in the well using a steel wire secured at the ground surface. The pump was equipped with a check valve to prevent backflow during the recovery portion of the test. A 2-inch diameter flexible hose discharge line was attached to the pump and extended up through the 4-inch diameter well casing and along the ground surface. 2-inch and 1.5-inch smooth-walled suction hoses were used to convey water from MW-15D to discharge into a dry creek bed approximately 300 feet west.
- A Seametrics 2-inch diameter, in-line, totalizing electronic flow meter was installed between two 6-foot sections of 2-inch polyvinyl chloride (PVC) solid pipe in the discharge line, to ensure that flow conditions suitable for producing accurate flow meter readings were met, in accordance with the manufacturer's specifications. The flow meter was pre-calibrated and verified by comparing with flow rates measured using a 5-gallon bucket and a stopwatch.
- A Honda E3500 gasoline generator was used to provide power for the pump, pump controller, and laptop computer.
- Aquistar PT2X pressure transducers were used to record groundwater levels in the pumping well and observation wells during the aquifer tests. The transducers installed in MW-3 and MW-15 were rated for use at 30 pounds per square inch (psi), and the transducer in MW-15D was rated for use at 50 psi. These instruments, which consist of pressure transducers that measure potentiometric head recorded by

integrated dataloggers, were deployed on fixed-length lines into wells. A laptop computer was used to program the pressure transducers at their prescribed data collection intervals and to synchronize all transducer clocks to a standard reference time within 1-second accuracy. Following the constant-discharge and recovery tests, all data were uploaded to the laptop.

- A data-logging barometric pressure transducer was deployed concurrently for barometric compensation of water level pressure data.
- An electronic water level indicator was used to measure groundwater levels manually in the control and observation wells prior to, during, and following each aquifer test. The manual measurements were used as a check on the transducer measurements.

2.2.2 Constant-discharge Testing

Constant-discharge testing was conducted on September 25 and 26, 2012 using MW-15D as the pumping well. MW-15D was pumped at approximately 25 gpm for 28 hours. Pumping was initiated at 14:45 on September 25 and halted at 18:45 on September 26. A total of approximately 41,712 gallons were pumped from MW-15D. The calculated average flow rate for MW-15D was 24.8 gpm.

Water level data were collected from MW-3, MW-15D, MW-15, MW-18, and MW-27. Transducers in MW-3, MW-15D, and MW-15 were programmed to read and record data at 1-second intervals. Transducers in MW-18 and MW-27 were programmed to record data at 2-second intervals.

Field personnel remained on-site throughout the test to verify that discharge from the pumping well remained constant, to fuel the generator, and to collect manual water level measurements. It was determined that sufficient aquifer stress had been achieved following 28 hours of pumping. Pumping was halted and data collection was continued to monitor the recovery portion of the test.

2.2.3 Recovery Testing

Recovery test measurements were collected on September 26 and 27, 2012. Water level data were collected from the five test wells (MW-3, MW-15D, MW-15, MW-18, and MW-27) at the same recording intervals as during constant-discharge testing. Transducers were removed from the wells and uploaded on the morning of September 27. Water levels in all five wells substantially recovered within approximately the first 90 minutes, so that no water level data from September 27 were used in recovery analysis.

3.0 Aquifer Test Analysis and Results

This section presents results and analysis of the aquifer testing described in the previous section. A summary of the results of aquifer testing is provided in Table 3.1, including estimated values for hydraulic conductivity, transmissivity, and storativity. Appendix B contains time-displacement curves for all test wells for both drawdown and recovery testing. Appendix C includes curve-fitting results for results used for estimating aquifer parameters. These results indicate that aquifer testing was properly conducted and that the resulting aquifer characteristics are suitable for use as part of the RI/FS.

3.1 AQUIFER TEST DATA QUALITY REVIEW AND ANALYSIS

Drawdown and recovery data were compensated for barometric pressure using Aqua4Plus software and then exported to Excel for processing. Pressure data were converted from pounds per square inch to feet of displaced water. Drawdown results were separated from recovery results. Portions of the datasets with 1-second interval measurements were filtered to reduce the number of records for data collected later in the test. Displacement and pumping rate data were imported into Aqtesolv Professional 4.5 for analysis.

Aquifer, borehole, well construction, and well location information was entered into Aqtesolv based on boring log information (refer to Appendix A). The silt unit was entered as an upper aquitard (b') with a depth of 40 feet. The gravel unit in which pumping well MW-15D is screened was entered as a confined aquifer, with an assumed thickness (b) of 100 feet, underlain by a lower aquitard (b") assumed to be 250 feet thick. An aquifer isotropic ratio (K_z/K_r) of 0.1 vertical to horizontal was generally assumed. Pumping wells and observation wells were entered as partially penetrating wells. The screened interval for MW-3 is located within the gravel aquifer unit, at greater depth than MW-15D. The screened intervals of MW-15, MW-18, and MW-27 span the contact between the upper silt aquitard and gravel aquifer units, and penetrate the gravel aquifer unit to varying depths. Screened interval elevation information is summarized in Table 3.1.

Based on the presence of a 5-foot thick clay layer noted in the boring log for MW-3 at 96 feet below ground surface (bgs; refer to Appendix A), separate analyses were performed in which aquifer dimension assumptions were varied. Use of a thinner aquifer (b=50 feet) and a shallower, thinner aquitard (b"=5 feet) did not result in substantial change in curve fitting results or aquifer test solutions. Separate analyses in which the upper silt aquitard and gravel aquifer units were assumed to be a single unconfined aquifer, in which the Theis (1935) method corrected for unconfined aquifers was used, produced results similar to those derived from confined aquifer assumptions, but poor curve matches were observed for the Neuman (1974), Moench (1997), and Tartakovsky-Neuman (2007) unconfined aquifer solutions. Therefore, confined aquifer assumptions were considered more appropriate and accurate for aquifer analysis, and solutions for unconfined aquifers are not presented in this report.

The quality of the drawdown and recovery data sets from the five test wells was evaluated for the suitability of using standard curve-matching techniques. In some cases, the data were found to have limitations that affected analysis. The following is a summary of the considerations affecting analysis of drawdown data:

- Drawdown data for the pumping well, MW-15D, were not used for analysis in favor of the recovery data because pumping well data typically understate the transmissivity of the formation (Fetter 2001).

- The drawdown displacement curves for observation wells MW-3 and MW-15 include ambient water level fluctuations attributed to Earth tides (refer to Section 2.1 above) that are substantial relative to the overall test measurements (refer to Appendix B and Figures 2.2 and 2.3). An example of the recurring pattern from a day 4 days before the test is overlain atop the drawdown displacement results for MW-15 in Figure 3.1 and for MW-3 in Figure 3.2. A simple subtraction of the two curves is shown to approximate what the data set would resemble without the ambient fluctuation.
- Based on the curve suggested by the subtraction of ambient fluctuation data in Figure 3.1, the ambient fluctuation was visually filtered out of the curve-matching analysis for MW-15. Because the approximate pattern of the ambient fluctuation is known, the displacement (refer to Table 3.1) of 0.31 feet is sufficient to allow analysis despite the ambient fluctuations, which account for approximately 0.1 feet of total displacement.
- The effects of the ambient water level fluctuations are visible in the drawdown displacement curves for observation wells MW-18 and MW-27 (refer to Appendix B) and were visually filtered out during curve-matching analysis. The displacement (refer to Table 3.1) for the two observation wells of 0.90 and 0.72 feet, respectively, is sufficient to allow curve-matching analysis. The magnitude of the fluctuations on both curves was on the order of 0.1 foot.
- The displacement for MW-3 is considered insufficient to allow accurate analysis given the magnitude of ambient fluctuation. Ambient fluctuations of up to 0.06 foot are greater than the apparent drawdown displacement resulting from pumping (less than approximately 0.025 foot; refer to Appendix B). No solutions for MW-3 drawdown are provided.

The following is a summary of the considerations affecting data analysis decisions for analysis of recovery data:

- Recovery analysis for MW-15D was limited to the Cooper-Jacob (1946) solution, which is considered the preferred solution for analysis in a pumping well, because it removes the influence of turbulent flow, wells skins, and partial penetration (Fetter 2001). Ambient water level fluctuations were negligible relative to the test displacement of 34.51 feet (refer to Table 3.1).
- For observation wells, ambient fluctuations were unable to be filtered out of recovery results sufficiently to provide for accurate curve-matching. Based on antecedent monitoring (refer to Figures 2.2 and 2.3), the daily cycle of fluctuation attributed to Earth tides was in a period of falling water levels during the recovery portion of the test, which is based on rising water levels. Curve-matching analyses were attempted using the initial 100 minutes of observation well recovery test results, during which the most displacement occurred. These analyses were considered unsuccessful because of the very limited displacement (0.11 feet, 0.08 feet, 0.04 feet, and 0.02 feet in MW-15, MW-18, MW-27, and MW-3, respectively) relative to the ambient fluctuations. No solutions are presented using recovery data from observation wells.

Subject to these limitations, drawdown and recovery in the selected pumping and observation wells were analyzed using one or more solutions in Aqtesolv:

- The Cooper-Jacob (1946) straight-line solution

- The Theis (1935) method for confined conditions, extended by Hantush (1961) for partially penetrating wells
- The Dougherty-Babu (1984) solution, which accounts for wellbore storage and wellbore skin for partially penetrating wells in confined aquifers
- The Hantush-Jacob (1955)/Hantush (1964) solution for partially penetrating wells in a leaky confined aquifer, with no storage in the aquitard

3.2 AQUIFER TEST RESULTS

Results of aquifer analysis are summarized in Table 3.1.

Analyses yielded transmissivity estimates ranging from 1,900 to 13,000 feet^2/day, hydraulic conductivity estimates from 23 to 140 feet/day (6.7 × 10^{-3} to 4.9 × 10^{-2} cm/s), and storativity values from 6.5 × 10^{-4} to 2.7 × 10^{-2}. Prior to aquifer testing, the estimated hydraulic conductivity of the unit was 1.5 × 10^{-3} cm/s (EMCON 1995), which is slightly lower than the lowest hydraulic conductivity values estimated based on this test.

The aquifer characteristics estimated from the solutions analyses provide for a sufficient degree of confidence in the accuracy of the results for use in the RI/FS. The range of aquifer parameters estimated from these results is reasonable and likely reflects the different well screen depths, placement relative to the contact between the upper silt aquitard and gravel aquifer, heterogeneities in aquifer materials, and horizontal distance from each other. To normalize the different ranges associated with these conditions, a geometric mean of the results was calculated. The geometric mean indicates an estimated overall transmissivity in the aquifer in the vicinity of the test of approximately 4,000 feet^2/day and a hydraulic conductivity of approximately 40 feet/day (1.4 x 10^{-2} cm/s). These values provide an indication of the tendency of the aquifer in this area to transmit water, and should be used in conjunction with information about the local aquifer thickness, hydraulic gradient, and other factors.

Storativity results are generally at the higher end of the range of values for confined aquifers of 0.005 to 0.00005 (Freeze and Cherry 1979).

3.3 HYDRAULIC CONNECTIVITY

The results indicate hydraulic connectivity between the screened interval of the pumping well (MW-15D) and hydrostratigraphic zones represented by well screens for the deeper observation well (MW-3) and shallower observation wells (MW-15, MW-18, and MW-27).

The results suggest that the screened interval of the pumping well, MW-15D (approximately 706 to 721 feet relative to the North American Vertical Datum of 1988 [NAVD88]) is located in a zone of similar transmissivity relative to three wells in the surrounding vicinity screened at shallower depths (i.e., MW-15, MW-18, and MW-27 are all screened from above 740 NAVD88) that penetrate the upper portions of the aquifer. A degree of homogeneity in the shallow portion of the aquifer can be seen in the similar responses in, and estimated transmissivity values derived from, MW-18 and MW-27. MW-18 is located 175 feet south of the pumping well, MW-15D, and MW-27 is located 344 feet northeast of MW-15D.

Storativity results at the higher end of the range for confined aquifers are consistent with a semi-confined aquifer with observation well screens crossing the assumed upper contact of the aquifer with the overlying aquitard. MW-15, with one storativity result (2.7 x 10^{-2}) greater than the range for confined aquifers, has the majority of its screened interval in the overlying silt unit.

Analysis using the Hantush-Jacob (1955)/Hantush (1964) solution for leakage into a confined aquifer did not result in acceptable fits over a range of leakage factors (r/B). The curve used in the Hantush-Jacob solution for leaky confined aquifers, which resembles a Theis curve that is flattened during late time in the test due to leakage, does not match the site data or results without flattening associated with leakage, and was not used to estimate aquifer properties. This suggests minimal recharge to the aquifer tested from leakage through the aquitard, which may be attributable to the well screens that cross into this unit, and the silt unit serving as an extension of the aquifer. As noted previously, analysis using solutions for unconfined aquifer conditions, such as Neuman (1974), did not result in acceptable curve fits.

These results, and the strong response of the three shallower wells to pumping in MW-15D, suggest that MW-15D exists in semi-confined conditions, with hydraulic connectivity between the upper silt aquitard and the gravel aquifer occurring under test conditions. The penetration of all three of the shallower wells into the gravel unit, however, limits the conclusions that can be drawn from these test results regarding the communication between the silt and gravel units.

Although MW-3 results were not suitable for estimating aquifer parameters, because of the low displacement and “noise” from ambient water level fluctuations, the results indicate a hydraulic connection between the screened intervals of MW-15D and MW-3, which is located approximately 26 feet below the bottom of the MW-15D screened interval. Although both wells are assumed to be within the same gravel aquifer unit, the results suggest a more complex local hydrostratigraphy at these depths. Local hydrostratigraphy may be influenced by one or more lower-permeability layers such as the 5-foot thick clay unit identified in the boring log at 96 to 101 feet bgs (approximately 688 to 693 feet NAVD88).

4.0 References

Cooper, H.H. and C.E. Jacob, 1946. A generalized graphical method for evaluating formation constants and summarizing well field history, Am. Geophys. Union Trans., vol. 27, pp. 526-534.

Dougherty, D.E and D.K. Babu, 1984. Flow to a partially penetrating well in a double-porosity reservoir, Water Resources Research, vol. 20, no. 8, pp. 1116-1122.

EMCON. 1995. *Hydrogeologic Report, Sudbury Road Landfill, Walla Walla County, Washington*. June.

Ferris, J.G., Knowles, D.B., Brown, R.H., and Stallman, R.W. 1962. Theory of aquifer tests: U.S. Geological Survey Water-Supply Paper 1536-E, 173 p.

Fetter, C.W. 2001. Applied Hydrogeology. Prentice-Hall Inc. Upper Saddle River, N.J.

Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice-Hall Inc.; Englewood Cliffs, N.J.

Hantush, M.S. and C.E. Jacob, 1955. Non-steady radial flow in an infinite leaky aquifer, Am. Geophys. Union Trans., vol. 36, no. 1, pp. 95-100.

Hantush, M.S., 1964. *Advances in Hydroscience*, chapter *Hydraulics of Wells*, pp 281–442. Academic Press.

Moench, A.F., 1997. Flow to a well of finite diameter in a homogeneous, anisotropic water table aquifer, Water Resources Research, vol. 33, no. 6, pp. 1397-1407.

Neuman, S.P., 1974. Effect of partial penetration on flow in unconfined aquifers considering delayed gravity response, Water Resources Research, vol. 10, no. 2, pp. 303-312.

Schwyn Environmental. 2011. *Data Summary and Remedial Investigation Work Plan, Sudbury Road Landfill.* Prepared for City of Walla Walla. December.

Tartakovsky, G.D. and S.P. Neuman, 2007. Three-dimensional saturated-unsaturated flow with axial symmetry to a partially penetrating well in a compressible unconfined aquifer, Water Resources Research, W01410, doi:1029/2006WR005153.

Theis, C.V. 1935. “The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Ground-water Storage.” *Transactions, American Geophysical Union 16:519–524*.

Sudbury Road Landfill

Aquifer Test Report

Tables

Table 3.1
Aquifer Test Analyses[1]

Observation Well	Observation Well Screen Length (ft) and Elevation (ft MSL)	Maximum Displacement (ft)	Analysis Method[2]	Aquifer Model	Estimated Transmissivity (ft^2/min)	Estimated Transmissivity (ft^2/day)	Estimated Hydraulic Conductivity (ft/day)	Estimated Hydraulic Conductivity (cm/s)	Estimated Storativity (--)
Drawdown Analyses									
MW-15[3]	15 747.52–762.52	0.31	Cooper-Jacob (1946)	Confined	8.8	13,000	130	4.6E-02	2.7E-02
			Theis (1935)/Hantush (1961)	Confined	9.7	14,000	140	4.9E-02	8.5E-03
MW-18	15 745.42–760.42	0.90	Cooper-Jacob (1946)	Confined	1.4	1,900	19	6.7E-03	1.7E-03
			Theis (1935)/Hantush (1961)	Confined	1.3	1,900	19	6.7E-03	2.7E-03
MW-27	10 740.38–750.38	0.72	Cooper-Jacob (1946)	Confined	1.6	2,300	23	8.1E-03	6.5E-04
			Theis (1935)/Hantush (1961)	Confined	1.6	2,300	23	8.1E-03	6.8E-04
Recovery Analyses									
MW-15D	15 706.64–721.64	34.51	Cooper-Jacob (1946)	Confined	3.5	5,000	50	1.8E-02	NA[4]
Geometric mean					2.8	4,000	40	1.4E-02	2.8E-03

Notes:

1 Results are from constant-discharge and recovery testing between September 25 and September 27, 2012, with MW-15D as the pumping well. Solutions are based on the assumptions that include the following. Pumping and observation wells are partially penetrating. A saturated aquifer thickness (b) of 100 feet was assumed. An aquifer isotropic ratio (Kz/Kr) of 0.1 vertical to horizontal was assumed. The borehole diameter, r(w) for the pumping well MW-15D was 0.36 foot, and the inside radius of the well casing, r(c) for MW-15D was 0.166 foot. Refer to curve-fitting solutions and boring logs for additional details.

2 Results obtained using the Dougherty-Babu solution for observation wells were identical to those obtained using the Theis/Hantush method, indicating that no wellbore effects influenced curve-fitting for observation wells. The curve used in the Hantush-Jacob solution for leaky confined aquifers, which resembles a Theis curve that is flattened during late time in the test due to leakage, did not match the site data as well as results without flattening associated with leakage.

3 The drawdown displacement curve for Monitoring Well MW-15 includes ambient water level fluctuations that are substantial relative to the overall test measurements. The effect of the fluctuations was visually filtered out of the curve-matching analysis for MW-15 drawdown displacement. Maximum displacement during drawdown was increased by an estimated 0.1 feet from ambient water level fluctuations.

4 Storativity cannot be determined accurately in the pumping well using the Cooper-Jacob solution.

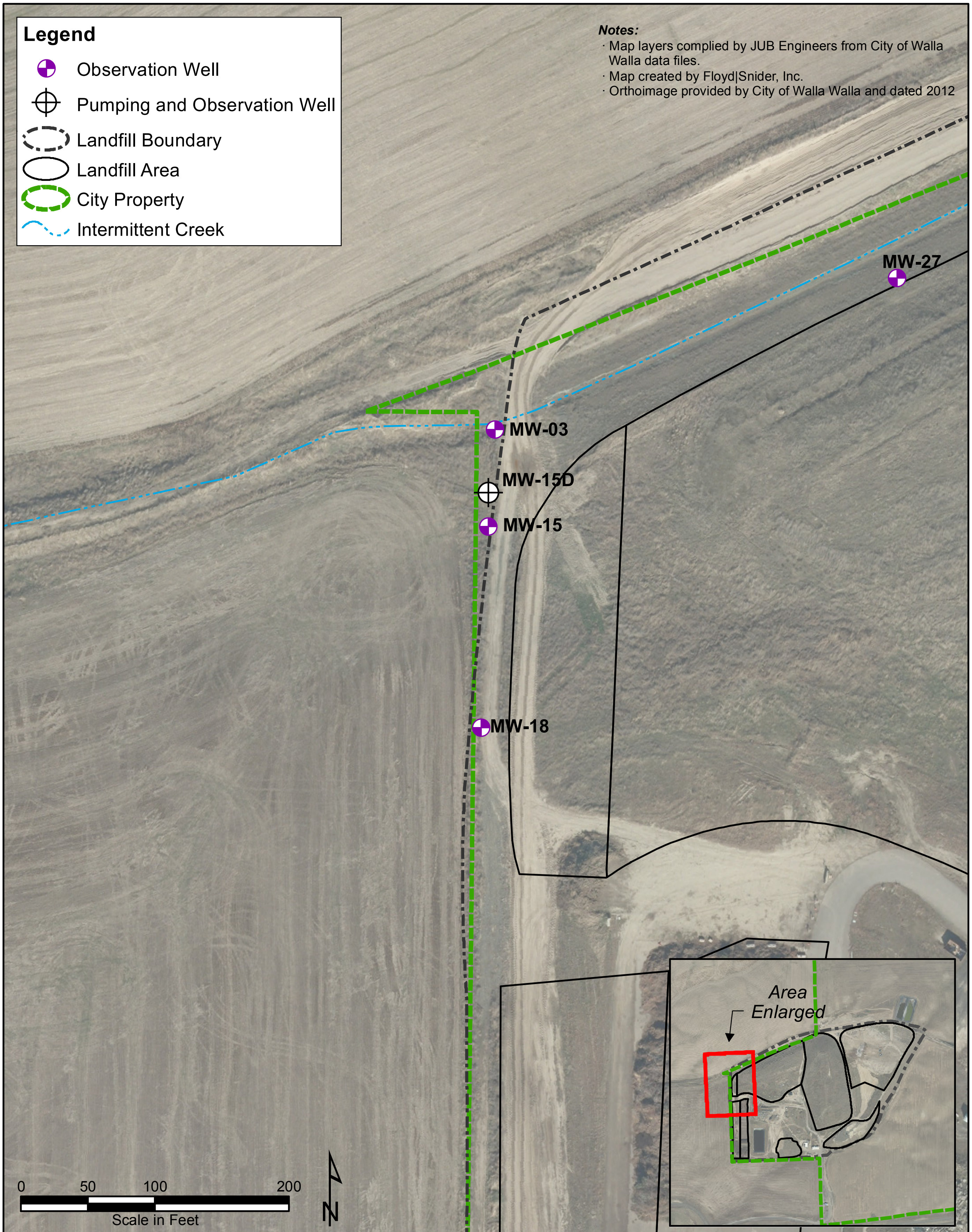
Abbreviations:

cm/s Centimeters per second
gpm Gallons per minute
ft Feet
min Minute
MSL Mean sea level
NA Not applicable

Sudbury Road Landfill

Aquifer Test Report

Figures



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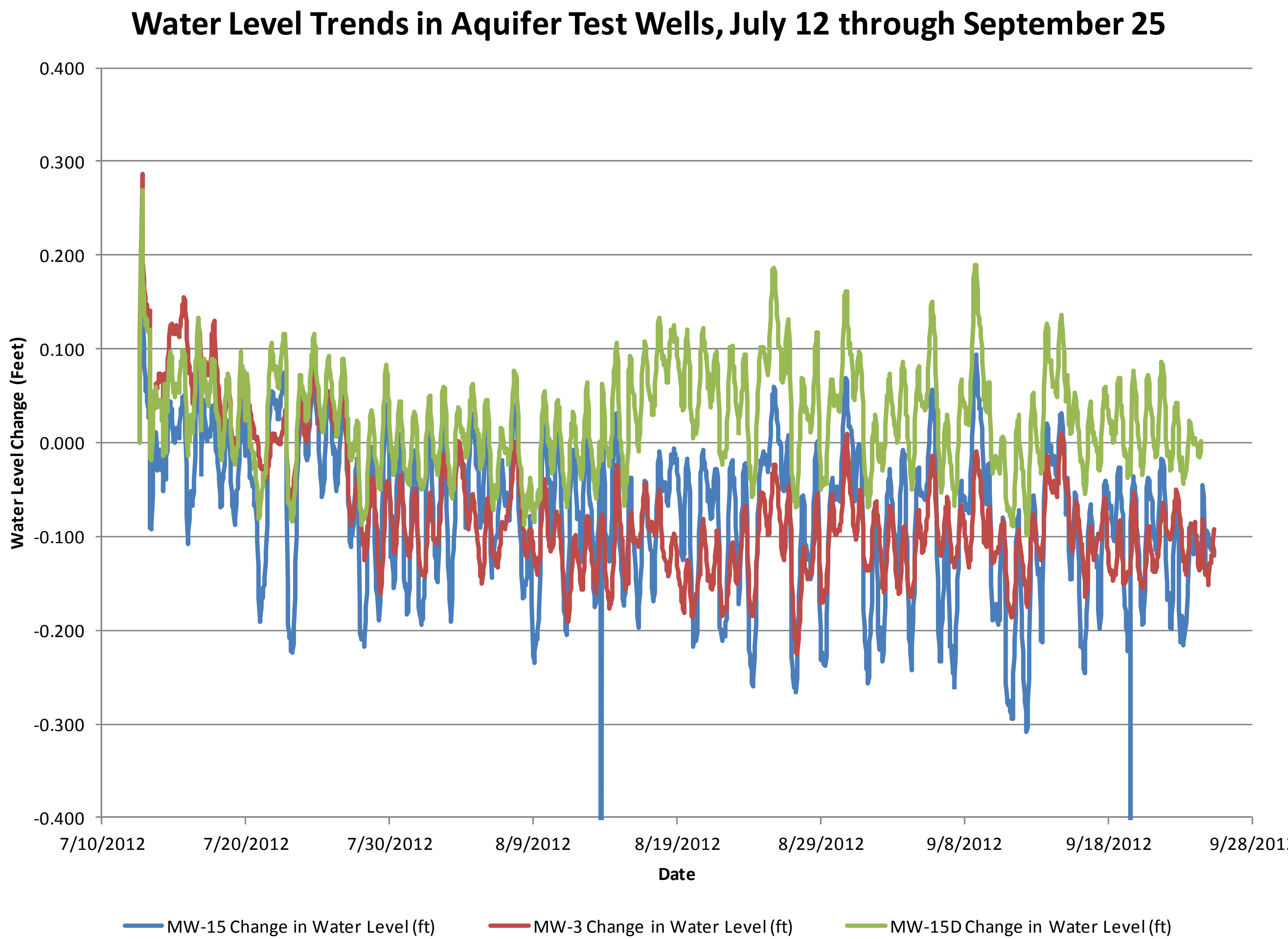
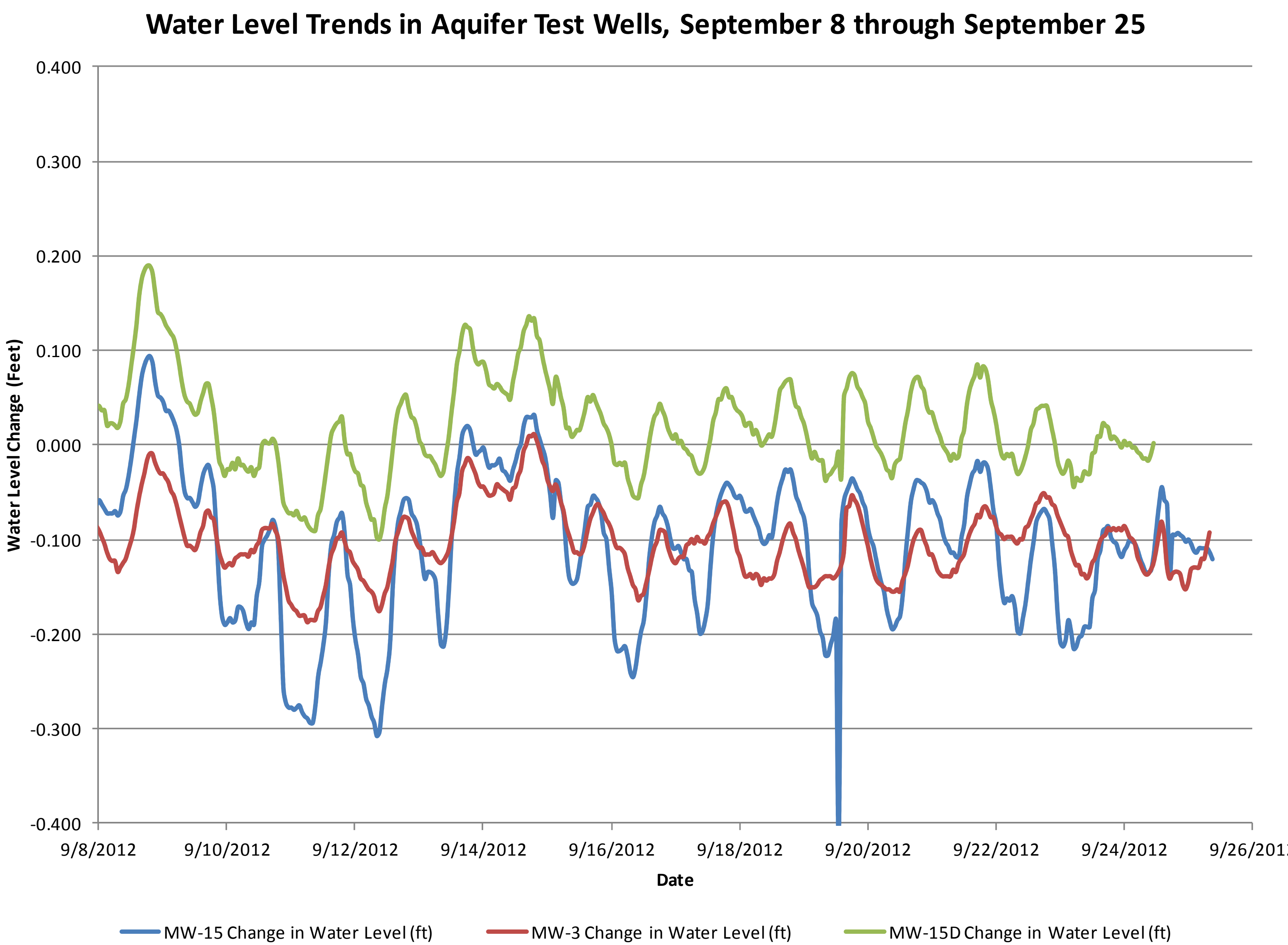
Aquifer Test Report
Sudbury Road Landfill
Walla Walla, Washington

Figure 2.1
Aquifer Test Monitoring Well Locations

F:\projects\Schywn-Sudbury\GIS\MXD\Schwyn Request\Misc\Figure 2.1 (FS Logo - Aquifer Test Monitoring Wells Locations).mxd
3/11/2013



FLOYD | SNIDER strategy ▪ science ▪ engineering	**Aquifer Test Report** **Sudbury Road Landfill** **Walla Walla, Washington**	Figure 2.2 Water Level Trends in Aquifer Test Wells, July 12 through September 25, 2012



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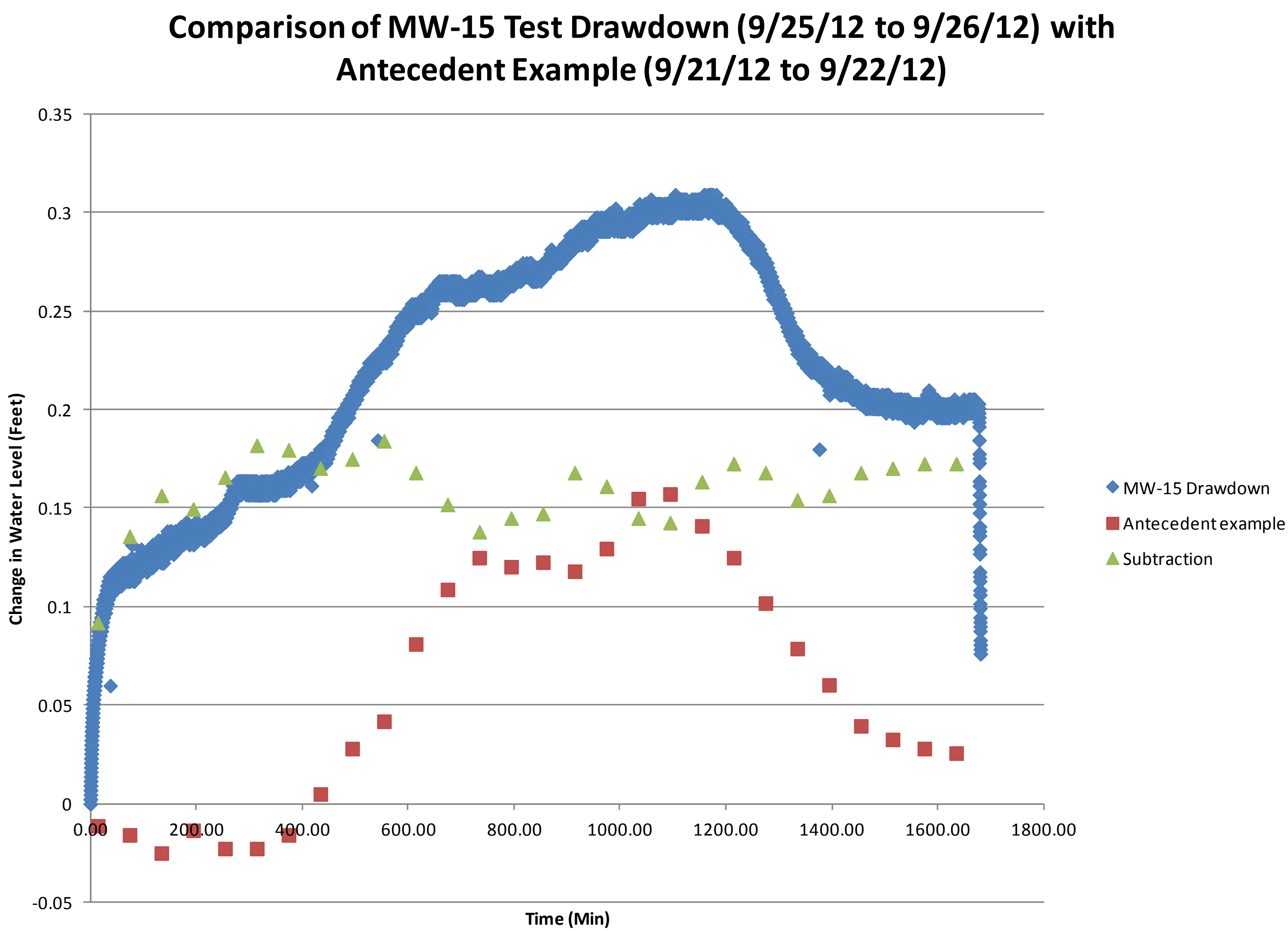
Aquifer Test Report
Sudbury Road Landfill
Walla Walla, Washington

Figure 2.3
Water Level Trends in Aquifer Test Wells, September 8 through September 25, 2012



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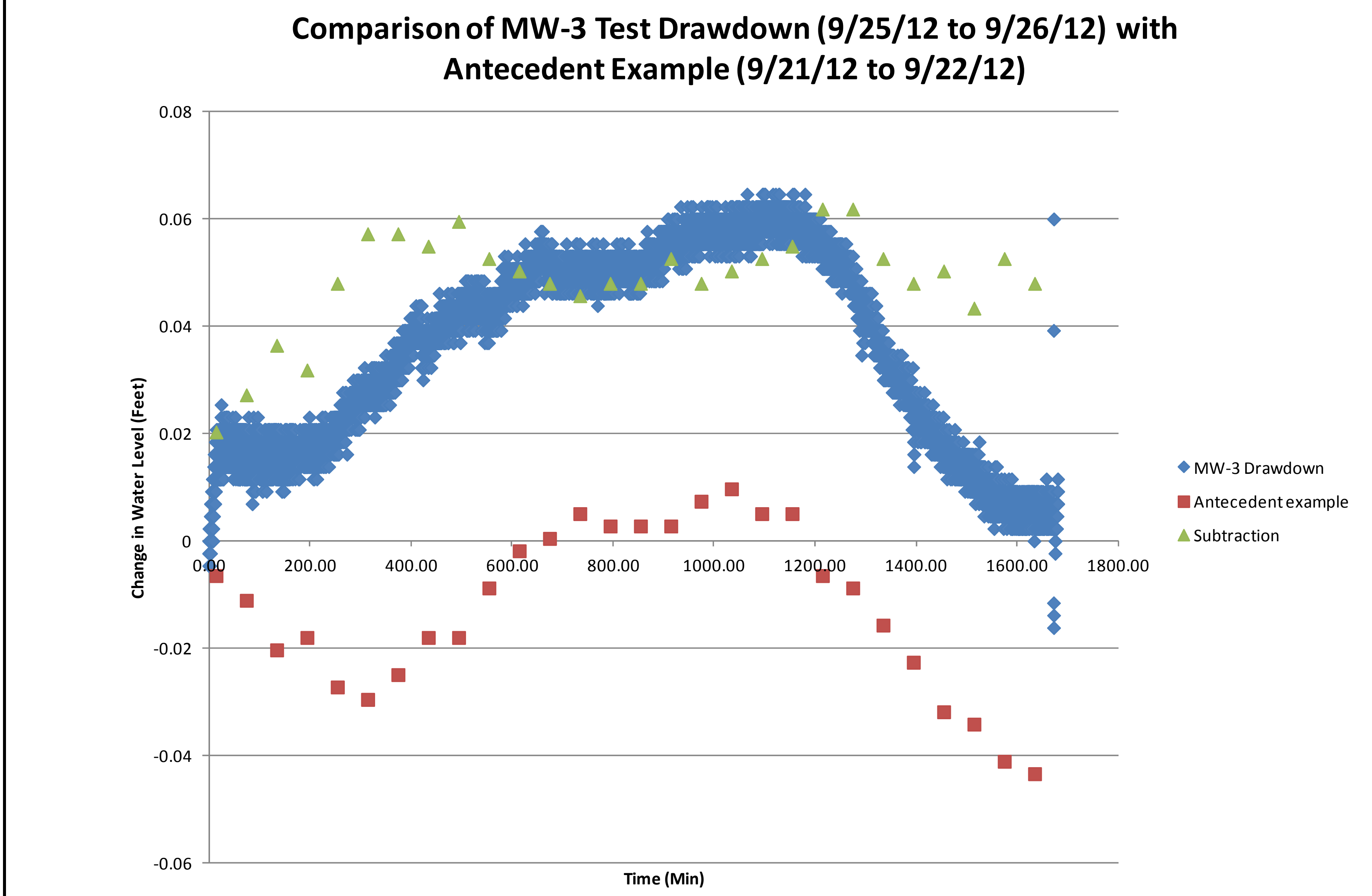
Aquifer Test Report
Sudbury Road Landfill
Walla Walla, Washington

Figure 3.1
Comparison of MW-15 Test Drawdown (9/25/12 to 9/26/12) with Antecedent Example (9/21/12 to 9/22/12)

March 2013



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Aquifer Test Report
Sudbury Road Landfill
Walla Walla, Washington

Figure 3.2
Comparison of MW-3 Test Drawdown (9/25/12 to 9/26/12) with Antecedent Example (9/21/12 to 9/22/12)

Sudbury Road Landfill

Aquifer Test Report

Appendix A
Aquifer Test Boring Logs

MW-3

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ....

Permit No. ....

OWNER: Name City of Walla Walla Address Box 478

(2) **LOCATION OF WELL:** County Walla Walla — NW ¼ NE ¼ Sec 22 T 7 N., R 35 W.M.

Bearing and distance from section or subdivision corner Ground surface elevation (2012)= 788.37 ft NAVD88

(3) **PROPOSED USE:** Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☒ Other ☐

(4) **TYPE OF WORK:** Owner's number of well (if more than one) 3

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) **DIMENSIONS:** Diameter of well .... inches.
Drilled .... ft. Depth of completed well .... ft.

(6) **CONSTRUCTION DETAILS:**

Casing installed: 2" Diam. from +2 ft. to 118 ft.
Threaded ☒ ....." Diam. from ..... ft. to ..... ft.
Welded ☐ ....." Diam. from ..... ft. to ..... ft.

Perforations: Yes ☐ No ☒
Type of perforator used ....
SIZE of perforations .... in. by .... in.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type 316 Model No. ....
Diam. 2 Slot size .010 from 108 ft. to 118 ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ....
Gravel placed from .... ft. to .... ft.

Surface seal: Yes ☒ No ☐ To what depth? .... ft.
Material used in seal ....
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? .... Depth of strata ....
Method of sealing strata off ....

(7) **PUMP:** Manufacturer's Name ....
Type: .... H.P. ....

(8) **WATER LEVELS:** Land-surface elevation above mean sea level .... ft.
Static level 26' ft. below top of well Date 10-22-86
Artesian pressure .... lbs. per square inch Date ....
Artesian water is controlled by .... (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Driller
Yield: 10 gal./min. with 2 ft. drawdown after 1 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
:00	28	:01	26		

Date of test 10-1-86
Bailer test .... gal./min. with .... ft. drawdown after .... hrs.
Artesian flow .... g.p.m. Date ....
Temperature of water 54 Was a chemical analysis made? Yes ☐ No ☒

10/29/86 [initials]

(10) **WELL LOG:**

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Topsoil	0	23
Brown Clay + Sand	23	42
Sand	42	59
Brown Clay	59	61
Sand + Gravel	61	74
Brown Clay + Gravel	74	96
Brown Clay	96	101
Gravel Water	101	121

Put in 8 Sacks 10-20 Filter Sand From 121' To 90'

Pumped in 13 Sacks Kol Clay From 90 To 16'

Put in Sand From 16' To 10'

Put in 9 Sacks Portland Cem From 10' To Ground Level

Work started 9-18 1986 Completed 10-21 1986

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Harding Drilling Co (Person, firm, or corporation) (Type or print)

Address Rt 3 Box 67 Walla Walla Wn.

[Signed] Mike Harding (Well Driller)

License No. 173 Date 10-29, 1986

MW-15

Drilling Method: TUBEX Air Rotary

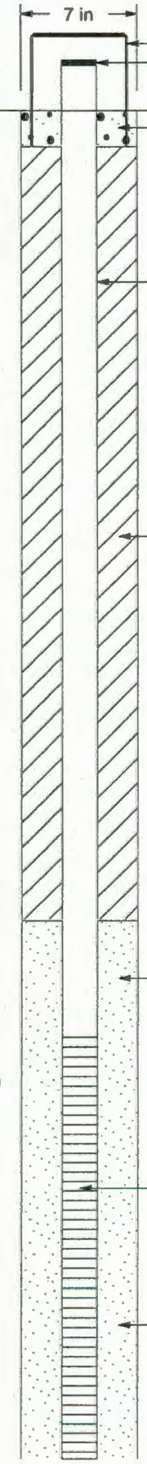
Ground Elevation (ft): ~~787.0 (MSL)~~ 790.02 NAVD88 *

Drilled By: Environmental West

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Water Level
0						ML	Brown SILT. Low plasticity. moist.	
10	D-1	b2	21			ML	Brown SILT. Low plasticity. Very stiff, moist.	
20	D-2	b2	36			ML	Brown SILT. Low plasticity. Very stiff, moist.	
30	D-3	b2	50/4"			ML	Brown SILT interbedded with 1/4-inch lenses of fine, basalt sand. Subangular. Hard, very moist to wet.	ATD ▽
35	D-4	b2	85			ML	Brown SILT. Hard, moist.	

GROUNDWATER

Well Detail



Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

* Ground surface elevation (2012) = 790.02 ft NAVD88

.3003. 10/1/01 C:\PROGRA~1\GINTW\PROJECTS\SUDBURY.GPJ WELL LOG

Landau Associates

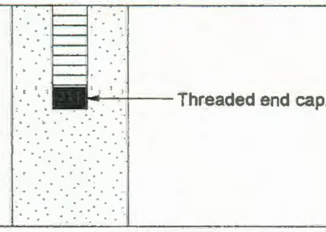
Sudbury Road Landfill
Walla Walla, Washington

Log of Boring and Well MW-15

Figure A-2 (1 of 2)

MW-15

SAMPLE DATA					SOIL PROFILE			GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: TUBEX Air Rotary Ground Elevation (ft): ~~787.0 (MSL)~~ 790.02 NAVD88* Drilled By: Environmental West	Water Level	Well Detail
40	D-5	b2	66			ML	Brown SILT with trace of sand and 1-inch rounded gravel. Hard, wet.		
						ML GW			Threaded end cap.
45	D-6	b2	50/5"				Brown sandy GRAVEL with silt. Surounded. Very dense, wet.		



Boring Completed 07/17/01
Total Depth of Boring = 46.5 ft.

Well Completed 07/17/01
Total Depth of Well = 43.0 ft.

50

55

60

65

70

75

80

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

J3003. 10/1/01 C:\PROGRA~1\GINTW\PROJECTS\SUDBURY.GPJ WELL LOG

Landau Associates	Sudbury Road Landfill Walla Walla, Washington	Log of Boring and Well MW-15	Figure A-2 (2 of 2)

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-15D
Unique Well ID: BCE 338

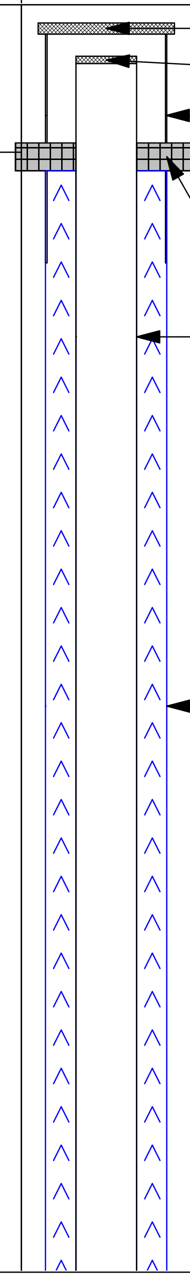
Drill Date: 5/23/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 8.75-in
Boring Depth (ft BGL): 87 ft.
Groundwater (ft BGL): 30 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 789.64 ft. MSL
Casing Elevation: 792.04 ft. MSL
Coordinate System: NAD/NAVD 88
Latitude/Northing: 278598
Longitude/Easting: 2169554

Remarks: Warm, partly cloudy

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-7			0	ML	ML: Very dark grayish brown SILT, trace fine sand, soft to medium stiff, low plasticity, damp.
Core 7-17			7.5		@ 7.5 to 17 ft.: sandy silt.
			8.5		@ 8.5 ft.: dark brown.
Core 17-27			21		@ 21 ft.: sandy silt.
			23		@ 23 ft.: 4" sandy lens.
			24		@ 24 ft.: moist.
Core 27-37			30		@ 30 ft.: wet.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▽ = denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-15D

Unique Well ID: BCE 338

Drill Date: 5/23/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
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Client: City of Walla Walla
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Casing Elevation: 792.04 ft. MSL
Coordinate System: NAD/NAVD 88
Latitude/Northing: 278598
Longitude/Easting: 2169554

Remarks: Warm, partly cloudy

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			31–39	ML	ML: SILT, cont.	4-in. dia. flush threaded PVC, 2.4 ft AGL to 68 ft BGL
Core 37-47			40–59	GM	GM: Dark yellowish brown Silty GRAVEL with cobbles, medium dense, well graded, fine to coarse sub-angular to sub-rounded sand, basalt gravel and cobbles, wet. @ 42 ft.: 8" sandy lens. @ 59 ft.: dark brown.	
Core 47-57						
Core 57-67			60–63	ML	ML: Dark brown Sandy SILT, fine to medium sand, soft, low plasticity, wet. @ 62 ft.: 6" sandy lens.	
			63–64	GM	GM: Dark grayish brown Silty GRAVEL with cobbles, loose,	

Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-15D

Unique Well ID: BCE 338

Drill Date: 5/23/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 8.75-in
Boring Depth (ft BGL): 87 ft.
Groundwater (ft BGL): 30 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 789.64 ft. MSL
Casing Elevation: 792.04 ft. MSL
Coordinate System: NAD/NAVD 88
Latitude/Northing: 278598
Longitude/Easting: 2169554

Remarks: Warm, partly cloudy

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description	Well Construction Detail
			65		well graded, fine to coarse, angular to sub-angular sand, basalt gravel and cobbles, wet.	
Core 67-77			67–68			10-20 Colo. silica sand
			73		@ 73 ft.: dry.	
			75		@ 75 ft.: moist.	0.01-in. slot PVC, 68 to 83 ft BGL
Core 77-82			77			
Core 82-87			82–83			Bottom cap
			83.5		@ 83.5 ft.: 12" silt layer.	
			85		@ 85 ft.: decreasing moisture, mosit to damp.	
			86		@ 86 ft.: dry.	

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-18

Unique Well ID: BCE 343

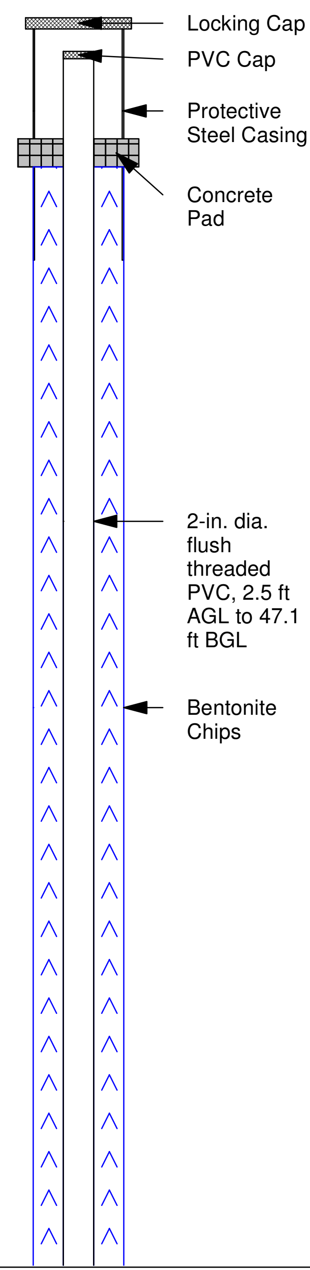
Drill Date: 5/20/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 63 ft.
Groundwater (ft BGL): 35.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 807.52 ft. MSL
Casing Elevation: 810.11 ft. MSL
Coordinate System: NAD/NAVD 88
Latitude/Northing: 278422
Longitude/Easting: 2169556

Remarks: Warm, Breeze

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-8			0–1		Fill: Crushed glass with some soil.
			1–8		ML: Very dark grayish brown Sandy SILT, soft to medium stiff, low plasticity, damp. [Fill]
Core 8-18			8		@ 8 ft.: 2" lens of white material, possible asbestos.
			8–		ML: Brown Sandy SILT, trace fine sand and clay, soft, low plasticity, damp.
			12.5		@ 12.5 ft.: stiff.
Core 18-28			23.5		@ 23.5 ft.: 6" sandy lens.
Core 28-38			29		@ 29 ft.: moist.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-18

Unique Well ID: BCE 343

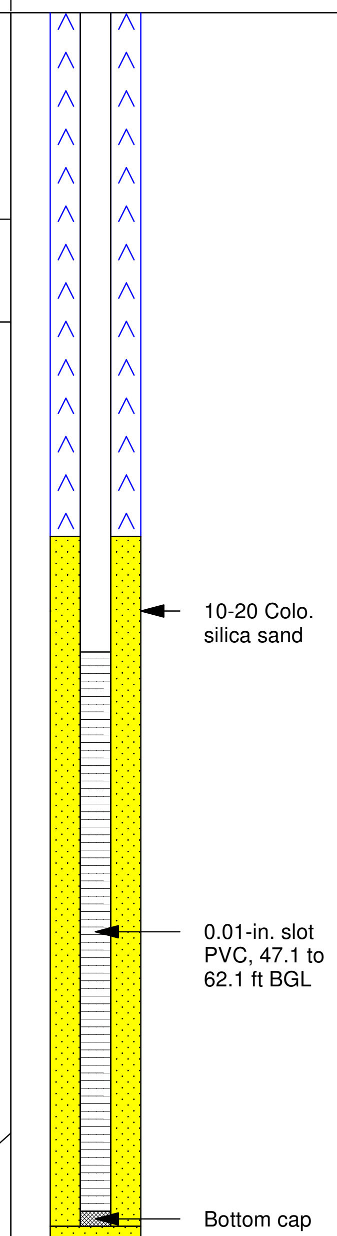
Drill Date: 5/20/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 63 ft.
Groundwater (ft BGL): 35.5 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 807.52 ft. MSL
Casing Elevation: 810.11 ft. MSL
Coordinate System: NAD/NAVD 88
Latitude/Northing: 278422
Longitude/Easting: 2169556

Remarks: Warm, Breeze

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			30–35.5	ML	ML: SILT, cont.
			35.5–38.2	CL	CL: Yellowish Brown Silty CLAY, medium stiff, high plasticity, wet.
Core 48-58			38.2–60	ML	ML: Brown Sandy SILT, trace fine sand and clay, soft, medium to high plasticity, caliche mottling, wet. @ 44 ft.: dark yellowish brown, low plasticity fines. @ 48 ft.: brown. @ 56 ft.: moist, increased caliche mottling. @ 58 ft.: dark brown, with grayish brown caliche mottling. @ 59 ft.: 12" sandy lens.
Core 58-63			60–63	GM	GM: Dark brown Silty GRAVEL with cobbles, medium dense, well graded, fine to coarse sub-angular to sub-rounded sand, basalt gravel and cobbles (some fractured), rust staining and mottling, wet.

Well Construction Detail



Notes:
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ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Monitoring Well ID: MW-27
Unique Well ID: BHP200

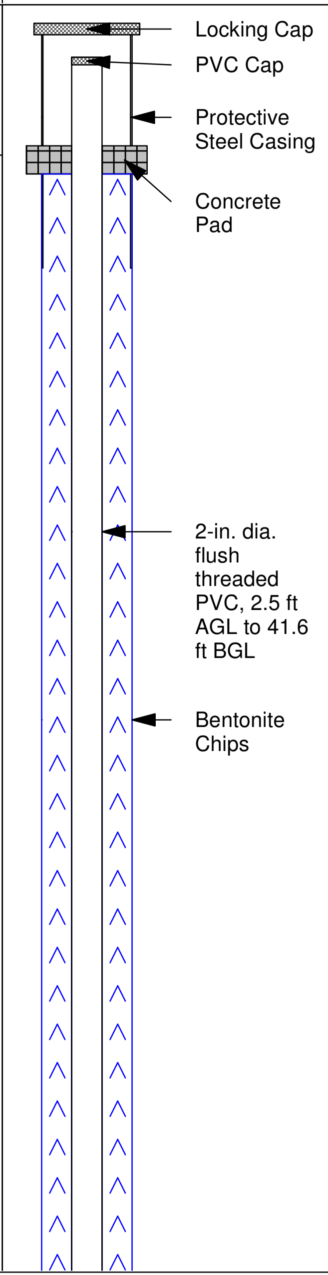
Drill Date: 8/28/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 52 ft.
Groundwater (ft BGL): 31 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 791.98 ft. MSL
Casing Elevation: 794.50 ft. MSL
Coordinate System: NAD/NAVD 88
Latitude/Northing: 278771
Longitude/Easting: 2169852

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
Core 0-4			0		ML: Light brownish gray Sandy SILT, fine sand with trace clay, soft, low plasticity, dry.
Core 4-7			4		
			5.5		@ 5.5 ft.: very dark gray.
Core 7-17			7		@ 7 ft.: damp to moist.
Core 17-27			17		
			21.5		@ 21.5 ft.: 8" fine sand lens.
Core 27-37			27		@ 27.25 ft.: 12" black medium sand lens.
			28.25		@28.25 ft.: olive gray, mottled.

Well Construction Detail



Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
= denotes groundwater table

Log of Exploration

Schwyn Environmental Services

Monitoring Well ID: MW-27

Unique Well ID: BHP200

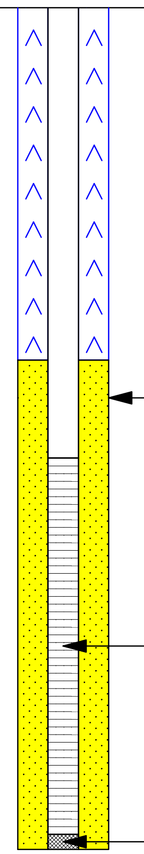
Drill Date: 8/28/2012
Logged By: E. Ramirez (Floyd|Snider)
Drilled By: Environmental West Exp.
Drill Type: Sonic
Sample Method: 4.25-in Sonic Core
Boring Diameter: 6.75-in
Boring Depth (ft BGL): 52 ft.
Groundwater (ft BGL): 31 ft.

Project: Sudbury Road Landfill Remedial Investigation
Client: City of Walla Walla
Site Location: Sudbury Road Landfill
Ground Elevation: 791.98 ft. MSL
Casing Elevation: 794.50 ft. MSL
Coordinate System: NAD/NAVD 88
Latitude/Northing: 278771
Longitude/Easting: 2169852

Remarks:

SAMPLE TYPE / ID	DRIVE / RECOVERY	BLOW COUNT	DEPTH FT BGS	USCS SYMBOL	Sample Description
			30–43	ML	ML: Silt, cont. @ 31 ft.: brown, wet. @ 32-33 ft.: caliche mottling. @ 34.5 ft.: 6" medium sand lens. @ 38-42.5 ft.: reddish mottling.
Core 37-47			43–45	GM	GM: Brown Silty GRAVEL, trace clay to coarse sub-rounded gravel, moderately graded, medium dense, wet. @ 43.5 ft.: 6" reddish mottled silt lens. @ 44.5 ft.: gravel size decreases to smaller sub-angular to sub-rounded coarse gravel.
			45–47.5	SP	SP: Dark reddish brown SAND, subangular, poorly graded, loose, wet.
Core 47-52			47.5–52	GM	GM: Dark reddish brown Sandy GRAVEL, trace fines, angular coarse sand to sub-rounded fine to coarse gravel, moderately graded, loose, wet. With depth, the gravel size fraction increases as the sand fraction decreases.

Well Construction Detail

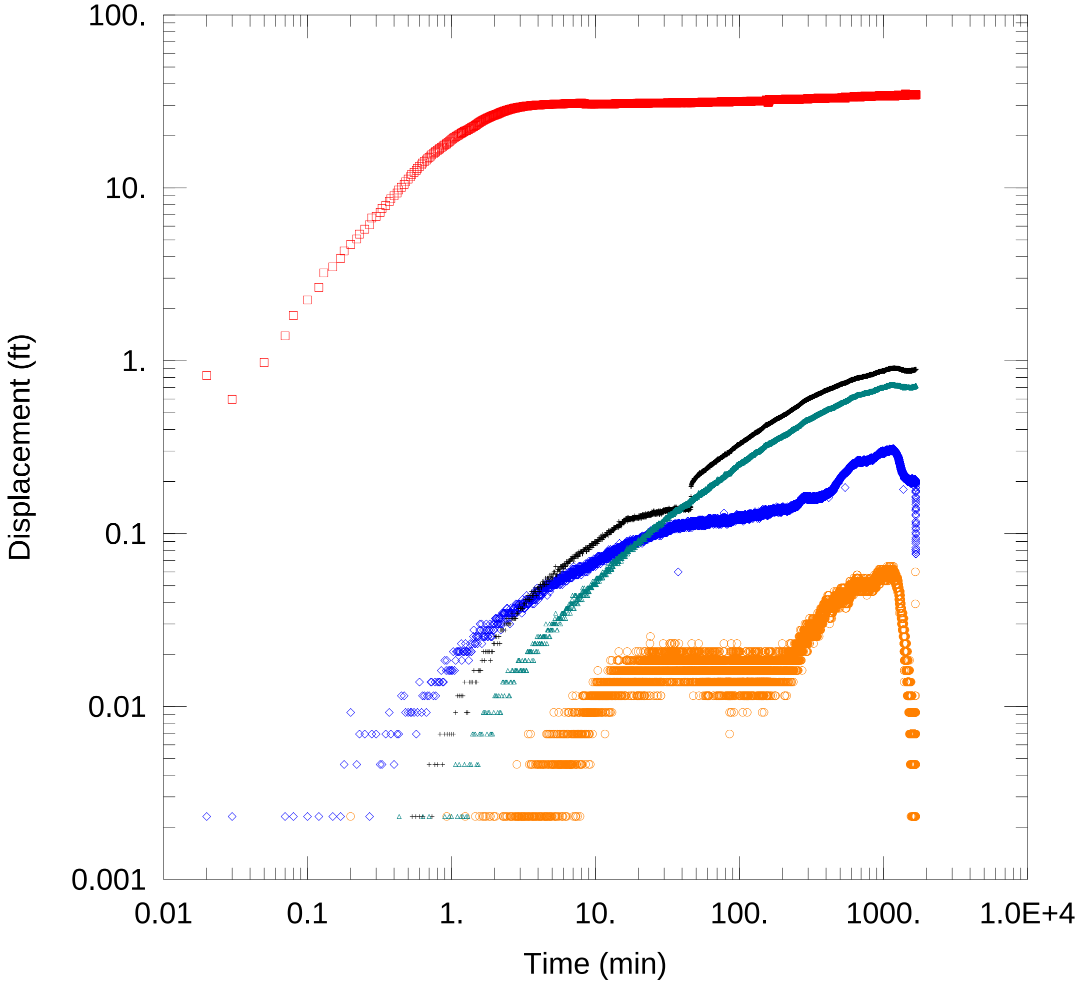


Notes:
ft BGL = feet below ground level
ft BTOC = feet below top of well casing
USCS = Unified Soil Classification System
▽ = denotes groundwater table

Sudbury Road Landfill

Aquifer Test Report

Appendix B
Time Displacement Plots



WELL TEST ANALYSIS

Data Set: F:\projects\Schywn-Sudbury\Field Work Related\Aquifer testing\Aquifer test data\Aqtw1.aqt
Date: 12/21/12 Time: 10:30:11

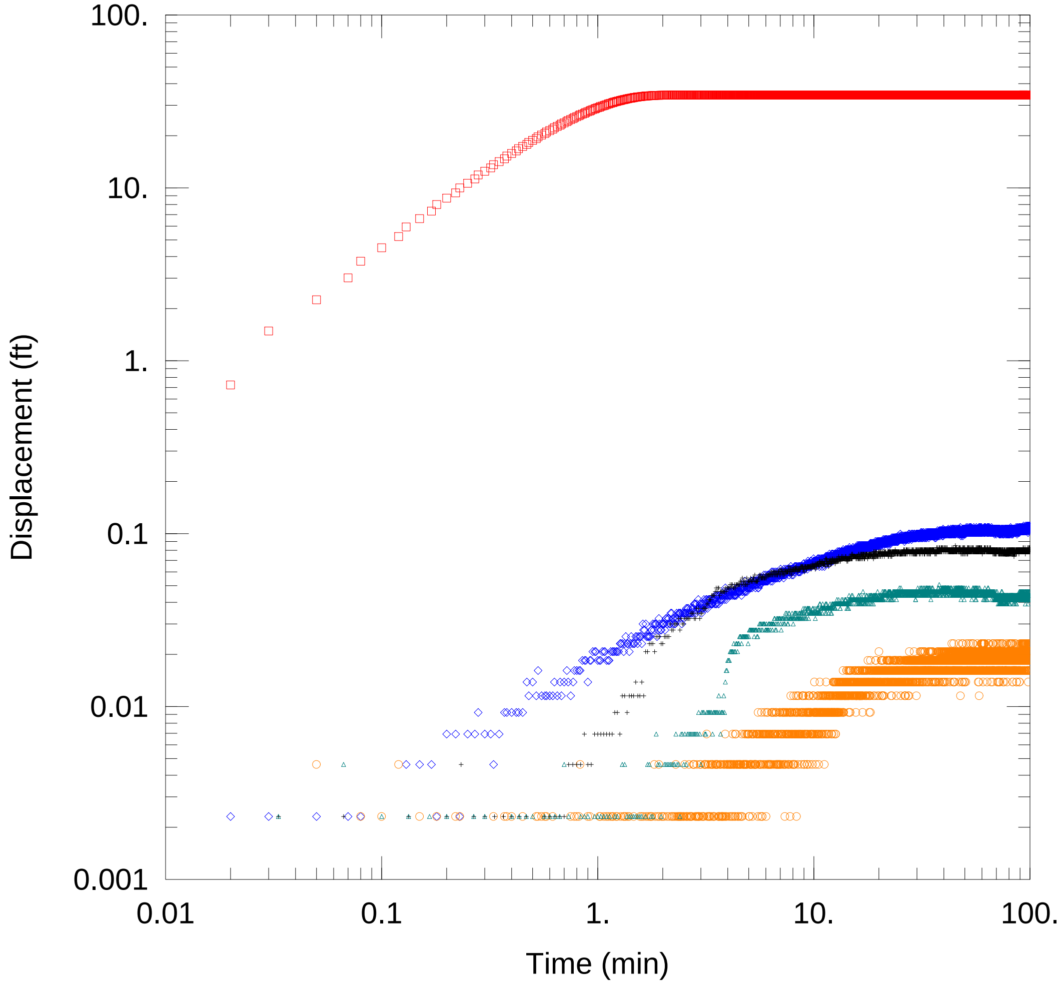
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

Observation Wells

Well Name	X (ft)	Y (ft)
□ MW-15D	2169554.033	278597.649
◇ MW-15	2169553.973	278571.431
○ MW-3	2169558.18	278640.58
+ MW-18	2169556.082	278422.199
△ MW-27	2169851.714	278770.732



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw100.aqt
Date: 12/21/12 Time: 10:31:34

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

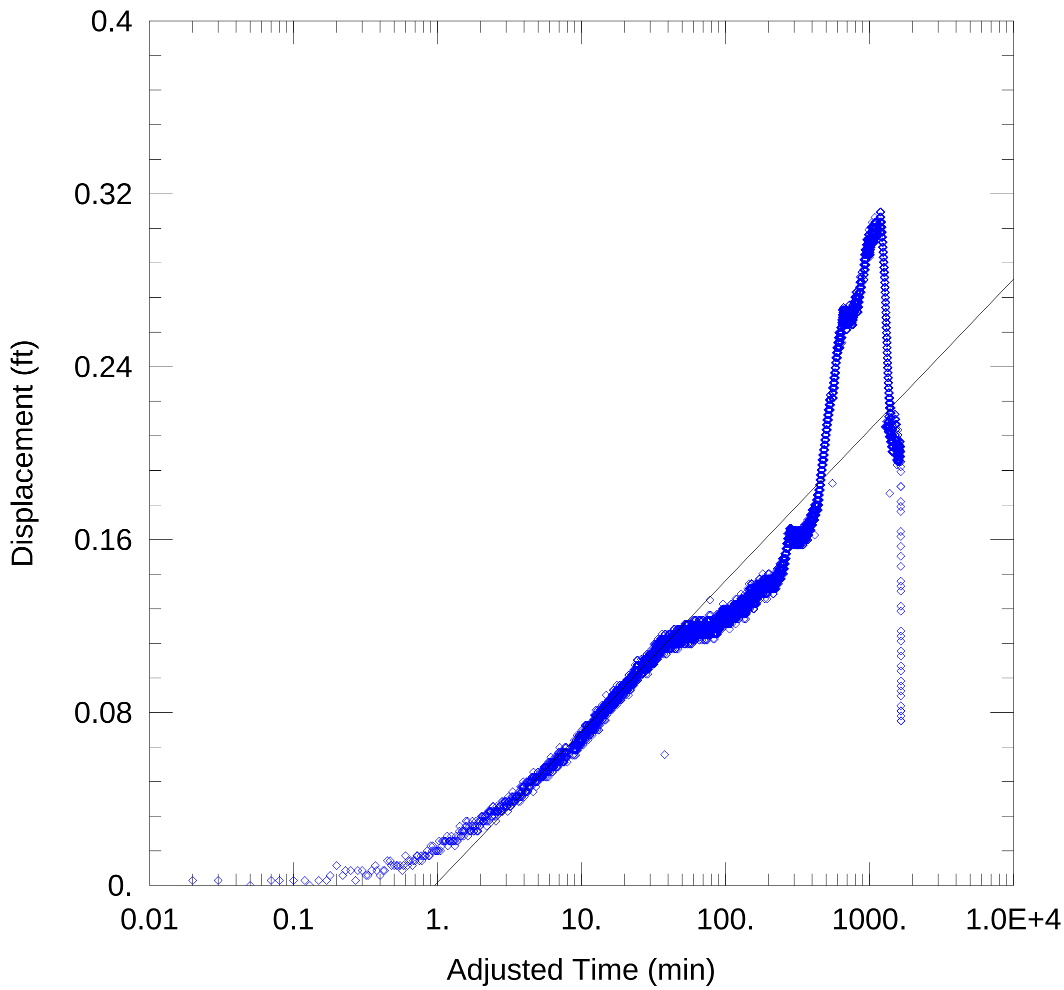
Observation Wells

Well Name	X (ft)	Y (ft)
□ MW-15D	2169554.033	278597.649
◇ MW-15	2169553.973	278571.431
○ MW-3	2169558.18	278640.58
+ MW-18	2169556.082	278422.199
△ MW-27	2169851.714	278770.732

Sudbury Road Landfill

Aquifer Test Report

Appendix C
Aquifer Test Solutions



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw5.aqt
Date: 02/13/13 Time: 16:50:17

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

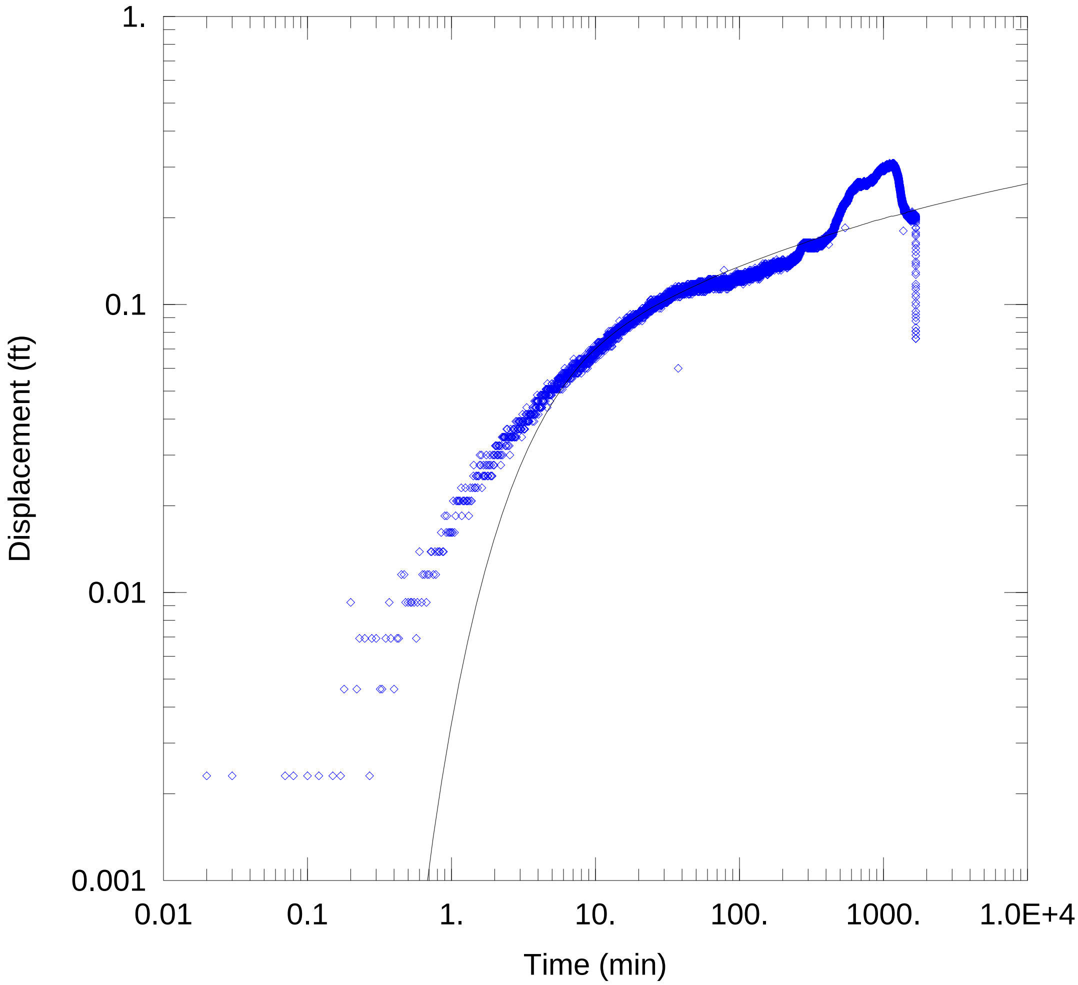
Observation Wells

Well Name	X (ft)	Y (ft)
◇ MW-15	2169553.973	278571.431

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob

T = 8.808 ft^2/min S = 0.02757



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw5.aqt
Date: 02/13/13
Time: 16:52:44

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

Observation Wells

Well Name	X (ft)	Y (ft)
◇ MW-15	2169553.973	278571.431

SOLUTION

Aquifer Model: Confined

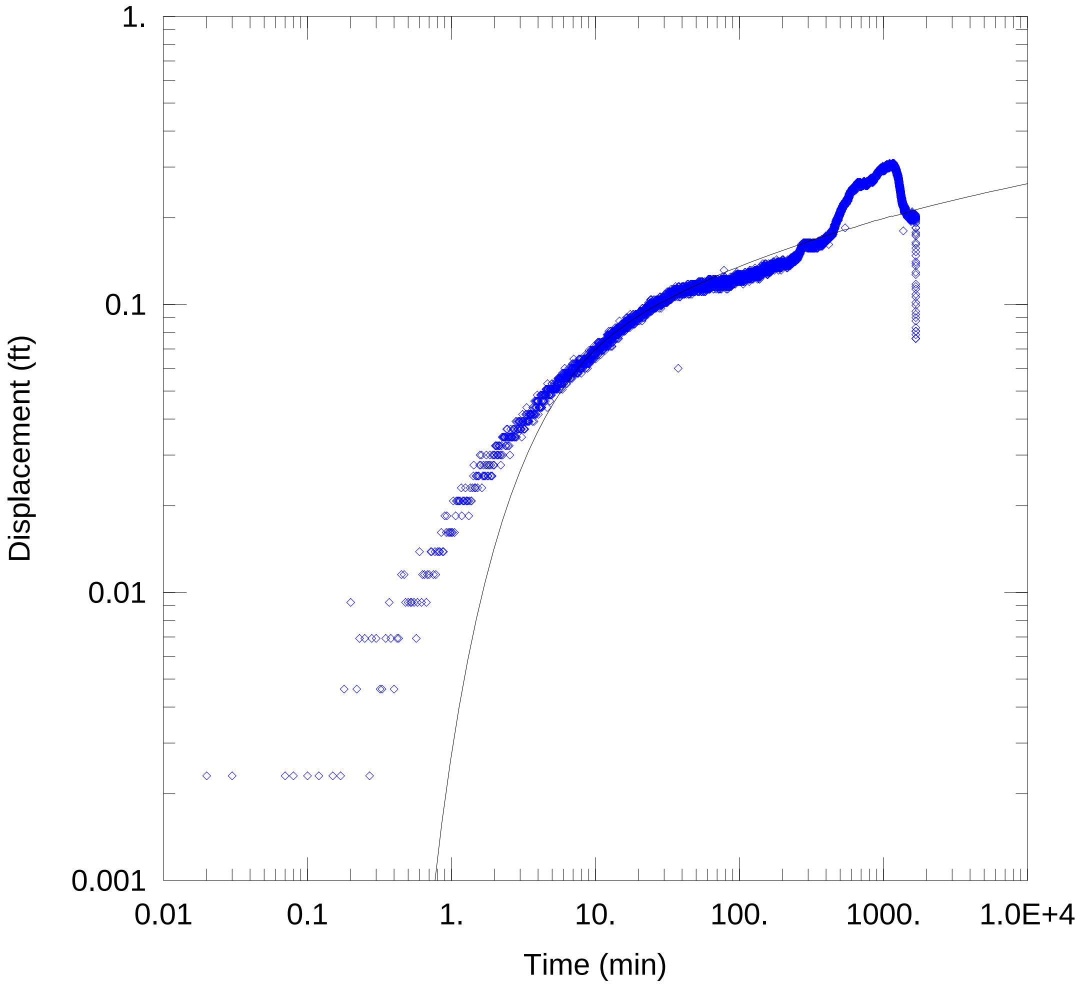
Solution Method: Theis

T = 9.747 ft^2/min

S = 0.008462

Kz/Kr = 0.1

b = 100. ft



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw5.aqt
Date: 02/13/13 Time: 16:54:01

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

Observation Wells

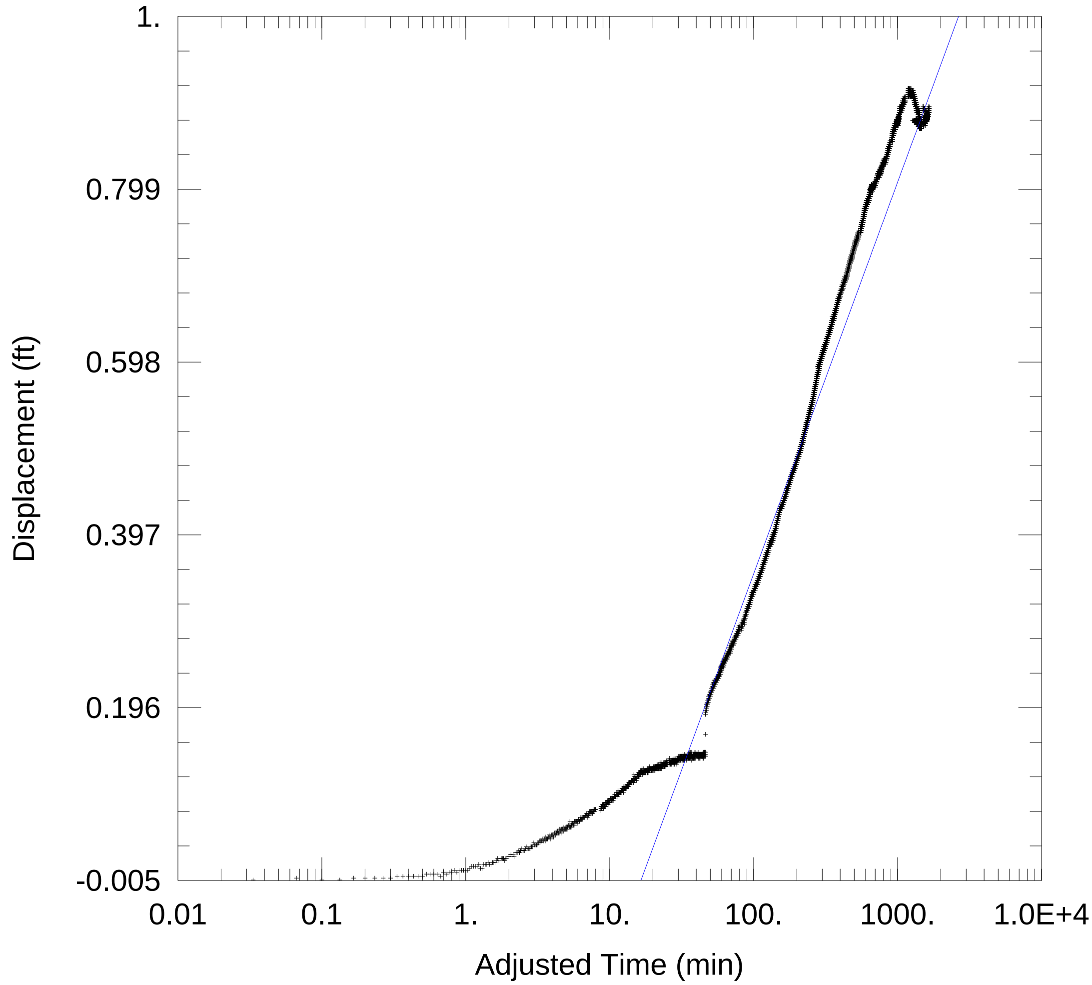
Well Name	X (ft)	Y (ft)
◇ MW-15	2169553.973	278571.431

SOLUTION

Aquifer Model: Confined Solution Method: Dougherty-Babu

T = 9.747 ft^2/min
Kz/Kr = 0.1
r(w) = 0.36 ft

S = 0.008462
Sw = 0.
r(c) = 0.166 ft



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw6.aqt
Date: 02/14/13 Time: 09:05:35

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

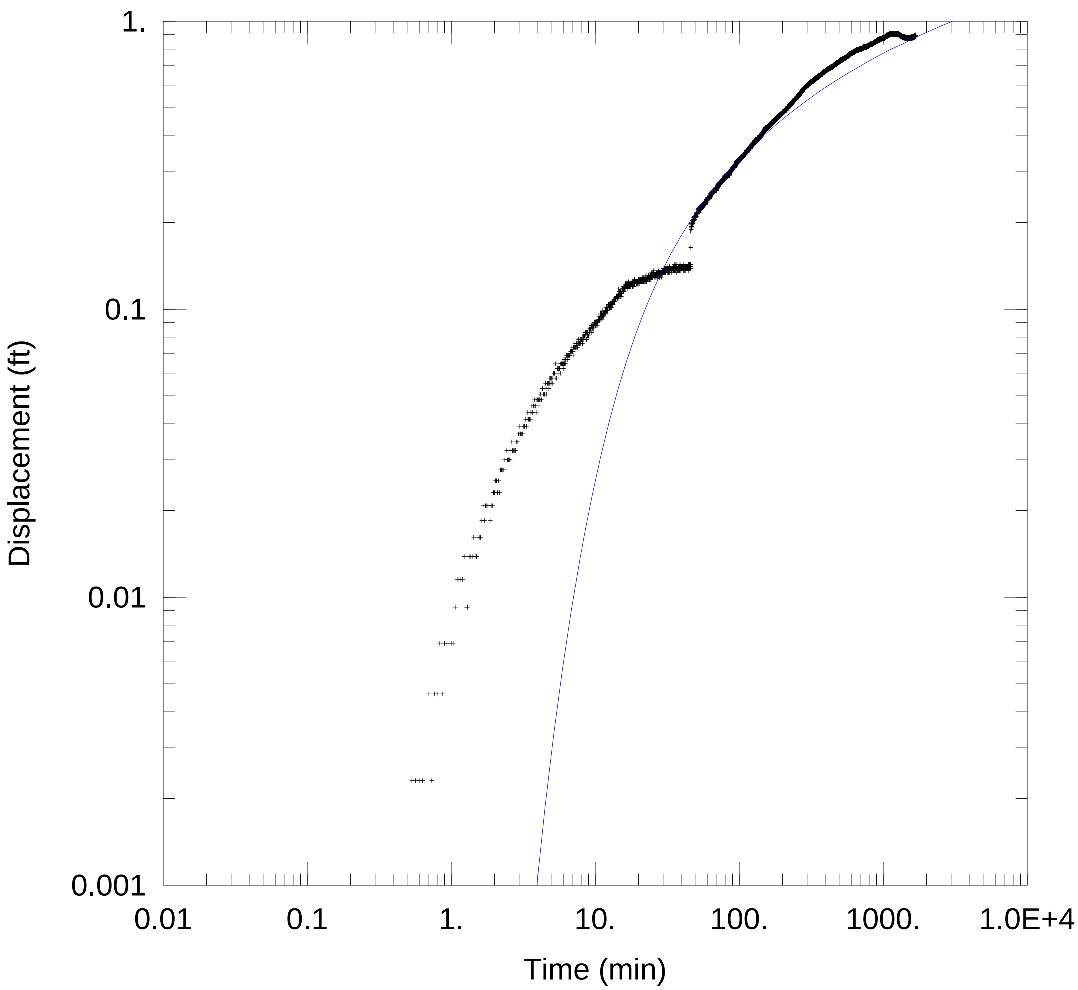
Observation Wells

Well Name	X (ft)	Y (ft)
MW-18	2169556.082	278422.199

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob

T = 1.35 ft^2/min S = 0.001667



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw6.aqt
Date: 02/14/13 Time: 08:52:46

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

Observation Wells

Well Name	X (ft)	Y (ft)
MW-18	2169556.082	278422.199

SOLUTION

Aquifer Model: Confined

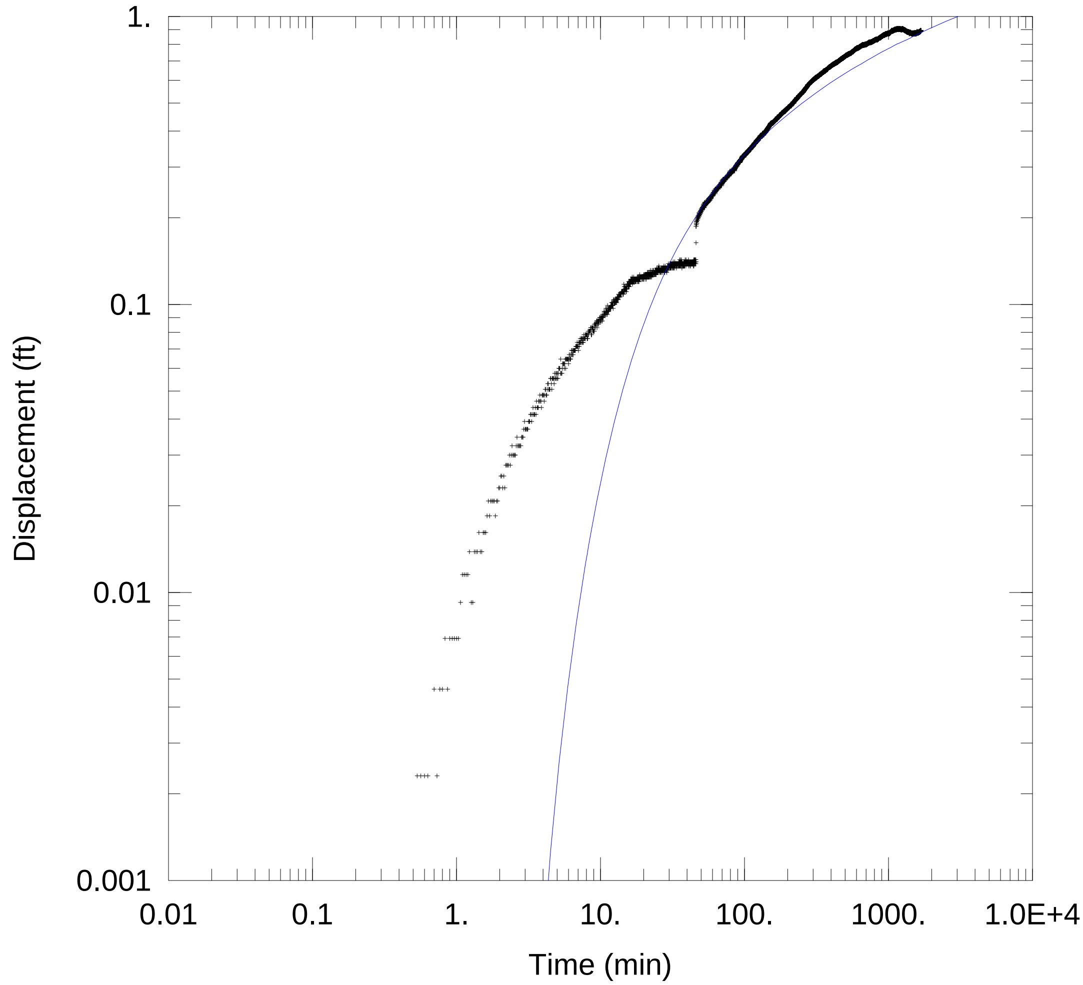
Solution Method: Theis

T = 1.306 ft^2/min

S = 0.002686

Kz/Kr = 0.1

b = 100. ft



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw6.aqt

Date: 02/14/13 Time: 08:54:39

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

Observation Wells

Well Name	X (ft)	Y (ft)
MW-18	2169556.082	278422.199

SOLUTION

Aquifer Model: Confined Solution Method: Dougherty-Babu

T = 1.306 ft^2/min

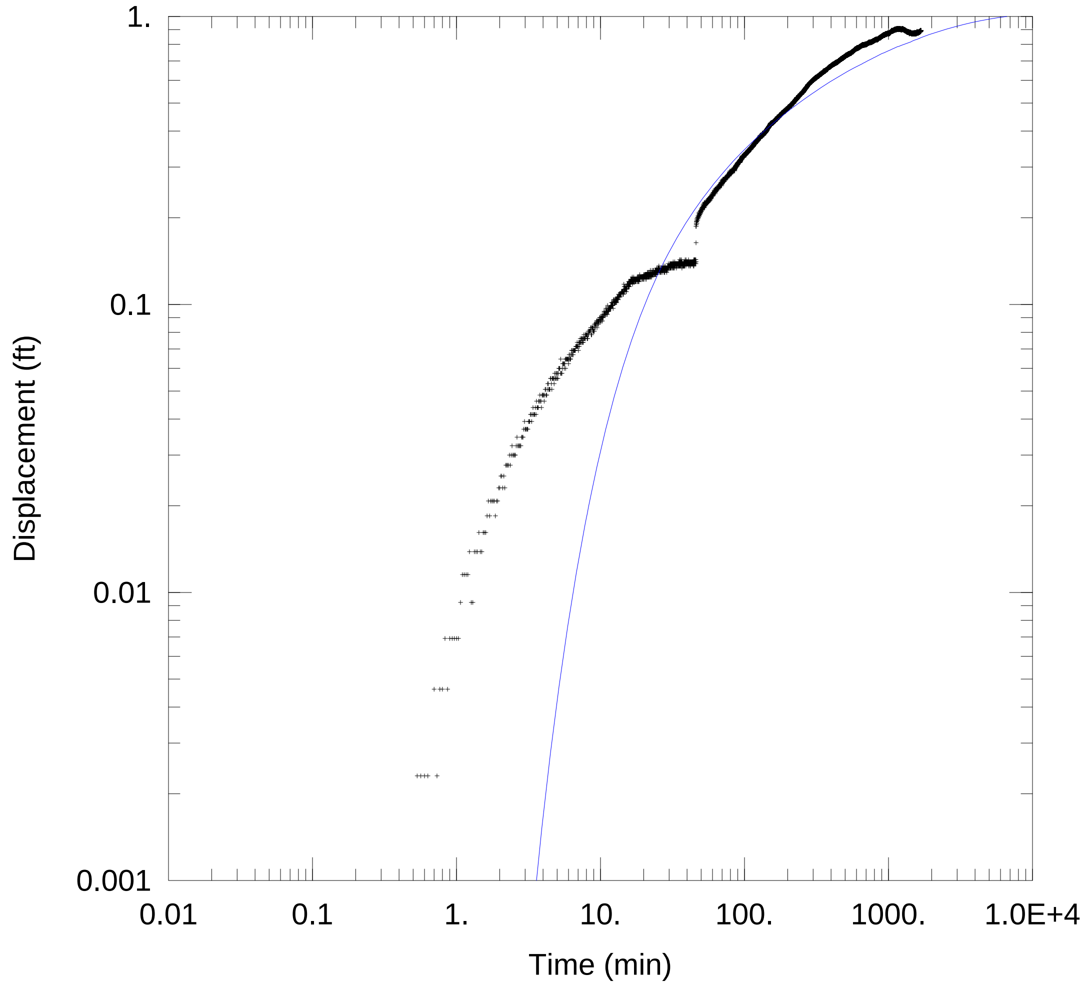
S = 0.002686

Kz/Kr = 0.1

Sw = 0.

r(w) = 0.36 ft

r(c) = 0.166 ft



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw6.aqt
Date: 02/14/13 Time: 09:03:30

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

Observation Wells

Well Name	X (ft)	Y (ft)
MW-18	2169556.082	278422.199

SOLUTION

Aquifer Model: Leaky

Solution Method: Hantush-Jacob

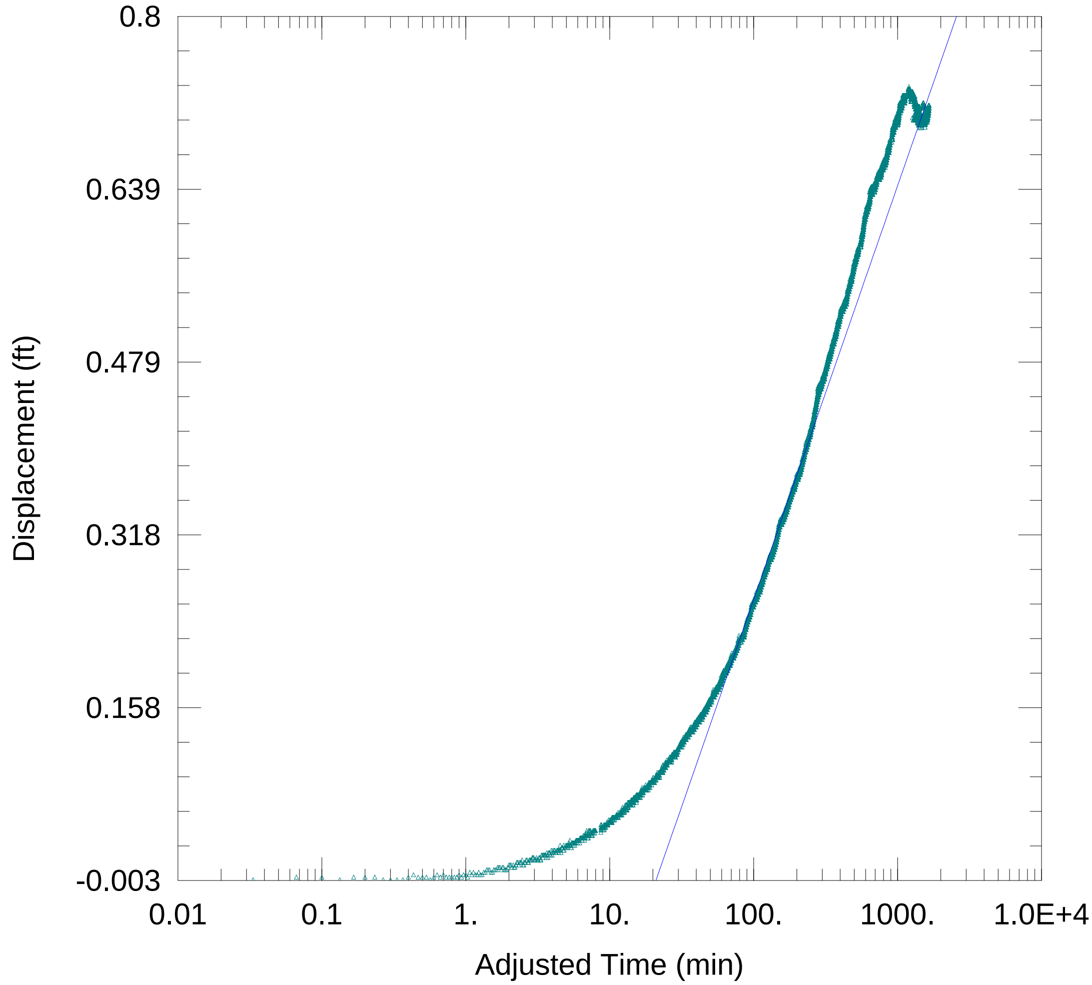
T = 1.306 ft^2/min

S = 0.002455

r/B = 0.1

Kz/Kr = 0.1

b = 100. ft



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw4.aqt
Date: 02/14/13 Time: 09:09:05

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

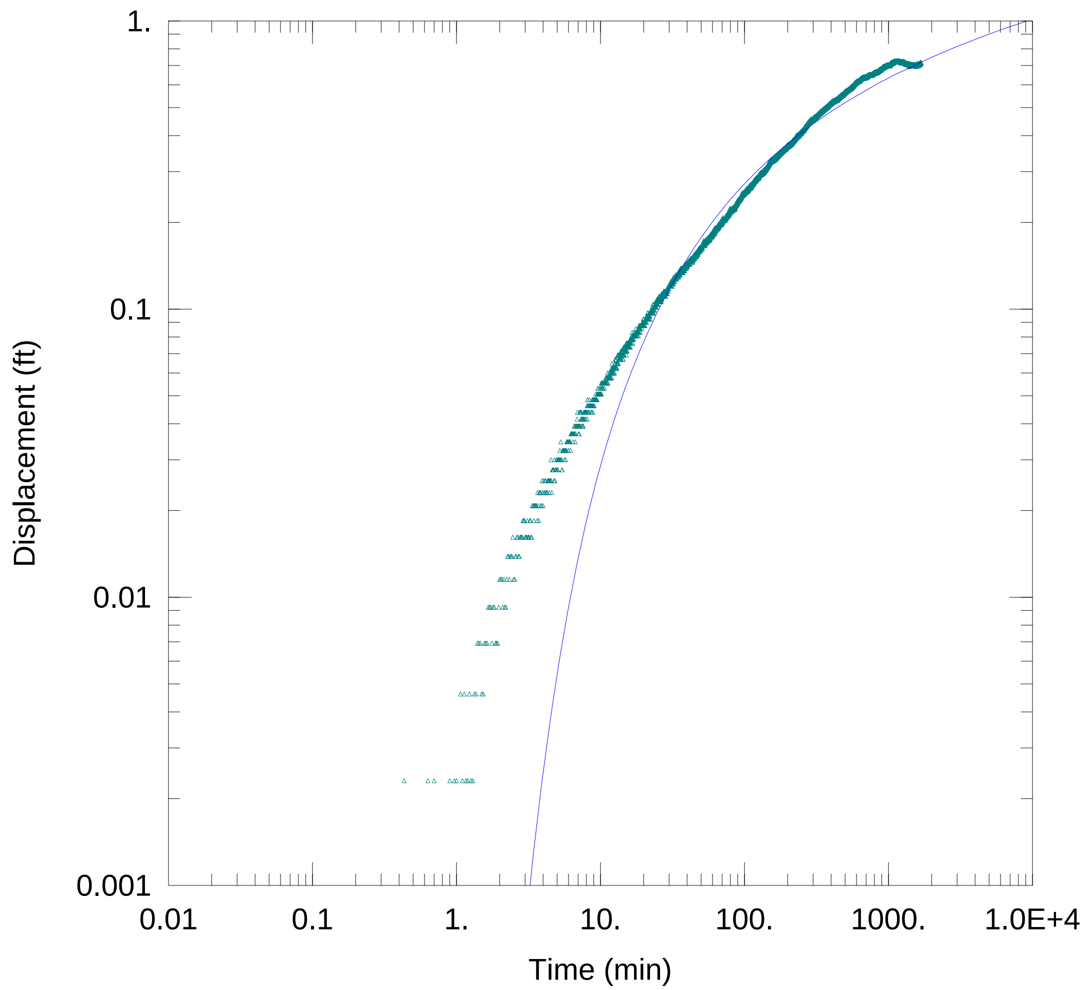
Observation Wells

Well Name	X (ft)	Y (ft)
MW-27	2169851.714	278770.732

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob

T = 1.599 ft^2/min S = 0.0006471



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw4.aqt
Date: 02/14/13 Time: 09:12:50

WELL DATA

Pumping Wells		
Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

Observation Wells		
Well Name	X (ft)	Y (ft)
MW-27	2169851.714	278770.732

SOLUTION

Aquifer Model: Confined

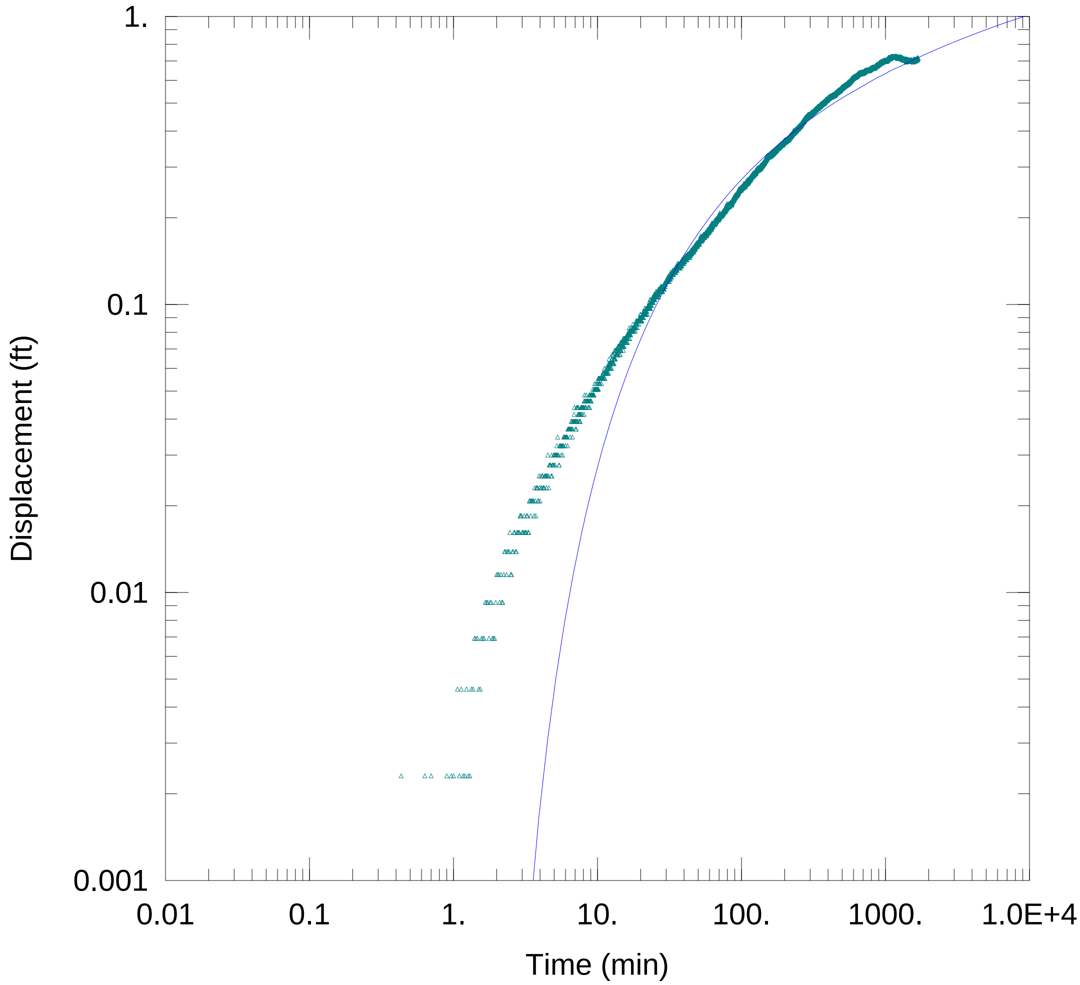
Solution Method: Theis

T = 1.617 ft^2/min

S = 0.0006845

Kz/Kr = 0.1

b = 100. ft



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw4.aqt
Date: 02/14/13 Time: 09:14:28

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

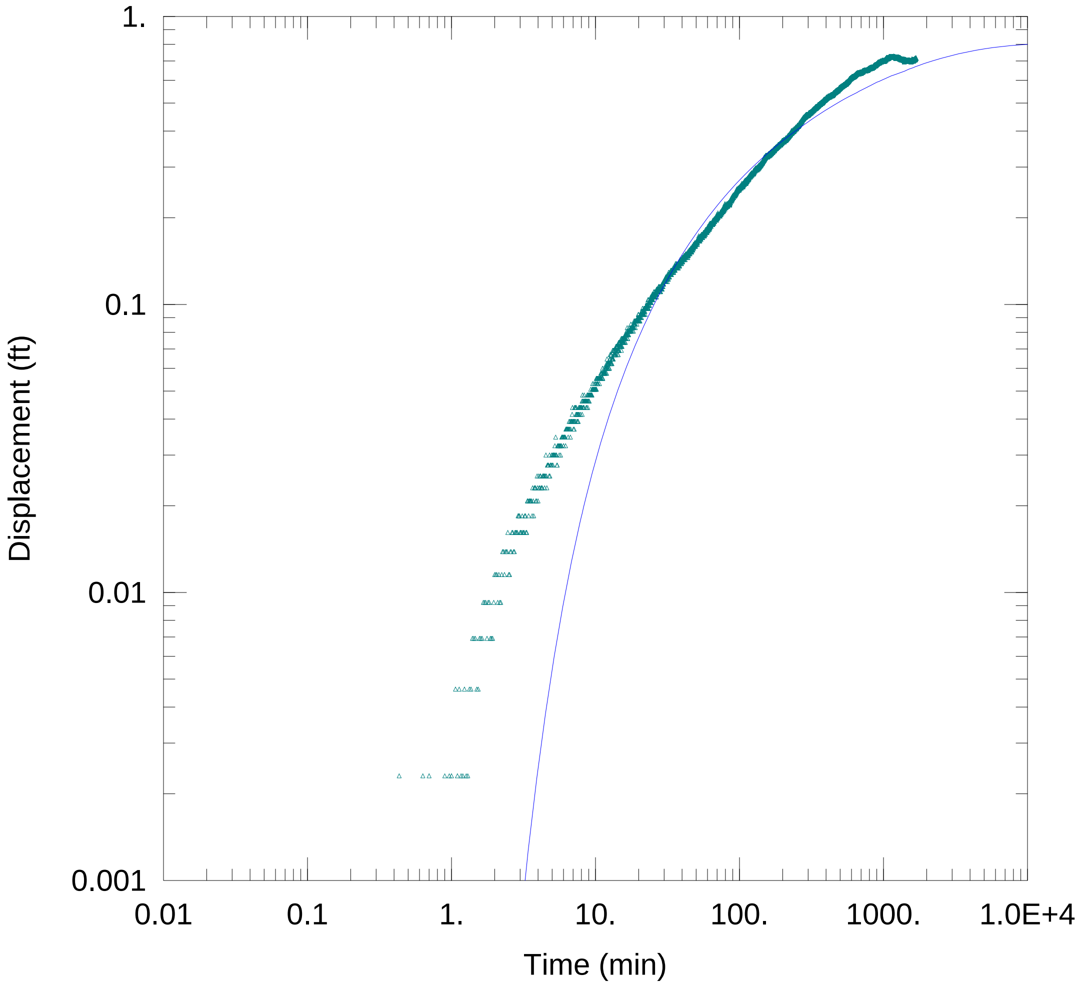
Observation Wells

Well Name	X (ft)	Y (ft)
MW-27	2169851.714	278770.732

SOLUTION

Aquifer Model: Confined Solution Method: Dougherty-Babu

T = 1.617 ft^2/min S = 0.0006845
Kz/Kr = 0.1 Sw = 0.
r(w) = 0.36 ft r(c) = 0.166 ft



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw4.aqt
Date: 02/14/13 Time: 09:16:18

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D	2169554.033	278597.649

Observation Wells

Well Name	X (ft)	Y (ft)
MW-27	2169851.714	278770.732

SOLUTION

Aquifer Model: Leaky

Solution Method: Hantush-Jacob

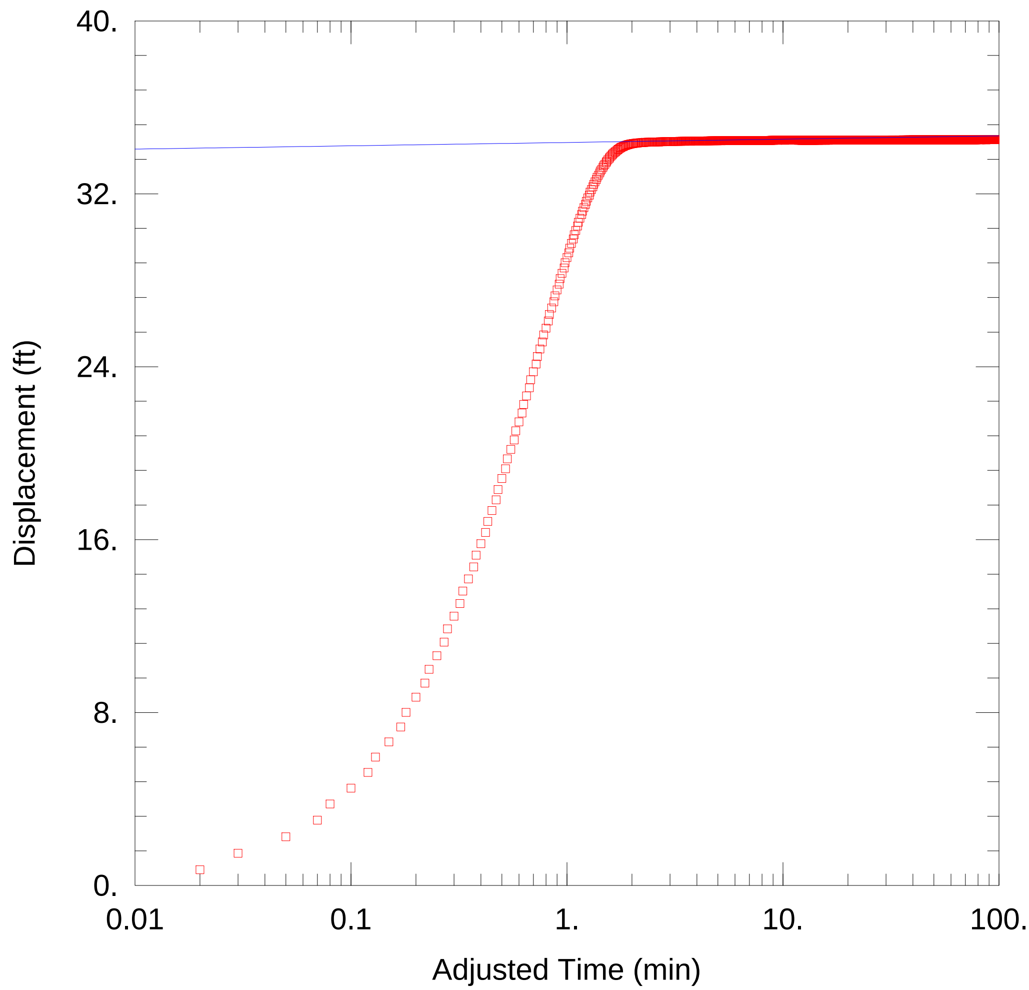
T = 1.617 ft^2/min

S = 0.0006845

r/B = 0.1

Kz/Kr = 0.1

b = 100. ft



WELL TEST ANALYSIS

Data Set: F:\...\Aqtw101.aqt
Date: 02/14/13 Time: 09:31:33

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-15D Recovery	2169554.033	278597.649

Observation Wells

Well Name	X (ft)	Y (ft)
MW-15D Recovery	2169554.033	278597.649

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob

T = 4.012 ft^2/min S = 3.211E-223

APPENDIX F

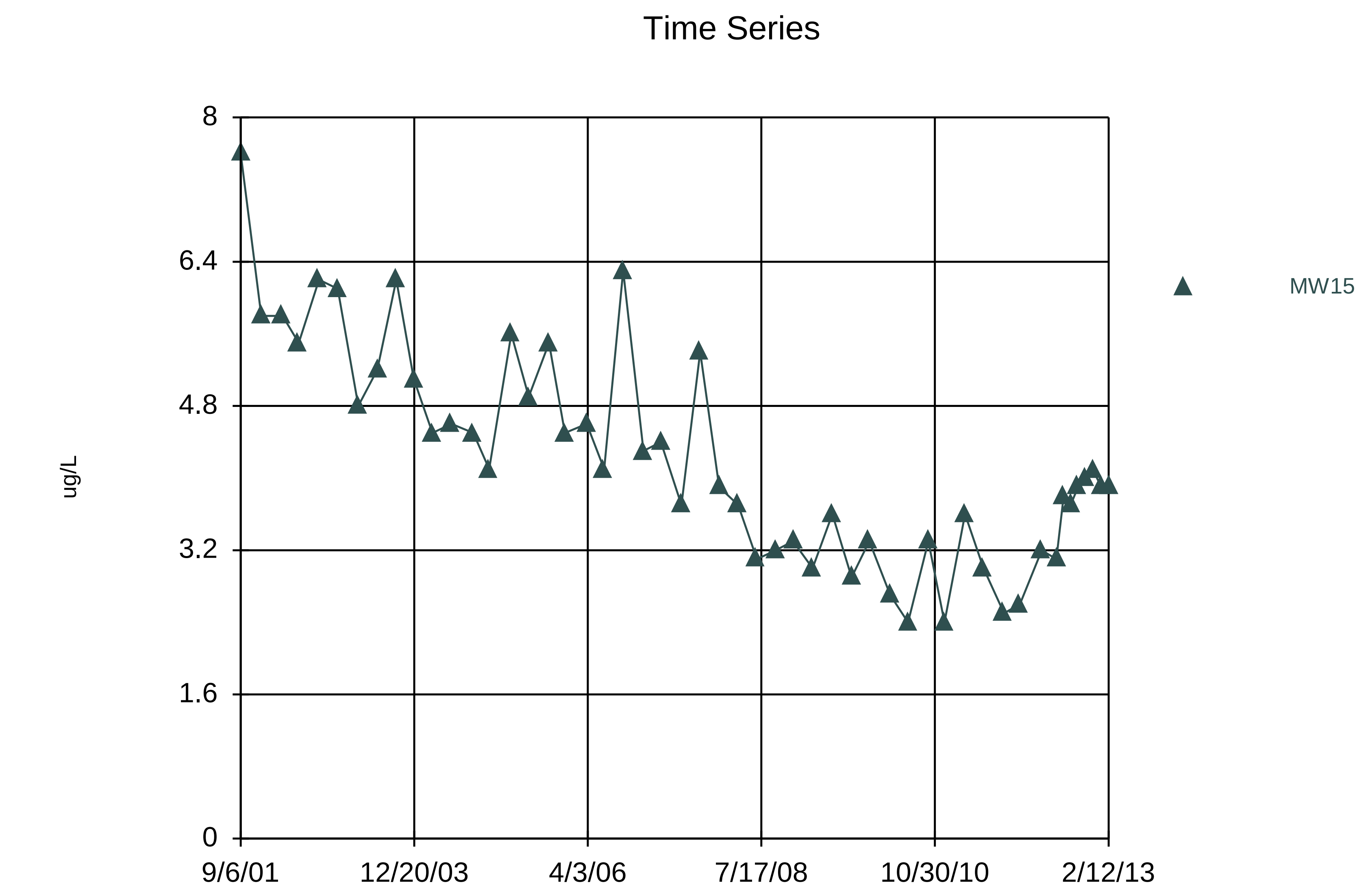
Groundwater Plots

APPENDIX F

MW-15 VOC In Groundwater Trends

Schwyn Environmental Services

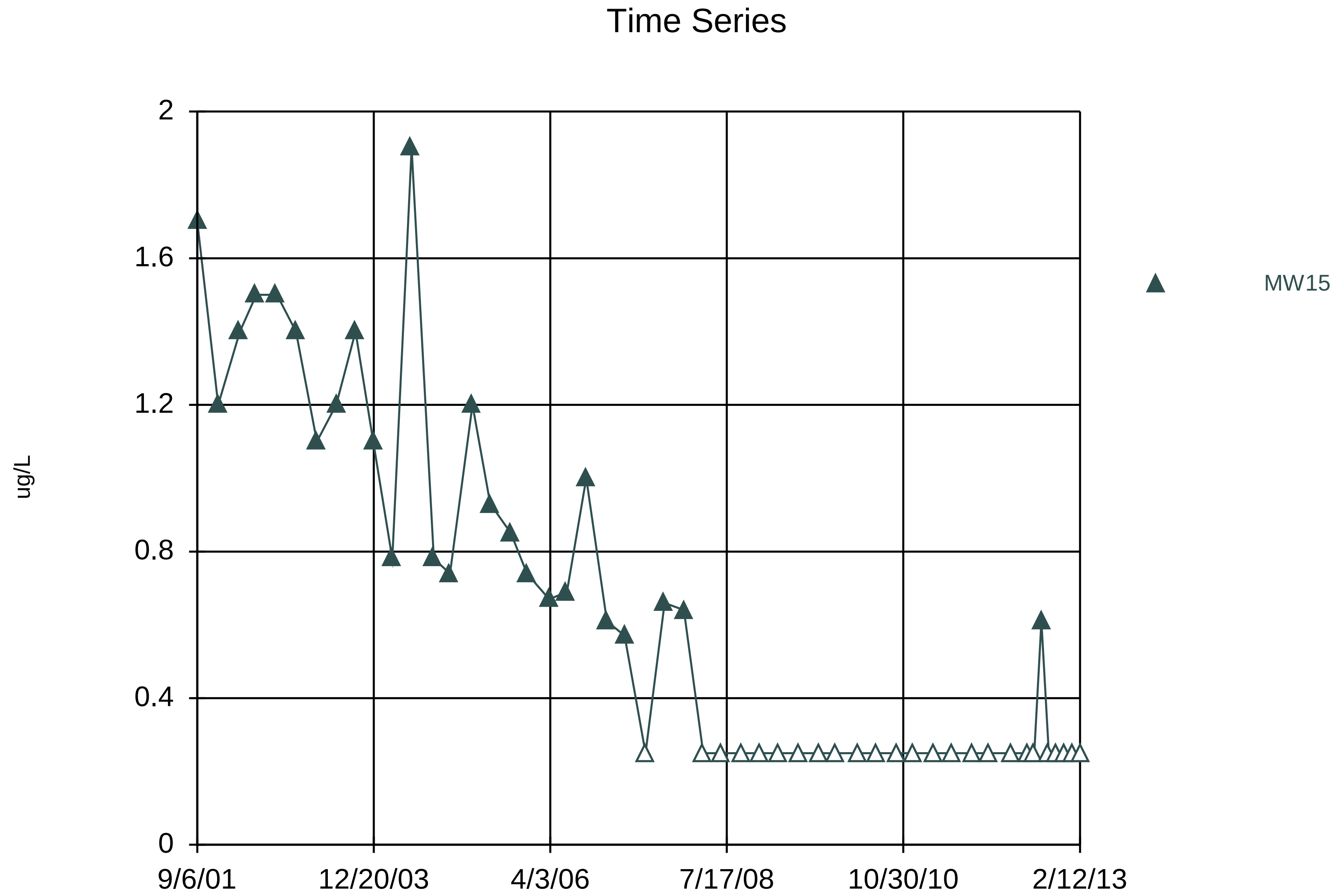
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG



Constituent: 1,1-Dichloroethane   Analysis Run 3/22/2013 1:55 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG
Hollow symbols indicate censored values.

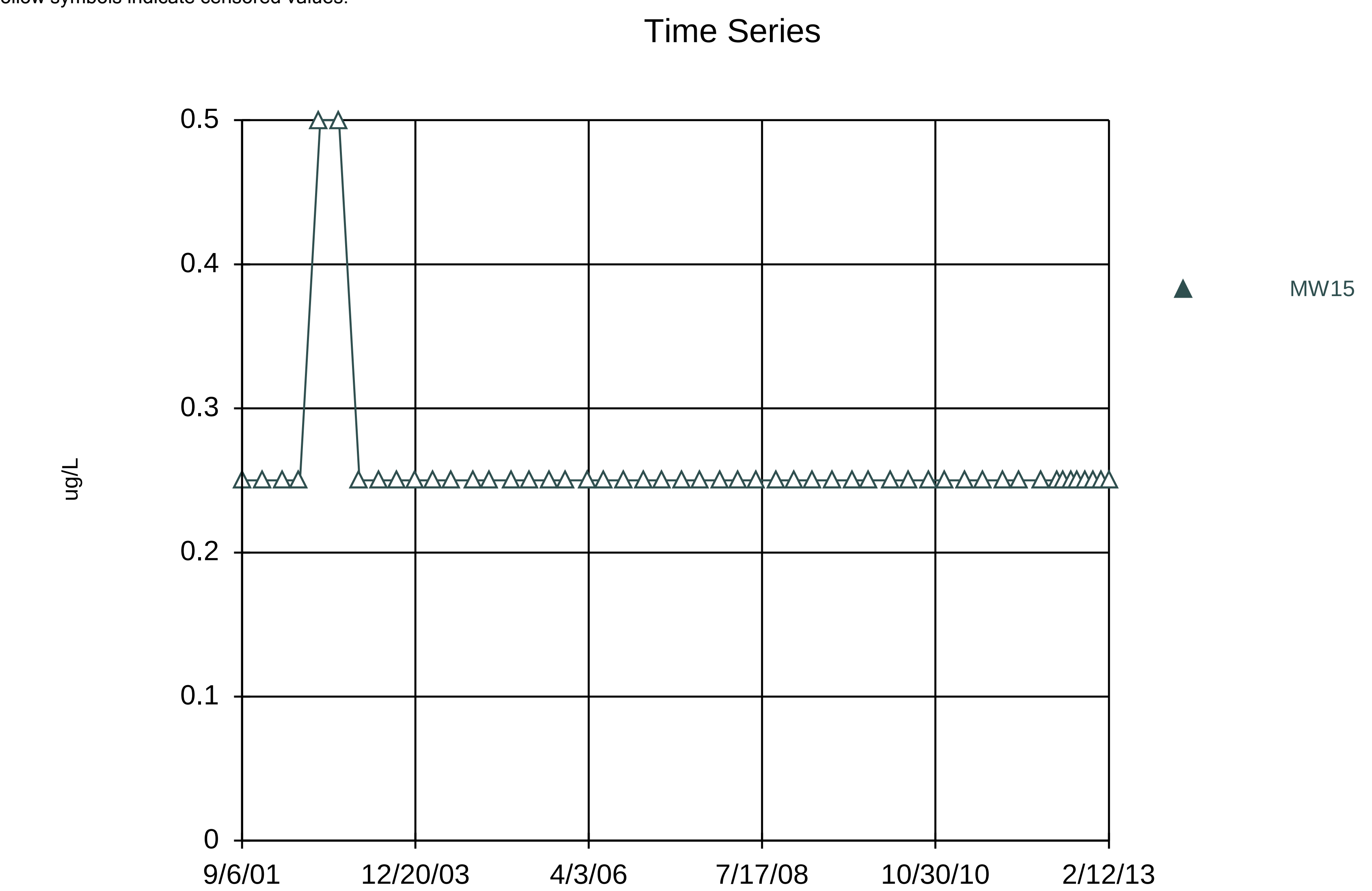


Constituent: Chloroethane   Analysis Run 3/22/2013 1:55 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

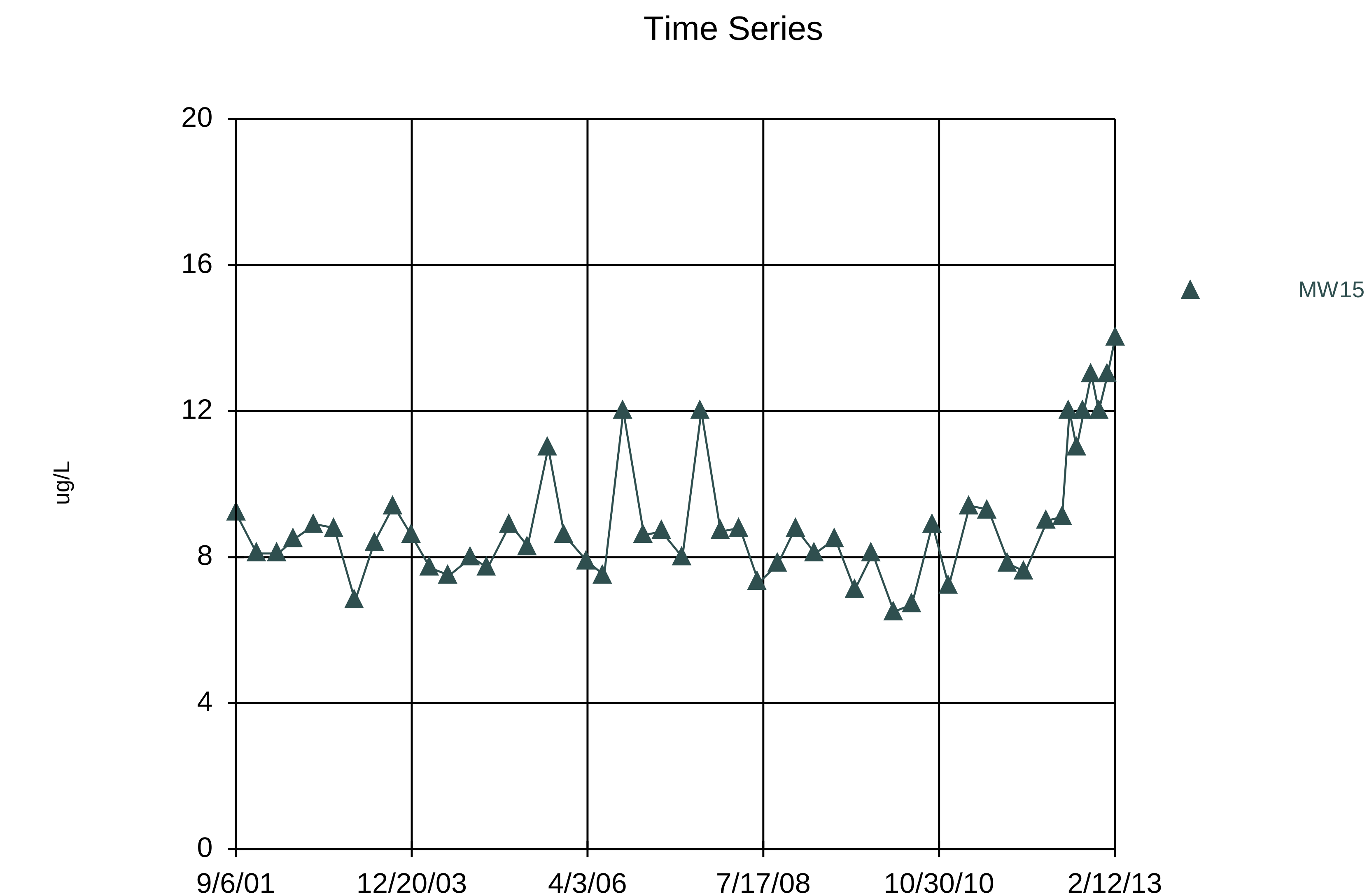
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG

Hollow symbols indicate censored values.



Constituent: Chloroform Analysis Run 3/22/2013 1:55 PM

Facility: Sudbury Road Landfill Client: City of Walla Walla Data File: S2

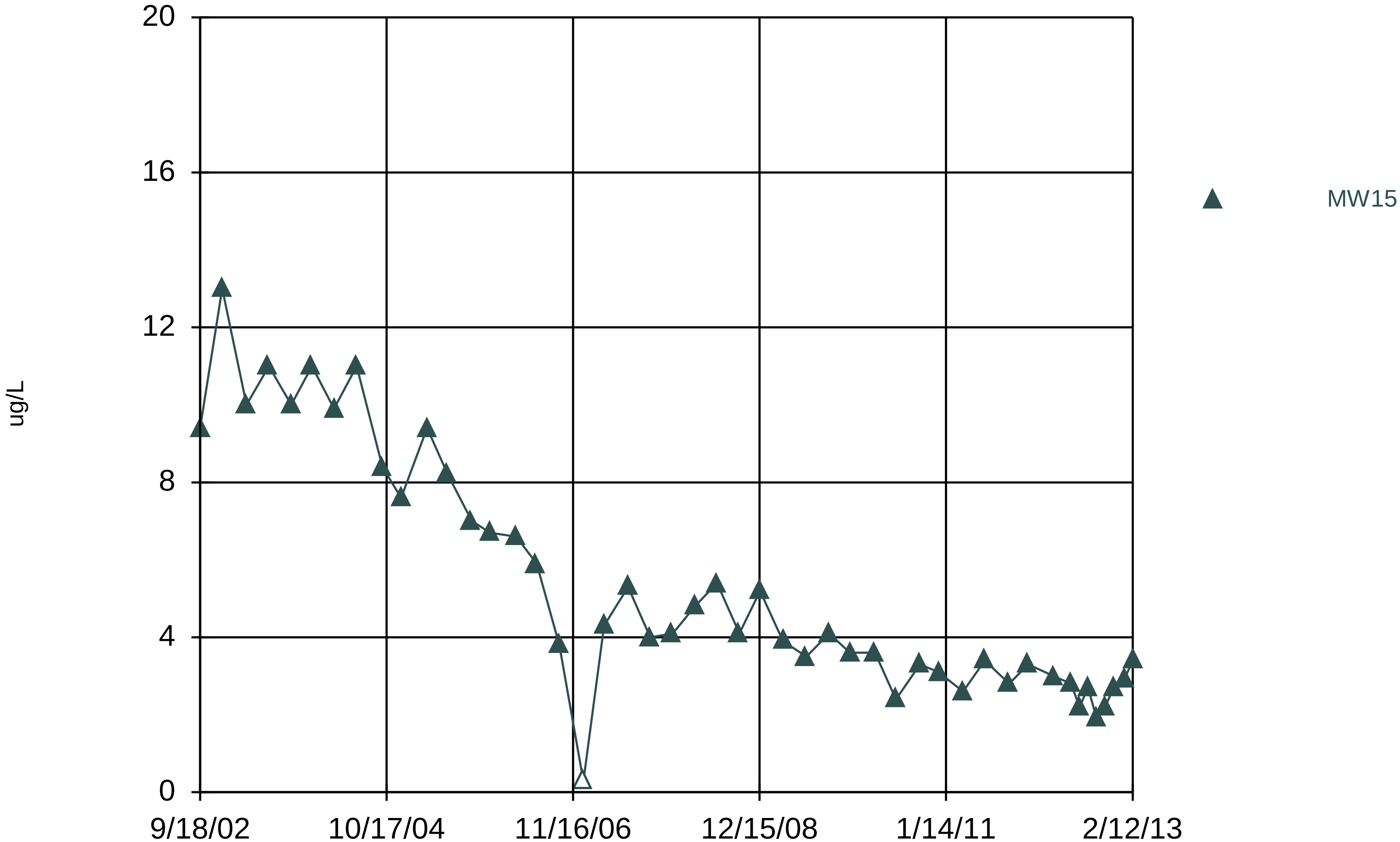


Constituent: cis-1,2-Dichloroethene   Analysis Run 3/22/2013 1:55 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG
Hollow symbols indicate censored values.

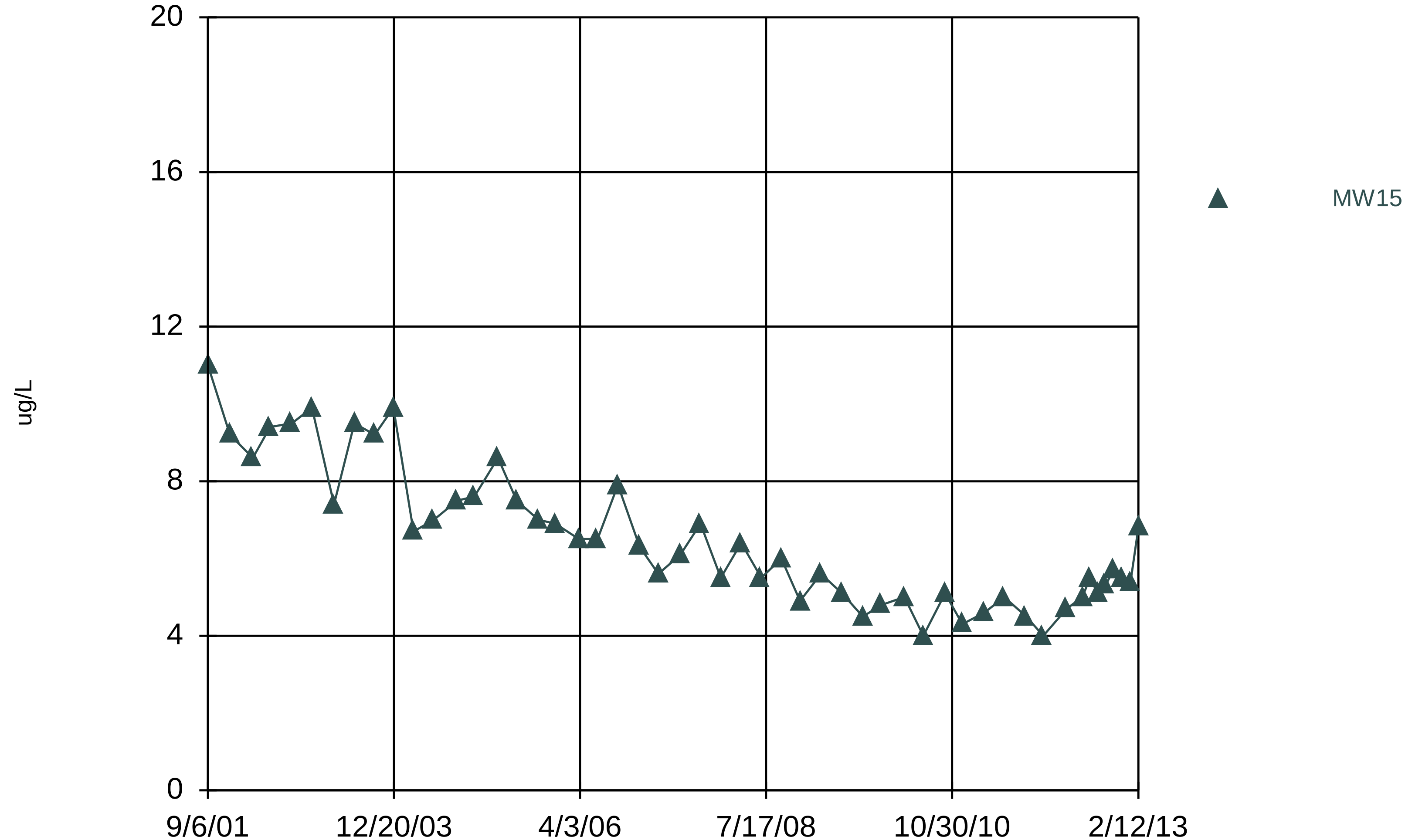
Time Series



Constituent: Dichlorodifluoromethane   Analysis Run 3/22/2013 1:55 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

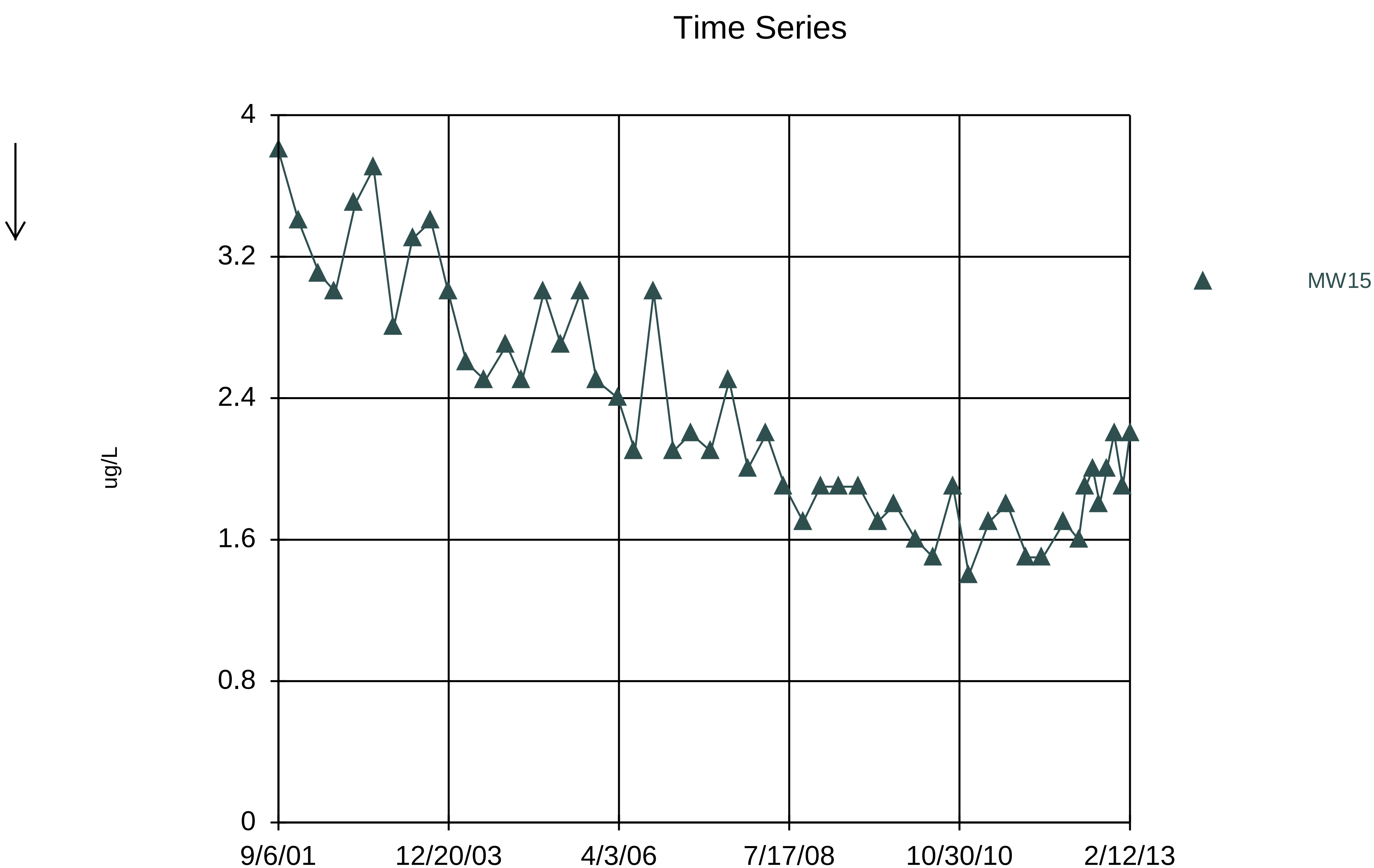
Time Series



Constituent: Tetrachloroethene   Analysis Run 3/22/2013 1:55 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

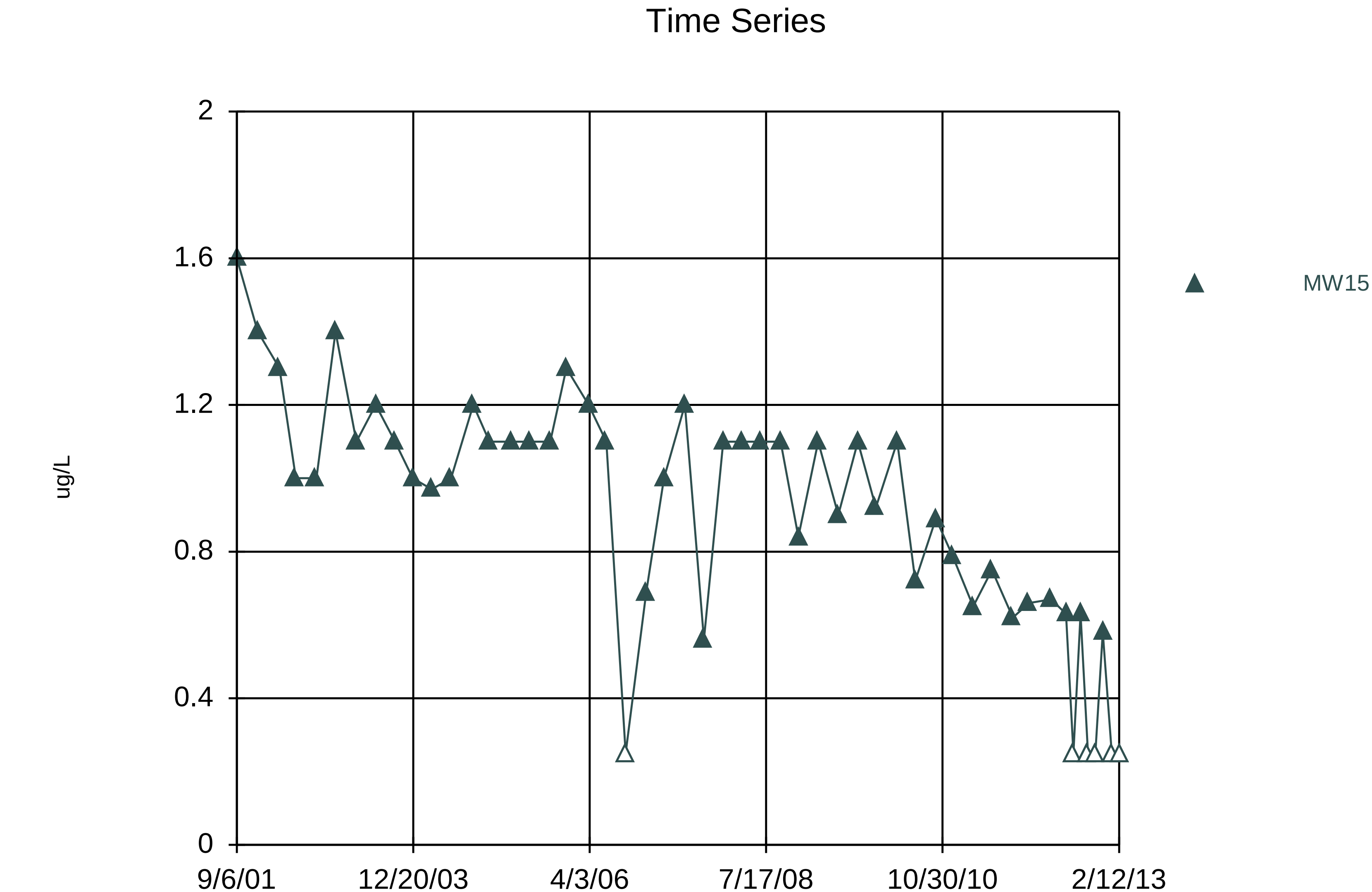
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG



Constituent: Trichloroethene Analysis Run 3/22/2013 1:55 PM

Facility: Sudbury Road Landfill Client: City of Walla Walla Data File: S2

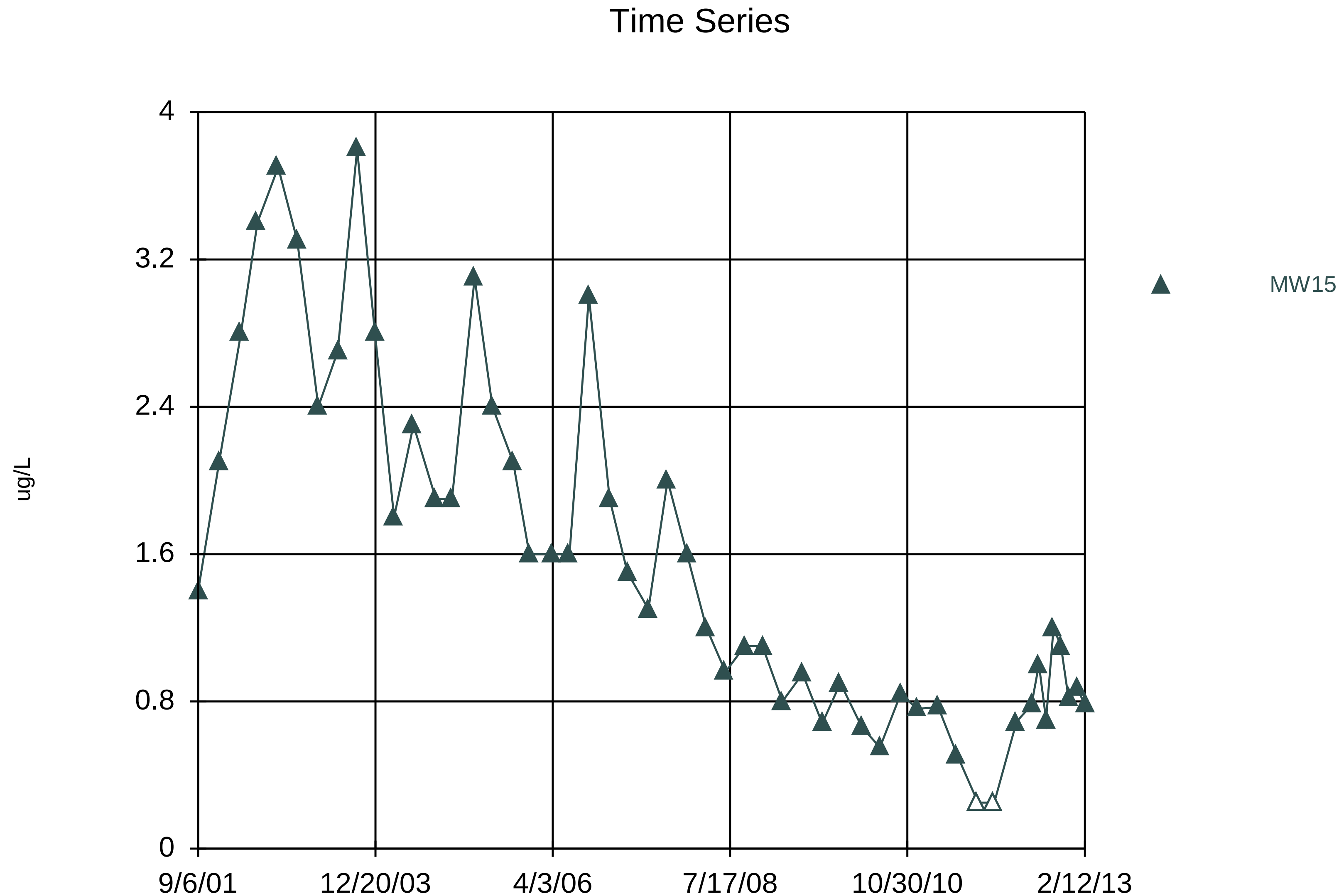
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG
Hollow symbols indicate censored values.



Constituent: Trichlorofluoromethane   Analysis Run 3/22/2013 1:55 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG
Hollow symbols indicate censored values.



Constituent: Vinyl chloride   Analysis Run 3/22/2013 1:55 PM

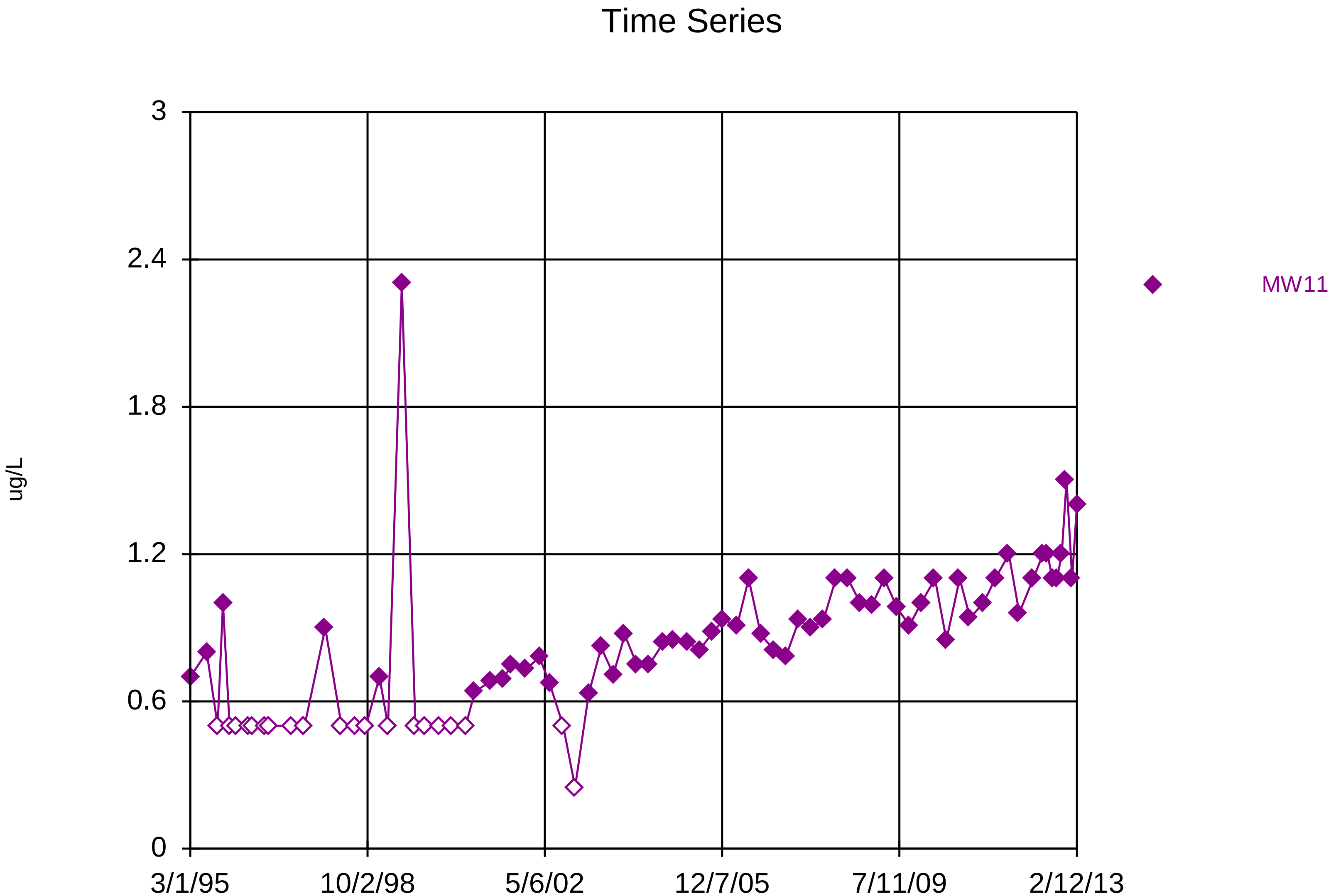
Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

APPENDIX F

MW-11 Tetrachloroethene In Groundwater Trend

Schwyn Environmental Services

Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG
Hollow symbols indicate censored values.



Constituent: Tetrachloroethene   Analysis Run 3/22/2013 2:22 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

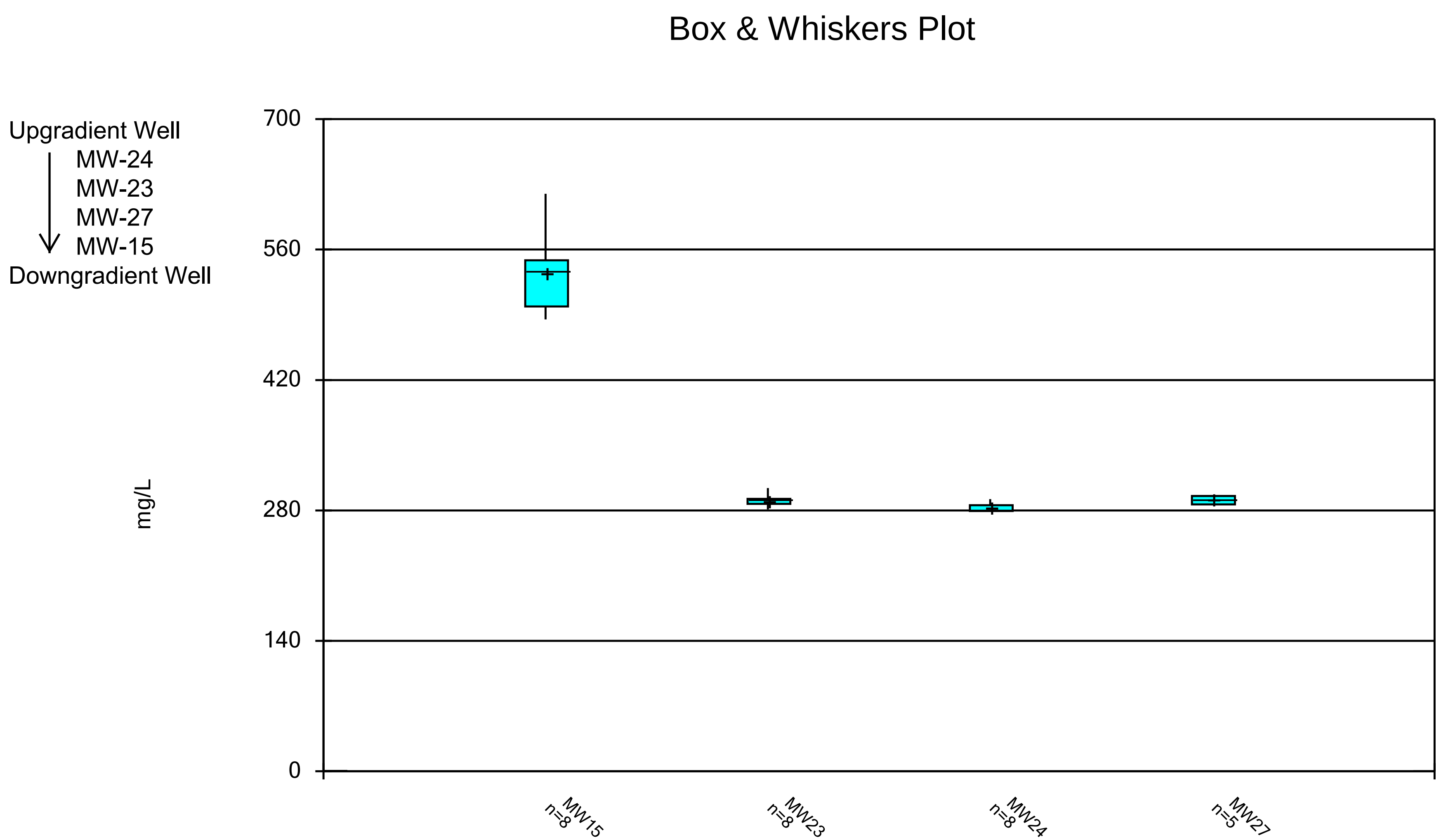
APPENDIX F

Box and Whisker Plots
Area 5 North Drainage Wells

From Upgradient to Downgradient
MW-24, MW-23, MW-27, MW-15

Schwyn Environmental Services

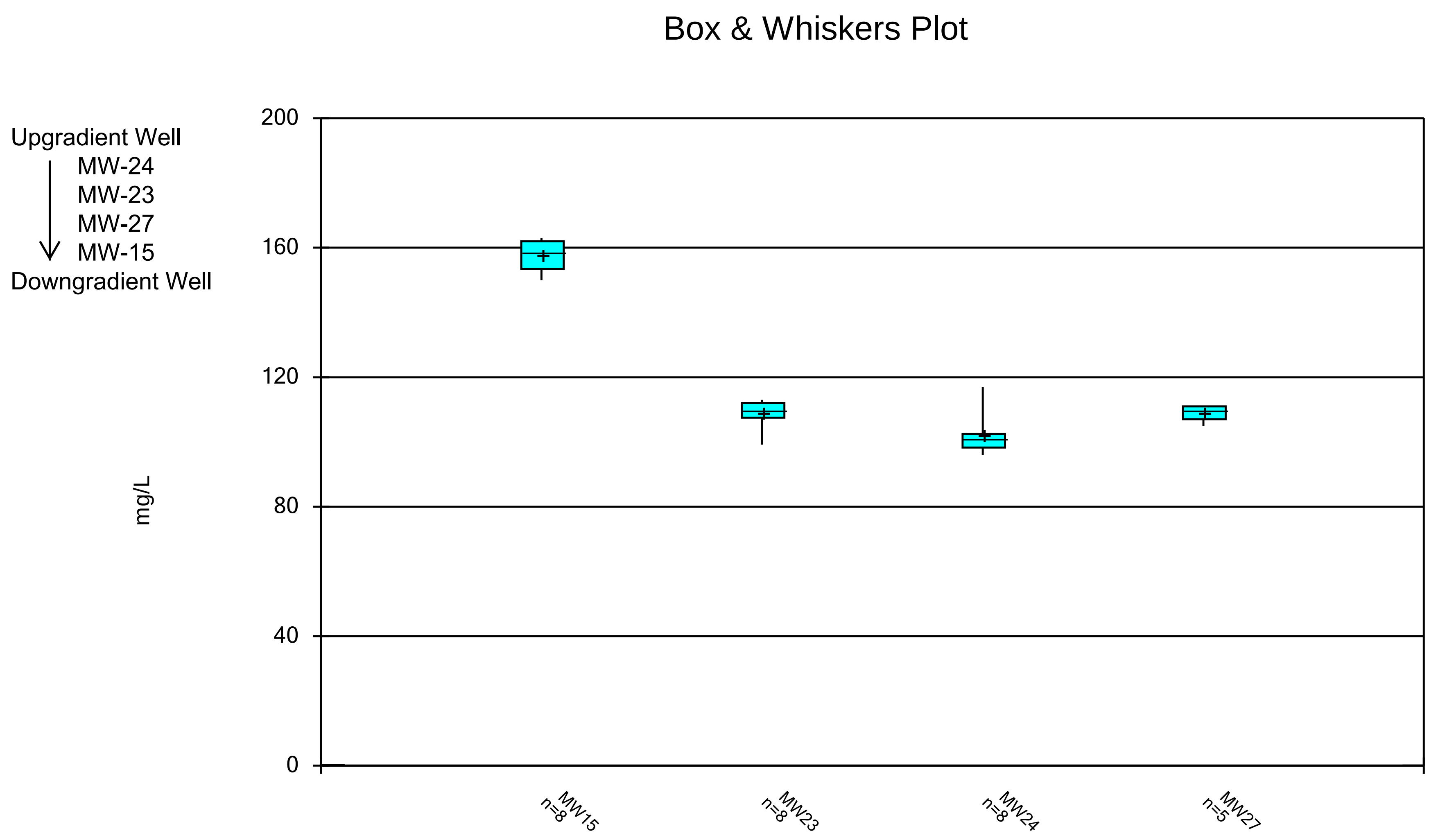
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG



Constituent: Alkalinity Analysis Run 3/23/2013 5:31 PM

Facility: Sudbury Road Landfill Client: City of Walla Walla Data File: S2

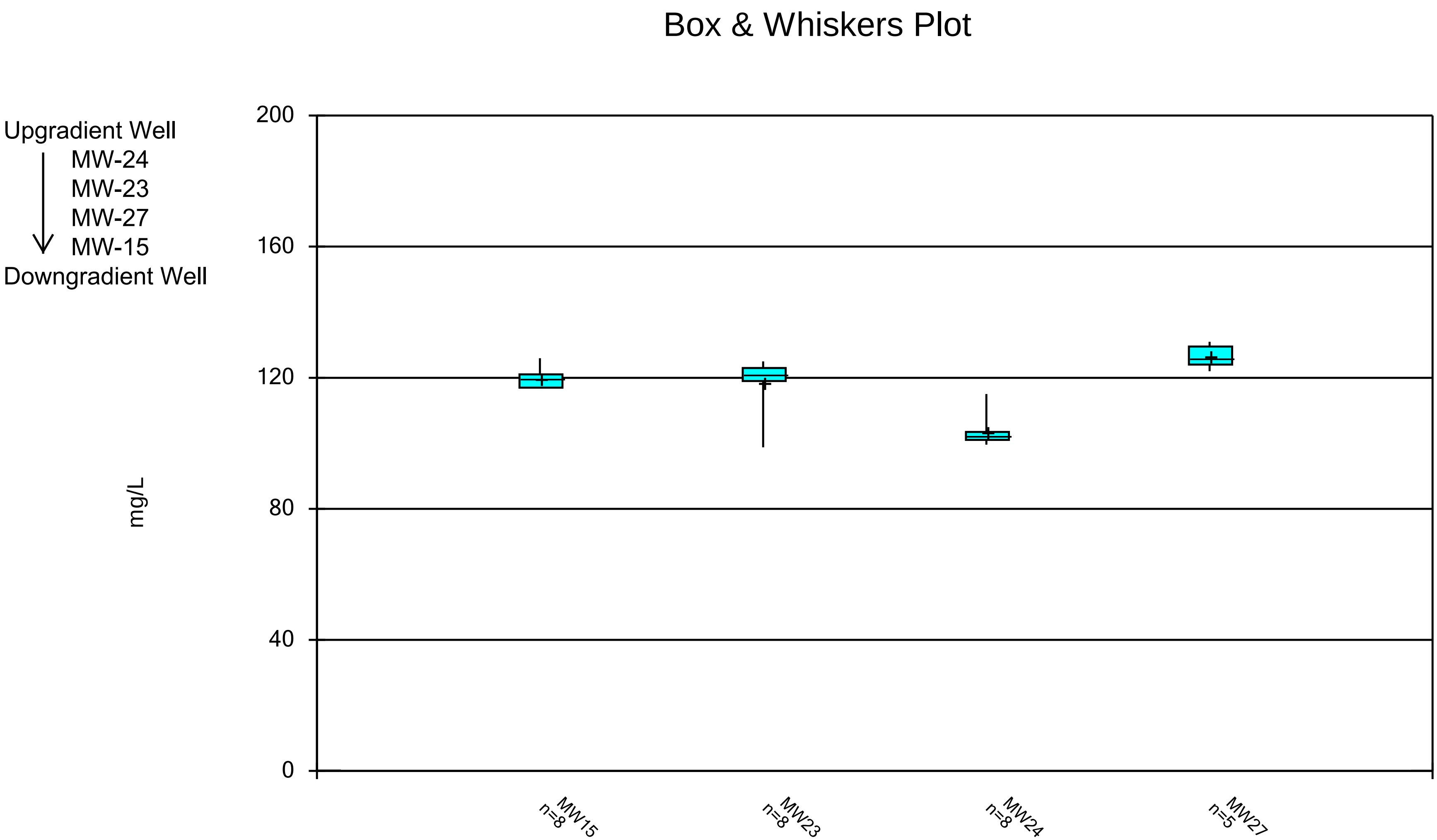
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG



Constituent: Calcium   Analysis Run 3/23/2013 5:31 PM

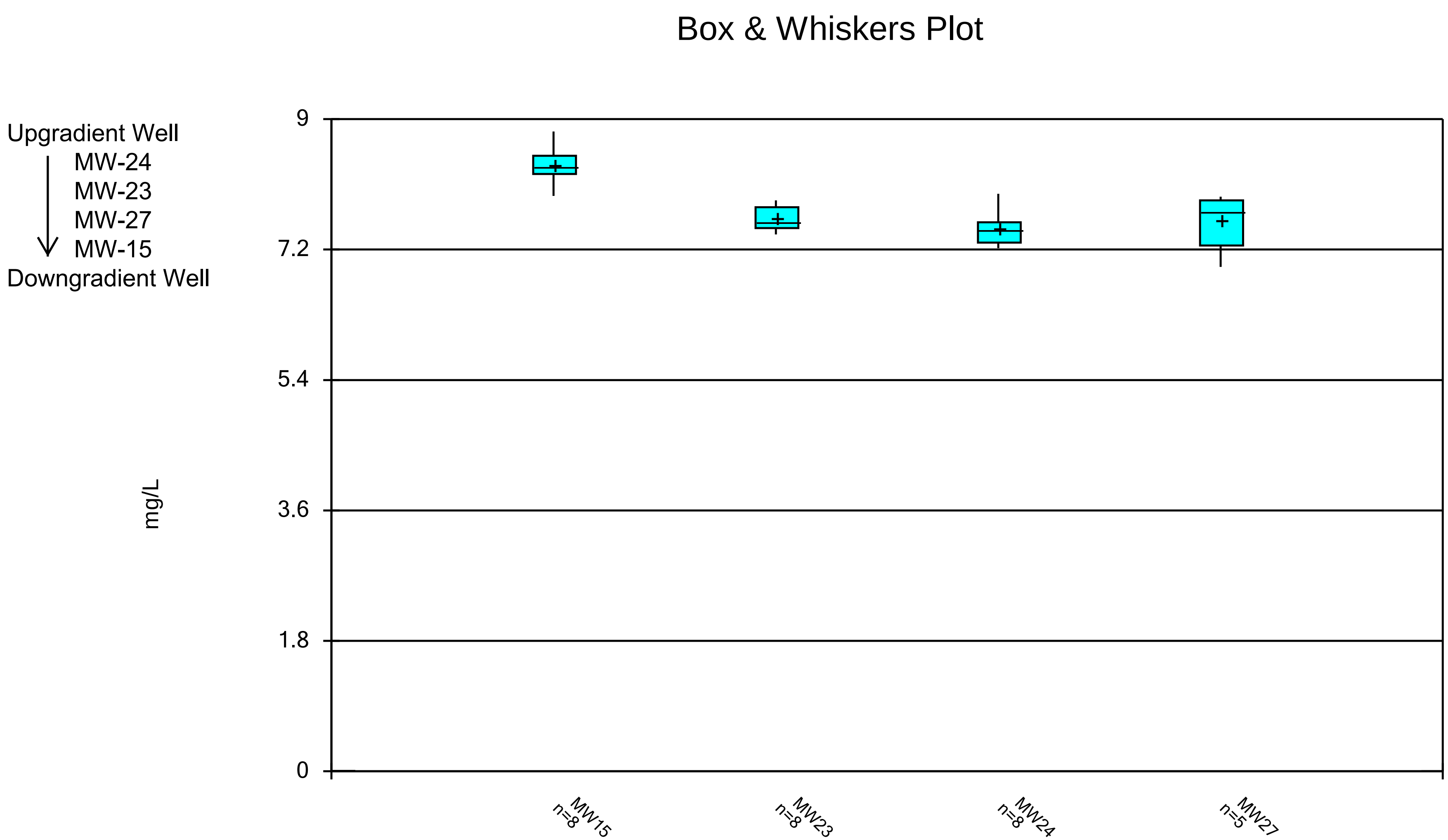
Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG



Constituent: Chloride Analysis Run 3/23/2013 5:31 PM

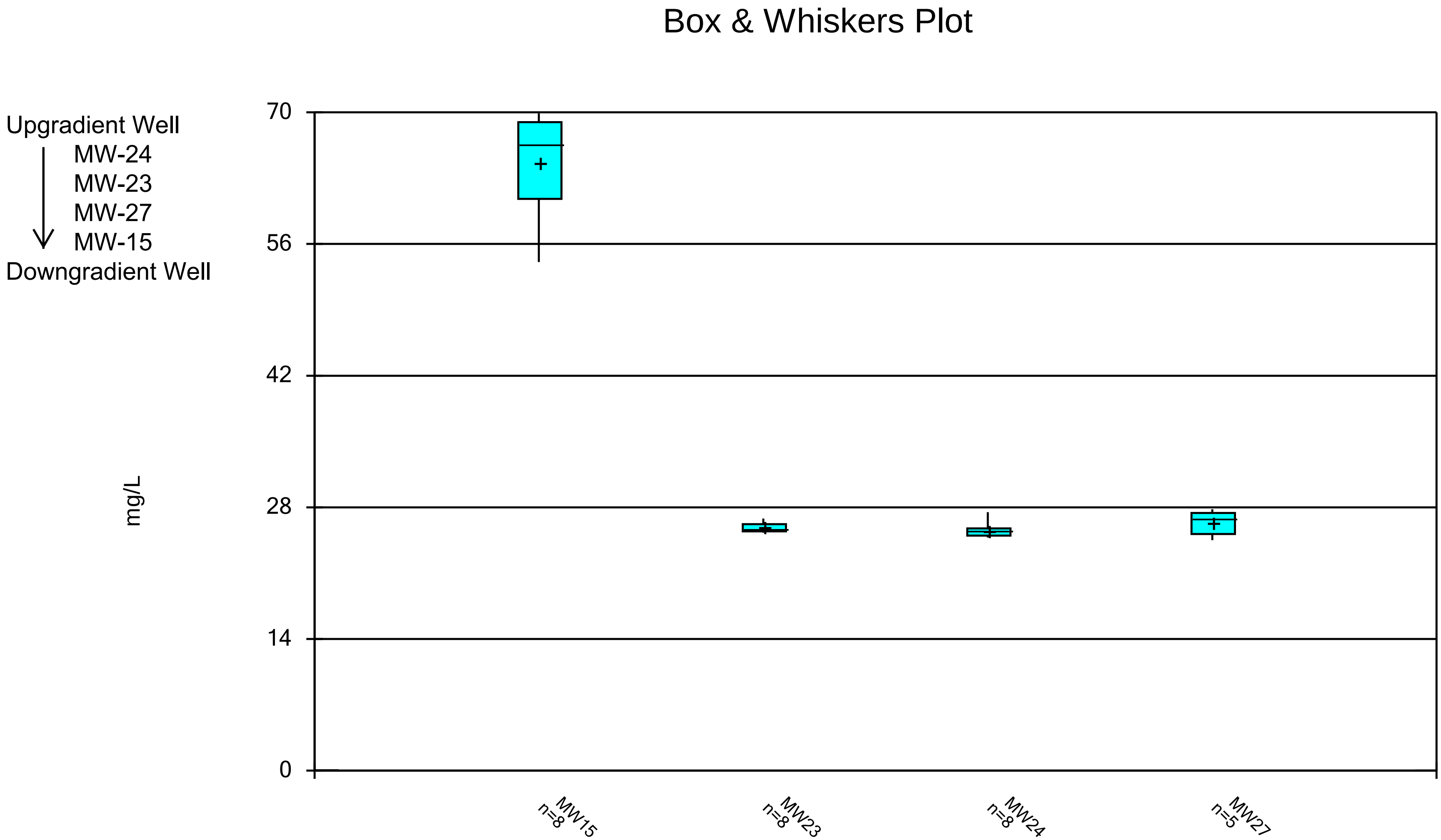
Facility: Sudbury Road Landfill Client: City of Walla Walla Data File: S2



Constituent: Potassium   Analysis Run 3/23/2013 5:31 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

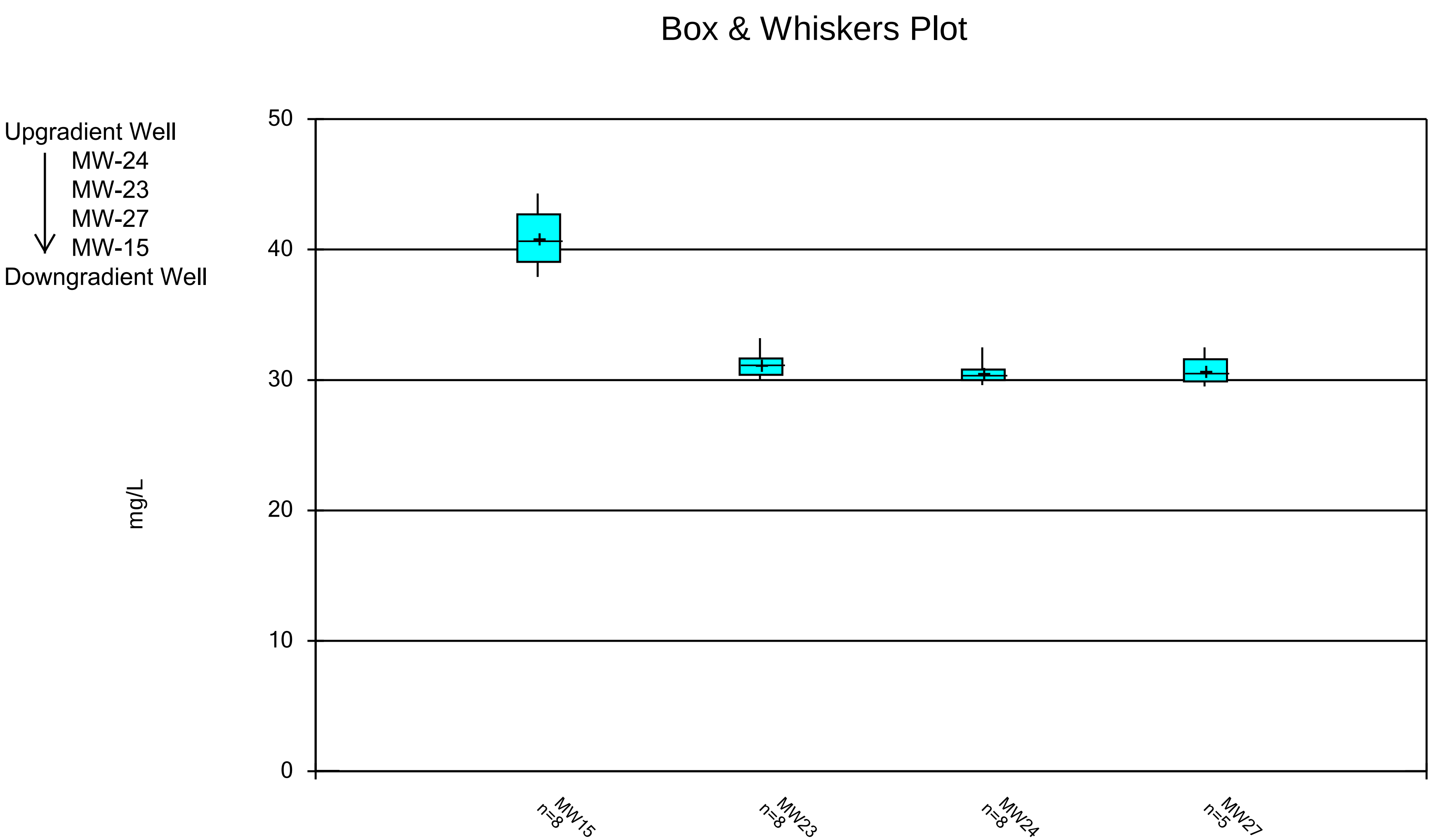
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG



Constituent: Sodium   Analysis Run 3/23/2013 5:31 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

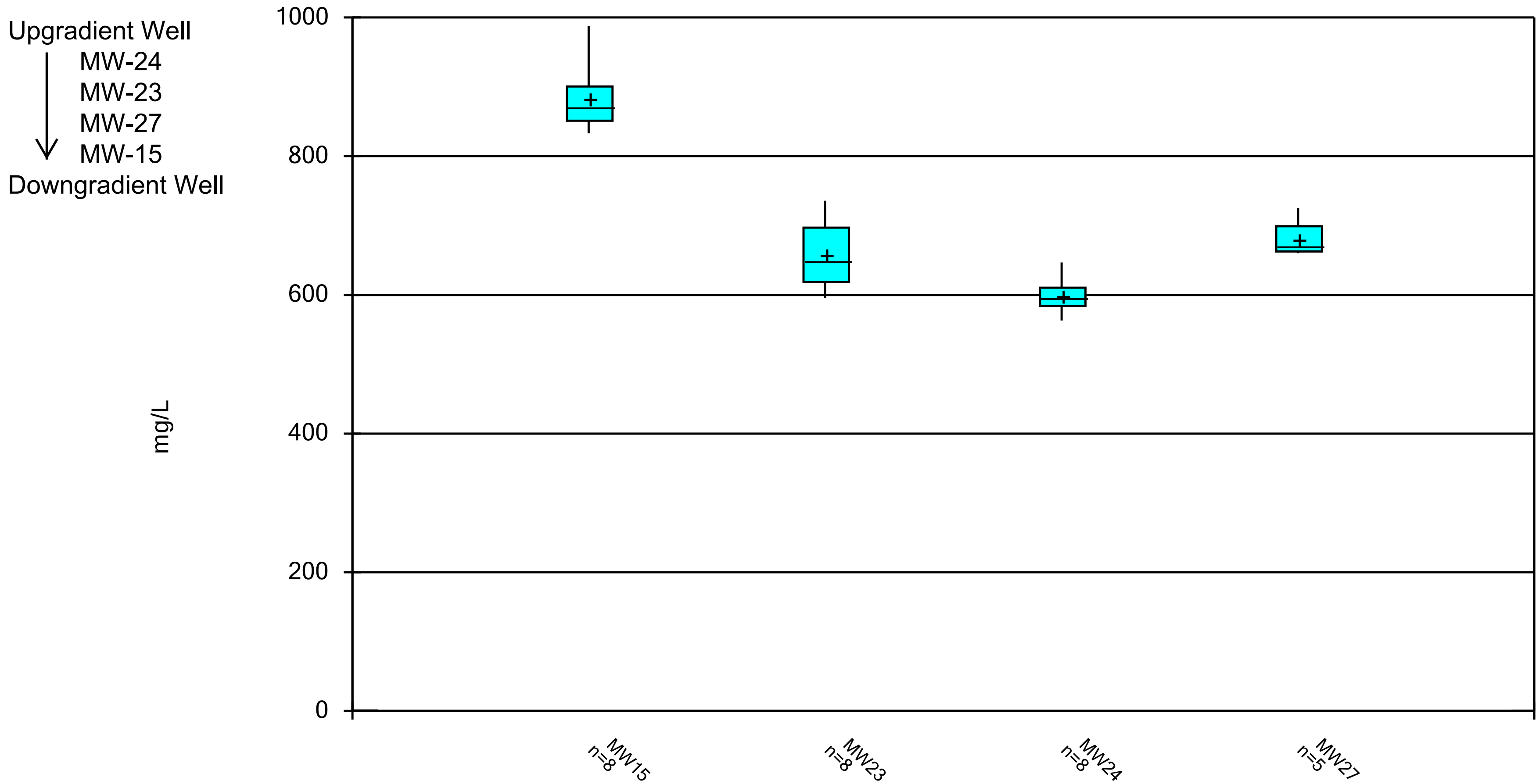
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG



Constituent: Sulfate Analysis Run 3/23/2013 5:31 PM

Facility: Sudbury Road Landfill Client: City of Walla Walla Data File: S2

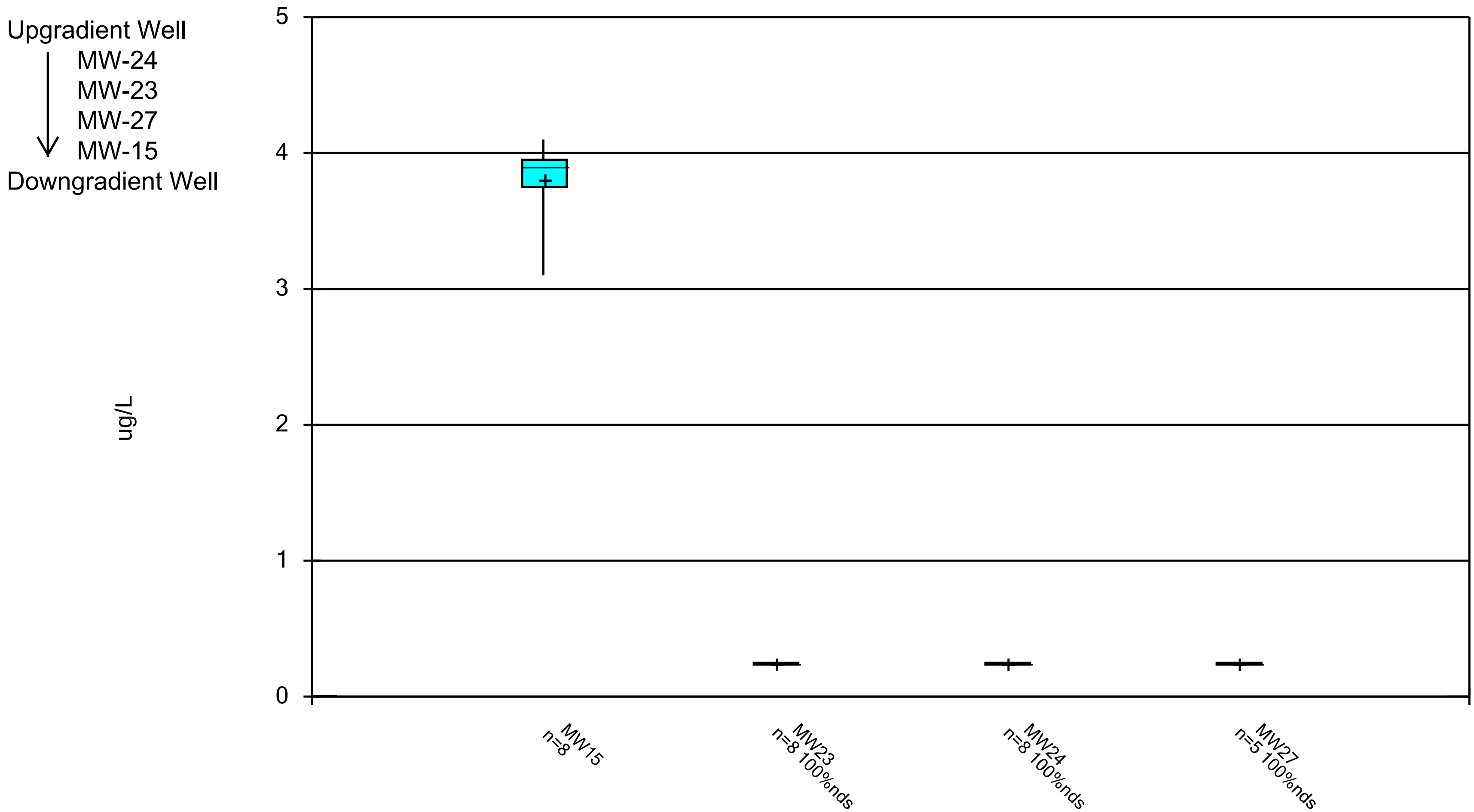
Box & Whiskers Plot



Constituent: Total Dissolved Solids   Analysis Run 3/23/2013 5:31 PM

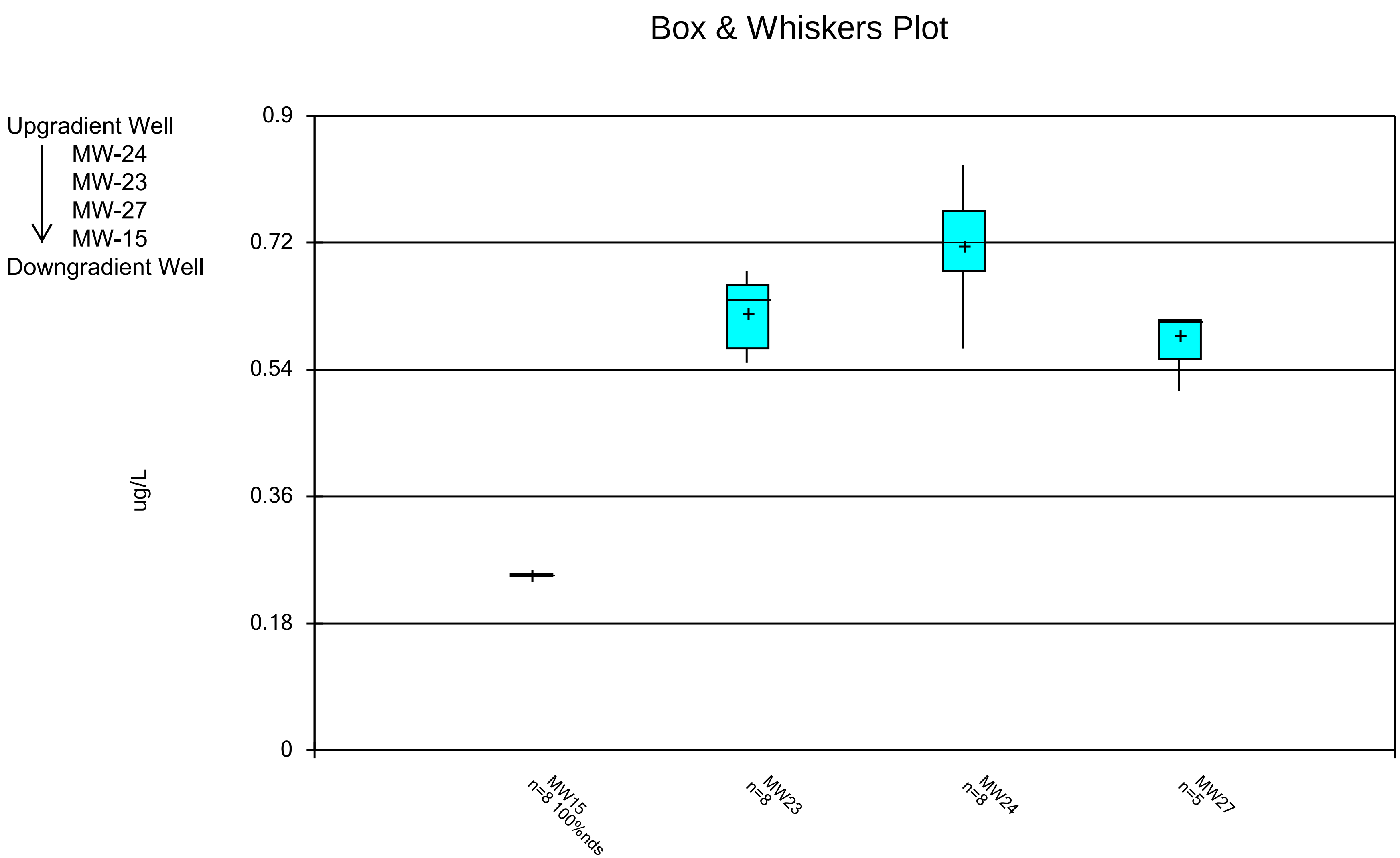
Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

Box & Whiskers Plot



Constituent: 1,1-Dichloroethane   Analysis Run 4/24/2013 1:05 PM

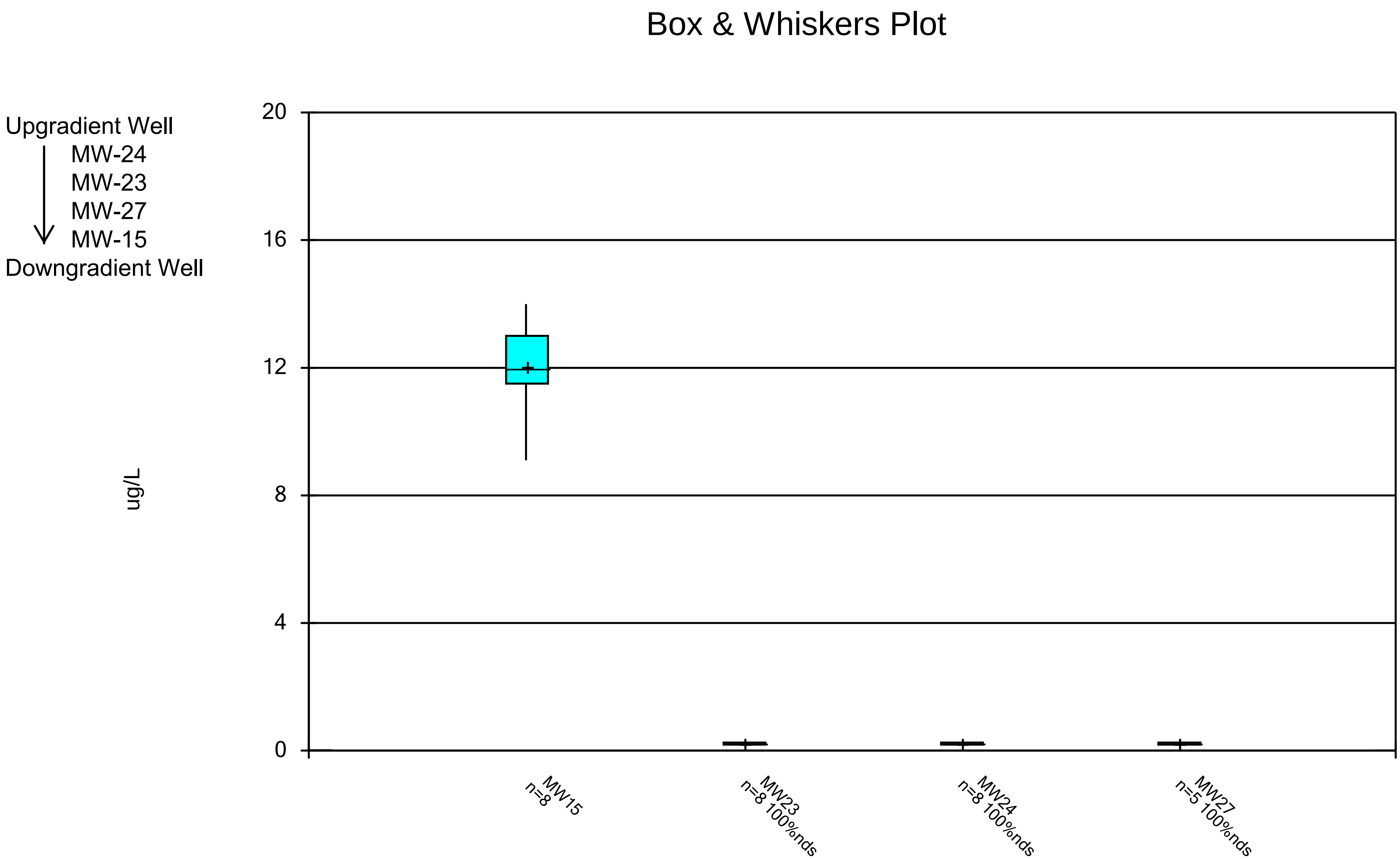
Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2



Constituent: Chloroform   Analysis Run 4/24/2013 1:05 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

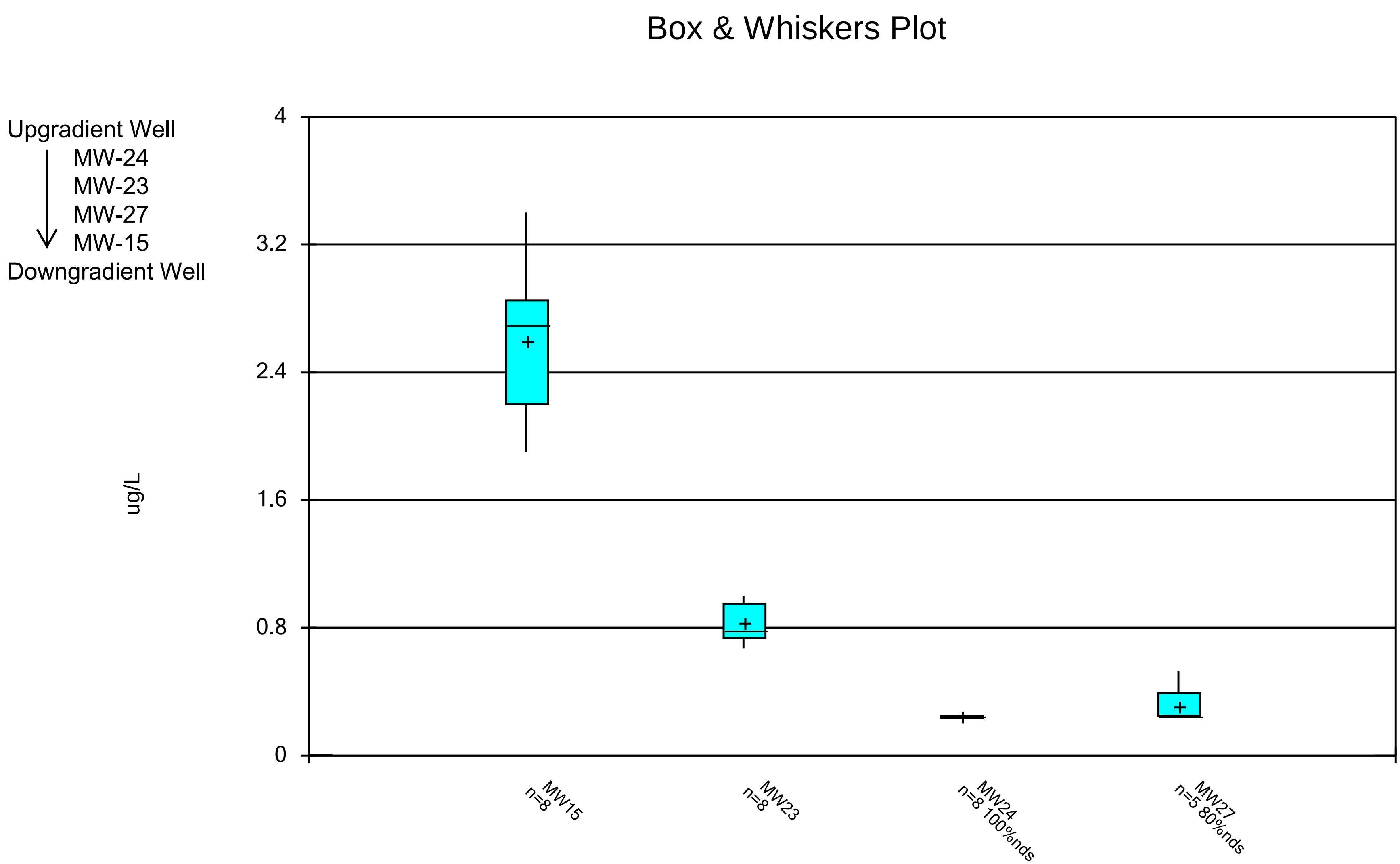
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG



Constituent: cis-1,2-Dichloroethene   Analysis Run 4/24/2013 1:05 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

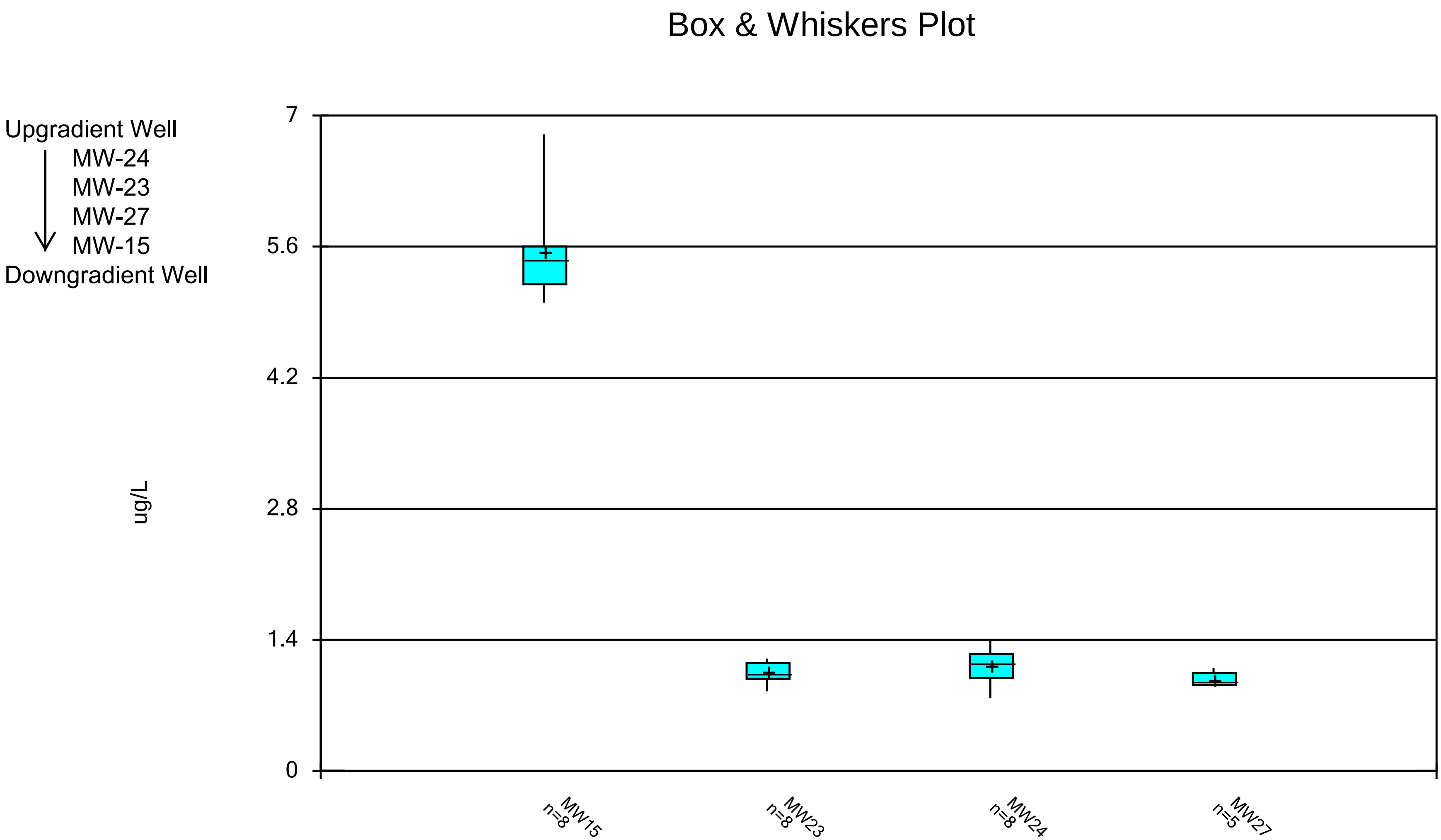
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG



Constituent: Dichlorodifluoromethane Analysis Run 4/24/2013 1:05 PM

Facility: Sudbury Road Landfill Client: City of Walla Walla Data File: S2

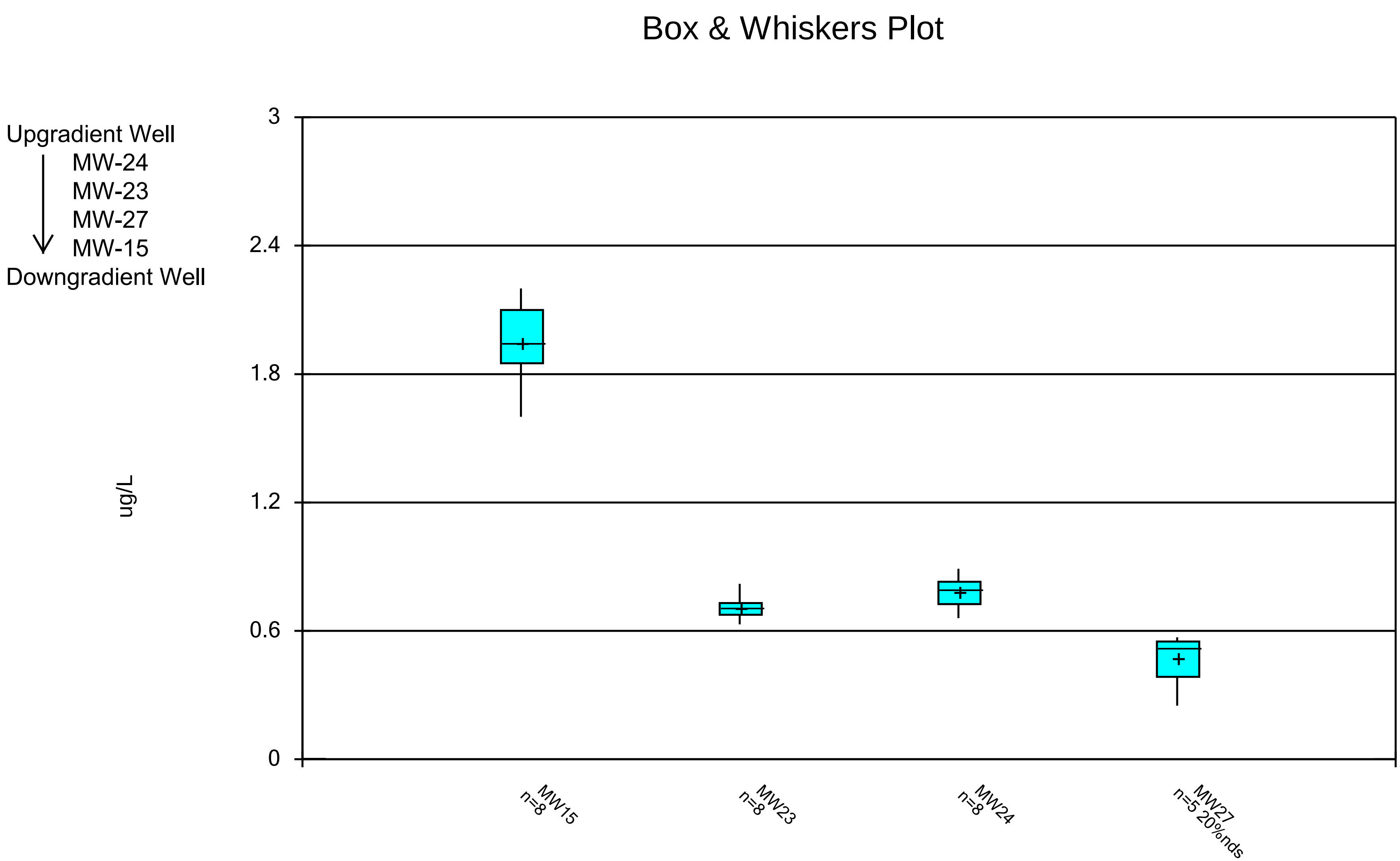
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG



Constituent: Tetrachloroethene   Analysis Run 4/24/2013 1:05 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG

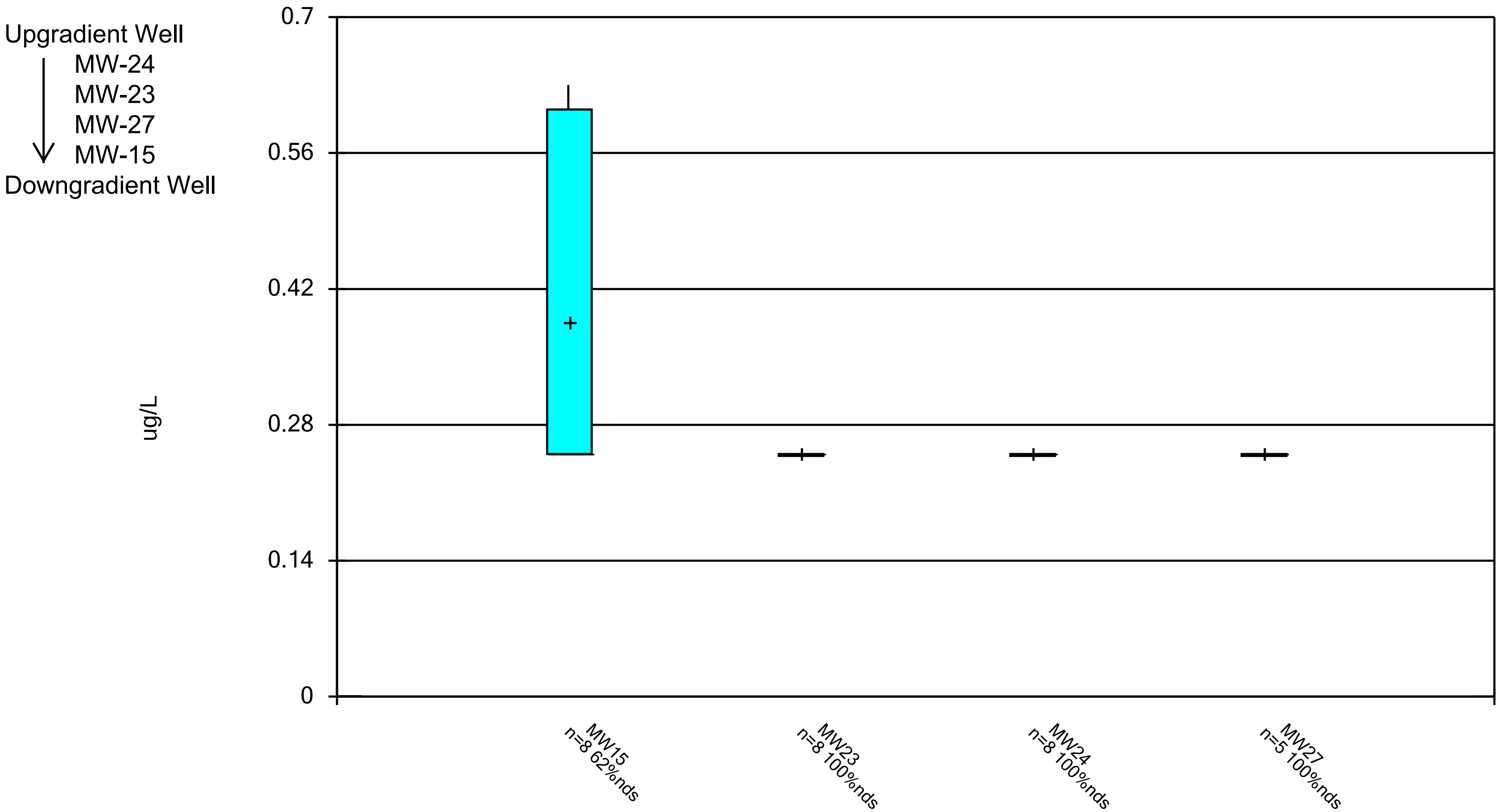


Constituent: Trichloroethene   Analysis Run 4/24/2013 1:05 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

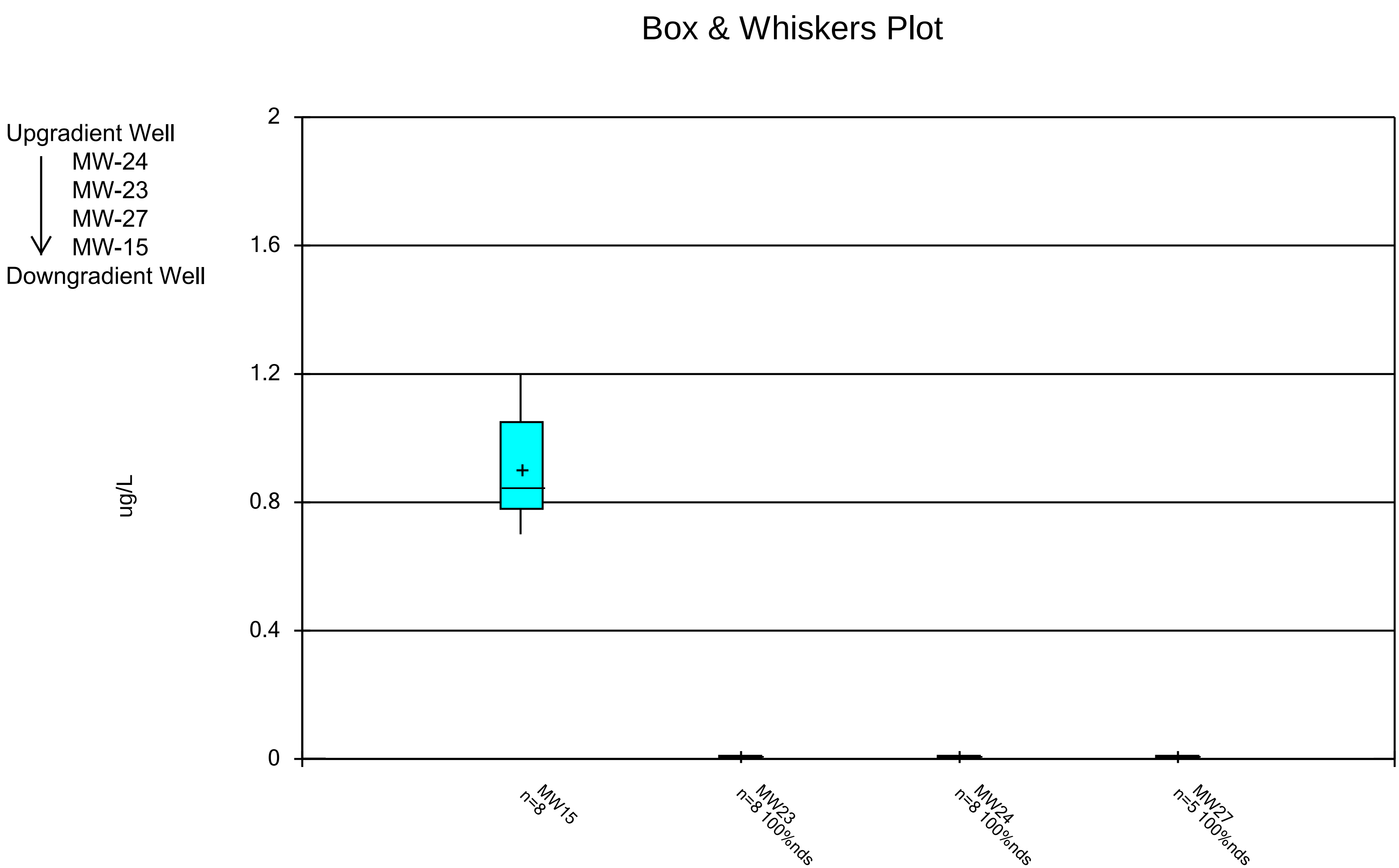
Sanitas™ v.9.3.24 For the statistical analysis of groundwater by Schwyn Environmental only. UG

Box & Whiskers Plot



Constituent: Trichlorofluoromethane Analysis Run 4/24/2013 1:05 PM

Facility: Sudbury Road Landfill Client: City of Walla Walla Data File: S2



Constituent: Vinyl chloride   Analysis Run 4/24/2013 1:05 PM

Facility: Sudbury Road Landfill   Client: City of Walla Walla   Data File: S2

APPENDIX G

Historical Data

Schwyn Environmental Services

TABLE G1
LIST OF HISTORICAL GROUNDWATER SAMPLES
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Conventionals	Metals	VOCs
Upgradient Wells					
MW-05	MW-5 Q1-91	03/01/1991	X	X	
MW-05	MW-5 Q2-91	06/01/1991	X	X	
MW-05	MW-5 Q3-91	09/01/1991	X	X	
MW-05	MW-5 Q4-91	12/01/1991	X	X	
MW-05	MW-5 Q1-92	03/01/1992	X	X	
MW-05	MW-5 Q2-92	06/01/1992	X	X	
MW-05	MW-5 Q3-92	09/01/1992	X	X	
MW-05	MW-5 Q4-92	12/01/1992	X	X	
MW-05	MW-5 Q1-93	03/30/1993	X	X	X
MW-05	MW-5 Q2-93	04/13/1993			X
MW-05	MW-5 Q2(Jun)-93	06/14/1993	X	X	X
MW-05	MW-5 Q3-93	09/01/1993	X	X	X
MW-05	MW-5 Q4- 93	12/01/1993	X	X	
MW-05	MW-5 Q1-94	03/01/1994	X		
MW-05	MW-5 Q2-94	04/01/1994		X	
MW-05	MW-5 Q3-94	08/01/1994	X	X	X
MW-05	MW-5 Q3(Sept)-94	09/01/1994	X	X	X
MW-05	MW-5 Q4-94	10/01/1994		X	
MW-05	MW-5 Q4(Nov)-94	11/01/1994	X	X	X
MW-05	MW-5 Q4(Dec)-94	12/01/1994	X	X	X
MW-05	MW-5 Q1-95	01/01/1995	X	X	X
MW-05	MW-5 Q1(Feb)-95	02/01/1995	X	X	X
MW-05	MW-5 Q4-95	10/30/1995	X		
MW-05	MW-5 Q4(Dec)-95	12/20/1995	X	X	X
MW-05	MW-5 Q1-96	02/01/1996	X		
MW-05	MW-5 Q2-96	05/01/1996	X	X	X
MW-05	MW-5 Q3-96	09/01/1996	X	X	X
MW-05	MW-5 Q4-96	10/01/1996	X	X	X
MW-05	MW-5 Q1-97	03/24/1997	X	X	
MW-05	MW-5 Q2-97	06/24/1997	X	X	X
MW-05	MW-5 Q3-97	09/11/1997	X	X	X
MW-05	MW-5 Q4-97	11/25/1997	X	X	X
MW-05	MW-5 Q1-98	03/25/1998	X	X	X
MW-05	MW-5 Q3-98	09/21/1998	X	X	X
MW-05	MW-5 Q4-98	12/30/1998	X	X	X
MW-05	MW-5 Q1-99	03/03/1999	X	X	X
MW-05	MW-5 Q2-99	06/14/1999	X	X	X
MW-05	MW-5 Q1-00	03/15/2000	X		X
MW-05	MW-5 Q3-00	09/27/2000	X		X
MW-05	MW-5 Q3-01	09/06/2001	X		X
MW-05	MW-5 Q4-01	12/14/2001	X		X
MW-05	MW-5 Q1-02	03/27/2002	X		X
MW-05	MW-5 Q2-04	06/17/2004			X
MW-07	MW-7 Q3-98	07/01/1998			X
MW-07	MW-7 Q1-01	01/31/2001			X
MW-07	MW-7 Q3-10	07/15/2010			X
MW-07	MW-7 Q4-10	11/03/2010			X
MW-07	SLF-MW-07-GW-110510	11/05/2010	X	X	X
MW-07	SLF-MW-07-GW-021011	02/10/2011	X	X	X
MW-09	MW-9 Q1-93	03/30/1993			X
MW-09	MW-9 Q2-93	04/13/1993			X

TABLE G1
LIST OF HISTORICAL GROUNDWATER SAMPLES
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Conventionals	Metals	VOCs
Upgradient Wells Continued					
MW-09	MW-9 Q2(Jun)-93	06/14/1993			X
MW-09	MW-9 Q3-93	08/31/1993			X
MW-09	MW-9 Q3(Sept)-93	09/01/1993			X
MW-09	MW-9 Q1-98	02/01/1998			X
MW-09	MW-9 Q2-98	07/01/1998			X
MW-09	MW-9 Q1-02	01/31/2002			X
MW-09	MW-9 Q3-10	07/15/2010			X
MW-09	SLF-MW-09-GW-110410	11/04/2010	X	X	X
MW-09	MW-9 Q4-10	11/04/2010			X
MW-09	SLF-MW-09-GW-021011	02/10/2011	X	X	X
MW-10	MW-10 Q1-98	02/01/1998			X
MW-10	MW-10 Q3-98	07/01/1998			X
MW-10	MW-10 Q1-02	03/27/2002			X
MW-10	MW-10 Q3-10	07/15/2010			X
MW-10	MW-10 Q4-10	11/04/2010			X
MW-10	SLF-MW-10-GW-110410	11/04/2010	X	X	X
MW-10	SLF-MW-10-GW-021011	02/10/2011	X	X	X
MW-12	MW-12 Q1-95	03/01/1995	X	X	X
MW-12	MW-12 Q3-95	07/01/1995	X	X	X
MW-12	MW-12 Q3(Sept)-95	09/20/1995	X	X	X
MW-12	MW-12 Q4t-95	10/30/1995	X	X	X
MW-12	MW-12 Q4(Nov)-95	11/29/1995	X	X	
MW-12	MW-12 Q4(Dec)-95	12/20/1995	X	X	X
MW-12	MW-12 Q1-96	02/01/1996	X	X	X
MW-12	MW-12 Q2-96	05/29/1996	X	X	X
MW-12	MW-12 Q2(Jun)-96	06/01/1996			X
MW-12	MW-12 Q3-96	09/01/1996	X	X	X
MW-12	MW-12 Q4-96	10/01/1996	X	X	X
MW-12	MW-12 Q1-97	03/24/1997	X	X	X
MW-12	MW-12 Q2-97	06/24/1997	X	X	X
MW-12	MW-12 Q3-97	09/11/1997	X	X	
MW-12	MW-12 Q4-97	11/25/1997	X	X	X
MW-12	MW-12 Q1-98	03/25/1998	X	X	X
MW-12	MW-12 Q2-98	06/29/1998	X	X	
MW-12	MW-12 Q3-98	09/21/1998	X	X	X
MW-12	MW-12 Q4-98	12/30/1998	X	X	X
MW-12	MW-12 Q1-99	03/03/1999	X	X	X
MW-12	MW-12 Q2-99	06/14/1999	X	X	X
MW-12	MW-12 Q3-99	09/22/1999	X	X	X
MW-12	MW-12 Q4-99	12/09/1999	X	X	X
MW-12	MW-12 Q1-00	03/15/2000	X	X	X
MW-12	MW-12 Q2-00	06/21/2000	X	X	X
MW-12	MW-12 Q3-00	09/27/2000	X	X	X
MW-12	MW-12 Q4-00	12/05/2000	X	X	X
MW-12	MW-12 Q1-01	03/27/2001	X	X	X
MW-12	MW-12 Q2-01	06/27/2001	X	X	X
MW-12	MW-12 Q3-01	09/06/2001	X	X	X
MW-12	MW-12 Q4-01	12/14/2001	X	X	X
MW-12	MW-12 Q1-02	03/27/2002	X	X	X
MW-12	MW-12 Q2-02	06/13/2002	X	X	X
MW-12	MW-12 Q3-02	09/18/2002	X	X	X

TABLE G1
LIST OF HISTORICAL GROUNDWATER SAMPLES
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Conventionals	Metals	VOCs
Upgradient Wells Continued					
MW-12	MW-12 Q4-02	12/17/2002	X	X	X
MW-12	MW-12 Q1-03	03/26/2003	X	X	X
MW-12	MW-12 Q2-03	06/26/2003	X	X	X
MW-12	MW-12 Q3-03	09/25/2003	X	X	X
MW-12	MW-12 Q4-03	12/18/2003	X	X	X
MW-12	MW-12 Q1-04	03/17/2004	X	X	X
MW-12	MW-12 Q2-04	06/17/2004	X	X	X
MW-12	MW-12 Q3-04	09/30/2004	X	X	X
MW-12	MW-12 Q4-04	12/15/2004	X	X	X
MW-12	MW-12 Q1-05	03/31/2005	X	X	X
MW-12	MW-12 Q2-05	06/23/2005	X	X	X
MW-12	MW-12 Q3-05	09/29/2005	X	X	X
MW-12	MW-12 Q1-06	03/30/2006	X	X	X
MW-12	MW-12 Q2-06	06/21/2006	X	X	X
MW-12	MW-12 Q3-06	09/21/2006	X	X	X
MW-12	MW-12 Q3-07	09/26/2007	X	X	X
MW-12b	MW-12b Q3-08	09/24/2008	X	X	X
MW-12b	MW-12b Q4-08	12/17/2008	X	X	X
MW-12b	MW-12b Q1-09	03/20/2009	X	X	X
MW-12b	MW-12b Q2-09	06/24/2009	X	X	X
MW-12b	MW-12b Q3-09	09/24/2009	X	X	X
MW-12b	MW-12b Q4-09	12/18/2009	X	X	X
MW-12b	MW-12b Q2-10	06/23/2010	X	X	X
MW-12b	MW-12b Q3-10	09/29/2010	X	X	X
MW-12b	MW-12b Q4-10	12/15/2010	X	X	X
MW-12b	MW-12b Q1-2011	03/24/2011	X	X	X
Downgradient Wells					
MW-01	MW-1 Q1-91	01/01/1991	X	X	
MW-01	MW-1 Q2-91	04/01/1991	X	X	
MW-01	MW-1 Q3-91	07/01/1991	X	X	
MW-01	MW-1 Q4-91	10/01/1991	X	X	
MW-01	MW-1 Q1-92	01/01/1992	X	X	
MW-01	MW-1 Q2-92	04/01/1992	X	X	
MW-01	MW-1 Q3-92	07/01/1992	X	X	
MW-01	MW-1 Q4-92	10/01/1992	X	X	
MW-01	MW-1 Q1-93	01/01/1993	X	X	
MW-01	MW-1 Q2-93	04/01/1993	X	X	
MW-01	MW-1 Q3-93	07/01/1993	X	X	
MW-01	MW-1 Q4-93	10/01/1993	X	X	
MW-01	MW-1 Q1-94	03/01/1994	X		
MW-01	MW-1 Q2-94	04/01/1994		X	
MW-01	MW-1 Q3-94	08/01/1994	X	X	X
MW-01	MW-1 Q3(Sept)-94	09/01/1994	X	X	X
MW-01	MW-1 Q4-94	10/01/1994		X	
MW-01	MW-1 Q4(Nov)-94	11/01/1994	X	X	X
MW-01	MW-1 Q4(Dec)-94	12/01/1994	X	X	X
MW-01	MW-1 Q1-95	01/01/1995	X	X	X
MW-01	MW-1 Q1(Feb)-95	02/01/1995	X	X	X
MW-01	MW-1 Q3-95	07/01/1995	X	X	X
MW-01	MW-1 Q1(Sep)-95	09/20/1995	X	X	X
MW-01	MW-1 Q4-95	12/18/1995	X	X	X

TABLE G1
LIST OF HISTORICAL GROUNDWATER SAMPLES
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Conventionals	Metals	VOCs
Downgradient Wells Continued					
MW-01	MW-1 Q1-96	02/01/1996	X	X	X
MW-01	MW-1 Q2-96	05/01/1996	X	X	X
MW-01	MW-1 Q3-96	09/01/1996	X	X	X
MW-01	MW-1 Q4-96	10/01/1996	X	X	X
MW-01	MW-1 Q1-97	03/24/1997	X	X	
MW-01	MW-1 Q2-97	06/24/1997	X	X	X
MW-01	MW-1 Q3-97	09/11/1997	X	X	X
MW-01	MW-1 Q4-97	11/25/1997			X
MW-01	MW-1 Q1-98	03/25/1998	X	X	X
MW-01	MW-1 Q2-98	06/29/1998	X	X	X
MW-01	MW-1 Q3-98	09/21/1998	X	X	X
MW-01	MW-1 Q1-99	03/03/1999	X	X	X
MW-01	MW-1 Q2-99	06/14/1999	X	X	X
MW-01	MW-1 Q3-99	09/22/1999	X	X	X
MW-01	MW-1 Q4-99	12/09/1999	X	X	X
MW-01	MW-1 Q1-00	03/15/2000	X	X	X
MW-01	MW-1 Q2-00	06/21/2000	X	X	X
MW-01	MW-1 Q3-00	09/27/2000	X	X	X
MW-01	MW-1 Q4-00	12/05/2000	X	X	X
MW-01	MW-1 Q1-01	03/27/2001	X	X	X
MW-01	MW-1 Q2-01	06/27/2001	X	X	X
Well #2	MW-13 Q4-02	12/17/2002			X
MW-03	MW-3 Q1-91	01/01/1991	X	X	
MW-03	MW-3 Q2-91	04/01/1991	X	X	
MW-03	MW-3 Q3-91	07/01/1991	X	X	
MW-03	MW-3 Q4-91	10/01/1991	X	X	
MW-03	MW-3 Q1-92	01/01/1992	X	X	
MW-03	MW-3 Q2-92	04/01/1992	X	X	
MW-03	MW-3 Q3-92	07/01/1992	X	X	
MW-03	MW-3 Q4-92	10/01/1992	X	X	
MW-03	MW-3 Q1-93	01/01/1993	X	X	
MW-03	MW-3 Q2-93	04/01/1993	X	X	
MW-03	MW-3 Q3-93	07/01/1993	X	X	
MW-03	MW-3 Q4-93	10/01/1993	X	X	
MW-03	MW-3 Q1-94	02/01/1994	X		
MW-03	MW-3 Q1(Mar)-94	03/01/1994	X		
MW-03	MW-3 Q2-94	04/01/1994		X	
MW-03	MW-3 Q3-94	08/01/1994	X	X	X
MW-03	MW-3 Q3(Sept)-94	09/01/1994	X	X	X
MW-03	MW-3 Q4-94	10/01/1994		X	
MW-03	MW-3 Q4(Nov)-94	11/01/1994	X	X	X
MW-03	MW-3 Q4(Dec)-94	12/01/1994	X	X	X
MW-03	MW-3 Q1-95	01/01/1995	X	X	X
MW-03	MW-3 Q1(Feb)-95	02/01/1995	X	X	X
MW-03	MW-3 Q3-95	07/01/1995	X	X	X
MW-03	MW-3 Q3(Sept)-95	09/20/1995		X	X
MW-03	MW-3 Q4-95	12/18/1995	X	X	X
MW-03	MW-3 Q1-96 Dup	02/01/1996		X	X
MW-03	MW-3 Q1-96	02/01/1996	X	X	X
MW-03	MW-3 Q2-96	05/01/1996	X	X	X
MW-03	MW-3 Q3-96	09/01/1996	X	X	X

TABLE G1
LIST OF HISTORICAL GROUNDWATER SAMPLES
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Conventionals	Metals	VOCs
Downgradient Wells Continued					
MW-03	MW-3 Q4-96	10/01/1996	X	X	X
MW-03	MW-3 Q1-97	03/24/1997	X	X	
MW-03	MW-3 Q2-97	06/24/1997	X	X	X
MW-03	MW-3 Q3-97	09/11/1997	X	X	X
MW-03	MW-3 Q4-97	11/25/1997	X	X	
MW-03	MW-3 Q1-98	03/25/1998	X	X	X
MW-03	MW-3 Q2-98	06/29/1998	X	X	X
MW-03	MW-3 Q3-98	09/21/1998	X	X	X
MW-03	MW-3 Q4-98	12/30/1998	X	X	X
MW-03	MW-3 Q1-99	03/03/1999	X	X	X
MW-03	MW-3 Q2-99	06/14/1999	X	X	X
MW-03	MW-3 Q3-99	09/22/1999	X	X	X
MW-03	MW-3 Q4-99	12/09/1999	X	X	X
MW-03	MW-3 Q1-00	03/15/2000	X	X	X
MW-03	MW-3 Q2-00	06/21/2000	X	X	X
MW-03	MW-3 Q3-00	09/27/2000	X	X	X
MW-03	MW-3 Q4-00	12/05/2000	X	X	X
MW-03	MW-3 Q1-01	03/27/2001	X	X	X
MW-03	MW-3 Q2-01	06/27/2001	X	X	X
MW-11	MW-11 Q1-95	03/01/1995	X	X	X
MW-11	MW-11 Q1-95 Dup	03/01/1995	X	X	X
MW-11	MW-11 Q3-95	07/01/1995	X	X	X
MW-11	MW-11 Q3-95 Dup	07/01/1995	X	X	X
MW-11	MW-11 Q3(Sept)-95	09/20/1995	X	X	X
MW-11	MW-11 Q3(Sept)-95 Dup	09/20/1995	X	X	X
MW-11	MW-11 Q4-95	10/30/1995	X	X	X
MW-11	MW-11 Q4-95 Dup	10/30/1995	X	X	X
MW-11	MW-11 Q4(Nov)-95	11/29/1995	X	X	
MW-11	MW-11 Q4(Nov)-95 Dup	11/29/1995	X	X	
MW-11	MW-11 Q4(Dec)-95	12/18/1995	X	X	X
MW-11	MW-11 Q1-96	02/01/1996	X	X	X
MW-11	MW-11 Q2-96	05/01/1996	X	X	X
MW-11	MW-11 Q2-96 Dup	05/01/1996		X	
MW-11	MW-11 Q2(Jun)-96	06/01/1996			X
MW-11	MW-11 Q3-96	09/01/1996	X	X	X
MW-11	MW-11 Q4-96	10/01/1996	X	X	X
MW-11	MW-11 Q1-97	03/24/1997	X	X	X
MW-11	MW-11 Q2-97	06/24/1997	X	X	X
MW-11	MW-11 Q3-97	09/11/1997	X	X	
MW-11	MW-11 Q4-97	11/25/1997	X	X	X
MW-11	MW-11 Q1-98	03/25/1998	X	X	X
MW-11	MW-11 Q2-98	06/29/1998	X	X	X
MW-11	MW-11 Q3-98	09/21/1998	X	X	X
MW-11	MW-11 Q4-98	12/30/1998	X	X	X
MW-11	MW-11 Q1-99	03/03/1999	X	X	X
MW-11	MW-11 Q2-99	06/14/1999	X	X	X
MW-11	MW-11 Q3-99	09/22/1999	X	X	X
MW-11	MW-11 Q4-99	12/09/1999	X	X	X
MW-11	MW-11 Q1-00	03/15/2000	X	X	X
MW-11	MW-11 Q2-00	06/21/2000	X	X	X
MW-11	MW-11 Q3-00	09/27/2000	X	X	X

TABLE G1
LIST OF HISTORICAL GROUNDWATER SAMPLES
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Conventionals	Metals	VOCs
Downgradient Wells Continued					
MW-11	MW-11 Q4-00	12/05/2000	X	X	X
MW-11	MW-11 Q1-01	03/27/2001	X	X	X
MW-11	MW-11 Q2-01	06/27/2001	X	X	X
MW-11	MW-11 Q3-01	09/06/2001	X	X	X
MW-11	MW-11 Q4-01	12/14/2001	X	X	X
MW-11	MW-11 Q1-02	03/27/2002	X	X	X
MW-11	MW-11 Q2-02	06/13/2002	X	X	X
MW-11	MW-11 Q3-02	09/18/2002	X	X	X
MW-11	MW-11 Q4-02	12/17/2002	X	X	X
MW-11	MW-11 Q1-03	03/26/2003	X	X	X
MW-11	MW-11 Q2-03	06/26/2003	X	X	X
MW-11	MW-11 Q3-03	09/25/2003	X	X	X
MW-11	MW-11 Q4-03	12/18/2003	X	X	X
MW-11	MW-11 Q1-04	03/17/2004	X	X	X
MW-11	MW-11 Q2-04	06/17/2004	X	X	X
MW-11	MW-11 Q3-04	09/30/2004	X	X	X
MW-11	MW-11 Q4-04	12/15/2004	X	X	X
MW-11	MW-11 Q1-05	03/31/2005	X	X	X
MW-11	MW-11 Q2-05	06/23/2005	X	X	X
MW-11	MW-11 Q3-05	09/29/2005	X	X	X
MW-11	MW-11 Q4-05	12/14/2005	X	X	X
MW-11	MW-11 Q1-06	03/30/2006	X	X	X
MW-11	MW-11 Q2-06	06/21/2006	X	X	X
MW-11	MW-11 Q3-06	09/21/2006	X	X	X
MW-11	MW-11 Q4-06	12/28/2006	X	X	X
MW-11	MW-11 Q1-07	03/22/2007	X	X	X
MW-11	MW-11 Q2-07	06/28/2007	X	X	X
MW-11	MW-11 Q3-07	09/26/2007	X	X	X
MW-11	MW-11 Q4-07	12/27/2007	X	X	X
MW-11	MW-11 Q1-08	03/27/2008	X	X	X
MW-11	MW-11 Q2-08	06/25/2008	X	X	X
MW-11	MW-11 Q3-08	09/24/2008	X	X	X
MW-11	MW-11 Q4-08	12/17/2008	X	X	X
MW-11	MW-11 Q1-09	03/20/2009	X	X	X
MW-11	MW-11 Q2-09	06/24/2009	X	X	X
MW-11	MW-11 Q3-09	09/24/2009	X	X	X
MW-11	MW-11 Q4-09	12/18/2009	X	X	X
MW-11	MW-11 Q1-10	03/30/2010	X	X	X
MW-11	MW-11 Q2-10	06/23/2010	X	X	X
MW-11	MW-11 Q3-10	09/29/2010	X	X	X
MW-11	MW-11 Q4-10	12/15/2010	X	X	X
MW-11	MW-11 Q1-2011	03/24/2011	X	X	X
MW-11	MW-11 Q2-2011	6/21/2011	X	X	X
MW-11	MW-11 Q3-2011	9/28/2011	X	X	X
MW-11	MW-11 Q4-2011	12/14/2011	X	X	X
MW-11	MW-11 Q1-2012	3/28/2012	X	X	X
MW-14	MW-14 Q3-99	09/22/1999	X	X	X
MW-14	MW-14 Q4-99	12/09/1999	X	X	X
MW-14	MW-14 Q1-00	03/15/2000	X	X	X
MW-14	MW-14 Q2-00	06/21/2000	X	X	X
MW-14	MW-14 Q3-00	09/27/2000	X	X	X

TABLE G1
LIST OF HISTORICAL GROUNDWATER SAMPLES
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Conventionals	Metals	VOCs
Downgradient Wells Continued					
MW-14	MW-14 Q4-00	12/05/2000	X	X	X
MW-14	MW-14 Q1-01	03/27/2001	X	X	X
MW-14	MW-14 Q2-01	06/27/2001	X	X	X
MW-14	MW-14 Q3-01	09/06/2001	X	X	X
MW-14	MW-14 Q4-01	12/14/2001	X	X	X
MW-14	MW-14 Q1-02	03/27/2002	X	X	X
MW-14	MW-14 Q2-02	06/13/2002	X	X	X
MW-14	MW-14 Q3-02	09/18/2002	X	X	X
MW-14	MW-14 Q4-02	12/17/2002	X	X	X
MW-14	MW-14 Q1-03	03/26/2003	X	X	X
MW-14	MW-14 Q2-03	06/26/2003	X	X	X
MW-14	MW-14 Q3-03	09/25/2003	X	X	X
MW-14	MW-14 Q4-03	12/18/2003	X	X	X
MW-14	MW-14 Q1-04	03/17/2004	X	X	X
MW-14	MW-14 Q2-04	06/17/2004	X	X	X
MW-14	MW-14 Q3-04	09/30/2004	X	X	X
MW-14	MW-14 Q4-04	12/15/2004	X	X	X
MW-14	MW-14 Q1-05	03/31/2005	X	X	X
MW-14	MW-14 Q2-05	06/23/2005	X	X	X
MW-14	MW-14 Q3-05	09/29/2005	X	X	X
MW-14	MW-14 Q4-05	12/14/2005	X	X	X
MW-14	MW-14 Q1-06	03/30/2006	X	X	X
MW-14	MW-14 Q3-06	09/21/2006	X	X	X
MW-14	MW-14 Q4-06	12/28/2006	X	X	X
MW-14	MW-14 Q1-07	03/22/2007	X	X	X
MW-14	MW-14 Q2-07	06/28/2007	X	X	X
MW-14	MW-14 Q3-07	09/26/2007	X	X	X
MW-14	MW-14 Q4-07	12/27/2007	X	X	X
MW-14	MW-14 Q1-08	03/27/2008	X	X	X
MW-14	MW-14 Q2-08	06/25/2008	X	X	X
MW-14	MW-14 Q3-08	09/24/2008	X	X	X
MW-14	MW-14 Q4-08	12/17/2008	X	X	X
MW-14	MW-14 Q1-09	03/20/2009	X	X	X
MW-14	MW-14 Q2-09	06/24/2009	X	X	X
MW-14	MW-14 Q3-09	09/24/2009	X	X	X
MW-14	MW-14 Q4-09	12/18/2009	X	X	X
MW-14	MW-14 Q1-10	03/30/2010	X	X	X
MW-14	MW-14 Q2-10	06/23/2010	X	X	X
MW-14	MW-14 Q3-10	09/29/2010	X	X	X
MW-14	MW-14 Q4-10	12/15/2010	X	X	X
MW-14	MW-14 Q1-2011	03/24/2011	X	X	X
MW-14	MW-14 Q2-2011	6/21/2011	X	X	X
MW-14	MW-14 Q3-2011	9/28/2011	X	X	X
MW-14	MW-14 Q4-2011	12/14/2011	X	X	X
MW-14	MW-14 Q1-2012	3/28/2012	X	X	X
MW-15	MW-15 Q3-01	09/06/2001	X	X	X
MW-15	MW-15 Q4-01	12/14/2001	X	X	X
MW-15	MW-15 Q1-02	03/27/2002	X	X	X
MW-15	MW-15 Q2-02	06/13/2002	X	X	X
MW-15	MW-15 Q3-02	09/18/2002	X	X	X
MW-15	MW-15 Q4-02	12/17/2002	X	X	X

TABLE G1
LIST OF HISTORICAL GROUNDWATER SAMPLES
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Conventionals	Metals	VOCs
Downgradient Wells Continued					
MW-15	MW-15 Q1-03	03/26/2003	X	X	X
MW-15	MW-15 Q2-03	06/26/2003	X	X	X
MW-15	MW-15 Q3-03	09/25/2003	X	X	X
MW-15	MW-15 Q4-03	12/18/2003	X	X	X
MW-15	MW-15 Q1-04	03/17/2004	X	X	X
MW-15	MW-15 Q2-04	06/17/2004	X	X	X
MW-15	MW-15 Q3-04	09/30/2004	X	X	X
MW-15	MW-15 Q4-04	12/15/2004	X	X	X
MW-15	MW-15 Q1-05	03/31/2005	X	X	X
MW-15	MW-15 Q2-05	06/23/2005	X	X	X
MW-15	MW-15 Q3-05	09/29/2005	X	X	X
MW-15	MW-15 Q4-05	12/14/2005	X	X	X
MW-15	MW-15 Q1-06	03/30/2006	X	X	X
MW-15	MW-15 Q2-06	06/21/2006	X	X	X
MW-15	MW-15 Q3(Sept)-06	09/21/2006	X	X	X
MW-15	MW-15 Q4-06	12/28/2006	X	X	X
MW-15	MW-15 Q1-07	03/22/2007	X	X	X
MW-15	MW-15 Q2-07	06/28/2007	X	X	X
MW-15	MW-15 Q3-07	09/26/2007	X	X	X
MW-15	MW-15 Q4-07	12/27/2007	X	X	X
MW-15	MW-15 Q1-08	03/27/2008	X	X	X
MW-15	MW-15 Q2-08	06/25/2008	X	X	X
MW-15	MW-15 Q3-08	09/24/2008	X	X	X
MW-15	MW-15 Q4-08	12/17/2008	X	X	X
MW-15	MW-15 Q1-09	03/20/2009	X	X	X
MW-15	MW-15 Q2-09	06/24/2009	X	X	X
MW-15	MW-15 Q3-09	09/24/2009	X	X	X
MW-15	MW-15 Q4-09	12/18/2009	X	X	X
MW-15	MW-15 Q1-10	03/30/2010	X	X	X
MW-15	MW-15 Q2-10	06/23/2010	X	X	X
MW-15	MW-15 Q3-10	09/29/2010	X	X	X
MW-15	MW-15 Q4-10	12/15/2010	X	X	X
MW-15	MW-15 Q1-2011	03/24/2011	X	X	X
MW-15	MW-15 Q2-2011	6/21/2011	X	X	X
MW-15	MW-15 Q3-2011	9/28/2011	X	X	X
MW-15	MW-15 Q4-2011	12/14/2011	X	X	X
MW-15	MW-15 Q1-2012	3/28/2012	X	X	X
MW-16	MW-16 Q3-05	09/01/2005	X	X	X
MW-16	MW-16 Q2-06	06/21/2006	X	X	X
MW-16	MW-16 Q3(Sept)-06	09/21/2006	X	X	X
MW-16	MW-16 Q1-2011	03/24/2011			X
Residential Wells					
Camp Ranch	Camp Q1-05	03/31/2005			X
Camp Ranch	Camp Q2-05	06/23/2005			X
Camp Ranch	Camp Q3-05	09/29/2005			X
Camp Ranch	Camp Q3-06	09/21/2006			X
Camp Ranch	Camp Q2-09	06/24/2009			X
Kinman Ranch	Kinman Q1-05	03/31/2005			X
Kinman Ranch	Kinman Q2-05	06/23/2005			X
Small Ranch	Small 061302	06/13/2002			X
Small Ranch	Small 062602	06/26/2002			X

TABLE G1
LIST OF HISTORICAL GROUNDWATER SAMPLES
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Conventionals	Metals	VOCs
Residential Wells Continued					
Small Ranch	Small Q1-04	03/17/2004			X
Small Ranch	Small Q3-04	09/30/2004			X
Small Ranch	Small Q4-04	12/15/2004			X
Small Ranch	Small Q1-05	03/31/2005			X
Small Ranch	Small Q3-05	09/29/2005			X
Small Ranch	Small Q3-06	09/21/2006			X
Small Ranch	Small Q2-09	06/24/2009			X
Small Ranch	Small Q3-10	09/29/2010			X

Notes:

X indicates that a sample was collected and analyzed for the specified chemical group.
Blank indicates that a sample was not analyzed for the specified chemical group.

TABLE G2
HISTORICAL SUMMARY OF CONVENTIONAL GROUNDWATER CHEMISTRY DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date (Parameter)	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Upgradient Wells													
MW-05	MW-5 Q1-91	03/01/1991	NA	0.05	NA	NA	56	700	9.87	NA	NA	NA	NA
MW-05	MW-5 Q2-91	06/01/1991	NA	0.05	NA	NA	39.6	640	10	NA	NA	NA	NA
MW-05	MW-5 Q3-91	09/01/1991	NA	0.025	NA	NA	65	750	10.25	NA	NA	NA	NA
MW-05	MW-5 Q4-91	12/01/1991	NA	NA	NA	NA	151	1080	1.3	NA	NA	NA	NA
MW-05	MW-5 Q1-92	03/01/1992	NA	0.05	NA	NA	80.8	710	10.9	NA	NA	NA	NA
MW-05	MW-5 Q2-92	06/01/1992	NA	0.05	NA	NA	74.7	700	9.7	NA	NA	NA	NA
MW-05	MW-5 Q3-92	09/01/1992	NA	0.05	NA	NA	50.1	600	11.5	NA	NA	NA	NA
MW-05	MW-5 Q4-92	12/01/1992	NA	0.05	NA	NA	49.4	610	11.4	NA	NA	NA	NA
MW-05	MW-5 Q1-93	03/30/1993	NA	0.1 U	NA	NA	55	735	53.8	NA	NA	NA	NA
MW-05	MW-5 Q2(Jun)-93	06/14/1993	NA	0.1 U	NA	NA	51.6	610	11.6	NA	NA	NA	NA
MW-05	MW-5 Q3-93	09/01/1993	NA	0.1 U	NA	NA	54.8	575	11.8	NA	NA	NA	NA
MW-05	MW-5 Q4- 93	12/01/1993	NA	0.1 U	NA	NA	61.2	582	11.7	NA	NA	NA	NA
MW-05	MW-5 Q1-94	03/01/1994	220	NA	NA	NA	NA	593	NA	7.1	NA	512	NA
MW-05	MW-5 Q3-94	08/01/1994	204.1	0.0025 U	NA	NA	58.5	570	14.2	6.9	32.8	431	5.5
MW-05	MW-5 Q3(Sept)-94	09/01/1994	195	0.0025 U	NA	NA	49.6	570	11.6	7	19.1	195	1.3
MW-05	MW-5 Q4(Nov)-94	11/01/1994	206	0.0025 U	257	NA	49.9	630	11.5	6.8	26.3	428	1.4
MW-05	MW-5 Q4(Dec)-94	12/01/1994	200	0.0025 U	261	NA	64.6	740	13	6.8	26.6	387	1.37
MW-05	MW-5 Q1-95	01/01/1995	204	0.0025 U	263	NA	56.8	810	14.4	6.8	22.2	468	0.8
MW-05	MW-5 Q1(Feb)-95	02/01/1995	116	0.0025 U	265	NA	61.1	770	14.5	6.7	21.6	456	0.865
MW-05	MW-5 Q4-95	10/30/1995	NA	NA	NA	NA	NA	840	14.5	NA	NA	NA	NA
MW-05	MW-5 Q4(Dec)-95	12/20/1995	210	0.0025 U	185	NA	166.5	961	16.2	NA	23.1	660	1.07
MW-05	MW-5 Q1-96	02/01/1996	NA	NA	NA	NA	NA	910	NA	7.1	NA	NA	NA
MW-05	MW-5 Q2-96	05/01/1996	NA	NA	NA	NA	NA	840	NA	7.2	NA	NA	NA
MW-05	MW-5 Q3-96	09/01/1996	219	0.05 U	219	NA	70	850	16	7.04	33	494	0.05 U
MW-05	MW-5 Q4-96	10/01/1996	212	0.05 U	212	NA	76	860	14	7.2	29	492	0.5 U

TABLE G2
HISTORICAL SUMMARY OF CONVENTIONAL GROUNDWATER CHEMISTRY DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date (Parameter)	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Upgradient Wells Continued													
MW-05	MW-5 Q1-97	03/24/1997	216	0.05 U	NA	NA	68	880	14	5.35	28	503	0.5 U
MW-05	MW-5 Q2-97	06/24/1997	210	0.05 U	210	NA	57	640	13	6.9	27	453	0.5 U
MW-05	MW-5 Q3-97	09/11/1997	210	NA	210	NA	56.3	712	12	7.23	24.6	424	NA
MW-05	MW-5 Q4-97	11/25/1997	212	0.05 U	NA	NA	55.6	612	13.7	7.81	NA	403	0.5 U
MW-05	MW-5 Q1-98	03/25/1998	207	0.05 U	207	NA	47.7	515	NA	7.12	25.8	408	0.5 U
MW-05	MW-5 Q3-98	09/21/1998	222	0.05 U	NA	NA	44.4	705	12.8	7.27	24.5	418	0.8
MW-05	MW-5 Q4-98	12/30/1998	212	0.05 U	212	NA	47	680	13.8	7.2	27.8	412	0.6
MW-05	MW-5 Q1-99	03/03/1999	207	0.05 U	207	NA	43.7	436	13.3	7.8	26	416	0.5 U
MW-05	MW-5 Q2-99	06/14/1999	215	0.05 U	215	NA	41.8	353	NA	7.31	24	449	0.6
MW-05	MW-5 Q1-00	03/15/2000	NA	NA	NA	NA	NA	729	NA	7.53	NA	NA	NA
MW-05	MW-5 Q3-00	09/27/2000	NA	NA	NA	NA	NA	640	NA	7.75	NA	NA	NA
MW-05	MW-5 Q3-01	09/06/2001	NA	NA	NA	NA	NA	560	NA	7.7	NA	NA	NA
MW-05	MW-5 Q4-01	12/14/2001	NA	NA	NA	NA	NA	120	NA	7.54	NA	NA	NA
MW-05	MW-5 Q1-02	03/27/2002	NA	NA	NA	NA	NA	490	NA	7.25	NA	NA	NA
MW-07	SLF-MW-07-GW-110510	11/05/2010	74	0.073	NA	20 U	NA	NA	1.6	NA	5 U	NA	NA
MW-07	SLF-MW-07-GW-021011	02/10/2011	74	0.05 U	NA	NA	NA	NA	1.4	NA	5 U	NA	NA
MW-09	SLF-MW-09-GW-110410	11/04/2010	330	0.1	NA	20 U	NA	NA	16	NA	28	NA	NA
MW-09	SLF-MW-09-GW-021011	02/10/2011	320	0.05 U	NA	NA	NA	NA	12	NA	27	NA	NA
MW-10	SLF-MW-10-GW-110410	11/04/2010	160	0.08	NA	20 U	NA	NA	6.6	NA	36	NA	NA
MW-10	SLF-MW-10-GW-021011	02/10/2011	150	0.05 U	NA	NA	NA	NA	6.8	NA	24	NA	NA
MW-12	MW-12 Q1-95	03/01/1995	321	0.0025 U	393.7	NA	182.8	1397	11.7	8.13	51.7	903	78.04
MW-12	MW-12 Q3-95	07/01/1995	346	0.0025 U	NA	NA	202.4	1400	10.6	6.2	53.6	849	2.21
MW-12	MW-12 Q3(Sept)-95	09/20/1995	320	0.0025 U	290	NA	193.1	157.5	10.8	6.5	57.9	815.3	NA
MW-12	MW-12 Q4t-95	10/30/1995	330	0.0025 U	310	NA	NA	162	10.6	7.78	5.8	762.9	NA
MW-12	MW-12 Q4(Nov)-95	11/29/1995	345	0.0025 U	310	NA	210.7	132	16.4	NA	39.6	782.3	24.5

TABLE G2
HISTORICAL SUMMARY OF CONVENTIONAL GROUNDWATER CHEMISTRY DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Upgradient Wells Continued													
MW-12	MW-12 Q4(Dec)-95	12/20/1995	230	0.0025 U	200	NA	221.7	1142	17.7	NA	41	770	3.1
MW-12	MW-12 Q1-96	02/01/1996	NA	NA	NA	NA	NA	1400	NA	6.8	NA	NA	NA
MW-12	MW-12 Q2-96	05/29/1996	NA	NA	NA	NA	NA	1390	NA	6.26	NA	NA	NA
MW-12	MW-12 Q3-96	09/01/1996	338	0.05 U	338	NA	190	1420	12	6.68	41	764	0.6
MW-12	MW-12 Q4-96	10/01/1996	320	0.1	320	NA	220	1390	12	6.62	48	840	0.7
MW-12	MW-12 Q1-97	03/24/1997	342	0.05 U	342	NA	220	1270	12	7.13	45	818	0.9
MW-12	MW-12 Q2-97	06/24/1997	339	0.05 U	339	NA	180	1280	12	7.09	40	800	0.5
MW-12	MW-12 Q3-97	09/11/1997	328	0.05 U	328	NA	182	1308	10.4	7.23	43.7	738	0.5
MW-12	MW-12 Q4-97	11/25/1997	335	0.05 U	NA	NA	210	822	11.6	7.65	NA	752	0.8
MW-12	MW-12 Q1-98	03/25/1998	298	0.05 U	298	NA	194	690	NA	7.2	54.6	725	0.7
MW-12	MW-12 Q2-98	06/29/1998	325	0.05 U	325	NA	199	884	12.2	7.1	41.4	791	0.7
MW-12	MW-12 Q3-98	09/21/1998	321	0.05 U	NA	NA	196	633	11.5	7.55	45	808	0.8
MW-12	MW-12 Q4-98	12/30/1998	295	0.05 U	295	NA	230	696	12.2	7.51	44.9	764	0.6
MW-12	MW-12 Q1-99	03/03/1999	302	0.05 U	302	NA	205	546	12.2	7.46	43.6	799	0.7
MW-12	MW-12 Q2-99	06/14/1999	317	0.05 U	317	NA	194	769	NA	7.23	44.2	800	0.8
MW-12	MW-12 Q3-99	09/22/1999	313	0.05 U	313	NA	193	742	11.3	6.96	42	852	0.5
MW-12	MW-12 Q4-99	12/09/1999	329	0.05 U	329	NA	200	1361	11.8	7.53	43.2	714	0.8
MW-12	MW-12 Q1-00	03/15/2000	316	NA	316	NA	186	1352	10.9	7.6	40.8	NA	NA
MW-12	MW-12 Q2-00	06/21/2000	323	0.05 U	323	NA	206	1384	11.8	7.79	42.7	823	0.8
MW-12	MW-12 Q3-00	09/27/2000	308	0.05 U	308	NA	189	1147	NA	8	NA	747	0.5 U
MW-12	MW-12 Q4-00	12/05/2000	305	0.05 U	305	NA	199	1030	11.1	7.98	41.1	792	0.8
MW-12	MW-12 Q1-01	03/27/2001	314	0.05 U	314	NA	184	620	11	8.3	39.9	816	0.7
MW-12	MW-12 Q2-01	06/27/2001	318	0.05 U	318	NA	191	530	11.9	7.4	41.5	644	0.9
MW-12	MW-12 Q3-01	09/06/2001	314	0.05 U	314	NA	205	590	12.4	7.65	45	736	0.8
MW-12	MW-12 Q4-01	12/14/2001	320	0.05 U	320	NA	209	490	12.1	7.65	43	700	0.6

TABLE G2
HISTORICAL SUMMARY OF CONVENTIONAL GROUNDWATER CHEMISTRY DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Upgradient Wells Continued													
MW-12	MW-12 Q1-02	03/27/2002	314	0.05 U	314	NA	184	849	12.1	7.4	44.5	976	0.7
MW-12	MW-12 Q2-02	06/13/2002	289	0.05 U	289	NA	194	877	12	7.39	46.8	868	0.6
MW-12	MW-12 Q3-02	09/18/2002	322	0.05 U	322	NA	182	859	11.9	7.35	42.6	632	1
MW-12	MW-12 Q4-02	12/17/2002	315	0.05 U	315	NA	184	877	13	7.32	42	776	1
MW-12	MW-12 Q1-03	03/26/2003	310	0.05 U	315	NA	173	877	12	7.32	45	772	1.1
MW-12	MW-12 Q2-03	06/26/2003	307	0.05 U	307	NA	174	853	10	7.2	45	804	1
MW-12	MW-12 Q3-03	09/25/2003	304	0.05 U	304	NA	161	863	10.9	7.14	46	760	0.5 U
MW-12	MW-12 Q4-03	12/18/2003	301	0.05 U	301	NA	190	791	10	7.28	51	865	1.1
MW-12	MW-12 Q1-04	03/17/2004	305	0.05 U	305	NA	199	684	10	7.37	45	890	1
MW-12	MW-12 Q2-04	06/17/2004	304	0.05 U	304	NA	186	737	9.4	7.37	44.9	820	1.1
MW-12	MW-12 Q3-04	09/30/2004	303	0.05 U	303	NA	190	737	9.6	6.84	43.6	856	0.9
MW-12	MW-12 Q4-04	12/15/2004	308	0.05 U	308	NA	240	700	9.8	7.13	44.6	880	1.1
MW-12	MW-12 Q1-05	03/31/2005	302	0.05 U	302	2 U	185	NA	11.4	NA	54	750	0.9
MW-12	MW-12 Q2-05	06/23/2005	300	0.05 U	300	NA	183	NA	11.5	NA	47	780	1
MW-12	MW-12 Q3-05	09/29/2005	291	0.05 U	291	2 U	176	NA	11.2	NA	48	785	1.5
MW-12	MW-12 Q1-06	03/30/2006	300	0.05 U	300	NA	174	769	12.1	7.22	45.5	755	1
MW-12	MW-12 Q2-06	06/21/2006	477	0.05 U	477	NA	100	751	19.8	7.18	31.6	788	1.2
MW-12	MW-12 Q3-06	09/21/2006	397	0.05 U	397	NA	126	NA	20.2	NA	37.5	735	1.4
MW-12	MW-12 Q3-07	09/26/2007	292	NA	292	NA	59	NA	NA	NA	17.8	NA	NA
MW-12b	MW-12b Q3-08	09/24/2008	295	0.05 U	295	NA	165	818	11.7	7.12	33.9	713	1
MW-12b	MW-12b Q4-08	12/17/2008	296	0.05 U	NA	NA	170	831	NA	7.2	35.6	NA	0.9
MW-12b	MW-12b Q1-09	03/20/2009	293	0.05 U	295	NA	173	825	12.5	7.15	37	737	0.5 U
MW-12b	MW-12b Q2-09	06/24/2009	304	0.05 U	295	NA	157	724	13	7.37	40	691	0.8
MW-12b	MW-12b Q3-09	09/24/2009	295	0.05 U	295	NA	168	748	12.4	7.38	39	700	0.84
MW-12b	MW-12b Q4-09	12/18/2009	287	0.05 U	NA	NA	164	758	12.9	7.38	41.2	669	0.76

TABLE G2
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City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Upgradient Wells Continued													
MW-12b	MW-12b Q2-10	06/23/2010	292	0.05 U	295	NA	126	854	12.8	6.7	42.3	696	0.71
MW-12b	MW-12b Q3-10	09/29/2010	299	0.05 U	NA	NA	161	NA	12.6	NA	41.7	1360	1.2
MW-12b	MW-12b Q4-10	12/15/2010	299	0.05 U	NA	NA	161	847	11.5	6.77	39.6	709	0.83
MW-12b	MW-12b Q1-2011	03/24/2011	284	0.05 U	NA	NA	158	NA	11.7	NA	39.3	556	0.69
MW-12b	MW-12b Q2-2011	6/21/2011	273	0.05 U	NA	NA	144	868	11.6	6.65	38.3	767	0.92
MW-12b	MW-12b Q3-2011	9/28/2011	277	0.05 U	NA	NA	151	859	9.9	6.54	35.9	687	0.62
MW-12b	MW-12b Q4-2011	12/14/2011	277	0.05 U	NA	NA	142	842	9.5	6.65	34.8	620	0.71
MW-12b	MW-12b Q1-2012	3/28/2012	279	0.05 U	NA	NA	143	847	10.4	6.85	39.2	681	0.82
Downgradient Wells													
MW-01	MW-1 Q1-91	01/01/1991	NA	0.05	NA	NA	111	750	0.0069	NA	NA	NA	NA
MW-01	MW-1 Q2-91	04/01/1991	NA	0.05	NA	NA	100	740	0.0091	NA	NA	NA	NA
MW-01	MW-1 Q3-91	07/01/1991	NA	0.05	NA	NA	99	750	0.0088	NA	NA	NA	NA
MW-01	MW-1 Q4-91	10/01/1991	NA	0.05	NA	NA	107	780	0.0013	NA	NA	NA	NA
MW-01	MW-1 Q1-92	01/01/1992	NA	0.05	NA	NA	105.7	740	0.0083	NA	NA	NA	NA
MW-01	MW-1 Q2-92	04/01/1992	NA	0.05	NA	NA	109.2	725	0.0097	NA	NA	NA	NA
MW-01	MW-1 Q3-92	07/01/1992	NA	0.05	NA	NA	110.7	740	0.0084	NA	NA	NA	NA
MW-01	MW-1 Q4-92	10/01/1992	NA	0.05	NA	NA	110.1	700	0.0084	NA	NA	NA	NA
MW-01	MW-1 Q1-93	01/01/1993	NA	0.1 U	NA	NA	112.3	900	0.0379	NA	NA	NA	NA
MW-01	MW-1 Q2-93	04/01/1993	NA	0.1 U	NA	NA	112.9	750	0.0086	NA	NA	NA	NA
MW-01	MW-1 Q3-93	07/01/1993	NA	0.1 U	NA	NA	102.6	465	0.0079	NA	NA	NA	NA
MW-01	MW-1 Q4-93	10/01/1993	NA	0.1 U	NA	NA	102.4	725	0.0084	NA	NA	NA	NA
MW-01	MW-1 Q1-94	03/01/1994	160	NA	NA	NA	NA	694	NA	6.2	NA	601	NA
MW-01	MW-1 Q3-94	08/01/1994	162.5	0.0025 U	NA	NA	118.8	796	8.6	NA	41.1	545	32.3
MW-01	MW-1 Q3(Sept)-94	09/01/1994	165	0.0025 U	NA	NA	117.5	670	8.4	7	37.7	535	33.1
MW-01	MW-1 Q4(Nov)-94	11/01/1994	174	0.0025 U	NA	NA	116.9	840	8.4	7	49.2	525	39.4

TABLE G2
HISTORICAL SUMMARY OF CONVENTIONAL GROUNDWATER CHEMISTRY DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Downgradient Wells Continued													
MW-01	MW-1 Q4(Dec)-94	12/01/1994	210	0.0025 U	NA	NA	119.4	800	9	6.6	50	543	0.9
MW-01	MW-1 Q1-95	01/01/1995	172.2	0.0025 U	NA	NA	103.7	880	9.3	6.4	40.8	508	1.3
MW-01	MW-1 Q1(Feb)-95	02/01/1995	156	0.0025 U	NA	NA	99.4	870	9.1	7.2	38.7	527	0.655
MW-01	MW-1 Q3-95	07/01/1995	165	0.0025 U	NA	NA	119.4	840	9	6.3	54.7	397	0.73
MW-01	MW-1 Q1(Sep)-95	09/20/1995	170	0.0025 U	NA	NA	120.7	830	9.9	6.2	53.7	586.8	NA
MW-01	MW-1 Q4-95	12/18/1995	180	0.0025 U	NA	NA	139.7	820	13.9	NA	46.5	608	3.34
MW-01	MW-1 Q1-96	02/01/1996	NA	NA	NA	NA	NA	750	NA	6.8	NA	NA	NA
MW-01	MW-1 Q2-96	05/01/1996	NA	NA	NA	NA	NA	740	NA	7.2	NA	NA	NA
MW-01	MW-1 Q3-96	09/01/1996	175	0.05 U	NA	NA	110	940	9.2	6.43	47	525	0.5 U
MW-01	MW-1 Q4-96	10/01/1996	171	0.05 U	NA	NA	130	960	9	7.2	49	582	0.5 U
MW-01	MW-1 Q1-97	03/24/1997	172	0.05 U	NA	NA	120	710	9.2	7.15	49	531	0.5 U
MW-01	MW-1 Q2-97	06/24/1997	166	0.05 U	NA	NA	110	720	9	6.62	110	560	0.5 U
MW-01	MW-1 Q3-97	09/11/1997	160	0.05 U	NA	NA	103	822	7.6	6.93	40.2	486	0.5 U
MW-01	MW-1 Q1-98	03/25/1998	150	0.05 U	NA	NA	103	548	NA	7.12	79	464	0.5 U
MW-01	MW-1 Q2-98	06/29/1998	165	0.05 U	NA	NA	119	642	9.1	7.3	45.5	523	0.5 U
MW-01	MW-1 Q3-98	09/21/1998	174	0.05 U	NA	NA	113	475	9.1	7.55	42.2	574	0.5 U
MW-01	MW-1 Q1-99	03/03/1999	161	0.05 U	NA	NA	104	384	8.5	7.34	39.3	475	0.5 U
MW-01	MW-1 Q2-99	06/14/1999	162	0.05 U	NA	NA	104	440	NA	7.29	39.4	1080	0.5 U
MW-01	MW-1 Q3-99	09/22/1999	156	0.05 U	NA	NA	95.1	409	8	7.01	36.6	468	0.5 U
MW-01	MW-1 Q4-99	12/09/1999	156	0.05 U	NA	NA	101	790	8.5	7.54	38.2	463	0.5 U
MW-01	MW-1 Q1-00	03/15/2000	150	NA	NA	NA	88.8	733	7.8	7.65	34.5	NA	NA
MW-01	MW-1 Q2-00	06/21/2000	152	0.05 U	NA	NA	97.6	746	8.3	7.85	35.7	476	0.5 U
MW-01	MW-1 Q3-00	09/27/2000	150	0.05 U	NA	NA	93.4	598	NA	8.03	NA	408	0.5 U
MW-01	MW-1 Q4-00	12/05/2000	154	0.05 U	NA	NA	93.6	567	8.3	8.07	38.4	472	0.5 U
MW-01	MW-1 Q1-01	03/27/2001	151	0.05 U	NA	NA	95.7	300	8	7.9	33.1	416	0.5 U

TABLE G2
HISTORICAL SUMMARY OF CONVENTIONAL GROUNDWATER CHEMISTRY DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Downgradient Wells Continued													
MW-01	MW-1 Q2-01	06/27/2001	156	0.05 U	NA	NA	90.1	320	9	7.51	34.9	438	0.7
MW-03	MW-3 Q1-91	01/01/1991	NA	0.05	NA	NA	74	525	7	NA	NA	NA	NA
MW-03	MW-3 Q2-91	04/01/1991	NA	0.05	NA	NA	107	750	9.14	NA	NA	NA	NA
MW-03	MW-3 Q3-91	07/01/1991	NA	0.05	NA	NA	100	750	8.46	NA	NA	NA	NA
MW-03	MW-3 Q4-91	10/01/1991	NA	0.05	NA	NA	77	600	1.3	NA	NA	NA	NA
MW-03	MW-3 Q1-92	01/01/1992	NA	0.05	NA	NA	96.2	660	8.1	NA	NA	NA	NA
MW-03	MW-3 Q2-92	04/01/1992	NA	0.05	NA	NA	104.6	660	9.4	NA	NA	NA	NA
MW-03	MW-3 Q3-92	07/01/1992	NA	0.05	NA	NA	105.3	625	8.2	NA	NA	NA	NA
MW-03	MW-3 Q4-92	10/01/1992	NA	0.05	NA	NA	111.9	680	0.97	NA	NA	NA	NA
MW-03	MW-3 Q1-93	01/01/1993	NA	0.1 U	NA	NA	126.4	934	41.2	NA	NA	NA	NA
MW-03	MW-3 Q2-93	04/01/1993	NA	0.1 U	NA	NA	113.1	740	8.7	NA	NA	NA	NA
MW-03	MW-3 Q3-93	07/01/1993	NA	0.1 U	NA	NA	115.7	770	8.8	NA	NA	NA	NA
MW-03	MW-3 Q4-93	10/01/1993	NA	0.1 U	NA	NA	123.3	790	9.2	NA	NA	NA	NA
MW-03	MW-3 Q1-94	02/01/1994	NA	NA	NA	NA	6.9	NA	NA	NA	NA	NA	NA
MW-03	MW-3 Q1(Mar)-94	03/01/1994	190	NA	NA	NA	7.5	730	NA	7	NA	703	NA
MW-03	MW-3 Q3-94	08/01/1994	177.4	0.0025 U	NA	NA	127.5	918	9.1	NA	37.2	619	34.9
MW-03	MW-3 Q3(Sept)-94	09/01/1994	165	0.0025 U	NA	NA	131.2	710	8.9	7.2	33.6	608	32.2
MW-03	MW-3 Q4(Nov)-94	11/01/1994	170	0.0025 U	NA	NA	130.1	880	8.7	7	43.9	531	38.4
MW-03	MW-3 Q4(Dec)-94	12/01/1994	150	0.0025 U	NA	NA	129.6	850	9.4	7.1	44.1	539	1
MW-03	MW-3 Q1-95	01/01/1995	162.4	0.0025 U	NA	NA	111.3	830	9.5	6.7	35.1	489	0.7
MW-03	MW-3 Q1(Feb)-95	02/01/1995	144	0.0025 U	NA	NA	112.5	850	9.7	NA	35.4	546	0.624
MW-03	MW-3 Q3-95	07/01/1995	200	0.0025 U	NA	NA	153.6	950	10.4	6.3	54	626	1.11
MW-03	MW-3 Q4-95	12/18/1995	190	0.0025 U	NA	NA	154.2	853	14.9	NA	40.6	590	0.82
MW-03	MW-3 Q1-96	02/01/1996	NA	NA	NA	NA	NA	1320	NA	7.1	NA	NA	NA
MW-03	MW-3 Q2-96	05/01/1996	NA	NA	NA	NA	NA	780	NA	7.5	NA	NA	NA

TABLE G2
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City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date (Parameter)	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Downgradient Wells Continued													
MW-03	MW-3 Q3-96	09/01/1996	183	0.05 U	NA	NA	140	1040	10.2	NA	44	583	0.5 U
MW-03	MW-3 Q4-96	10/01/1996	179	0.1 U	NA	NA	160	1070	10	7.4	47	674	0.5 U
MW-03	MW-3 Q1-97	03/24/1997	185	0.05 U	NA	NA	150	834	11	7.08	49	586	0.5
MW-03	MW-3 Q2-97	06/24/1997	196	0.05 U	NA	NA	160	930	10	7.03	44	632	0.5 U
MW-03	MW-3 Q3-97	09/11/1997	153	0.05 U	NA	NA	124	830	8.4	7.99	39.2	528	0.5 U
MW-03	MW-3 Q4-97	11/25/1997	146	0.05 U	NA	NA	117	444	9.5	7.95	NA	416	0.5 U
MW-03	MW-3 Q1-98	03/25/1998	163	0.05 U	NA	NA	139	880	NA	7.72	39.4	480	0.5 U
MW-03	MW-3 Q2-98	06/29/1998	189	0.05 U	NA	NA	154	751	10.7	7.43	45.1	614	0.5 U
MW-03	MW-3 Q3-98	09/21/1998	195	0.05 U	NA	NA	156	539	10.7	7.49	41.8	656	0.7
MW-03	MW-3 Q4-98	12/30/1998	142	0.05 U	NA	NA	85.4	486	7.3	8.4	31	372	0.9
MW-03	MW-3 Q1-99	03/03/1999	138	0.05 U	NA	NA	86	285	7.1	8.7	28.9	365	0.5 U
MW-03	MW-3 Q2-99	06/14/1999	206	0.05 U	NA	NA	152	620	NA	7.46	41.2	696	0.5
MW-03	MW-3 Q3-99	09/22/1999	214	0.05 U	NA	NA	98.2	574	10.6	7.4	43.3	680	0.5 U
MW-03	MW-3 Q4-99	12/09/1999	225	0.05 U	NA	NA	154	928	10.3	8.28	41.9	593	0.5
MW-03	MW-3 Q1-00	03/15/2000	198	NA	NA	NA	154	986	10	7.72	39.9	NA	NA
MW-03	MW-3 Q2-00	06/21/2000	210	0.05 U	NA	NA	169	1048	10.7	7.73	42.9	600	0.5 U
MW-03	MW-3 Q3-00	09/27/2000	177	0.05 U	NA	NA	150	844	NA	8.04	NA	561	0.5 U
MW-03	MW-3 Q4-00	12/05/2000	196	0.05 U	NA	NA	138	708	9.8	7.9	40.2	612	0.5 U
MW-03	MW-3 Q1-01	03/27/2001	158	0.05 U	NA	NA	125	410	9.5	7.6	36.4	616	0.5 U
MW-03	MW-3 Q2-01	06/27/2001	206	0.05 U	NA	NA	155	410	10.9	7.5	39.1	620	0.6
MW-11	MW-11 Q1-95	03/01/1995	318	0.0025 U	401.1	NA	169.7	1262	13.3	7.44	50.9	845	75.97
MW-11	MW-11 Q1-95 Dup	03/01/1995	NA	NA	400.5	NA	NA	NA	NA	NA	NA	NA	NA
MW-11	MW-11 Q3-95	07/01/1995	335	0.0025 U	NA	NA	181.3	1320	11.4	6.2	54.7	814	1.6
MW-11	MW-11 Q3-95 Dup	07/01/1995	336	0.0025 U	NA	NA	179	1320	11.4	6.2	55	823	2.67
MW-11	MW-11 Q3(Sept)-95	09/20/1995	323	0.0025 U	280	NA	177.7	1320	12.9	6.3	54	816.7	NA

TABLE G2
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City of Walla Walla Sudbury Road Landfill

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Downgradient Wells Continued													
MW-11	MW-11 Q3(Sept)-95 Dup	09/20/1995	325	0.0025 U	280	NA	177.7	1320	12.8	6.3	54.3	793	NA
MW-11	MW-11 Q4-95	10/30/1995	360	0.0025 U	340	NA	NA	150	11.6	7.37	49.3	754.3	NA
MW-11	MW-11 Q4-95 Dup	10/30/1995	360	0.0025 U	340	NA	177.7	150	11.2	7.36	49.2	768	NA
MW-11	MW-11 Q4(Nov)-95	11/29/1995	310	0.0025 U	270	NA	174.5	124	15.5	NA	41.4	766.2	3.7
MW-11	MW-11 Q4(Nov)-95 Dup	11/29/1995	330	0.0025 U	310	NA	186.4	123	16.5	NA	43.6	750.7	4.85
MW-11	MW-11 Q4(Dec)-95	12/18/1995	320	0.0025 U	280	NA	194.2	1172	17.6	NA	44.4	812	8.25
MW-11	MW-11 Q1-96	02/01/1996	NA	NA	NA	NA	NA	1290	NA	6.5	NA	NA	NA
MW-11	MW-11 Q2-96	05/01/1996	NA	NA	NA	NA	NA	840	NA	6.29	NA	NA	NA
MW-11	MW-11 Q3-96	09/01/1996	319	0.05 U	319	NA	170	1140	14	6.43	46	750	0.06
MW-11	MW-11 Q4-96	10/01/1996	308	0.05 U	398	NA	200	1145	12	6.5	48	860	0.5 U
MW-11	MW-11 Q1-97	03/24/1997	326	0.05 U	326	NA	200	1400	12	6.32	48	754	0.8
MW-11	MW-11 Q2-97	06/24/1997	321	0.05	321	NA	180	1200	11	6.52	43	786	0.5
MW-11	MW-11 Q3-97	09/11/1997	310	0.05 U	310	NA	182	1288	10.3	7.39	42.4	720	0.5 U
MW-11	MW-11 Q4-97	11/25/1997	327	0.05 U	NA	NA	192	1185	11.2	7.33	NA	788	0.5 U
MW-11	MW-11 Q1-98	03/25/1998	312	0.05 U	312	NA	182	810	NA	6.94	44.3	741	0.6
MW-11	MW-11 Q2-98	06/29/1998	324	0.05 U	324	NA	188	894	12	7.18	44.9	784	0.7
MW-11	MW-11 Q3-98	09/21/1998	336	0.05 U	NA	NA	183	1553	11.5	7.27	48.7	806	0.8
MW-11	MW-11 Q4-98	12/30/1998	318	0.05 U	318	NA	197	592	12.4	7.49	49.8	744	0.6
MW-11	MW-11 Q1-99	03/03/1999	312	0.05 U	312	NA	184	664	12.2	7.3	47.2	769	0.7
MW-11	MW-11 Q2-99	06/14/1999	316	0.05 U	316	NA	177	823	NA	7.2	47	773	0.8
MW-11	MW-11 Q3-99	09/22/1999	320	0.05 U	320	NA	168	603	11.4	7.1	41	804	0.6
MW-11	MW-11 Q4-99	12/09/1999	326	0.05 U	326	NA	190	603	12	7.4	46	745	0.8
MW-11	MW-11 Q1-00	03/15/2000	320	NA	320	NA	181	1392	11.1	7.57	43.4	NA	NA
MW-11	MW-11 Q2-00	06/21/2000	320	0.05 U	320	NA	190	1319	11.8	7.5	48	775	0.7
MW-11	MW-11 Q3-00	09/27/2000	307	0.05 U	307	NA	183	1317	NA	7.71	NA	726	0.6

TABLE G2
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City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date (Parameter)	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Downgradient Wells Continued													
MW-11	MW-11 Q4-00	12/05/2000	312	0.05 U	312	NA	182	1005	11.5	7.73	46.1	824	0.7
MW-11	MW-11 Q1-01	03/27/2001	314	0.05 U	314	NA	170	560	11.3	7.1	43.5	688	0.7
MW-11	MW-11 Q2-01	06/27/2001	310	0.05 U	310	NA	170	580	12.1	7.18	42.5	732	2.1
MW-11	MW-11 Q3-01	09/06/2001	314	0.05 U	314	NA	175	575	12.5	7.14	46.6	688	0.9
MW-11	MW-11 Q4-01	12/14/2001	322	0.05 U	322	NA	180	730	12.8	7.38	44.9	816	0.6
MW-11	MW-11 Q1-02	03/27/2002	312	0.05 U	312	NA	191	822	13	7.21	42.3	836	0.7
MW-11	MW-11 Q2-02	06/13/2002	291	0.05 U	291	NA	184	894	13.3	7.16	44.6	796	0.8
MW-11	MW-11 Q3-02	09/18/2002	320	0.05 U	320	NA	172	883	13.2	7.14	40.8	788	0.7
MW-11	MW-11 Q4-02	12/17/2002	320	0.05 U	320	NA	177	879	13	7.09	39	940	0.9
MW-11	MW-11 Q1-03	03/26/2003	313	0.05 U	320	NA	174	879	13	7.09	39	916	0.9
MW-11	MW-11 Q2-03	06/26/2003	316	0.05 U	316	NA	175	864	11	7.14	41	808	1
MW-11	MW-11 Q3-03	09/25/2003	310	0.05 U	310	NA	151	855	12.3	6.94	41	700	0.5 U
MW-11	MW-11 Q4-03	12/18/2003	304	0.05 U	304	NA	177	776	11	7.14	42	820	0.9
MW-11	MW-11 Q1-04	03/17/2004	307	0.05 U	307	NA	198	665	10	7.73	38	750	1.6
MW-11	MW-11 Q2-04	06/17/2004	311	0.05 U	311	NA	170	714	10.7	7.02	36.9	792	1
MW-11	MW-11 Q3-04	09/30/2004	310	0.05 U	310	NA	177	683	10.6	7.04	36.1	848	0.7
MW-11	MW-11 Q4-04	12/15/2004	304	0.05 U	304	NA	147	659	10.3	7.01	36.6	880	1
MW-11	MW-11 Q1-05	03/31/2005	302	0.05 U	302	2 U	151	NA	12.5	NA	44	700	0.6
MW-11	MW-11 Q2-05	06/23/2005	302	0.05 U	302	NA	150	NA	12.1	NA	39.2	705	0.8
MW-11	MW-11 Q3-05	09/29/2005	302	0.05 U	302	2 U	140	NA	11.9	NA	39.7	740	0.7
MW-11	MW-11 Q4-05	12/14/2005	296	0.05 U	296	NA	142	686	12.4	7.15	36	665	1.1
MW-11	MW-11 Q1-06	03/30/2006	318	0.05 U	318	NA	131	699	11.7	7.14	37.6	730	0.9
MW-11	MW-11 Q2-06	06/21/2006	301	0.05 U	301	NA	128	718	11.2	7	37.6	663	0.6
MW-11	MW-11 Q3-06	09/21/2006	296	0.05 U	296	NA	132	NA	11.3	NA	37.1	656	0.9
MW-11	MW-11 Q4-06	12/28/2006	294	0.05 U	294	NA	151	736	10.9	7.36	35.3	671	0.8

TABLE G2
HISTORICAL SUMMARY OF CONVENTIONAL GROUNDWATER CHEMISTRY DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date (Parameter)	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Downgradient Wells Continued													
MW-11	MW-11 Q1-07	03/22/2007	310	0.05 U	310	NA	136	730	11.5	7.07	36.8	643	1
MW-11	MW-11 Q2-07	06/28/2007	294	0.05 U	294	NA	132	728	11.2	7.45	36.8	631	0.7
MW-11	MW-11 Q3-07	09/26/2007	286	0.05 U	286	NA	127	732	10.8	6.91	35.2	575	0.6
MW-11	MW-11 Q4-07	12/27/2007	287	0.05 U	287	NA	126	730	10.9	6.89	34.9	623	0.9
MW-11	MW-11 Q1-08	03/27/2008	288	0.05 U	288	NA	126	745	11.1	6.94	35.5	635	0.7
MW-11	MW-11 Q2-08	06/25/2008	282	0.05 U	282	NA	128	748	10.8	6.99	36.5	703	0.8
MW-11	MW-11 Q3-08	09/24/2008	284	0.05 U	284	NA	124	726	10.3	7.09	33.3	539	0.9
MW-11	MW-11 Q4-08	12/17/2008	286	0.05 U	NA	NA	99	735	NA	7.03	31	NA	0.8
MW-11	MW-11 Q1-09	03/20/2009	282	0.05 U	288	NA	117	717	10.9	7.14	33.7	608	0.6
MW-11	MW-11 Q2-09	06/24/2009	296	0.05 U	282	NA	113	639	10.8	7.26	34	593	0.8
MW-11	MW-11 Q3-09	09/24/2009	281	0.05 U	284	NA	110	649	10.7	7.1	33	599	0.79
MW-11	MW-11 Q4-09	12/18/2009	278	0.05 U	NA	NA	107	654	10.9	7.15	33.8	579	0.59
MW-11	MW-11 Q1-10	03/30/2010	288	0.05	NA	NA	102	NA	9.9	NA	32	557	0.51
MW-11	MW-11 Q2-10	06/23/2010	289	0.05 U	282	NA	80.3	719	10.6	6.67	34.2	573	0.88
MW-11	MW-11 Q3-10	09/29/2010	290	0.05 U	NA	NA	102	NA	10.4	NA	33.8	139	1.22
MW-11	MW-11 Q4-10	12/15/2010	288	0.05 U	NA	NA	101	716	9.51	6.71	31.8	515	0.83
MW-11	MW-11 Q1-2011	03/24/2011	286	0.05 U	NA	NA	101	NA	9.8	NA	33.9	540	0.5 U
MW-11	MW-11 Q2-2011	6/21/2011	281	0.05 U	NA	NA	96.2	752	9.74	6.46	32.9	615	0.79
MW-11	MW-11 Q3-2011	9/28/2011	270	0.05 U	NA	NA	97.2	745	8.3	6.45	30.7	563	0.51
MW-11	MW-11 Q4-2011	12/14/2011	266	0.05 U	NA	NA	89.6	725	9.01	6.52	28.7	641	0.69
MW-11	MW-11 Q1-2012	3/28/2012	275	0.05 U	NA	NA	87.8	718	8.52	6.68	31.0	568	0.85
MW-14	MW-14 Q3-99	09/22/1999	150	0.05 U	150	NA	109	280	7.5	7.36	44.1	538	0.5 U
MW-14	MW-14 Q4-99	12/09/1999	168	0.05 U	168	NA	110	584	8.1	8.12	45.5	485	0.5
MW-14	MW-14 Q1-00	03/15/2000	119	NA	119	NA	79.9	571	6.8	8.16	32.7	NA	NA
MW-14	MW-14 Q2-00	06/21/2000	117	0.05 U	117	NA	79.6	581	7	8.25	33.4	414	0.5 U

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City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Sample Date (Parameter)	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
Downgradient Wells Continued													
MW-14	MW-14 Q3-00	09/27/2000	111	0.05 U	111	NA	69.2	533	NA	8.58	NA	353	0.5 U
MW-14	MW-14 Q4-00	12/05/2000	108	0.05 U	108	NA	92.4	497	6.8	8.48	29.5	394	0.5 U
MW-14	MW-14 Q1-01	03/27/2001	112	0.05 U	112	NA	43.3	350	5.9	8.8	15.4	278	0.5 U
MW-14	MW-14 Q2-01	06/27/2001	112	0.05 U	112	NA	42.8	405	6.1	8.01	18.1	278	0.5 U
MW-14	MW-14 Q3-01	09/06/2001	118	0.05 U	118	NA	85.3	375	8	7.81	34.7	350	0.5 U
MW-14	MW-14 Q4-01	12/14/2001	134	0.05 U	134	NA	92	340	7.8	8.36	38.6	420	0.5 U
MW-14	MW-14 Q1-02	03/27/2002	124	0.05 U	124	NA	65.2	388	7.2	8.04	25	302	0.5 U
MW-14	MW-14 Q2-02	06/13/2002	103	0.05 U	106	NA	71.7	422	7.7	8.02	30.6	420	0.1 U
MW-14	MW-14 Q3-02	09/18/2002	129	0.05 U	129	NA	62.8	352	7.6	8.08	24.8	358	0.5 U
MW-14	MW-14 Q4-02	12/17/2002	117	0.05 U	117	NA	58	419	6.7	7.99	27	354	0.5 U
MW-14	MW-14 Q1-03	03/26/2003	120	0.05 U	117	NA	61	419	7	7.99	27	408	0.5 U
MW-14	MW-14 Q2-03	06/26/2003	136	0.05 U	136	NA	84	370	6	8.02	38	420	0.5 U
MW-14	MW-14 Q3-03	09/25/2003	110	0.05 U	110	NA	52	354	6	7.94	23	332	0.5 U
MW-14	MW-14 Q4-03	12/18/2003	140	0.05 U	140	NA	99	491	7	7.83	53	404	0.6
MW-14	MW-14 Q1-04	03/17/2004	136	0.05 U	136	NA	78	385	6.5	7.82	33	368	0.5 U
MW-14	MW-14 Q2-04	06/17/2004	132	0.05 U	132	NA	57.8	372	5.5	7.8	30.7	424	0.5 U
MW-14	MW-14 Q3-04	09/30/2004	136	0.05 U	136	NA	65.8	373	5.6	7.82	31.5	436	0.5 U
MW-14	MW-14 Q4-04	12/15/2004	131	0.05 U	131	NA	65.4	357	5.6	7.55	31.6	396	0.5 U
MW-14	MW-14 Q1-05	03/31/2005	148	0.05 U	148	2 U	79.1	NA	6.7	NA	46.2	408	0.5 U
MW-14	MW-14 Q2-05	06/23/2005	115	0.08	115	NA	40.5	NA	5.3	NA	18.5	252	0.5 U
MW-14	MW-14 Q3-05	09/29/2005	122	0.05 U	122	2 U	44.8	NA	5.4	NA	23.2	344	0.5 U
MW-14	MW-14 Q4-05	12/14/2005	131	0.05 U	131	NA	44.8	374	5.6	7.69	23.4	336	0.5 U
MW-14	MW-14 Q1-06	03/30/2006	157	0.05 U	157	NA	59.3	345	5.9	7.75	37.7	376	0.5 U
MW-14	MW-14 Q3-06	09/21/2006	127	0.05 U	127	NA	43.6	NA	6	NA	22.3	313	0.5 U
MW-14	MW-14 Q4-06	12/28/2006	123	0.05 U	123	NA	49.8	487	6.3	7.48	26.5	345	0.5 U

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Downgradient Wells Continued													
MW-14	MW-14 Q1-07	03/22/2007	156	0.05 U	156	NA	81.7	430	6.2	8.03	48.3	458	0.6
MW-14	MW-14 Q2-07	06/28/2007	127	0.05 U	127	NA	42.1	374	5.1	7.85	23.2	287	0.5 U
MW-14	MW-14 Q3-07	09/26/2007	134	0.05 U	134	NA	36.9	415	5.4	7.23	19.9	259	0.5 U
MW-14	MW-14 Q4-07	12/27/2007	148	0.05 U	148	NA	41.8	415	5.8	7.33	23.9	322	0.5 U
MW-14	MW-14 Q1-08	03/27/2008	168	0.05 U	168	NA	58	488	6.4	7.59	33.7	364	0.5
MW-14	MW-14 Q2-08	06/25/2008	138	0.05 U	138	NA	38.9	425	5.4	7.23	20.6	345	0.5 U
MW-14	MW-14 Q3-08	09/24/2008	142	0.05 U	142	NA	38.1	462	5.9	7.35	22.5	284	0.6
MW-14	MW-14 Q4-08	12/17/2008	146	0.05 U	NA	NA	52	502	NA	7.68	28.6	NA	0.5 U
MW-14	MW-14 Q1-09	03/20/2009	136	0.05 U	168	NA	42.8	504	5.6	7.29	22.2	304	0.5 U
MW-14	MW-14 Q2-09	06/24/2009	164	0.05 U	138	NA	53.3	382	6.4	7.58	27.9	373	0.5 U
MW-14	MW-14 Q3-09	09/24/2009	152	0.05 U	142	NA	52.5	415	6.24	7.78	27.1	354	5 U
MW-14	MW-14 Q4-09	12/18/2009	152	0.05 U	NA	NA	72.7	448	6.62	7.46	46.9	427	0.5 U
MW-14	MW-14 Q1-10	03/30/2010	166	0.05	NA	NA	52.2	NA	6.78	NA	28.3	334	0.5
MW-14	MW-14 Q2-10	06/23/2010	165	0.05 U	138	NA	78.7	448	7.81	7.21	44.3	428	0.5 U
MW-14	MW-14 Q3-10	09/29/2010	151	0.05 U	NA	NA	54	NA	5.1	NA	25.9	677	0.65
MW-14	MW-14 Q4-10	12/15/2010	151	0.05 U	NA	NA	49.8	512	4.86	7.38	22.2	121	0.5 U
MW-14	MW-14 Q1-2011	03/24/2011	160	0.05 U	NA	NA	77	NA	5.8	NA	38.1	437	0.5 U
MW-14	MW-14 Q1-2011	03/24/2011	160	0.05 U	NA	NA	77	NA	5.8	NA	38.1	437	0.5 U
MW-14	MW-14 Q1-2011	6/21/2011	140	0.05 U	NA	NA	54.4	575	6.08	7.00	38.1	387	0.5 U
MW-14	MW-14 Q1-2011	9/28/2011	175	0.05 U	NA	NA	56.4	560	5.1	7.04	38.1	387	0.50 U
MW-14	MW-14 Q1-2011	12/14/2011	154	0.05 U	NA	NA	52.8	509	5.43	7.11	38.1	376	0.5 U
MW-14	MW-14 Q1-2011	3/28/2012	164	0.05 U	NA	NA	78.3	566	6.03	7.23	38.1	460	0.52
MW-15	MW-15 Q3-01	09/06/2001	648	0.05 U	648	NA	105	415	9.5	7.55	44.8	992	1.7
MW-15	MW-15 Q4-01	12/14/2001	568	0.05 U	568	NA	116	360	9.3	7.35	43.4	924	1.3
MW-15	MW-15 Q1-02	03/27/2002	570	0.05 U	570	NA	114	985	9.6	7.04	44	856	1

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Downgradient Wells Continued													
MW-15	MW-15 Q2-02	06/13/2002	613	0.05 U	613	NA	99.2	1053	9.3	7.03	47	1060	1.2
MW-15	MW-15 Q3-02	09/18/2002	658	0.05 U	658	NA	109	1046	9.6	7.02	42.1	868	2.2
MW-15	MW-15 Q4-02	12/17/2002	598	0.05 U	598	NA	120	1012	10	7.07	41	812	1.6
MW-15	MW-15 Q1-03	03/26/2003	634	0.05 U	598	NA	274 J	1012	9	7.07	43	936	2
MW-15	MW-15 Q2-03	06/26/2003	658	0.05 U	658	NA	117	1012	7	6.95	44	980	2.4
MW-15	MW-15 Q3-03	09/25/2003	618	0.05 U	618	NA	99	1049	8	6.97	41	890	0.9
MW-15	MW-15 Q4-03	12/18/2003	593	0.05 U	593	NA	115	902	8	7.02	45	940	2.2
MW-15	MW-15 Q1-04	03/17/2004	513	0.05 U	513	NA	145	761	8.7	7.01	42	920	1.8
MW-15	MW-15 Q2-04	06/17/2004	564	0.05 U	564	NA	113	818	7.1	6.9	39.3	820	2.1
MW-15	MW-15 Q3-04	09/30/2004	566	0.05 U	566	NA	133	782	7.3	6.9	38.6	880	1.7
MW-15	MW-15 Q4-04	12/15/2004	520	0.05 U	520	NA	130	780	7.8	6.8	39.6	915	1.5
MW-15	MW-15 Q1-05	03/31/2005	716	0.05 U	716	2 U	101	NA	7.7	NA	49	965	2.1
MW-15	MW-15 Q2-05	06/23/2005	94	0.19	94	NA	132	NA	8.1	NA	42.9	945	2.4
MW-15	MW-15 Q3-05	09/29/2005	532	0.05 U	532	2 U	125	NA	8.2	NA	44.9	890	1.6
MW-15	MW-15 Q4-05	12/14/2005	502	0.05 U	502	NA	131	820	8.8	7.05	39.8	875	1.7
MW-15	MW-15 Q1-06	03/30/2006	64	0.05 U	64	NA	111	859	7.5	7	45.6	898	1.7
MW-15	MW-15 Q2-06	06/21/2006	528	0.05 U	528	NA	124	876	7.7	7	45	880	1.5
MW-15	MW-15 Q3(Sept)-06	09/21/2006	582	0.05 U	582	NA	128	NA	8.1	NA	45.1	905	1.6
MW-15	MW-15 Q4-06	12/28/2006	628	0.05 U	628	NA	107	969	7.3	7.02	43.6	931	2.5
MW-15	MW-15 Q1-07	03/22/2007	606	0.05 U	606	NA	133	935	8.9	7.04	43.4	853	2
MW-15	MW-15 Q2-07	06/28/2007	555	0.05 U	555	NA	133	947	7.6	6.99	46.6	885	1.5
MW-15	MW-15 Q3-07	09/26/2007	586	0.05 U	586	NA	115	945	7.2	6.93	43.4	924	1.9
MW-15	MW-15 Q4-07	12/27/2007	557	0.05 U	557	NA	133	943	9.2	6.9	39.9	855	2
MW-15	MW-15 Q1-08	03/27/2008	498	0.05 U	498	NA	148	952	10	6.98	41.1	812	1.3
MW-15	MW-15 Q2-08	06/25/2008	512	0.05 U	512	NA	144	961	9.1	6.98	39.8	820	1.5
MW-15	MW-15 Q3-08	09/24/2008	488	0.05 U	488	NA	132	949	9.9	7.04	40.6	777	1.9

TABLE G2
HISTORICAL SUMMARY OF CONVENTIONAL GROUNDWATER CHEMISTRY DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Alkalinity (mg/L)	Ammonia (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Conductivity (uohm/cm)	Nitrate (mg/L)	pH (std pH units)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)	Total Organic Carbon (mg/L)
MW-15	MW-15 Q4-08	12/17/2008	475	0.05 U	NA	NA	147	946	NA	7.14	42.1	NA	1.3
MW-15	MW-15 Q1-09	03/20/2009	467	0.05 U	498	NA	151	947	9.3	7.11	42.6	824	1.1
MW-15	MW-15 Q2-09	06/24/2009	507	0.05 U	512	NA	141	826	9.9	7.26	39	856	1.3
MW-15	MW-15 Q3-09	09/24/2009	489	0.05 U	488	NA	140	851	7.5	7.12	38.3	861	1.63
MW-15	MW-15 Q4-09	12/18/2009	447	0.05 U	NA	NA	138	877	8.91	7.27	44.5	857	1.01
MW-15	MW-15 Q1-10	03/30/2010	490	0.05	NA	NA	138	NA	8.2	NA	42.4	796	1.06
MW-15	MW-15 Q2-10	06/23/2010	472	0.05 U	512	NA	144	1002	9.01	6.59	45.4	837	1.22
MW-15	MW-15 Q3-10	09/29/2010	467	0.05 U	NA	NA	144	NA	9.17	NA	44	488	1.81
MW-15	MW-15 Q4-10	12/15/2010	488	0.05 U	NA	NA	139	1005	8.12	6.76	42.7	837	1.43
MW-15	MW-15 Q1-2011	03/24/2011	499	0.05 U	NA	NA	136	NA	8.18	NA	44.8	860	1.57
MW-15	MW-15 Q2-2011	6/21/2011	455	0.05 U	NA	NA	136	1038	9.19	6.53	41.8	901	1.20
MW-15	MW-15 Q3-2011	9/28/2011	452	0.05 U	NA	NA	136	1036	7.2	6.30	39.3	860	1.06
MW-15	MW-15 Q4-2011	12/14/2011	438	0.05 U	NA	NA	136	1008	7.3	6.58	37.3	776	1.28
MW-15	MW-15 Q1-2012	3/28/2012	486	0.05 U	NA	NA	136	1023	6.21	6.64	43.3	884	1.64
MW-16	MW-16 Q3-05	09/01/2005	541	NA	NA	NA	185	NA	11.6	NA	45.1	NA	NA
MW-16	MW-16 Q2-06	06/21/2006	256	0.05 U	256	NA	130	690	9.5	7.23	42.6	618	0.6
MW-16	MW-16 Q3(Sept)-06	09/21/2006	262	0.05 U	262	NA	163	NA	9.9	NA	42.1	671	0.5

Notes:

Only samples that were tested for at least one Conventional Analyte appear in this Table. See Table D.1 for an complete Analytical Schedule by sample.

J Analyte was detected, the result is an estimated value.

U Analyte was not detected at the given reporting limit.

NA Not analyzed

TABLE G3
HISTORICAL SUMMARY OF METALS GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Calcium (mg/L)	Cyanide (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Sodium (mg/L)
Upgradient Wells																									
MW-05	MW-5 Q1-91	03/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.39	NA	0.005	NA	NA
MW-05	MW-5 Q2-91	06/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01	NA	0.005	NA	NA
MW-05	MW-5 Q3-91	09/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.76	NA	0.005	NA	NA
MW-05	MW-5 Q4-91	12/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.17	NA	0.025	NA	NA
MW-05	MW-5 Q1-92	03/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.18	NA	0.0005	NA	NA
MW-05	MW-5 Q2-92	06/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.69	NA	0.0005	NA	NA
MW-05	MW-5 Q3-92	09/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.46	NA	0.006	NA	NA
MW-05	MW-5 Q4-92	12/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.94	NA	0.0005	NA	NA
MW-05	MW-5 Q1-93	03/30/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.96	NA	0.001	NA	NA
MW-05	MW-5 Q2(Jun)-93	06/14/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.262	NA	0.003 U	NA	NA
MW-05	MW-5 Q3-93	09/01/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.086	NA	0.003 U	NA	NA
MW-05	MW-5 Q4- 93	12/01/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.433	NA	0.003 U	NA	NA
MW-05	MW-5 Q2-94	04/01/1994	NA	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-05	MW-5 Q3-94	08/01/1994	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	68.5	NA	NA	33.4	NA	9.3	14.4
MW-05	MW-5 Q3(Sept)-94	09/01/1994	10 U	0.01 U	NA	0.0002 U	2 U	9.4	0.005 U	3.5	2 U	NA	0.5 U	5 U	5 U	0.002 U	0.013	231.6	66.7	NA	0.0137	22.4	NA	6.4	13.1
MW-05	MW-5 Q4-94	10/01/1994	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-05	MW-5 Q4(Nov)-94	11/01/1994	10 U	0.01 U	NA	0.0002 U	2 U	6.3	0.005 U	2 U	2 U	NA	0.5 U	5 U	5 U	0.002 U	0.011	158.8	61.7	NA	0.0091	31.7	NA	7.5	15.7
MW-05	MW-5 Q4(Dec)-94	12/01/1994	10 U	0.01 U	NA	0.0002 U	2 U	5.7	0.005 U	2 U	2 U	NA	0.5 U	5 U	5 U	0.002 U	0.012	259.7	74.1	NA	0.0219	19.4	NA	6.5	13.7
MW-05	MW-5 Q1-95	01/01/1995	10 U	10 U	130	2 U	2 U	13	10 U	2.01	2 U	NA	0.5 U	5 U	5 U	2 U	19	293.4	95.1	NA	0.0177	34.6	10 U	7.4	22.9
MW-05	MW-5 Q1(Feb)-95	02/01/1995	5 U	10 U	290	2 U	2 U	10 U	10 U	20 U	2 U	NA	0.04 U	5 U	10 U	2 U	49	580	48.3	NA	0.33	19.4	10 U	6.5	13.1
MW-05	MW-5 Q4(Dec)-95	12/20/1995	0.02	0.5 U	93.8	0.02 U	0.03	0.7	0.2	1.85	1.41	NA	1.7	5 U	0.02 U	0.02 U	10.5	188	141.2	NA	238	48.7	0.00141	7.4	35.8
MW-05	MW-5 Q2-96	05/01/1996	0.03	0.5 U	81.1	5 U	0.07	0.5	0.38	1.1	0.52	NA	4.3	5 U	0.11	0.02 U	10.2	150	NA	NA	NA	NA	NA	NA	NA
MW-05	MW-5 Q3-96	09/01/1996	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	81.6	NA	0.176	35.8	0.005 U	6.9	22.1
MW-05	MW-5 Q4-96	10/01/1996	50 U	5 U	64	0.02 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	312	89.7	NA	0.135	38.6	0.005 U	9.07	22.9
MW-05	MW-5 Q1-97	03/24/1997	50 U	5 U	63	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	101	78.8	NA	0.05	35	0.005 U	6.87	19.6
MW-05	MW-5 Q2-97	06/24/1997	50 U	5 U	66	5 U	4 U	5 U	10 U	10 U	6	NA	20 U	5 U	10 U	5 U	14	393	75.2	NA	1.36	32.8	0.007	7.1	20.5
MW-05	MW-5 Q3-97	09/11/1997	50 U	5 U	65	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	212	74.7	NA	0.115	32.7	0.005 U	6.86	20.6
MW-05	MW-5 Q4-97	11/25/1997	50 U	5 U	5 U	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	215	70.6	NA	0.164	31.1	0.005 U	6.4	19.6
MW-05	MW-5 Q1-98	03/25/1998	50 U	5 U	59	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	206	73	NA	0.314	31.2	0.005 U	6.7	18.7
MW-05	MW-5 Q3-98	09/21/1998	0.04 U	1 U	58.4	0.04 U	0.2	0.6	0.4	0.8	0.79	NA	8.4	5 U	0.04 U	0.04 U	10.4	196	70	NA	0.171	31.4	0.00128	7.6	17.4
MW-05	MW-5 Q4-98	12/30/1998	50 U	5 U	58	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	275	77.2	NA	1.32	32.6	0.008	7	16.8
MW-05	MW-5 Q1-99	03/03/1999	50 U	5 U	55	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	185	72.5	NA	0.239	32.1	0.005 U	6.38	15.5
MW-05	MW-5 Q2-99	06/14/1999	0.02 U	2.4	58.2	0.02 U	0.03	5.3	0.5	0.8	5.7	NA	6.9	15	0.02 U	0.03	10.9	371	73.1	NA	0.464	31.4	0.005 U	7.78	15.5
MW-07	SLF-MW-07-GW-110510	11/05/2010	NA	3 U	NA	NA	4 U	10 U	NA	10 U	1 U	0.5 U	NA	NA	NA	NA	NA	NA	15	NA	NA	NA	0.01 U	NA	6.3
MW-07	SLF-MW-07-GW-021011	02/10/2011	NA	3 U	NA	NA	4 U	10 U	NA	10 U	1 U	0.5 U	NA	NA	NA	NA	NA	NA	14	NA	NA	NA	0.011 U	NA	6.4
MW-09	SLF-MW-09-GW-110410	11/04/2010	NA	3.3 U	NA	NA	4.4 U	11 U	NA	11 U	6.6	0.5 U	NA	NA	NA	NA	NA	NA	88	NA	NA	NA	0.012	NA	34
MW-09	SLF-MW-09-GW-021011	02/10/2011	NA	3 U	NA	NA	4 U	10 U	NA	10 U	1 U	0.5 U	NA	NA	NA	NA	NA	NA	90	NA	NA	NA	0.011 U	NA	35
MW-10	SLF-MW-10-GW-110410	11/04/2010	NA	3 U	NA	NA	4 U	10 U	NA	10 U	1 U	0.5 U	NA	NA	NA	NA	NA	NA	48	NA	NA	NA	0.01 U	NA	16
MW-10	SLF-MW-10-GW-021011	02/10/2011	NA	3 U	NA	NA	4 U	10 U	NA	10 U	1 U	0.5 U	NA	NA	NA	NA	NA	NA	45	NA	NA	NA	0.011 U	NA	17
MW-12	MW-12 Q1-95	03/01/1995	5 U	10 U	410	2 U	4	10 U	10 U	20 U	2 U	NA	0.04 U	5 U	10 U	2 U	36	NA	52.7	NA	380	34.5	0.172	10.1	6.3
MW-12	MW-12 Q3-95	07/01/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 U	5 U	NA	NA	30 U	140.5	NA	NA	58.6	NA	10.4	65
MW-12	MW-12 Q3(Sept)-95	09/20/1995	0.1	0.7	93.1	0.02 U	0.44	1.4	1.69	2.81	0.05	NA	13.2	5 U	0.04	0.02 U	9.4	6.9	76.6	NA	0.039	50.4	0.0994	9.2	61.2
MW-12	MW-12 Q4t-95	10/30/1995	0.1	0.6	97.9	0.07	0.31	5.5	4.1	2.93	0.05	NA	66.3	5 U	0.02 U	0.02 U	10.8	5.5	143.1	NA	0.039	59.5	0.109	8.5	45.1
MW-12	MW-12 Q4(Nov)-95	11/29/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	109.5	NA	NA	62.2	NA	9.3	72

TABLE G3
HISTORICAL SUMMARY OF METALS GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Calcium (mg/L)	Cyanide (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Sodium (mg/L)
Upgradient Wells Continued																									
MW-12	MW-12 Q4(Dec)-95	12/20/1995	0.12	0.5 U	106	0.03	0.15	9.9	3.97	5.6	1.35	NA	35.1	5 U	0.02 U	0.02 U	13.6	5.5	160.7	NA	3.29	69.8	0.0978	9.3	75.1
MW-12	MW-12 Q1-96	02/01/1996	0.22	0.5 U	90.3	0.02 U	0.13	4.4	7.58	2.15	0.03	NA	175	5 U	0.02 U	0.02 U	10.1	3.3	NA	NA	0.039	NA	0.073	NA	NA
MW-12	MW-12 Q2-96	05/29/1996	0.62	0.7	98	0.02 U	0.21	1.7	5.29	2.9	0.22	NA	12.7	5 U	0.35	0.02 U	10.2	33.1	NA	NA	0.041	NA	0.0275	NA	NA
MW-12	MW-12 Q3-96	09/01/1996	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	125	NA	2.33	56.8	0.046	9.1	59.9
MW-12	MW-12 Q4-96	10/01/1996	50 U	5 U	84	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	127	NA	2.32	58	0.062	8.7	59.2
MW-12	MW-12 Q1-97	03/24/1997	50 U	5 U	90	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	128	NA	3.49	59.3	0.08	9.47	59.6
MW-12	MW-12 Q2-97	06/24/1997	50 U	5 U	102	5 U	4 U	8	10 U	10 U	2 U	NA	26	5 U	10 U	22	18	10 U	130	NA	4.29	60.6	0.099	9.9	60.9
MW-12	MW-12 Q3-97	09/11/1997	50 U	5 U	96	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	132	NA	2.03	60.2	0.065	9.73	59.3
MW-12	MW-12 Q4-97	11/25/1997	50 U	5 U	144	5 U	4 U	25	16	42	5	NA	46	5 U	10 U	5 U	58	46	119	NA	7.39	54.7	0.161	10.7	58.4
MW-12	MW-12 Q1-98	03/25/1998	50 U	5 U	88	5 U	4 U	8	10 U	10 U	2 U	NA	24	5 U	10 U	5 U	13	10 U	125	NA	0.854	55.8	0.029	10.2	57.8
MW-12	MW-12 Q2-98	06/29/1998	50 U	5 U	102	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	10 U	10 U	124	NA	1.49	57.2	0.027	7.9	58.2
MW-12	MW-12 Q3-98	09/21/1998	0.13	1 U	100	0.05	0.3	21.7	3.21	2.5	0.62	NA	46.4	5 U	0.04 U	0.04 U	14.2	3	126	NA	3.78	58.9	0.032	10.5	57.1
MW-12	MW-12 Q4-98	12/30/1998	50 U	5 U	89	5 U	4 U	5 U	10 U	10 U	2 U	NA	67	5 U	10 U	5 U	14	3 U	135	NA	2.09	59.4	0.054	10.3	56.2
MW-12	MW-12 Q1-99	03/03/1999	50 U	5 U	83	5 U	4 U	5 U	10 U	10 U	2 U	NA	41	5 U	10 U	5 U	12	10 U	130	NA	3.9	59.9	0.097	9.34	54.3
MW-12	MW-12 Q2-99	06/14/1999	0.1	3.6	92	0.03	0.04	18.1	2.55	2.5	6.94	NA	53.3	24	0.02 U	0.03	12.8	1.24	124	NA	1.38	55.9	0.043	10.2	52.7
MW-12	MW-12 Q3-99	09/22/1999	50 U	5 U	83	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	137	NA	35.1	61	0.567	10.2	55.4
MW-12	MW-12 Q4-99	12/09/1999	50 U	5 U	90	5 U	4 U	5 U	10 U	10 U	2 U	NA	41	5 U	10 U	5 U	16	10 U	137	NA	9.18	62	0.167	11	55.8
MW-12	MW-12 Q1-00	03/15/2000	50 U	10 U	80	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	132	NA	4.02	62.2	0.071	8.8	57.8
MW-12	MW-12 Q2-00	06/21/2000	50 U	5 U	84	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	122	NA	5.93	55.8	0.1	8.7	49.3
MW-12	MW-12 Q3-00	09/27/2000	50 U	5 U	80	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	122	NA	1.53	56.6	0.026	8.2	49.7
MW-12	MW-12 Q4-00	12/05/2000	50 U	5 U	87	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	121	NA	1.87	58.4	0.033	9	52.4
MW-12	MW-12 Q1-01	03/27/2001	50 U	5 U	94	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	18	10 U	136	NA	0.942	62.1	0.018	8.63	53.2
MW-12	MW-12 Q2-01	06/27/2001	50 U	5 U	85	5 U	4 U	5 U	26	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	135	NA	2.47	62	0.05	8.3	51.2
MW-12	MW-12 Q3-01	09/06/2001	50 U	5 U	82	5 U	5 U	5 U	11	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	133	NA	1.49	61.2	0.031	9.36	50.1
MW-12	MW-12 Q4-01	12/14/2001	50 U	5 U	88.5	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	15.9	10 U	133	NA	0.652	61.3	0.0195	9.24	50.4
MW-12	MW-12 Q1-02	03/27/2002	50 U	5 U	85.4	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	12	10 U	131	NA	0.884	61.9	0.0197	8.82	49.2
MW-12	MW-12 Q2-02	06/13/2002	50 U	5 U	89	5 U	5 U	6	19	10 U	2 U	NA	20 U	10 U	10 U	5 U	20	10 U	131	NA	1.2	62.4	0.0228	9.67	50.8
MW-12	MW-12 Q3-02	09/18/2002	50 U	5 U	84.6	5 U	5 U	5 U	17	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	124	NA	1.24	58.4	0.0251	8.63	47.1
MW-12	MW-12 Q4-02	12/17/2002	50 U	5 U	83.4	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	12.7	10 U	124	NA	0.423	60.2	0.0086	8.41	47.9
MW-12	MW-12 Q1-03	03/26/2003	50 U	5 U	80.2	5 U	5 U	8	30	10 U	2 U	NA	20 U	10 U	10 U	5 U	13	10 U	122	0.01 U	5.53	57.2	0.0952	8.54	45.2
MW-12	MW-12 Q2-03	06/26/2003	50 U	5 U	78	5 U	5 U	6.6	12	10 U	2 U	NA	20 U	10 U	10 U	5 U	17	10 U	127	0.01 U	0.382	56	0.0085	7.63	43.5
MW-12	MW-12 Q3-03	09/25/2003	50 U	5 U	72	5 U	5 U	7.1	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	11	10 U	123	0.01 U	0.173	55.5	0.0074	7.97	42.8
MW-12	MW-12 Q4-03	12/18/2003	50 U	8 U	75	5 U	5 U	7.6	11	10 U	2 U	NA	20 U	8 U	10 U	5 U	14	10 U	127	0.01 U	0.131	55.4	0.005 U	8.32	44.1
MW-12	MW-12 Q1-04	03/17/2004	50 U	5 U	78	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13.2	10 U	127	NA	0.16	58.7	0.005 U	9.19	44.1
MW-12	MW-12 Q2-04	06/17/2004	50 U	5 U	75.3	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	14	10 U	124	NA	0.603	60.5	0.0106	9.19	45.2
MW-12	MW-12 Q3-04	09/30/2004	50 U	5 U	81.9	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	16	10 U	130	NA	0.604	59.2	0.0132	8.44	44.5
MW-12	MW-12 Q4-04	12/15/2004	50 U	5 U	78.8	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15.5	10 U	125	NA	0.182	58.1	0.005 U	8.65	42.7
MW-12	MW-12 Q1-05	03/31/2005	50 U	5 U	79	5 U	5 U	5 U	26	10 U	2 U	NA	20 U	10 U	10 U	5 U	16	10 U	127	NA	1.92	58.4	0.0447	7.67	43.7
MW-12	MW-12 Q2-05	06/23/2005	50 U	5 U	82	5 U	5 U	5 U	14	10 U	4 U	NA	20 U	5 U	10 U	5 U	12	10 U	126	NA	0.443	58.1	0.012	8.82	43.2
MW-12	MW-12 Q3-05	09/29/2005	50 U	5 U	80.6	5 U	5 U	5 U	88	10 U	2 U	NA	20 U	5 U	10 U	5 U	10	10 U	12.8	NA	1.32	60.7	0.0249	8.4	46.6
MW-12	MW-12 Q1-06	03/30/2006	50 U	5 U	76.5	5 U	5 U	5 U	107	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	143	NA	4.59	58.8	0.091	9.65	42
MW-12	MW-12 Q2-06	06/21/2006	50 U	5 U	90.6	5 U	5 U	5 U	189	15	2 U	NA	37	5 U	10 U	5 U	17	10 U	138	NA	0.287	63.6	0.0277	9.31	45.6
MW-12	MW-12 Q3-06	09/21/2006	50 U	5 U	86.3	5 U	5 U	5 U	85	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	132	NA	0.738	60.1	0.018	9.2	43.5
MW-12	MW-12 Q3-07	09/26/2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	123	NA	7.98	57.7	0.19	9.1	43.3

TABLE G3
HISTORICAL SUMMARY OF METALS GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Calcium (mg/L)	Cyanide (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Sodium (mg/L)
Upgradient Wells Continued																									
MW-12b	MW-12b Q3-08	09/24/2008	50 U	5 U	86.5	5 U	5 U	5 U	10 U	10 U	10 U	NA	20 U	5 U	10 U	5 U	14	10 U	111	NA	0.228	52.3	0.0053	8.11	29.5
MW-12b	MW-12b Q4-08	12/17/2008	50 U	5 U	73	5 U	5 U	5 U	10 U	10 U	10 U	NA	20 U	5 U	10 U	5 U	12	10 U	112	NA	0.093	52.7	0.005 U	7.96	30.8
MW-12b	MW-12b Q1-09	03/20/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	120	NA	0.088	55.3	0.005 U	8.46	33.5
MW-12b	MW-12b Q2-09	06/24/2009	50 U	5 U	86.1	5 U	5 U	5 U	10 U	10 U	10 U	NA	20 U	5 U	10 U	5 U	14	10 U	118	NA	0.0448	54.7	0.005 U	8.14	33.4
MW-12b	MW-12b Q3-09	09/24/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	118	NA	0.024	54	0.005 U	8.14	34.2
MW-12b	MW-12b Q4-09	12/18/2009	50 U	5 U	85.2	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13.6	10 U	120	NA	0.0362	56.7	0.005 U	8.4	35.4
MW-12b	MW-12b Q2-10	06/23/2010	50 U	5 U	84.5	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	4 U	10 U	5 U	15	10 U	117	NA	5.71	52.4	0.0835	8.66	32.7
MW-12b	MW-12b Q3-10	09/29/2010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	117	NA	0.235	54.6	0.005 U	8.33	33.5
MW-12b	MW-12b Q4-10	12/15/2010	50 U	5 U	71.6	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	117	NA	0.101	53.1	0.005 U	8.1	33.2
MW-12b	MW-12b Q1-2011	03/24/2011	50 U	5 U	79.2	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	14.5	10 U	113	NA	0.2	52	0.005 U	7.77	32.6
MW-12b	MW-12b Q2-2011	6/21/2011	50 U	5 U	66	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	108	NA	0.02 U	49.3	0.005 U	7.49	29.5
MW-12b	MW-12b Q3-2011	9/28/2011	50 U	5 U	73	5 U	5 U	10 U	10 U	10 U	2 U	NA	20 U	4 U	20 U	5 U	20 U	10 U	112	NA	0.095	52.2	0.0050 U	7.88	30.6
MW-12b	MW-12b Q4-2011	12/14/2011	50 U	5 U	74.8	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16.1	10 U	103	NA	0.0224	48.9	0.0050 U	7.37	30.30
MW-12b	MW-12b Q1-2012	3/28/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	109.0	NA	0.047	49.9	0.005 U	7.87	31.9
Downgradient Wells																									
MW-01	MW-1 Q1-91	01/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.9	NA	0.005	NA	NA
MW-01	MW-1 Q2-91	04/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02	NA	0.005	NA	NA
MW-01	MW-1 Q3-91	07/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.69	NA	0.04	NA	NA
MW-01	MW-1 Q4-91	10/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.16	NA	0.05	NA	NA
MW-01	MW-1 Q1-92	01/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.025	NA	0.001	NA	NA
MW-01	MW-1 Q2-92	04/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.48	NA	0.001	NA	NA
MW-01	MW-1 Q3-92	07/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.38	NA	0.001	NA	NA
MW-01	MW-1 Q4-92	10/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.12	NA	0.001	NA	NA
MW-01	MW-1 Q1-93	01/01/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.2	NA	0.006	NA	NA
MW-01	MW-1 Q2-93	04/01/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.438	NA	0.014	NA	NA
MW-01	MW-1 Q3-93	07/01/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.096	NA	0.0003 U	NA	NA
MW-01	MW-1 Q4-93	10/01/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.432	NA	0.001	NA	NA
MW-01	MW-1 Q2-94	04/01/1994	NA	7.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-01	MW-1 Q3-94	08/01/1994	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	82.5	NA	NA	43.8	NA	6.6	13.3
MW-01	MW-1 Q3(Sept)-94	09/01/1994	10 U	0.01 U	NA	0.002 U	2 U	9.8	0.005 U	2 U	2 U	NA	50 U	5 U	5 U	0.002 U	0.015 U	80 U	86.7	NA	NA	40.2	NA	7	11.1
MW-01	MW-1 Q4-94	10/01/1994	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-01	MW-1 Q4(Nov)-94	11/01/1994	10 U	0.01 U	NA	0.002 U	2 U	9.9	0.005 U	2 U	2 U	NA	50 U	5 U	5 U	0.002 U	0.016	80 U	72.8	NA	0.005 U	38.3	NA	7.6	11.8
MW-01	MW-1 Q4(Dec)-94	12/01/1994	10 U	0.01 U	NA	0.002 U	2 U	8.5	0.005 U	2 U	2 U	NA	50 U	5 U	5 U	0.002 U	0.012	80 U	81.6	NA	0.005 U	36	NA	6.7	12.8
MW-01	MW-1 Q1-95	01/01/1995	10 U	10 U	220	2 U	2 U	12.4	10 U	2.8	2 U	NA	50 U	5 U	10 U	2 U	12	80 U	70.8	NA	0.005 U	29.3	0.001 U	10.3	52.4
MW-01	MW-1 Q1(Feb)-95	02/01/1995	5 U	10 U	380	2 U	2 U	10 U	10 U	20 U	2 U	NA	40 U	5 U	5 U	2 U	55	50 U	51.1	NA	0.08	19.9	0.001 U	6.3	9.2
MW-01	MW-1 Q3-95	07/01/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 U	5 U	NA	NA	30 U	82.9	NA	NA	37	NA	7.5	13.5
MW-01	MW-1 Q1(Sep)-95	09/20/1995	0.04	0.5 U	61	0.02 U	0.08	0.7	0.42	0.72	0.12	NA	6.6	5 U	0.06	0.02 U	10.6	11.4	58.8	NA	0.027	86.2	0.00016	6.5	12.7
MW-01	MW-1 Q4-95	12/18/1995	0.04	0.5 U	65.8	0.02 U	0.08	1.4	0.16	1.97	0.28	NA	1.6	5 U	0.02 U	0.02 U	12.8	5.2	114.2	NA	0.079	42.5	0.00099	6.43	14.99
MW-01	MW-1 Q1-96	02/01/1996	0.02 U	0.5	61.7	0.02 U	0.07	2.5	0.14	1.55	0.06	NA	1.7	5 U	0.02 U	0.02 U	13.2	5.7	NA	NA	0.027	NA	0.00012	NA	NA
MW-01	MW-1 Q2-96	05/01/1996	0.02 U	0.6	63.9	0.02 U	0.16	0.8	0.36	1.3	0.17	NA	4.3	5 U	0.1	0.02 U	12	10.7	NA	NA	NA	NA	NA	NA	NA
MW-01	MW-1 Q3-96	09/01/1996	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	90.2	NA	0.052	41.6	0.005 U	7	12.5
MW-01	MW-1 Q4-96	10/01/1996	0.5 U	5	57	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10	89.7	NA	0.071	41.2	0.005 U	6.2	12.3
MW-01	MW-1 Q1-97	03/24/1997	50 U	5 U	58	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	11	79.2	NA	0.087	36.9	0.005 U	6.58	12
MW-01	MW-1 Q2-97	06/24/1997	50 U	5 U	60 U	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	84	NA	0.063	38.8	0.005 U	7.1	12.1

TABLE G3
HISTORICAL SUMMARY OF METALS GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Calcium (mg/L)	Cyanide (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Sodium (mg/L)
Downgradient Wells Continued																									
MW-01	MW-1 Q3-97	09/11/1997	50 U	5 U	62	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	56	78.6	NA	0.034	36.2	0.005 U	6.61	11.6
MW-01	MW-1 Q1-98	03/25/1998	50 U	5 U	60	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	82.6	NA	0.72	37.2	0.005 U	6.8	12.5
MW-01	MW-1 Q2-98	06/29/1998	50 U	5 U	59	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	81.2	NA	0.043	37.2	0.005 U	6	12.2
MW-01	MW-1 Q3-98	09/21/1998	0.04 U	1 U	62.1	0.04 U	0.2	1.3	0.47	1.2	0.12	NA	12.5	5 U	0.04 U	0.04 U	12	3	82.2	NA	0.08	39.1	0.00122	7.9	1.2
MW-01	MW-1 Q1-99	03/03/1999	50 U	5 U	54	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	81.1	NA	0.267	37.3	0.006	6.4	11.5
MW-01	MW-1 Q2-99	06/14/1999	0.02 U	2.3	56.8	0.02 U	0.11	4.5	0.57	1.5	0.41	NA	7.6	15	0.02 U	0.04	10.9	2.5	82.9	NA	0.102	37.4	0.005 U	7.7	12
MW-01	MW-1 Q3-99	09/22/1999	50 U	5 U	53	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	76.1	NA	0.029	34.3	0.005 U	6.1	11.6
MW-01	MW-1 Q4-99	12/09/1999	50 U	5 U	55	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	77.4	NA	0.167	35.9	0.006	6.5	11.9
MW-01	MW-1 Q1-00	03/15/2000	50 U	10 U	54	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	18	10 U	75.4	NA	0.136	35.5	0.005 U	5.9	12.3
MW-01	MW-1 Q2-00	06/21/2000	50 U	5 U	49	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	72.9	NA	0.09	33.8	0.005 U	6.1	11.4
MW-01	MW-1 Q3-00	09/27/2000	50 U	5 U	49	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	72.4	NA	0.077	33.3	0.005 U	6	11.1
MW-01	MW-1 Q4-00	12/05/2000	50 U	5 U	53	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	71.2	NA	0.098	34.3	0.005 U	6.4	11.8
MW-01	MW-1 Q1-01	03/27/2001	50 U	5 U	56	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	76.6	NA	0.061	35.1	0.005	5.82	12.1
MW-01	MW-1 Q2-01	06/27/2001	50 U	5 U	54	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	78.1	NA	0.063	35.8	5 U	5.4	11.8
MW-03	MW-3 Q1-91	01/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	NA	0.005	NA	NA
MW-03	MW-3 Q2-91	04/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.03	NA	0.005	NA	NA
MW-03	MW-3 Q3-91	07/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.12	NA	0.005	NA	NA
MW-03	MW-3 Q4-91	10/01/1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.09	NA	0.05	NA	NA
MW-03	MW-3 Q1-92	01/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05	NA	0.005	NA	NA
MW-03	MW-3 Q2-92	04/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.51	NA	0.005	NA	NA
MW-03	MW-3 Q3-92	07/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.42	NA	0.002	NA	NA
MW-03	MW-3 Q4-92	10/01/1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.029	NA	0.0005	NA	NA
MW-03	MW-3 Q1-93	01/01/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.9	NA	0.003	NA	NA
MW-03	MW-3 Q2-93	04/01/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2	NA	0.0003 U	NA	NA
MW-03	MW-3 Q3-93	07/01/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11	NA	0.0003 U	NA	NA
MW-03	MW-3 Q4-93	10/01/1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.383	NA	0.0003 U	NA	NA
MW-03	MW-3 Q2-94	04/01/1994	NA	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-03	MW-3 Q3-94	08/01/1994	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	93.2	NA	NA	44.8	NA	6.6	17
MW-03	MW-3 Q3(Sept)-94	09/01/1994	10 U	0.01 U	NA	0.002 U	2 U	10.2	0.005 U	2 U	2 U	NA	50 U	5 U	NA	0.005 U	0.016	80 U	88.7	NA	NA	44.8	NA	7.1	14.3
MW-03	MW-3 Q4-94	10/01/1994	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	50 U	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-03	MW-3 Q4(Nov)-94	11/01/1994	10 U	0.01 U	NA	0.002 U	2 U	7.7	0.005 U	2 U	2 U	NA	50 U	5 U	5 U	0.005 U	0.014	80 U	73.7	NA	5 U	41	NA	7.6	16.3
MW-03	MW-3 Q4(Dec)-94	12/01/1994	10 U	0.01 U	NA	0.002 U	2 U	9.2	0.005 U	2 U	2 U	NA	50 U	5 U	5 U	0.005 U	0.016	80 U	79.8	NA	5 U	37	NA	7.6	16.8
MW-03	MW-3 Q1-95	01/01/1995	10 U	10 U	230	2 U	2 U	14.5	10 U	2 U	2 U	NA	50 U	5 U	5 U	2 U	14	80 U	68.9	NA	5 U	29.8	10 U	7	12.8
MW-03	MW-3 Q1(Feb)-95	02/01/1995	5 U	10 U	390	2 U	3	10 U	10 U	20 U	2 U	NA	40 U	5 U	10 U	2 U	10 U	50 U	50.9	NA	50	21.6	10 U	6.3	11.4
MW-03	MW-3 Q3-95	07/01/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 U	5 U	NA	NA	30 U	101.4	NA	NA	46.3	NA	7.7	16.3
MW-03	MW-3 Q3(Sept)-95	09/20/1995	0.1	0.6	62.4	0.02 U	0.06	1.6	0.36	2.69	0.19	NA	8.6	5 U	0.07	0.02	12.4	6.4	NA	NA	0.021	NA	0.00035	NA	NA
MW-03	MW-3 Q4-95	12/18/1995	0.05	0.5 U	76.2	0.02 U	0.04	1.9	0.17	2.52	0.23	NA	3.5	5 U	0.02 U	0.02 U	14.9	4.4	112.9	NA	0.044	47.6	0.00038	6.62	20.5
MW-03	MW-3 Q1-96 Dup	02/01/1996	0.02 U	0.5	61.8	0.02 U	0.03	2.5	0.11	1.33	0.06	NA	1.7	5 U	0.02 U	0.02 U	15.5	3.4	NA	NA	0.021	NA	0.00011	NA	NA
MW-03	MW-3 Q1-96	02/01/1996	0.02 U	0.5 U	59.9	0.02 U	0.02 U	2.7	0.11	1.37	0.06	NA	1.9	5 U	0.02 U	0.02 U	15.5	7	NA	NA	0.02 U	NA	0.00029	NA	NA
MW-03	MW-3 Q2-96	05/01/1996	0.04	0.5	75.8	0.02 U	0.27	1.9	0.36	2.9	0.64	NA	5.1	5 U	0.2	0.02 U	13.3	23	NA	NA	NA	NA	NA	NA	NA
MW-03	MW-3 Q3-96	09/01/1996	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	110	NA	0.042	53.3	0.005 U	8.1	18.7
MW-03	MW-3 Q4-96	10/01/1996	50 U	50 U	73	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	93.3	NA	0.034	45.2	0.005 U	7.4	16.5
MW-03	MW-3 Q1-97	03/24/1997	50 U	5 U	76	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10	93.9	NA	0.032	46.1	0.005 U	6.96	16.4
MW-03	MW-3 Q2-97	06/24/1997	50 U	5 U	84	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	99.9	NA	0.046	49	0.005 U	7.4	17

TABLE G3
HISTORICAL SUMMARY OF METALS GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Calcium (mg/L)	Cyanide (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Sodium (mg/L)
Downgradient Wells Continued																									
MW-03	MW-3 Q3-97	09/11/1997	50 U	5 U	82	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	98.5	NA	0.027	48.6	0.005 U	7.27	17.5
MW-03	MW-3 Q4-97	11/25/1997	50 U	5 U	5 U	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	19	10 U	62.8	NA	0.095	37.2	0.005 U	7	19.2
MW-03	MW-3 Q1-98	03/25/1998	50 U	5 U	67	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	90.9	NA	0.48	44.8	0.005 U	7.2	17.9
MW-03	MW-3 Q2-98	06/29/1998	50 U	5 U	82	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	95.6	NA	0.055	46.8	0.005 U	6.3	17.1
MW-03	MW-3 Q3-98	09/21/1998	0.04 U	1 U	79.8	0.04 U	0.2	1.2	0.52	1.4	0.08	NA	11.6	5 U	0.05	0.04 U	12.8	2	96.2	NA	0.032	47.6	0.00025	8.1	16.5
MW-03	MW-3 Q4-98	12/30/1998	50 U	5 U	37	5 U	4 U	5 U	10 U	18	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	29.5	NA	0.648	43.1	0.022	9.4	32.8
MW-03	MW-3 Q1-99	03/03/1999	50 U	5 U	33	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	26.4	NA	0.126	40.8	0.005 U	8.4	29
MW-03	MW-3 Q2-99	06/14/1999	0.02 U	4.1	86.4	0.02 U	0.04	8.8	0.8	1.3	0.1	NA	10.4	28	0.02 U	0.03	13	2.8	107	NA	0.094	50.6	0.005 U	8.5	17.2
MW-03	MW-3 Q3-99	09/22/1999	50 U	5 U	42	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	104	NA	0.265	49.4	0.006	6.4	16.4
MW-03	MW-3 Q4-99	12/09/1999	50 U	5 U	79	5 U	4 U	5 U	10 U	10 U	2 U	NA	330	5 U	10 U	5 U	16	10 U	97.4	NA	0.373	54.4	0.011	8.1	18.5
MW-03	MW-3 Q1-00	03/15/2000	50 U	10 U	82	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	106	NA	0.06	52.8	0.005 U	6.9	18.3
MW-03	MW-3 Q2-00	06/21/2000	50 U	5 U	82	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	18	10 U	105	NA	0.051	49.6	0.005 U	7.1	16.7
MW-03	MW-3 Q3-00	09/27/2000	50 U	5 U	75	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	18	10 U	97	NA	0.042	47.8	0.005 U	6.8	17
MW-03	MW-3 Q4-00	12/05/2000	50 U	5 U	80	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	92.3	NA	0.199	47.7	0.006	7.1	17.6
MW-03	MW-3 Q1-01	03/27/2001	50 U	5 U	77	5 U	4 U	5 U	10 U	10 U	2 U	NA	78	5 U	10 U	5 U	18	10 U	88.2	NA	0.054	42	0.005	6.28	17.8
MW-03	MW-3 Q2-01	06/27/2001	50 U	5 U	84	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	18	10 U	108	NA	0.062	52.3	5 U	6.5	17.5
MW-11	MW-11 Q1-95	03/01/1995	5 U	10 U	500	2 U	3	10 U	10 U	20 U	2 U	NA	4 U	5 U	10 U	2 U	40	50 U	66.6	NA	NA	36	0.027	10.3	1
MW-11	MW-11 Q1-95 Dup	03/01/1995	5 U	10 U	410	2 U	3	10 U	10 U	20 U	2 U	NA	4 U	5 U	10 U	2 U	37	NA	NA	NA	NA	NA	NA	NA	NA
MW-11	MW-11 Q3-95	07/01/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 U	5	NA	NA	30 U	151.8	NA	NA	54.1	NA	9.9	48.7
MW-11	MW-11 Q3-95 Dup	07/01/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 U	5	NA	NA	30 U	149.1	NA	NA	53.6	NA	9.9	49.2
MW-11	MW-11 Q3(Sept)-95	09/20/1995	0.05	0.05 U	109	0.02 U	0.06	1.7	0.6	0.61	0.05	NA	9.7	5 U	0.08	0.02 U	9.1	1.2	71.6	NA	0.035	96.5	0.00048	8.6	46.3
MW-11	MW-11 Q3(Sept)-95 Dup	09/20/1995	0.03	0.05 U	109	0.02 U	0.06	1.7	0.64	1.03	0.07	NA	9.3	5 U	0.03	0.02 U	9.4	1.8	71.29	NA	0.035	126.1	0.00054	8.5	45.6
MW-11	MW-11 Q4-95	10/30/1995	0.02 U	0.5 U	113	0.1	0.05	8.1	0.57	0.97	0.05	NA	8.4	5 U	0.02 U	0.02 U	11.7	3.9	141.9	NA	0.038	59	0.00047	8.5	45.1
MW-11	MW-11 Q4-95 Dup	10/30/1995	0.02 U	0.5 U	113	0.09	0.05	8.2	0.56	1.02	0.05	NA	7.7	5 U	0.02 U	0.02 U	11.6	3.7	142.3	NA	0.039	60.2	0.00044	8.5	45.1
MW-11	MW-11 Q4(Nov)-95	11/29/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	111.88	NA	NA	52.33	NA	8.75	53.63
MW-11	MW-11 Q4(Nov)-95 Dup	11/29/1995	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	111.18	NA	NA	55.57	NA	9.05	53.23
MW-11	MW-11 Q4(Dec)-95	12/18/1995	0.13	0.6	133	0.11	0.18	6.5	3.47	37.4	3.57	NA	18.3	5 U	0.02 U	0.03	16.3	17.3	186.4	NA	7.86	59.5	0.0822	8.7	55.7
MW-11	MW-11 Q1-96	02/01/1996	0.02 U	0.5 U	95.7	0.02 U	0.02	5.3	1.5	0.88	0.03	NA	2.9	5 U	0.02 U	0.02 U	11.5	4.3	NA	NA	0.034	NA	0.00107	NA	NA
MW-11	MW-11 Q2-96	05/01/1996	0.03	0.5 U	107	0.02 U	0.04	1.6	1.8	2.6	0.27	NA	6.4	5 U	0.21	0.02 U	10	1.5	NA	NA	0.038	NA	0.0017	NA	NA
MW-11	MW-11 Q2-96 Dup	05/01/1996	0.02	0.5 U	109	0.02 U	0.04	1.6	1.9	0.6	0.16	NA	6.3	5 U	0.64	0.02 U	10.2	0.9	NA	NA	0.041	NA	0.00128	NA	NA
MW-11	MW-11 Q3-96	09/01/1996	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	129	NA	0.116	51.6	0.005 U	9.2	45.9
MW-11	MW-11 Q4-96	10/01/1996	50 U	5 U	94	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	133	NA	0.316	52.8	0.007	8.8	46.5
MW-11	MW-11 Q1-97	03/24/1997	50 U	5 U	96	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	130	NA	2.53	53.1	0.044	9.46	48
MW-11	MW-11 Q2-97	06/24/1997	50 U	5 U	107	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	135	NA	0.152	54	0.005 U	9.8	51.1
MW-11	MW-11 Q3-97	09/11/1997	50 U	5 U	100	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	132	NA	0.338	53.6	0.009	9.71	53.1
MW-11	MW-11 Q4-97	11/25/1997	50 U	5 U	5 U	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	18	10 U	129	NA	1.04	51.9	0.02	9.6	50.4
MW-11	MW-11 Q1-98	03/25/1998	50 U	5 U	99	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	133	NA	1.4	52.5	0.032	9.9	54.1
MW-11	MW-11 Q2-98	06/29/1998	50 U	5 U	86	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	125	NA	0.129	49.9	0.005 U	7.9	51.2
MW-11	MW-11 Q3-98	09/21/1998	0.09	1 U	106	0.05	0.3	3.4	1.18	1.9	0.64	NA	16	5 U	0.05	0.04 U	10.6	2	132	NA	2.04	54	0.0174	10.8	53.5
MW-11	MW-11 Q4-98	12/30/1998	50 U	5 U	101	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	142	NA	3.56	56	0.051	10.7	56.5
MW-11	MW-11 Q1-99	03/03/1999	50 U	5 U	102	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	10 U	134	NA	0.305	54.1	0.005	9.23	52.8
MW-11	MW-11 Q2-99	06/14/1999	0.02 U	2.6	103	0.02 U	0.03	11.8	1.26	1.3	0.08	NA	13.7	18	0.02 U	0.04	11.2	0.33	133	NA	0.308	52.1	0.005	10.8	53.2
MW-11	MW-11 Q3-99	09/22/1999	50 U	5 U	95	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	129	NA	0.485	50.9	0.005	9.1	54.1
MW-11	MW-11 Q4-99	12/09/1999	50 U	5 U	108	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	134	NA	0.189	53.8	0.005 U	10	54.4

TABLE G3
HISTORICAL SUMMARY OF METALS GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Calcium (mg/L)	Cyanide (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Sodium (mg/L)
Downgradient Wells Continued																									
MW-11	MW-11 Q1-00	03/15/2000	50 U	10 U	104	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	129	NA	0.554	52.5	0.01	9.2	55.8
MW-11	MW-11 Q2-00	06/21/2000	50 U	5 U	97	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	125	NA	0.02 U	49	0.005 U	8.5	49.8
MW-11	MW-11 Q3-00	09/27/2000	50 U	5 U	92	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	10 U	124	NA	0.109	50.5	0.005 U	9	53
MW-11	MW-11 Q4-00	12/05/2000	50 U	5 U	99	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	123	NA	0.455	52	0.007	9.7	55.1
MW-11	MW-11 Q1-01	03/27/2001	50 U	5 U	110	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	131	NA	0.03	52.3	0.006	9.46	56.1
MW-11	MW-11 Q2-01	06/27/2001	50 U	5 U	105	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	10 U	133	NA	20 U	52.7	5 U	9	54.2
MW-11	MW-11 Q3-01	09/06/2001	50 U	5 U	95	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	10 U	129	NA	0.07	52	0.005 U	9.86	54
MW-11	MW-11 Q4-01	12/14/2001	50 U	5 U	105	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	13.1	10 U	133	NA	0.02 U	53.3	0.005 U	9.82	55.1
MW-11	MW-11 Q1-02	03/27/2002	50 U	5 U	100	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	12	10 U	126	NA	0.104	52.1	0.005 U	8.9	52.6
MW-11	MW-11 Q2-02	06/13/2002	50 U	5 U	107	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	14	10 U	131	NA	2.08	54.9	0.0344	10.5	57.3
MW-11	MW-11 Q3-02	09/18/2002	50 U	5 U	96.2	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	129	0.01 U	0.02 U	52.9	0.005 U	10.1	55
MW-11	MW-11 Q4-02	12/17/2002	50 U	5 U	106	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	11.4	10 U	129	0.01 U	0.102	54.4	0.005 U	9.83	55.8
MW-11	MW-11 Q1-03	03/26/2003	50 U	5 U	97.3	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	14	10 U	121	0.01 U	1.31	50	0.0256	9.4	51.7
MW-11	MW-11 Q2-03	06/26/2003	50 U	5 U	95	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	16	10 U	133	0.01 U	0.02 U	51.7	0.005 U	9.26	53.8
MW-11	MW-11 Q3-03	09/25/2003	50 U	5 U	88	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	12	10 U	122	NA	1.69	49.1	0.03	8.73	50.5
MW-11	MW-11 Q4-03	12/18/2003	50 U	8 U	88	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	8 U	10 U	5 U	14	10 U	127	NA	0.183	48.9	0.005 U	9.31	52.5
MW-11	MW-11 Q1-04	03/17/2004	50 U	5 U	89.4	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13.5	10 U	122	NA	0.026	49.8	0.005 U	10.3	52.6
MW-11	MW-11 Q2-04	06/17/2004	50 U	5 U	87.2	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	13	10 U	117	NA	0.427	49.7	0.0063	9.78	52.8
MW-11	MW-11 Q3-04	09/30/2004	50 U	5 U	90.4	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	12	10 U	120	NA	0.072	47.4	0.005 U	9.49	51.8
MW-11	MW-11 Q4-04	12/15/2004	50 U	5 U	94.6	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15.1	10 U	117	NA	0.104	47.6	0.005 U	9.21	51.5
MW-11	MW-11 Q1-05	03/31/2005	50 U	5 U	87	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	13	10 U	116	NA	0.45	46.7	0.0102	8.49	51.7
MW-11	MW-11 Q2-05	06/23/2005	50 U	5 U	91	5 U	5 U	5 U	10 U	10 U	4 U	NA	20 U	5 U	10 U	5 U	11	10 U	115	NA	0.142	46.3	0.005 U	10	51.4
MW-11	MW-11 Q3-05	09/29/2005	50 U	5 U	92.9	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	117	NA	0.038	48.3	0.005 U	8.8	54.7
MW-11	MW-11 Q4-05	12/14/2005	50 U	5 U	89	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	118	NA	0.02 U	46	0.005 U	9.04	50.5
MW-11	MW-11 Q1-06	03/30/2006	50 U	5 U	82.4	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	10 U	10 U	116	NA	0.407	43.3	0.0083	9.83	48.7
MW-11	MW-11 Q2-06	06/21/2006	50 U	5 U	88.9	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	114	NA	0.03	45.8	0.005 U	9.31	49.9
MW-11	MW-11 Q3-06	09/21/2006	50 U	5 U	86.4	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	110	NA	0.128	43.4	0.005 U	10	46.7
MW-11	MW-11 Q4-06	12/28/2006	50 U	5 U	84.8	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	114	NA	0.223	43.9	0.005 U	9.1	47.3
MW-11	MW-11 Q1-07	03/22/2007	50 U	5 U	82.4	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	111	NA	0.454	44.9	0.0071	7.8	49.5
MW-11	MW-11 Q2-07	06/28/2007	50 U	5 U	83.3	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	110	NA	0.406	43.7	0.005 U	10	48.2
MW-11	MW-11 Q3-07	09/26/2007	50 U	5 U	74.3	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	108	NA	0.084	43.1	0.005 U	9	46.8
MW-11	MW-11 Q4-07	12/27/2007	50 U	5 U	78.3	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	10 U	111	NA	0.043	44	0.005 U	8.65	47
MW-11	MW-11 Q1-08	03/27/2008	50 U	5 U	69.8	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	10 U	10 U	101	NA	0.297	41.6	0.005 U	9.3	43.1
MW-11	MW-11 Q2-08	06/25/2008	50 U	5 U	71.7	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	10 U	10 U	103	NA	0.035	41.6	0.005 U	9.11	44.6
MW-11	MW-11 Q3-08	09/24/2008	50 U	5 U	79.8	5 U	5 U	5 U	10 U	10 U	10 U	NA	20 U	5 U	10 U	5 U	13	10 U	96.2	NA	0.02 U	39.7	0.005 U	8.83	43.1
MW-11	MW-11 Q4-08	12/17/2008	50 U	5 U	65	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	94.1	NA	6.23	39.5	0.0939	8.62	40.9
MW-11	MW-11 Q1-09	03/20/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	101	NA	0.02 U	40.7	0.005 U	8.92	44.5
MW-11	MW-11 Q2-09	06/24/2009	50 U	5 U	79.3	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	10 U	97.9	NA	0.0254	39.4	0.005 U	8.46	42.5
MW-11	MW-11 Q3-09	09/24/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	97.6	NA	0.02 U	39.4	0.005 U	8.47	42.7
MW-11	MW-11 Q4-09	12/18/2009	50 U	5 U	77.8	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12.5	10 U	100	NA	0.02 U	40.8	0.005 U	8.66	43.4
MW-11	MW-11 Q1-10	03/30/2010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	95.1	NA	0.02 U	38.5	0.005	8.44	41.1
MW-11	MW-11 Q2-10	06/23/2010	50 U	5 U	77.7	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	4 U	10 U	5 U	14	10 U	95.8	NA	0.05 U	37.3	0.005 U	8.35	38.9
MW-11	MW-11 Q3-10	09/29/2010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	98.4	NA	0.569	39.5	0.0101	8.73	40.5
MW-11	MW-11 Q4-10	12/15/2010	50 U	5 U	63.9	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	95.6	NA	0.027	38.1	0.005 U	8.59	40.2

TABLE G3
HISTORICAL SUMMARY OF METALS GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Calcium (mg/L)	Cyanide (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Sodium (mg/L)
Downgradient Wells Continued																									
MW-11	MW-11 Q1-2011	03/24/2011	50 U	5 U	71.9	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	13.6	10 U	95	NA	0.0353	37.9	0.005 U	8.05	39.6
MW-11	MW-11 Q2-2011	6/21/2011	50 U	5 U	61	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	93.2	NA	0.025	36.8	0.005 U	7.83	36.2
MW-11	MW-11 Q3-2011	9/28/2011	50 U	5 U	68	5 U	5 U	10 U	10 U	10 U	2 U	NA	20 U	16 U	20 U	5 U	20 U	10 U	98.0	NA	0.025	39.5	0.0050 U	8.46	38.6
MW-11	MW-11 Q4-2011	12/14/2011	50 U	5 U	67.6	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14.1	10 U	84.9	NA	0.020 U	35.8	0.0050 U	7.70	36.9
MW-11	MW-11 Q1-2012	3/28/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	91.3	NA	0.020 U	36.5	0.005 U	8.21	38.0
MW-14	MW-14 Q3-99	09/22/1999	50 U	5 U	49	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	102	NA	8.83	36	0.213	7.2	12.4
MW-14	MW-14 Q4-99	12/09/1999	50 U	5 U	64	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	127	NA	24.8	46.6	0.468	9.5	13
MW-14	MW-14 Q1-00	03/15/2000	50 U	10 U	40	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	62.9	NA	1.35	27.5	0.032	4.6	10.6
MW-14	MW-14 Q2-00	06/21/2000	50 U	5 U	32	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	57.9	NA	0.108	25.4	0.008	5	9.96
MW-14	MW-14 Q3-00	09/27/2000	50 U	5 U	35	5 U	4 U	5 U	10 U	10 U	2 U	NA	35	5 U	10 U	5 U	14	10 U	59	NA	0.162	24.6	0.008	4.5	9.93
MW-14	MW-14 Q4-00	12/05/2000	50 U	5 U	31	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	59.7	NA	1.2	24.6	0.24	5.4	10.4
MW-14	MW-14 Q1-01	03/27/2001	50 U	5 U	31	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	22	10 U	51.8	NA	0.267	23.5	0.008	4.09	9.76
MW-14	MW-14 Q2-01	06/27/2001	50 U	15	26	5 U	4 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	20	10 U	51.5	NA	0.334	22.7	0.01	3.2	9.31
MW-14	MW-14 Q3-01	09/06/2001	50 U	5 U	32	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	62.1	NA	0.154	26.3	0.005	5.07	10
MW-14	MW-14 Q4-01	12/14/2001	50 U	5 U	37	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	15.6	10 U	70.2	NA	0.129	29.2	0.0057	5.52	11.2
MW-14	MW-14 Q1-02	03/27/2002	50 U	5 U	25.1	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	20	10 U	57.1	NA	0.082	25.7	0.005 U	4.41	9.98
MW-14	MW-14 Q2-02	06/13/2002	50 U	5 U	30.2	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	18	10 U	61.4	NA	0.122	27.1	0.005 U	5.74	10.6
MW-14	MW-14 Q3-02	09/18/2002	50 U	5 U	25.8	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	19	10 U	56.8	NA	0.035	23.8	0.005 U	4.95	9.86
MW-14	MW-14 Q4-02	12/17/2002	50 U	5 U	39.6	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	10.5	10 U	50.3	0.02	0.213	22.2	0.005 U	4.79	9.57
MW-14	MW-14 Q1-03	03/26/2003	50 U	5 U	33	5 U	5 U	5 U	10 U	10 U	2 U	NA	21	10 U	10 U	5 U	14	10 U	48.2	0.01 U	0.521	21.1	0.0132	4.49	8.69
MW-14	MW-14 Q2-03	06/26/2003	50 U	5 U	35.1	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	18	10 U	69.6	0.01 U	0.45	26.7	0.011	4.98	10.8
MW-14	MW-14 Q3-03	09/25/2003	50 U	5 U	27	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	18	10 U	54.1	0.01 U	0.097	22.4	0.005 U	4.49	9.21
MW-14	MW-14 Q4-03	12/18/2003	50 U	8 U	37	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	8 U	10 U	5 U	11	10 U	86.2	NA	1.72	31.5	0.041	5.94	12.4
MW-14	MW-14 Q1-04	03/17/2004	50 U	5 U	32.8	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	66.5	0.01 U	0.102	27.1	0.005 U	6.06	10.8
MW-14	MW-14 Q2-04	06/17/2004	50 U	5 U	29.2	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	15	10 U	59.2	0.01 U	0.056	25.9	0.005 U	5.19	10.6
MW-14	MW-14 Q3-04	09/30/2004	50 U	5 U	33.7	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	15	10 U	64.1	0.01 U	0.479	24.3	0.0133	4.97	10.4
MW-14	MW-14 Q4-04	12/15/2004	50 U	5 U	34.2	5 U	5 U	6.6	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	18	10 U	63.5	0.01 U	0.113	24.6	0.005 U	5.55	10.7
MW-14	MW-14 Q1-05	03/31/2005	50 U	5 U	32	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	20	10 U	78.1	NA	7.31	31.1	0.0952	5.35	11.8
MW-14	MW-14 Q2-05	06/23/2005	50 U	5 U	25	5 U	5 U	5 U	10 U	10 U	4 U	NA	35	5 U	10 U	5 U	17	10 U	44	NA	0.45	19	0.0114	4.08	8.83
MW-14	MW-14 Q3-05	09/29/2005	50 U	5 U	26.5	5 U	5 U	5 U	10 U	10 U	2 U	NA	44	5 U	10 U	5 U	13	10 U	51.6	NA	0.108	20.8	0.005 U	3.84	10.3
MW-14	MW-14 Q4-05	12/14/2005	50 U	5 U	29	5 U	5 U	5 U	10 U	10 U	2 U	NA	46	5 U	10 U	5 U	15	10 U	54	NA	0.081	21	0.005 U	4.53	9.67
MW-14	MW-14 Q1-06	03/30/2006	50 U	5 U	34.4	5 U	5 U	5.8	10 U	10 U	2 U	NA	62	5 U	10 U	5 U	10	10 U	60.8	NA	1.4	23.7	0.034	5.31	9.73
MW-14	MW-14 Q3-06	09/21/2006	50 U	5 U	30	5 U	5 U	5 U	10 U	10 U	2 U	NA	35	5 U	10 U	5 U	17	10 U	56.3	NA	0.18	21.7	0.005 U	4.7	10.2
MW-14	MW-14 Q4-06	12/28/2006	50 U	5 U	38.8	5 U	5 U	5 U	10 U	10 U	2 U	NA	36	5 U	10 U	5 U	12	10 U	47.3	NA	0.28	19.6	0.0085	4.6	8.56
MW-14	MW-14 Q1-07	03/22/2007	50 U	5 U	25.8	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	18	10 U	81.8	NA	0.818	31.2	0.0198	5.5	12.7
MW-14	MW-14 Q2-07	06/28/2007	50 U	5 U	27.7	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	55.5	NA	0.143	21.7	0.005 U	5.5	10.2
MW-14	MW-14 Q3-07	09/26/2007	50 U	5 U	21.6	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	18	10 U	49.1	NA	0.137	20.4	0.005 U	4.6	9.19
MW-14	MW-14 Q4-07	12/27/2007	50 U	5 U	30.7	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	56.5	NA	0.144	22.3	0.0057	5.35	10
MW-14	MW-14 Q1-08	03/27/2008	50 U	5 U	32.9	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10.5	10 U	5 U	11.5	10 U	85.8	NA	0.439	32.9	0.012	6.37	12.3
MW-14	MW-14 Q2-08	06/25/2008	50 U	5 U	28.4	5 U	5 U	6.1	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	10 U	53.6	NA	0.089	21.9	0.005 U	4.95	9.76
MW-14	MW-14 Q3-08	09/24/2008	50 U	5 U	29.7	5 U	5 U	5.6	10 U	10 U	10 U	NA	20 U	5 U	10 U	5 U	16	10 U	48.2	NA	0.104	19.9	0.005 U	4.46	9.04
MW-14	MW-14 Q4-08	12/17/2008	50 U	5 U	25	5 U	5 U	5.1	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	10 U	49	NA	0.096	20.4	0.005 U	4.46	9.1
MW-14	MW-14 Q1-09	03/20/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	52.7	NA	0.225	21.3	0.0068	4.75	9.71
MW-14	MW-14 Q2-09	06/24/2009	50 U	5 U	36.8	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	68.4	NA	0.143	26.5	0.0057	5.21	11.5

TABLE G3
HISTORICAL SUMMARY OF METALS GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Calcium (mg/L)	Cyanide (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Sodium (mg/L)
Downgradient Wells Continued																									
MW-14	MW-14 Q3-09	09/24/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	63.9	NA	0.049	25.1	0.005 U	5.16	11.2
MW-14	MW-14 Q4-09	12/18/2009	50 U	5 U	36.1	5 U	5 U	5	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14.1	10 U	65.9	NA	1.13	26.7	0.0324	5.4	11.2
MW-14	MW-14 Q1-10	03/30/2010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	79.5	NA	0.507	29.7	0.0133	5.82	12.2
MW-14	MW-14 Q2-10	06/23/2010	50 U	5 U	43.2	5 U	5 U	5.3	10 U	10 U	2 U	NA	20 U	2 U	10 U	5 U	14	10 U	73.7	NA	0.905	27.6	0.0219	5.7	11.2
MW-14	MW-14 Q3-10	09/29/2010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	71.9	NA	1.22	27.2	0.0294	5.68	11
MW-14	MW-14 Q4-10	12/15/2010	50 U	5 U	33.4	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	70.8	NA	1.86	26.4	0.0461	5.65	10.7
MW-14	MW-14 Q1-2011	03/24/2011	50 U	5 U	31.3	5 U	5 U	5.8	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	14.5	10 U	83.3	NA	1.59	31.6	0.0409	5.97	12.4
MW-14	MW-14 Q2-2011	6/21/2011	50 U	5 U	34	5 U	5 U	5.0 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	62.3	NA	0.191	24.0	0.0054	4.80	9.55
MW-14	MW-14 Q3-2011	9/28/2011	50 U	5 U	37	5 U	5 U	10 U	10 U	10 U	2 U	NA	20 U	10 U	20 U	5 U	20 U	10 U	89.2	NA	2.710	33.4	0.0584	6.12	12.8
MW-14	MW-14 Q4-2011	12/14/2011	50 U	5 U	33.8	5 U	5 U	7.7	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16.2	10 U	62.6	NA	0.0499	25.6	0.0050 U	5.05	10.7
MW-14	MW-14 Q1-2012	3/28/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	75.5	NA	0.149	28.8	0.005 U	5.67	12.0
MW-15	MW-15 Q3-01	09/06/2001	50 U	5 U	245	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	170	NA	0.034	56.2	0.025	9.92	102
MW-15	MW-15 Q4-01	12/14/2001	50 U	5 U	240	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	17.9	10 U	175	NA	0.0719	58.3	0.0101	10.1	95.1
MW-15	MW-15 Q1-02	03/27/2002	50 U	5 U	228	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	16	10 U	174	NA	0.061	59.3	0.0072	9.58	93.8
MW-15	MW-15 Q2-02	06/13/2002	58	5 U	320	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	18	10 U	177	NA	0.02 U	60.2	0.0104	11.4	118
MW-15	MW-15 Q3-02	09/18/2002	50 U	5 U	274	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	175	NA	0.047	59.4	0.0073	10.8	99.8
MW-15	MW-15 Q4-02	12/17/2002	50 U	5 U	242	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	13.2	10 U	162	0.01 U	0.163	56.9	0.0065	10.2	87
MW-15	MW-15 Q1-03	03/26/2003	50 U	5 U	263	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	14	10 U	165	0.01 U	0.16	55.7	0.0101	9.46	110
MW-15	MW-15 Q2-03	06/26/2003	50 U	5 U	226	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	16	10 U	176	0.01 U	0.048	56	0.0053	8.56	99.3
MW-15	MW-15 Q3-03	09/25/2003	50 U	5 U	229	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	13	10 U	167	0.01 U	0.026	54	0.005 U	8.7	91.6
MW-15	MW-15 Q4-03	12/18/2003	50 U	8 U	225	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	8 U	10 U	5 U	18	10 U	168	NA	0.064	51.5	0.005	8.95	92.1
MW-15	MW-15 Q1-04	03/17/2004	50 U	5 U	202	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14.8	10 U	158	NA	0.061	53.5	0.005 U	10.3	90.4
MW-15	MW-15 Q2-04	06/17/2004	50 U	5 U	201	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	15	10 U	152	NA	0.024	52.2	0.0051	9.46	94.4
MW-15	MW-15 Q3-04	09/30/2004	50 U	5 U	205	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	14	10 U	154	NA	0.02 U	50.6	0.005 U	8.47	74.7
MW-15	MW-15 Q4-04	12/15/2004	50 U	5 U	202	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	163	NA	0.02 U	55.7	0.005 U	10.1	75
MW-15	MW-15 Q1-05	03/31/2005	50 U	5 U	251	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	16	10 U	178	NA	0.02 U	57.1	0.0165	9.4	124
MW-15	MW-15 Q2-05	06/23/2005	50 U	5 U	221	5 U	5 U	5 U	10 U	10 U	4 U	NA	20 U	5 U	10 U	5 U	14	10 U	167	NA	0.02 U	55.2	0.0185	9.44	87.1
MW-15	MW-15 Q3-05	09/29/2005	50 U	5 U	213	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	168	NA	0.02 U	57.2	0.0163	8.7	75.1
MW-15	MW-15 Q4-05	12/14/2005	50 U	5 U	198	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	170	NA	0.02 U	55.1	0.0246	9.11	69.8
MW-15	MW-15 Q1-06	03/30/2006	50 U	5 U	194	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	174	NA	0.02 U	53	0.038	9.49	74.2
MW-15	MW-15 Q2-06	06/21/2006	50 U	5 U	212	5 U	5 U	5 U	10 U	10 U	2.7	NA	20 U	5 U	10 U	5 U	14	10 U	162	NA	0.02 U	53	0.0436	9.34	75.6
MW-15	MW-15 Q3(Sept)-06	09/21/2006	50 U	5 U	221	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	167	NA	0.02 U	53.2	0.0521	9.38	82.2
MW-15	MW-15 Q4-06	12/28/2006	50 U	5 U	226	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	173	NA	0.02 U	52.5	0.0641	9.2	90.5
MW-15	MW-15 Q1-07	03/22/2007	50 U	5 U	200	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	17	10 U	163	NA	0.02 U	52.2	0.0588	8.8	86.5
MW-15	MW-15 Q2-07	06/28/2007	50 U	5 U	211	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	169	NA	0.02 U	55.4	0.0477	10.1	78
MW-15	MW-15 Q3-07	09/26/2007	50 U	5 U	188	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	13	10 U	169	NA	0.795	55.1	0.0655	9.4	81.1
MW-15	MW-15 Q4-07	12/27/2007	50 U	5 U	208	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	163	NA	0.02 U	53.5	0.0505	8.98	66.8
MW-15	MW-15 Q1-08	03/27/2008	50 U	5 U	163	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	11.8	10 U	149	NA	0.02 U	51.3	0.0369	9.38	57
MW-15	MW-15 Q2-08	06/25/2008	50 U	5 U	178	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	160	NA	0.024	52.8	0.0375	9.12	62.2
MW-15	MW-15 Q3-08	09/24/2008	50 U	5 U	193	5 U	5 U	5 U	10 U	10 U	10 U	NA	20 U	5 U	10 U	5 U	15	10 U	151	NA	0.02 U	51.3	0.04	9.02	61.7
MW-15	MW-15 Q4-08	12/17/2008	50 U	5 U	151	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	11	10 U	145	NA	0.02 U	49.4	0.0273	8.38	59
MW-15	MW-15 Q1-09	03/20/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	158	NA	0.02 U	53.2	0.0342	9.01	57.2
MW-15	MW-15 Q2-09	06/24/2009	50 U	5 U	198	5 U	5 U	5 U	10 U	19	2 U	NA	20 U	5 U	10 U	5 U	14	10 U	160	NA	0.02 U	53	0.0409	8.86	66.5
MW-15	MW-15 Q3-09	09/24/2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159	NA	0.02 U	52.5	0.0343	8.87	65.5

TABLE G3
HISTORICAL SUMMARY OF METALS GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter Sample Date	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Lead (µg/L)	Mercury (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Thallium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Calcium (mg/L)	Cyanide (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Sodium (mg/L)
Downgradient Wells Continued																									
MW-15	MW-15 Q4-09	12/18/2009	50 U	5 U	194	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	14.2	10 U	161	NA	0.02 U	53.8	0.0331	8.86	62.1
MW-15	MW-15 Q1-10	03/30/2010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159	NA	0.02 U	52.9	0.0327	8.78	58.2
MW-15	MW-15 Q2-10	06/23/2010	50 U	5 U	186	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16	10 U	159	NA	0.02 U	50.3	0.036	8.76	52.6
MW-15	MW-15 Q3-10	09/29/2010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	161	NA	0.0214	53.9	0.0299	8.9	55.3
MW-15	MW-15 Q4-10	12/15/2010	50 U	5 U	166	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	15	10 U	154	NA	0.023	51.3	0.0297	8.57	55
MW-15	MW-15 Q1-2011	03/24/2011	50 U	5 U	198	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	15.4	10 U	163	NA	0.02 U	51.5	0.0472	8.56	63.8
MW-15	MW-15 Q2-2011	6/21/2011	50 U	5 U	160	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	12	10 U	150	NA	0.020 U	48.9	0.0335	8.00	53.9
MW-15	MW-15 Q3-2011	9/28/2011	50 U	5 U	174	5 U	5 U	10 U	10 U	10 U	2 U	NA	20 U	6 U	20 U	5 U	20 U	10 U	158	NA	0.0200 U	52.7	0.0335	8.63	59.7
MW-15	MW-15 Q4-2011	12/14/2011	50 U	5 U	168	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	16.0	10 U	143	NA	0.032	50.0	0.0341	8.12	54.9
MW-15	MW-15 Q1-2012	3/28/2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	155.0	NA	0.036	50.3	0.0394	8.59	60.1
MW-15	MW-15 Q1-2011	03/24/2011	50 U	5 U	198	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	15.4	10 U	163	NA	0.02 U	51.5	0.0472	8.56	63.8
MW-15	MW-15 Q1-2011	03/24/2011	50 U	5 U	198	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	15.4	10 U	163	NA	0.02 U	51.5	0.0472	8.56	63.8
MW-15	MW-15 Q1-2011	03/24/2011	50 U	5 U	198	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	15.4	10 U	163	NA	0.02 U	51.5	0.0472	8.56	63.8
MW-15	MW-15 Q1-2011	03/24/2011	50 U	5 U	198	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	10 U	10 U	5 U	15.4	10 U	163	NA	0.02 U	51.5	0.0472	8.56	63.8
MW-16	MW-16 Q3-05	09/01/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	213	NA	NA	NA	NA	17.2	21.8
MW-16	MW-16 Q2-06	06/21/2006	50 U	5 U	88.8	5 U	5 U	7.2	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	20	15	119	NA	0.313	51.9	0.0345	7.8	23.6
MW-16	MW-16 Q3(Sept)-06	09/21/2006	50 U	5 U	85.6	5 U	5 U	5 U	10 U	10 U	2 U	NA	20 U	5 U	10 U	5 U	19	10 U	119	NA	2.04	51.8	0.0275	7.97	23.5

Notes:

Only samples that were tested for at least one metal analyte appear in this Table. See Table D.1 for a complete analytical schedule by sample.

U Analyte was not detected at the given reporting limit.

NA Not analyzed

TABLE G4
HISTORICAL SUMMARY OF VOLATILE ORGANIC CONSTITUENT GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	1,1-Dichloroethane (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	Benzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	p-Isopropyltoluene (p-Cymene) (µg/L)	Dichlorodifluoromethane (µg/L)	iso-Propylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (µg/L)	Vinyl chloride (µg/L)	Xylene (meta & para) (µg/L)	Xylene (ortho) (µg/L)	Xylene (total) (µg/L)
Upgradient Wells																					
MW-05	MW-5 Q1-93	03/30/1993	NA	NA	NA	0.5 U	1 U	NA	NA	NA	NA	NA	NA	5.3	0.5 U	0.5 U	0.5 U	0.2 U	NA	NA	0.5 U
MW-05	MW-5 Q2-93	04/13/1993	NA	NA	NA	0.5 U	1 U	NA	NA	NA	NA	NA	NA	7.1	0.5 U	2.6	0.5 U	0.2 U	NA	NA	0.5 U
MW-05	MW-5 Q2(Jun)-93	06/14/1993	NA	NA	NA	0.5 U	1 U	NA	NA	NA	NA	NA	NA	6.5	0.5 U	4	0.5 U	0.2 U	NA	NA	0.5 U
MW-05	MW-5 Q3-93	09/01/1993	NA	NA	NA	0.5 U	1 U	NA	NA	NA	NA	NA	NA	5.5	0.5 U	3.7	0.5 U	0.2 U	NA	NA	0.5 U
MW-05	MW-5 Q3-94	08/01/1994	0.5 U	NA	NA	0.5 U	0.5 U	1.3	NA	0.5 U	NA	NA	NA	5.6	0.5 U	3.4	0.6	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q3(Sept)-94	09/01/1994	0.5 U	NA	NA	0.5 U	0.5 U	1	NA	0.5 U	NA	NA	NA	4.2	0.5 U	2.6	0.5 U	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q4(Nov)-94	11/01/1994	0.5 U	NA	NA	0.5 U	0.5 U	0.9	NA	0.5 U	NA	NA	NA	4.2	0.5 U	0.5 U	0.6	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q4(Dec)-94	12/01/1994	0.5 U	NA	NA	0.5 U	0.5 U	0.9	NA	0.5 U	NA	NA	NA	3.83	0.5 U	2.39	0.5 U	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q1-95	01/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	0.9	NA	0.5 U	NA	NA	NA	3.7	0.5 U	2.4	0.5 U	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q1(Feb)-95	02/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	0.6	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q4(Dec)-95	12/20/1995	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	2	1 U	1	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q2-96	05/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	3	1 U	2	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q3-96	09/01/1996	1 U	NA	NA	1 U	1 U	1	NA	1 U	NA	NA	NA	3	1 U	2	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q4-96	10/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	3	1 U	2	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q2-97	06/24/1997	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	3	1	2	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q3-97	09/11/1997	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	3	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q4-97	11/25/1997	0.5 U	NA	NA	0.5 U	0.5 U	0.8	NA	0.5 U	NA	NA	NA	3	0.5 U	2.5	0.5 U	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q1-98	03/25/1998	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	3	1 U	2	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q3-98	09/21/1998	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	3	1 U	3	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q4-98	12/30/1998	0.5 U	NA	NA	0.5 U	0.5 U	0.7	NA	0.5 U	NA	NA	NA	2.3	0.5 U	2.7	0.5 U	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q1-99	03/03/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	2	1 U	2	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q2-99	06/14/1999	0.5 U	NA	NA	0.5 U	0.5 U	0.8	NA	0.5 U	NA	NA	NA	2.5	0.5 U	2.8	0.5 U	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q1-00	03/15/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	2	0.6 U	3	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q3-00	09/27/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1.9	1 U	2.8	1 U	1 U	NA	NA	1 U
MW-05	MW-5 Q3-01	09/06/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.87	NA	0.5 U	NA	NA	NA	1.8	0.5 U	3.4	0.5 U	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q4-01	12/14/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.83	NA	0.5 U	NA	NA	NA	1.8	0.5 U	3.1	0.5 U	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q1-02	03/27/2002	0.5 U	NA	NA	0.5 U	0.5 U	0.84	NA	0.5 U	NA	NA	NA	1.7	0.5 U	3.2	0.5 U	0.5 U	NA	NA	0.5 U
MW-05	MW-5 Q2-04	06/17/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.75	NA	0.5 U	NA	0.5 U	NA	1.3	0.5 U	2.8	0.5 U	0.5 U	NA	NA	NA
MW-07	MW-7 Q3-98	07/01/1998	NA	NA	NA	NA	NA	0.5 UJ	NA	NA	NA	NA	NA	1.26	NA	0.5 UJ	NA	NA	NA	NA	NA
MW-07	MW-7 Q1-01	01/31/2001	0.5 U	NA	NA	NA	0.5 U	0.6	NA	0.5 U	NA	NA	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	NA	NA	NA
MW-07	MW-7 Q3-10	07/15/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-07	MW-7 Q4-10	11/03/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-07	SLF-MW-07-GW-110510	11/05/2010	0.2 U	0.2 U	0.2 U	0.2 U	1 U	0.2 U	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1 U	0.2 U	0.2 U	0.2 U	0.4 U	0.2 U	NA
MW-07	SLF-MW-07-GW-021011	02/10/2011	0.2 U	0.2 U	0.2 U	0.2 U	1 U	0.2 U	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1 U	0.2 U	0.2 U	0.2 U	0.4 U	0.2 U	NA
MW-09	MW-9 Q1-93	03/30/1993	0.5 U	NA	NA	NA	1 U	0.5 U	NA	0.5 U	NA	NA	NA	3.6	NA	0.5 U	0.5 U	0.2 U	NA	NA	NA
MW-09	MW-9 Q2-93	04/13/1993	0.5 U	NA	NA	NA	1 U	1.5	NA	0.5 U	NA	NA	NA	4.1	NA	2.6	0.5 U	0.2 U	NA	NA	NA
MW-09	MW-9 Q2(Jun)-93	06/14/1993	0.5 U	NA	NA	NA	1 U	0.2 U	NA	0.5 U	NA	NA	NA	2.3	NA	1.7	0.5 U	0.2 U	NA	NA	NA
MW-09	MW-9 Q3-93	08/31/1993	0.5 U	NA	NA	NA	1 U	1.3	NA	0.5 U	NA	NA	NA	3.1	NA	2.3	0.5 U	0.2 U	NA	NA	NA
MW-09	MW-9 Q3(Sept)-93	09/01/1993	0.5 U	NA	NA	NA	1 U	1.3	NA	0.5 U	NA	NA	NA	3.1	NA	2.3	0.5 U	0.2 U	NA	NA	NA

TABLE G4
HISTORICAL SUMMARY OF VOLATILE ORGANIC CONSTITUENT GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	1,1-Dichloroethane (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	Benzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	p-Isopropyltoluene (p-Cymene) (µg/L)	Dichlorodifluoromethane (µg/L)	iso-Propylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (µg/L)	Vinyl chloride (µg/L)	Xylene (meta & para) (µg/L)	Xylene (ortho) (µg/L)	Xylene (total) (µg/L)
Upgradient Wells Continued																					
MW-09	MW-9 Q1-98	02/01/1998	NA	NA	NA	NA	NA	1.05	NA	NA	NA	NA	NA	1.8	NA	2.5	NA	NA	NA	NA	NA
MW-09	MW-9 Q2-98	07/01/1998	NA	NA	NA	NA	NA	0.5 UJ	NA	NA	NA	NA	NA	1.6	NA	3.2	NA	NA	NA	NA	NA
MW-09	MW-9 Q1-02	01/31/2002	0.5 U	NA	NA	NA	0.5 U	1.2	NA	0.5 U	NA	NA	NA	0.9	NA	4	0.5 U	0.5 U	NA	NA	NA
MW-09	MW-9 Q3-10	07/15/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.87	0.5 U	0.5 U	NA	0.5 U	NA	0.62	0.5 U	1.5	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-09	SLF-MW-09-GW-110410	11/04/2010	0.2 U	0.2 U	0.2 U	0.2 U	1 U	0.63	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.53	1 U	1.1	0.2 U	0.2 U	0.4 U	0.2 U	NA
MW-09	MW-9 Q4-10	11/04/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.77	0.5 U	0.5 U	NA	0.5 U	NA	0.54	0.5 U	1.4	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-09	SLF-MW-09-GW-021011	02/10/2011	0.2 U	0.2 U	0.2 U	0.2 U	1 U	0.72	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.49	1 U	1.2	0.2 U	0.2 U	0.4 U	0.2 U	NA
MW-10	MW-10 Q1-98	02/01/1998	NA	NA	NA	NA	NA	2.04	NA	NA	NA	NA	NA	0.5 UJ	NA	0.5 UJ	NA	NA	NA	NA	NA
MW-10	MW-10 Q3-98	07/01/1998	NA	NA	NA	NA	NA	1.49	NA	NA	NA	NA	NA	0.5 UJ	NA	0.5 UJ	NA	NA	NA	NA	NA
MW-10	MW-10 Q1-02	03/27/2002	0.5 U	NA	NA	NA	0.5 U	1.7	NA	0.5 U	NA	NA	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	NA	NA	NA
MW-10	MW-10 Q3-10	07/15/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.7	0.5 U	0.5 U	NA	0.5 U	NA	0.52	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-10	MW-10 Q4-10	11/04/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.2	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-10	SLF-MW-10-GW-110410	11/04/2010	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1.1	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.39	1 U	0.2 U	0.2 U	0.2 U	0.4 U	0.2 U	NA
MW-10	SLF-MW-10-GW-021011	02/10/2011	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1.5	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.49	1 U	0.2 U	0.2 U	0.2 U	0.4 U	0.2 U	NA
MW-12	MW-12 Q1-95	03/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	2.2	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q3-95	07/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	0.7	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q3(Sept)-95	09/20/1995	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q4t-95	10/30/1995	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q4(Dec)-95	12/20/1995	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q1-96	02/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q2-96	05/29/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q2(Jun)-96	06/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q3-96	09/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q4-96	10/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q1-97	03/24/1997	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q2-97	06/24/1997	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q4-97	11/25/1997	0.5 U	NA	NA	0.5 U	0.5 U	0.6	NA	0.5 U	NA	NA	NA	0.6	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q1-98	03/25/1998	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q3-98	09/21/1998	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q4-98	12/30/1998	0.5 U	NA	NA	0.5 U	0.5 U	0.5	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q1-99	03/03/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q2-99	06/14/1999	0.5 U	NA	NA	0.5 U	0.5 U	0.5	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q3-99	09/22/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q4-99	12/09/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q1-00	03/15/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q2-00	06/21/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q3-00	09/27/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-12	MW-12 Q4-00	12/05/2000	0.5 U	NA	NA	0.5 U	0.5 U	0.54	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q1-01	03/27/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.56	NA	0.5 U	NA	NA	NA	0.51	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U

TABLE G4
HISTORICAL SUMMARY OF VOLATILE ORGANIC CONSTITUENT GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter Sample Date	1,1-Dichloroethane (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	Benzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	p-Isopropyltoluene (p-Cymene) (µg/L)	Dichlorodifluoromethane (µg/L)	iso-Propylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (µg/L)	Vinyl chloride (µg/L)	Xylene (meta & para) (µg/L)	Xylene (ortho) (µg/L)	Xylene (total) (µg/L)
Upgradient Wells Continued																					
MW-12	MW-12 Q2-01	06/27/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.54	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q3-01	09/06/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.61	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q4-01	12/14/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.61	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q1-02	03/27/2002	0.5 U	NA	NA	0.5 U	0.5 U	0.63	NA	0.5 U	NA	NA	NA	0.5	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q2-02	06/13/2002	0.5 U	NA	NA	0.5 U	0.5 U	0.5	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q3-02	09/18/2002	1 U	NA	NA	0.5 U	1 U	1 U	NA	1 U	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	NA	NA	0.5 U
MW-12	MW-12 Q4-02	12/17/2002	0.5 U	NA	NA	0.5 U	0.5 U	0.59	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q1-03	03/26/2003	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q2-03	06/26/2003	0.5 U	NA	NA	0.5 U	0.5 U	0.53	NA	0.5 U	NA	0.5 U	NA	0.5 U	0.97	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q3-03	09/25/2003	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q4-03	12/18/2003	0.5 U	NA	NA	0.5 U	0.5 U	0.5	NA	0.5 U	NA	0.5 U	NA	0.58	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q1-04	03/17/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.57	NA	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q2-04	06/17/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.56	NA	0.5 U	NA	0.5 U	NA	0.5	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q3-04	09/30/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.56	NA	0.5 U	NA	0.5 U	NA	0.52	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q4-04	12/15/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.54	NA	0.5 U	NA	0.5 U	NA	0.55	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q1-05	03/31/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.58	0.5 U	0.5 U	NA	0.5 U	NA	0.52	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-12	MW-12 Q2-05	06/23/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.52	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-12	MW-12 Q3-05	09/29/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-12	MW-12 Q1-06	03/30/2006	0.5 U	NA	NA	0.5 U	0.5 U	0.51	NA	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q2-06	06/21/2006	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12	MW-12 Q3-06	09/21/2006	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-12	MW-12 Q3-07	09/26/2007	NA	NA	NA	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	NA	NA	NA	0.5 U
MW-12b	MW-12b Q3-08	09/24/2008	0.5 U	NA	NA	0.5 U	0.5 U	0.75	NA	0.5 U	NA	0.5 U	NA	0.9	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12b	MW-12b Q4-08	12/17/2008	0.5 U	NA	NA	0.5 U	0.5 U	0.78	NA	0.5 U	NA	0.5 U	NA	0.72	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12b	MW-12b Q1-09	03/20/2009	0.5 U	NA	NA	0.5 U	0.5 U	0.73	NA	0.5 U	NA	0.5 U	NA	0.81	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12b	MW-12b Q2-09	06/24/2009	0.5 U	NA	NA	0.5 U	0.5 U	0.89	NA	0.5 U	NA	0.5 U	NA	0.73	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12b	MW-12b Q3-09	09/24/2009	0.5 U	NA	NA	0.5 U	0.5 U	0.9	NA	0.5 U	NA	0.5 U	NA	0.69	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12b	MW-12b Q4-09	12/18/2009	0.5 U	NA	NA	0.5 U	0.5 U	0.88	NA	0.5 U	NA	0.5 U	NA	0.67	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12b	MW-12b Q2-10	06/23/2010	0.5 U	NA	NA	0.5 U	0.5 U	0.68	NA	0.5 U	NA	0.5 U	NA	0.61	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12b	MW-12b Q3-10	09/29/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.93	0.5 U	0.5 U	NA	0.5 U	NA	0.77	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-12b	MW-12b Q4-10	12/15/2010	0.5 U	NA	NA	0.5 U	0.5 U	0.65	NA	0.5 U	NA	0.5 U	NA	0.65	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-12b	MW-12b Q1-2011	03/24/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.83	0.5 U	0.5 U	NA	0.5 U	NA	0.62	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-12b	MW-12b Q2-2011	6/21/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.94	0.5 U	0.5 U	NA	0.5 U	NA	0.73	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-12b	MW-12b Q3-2011	9/28/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.70	0.5 U	0.5 U	NA	0.5 U	NA	0.68	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-12b	MW-12b Q4-2011	12/14/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.73	0.5 U	0.5 U	NA	0.5 U	NA	0.61	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-12b	MW-12b Q1-2012	3/28/2012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.89	0.5 U	0.5 U	NA	0.5 U	NA	0.71	0.5 U	0.5 U	0.5 U	0.02 U	0.5 U	0.5 U	NA

TABLE G4
HISTORICAL SUMMARY OF VOLATILE ORGANIC CONSTITUENT GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	1,1-Dichloroethane (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	Benzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	p-Isopropyltoluene (p-Cymene) (µg/L)	Dichlorodifluoromethane (µg/L)	iso-Propylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (µg/L)	Vinyl chloride (µg/L)	Xylene (meta & para) (µg/L)	Xylene (ortho) (µg/L)	Xylene (total) (µg/L)
Downgradient Wells																					
MW-01	MW-1 Q3-94	08/01/1994	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	NA	NA	0.9	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q3(Sept)-94	09/01/1994	0.5 U	NA	NA	0.5 U	0.5 U	1	NA	0.5 U	NA	NA	NA	0.9	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q4(Nov)-94	11/01/1994	0.5 U	NA	NA	0.5 U	0.5 U	0.9	NA	0.5 U	NA	NA	NA	0.8	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q4(Dec)-94	12/01/1994	0.5 U	NA	NA	0.5 U	0.5 U	0.91	NA	0.5 U	NA	NA	NA	0.78	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q1-95	01/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	0.9	NA	0.5 U	NA	NA	NA	0.8	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q1(Feb)-95	02/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	0.9	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q3-95	07/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	NA	NA	0.8	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q1(Sep)-95	09/20/1995	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q4-95	12/18/1995	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q1-96	02/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q2-96	05/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q3-96	09/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q4-96	10/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q2-97	06/24/1997	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q3-97	09/11/1997	1 U	NA	NA	1 U	1 U	1	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q4-97	11/25/1997	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	NA	NA	0.8	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q1-98	03/25/1998	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q2-98	06/29/1998	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q3-98	09/21/1998	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q1-99	03/03/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q2-99	06/14/1999	0.5 U	NA	NA	0.5 U	0.5 U	0.9	NA	0.5 U	NA	NA	NA	0.8	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q3-99	09/22/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q4-99	12/09/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q1-00	03/15/2000	1 U	NA	NA	1 U	1 U	0.9 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q2-00	06/21/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q3-00	09/27/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-01	MW-1 Q4-00	12/05/2000	0.5 U	NA	NA	0.5 U	0.5 U	0.76	NA	0.5 U	NA	NA	NA	0.64	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q1-01	03/27/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.77	NA	0.5 U	NA	NA	NA	0.66	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-01	MW-1 Q2-01	06/27/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.78	NA	0.5 U	NA	NA	NA	0.66	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
Well #2	MW-13 Q4-02	12/17/2002	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.79	0.5 U	0.5 U	NA	NA	NA	0.67	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-03	MW-3 Q3-94	08/01/1994	NA	NA	NA	0.6	0.5 U	0.6	NA	0.5 U	NA	NA	NA	0.6	2.2	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q3(Sept)-94	09/01/1994	NA	NA	NA	0.5 U	0.5 U	0.7	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q4(Nov)-94	11/01/1994	NA	NA	NA	0.5 U	0.5 U	0.6	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q4(Dec)-94	12/01/1994	NA	NA	NA	0.5 U	0.5 U	0.6	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q1-95	01/01/1995	NA	NA	NA	0.5 U	0.5 U	0.6	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q1(Feb)-95	02/01/1995	NA	NA	NA	0.5 U	0.5 U	0.6	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q3-95	07/01/1995	NA	NA	NA	0.5 U	0.5 U	0.6	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q3(Sept)-95	09/20/1995	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q4-95	12/18/1995	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U

TABLE G4
HISTORICAL SUMMARY OF VOLATILE ORGANIC CONSTITUENT GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	1,1-Dichloroethane (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	Benzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	p-Isopropyltoluene (p-Cymene) (µg/L)	Dichlorodifluoromethane (µg/L)	iso-Propylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (µg/L)	Vinyl chloride (µg/L)	Xylene (meta & para) (µg/L)	Xylene (ortho) (µg/L)	Xylene (total) (µg/L)
Downgradient Wells Continued																					
MW-03	MW-3 Q1-96 Dup	02/01/1996	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q1-96	02/01/1996	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q2-96	05/01/1996	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q3-96	09/01/1996	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q4-96	10/01/1996	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q2-97	06/24/1997	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q3-97	09/11/1997	NA	NA	NA	1 U	1 U	1	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q1-98	03/25/1998	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q2-98	06/29/1998	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q3-98	09/21/1998	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q4-98	12/30/1998	NA	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q1-99	03/03/1999	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q2-99	06/14/1999	NA	NA	NA	0.5 U	0.5 U	0.6	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q3-99	09/22/1999	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q4-99	12/09/1999	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q1-00	03/15/2000	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q2-00	06/21/2000	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q3-00	09/27/2000	NA	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-03	MW-3 Q4-00	12/05/2000	NA	NA	NA	0.5 U	0.5 U	0.56	NA	0.5 U	NA	NA	NA	0.63	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q1-01	03/27/2001	NA	NA	NA	0.5 U	0.5 U	0.51	NA	0.5 U	NA	NA	NA	0.75	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-03	MW-3 Q2-01	06/27/2001	NA	NA	NA	0.5 U	0.5 U	0.5	NA	0.5 U	NA	NA	NA	0.72	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-95	03/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	1	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.8	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-95 Dup	03/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	0.9	NA	0.5 U	NA	NA	NA	0.6	0.5 U	0.5 U	0.8	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-95	07/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	1	NA	0.5 U	NA	NA	NA	0.8	0.5 U	0.5 U	1	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-95 Dup	07/01/1995	0.5 U	NA	NA	0.5 U	0.5 U	1	NA	0.5 U	NA	NA	NA	0.8	0.5 U	0.5 U	1	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3(Sept)-95	09/20/1995	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q3(Sept)-95 Dup	09/20/1995	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q4-95	10/30/1995	1 U	NA	NA	1 U	1 U	1	NA	1 U	NA	NA	NA	1	1 U	1 U	1	1 U	NA	NA	1 U
MW-11	MW-11 Q4-95 Dup	10/30/1995	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q4(Dec)-95	12/18/1995	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q1-96	02/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q2-96	05/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q2(Jun)-96	06/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q3-96	09/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q4-96	10/01/1996	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q1-97	03/24/1997	1 U	NA	NA	1 U	1 U	1	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q2-97	06/24/1997	1 U	NA	NA	1 U	1 U	1	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q4-97	11/25/1997	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	NA	NA	0.9	0.5 U	0.5 U	1	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-98	03/25/1998	1 U	NA	NA	1 U	1 U	1	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U

TABLE G4
HISTORICAL SUMMARY OF VOLATILE ORGANIC CONSTITUENT GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	1,1-Dichloroethane (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	Benzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	p-Isopropyltoluene (p-Cymene) (µg/L)	Dichlorodifluoromethane (µg/L)	iso-Propylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (µg/L)	Vinyl chloride (µg/L)	Xylene (meta & para) (µg/L)	Xylene (ortho) (µg/L)	Xylene (total) (µg/L)
Downgradient Wells Continued																					
MW-11	MW-11 Q2-98	06/29/1998	1 U	NA	NA	1 U	1 U	1	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q3-98	09/21/1998	1 U	NA	NA	1 U	1 U	1	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q4-98	12/30/1998	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	NA	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-99	03/03/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q2-99	06/14/1999	0.5 U	NA	NA	0.5 U	0.5 U	0.8	NA	0.5 U	NA	NA	NA	2.3	0.5 U	2.8	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-99	09/22/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q4-99	12/09/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q1-00	03/15/2000	1 U	NA	NA	1 U	1 U	1	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q2-00	06/21/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q3-00	09/27/2000	1 U	NA	NA	1 U	1 U	1.1	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-11	MW-11 Q4-00	12/05/2000	0.5 U	NA	NA	0.5 U	0.5 U	0.98	NA	0.5 U	NA	NA	NA	0.64	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-01	03/27/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.98	NA	0.5 U	NA	NA	NA	0.68	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q2-01	06/27/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.99	NA	0.5 U	NA	NA	NA	0.69	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-01	09/06/2001	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	NA	NA	0.75	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q4-01	12/14/2001	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	NA	NA	0.73	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-02	03/27/2002	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	NA	NA	0.78	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q2-02	06/13/2002	0.5 U	NA	NA	0.5 U	0.5 U	0.97	NA	0.5 U	NA	NA	NA	0.67	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-02	09/18/2002	1 U	NA	NA	0.5 U	1 U	1.1	NA	1 U	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	NA	NA	0.5 U
MW-11	MW-11 Q4-02	12/17/2002	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	1 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-03	03/26/2003	0.5 U	NA	NA	0.5 U	0.5 U	0.94	NA	0.5 U	NA	0.5 U	NA	0.63	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q2-03	06/26/2003	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	0.64	NA	0.82	1.1	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-03	09/25/2003	0.5 U	NA	NA	0.5 U	0.5 U	1	NA	0.5 U	NA	0.56	NA	0.71	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q4-03	12/18/2003	0.5 U	NA	NA	0.5 U	0.5 U	1	NA	0.5 U	NA	0.75	NA	0.87	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-04	03/17/2004	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	0.8	NA	0.75	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q2-04	06/17/2004	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	0.8	NA	0.75	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-04	09/30/2004	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	0.71	NA	0.84	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q4-04	12/15/2004	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	0.63	NA	0.85	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-05	03/31/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3	0.5 U	0.5 U	NA	0.8	NA	0.84	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-11	MW-11 Q2-05	06/23/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1	0.5 U	0.5 U	NA	0.77	NA	0.81	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-11	MW-11 Q3-05	09/29/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.2	0.5 U	0.5 U	NA	0.5 U	NA	0.88	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-11	MW-11 Q4-05	12/14/2005	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	0.76	NA	0.93	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-06	03/30/2006	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	0.94	NA	0.91	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q2-06	06/21/2006	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	0.8	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-06	09/21/2006	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.2	0.5 U	0.5 U	NA	0.84	NA	0.87	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-11	MW-11 Q4-06	12/28/2006	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	0.93	NA	0.81	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-07	03/22/2007	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	0.72	NA	0.78	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q2-07	06/28/2007	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	0.69	NA	0.93	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-07	09/26/2007	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	0.69	NA	0.9	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q4-07	12/27/2007	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	0.63	NA	0.93	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U

TABLE G4
HISTORICAL SUMMARY OF VOLATILE ORGANIC CONSTITUENT GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	1,1-Dichloroethane (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	Benzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	p-Isopropyltoluene (p-Cymene) (µg/L)	Dichlorodifluoromethane (µg/L)	iso-Propylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (µg/L)	Vinyl chloride (µg/L)	Xylene (meta & para) (µg/L)	Xylene (ortho) (µg/L)	Xylene (total) (µg/L)
Downgradient Wells Continued																					
MW-11	MW-11 Q1-08	03/27/2008	0.5 U	NA	NA	0.5 U	0.5 U	1.3	NA	0.5 U	NA	0.92	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q2-08	06/25/2008	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	0.8	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-08	09/24/2008	0.5 U	NA	NA	0.5 U	0.5 U	1.1	NA	0.5 U	NA	0.76	NA	1	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q4-08	12/17/2008	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	0.83	NA	0.99	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-09	03/20/2009	0.5 U	NA	NA	0.5 U	0.5 U	1.2	NA	0.5 U	NA	0.52	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q2-09	06/24/2009	0.5 U	NA	NA	0.5 U	0.5 U	1.3	NA	0.5 U	NA	0.5 U	NA	0.98	0.69	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-09	09/24/2009	0.5 U	NA	NA	0.5 U	0.5 U	1.3	NA	0.5 U	NA	0.55	NA	0.91	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q4-09	12/18/2009	0.5 U	NA	NA	0.5 U	0.5 U	1.4	NA	0.5 U	NA	0.5 U	NA	1	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-10	03/30/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3	0.5 U	0.5 U	NA	0.52	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-11	MW-11 Q2-10	06/23/2010	0.5 U	NA	NA	0.5 U	0.5 U	1	NA	0.5 U	NA	0.5 U	NA	0.85	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q3-10	09/29/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.5	0.5 U	0.5 U	NA	0.5 U	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-11	MW-11 Q4-10	12/15/2010	0.5 U	NA	NA	0.5 U	0.5 U	0.98	NA	0.5 U	NA	0.5 U	NA	0.94	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-11	MW-11 Q1-2011	03/24/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.2	0.5 U	0.5 U	NA	0.5 U	NA	1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-11	MW-11 Q2-2011	6/21/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3	0.5 U	0.5 U	NA	0.51	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-11	MW-11 Q3-2011	9/28/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.1	0.5 U	0.5 U	NA	0.50 U	NA	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-11	MW-11 Q4-2011	12/14/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.0	0.5 U	0.5 U	NA	0.60	NA	0.96	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-11	MW-11 Q1-2012	3/28/2012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.2	0.5 U	0.5 U	NA	0.58	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q3-99	09/22/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-14	MW-14 Q4-99	12/09/1999	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-14	MW-14 Q1-00	03/15/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-14	MW-14 Q2-00	06/21/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-14	MW-14 Q3-00	09/27/2000	1 U	NA	NA	1 U	1 U	1 U	NA	1 U	NA	NA	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	1 U
MW-14	MW-14 Q4-00	12/05/2000	0.5 U	NA	NA	0.5 U	0.5 U	0.9	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q1-01	03/27/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.56	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q2-01	06/27/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.79	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q3-01	09/06/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.82	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q4-01	12/14/2001	0.5 U	NA	NA	0.5 U	0.5 U	0.85	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q1-02	03/27/2002	0.5 U	NA	NA	0.5 U	0.5 U	0.76	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q2-02	06/13/2002	0.5 U	NA	NA	0.5 U	0.5 U	0.66	NA	0.5 U	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q3-02	09/18/2002	1 U	NA	NA	0.5 U	1 U	1 U	NA	1 U	NA	1 U	NA	1 U	0.5 U	1 U	1 U	1 U	NA	NA	0.5 U
MW-14	MW-14 Q4-02	12/17/2002	0.5 U	NA	NA	0.5 U	0.5 U	1 U	NA	0.5 U	NA	1.6	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q1-03	03/26/2003	0.5 U	NA	NA	0.5 U	0.5 U	0.68	NA	0.5 U	NA	1.2	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q2-03	06/26/2003	0.5 U	NA	NA	0.5 U	0.5 U	0.76	NA	0.5 U	NA	0.5 U	NA	0.5 U	0.61	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q3-03	09/25/2003	0.5 U	NA	NA	0.5 U	0.5 U	0.67	NA	0.5 U	NA	1.1	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q4-03	12/18/2003	0.5 U	NA	NA	0.5 U	0.5 U	0.82	NA	0.5 U	NA	1.9	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q1-04	03/17/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.82	NA	0.5 U	NA	1.7	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q2-04	06/17/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.63	NA	0.5 U	NA	1.3	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q3-04	09/30/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.76	NA	0.5 U	NA	1.4	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q4-04	12/15/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.7	NA	0.5 U	NA	1.2	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U

TABLE G4
HISTORICAL SUMMARY OF VOLATILE ORGANIC CONSTITUENT GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	1,1-Dichloroethane (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	Benzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	p-Isopropyltoluene (p-Cymene) (µg/L)	Dichlorodifluoromethane (µg/L)	iso-Propylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (µg/L)	Vinyl chloride (µg/L)	Xylene (meta & para) (µg/L)	Xylene (ortho) (µg/L)	Xylene (total) (µg/L)
Downgradient Wells Continued																					
MW-14	MW-14 Q1-05	03/31/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.78	0.5 U	0.5 U	NA	1	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q2-05	06/23/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.51	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q3-05	09/29/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.57	0.5 U	0.5 U	NA	0.83	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q4-05	12/14/2005	0.5 U	NA	NA	0.5 U	0.5 U	0.63	NA	0.5 U	NA	0.94	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q1-06	03/30/2006	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.58	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q3-06	09/21/2006	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	NA	0.86	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q4-06	12/28/2006	0.5 U	NA	NA	0.5 U	0.5 U	0.65	NA	0.5 U	NA	1.7	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q1-07	03/22/2007	0.5 U	NA	NA	0.5 U	0.5 U	0.56	NA	0.5 U	NA	0.85	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q2-07	06/28/2007	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q3-07	09/26/2007	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q4-07	12/27/2007	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q1-08	03/27/2008	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.74	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q2-08	06/25/2008	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	1	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q3-08	09/24/2008	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.74	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q4-08	12/17/2008	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.53	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q1-09	03/20/2009	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.68	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q2-09	06/24/2009	0.5 U	NA	NA	0.5 U	0.5 U	0.52	NA	0.5 U	NA	0.91	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q3-09	09/24/2009	0.5 U	NA	NA	0.5 U	0.5 U	0.65	NA	0.5 U	NA	1.4	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q4-09	12/18/2009	0.5 U	NA	NA	0.5 U	0.5 U	0.61	NA	0.5 U	NA	0.88	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q1-10	03/30/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.61	0.5 U	0.5 U	NA	1.3	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q2-10	06/23/2010	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.53	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q3-10	09/29/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.76	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q4-10	12/15/2010	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	1.1	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
MW-14	MW-14 Q1-2011	03/24/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.55	0.5 U	0.5 U	NA	0.71	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q2-2011	6/21/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.60	0.5 U	0.5 U	NA	1.2	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q3-2011	9/28/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.62	0.5 U	0.5 U	NA	1.3	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q4-2011	12/14/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.68	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
MW-14	MW-14 Q1-2012	3/28/2012	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.67	0.5 U	0.5 U	NA	1.4	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.02 U	0.5 U	0.5 U	NA
MW-15	MW-15 Q3-01	09/06/2001	7.6	NA	NA	0.5 U	1.7	0.5 U	NA	9.2	NA	NA	NA	11	0.5 U	3.8	1.6	1.4	NA	NA	0.5 U
MW-15	MW-15 Q4-01	12/14/2001	5.8	NA	NA	0.5 U	1.2	0.5 U	NA	8.1	NA	NA	NA	9.2	0.5 U	3.4	1.4	2.1	NA	NA	0.5 U
MW-15	MW-15 Q1-02	03/27/2002	5.8	NA	NA	0.5 U	1.4	0.5 U	NA	8.1	NA	NA	NA	8.6	0.5 U	3.1	1.3	2.8	NA	NA	0.5 U
MW-15	MW-15 Q2-02	06/13/2002	5.5	NA	NA	0.5 U	1.5	0.5 U	NA	8.5	NA	NA	NA	9.4	0.5 U	3	1	3.4	NA	NA	0.5 U
MW-15	MW-15 Q3-02	09/18/2002	6.2	NA	NA	0.5 U	1.5	1 U	NA	8.9	NA	9.4	NA	9.5	0.5 U	3.5	1	3.7	NA	NA	0.5 U
MW-15	MW-15 Q4-02	12/17/2002	6.1	NA	NA	0.5 U	1.4	1 U	NA	8.8	NA	13	NA	9.9	0.5 U	3.7	1.4	3.3	NA	NA	0.5 U
MW-15	MW-15 Q1-03	03/26/2003	4.8	NA	NA	0.5 U	1.1	0.5 U	NA	6.8	NA	10	NA	7.4	0.5 U	2.8	1.1	2.4	NA	NA	0.5 U
MW-15	MW-15 Q2-03	06/26/2003	5.2	NA	NA	0.5 U	1.2	0.5 U	NA	8.4	NA	11	NA	9.5	0.5 U	3.3	1.2	2.7	NA	NA	0.5 U
MW-15	MW-15 Q3-03	09/25/2003	5.9	NA	NA	0.5 U	1.4	0.5 U	NA	9.4	NA	10	NA	9.2	0.5 U	3.4	1.1	3.8	NA	NA	0.5 U
MW-15	MW-15 Q4-03	12/18/2003	5.1	NA	NA	0.5 U	1.1	0.5 U	NA	8.6	NA	11	NA	9.9	0.5 U	3	1	2.8	NA	NA	0.5 U
MW-15	MW-15 Q1-04	03/17/2004	4.5	NA	NA	0.5 U	0.78	0.5 U	NA	7.7	NA	9.9	NA	6.7	0.68	2.6	0.97	1.8	NA	NA	0.5 U

TABLE G4
HISTORICAL SUMMARY OF VOLATILE ORGANIC CONSTITUENT GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	1,1-Dichloroethane (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	Benzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	p-Isopropyltoluene (p-Cymene) (µg/L)	Dichlorodifluoromethane (µg/L)	iso-Propylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (µg/L)	Vinyl chloride (µg/L)	Xylene (meta & para) (µg/L)	Xylene (ortho) (µg/L)	Xylene (total) (µg/L)
Downgradient Wells Continued																					
MW-15	MW-15 Q2-04	06/17/2004	4.6	NA	NA	0.5 U	1.9	0.5 U	NA	7.5	NA	11	NA	7	0.5 U	2.5	1	2.3	NA	NA	0.5 U
MW-15	MW-15 Q3-04	09/30/2004	4.5	NA	NA	0.5 U	0.78	0.5 U	NA	8	NA	8.4	NA	7.5	0.5 U	2.7	1.2	1.9	NA	NA	0.5 U
MW-15	MW-15 Q4-04	12/15/2004	4.1	NA	NA	0.5 U	0.74	0.5 U	NA	7.7	NA	7.6	NA	7.6	0.5 U	2.5	1.1	1.9	NA	NA	0.5 U
MW-15	MW-15 Q1-05	03/31/2005	5.6	0.5 U	0.5 U	0.5 U	1.2	0.5 U	0.5 U	8.9	NA	9.4	NA	8.6	0.5 U	3	1.1	3.1	0.5 U	0.5 U	NA
MW-15	MW-15 Q2-05	06/23/2005	4.9	0.5 U	0.5 U	0.5 U	0.93	0.5 U	0.5 U	8.3	NA	8.2	NA	7.5	0.5 U	2.7	1.1	2.4	0.5 U	0.5 U	NA
MW-15	MW-15 Q3-05	09/29/2005	5.5	0.5 U	0.5 U	0.5 U	0.85	0.5 U	0.5 U	11	NA	7	NA	7	0.5 U	3	1.1	2.1	0.5 U	0.5 U	NA
MW-15	MW-15 Q4-05	12/14/2005	4.5	NA	NA	0.5 U	0.74	0.5 U	NA	8.6	NA	6.7	NA	6.9	0.5 U	2.5	1.3	1.6	NA	NA	0.5 U
MW-15	MW-15 Q1-06	03/30/2006	4.6	NA	NA	0.5 U	0.67	0.5 U	NA	7.9	NA	6.6	NA	6.5	0.5 U	2.4	1.2	1.6	NA	NA	0.5 U
MW-15	MW-15 Q2-06	06/21/2006	4.1	NA	NA	0.5 U	0.69	0.5 U	NA	7.5	NA	5.9	NA	6.5	0.5 U	2.1	1.1	1.6	NA	NA	0.5 U
MW-15	MW-15 Q3(Sept)-06	09/21/2006	6.3	0.5 U	0.5 U	0.5 U	1	0.5 U	0.5 U	12	NA	3.8	NA	7.9	0.5 U	3	0.5 U	3	0.5 U	0.5 U	NA
MW-15	MW-15 Q4-06	12/28/2006	4.3	NA	NA	0.5 U	0.61	0.5 U	NA	8.6	NA	0.57 U	NA	6.3	0.5 U	2.1	0.69	1.9	NA	NA	0.5 U
MW-15	MW-15 Q1-07	03/22/2007	4.4	NA	NA	0.5 U	0.57	0.5 U	NA	8.7	NA	4.3	NA	5.6	0.5 U	2.2	1	1.5	NA	NA	0.5 U
MW-15	MW-15 Q2-07	06/28/2007	3.7	NA	NA	0.5 U	0.5 U	0.5 U	NA	8	NA	5.3	NA	6.1	0.5 U	2.1	1.2	1.3	NA	NA	0.5 U
MW-15	MW-15 Q3-07	09/26/2007	5.4	NA	NA	0.5 U	0.66	0.5 U	NA	12	NA	4	NA	6.9	0.5 U	2.5	0.56	2	NA	NA	0.5 U
MW-15	MW-15 Q4-07	12/27/2007	3.9	NA	NA	0.5 U	0.64	0.5 U	NA	8.7	NA	4.1	NA	5.5	0.5 U	2	1.1	1.6	NA	NA	0.5 U
MW-15	MW-15 Q1-08	03/27/2008	3.7	NA	NA	0.5 U	0.5 U	0.5 U	NA	8.8	NA	4.8	NA	6.4	0.5 U	2.2	1.1	1.2	NA	NA	0.5 U
MW-15	MW-15 Q2-08	06/25/2008	3.1	NA	NA	0.5 U	0.5 U	0.5 U	NA	7.3	NA	5.4	NA	5.5	0.5 U	1.9	1.1	0.96	NA	NA	0.5 U
MW-15	MW-15 Q3-08	09/24/2008	3.2	NA	NA	0.5 U	0.5 U	0.5 U	NA	7.8	NA	4.1	NA	6	0.5 U	1.7	1.1	1.1	NA	NA	0.5 U
MW-15	MW-15 Q4-08	12/17/2008	3.3	NA	NA	0.5 U	0.5 U	0.5 U	NA	8.8	NA	5.2	NA	4.9	0.5 U	1.9	0.84	1.1	NA	NA	0.5 U
MW-15	MW-15 Q1-09	03/20/2009	3	NA	NA	0.5 U	0.5 U	0.5 U	NA	8.1	NA	3.9	NA	5.6	0.5 U	1.9	1.1	0.8	NA	NA	0.5 U
MW-15	MW-15 Q2-09	06/24/2009	3.6	NA	NA	0.5 U	0.5 U	0.5 U	NA	8.5	NA	3.5	NA	5.1	0.5 U	1.9	0.9	0.95	NA	NA	0.5 U
MW-15	MW-15 Q3-09	09/24/2009	2.9	NA	NA	0.5 U	0.5 U	0.5 U	NA	7.1	NA	4.1	NA	4.5	0.5 U	1.7	1.1	0.68	NA	NA	0.5 U
MW-15	MW-15 Q4-09	12/18/2009	3.3	NA	NA	0.5 U	0.5 U	0.5 U	NA	8.1	NA	3.6	NA	4.8	0.5 U	1.8	0.92	0.9	NA	NA	0.5 U
MW-15	MW-15 Q1-10	03/30/2010	2.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	6.5	NA	3.6	NA	5	0.5 U	1.6	1.1	0.66	0.5 U	0.5 U	NA
MW-15	MW-15 Q2-10	06/23/2010	2.4	NA	NA	0.5 U	0.5 U	0.5 U	NA	6.7	NA	2.4	NA	4	0.5 U	1.5	0.72	0.55	NA	NA	0.5 U
MW-15	MW-15 Q3-10	09/29/2010	3.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	8.9	NA	3.3	NA	5.1	0.5 U	1.9	0.89	0.84	0.5 U	0.5 U	NA
MW-15	MW-15 Q4-10	12/15/2010	2.4	NA	NA	0.5 U	0.5 U	0.5 U	NA	7.2	NA	3.1	NA	4.3	0.5 U	1.4	0.79	0.76	NA	NA	0.5 U
MW-15	MW-15 Q1-2011	03/24/2011	3.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	9.4	NA	2.6	NA	4.6	0.5 U	1.7	0.65	0.77	0.5 U	0.5 U	NA
MW-15	MW-15 Q1-2011	03/24/2011	3.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	9.4	NA	2.6	NA	4.6	0.5 U	1.7	0.65	0.77	0.5 U	0.5 U	NA
MW-15	MW-15 Q2-2011	6/21/2011	3.0	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	9.3	NA	3.4	NA	5.0	0.5 U	1.7	0.65	0.51	0.5 U	0.5 U	NA
MW-15	MW-15 Q3-2011	9/28/2011	2.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	7.8	NA	2.8	NA	4.5	0.5 U	1.7	0.65	0.5 U	0.5 U	0.5 U	NA
MW-15	MW-15 Q4-2011	12/14/2011	2.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	7.6	NA	3.3	NA	4.0	0.5 U	1.7	0.65	0.5 U	0.5 U	0.5 U	NA
MW-15	MW-15 Q1-2012	3/28/2012	3.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	9.0	NA	3.0	NA	4.7	0.5 U	1.7	0.65	0.66	0.5 U	0.5 U	NA
MW-16	MW-16 Q3-05	09/01/2005	1 U	1 U	1 U	1 U	1 U	1 U	5 U	1 U	5 U	1 U	1.61	1 U	1 U	1 U	1 U	0.2 U	2 U	1 U	NA
MW-16	MW-16 Q2-06	06/21/2006	0.5 U	NA	NA	0.5 U	0.5 U	0.54	NA	0.5 U	NA	0.74	NA	0.52	0.5 U	0.5 U	1.8	0.5 U	NA	NA	0.5 U
MW-16	MW-16 Q3(Sept)-06	09/21/2006	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.63	NA	0.5 U	0.5 U	0.5 U	1.4	0.5 U	0.5 U	0.5 U	NA
MW-16	MW-16 Q1-2011	03/24/2011	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.57	0.5 U	0.5 U	NA	0.54	NA	0.64	0.5 U	0.5 U	0.74	0.5 U	0.5 U	0.5 U	NA

TABLE G4
HISTORICAL SUMMARY OF VOLATILE ORGANIC CONSTITUENT GROUNDWATER DATA
City of Walla Walla Sudbury Road Landfill

Location	Sample ID	Parameter / Sample Date	1,1-Dichloroethane (µg/L)	1,2-Dichloroethane (µg/L)	1,2-Dichloropropane (µg/L)	Benzene (µg/L)	Chloroethane (µg/L)	Chloroform (µg/L)	Chloromethane (µg/L)	cis-1,2-Dichloroethene (µg/L)	p-Isopropyltoluene (p-Cymene) (µg/L)	Dichlorodifluoromethane (µg/L)	iso-Propylbenzene (µg/L)	Tetrachloroethene (µg/L)	Toluene (µg/L)	Trichloroethene (µg/L)	Trichlorofluoromethane (µg/L)	Vinyl chloride (µg/L)	Xylene (meta & para) (µg/L)	Xylene (ortho) (µg/L)	Xylene (total) (µg/L)
Residential Wells																					
Camp	Camp Q1-05	03/31/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.74	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Camp	Camp Q2-05	06/23/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.67	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Camp	Camp Q3-05	09/29/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.73	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Camp	Camp Q3-06	09/21/2006	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.76	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Camp	Camp Q2-09	06/24/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Kinman	Kinman Q1-05	03/31/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Kinman	Kinman Q2-05	06/23/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Small	Small 061302	06/13/2002	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	1	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
Small	Small 062602	06/26/2002	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	1	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
Small	Small Q1-04	03/17/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.99	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
Small	Small Q3-04	09/30/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.52	NA	0.5 U	NA	0.5 U	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
Small	Small Q4-04	12/15/2004	0.5 U	NA	NA	0.5 U	0.5 U	0.51	NA	0.5 U	NA	0.5 U	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	NA	NA	0.5 U
Small	Small Q1-05	03/31/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.55	0.5 U	0.5 U	NA	0.5 U	NA	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Small	Small Q3-05	09/29/2005	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.54	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Small	Small Q3-06	09/21/2006	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.51	0.5 U	0.5 U	NA	0.5 U	NA	1.2	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Small	Small Q2-09	06/24/2009	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.56	0.5 U	0.5 U	NA	0.5 U	NA	1.4	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA
Small	Small Q3-10	09/29/2010	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.62	0.5 U	0.5 U	NA	0.5 U	NA	1.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA

Notes:

Only VOC analytes that had at least one detection, or are a chemical of concern are appear in this Table. See Table D.5 for the list of the VOC analytes that were 100% non-detects and their reporting limit range.

Only samples that were tested for at least one VOC Analyte appear in this Table. See Table D.1 for an complete Analytical Schedule by sample.

J Analyte was detected, the result is an estimated value.

U Analyte was not detected at the given reporting limit.

UJ Analyte was not detected, and the given reporting limit is an estimated value.

NA Not analyzed

APPENDIX H

HWA GeoSciences Memorandum

HWA GEOSCIENCES INC.
Geotechnical & Pavement Engineering · Hydrogeology · Geoenvironmental · Inspection & Testing

January 27, 2010
HWA Project No. 2009-094-21

J-U-B Engineers, Inc.
2810 Clearwater Avenue, Suite 201
Kennewick, Washington 98336

Attention: Alex Fazzari, P.E.

Subject: **Alternative FINAL COVER DESIGN**
AREA 6 CLOSURE
Sudbury Road Landfill
Walla Walla, Washington

Dear Alex:

We understand that the City of Walla Walla is proposing the use of an alternative final cover system comprised of an Evapotranspiration Cap for the Area 6 closure at Sudbury Road Landfill. At your request, HWA Geosciences Inc., has conducted laboratory and engineering analyses to calculate the minimum depth for a monolithic soil layer comprised of on-site soils to ensure that the required water storage of the cover is less than the available water storage capacity of the soil. The current EPA guidance (Albright et al, 2009) based on data from the Alternative Cover Assessment Program (ACAP), is that typical composite cover systems exhibit percolation rate in the range of 4 mm/year. In contrast, a performance criteria limiting basal flow through a soil cover to less than 3% of annual precipitation has been proposed by Hauser (2009) based on measured leakage rates from conventional covers (compacted soil, and composite covers) which range from 2 to 10% of annual precipitation. However, for the purposes of this evaluation, a percolation rate of less than 4mm/year from the base of the cover soil layer was used as the limiting design criteria.

Monolithic Water Storage Layer

The proposed cover soil (native soils from the existing on-site stockpile) consist of sandy Silt (ML) found at the Sudbury Road landfill site predominately belonging to the map unit locally termed Touchet Beds which consist of fine-grained soils deposited in ponded waters from a succession of glacial outburst floods. These soils are classified as silt loam using the USDA soil classification and appear to have a water storage capacity ranging between 17 to 20 percent (USDA physical properties for Walla Walla silt loam). The material samples used in this evaluation were obtained by a City of Walla Walla representative at three locations within the stockpile area as shown on Figure 1.

19730 - 64th Avenue W.
Suite 200
Lynnwood, WA 98036.5957
Tel: 425.774.0106
Fax: 425.774.2714
www.hwageo.com

The material utilized is this evaluation has the following general characteristics:

Table 1 General Characteristics of Stockpile Soils

Moderate relative density	Moderate Compressibility
Non-plastic	High Frost Susceptibility
Non-Expansive	Low permeability
Moderate friction angle	High capillary potential
Slight cohesion	Low organic content

Laboratory testing of the soil samples was performed by HWA GeoSciences, at our laboratory in Lynnwood, Washington. Laboratory tests included determination of in-situ moisture content, grain size distribution, soil moisture-density relationship determination (proctor), and hydraulic conductivity of soils. The laboratory tests were conducted in general accordance with appropriate American Society of Testing and Materials (ASTM) standards, and are discussed in further detail in Appendix A.

Table 2 Summary of Laboratory Test Results for Stockpile Soils

Engineering Properties	Laboratory Value
Field Moisture	Gravimetric = 10%, Volumetric = 18%
Maximum Density (ASTM D 698)	106.7 pcf
Optimum Moisture (ASTM D 698)	18.1% by dry weight
Specific Gravity	2.73
Hydraulic Conductivity	3.0×10^{-5} cm/sec.

Table 3 Stockpile Soil Gradation (USDA Classification)

Sample Designation	Sand (2.0 to 0.05 mm)	Silt (0.05 to 0.002 mm)	Clay <0.002 mm
1-3 Composite	40%	55%	5%

Table 4 Estimated Soil Water Characteristics (USDA)

Field Capacity	0.243
Wilting Point	0.058
Available Water Holding Capacity Volume	0.185

Design Criteria Assumptions

1. The soil water characteristic curve properties of the stockpile soils used in this analysis are based on those presented by Albright (2009) and are summarized below:

   I. Residual water content is 0%

   II. Van Genuchten "n" value is 1.3

   III. Van Genuchten α is 0.01; and

   IV. Exponent of pore interaction is -2

2. Stockpile sample soils consist of 40% sand, 55% silt and 5% clay (USDA classification).

3. Precipitation data measured on site from 1991 through June 2004 was used to estimate the required thickness of cover soil for water storage. For the period from 1991 through June 2004, average annual precipitation was 11.53 inches per year. The maximum annual precipitation amount measured at this location was 16.47 inches during 1996 (See Table 5).

4. The nearest weather station with long term weather reporting is located at the Whitman Mission and was available on-line from the Western Regional Climate Center and NOAA's National Weather service website. For the period from 1962 to 2009, average annual precipitation was 13.95 inches per year. The maximum annual precipitation amount measured at this location was 20.8 inches also during 1996.

5. Data from the Western Regional Climate Center was used to obtain average temperature, snowfall, dew point; wind velocity and cloud cover input.

Design Analysis

Precipitation records were collected from a weather station located at the Sudbury Road Landfill site from 1991 through June, 2004. The data was summarized in the Design report prepared by EMCON and is summarized in Table 5 below:

Table 5 Annual Rainfall Measured at Sudbury Road Landfill (inches)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOT
1991	0.71	1.00	0.72	0.74	2.35	1.10	0.42	0.33	0.00	0.79	2.03	1.41	11.60
1992	0.78	1.29	0.38	0.98	0.41	1.74	1.94	0.53	0.75	0.03	2.01	0.24	11.06
1993	1.05	0.60	0.90	1.00	1.24	1.48	0.86	1.06	0.00	0.33	0.06	1.79	10.37
1994	1.14	0.88	0.67	0.38	0.79	1.38	0.28	0.16	0.11	0.32	0.68	0.35	7.14
1995	0.09	0.46	2.13	2.28	0.75	1.11	0.49	0.69	1.47	1.16	1.21	1.63	13.47
1996	2.04	2.68	0.61	2.33	1.58	0.82	0.00	0.44	0.02	1.62	1.62	2.71	**16.47**
1997	2.45	0.61	1.38	2.06	1.14	0.05	0.46	0.00	0.84	1.09	1.11	0.85	12.04
1998	1.70	0.99	0.32	1.00	2.27	0.63	0.18	0.04	0.53	0.65	1.82	0.69	10.82
1999	1.13	1.15	1.04	0.72	0.44	0.22	0.15	0.10	0.75	1.26	1.45	1.65	10.06
2000	1.08	2.01	1.68	0.43	1.57	0.90	0.00	0.00	1.09	1.02	0.99	0.99	11.76
2001	0.87	0.72	1.17	1.53	0.51	1.32	0.23	0.18	0.51	1.53	1.75	1.27	11.59
2002	1.09	1.27	1.71	0.94	1.26	1.31	0.08	0.00	0.19	0.11	0.89	2.97	11.82
2003	3.67	1.77	1.27	0.98	0.71	0.34	0.00	0.26	0.17	0.35	0.86	1.42	11.08
2004	2.45	1.32	1.03	0.65	0.94	1.27	-	-	-	-	-	-	-
MIN	0.09	0.46	0.32	0.38	0.41	0.05	0.00	0.00	0.00	0.03	0.06	0.24	7.14
MAX	3.67	2.68	2.13	2.33	2.35	1.74	1.94	1.06	1.47	1.62	2.03	2.97	16.47
AVG	1.45	1.20	1.07	1.14	1.07	0.98	0.39	0.29	0.50	0.79	1.27	1.38	11.53

The precipitation data for 1996 in Table 5 and the estimated soil water characteristics contained in Table 4 were used to estimate the required thickness of the soil cover for the water balance modeling as described in the following section.

Soil-Water Storage

Soil's ability to absorb and retain water is controlled by their pore structure. Typically, finer-grained soils (silty or clayey soils) can store more water than more coarse (sandy) soils. The available water holding capacity is defined as the quantity of water that can be stored within the soil before significant drainage occurs. Soil scientists define the available water holding capacity as the difference between the soil's field capacity (volume of stored water under a tension of 33 kPa) and its wilting point (volume of stored water under tension greater than 1500 kPa). The wilting point is traditionally considered to be the moisture content below which plants do not have the ability to remove additional water.

The soils available water holding capacity defined as cm/cm (or inches per inch) as used in this evaluation is about 0.185 derived as the average between the range of 0.17 to 0.20 reported by the USDA for the Walla Walla silt loam (see table in Appendix A). In order to determine the minimum thickness of the soil layer that will have the ability to store infiltrated precipitation with minimal drainage site rainfall records were utilized (Emcon, 2005). According to the data contained in Table 5, the wettest year on record at the site was in 1996 when 16.47 inches was measured. Using this site data and local evaporation data a minimum soil layer thickness was estimated using criteria developed for estimating change in monthly soil storage required to accommodate potential infiltration as described by Benson (2006) as summarized in Table 6 below:

Table 6 Data for Calculating Required Storage for 1996 site

Month	Monthly Precipitation (cm)	Monthly Evaporation (cm)	PET Coefficient	Monthly PET (cm/mo.)	P/PET	P/PET Threshold	Does it exceed Threshold?
January	5.18	2.99	0.55	1.64	**3.15**	>0.51	**Yes**
February	6.81	3.98	0.70	2.79	**2.44**	>0.51	**Yes**
March	1.55	6.4	0.78	4.99	0.31	>0.32	No
April	5.92	10.67	0.84	8.96	0.66	>0.97	No
May	4.01	14.22	0.88	12.51	0.32	>0.97	No
June	2.08	18.63	0.88	16.39	0.13	>0.97	No
July	0.00	22.9	0.88	20.15	0.00	>0.97	No
August	1.12	22.47	0.86	19.32	0.06	>0.97	No
September	0.05	17.78	0.80	14.22	0.00	>0.34	No
October	4.11	12.09	0.70	8.46	**0.49**	>0.34	**Yes**
November	4.11	6.54	0.58	3.79	**1.08**	>0.51	**Yes**
December	6.88	3.57	0.53	1.89	**3.65**	>0.51	**Yes**

Table 7 Estimate of Required Storage per Month for 1996 Precipitation

Month	Required Storage (cm)
January	5.97
February	7.44
March	0.0
April	0.0
May	0.o
June	0.0
July	0.0
August	0.0
September	0.0
October	1.19
November	4.79
December	7.58
Total	26.87

Change in storage calculated using the following equation:

$$\Delta S = P - \beta \, PET - \Lambda$$

Where:

Climate	Season	β	Λ
No Snow & Frozen Ground	Fall-Winter	0.30	2.71
	Spring-Summer	1.00	16.78
Snow & Frozen Ground	Fall-Winter	0.37	-0.89
	Spring-Summer	1.00	16.78

Fall & Winter Months= September – February
Spring and Summer Months= March - August

Required Cover Thickness = L

L = (Required Storage) / (Available Volume)

L= (26.87 cm) / (0.185) = 145.2 cm, say 145 cm (1.45 m), or 4.8 feet.

Water Balance Modeling

Water balance modeling was conducted to evaluate the performance of the proposed Evapotranspiration cover with the purpose of verifying that the sum of water storage capacity of the cover, runoff, and evapotranspiration is greater than rainfall and that the performance criteria of a percolation rate of less than 4mm/year from the base of the cover soil layer was achieved during simulations.

Simulations were conducted using WinUNSAT-H, which is the Microsoft Windows version of the FORTRAN program UNSAT-H developed at Pacific Northwest National Laboratory for use at Hanford Nuclear Reservation. The Windows version was developed by Professor P. S. Bosscher of the University of Wisconsin-Madison and is widely used for cover design.

Input

The following data and property assumptions where used as input for the simulations:

Precipitation. Data Obtained from the Western Regional Climate Center and NOAA's National Weather Service for Whitman Mission Station.

Air Temperature. Average maximum and minimum daily temperature data was obtained from the Western Regional Climate Center for the Whitman Mission station. The dew point data available was for the Spokane region as available from the Western Regional Climate Center.

Solar Radiation. The average monthly solar radiation was obtained from the Western Regional Climate Center for the Spokane region.

Wind Speed. The average monthly wind speed was obtained from the Western Regional Climate Center for the Walla Walla Airport

Geotechnical Data. The geotechnical input parameters consisted of those summarized previously in Tables 3 and 4 and those assumptions listed in the Design Criteria section.

Vegetation Data. Assumptions with regard to vegetation input parameters were made based on the intent to install a dense perennial grass vegetative layer in accordance with the erosion and stabilization vegetation currently growing along the SR-12 embankments adjacent to the project site. Assumptions included: first day of germination at day 91, last day of transpiration at day 290, a LAI of 2.0, established during day 211 and declining after day 266, Area coverage percentage of 40%, and root length density parameters of a = 1.16, b = 0.13, and c = 0.02

Simulation Strategy

Initially, three simulation runs were conducted to "warm-up" the profile using the soil suction head determined for end of each simulated year as input for the initial conditions on the next most recent year. During the warm-up simulations daily precipitation data for the three most recent complete records 2006, 2007, and 2008 measured at the Whitman Mission Station was used. After these simulations were run, the data collected at the Whitman Mission in 1996, which is the wettest year on record at that location was run. The results are summarized in Table 8 below:

Table 8 Summary of WinUNSAT-H Predictions for Sudbury Road Landfill

Simulation Year[1]	Annual Precipitation (inches/cm)	Annual Runoff (cm)	Annual ET (cm)	Depth where percolation rate < 4mm (cm)
2006	16.53 / 41.99	4.6	31.2	≈79
2007	13.29 / 33.76	3.6	26.6	≈114
2008	12.98 / 32.97	3.6	28.6	≈118
1996	20.8 / 52.8	8.7	41.3	≈129

1-Daily Precipitation Data for 1996, 2006, 2007, and 2008 collected at Whitman Mission Weather Station.

Conclusions

1. Based on the computer simulations, the proposed alternative final cover system will transmit less than 4 mm of percolation into the underlying waste after 3 years of typical precipitation and one year of the historically wettest.

2. The alternative final cover will have at least 4.8 feet of earthen material that is capable of sustaining the proscribed ground cover, which will transpire infiltrating water and provide erosion protection.

Construction, Quality Control and Quality Assurance

Construction

- Smooth the existing surface grade prior to placement of cover soil by blading to remove existing ruts and furrows with a low ground pressure tracked dozer.

- Grades shall be maintained from a minimum slope of 3 to 5% and a maximum slope of 33%. Grades shall be maintained so that when the final cover is completed; all areas drain to the perimeter drains.

- Soil will be hauled from the soil stockpile and placed in lifts not exceeding 24 inches in thickness. Soils shall be placed by spreading and grading with a low ground pressure tracked dozer. Ruts created by the use of rubber tired equipment shall be scarified during the spreading, blading, and compaction process. Rubber tired equipment will not be allowed on the final cover surface.

- In order to achieve maximum water storage capacity and promote plant growth, the cover soil material shall be placed at about an in-place density of 82 percent and not more than 88 percent of its maximum Standard Proctor density at moisture content range of optimum to 4% dry of optimum (ASTM D 698).

- After placement and compaction, compost or biosolids should be spread over the upper surface of the soil cover and tilled or tracked into place with low ground pressure tracked equipment.

- The construction of surface runoff control features will be completed in conjunction with the Evapotranspiration Cap cover soil layer.

Test Strip Construction

At the beginning of cover construction, we recommend that the Contractor be required to construct a test strip using the equipment and demonstrate the means and methods the Contractor expects to use for handling, placement and compaction of the cover soil. The test strip should be constructed by placement and compaction of 2 lifts of not more than 24 inches in thickness each over the entire designated area. The test section should be constructed within a 10,000 SF area designated by the Engineer as shown on the approved plans. The construction of the test strip should be monitored by the Engineer and the owner's field CQA representative. The Contractor should employ independent field QC testing during construction of the test strip to obtain real-time feedback with regard to the affects of procedures and/or equipment type to in-place soil moisture/density.

Quality Control

The Contractor should provide independent field and laboratory quality control services during construction of the soil cover to verify that project requirements are met prior to acceptance testing by the Engineer.

Quality Assurance

Quality assurance and cover acceptance will be conducted by the Engineer supported by the Owner's on-site field representative.

The thickness of additional soil required to construct the final cover layer can be estimated by reviewing of the map shown on Figure 2, which depicts the measured thickness of the existing intermediate cover soils that are currently in-place over waste on Area 6. The thickness of the existing intermediate cover will be counted as part of the final cover.

To verify that the final cover soil properties will be consistent with the soil properties assumed for the analysis, visual observation, grain size analysis, hydraulic conductivity testing, and in-place density testing will be utilized as discussed below:

- **Visual Observation –** Continuous observations of material placed as final cover soil and compost. Where visual observations indicate the soil is not similar to the typical material sampled from the on-site stockpile during design, a sample will be obtained for grain size analysis to verify suitability.

- **Moisture/Density Relationship –** A Moisture/Density relationship curve should be determined for soils identified as having a significantly different grading than that sampled from the stockpile during design, but which is considered suitable by the Engineer for use as cover soil. The Moisture/density relationship should be determined for the new material in accordance with **ASTM D 698** for use in the field.

- **Hydraulic Conductivity –** A minimum of one sample per soil type identified and used during construction of the final cover layer shall be tested for remolded hydraulic conductivity. The sample should be remolded at field moisture content to approximately 85% of the Standard Proctor maximum dry density. The laboratory measured hydraulic conductivity of each remolded soil sample shall be equal to or less than the design rate of 3.0×10^{-5} cm/sec.

- **In-Place Density –** A minimum of three random tests per lift per acre of final cover soil constructed. An in-place density of no less than 82 percent of the standard proctor maximum dry density will be required unless a greater density is required to attain the appropriate minimum hydraulic conductivity stated above.

Table 9 Construction Quality Assurance

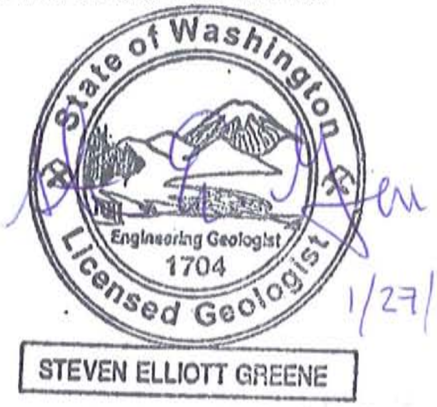
Layer	Property	Procedure	Frequency	Requirement
Intermediate Cover	Quantity	Estimate from Figure 2	N/A	N/A
Cover Soil	Thickness	Survey/Grade Stakes	1 per 10,000 sf	4.8 feet total above waste
Cover Soil	Material	Visual/Gradation ASTM D 422 sieve & hydrometer	As-needed or if soil type or source changes	Silt Loam
Cover Soil	Moisture/Density	ASTM D 698	As-needed or if soil type changes	N/A
Cover Soil	Hydraulic Conductivity	Laboratory Test ASTM D 5084	1 soil type	<3.0 x 10^{-5} cm/sec.
Cover Soil	Compaction	Field Moisture/Density	3 per lift per acre	82% to 88% or as needed to meet permeability.
Compost/Biosoilds	Thickness	Field-Visual	As needed	1-inch Minimum

*Note-In place thickness of intermediate cover soil can be counted as part of the final cover thickness.

We appreciate the opportunity to provide geotechnical services on this project. Should you have any questions or comments, or if we may be of further service, please do not hesitate to call.

Sincerely,

HWA GEOSCIENCES INC.



1/27/10

Steven E. Greene, L.G., L.E.G.
Vice President

Attachments:

Figure 1.	Sample Location Map
Figure 2	Estimated Cover Soil Requirements

Appendix A: Soils Data

Figures A-1 – A-2	Particle Size Analyses of Soils (USDA Classification)
Figure A-3	USDA Soils Classification Chart
Figure A-4	Laboratory Compaction Characteristics of Soils
Figures A-5 – A-6	Hydraulic Conductivity of Soils

USDA Table of Soil Physical Properties for Walla Walla silt loam

Appendix B: Climatological Data

Record of Climatological Observations-Whitman Mission Station (1996, 2006, 2007, and 2008)

Appendix C: Simulation Input

Climatological Input

Appendix D: Simulation Output

Suction Head Input
Simulation Summaries
Water Balance Plots for 2006, 2007, 2008, and 1996

References

Albright, W., (2009) *Cover Design Steps, Selection, Validation, Basic Soil Physics (2009), Desert Research Institute, Reno, Nevada*.

Benson, C., (2000) "*A Tutorial for WinUNSAT-H*", Powerpoint presentation, University of Wisconsin-Madison.

Benson, C., (2006) "*An Introduction to Water Balance Modeling*, University of Wisconsin-Madison.

EMCON, (2005), "*Solid Waste Permit Application for Lateral Expansion, Sudbury Road Landfill, Walla Walla, Washington, Prepared for the City of Walla Walla, Washington*", May, 2005.

Hauser, V.L, (2009), *Evapotranspiration Covers for Landfills and Waste Sites*, CRC press, 203 p.

SUDBURY LANDFILL - AREA 6 CLOSURE
SOIL SAMPLE LOCATIONS

Print Date: 12/10/2009

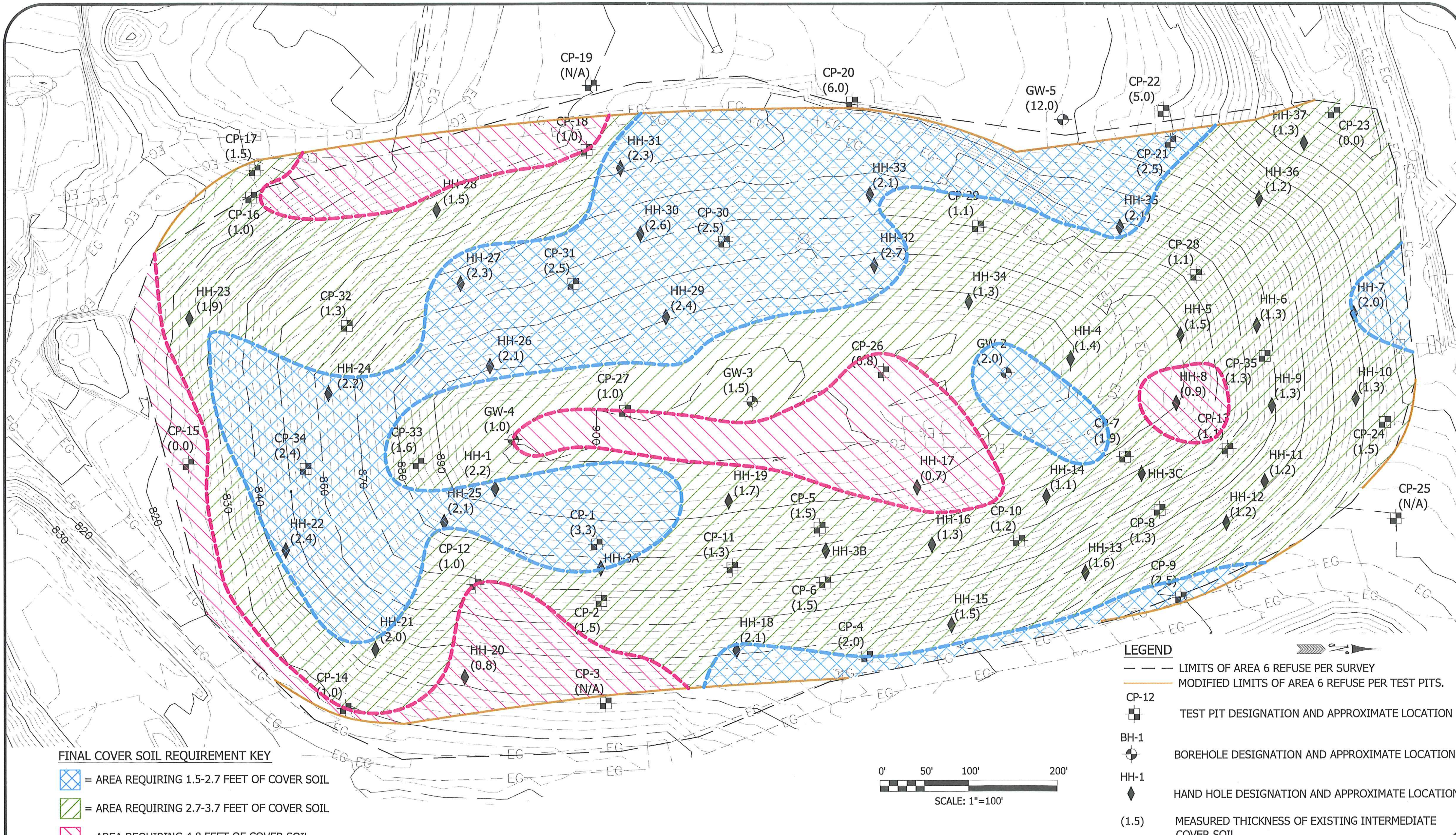
0 85 170 340 Feet

The City of Walla Walla does not warrant, guarantee or accept any liability for the accuracy, precision or completeness of any information shown or described hereon or for any inferences made therefrom. Any use made of this information is solely at the risk of the user.

CITY OF WALLA WALLA

HWA GEOSCIENCES INC.

SOIL SAMPLE LOCATION MAP	FIGURE NO. 1
ALTERNATIVE FINAL COVER DESIGN AREA 6 CLOSURE SUDBURY ROAD LANDFILL WALLA WALLA, WASHINGTON	PROJECT NO. 2009-094



FINAL COVER SOIL REQUIREMENT KEY

= AREA REQUIRING 1.5-2.7 FEET OF COVER SOIL

= AREA REQUIRING 2.7-3.7 FEET OF COVER SOIL

= AREA REQUIRING 4.8 FEET OF COVER SOIL

1. THE SOIL THICKNESS MEASUREMENTS SHOWN ARE BASED ON WIDELY SPACED HAND HOLES AND TEST PITS LOCATED BY HAND HELD GPS IN THE FIELD AND SHOULD BE CONSIDERED APPROXIMATE.
2. FINAL COVER SOIL REQUIREMENTS BASED ON MEASURED DATA (-0.5) FOOT.

BASE MAP PROVIDED BY J-U-B ENGINEERS, INC. - DATED 09-17-09

HWA GEOSCIENCES INC.

ALTERATIVE FINAL COVER DESIGN
AREA 6 CLOSURE
SUDBURY ROAD LANDFILL
WALLA WALLA, WASHINGTON

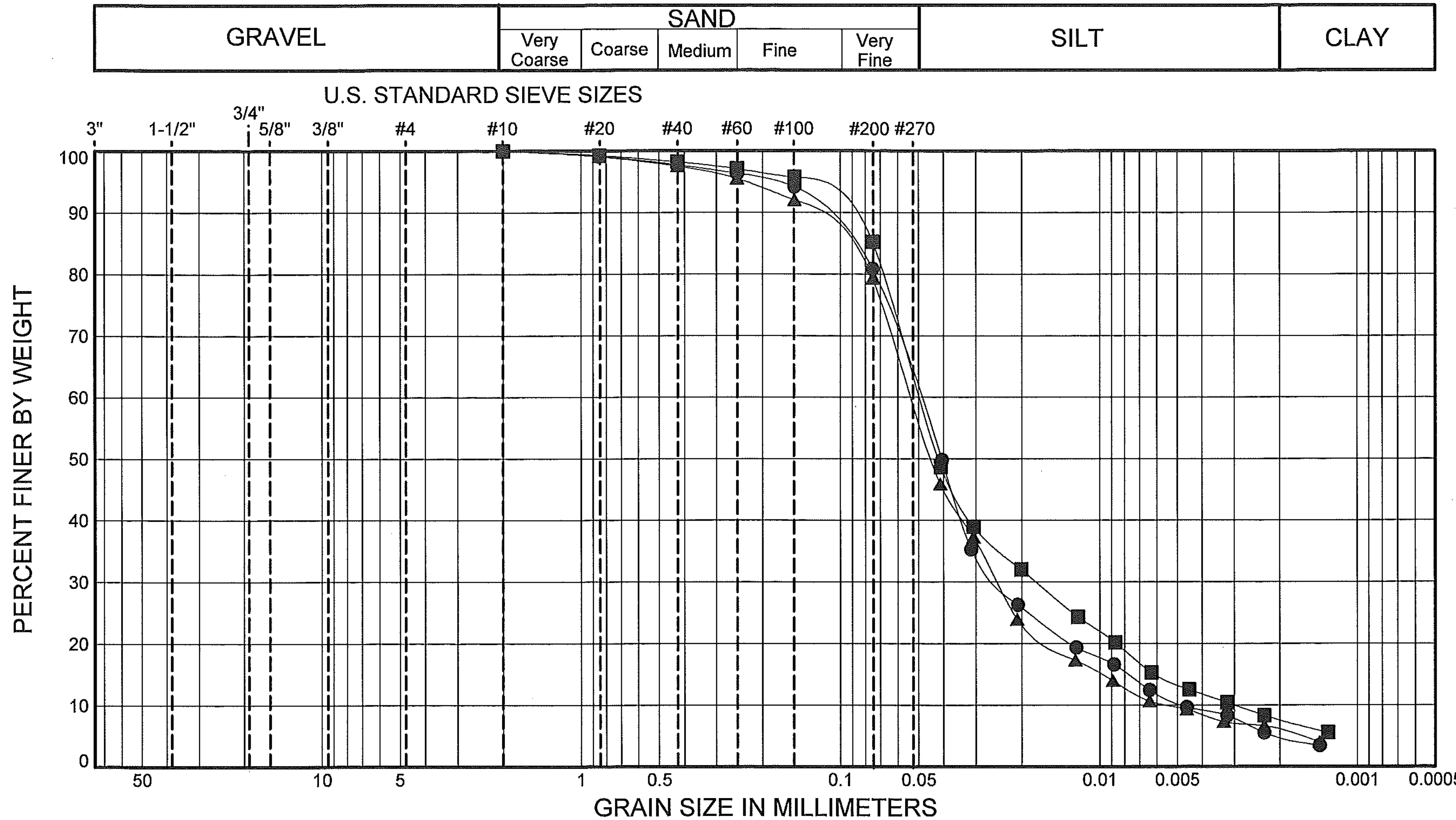
ESTIMATED COVER SOIL REQUIREMENTS

DRAWN BY EFK	FIGURE NO. 2
CHECK BY SG	PROJECT NO.
DATE 11.27.09	2009-094-21

S:\2009 PROJECTS\2009-094-21 SUDBURY LF\CAD\HWA 2009-094.DWG <FIGURE 2 cover soil requirements> Plotted: 1/28/2010 10:47 AM

APPENDIX A

Soil Data



SYMBOL	SAMPLE	DEPTH (ft)	**USDA CLASSIFICATION** (Based on portion of material passing 2.0 mm sieve.)	% MC	% Gravel of total	% Sand	% Silt	% Clay
●	Comp-1		Brown, silt loam	10		36.7	58.4	5.0
■	S-1		Brown, silt loam	11		35.8	56.6	7.7
▲	S-2		Brown, silt loam	9		40.1	54.0	5.9

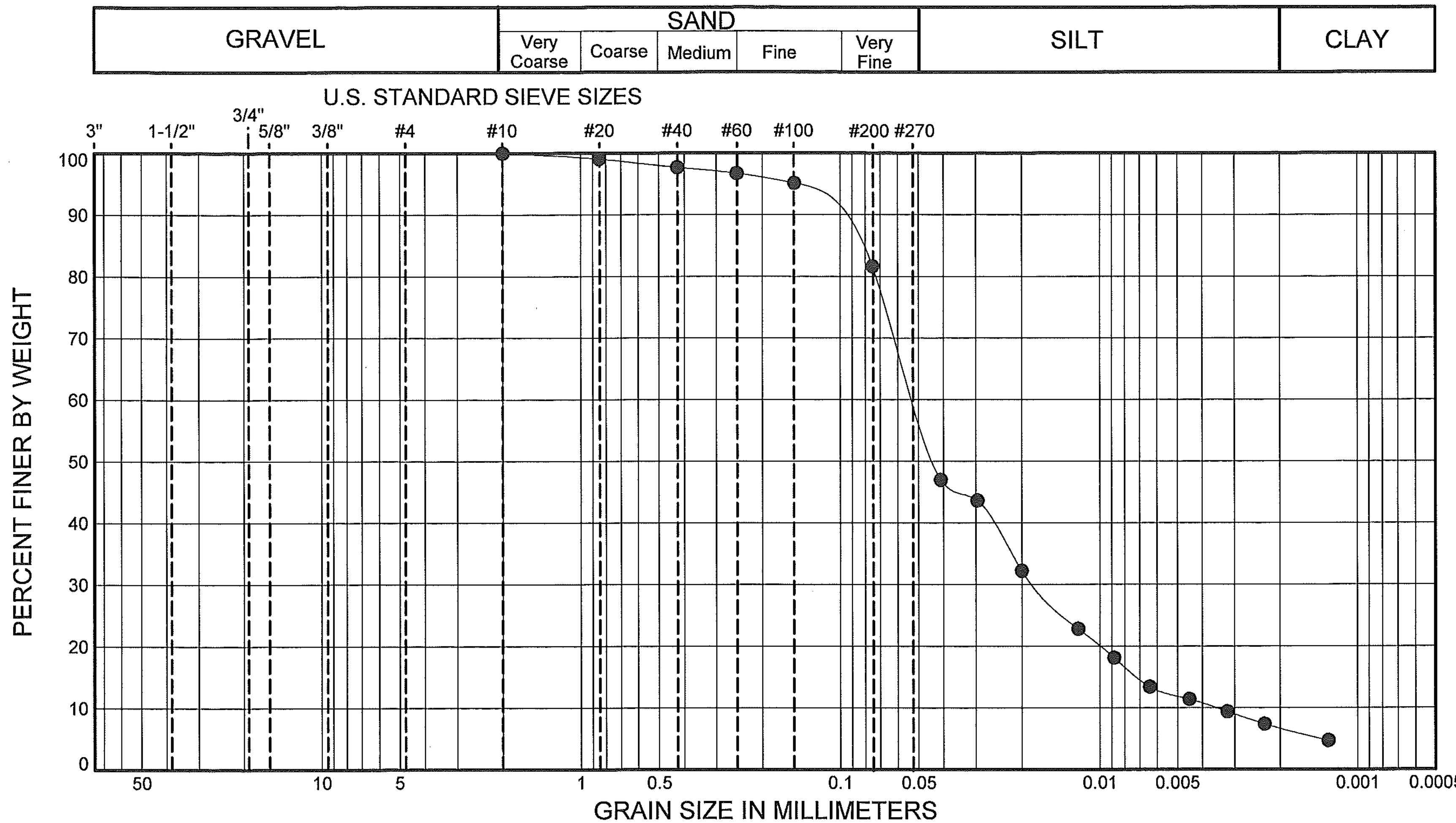
HWA GEOSCIENCES INC.

ALTERNATIVE FINAL COVER DESIGN
AREA 6 CLOSURE
SUDBURY ROAD LANDFILL
WALLA WALLA, WASHINGTON

PARTICLE-SIZE ANALYSIS OF SOILS
METHOD ASTM D422
USDA CLASSIFICATION

PROJECT NO.: 2009-094 FIGURE: A-1

HWAUSDA 2009-094.GPJ 1/26/10



SYMBOL	SAMPLE		DEPTH (ft)	**USDA CLASSIFICATION** (Based on portion of material passing 2.0 mm sieve.)	% MC	% Gravel of total	% Sand	% Silt	% Clay
●	S-3			Brown, silt loam	10		38.3	55.0	6.7

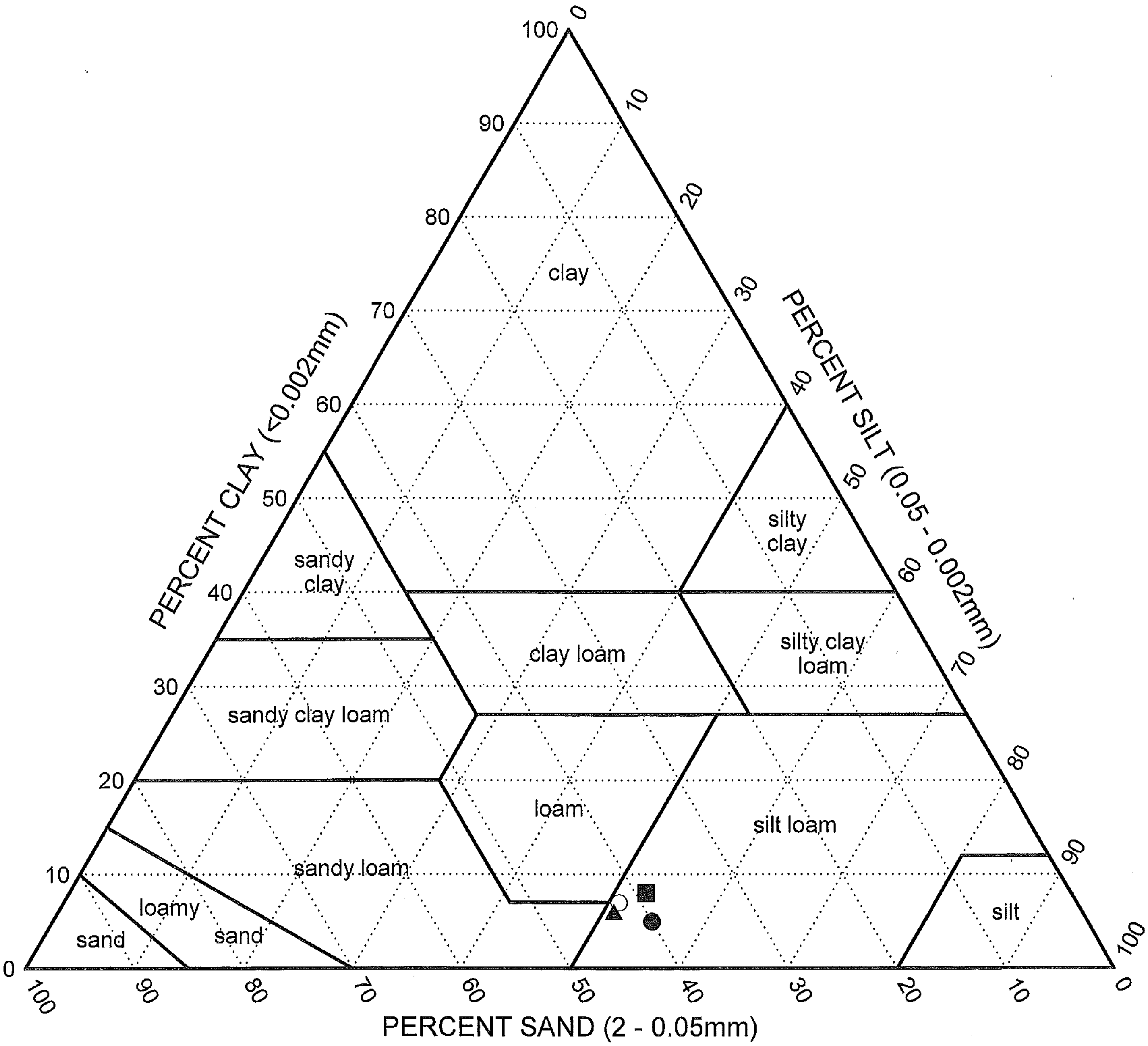
HWA GEOSCIENCES INC.

ALTERNATIVE FINAL COVER DESIGN
AREA 6 CLOSURE
SUDBURY ROAD LANDFILL
WALLA WALLA, WASHINGTON

PARTICLE-SIZE ANALYSIS OF SOILS
METHOD ASTM D422
USDA CLASSIFICATION

PROJECT NO.: 2009-094 FIGURE: A-2

HWAUSDA 2009-094.GPJ 1/26/10



	Borehole	Depth (ft)	USDA Classification	Sand (%)	Silt (%)	Clay (%)
●	**Comp-1**	**0.0**	**SILT LOAM**	**39.6**	**55.4**	**5.0**
■	**S-1**	**0.0**	**SILT LOAM**	**39.3**	**53.0**	**7.7**
▲	**S-2**	**0.0**	**SILT LOAM**	**43.3**	**50.8**	**5.9**
○	**S-3**	**0.0**	**SILT LOAM**	**41.6**	**51.7**	**6.7**

Fractions normalized to 100% passing the 2mm (#10) sieve

HWA GEOSCIENCES INC.

ALTERNATIVE FINAL COVER DESIGN
AREA 6 CLOSURE
SUDBURY ROAD LANDFILL
WALLA WALLA, WASHINGTON

USDA Textural Classification Chart

PROJECT NO.: 2009-094 FIGURE: A-3

LABORATORY COMPACTION CHARACTERISTICS OF SOIL

HWA GEOSCIENCES INC.

CLIENT: *J-U-B Engineers*

PROJECT: *Alternative Final Cover Design-Area 6, Sudbry Rd LF* SAMPLE ID: *1-3 Comp*

PROJECT NO: *2009094* Sampled By: *Client* Tested By: *SEG*

Date Sampled: *12/09/2009* Date Received: *12/11/2009* Date Tested: *12/12/2009*

MATERIAL TYPE OR DESCRIPTION:
Light brown SILT with fine sand (ML)

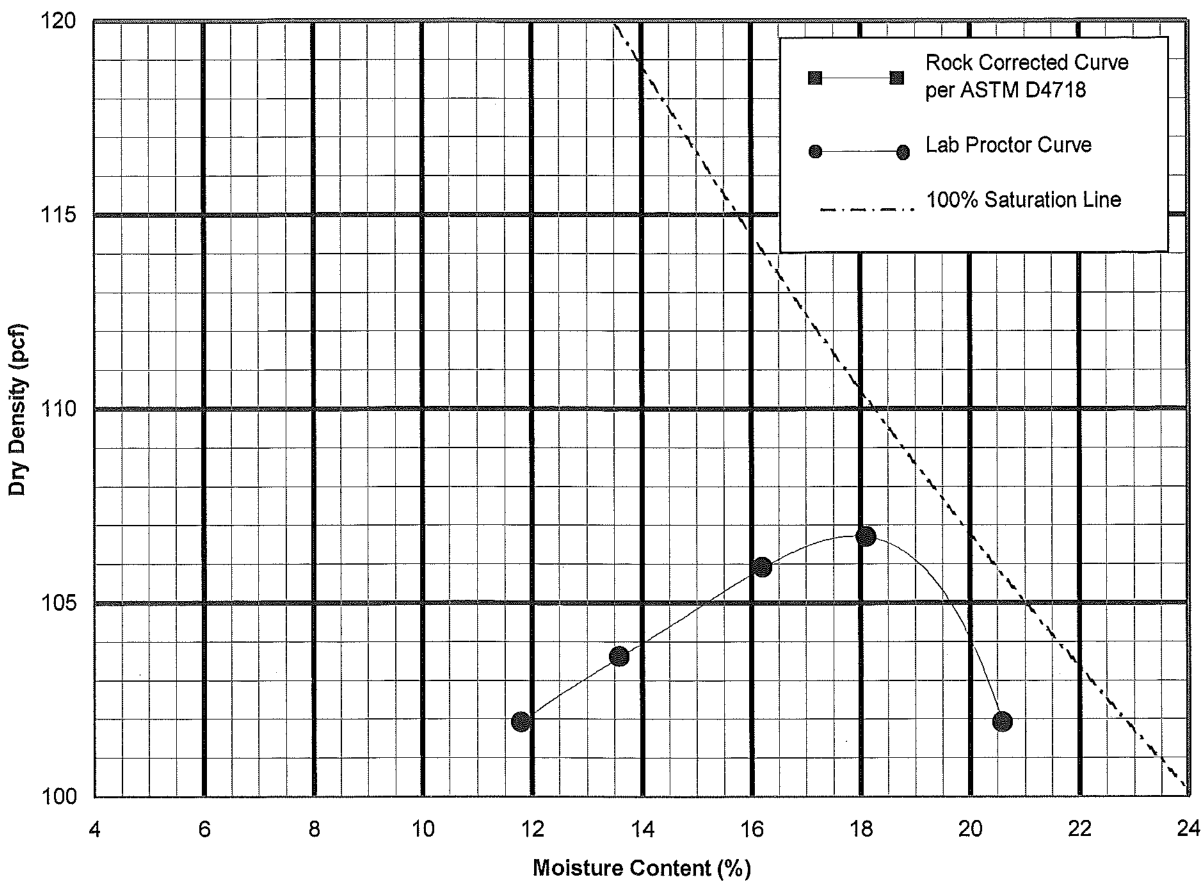
MATERIAL SOURCE, SAMPLE LOCATION AND DEPTH:
Composite of stockpile samples No. 1-3

Designation: [X] ASTM D 698 [ ] ASTM D 1557 Natural Moisture Content: 11.8 %

Method: [X] A [ ] B [ ] C Oversize: 0 % retained on: 3/4 in.

Preparation: [ ] Dry [X] Moist Rammer: [ ] Auto [X] Manual Assumed S.G.: 2.6

Test Data					
Dry Density (pcf)	101.9	103.6	105.9	106.7	101.9
Moisture Content (%)	11.8	13.6	16.2	18.1	20.6



Data Summary*	
Percent Oversize	<5%
Max. Dry Density (pcf)*	106.7
Optimum Moisture (%)*	18.1

Test Values At Other Oversize Percentages						
0.0%	5.0%	10.0%	15.0%	20.0%	25.0%	30.0%
106.7	108.6	110.5	112.5	114.6	116.7	118.9
18.1	17.2	16.4	15.5	14.7	13.8	13.0

* values corrected for oversize material per ASTM D4718, using assumed Specific Gravity shown and oversize moisture content of 1%

Reviewed By: FIGURE *A-4*

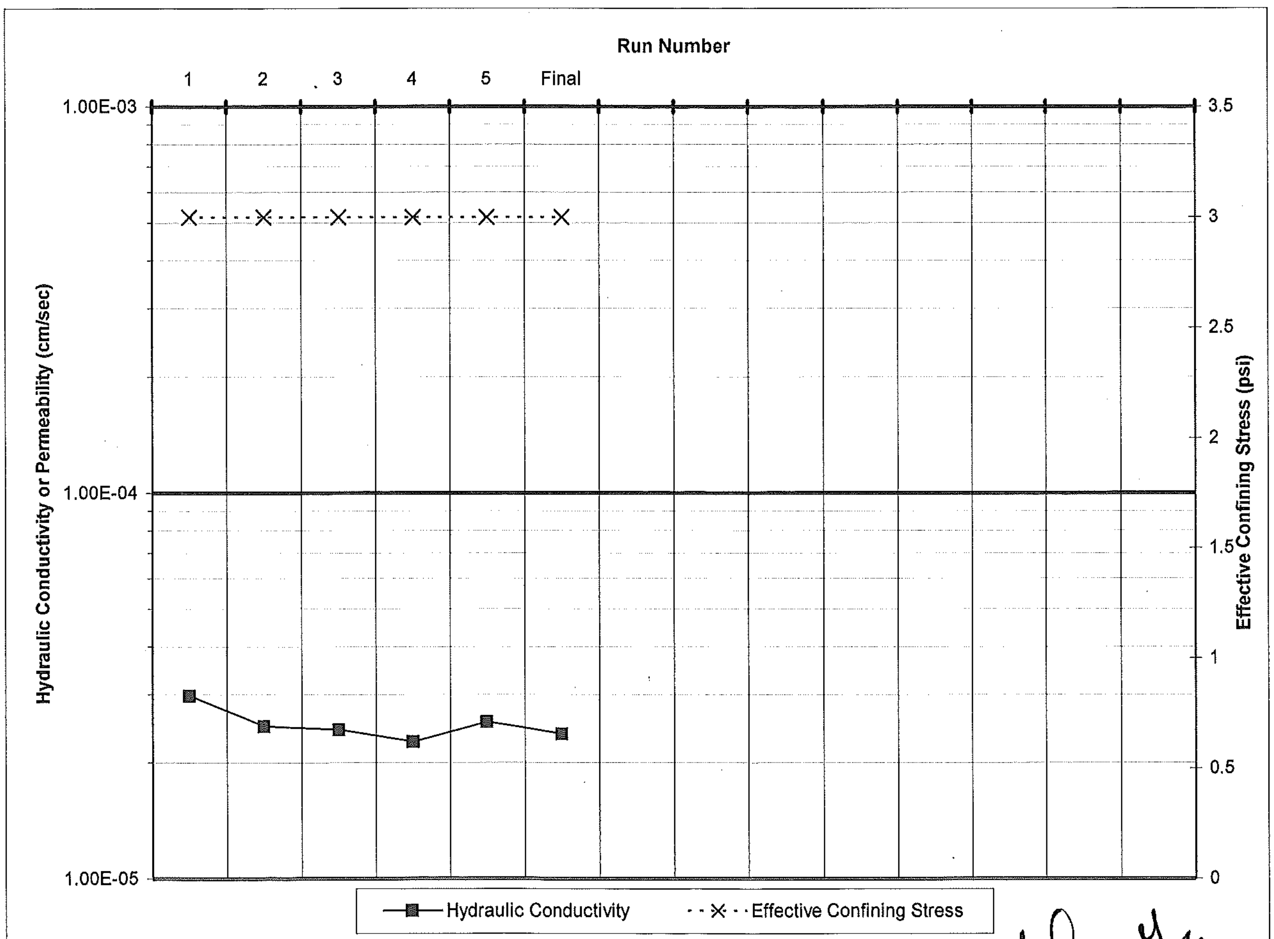
Hydraulic Conductivity (a.k.a. Permeability) Test Report

Method ASTM D 5084

HWA GEOSCIENCES INC.

Project	Alternative Final Cover Design: Area 6	Assumed Specific Gravity	2.70		
Client	?	Initial Sample Area (cm2)	81.37	Final Sample Area (cm2)	81.36
Project number	2009-094	Initial Sample Length (cm)	11.66	Final Sample Length (cm)	11.64
Date	12/17/2009	Initial Sample Volume (cc)	948.4	Final Sample Volume (cc)	947.1
Technician	HB/AC	Initial moisture (%)	11.9	Final moisture (%)	26.6
Sample point	0.85	Initial wet unit wt. (pcf)	98.6	Final wet unit weight (pcf)	111.0
Sample number	Composite	Initial dry unit wt. (pcf)	88.1	Final dry unit weight (pcf)	87.7
Sample depth	NA	Initial void ratio	0.912	Final void ratio	0.921
Sample description	Remolded silty Sand	Initial porosity	0.477	Final porosity	0.479
		Initial saturation (%)	35.2	Final saturation (%)	78.0

Run No.	Hydraulic Conductivity (cm/s)	Running Average of 4 Readings (cm/s)	Maximum % Deviation from Average (should be less than 25%)	Flow Ratio (0.75 to 1.25 required)	Effective Confining Stress (psi)	Other Information
1	3.0E-05	n.a.		1.19	3	Maximum Gradient 13.3
2	2.5E-05	n.a.		1.17	3	Minimum Gradient 10.9
3	2.4E-05	n.a.		1.15	3	Max. Back Pressure (psi) 6.0
4	2.3E-05	2.5E-05	17.2%	1.21	3	
5	2.6E-05	2.4E-05	6.7%	1.20	3	Min. Back Pressure (psi) 6.0
Final	2.4E-05	**2.4E-05**	6.0%	1.18	3	



Checked by:

FIGURE: A-5

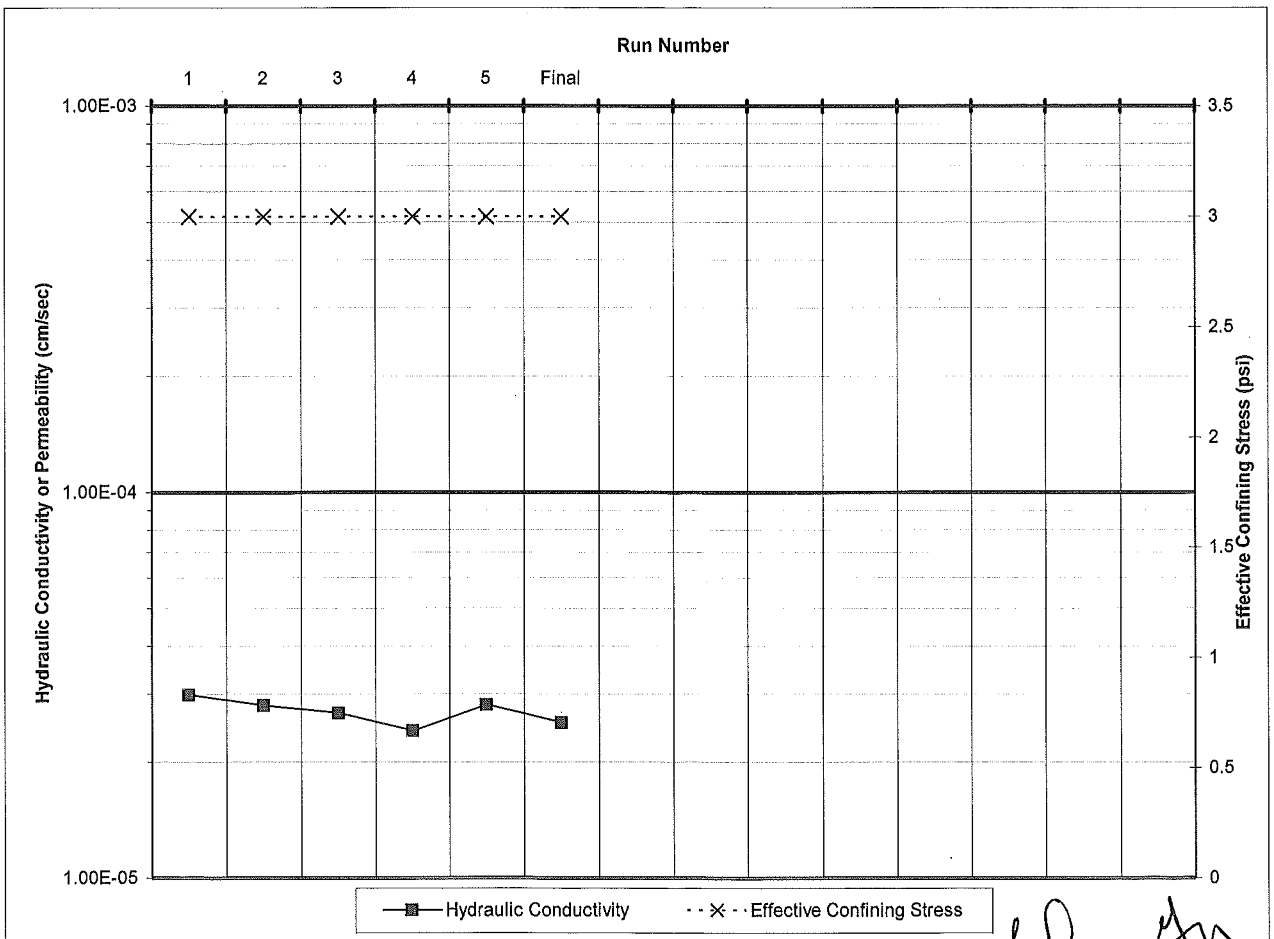
Hydraulic Conductivity (a.k.a. Permeability) Test Report

Method ASTM D 5084

HWA GEOSCIENCES INC.

Project	Alternative Final Cover Design, Area 6	Assumed Specific Gravity	2.65		
Client	J-U-B Engineers Inc.	Initial Sample Area (cm2)	82.76	Final Sample Area (cm2)	82.76
Project number	2009-094	Initial Sample Length (cm)	11.68	Final Sample Length (cm)	11.68
Date	12/17/2009	Initial Sample Volume (cc)	967.0	Final Sample Volume (cc)	967.0
Technician	HB/AC	Initial moisture (%)	12.1	Final moisture (%)	26.0
Sample point	0.9	Initial wet unit wt. (pcf)	105.6	Final wet unit weight (pcf)	118.4
Sample number	Composite	Initial dry unit wt. (pcf)	94.2	Final dry unit weight (pcf)	93.9
Sample depth	NA	Initial void ratio	0.756	Final void ratio	0.760
Sample description	Remolded silty Sand	Initial porosity	0.431	Final porosity	0.432
		Initial saturation (%)	42.4	Final saturation (%)	90.8

Run No.	Hydraulic Conductivity (cm/s)	Running Average of 4 Readings (cm/s)	Maximum % Deviation from Average (should be less than 25%)	Flow Ratio (0.75 to 1.25 required)	Effective Confining Stress (psi)	Other Information
						Maximum Gradient
						13.0
1	3.0E-05	n.a.		1.00	3	Minimum Gradient
2	2.8E-05	n.a.		0.95	3	9.5
3	2.7E-05	n.a.		1.00	3	Max. Back Pressure (psi)
4	2.4E-05	2.7E-05	11.5%	1.00	3	6.0
5	2.8E-05	2.7E-05	10.0%	0.97	3	Min. Back Pressure (psi)
Final	2.5E-05	**2.6E-05**	7.8%	0.98	3	6.0



Checked by:

FIGURE: A-6

APPENDIX B

Climatological Input Data

WHITMAN MISSION, WASHINGTON

Monthly Average Temperature (Degrees Fahrenheit)

(459200)

File last updated on Dec 22, 2009
*** Note *** Provisional Data *** After Year/Month 200908
a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,
z = 26 or more days missing, A = Accumulations present
Long-term means based on columns; thus, the monthly row may not
sum (or average) to the long-term annual value.
MAXIMUM ALLOWABLE NUMBER OF MISSING DAYS : 5
Individual Months not used for annual or monthly statistics if more than 5 days are missing.
Individual Years not used for annual statistics if any month in that year has more than 5 days missing.

YEAR (S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1962	-----z	-----z	-----z	-----z	-----z	-----z	-----z	-----z	-----z	51.94	46.05	39.82	45.94
1963	29.00	40.38	46.65	49.48	57.89	65.80	67.39	71.16	66.88	55.16	44.38	32.65	52.23
1964	39.85	40.34	43.21	49.42	55.95	65.07	70.90	67.20 a	60.35	49.50	40.48	32.39	51.22
1965	36.08	42.32	40.97	53.55	57.10 a	64.43	71.94	71.52	58.83	54.71	44.73 b	35.88 a	52.67
1966	36.95	38.93	44.90	50.92	59.21	63.28	68.68	69.31	65.82	52.55	44.21 a	41.05	52.98
1967	43.67 a	42.59	44.95	46.55	57.06	67.43	73.29	74.68	67.92	53.40	41.18	36.45	54.10
1968	37.71	42.64	47.74	48.93	57.68	65.62	73.55	68.18	62.72	49.60	42.33	32.68	52.45
1969	21.66	35.25	44.39	50.80	60.84	69.17	70.66	68.10	63.75	48.56	42.23	35.87	50.94
1970	33.66	41.32	43.76	46.95	58.74	69.48	74.03	70.48	58.00	48.71	40.98 a	36.16	51.86
1971	41.07 a	40.12	42.16	49.40	59.05	62.08	72.23	73.71	56.72	48.32	42.80	37.08	52.06
1972	32.94	37.00	47.65	47.43	59.40 a	66.33	70.66	71.24	57.62 d	50.05	41.73	27.24	50.77
1973	30.32	37.00	46.90	50.73	59.87	65.40	71.00	70.00	61.98	51.68	41.07	40.55	52.21
1974	28.66	43.05	45.29 c	50.45	56.00	67.17	70.37	70.35	61.63	49.69	44.23	38.97	52.16
1975	34.48	35.36	41.53	46.08	55.94	62.62	73.98	66.87	60.57	52.03	41.52	37.56	50.71
1976	37.81	39.12	42.15	47.75	57.15	60.60	70.11	67.50	64.05	49.37	41.53	33.52	50.89
1977	25.13	40.45	44.76	53.23	54.52	67.82	69.68	74.42	59.42	49.34	40.03	37.11	51.32
1978	32.39	39.38	46.97 a	50.62	56.39	65.22	71.15	68.42	59.62	48.90	33.18	30.90	50.26
1979	15.06	37.12	45.68	51.42	59.08	65.38	71.31	71.30 a	64.14 b	53.02	35.93	38.73	50.68
1980	26.37	35.98	43.43 a	53.48	58.25 a	62.21 a	70.52	65.47	61.73	49.62 b	42.57	37.87 a	50.62
1981	36.61 c	38.98	46.11	50.85	56.87	61.97	68.76	71.76 b	61.15	48.44	42.59 a	36.63	51.73
1982	33.90	38.91	44.11	47.02	56.13	67.43	69.69	68.27	57.25	47.97	35.88	35.00	50.13
1983	38.85	41.54	46.82	48.42	59.27	63.20	67.68	71.24	56.73	49.45	46.40	23.35	51.08
1984	33.74 n	39.76	47.76	49.58	54.69	62.57	70.95	68.97	61.70 j	47.79	41.33	28.87	51.23
1985	27.03	31.89	43.85	54.72	59.94	64.88	75.02	66.52	56.70	-----z	27.90	20.07 a	48.05
1986	33.77	38.84	48.42	50.40	58.66	69.97	70.34	74.44	59.63	52.35	43.73	32.74	52.77
1987	30.19	39.38	47.52	54.58	61.63	66.83	69.58	68.37	63.80	50.13	42.86 b	34.58	52.45
1988	33.13	39.59	45.03	52.80	57.98	64.68	70.79	67.98	60.98	55.60	45.55	33.31	52.29
1989	38.08	23.36	42.27	53.07	56.37	66.25	69.65	68.61	60.65	50.56	45.15	34.23	50.69
1990	40.26	36.98	44.82	54.70	56.42	64.32	72.74	70.81	66.12	50.23	45.43	25.00	52.32

1991	30.58	44.11	43.13	51.72	56.06	60.77	70.61	72.23	62.22	49.95	40.72	37.53	51.64
1992	38.87	42.02	47.15	53.73	60.84	69.28	69.82	70.63	59.37	51.29	40.83	33.21	53.09
1993	22.90	28.68	41.15	51.27	61.53	63.60	66.37	67.08	61.02	52.42	33.88	36.34	48.85
1994	39.84	36.27	46.19	55.40	60.27	64.58	74.18	70.81	63.87	49.74	40.83	36.66	53.22
1995	33.29	42.66	44.34	49.37	58.27	62.83	71.73	66.21	64.27	48.87	45.07	34.68	51.80
1996	33.60	31.78	43.66	52.65	55.31	63.30	72.65	69.19	60.32	50.68	39.35 j	32.82 a	51.45
1997	31.10 p	40.05	47.74	49.63	60.06	63.70	69.66	72.56	63.45	50.61	41.40	35.98	54.08
1998	36.19 b	41.84	44.89	49.42	-----z	65.18	-----z	-----z	66.92	-----z	-----z	35.80 a	48.60
1999	40.60 a	42.77	44.94	47.98	54.95	64.15	69.13	70.91 b	59.23	48.84	45.26 a	39.62 a	52.36
2000	36.02 b	39.34	44.10	53.35	58.55	64.13	70.90	69.57 a	60.05	49.11	33.88 a	31.72 a	50.89
2001	33.33 a	36.52	45.02	49.25	59.02	62.33	70.23 a	71.10 a	64.03	49.68 a	41.66 a	37.00 a	51.60
2002	37.32	38.34	41.84	51.30	56.27	66.50	73.92	67.50	60.38	46.82	39.05	39.00	51.52
2003	40.40	38.84	49.34	50.78	57.76	67.15	73.98	71.85	63.90	54.50	37.22	34.94	53.39
2004	27.79	38.29	48.76	51.52	57.97	66.05	73.63	73.76	61.48	52.52	39.92	36.87	52.38
2005	33.19	35.82	47.82	51.47	60.82	63.72	72.53	71.73	60.12	52.18	39.20	29.27	51.49
2006	42.79	35.29	44.73	50.78	58.77	66.32	75.52	69.63	61.63	49.95	42.20	31.02	52.39
2007	30.87	37.98	46.24	50.33	58.92	65.93	75.13	69.15	60.70	49.11	38.97	36.34	51.64
2008	31.58	39.79	42.98	47.18	59.03	63.48	71.21	69.74	59.60	48.35	41.73	26.45	50.10
2009	33.68	35.39	41.02	48.87	58.10	66.47	73.11	71.74	63.28	46.60 a	41.69 c	26.30 i	52.72

Period of Record Statistics

MEAN	33.72	38.37	45.00	50.62	58.06	65.04	71.32	70.05	61.53	50.43	41.12	34.29	51.71
S.D.	5.87	3.86	2.21	2.35	1.84	2.24	2.12	2.29	2.81	2.13	3.75	4.49	1.05
SKEW	-0.83	-1.59	-0.04	0.08	-0.04	0.21	0.04	0.16	0.28	0.66	-1.33	-1.15	-0.26
MAX	43.67	44.11	49.34	55.40	61.63	69.97	75.52	74.68	67.92	55.60	46.40	41.05	54.10
MIN	15.06	23.36	40.97	46.08	54.52	60.60	66.37	65.47	56.70	46.60	27.90	20.07	48.85
NO YRS	45	47	47	47	46	47	46	46	46	46	46	47	41

WHITMAN MISSION, WASHINGTON

Period of Record General Climate Summary - Growing Degree Days

Station:(459200) WHITMAN MISSION													
From Year=1962 To Year=2009													
Growing Degree Days for Selected Base Temperature (F)													
Base	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
40 M	48	66	178	320	560	751	971	932	645	332	116	49	4967
40 S	48	114	292	612	1172	1923	2894	3825	4470	4802	4918	4967	4967
45 M	16	22	74	184	405	601	816	777	495	195	47	17	3649
45 S	16	38	112	296	701	1302	2118	2894	3390	3585	3632	3649	3649
50 M	4	5	23	83	258	451	661	622	349	92	15	4	2566
50 S	4	9	32	114	372	824	1485	2106	2455	2548	2562	2566	2566
55 M	0	1	5	29	138	304	506	467	213	34	4	0	1700
55 S	0	1	6	35	172	476	982	1449	1662	1696	1699	1700	1700
60 M	0	0	1	7	59	173	353	315	105	7	1	0	1021
60 S	0	0	1	8	67	241	593	909	1013	1021	1021	1021	1021
Corn Growing Degree Days													
50 M	22	39	118	210	354	467	594	576	438	249	61	23	3150
50 S	22	61	179	389	743	1209	1804	2380	2818	3066	3127	3150	3150

M = Monthly Data
S - Running sum of monthly data.
Growing Degree Day units are computed as the difference between the daily average temperature and the base temperature. (Daily Ave. Temp. - Base Temp.) One unit is accumulated for each degree Fahrenheit the average temperature is above the base temperature. Negative numbers are discarded. Example: If the days high temperature was 95 and the low temperature was 51, the base 60 heating degree day units is ((95 + 51) / 2) - 60 = 13. This is done for each day of the month and summed.
Corn Growing Degree Day units have the limitations that the maximum daily temperatures greater than 86 F are set to 86 F and minimums less than 50 F are set to 50 F.
Table updated on Dec 28, 2009
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered

WHITMAN MISSION, WASHINGTON

Monthly Total Precipitation (inches)

(459200)

File last updated on Dec 22, 2009
*** Note *** Provisional Data *** After Year/Month 200908
a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,
z = 26 or more days missing, A = Accumulations present
Long-term means based on columns; thus, the monthly row may not
sum (or average) to the long-term annual value.
MAXIMUM ALLOWABLE NUMBER OF MISSING DAYS : 5
Individual Months not used for annual or monthly statistics if more than 5 days are missing.
Individual Years not used for annual statistics if any month in that year has more than 5 days missing.

YEAR (S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1962	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	0.00z	2.14	1.42	2.12	5.68
1963	0.74	1.50	0.62	1.75	0.60	0.17	0.49	0.87	0.60	0.51	1.78	1.63	11.26
1964	0.74	0.00	0.25	0.46	0.06	1.15	1.14	0.29	0.23	0.64	2.16	4.41	11.53
1965	2.99	0.40	0.16	1.53	0.71	0.70	0.63	1.52	0.19	0.43	1.92	0.50	11.68
1966	1.91	0.53	1.36	0.14	0.44	1.11	1.66	0.14	0.13	0.63	2.56	2.65	13.26
1967	1.64	0.28	1.53	0.98	1.49	0.65	0.02	0.00	0.70	0.45	0.82	0.90	9.46
1968	0.83	2.10	0.57	0.19	0.61	1.01	0.36	0.82	1.27	1.61	2.43	2.22	14.02
1969	4.15	0.92	0.73	2.31	1.07	0.84	0.02	0.00	0.56	1.26	0.48	1.97	14.31
1970	4.92	1.95	1.35	0.91	0.58	1.20	0.21	0.01	1.07	1.38	2.22	0.49	16.29
1971	1.03	0.69	1.21	0.94	1.45	2.86	0.57	0.62	0.99	0.78	2.39	2.76	16.29
1972	1.49	1.20	2.19	0.52	1.71	0.61	1.13	0.21	0.01	0.58	0.94	2.15	12.74
1973	0.92	1.22	0.86	0.25	0.95	0.22	0.10	0.01	1.38	1.19	4.38	4.98	16.46
1974	0.87	1.12	1.50	2.21	0.27	0.48	1.20	0.00	0.00	0.40	1.40	1.64	11.09
1975	3.52	1.39	0.81	1.05	0.54	0.75	0.28	1.25	0.00	1.48	1.16	1.99	14.22
1976	1.63	1.00	0.99	1.52	0.80	0.45	0.17	1.34	0.08	0.57	0.78	0.79	10.12
1977	0.43	0.47	1.19	0.10	1.01	0.32	0.37	3.50	1.25	0.47	1.65	3.03	13.79
1978	2.41	0.99	0.62	2.96	0.54	0.54	0.70	2.20	1.67	0.02	1.69	1.77	16.11
1979	1.27	1.10	1.49	1.40	0.78	0.19	0.13	0.93	0.41	2.26	2.14	0.86	12.96
1980	2.44	1.34	1.40	0.81	1.56	0.58	0.23	0.37	1.22	2.48	1.23	2.20	15.86
1981	0.99	2.22	2.00	0.80	2.09	2.24	0.47	0.04	0.88	1.41	1.65	1.65	16.44
1982	1.15	0.88	1.83	1.12	0.35	1.12	0.61	0.39	1.69	2.58	0.90	2.30	14.92
1983	1.67	2.09	2.65	1.03	0.71	1.32a	1.01	0.63	0.64	1.20	3.07	2.46	18.48
1984	0.70a	1.91	2.83	1.26	1.34	1.94	0.04	0.34	0.72	1.18	2.80	1.68c	16.74
1985	0.61a	1.33a	1.19a	0.42	0.58	0.68	0.18	0.94	1.09	0.87	2.36a	0.78	11.03
1986	1.94	2.75	1.63	0.77	1.31	0.13	0.66	0.09	1.42	0.81	2.73a	0.58a	14.82
1987	0.86	0.89	0.76	0.47	1.60	0.61	0.77	0.15	0.02	0.01	0.80	0.84a	7.78
1988	1.32	0.38	1.16	3.12	1.61	0.52	0.10	0.00	0.34	0.10	1.98a	0.72	11.35
1989	2.14a	1.37	2.87	1.28	2.08	0.28	0.04	0.83	0.17	0.39	1.10	0.87a	13.42
1990	0.76	0.32b	1.40	2.12	2.35	0.62	0.19	1.06	0.04	1.82	1.08	1.63	13.39
1991	1.06	0.62	1.66	0.55	4.38	2.00	0.32	0.27	0.00	1.02	3.14a	0.64	15.66

1992	0.76	1.12	0.33	1.26	0.33	0.96	1.61	1.35	0.96	0.88	1.60 a	1.10 a	12.26
1993	1.29	1.12	1.26	2.52	2.00	1.98	1.26	1.96	0.00	0.45	0.27	1.05	15.16
1994	2.32 a	1.56	0.28	1.15	1.02	0.76	0.29	0.00	0.48	1.49	2.97 a	1.67 a	13.99
1995	2.46	1.23	2.23	2.57	1.10	2.17	0.68	0.88	0.89	2.22	2.48 a	1.50 g	18.91
1996	2.72 c	2.39	0.90	2.45	1.81	1.03	0.01	0.05	0.64	1.92	2.83	4.05 a	20.80
1997	1.84 a	0.96	1.64 a	2.24	0.73	0.96	0.66	0.00	1.44	1.64	1.34	0.97	14.42
1998	2.64	1.21	1.08	1.23	0.00 z	0.48	0.00 z	0.00 z	0.80	0.00 z	0.00 z	1.35 a	8.79
1999	0.74	1.58	1.09	0.63	1.52	0.30	0.01	0.36	0.00	1.18	1.32 a	1.27 b	10.00
2000	2.29 a	2.86	2.85	0.65	2.41	0.98	0.26	0.00	1.38	1.62	1.75 a	1.12	18.17
2001	1.05	0.89	1.47	2.38	0.75	1.74	0.31	0.01	0.28	2.04	2.16 a	1.36 a	14.44
2002	0.73 a	1.21	1.44	0.83	1.23	1.86	0.48	0.00	0.35	0.19	1.06 a	2.72 a	12.10
2003	2.89 a	2.49	1.57	2.89	0.69	0.00	0.00	0.14	1.26	0.30	1.54	3.23 a	17.00
2004	3.41 a	2.46	0.59	1.41	1.62	1.45	0.14	1.02	0.29	1.06	1.85 a	1.14 a	16.44
2005	0.57 a	0.10	1.08	1.43	1.65	0.84	0.14	0.01	0.11	1.26	1.12 a	2.39 a	10.70
2006	2.55 a	0.97	2.05	2.56	1.51	1.25	0.04	0.00	0.66	0.66	1.94 a	2.34 a	16.53
2007	1.04 b	1.65	2.13	0.91	0.52	1.30	0.30	0.49	0.28	1.18	1.91 a	1.58 b	13.29
2008	1.56 a	0.55	1.39	0.51	1.26	0.74	0.38	0.36	0.35	0.45	2.11 a	3.32 a	12.98
2009	2.10 a	0.98	2.59	1.51	1.11	1.04	0.13	1.05	0.00	2.10 a	0.80 c	2.80 i	13.41

Period of Record Statistics

MEAN	1.70	1.24	1.38	1.32	1.19	0.96	0.45	0.58	0.62	1.09	1.79	1.82	13.95
S.D.	1.02	0.70	0.70	0.82	0.75	0.64	0.43	0.72	0.52	0.69	0.81	1.04	2.67
SKEW	1.08	0.51	0.45	0.56	1.68	0.92	1.24	1.92	0.45	0.41	0.61	1.05	0.06
MAX	4.92	2.86	2.87	3.12	4.38	2.86	1.66	3.50	1.69	2.58	4.38	4.98	20.80
MIN	0.43	0.00	0.16	0.10	0.06	0.00	0.00	0.00	0.00	0.01	0.27	0.49	7.78
NO YRS	47	47	47	47	46	47	46	46	47	47	47	46	44

Dew Point

WASHINGTON	J	F	M	A	M	J	J	A	S	O	N	D	
ARLINGTON	33	36	37	40	45	49	51	52	50	45	40	37	43
ELLENSBURG	15	24	27	31	38	43	46	47	43	37	32	25	34
EPHRATA	21	27	28	33	39	44	45	44	41	38	30	27	35
FORT LEWIS AAF	35	36	38	40	43	47	50	51	48	44	39	33	42
HOQUIAM	36	40	36	40	46	49	53	55	54	49	46	41	45
MCCHORD AFB	32	35	36	38	43	48	52	52	49	43	37	33	42
MOSES LAKE	22	27	29	33	40	44	45	44	41	38	30	27	35
OLYMPIA	36	36	38	41	45	50	53	49	50	42	40	33	43
PASCO	29	31	35	35	37	40	43	44	41	40	35	28	37
PORT ANGELES	33	35	36	40	45	48	50	51	49	45	41	37	43
QUILLAYUTE	38	37	40	42	46	50	53	53	51	46	42	35	44
SEATTLE-TACOMA AP	35	36	39	42	46	49	53	53	51	46	40	35	44
SEATTLE URBAN SITE													
SPOKANE	25	26	30	34	39	44	45	41	40	35	30	24	34
SPOKANE-FAIRCHILD	23	26	31	33	39	45	46	45	40	36	30	23	35
STAMPEDE PASS													
WALLA WALLA	23	29	32	35	42	47	47	48	43	40	36	30	38
WHIDBEY ISLAND	34	36	38	41	45	49	51	52	50	45	39	36	43
YAKIMA	23	26	29	34	40	44	48	45	44	37	28	24	35

WASHINGTON

AVERAGE WIND SPEED - MPH

STATION	ID	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
ARLINGTON AIRPORT AWOS	KAWO	1996-2006	5.6	4.9	6.2	5.2	4.8	4.5	4.5	4.3	3.6	4.1	5.2	5.3	4.9
BELLINGHAM AP ASOS	KBLI	1996-2006	9.0	8.0	8.9	7.4	7.4	7.8	8.0	7.4	5.8	6.4	8.0	8.7	7.7
BREMERTON AIRPORT AWOS	KPWT	1996-2006	5.9	5.4	6.3	5.7	5.7	5.5	5.0	4.6	4.7	5.1	5.0	5.2	5.3
BURLINGTON-MT VERNON AP	KBVS	2003-2006	7.0	6.1	7.2	6.1	5.1	5.2	5.1	4.7	4.5	5.1	6.3	6.3	5.7
DEER PARK AIRPORT	KDEW	1999-2006	5.3	5.4	6.6	6.8	7.0	6.6	6.0	5.6	5.1	5.2	5.1	4.9	5.8
ELLENSBURG AIRPORT ASOS	KELN	1998-2006	4.3	5.4	9.7	11.4	12.9	15.0	15.4	13.5	10.5	8.0	4.9	4.2	9.5
EPHRATA AIRPORT ASOS	KEPH	1996-2006	6.9	7.9	8.8	9.1	9.5	10.0	9.7	8.8	8.2	7.6	6.9	6.6	8.3
EVERETT-PAINE FLD ASOS	KPAE	1996-2006	9.3	8.2	9.2	8.1	7.6	7.3	7.1	6.9	6.3	7.3	8.9	9.0	8.0
FORT LEWIS-GRAY AAF	KGRF	1996-2006	6.4	6.5	7.5	6.7	6.6	6.5	6.1	5.8	5.6	6.0	6.0	6.6	6.4
FRIDAY HARBOR AP ASOS	KFHR	1997-2006	7.2	7.2	7.3	5.8	5.2	5.3	4.8	4.1	3.6	4.9	6.7	7.9	5.8
HANFORD	KHMS	1996-2006	7.5	8.2	9.4	9.2	9.9	10.3	9.9	9.2	8.4	8.0	7.8	7.2	8.8
HOQUIAM AIRPORT ASOS	KHQM	1996-2006	11.0	10.3	10.3	9.1	9.0	8.9	8.4	7.9	7.5	8.5	10.0	11.1	9.3
KELSO-LONGVIEW AP ASOS	KKLS	1996-2006	5.9	5.0	5.4	4.8	4.6	5.2	5.8	5.4	4.4	4.1	5.0	5.8	5.1
MOSES LAKE AIRPORT ASOS	KMWH	1996-2006	6.4	6.9	8.1	8.1	8.5	8.6	7.9	7.3	6.9	7.0	6.5	5.9	7.3
OLYMPIA AIRPORT ASOS	KOLM	1996-2006	6.0	5.5	6.6	5.8	5.9	5.9	5.3	4.9	4.6	5.3	5.7	5.9	5.6
OMAK AIRPORT ASOS	KOMK	1998-2006	5.0	5.9	7.3	7.9	7.8	8.0	8.4	8.3	8.0	6.9	5.2	4.2	6.9
ORCAS ISLAND AP AWOS	KORS	2004-2006	7.4	5.6	5.8	5.8	5.6	5.6	6.0	5.8	4.3	5.0	6.5	5.9	5.8
PASCO-TRI CITIES ASOS	KPSC	1996-2006	6.7	6.4	7.8	7.5	8.0	8.0	6.9	6.5	5.6	6.0	6.3	6.1	6.8
PORT ANGELES AP ASOS	KCLM	1996-2006	4.2	4.7	5.2	5.9	6.4	6.6	6.6	5.6	4.6	4.2	4.2	4.6	5.2
PULLMAN-MOSCOW AP ASOS	KPUW	1996-2006	9.1	8.5	8.8	7.8	7.2	6.1	4.7	5.1	5.5	6.6	8.6	9.3	7.3
QUILLAYUTE AIRPORT ASOS	KUIL	1996-2006	6.5	6.2	6.5	5.8	5.2	4.8	4.6	4.2	3.9	4.8	5.8	6.3	5.4
RENTON AIRPORT ASOS	KRNT	1996-2006	6.5	6.7	7.5	7.3	7.3	7.4	7.6	7.2	6.5	5.9	5.8	6.1	6.8
SEATTLE-BOEING FIELD	KBFI	1996-2006	6.4	5.9	7.1	6.5	6.5	6.5	6.1	5.8	5.4	5.7	6.1	6.3	6.2
SEATTLE-TACOMA AP ASOS	KSEA	1996-2006	8.3	8.2	8.5	7.4	7.3	7.2	7.0	6.4	6.5	6.9	7.5	8.3	7.5
SHELTON AIRPORT ASOS	KSHN	1996-2006	4.4	4.8	6.2	6.4	7.5	8.0	8.1	7.3	5.3	4.9	4.4	4.5	6.0
SKYKOMISH AP, WA (S88).	WIN	1992-1994	5.5	5.1	5.4	6.4	5.8	5.3	4.2	4.3	4.2	4.3	4.1	4.8	4.9
SPOKANE INTL AP ASOS	KGEG	1996-2006	8.7	8.2	10.2	9.5	9.5	9.3	8.8	8.2	8.0	8.3	8.4	8.1	8.7
SPOKANE-FAIRCHILD AFB	KSKA	1996-2006	10.1	9.6	10.7	10.2	9.7	9.2	8.5	8.5	8.3	8.9	9.6	9.6	9.4
SPOKANE-FELTS FLD ASOS	KSFF	1996-2006	4.5	4.6	6.5	6.4	6.5	6.4	6.3	5.8	5.1	4.9	4.7	4.3	5.5
STAMPEDE PASS ASOS	KSMP	1996-2006	7.0	7.7	7.5	7.3	7.6	8.1	8.3	7.8	7.5	7.5	7.3	7.2	7.6
TACOMA NARROWS AP ASOS	KTIW	1999-2006	7.0	6.7	7.6	6.8	6.8	6.5	6.2	5.5	5.4	6.2	6.5	6.4	6.5
TACOMA-MCCHORD AFB	KTCM	1996-2006	7.4	7.3	8.6	7.7	7.6	7.5	7.0	6.5	6.3	6.8	7.1	7.2	7.2
TOLEDO AIRPORT	KTDO	1996-2006	3.4	4.3	4.9	4.9	4.5	4.6	4.7	4.3	3.9	3.6	3.5	3.5	4.1
VANCOUVER AIRPORT ASOS	KVUO	1996-2006	5.6	5.5	5.0	4.7	4.7	5.2	5.5	5.1	4.2	4.0	4.8	5.6	5.0
WALLA WALLA AP ASOS	KALW	1996-2006	8.0	8.0	9.8	9.1	9.1	9.3	9.1	8.8	8.1	7.8	7.7	7.6	8.5
WENATCHEE-PANGBORN AP	KEAT	1996-2006	3.3	4.2	7.1	8.4	9.3	10.3	9.8	9.2	7.8	6.0	4.0	3.3	6.9
WHIDBEY ISLAND NAS	KNUW	1996-2006	10.7	9.5	10.9	9.0	7.9	7.4	6.9	6.3	5.9	8.3	10.2	11.0	8.6
YAKIMA AIRPORT ASOS	KYKM	1996-****	4.0	5.5	6.8	7.3	7.5	7.9	7.2	6.7	6.3	5.6	4.7	3.8	6.0

Station: WHITMAN MISSION
State: WA County: WALLA WALLA Standard Time:
Observation Time Temperature: 0800 Precipitation: 9900 (LST)

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	1996	01	1	54	29	99999	42	0	23	999.99		9999.9		99999									
	1996	01	2	40	30	99999	35	0	30	999.99		9999.9		99999									
	1996	01	3	62	30	50	46	0	19	999.99		9999.9		99999									
	1996	01	4	56	36	38	46	0	19	T		0		0									
	1996	01	5	41	30	31	36	0	29	T		0		0									
	1996	01	6	36	27	27	32	0	33	0.10		9999.9		1									
	1996	01	7	31	27	30	29	0	36	0		0		99999									
	1996	01	8	46	30	33	38	0	27	0.47		0		99999									
	1996	01	9	38	32	32	35	0	30	0.02		0		99999									
	1996	01	10	43	32	41	38	0	27	0.22		0		99999									
	1996	01	11	52	31	32	42	0	23	0		0		0									
	1996	01	12	60	27	28	44	0	21	0		0		0									
	1996	01	13	42	26	28	34	0	31	0		0		0									
	1996	01	14	58	27	45	43	0	22	T		0		0									
	1996	01	15	62	44	58	53	0	12	0.10		0		0									
	1996	01	16	60	46	46	53	0	12	0.01		0		0									
	1996	01	17	46	31	33	39	0	26	0.14		0		0									
	1996	01	18	41	20	21	31	0	34	0		0		0									
	1996	01	19	36	21	28	29	0	36	0.11		9999.9		1									
	1996	01	20	40	28	40	34	0	31	0.30		9999.9		2									
	1996	01	21	47	33	42	40	0	25	0.04		0		0									
	1996	01	22	41	28	30	35	0	30	0		0		0									
	1996	01	23	42	29	37	36	0	29	T		0		0									
	1996	01	24	44	26	28	35	0	30	0.50		9999.9		6									
	1996	01	25	42	25	26	34	0	31	0.07		1.0		5									
	1996	01	26	37	20	22	29	0	36	0		0		4									
	1996	01	27	26	18	19	22	0	43	0.01		T		3									
	1996	01	28	30	18	28	24	0	41	0.52		6.5		10								2.22	
	1996	01	29	35	10	12	23	0	42	0.05		1.0		10									
	1996	01	30	15	-7	-7	4	0	61	0.06		2.0		10									
	1996	01	31	-2	-22	-21	-12	0	77	0		0		9	33.6	42.0	25.2	62	-22	0	966	2.72	10.5

The '*' flags in Preliminary indicate the data has not completed processing and quality control and may contain errors

All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

**T=TRACE, A=Accumulated amount since last measure, B=Accumulated amount includes estimated values, S=Included in a subsequent value, E=Estimated amount.

Station: WHITMAN MISSION
State: WA County: WALLA WALLA Standard Time:

Observation Time Temperature: 0800 Precipitation: 0800 (LST)

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	1996	02	1	-4	-21	-12	-12	0	77	0		0		9									
	1996	02	2	-2	-20	-20	-11	0	76	T		T		9									
	1996	02	3	-2	-21	-13	-11	0	76	0		0		8									
	1996	02	4	6	-13	6	-3	0	68	0.17		2.0		10									
	1996	02	5	18	1	18	10	0	55	T		T		8									
	1996	02	6	49	18	37	34	0	31	0.18		0		6									
	1996	02	7	57	37	47	47	0	18	0.22		0		T									
	1996	02	8	61	45	60	53	0	12	0.50		0		0									
	1996	02	9	66	48	48	57	0	8	0.12		0		0									
	1996	02	10	54	24	25	39	0	26	0		0		0									
	1996	02	11	42	24	26	33	0	32	0		0		0									
	1996	02	12	45	25	27	35	0	30	0		0		0									
	1996	02	13	48	26	27	37	0	28	0		0		0									
	1996	02	14	48	25	27	37	0	28	0		0		0									
	1996	02	15	51	26	27	39	0	26	0		0		0									
	1996	02	16	51	26	26	39	0	26	0		0		0									
	1996	02	17	54	26	39	40	0	25	0.05		0		0									
	1996	02	18	54	39	53	47	0	18	0.10		0		0									
	1996	02	19	62	44	44	53	0	12	0.12		0		0									
	1996	02	20	57	38	47	48	0	17	0.03		0		0									
	1996	02	21	63	37	37	50	0	15	0.27		0		0									
	1996	02	22	51	33	36	42	0	23	0.18		0		0									
	1996	02	23	49	35	35	42	0	23	0.18		0		0									
	1996	02	24	44	30	33	37	0	28	T		0		0									
	1996	02	25	41	32	32	37	0	28	0.04		T		0									
	1996	02	26	35	14	18	25	0	40	0.23		2.0		1									
	1996	02	27	35	15	22	25	0	40	0		0		99999									
	1996	02	28	36	19	19	28	0	37	0		0		99999									
	1996	02	29	43	19	20	31	0	34	0		0		99999	31.8	41.8	21.8	66	-21	0	957	2.39	4.0
	1996	03	1	41	22	99999	32	0	33	0		0		0									
	1996	03	2	50	24	25	37	0	28	0		0		0									
	1996	03	3	61	25	44	43	0	22	0.06		0		0									
	1996	03	4	62	40	41	51	0	14	0.03		0		0									
	1996	03	5	49	32	32	41	0	24	0.19		0		0									
	1996	03	6	38	32	38	35	0	30	0		0		0									
	1996	03	7	57	35	35	46	0	19	0		0		0									
	1996	03	8	47	35	39	41	0	24	0.21		0		0									
	1996	03	9	45	39	39	42	0	23	0		0		0									
	1996	03	10	52	39	42	46	0	19	0		0		0									
	1996	03	11	59	42	49	51	0	14	0.04		0		0									
	1996	03	12	68	47	48	58	0	7	0.16		0		0									

1996	03	13	59	34	35	47	0	18	T	0	0									
1996	03	14	58	34	37	46	0	19	0	0	0									
1996	03	15	65	37	49	51	0	14	0	0	0									
1996	03	16	60	31	39	46	0	19	0	0	0									
1996	03	17	57	32	37	45	0	20	0	0	0									
1996	03	18	60	27	33	44	0	21	0	0	0									
1996	03	19	65	32	42	49	0	16	0	0	0									
1996	03	20	62	33	45	48	0	17	0	0	0									
1996	03	21	58	27	32	43	0	22	0	0	0									
1996	03	22	55	32	43	44	0	21	0.12	0	0									
1996	03	23	58	34	38	46	0	19	T	0	0									
1996	03	24	58	31	31	45	0	20	0.07	0	0									
1996	03	25	38	19	23	29	0	36	0	0	0									
1996	03	26	45	23	34	34	0	31	0	0	0									
1996	03	27	50	33	39	42	0	23	0	0	0									
1996	03	28	54	33	33	44	0	21	0	0	0									
1996	03	29	53	33	42	43	0	22	0	0	0									
1996	03	30	56	36	40	46	0	19	0	0	0									
1996	03	31	57	37	42	47	0	18	0.02	0	0	43.7	54.7	32.6	68	19	0	653	0.90	0
1996	04	1	47	42	44	45	0	20	0.54	0	0									
1996	04	2	60	43	48	52	0	13	0.03	0	0									
1996	04	3	60	29	44	45	0	20	0	0	0									
1996	04	4	59	31	42	45	0	20	0	0	0									
1996	04	5	67	31	39	49	0	16	0	0	0									
1996	04	6	73	39	50	56	0	9	0	0	0									
1996	04	7	77	45	46	61	0	4	0	0	0									
1996	04	8	81	46	48	64	0	1	0	0	0									
1996	04	9	82	48	56	65	0	0	0	0	0									
1996	04	10	75	47	47	61	0	4	0.05	0	0									
1996	04	11	65	47	49	56	0	9	0.03	0	0									
1996	04	12	65	42	46	54	0	11	0.26	0	0									
1996	04	13	59	42	44	51	0	14	0	0	0									
1996	04	14	63	32	34	48	0	17	0	0	0									
1996	04	15	74	34	48	54	0	11	0	0	0									
1996	04	16	73	48	50	61	0	4	0.06	0	0									
1996	04	17	70	39	44	55	0	10	0.12	0	0									
1996	04	18	63	42	43	53	0	12	0.23	0	0									
1996	04	19	61	33	35	47	0	18	0	0	0									
1996	04	20	60	35	42	48	0	17	0.29	0	0									
1996	04	21	61	31	36	46	0	19	0	0	0									
1996	04	22	65	36	40	51	0	14	T	0	0									
1996	04	23	61	40	58	51	0	14	0.18	0	0									
1996	04	24	66	47	47	57	0	8	0.63	0	0									
1996	04	25	62	44	46	53	0	12	0	0	0									
1996	04	26	62	39	42	51	0	14	0.03	0	0									
1996	04	27	62	39	44	51	0	14	0	0	0									
1996	04	28	63	31	38	47	0	18	T	0	0									
1996	04	29	69	38	51	54	0	11	0	0	0									
1996	04	30	70	44	51	57	0	8	T	0	0	52.6	65.8	39.5	82	29	0	362	2.45	0
1996	05	1	67	45	47	56	0	9	T	0	0									
1996	05	2	64	40	46	52	0	13	0	0	0									
1996	05	3	60	41	43	51	0	14	0	0	0									
1996	05	4	59	40	45	50	0	15	0	0	0									
1996	05	5	62	29	34	46	0	19	0	0	0									
1996	05	6	65	33	46	49	0	16	0	0	0									
1996	05	7	69	43	45	56	0	9	0	0	0									
1996	05	8	63	31	39	47	0	18	0	0	0									
1996	05	9	61	29	38	45	0	20	0	0	0									
1996	05	10	64	33	46	49	0	16	0	0	0									
1996	05	11	68	46	53	57	0	8	0	0	0									
1996	05	12	71	49	51	60	0	5	T	0	0									

1996	05	13	70	51	60	61	0	4	0	0	0									
1996	05	14	72	54	55	63	0	2	0.44	0	0									
1996	05	15	72	55	56	64	0	1	0.24	0	0									
1996	05	16	71	52	55	62	0	3	0.12	0	0									
1996	05	17	71	53	57	62	0	3	0.07	0	0									
1996	05	18	71	46	50	59	0	6	0.38	0	0									
1996	05	19	71	46	51	59	0	6	0.20	0	0									
1996	05	20	66	44	50	55	0	10	T	0	0									
1996	05	21	67	42	48	55	0	10	0	0	0									
1996	05	22	60	48	51	54	0	11	0.34	0	0									
1996	05	23	61	38	46	50	0	15	0.01	0	0									
1996	05	24	65	38	45	52	0	13	T	0	0									
1996	05	25	74	40	50	57	0	8	0	0	0									
1996	05	26	79	45	56	62	0	3	0	0	0									
1996	05	27	78	49	55	64	0	1	0	0	0									
1996	05	28	72	46	51	59	0	6	0	0	0									
1996	05	29	66	44	52	55	0	10	0	0	0									
1996	05	30	68	39	50	54	0	11	0.01	0	0									
1996	05	31	69	44	54	57	0	8	0	0	0	55.3	67.6	43.0	79	29	0	293	1.81	0
1996	06	1	74	44	59	59	0	6	0	0	0									
1996	06	2	80	57	99999	69	4	0	0	0	0									
1996	06	3	87	55	64	71	6	0	0	0	0									
1996	06	4	86	60	63	73	8	0	0	0	0									
1996	06	5	77	43	58	60	0	5	0	0	0									
1996	06	6	78	40	51	59	0	6	0	0	0									
1996	06	7	88	49	66	69	4	0	0	0	0									
1996	06	8	91	57	64	74	9	0	0	0	0									
1996	06	9	85	49	59	67	2	0	0	0	0									
1996	06	10	74	42	58	58	0	7	0	0	0									
1996	06	11	78	51	57	65	0	0	0	0	0									
1996	06	12	76	40	53	58	0	7	0	0	0									
1996	06	13	82	42	58	62	0	3	0	0	0									
1996	06	14	85	49	61	67	2	0	0	0	0									
1996	06	15	83	47	60	65	0	0	0	0	0									
1996	06	16	84	42	53	63	0	2	0	0	0									
1996	06	17	78	52	54	65	0	0	0	0	0									
1996	06	18	66	42	52	54	0	11	0	0	0									
1996	06	19	69	38	53	54	0	11	0	0	0									
1996	06	20	79	37	47	58	0	7	0	0	0									
1996	06	21	82	41	54	62	0	3	0	0	0									
1996	06	22	82	51	59	67	2	0	0	0	0									
1996	06	23	82	51	60	67	2	0	T	0	0									
1996	06	24	71	47	54	59	0	6	0.14	0	0									
1996	06	25	72	46	56	59	0	6	0	0	0									
1996	06	26	76	50	56	63	0	2	0	0	0									
1996	06	27	81	56	59	69	4	0	0.62	0	0									
1996	06	28	73	51	59	62	0	3	0.27	0	0									
1996	06	29	76	46	59	61	0	4	0	0	0									
1996	06	30	81	47	57	64	0	1	0	0	0	63.3	79.2	47.4	91	37	43	90	1.03	0
1996	07	1	88	54	68	71	6	0	0	0	0									
1996	07	2	93	54	67	74	9	0	0	0	0									
1996	07	3	98	60	75	79	14	0	0	0	0									
1996	07	4	91	64	64	78	13	0	0	0	0									
1996	07	5	77	44	56	61	0	4	0	0	0									
1996	07	6	77	39	51	58	0	7	0	0	0									
1996	07	7	88	42	54	65	0	0	0	0	0									
1996	07	8	94	47	61	71	6	0	0	0	0									
1996	07	9	95	56	72	76	11	0	0	0	0									
1996	07	10	90	48	66	69	4	0	0	0	0									
1996	07	11	88	46	57	67	2	0	0	0	0									
1996	07	12	94	46	62	70	5	0	0	0	0									

1996	07	13	94	51	62	73	8	0	0	0	0									
1996	07	14	101	52	68	77	12	0	0	0	0									
1996	07	15	98	60	79	79	14	0	0	0	0									
1996	07	16	100	63	70	82	17	0	0	0	0									
1996	07	17	100	60	66	80	15	0	0	0	0									
1996	07	18	82	52	56	67	2	0	0.01	0	0									
1996	07	19	75	48	59	62	0	3	T	0	0									
1996	07	20	77	48	56	63	0	2	0	0	0									
1996	07	21	82	53	62	68	3	0	0	0	0									
1996	07	22	88	49	61	69	4	0	0	0	0									
1996	07	23	96	48	61	72	7	0	0	0	0									
1996	07	24	102	50	59	76	11	0	0	0	0									
1996	07	25	100	56	69	78	13	0	0	0	0									
1996	07	26	100	47	60	74	9	0	0	0	0									
1996	07	27	107	59	67	83	18	0	0	0	0									
1996	07	28	101	60	68	81	16	0	0	0	0									
1996	07	29	100	68	75	84	19	0	0	0	0									
1996	07	30	92	59	70	76	11	0	T	0	0									
1996	07	31	97	56	69	77	12	0	0	0	0	72.6	92.4	52.9	107	39	261	16	0.01	0
1996	08	1	93	52	66	73	8	0	0	0	0									
1996	08	2	93	60	63	77	12	0	0	0	0									
1996	08	3	79	46	57	63	0	2	0.05	0	0									
1996	08	4	76	48	60	62	0	3	0	0	0									
1996	08	5	81	59	59	70	5	0	0	0	0									
1996	08	6	77	45	58	61	0	4	0	0	0									
1996	08	7	84	43	54	64	0	1	0	0	0									
1996	08	8	95	47	57	71	6	0	0	0	0									
1996	08	9	100	51	58	76	11	0	0	0	0									
1996	08	10	101	49	55	75	10	0	0	0	0									
1996	08	11	104	55	65	80	15	0	0	0	0									
1996	08	12	95	45	56	70	5	0	0	0	0									
1996	08	13	88	47	54	68	3	0	0	0	0									
1996	08	14	94	54	70	74	9	0	0	0	0									
1996	08	15	98	56	61	77	12	0	0	0	0									
1996	08	16	94	56	65	75	10	0	0	0	0									
1996	08	17	92	48	49	70	5	0	0	0	0									
1996	08	18	79	49	56	64	0	1	0	0	0									
1996	08	19	79	42	49	61	0	4	0	0	0									
1996	08	20	86	42	61	64	0	1	0	0	0									
1996	08	21	80	40	50	60	0	5	0	0	0									
1996	08	22	84	40	48	62	0	3	0	0	0									
1996	08	23	92	42	48	67	2	0	0	0	0									
1996	08	24	96	44	49	70	5	0	0	0	0									
1996	08	25	96	48	50	72	7	0	0	0	0									
1996	08	26	98	50	55	74	9	0	0	0	0									
1996	08	27	89	55	74	72	7	0	0	0	0									
1996	08	28	78	57	61	68	3	0	0	0	0									
1996	08	29	83	48	53	66	1	0	0	0	0									
1996	08	30	100	53	57	77	12	0	0	0	0									
1996	08	31	86	49	54	68	3	0	0	0	0	69.2	89.4	49.0	104	40	160	24	0.05	0
1996	09	1	80	43	48	62	0	3	0	0	0									
1996	09	2	79	42	46	61	0	4	0	0	0									
1996	09	3	81	46	50	64	0	1	0	0	0									
1996	09	4	82	50	52	66	1	0	0	0	0									
1996	09	5	73	52	53	63	0	2	T	0	0									
1996	09	6	73	48	49	61	0	4	0	0	0									
1996	09	7	74	47	60	61	0	4	0	0	0									
1996	09	8	82	50	60	66	1	0	0	0	0									
1996	09	9	86	47	48	67	2	0	0	0	0									
1996	09	10	85	41	44	63	0	2	0	0	0									
1996	09	11	89	44	47	67	2	0	0	0	0									

1996	09	12	89	47	56	68	3	0	0	0	0									
1996	09	13	82	54	59	68	3	0	0.05	0	0									
1996	09	14	80	56	56	68	3	0	0.09	0	0									
1996	09	15	76	56	57	66	1	0	0.32	0	0									
1996	09	16	70	48	50	59	0	6	T	0	0									
1996	09	17	70	46	47	58	0	7	0	0	0									
1996	09	18	70	41	46	56	0	9	0	0	0									
1996	09	19	71	43	53	57	0	8	0.15	0	0									
1996	09	20	70	46	47	58	0	7	0.03	0	0									
1996	09	21	70	41	45	56	0	9	0	0	0									
1996	09	22	68	42	43	55	0	10	0	0	0									
1996	09	23	65	27	29	46	0	19	0	0	0									
1996	09	24	64	29	29	47	0	18	0	0	0									
1996	09	25	64	29	31	47	0	18	0	0	0									
1996	09	26	71	30	41	51	0	14	0	0	0									
1996	09	27	73	41	42	57	0	8	0	0	0									
1996	09	28	87	42	49	65	0	0	0	0	0									
1996	09	29	90	48	51	69	4	0	0	0	0									
1996	09	30	87	42	44	65	0	0	0	0	0	60.3	76.7	43.9	90	27	20	153	0.64	0
1996	10	1	83	35	37	59	0	6	0	0	0									
1996	10	2	75	34	37	55	0	10	0	0	0									
1996	10	3	69	37	42	53	0	12	0	0	0									
1996	10	4	80	40	41	60	0	5	T	0	0									
1996	10	5	78	41	50	60	0	5	0.05	0	0									
1996	10	6	72	39	42	56	0	9	0	0	0									
1996	10	7	75	38	40	57	0	8	0	0	0									
1996	10	8	81	40	42	61	0	4	0	0	0									
1996	10	9	79	38	39	59	0	6	0	0	0									
1996	10	10	75	39	53	57	0	8	0	0	0									
1996	10	11	79	52	59	66	1	0	0	0	0									
1996	10	12	75	44	47	60	0	5	0	0	0									
1996	10	13	74	47	49	61	0	4	0.06	0	0									
1996	10	14	61	45	49	53	0	12	0.06	0	0									
1996	10	15	62	43	44	53	0	12	0.14	0	0									
1996	10	16	62	37	37	50	0	15	0	0	0									
1996	10	17	56	23	24	40	0	25	0	0	0									
1996	10	18	54	24	48	39	0	26	0.42	0	0									
1996	10	19	55	39	42	47	0	18	0.11	0	0									
1996	10	20	55	29	31	42	0	23	0	0	0									
1996	10	21	54	26	28	40	0	25	0	0	0									
1996	10	22	58	28	53	43	0	22	0.06	0	0									
1996	10	23	56	33	35	45	0	20	0.12	0	0									
1996	10	24	56	34	52	45	0	20	0.49	0	0									
1996	10	25	60	38	43	49	0	16	0.07	0	0									
1996	10	26	57	35	36	46	0	19	T	0	0									
1996	10	27	51	31	38	41	0	24	T	0	0									
1996	10	28	64	34	38	49	0	16	0	0	0									
1996	10	29	65	38	46	52	0	13	0.27	0	0									
1996	10	30	50	38	40	44	0	21	0.07	0	0									
1996	10	31	44	28	34	36	0	29	0	0	0	50.7	65.0	36.4	83	23	1	438	1.92	0
1996	11	1	49	25	26	37	0	28	0	0	0									
1996	11	2	50	26	31	38	0	27	0	0	0									
1996	11	3	44	28	43	36	0	29	T	0	0									
1996	11	4	57	41	43	49	0	16	0.03	0	0									
1996	11	5	52	37	40	45	0	20	0	0	0									
1996	11	6	52	38	47	45	0	20	0.02	0	0									
1996	11	7	57	32	36	45	0	20	0.01	0	0									
1996	11	8	53	36	53	45	0	20	T	0	0									
1996	11	9	65	29	31	47	0	18	0	0	0									
1996	11	10	65	29	33	47	0	18	0	0	0									
1996	11	11	41	33	36	37	0	28	0.01	0	0									

1996	11	12	52	28	31	40	0	25	0	0	0									
1996	11	13	56	30	48	43	0	22	0.13	0	0									
1996	11	14	59	42	43	51	0	14	0.05	0	0									
1996	11	15	99999	99999	99999	99999	99999	99999	T	0	0									
1996	11	16	99999	99999	99999	99999	99999	99999	0	0	0									
1996	11	17	99999	99999	99999	99999	99999	99999	0.04	0	0									
1996	11	18	99999	99999	99999	99999	99999	99999	0.03	0	0									
1996	11	19	99999	99999	99999	99999	99999	99999	1.90	0	0									
1996	11	20	40	32	35	36	0	29	0.23	0	0									
1996	11	21	48	24	26	36	0	29	0.03	0	0									
1996	11	22	99999	99999	30	99999	99999	99999	0.12	0	0									
1996	11	23	34	28	28	31	0	34	T	0	0									
1996	11	24	28	25	27	27	0	38	0.21	0.5	0									
1996	11	25	30	23	23	27	0	38	0.02	0	0									
1996	11	26	33	23	29	28	0	37	T	0	0									
1996	11	27	99999	99999	99999	99999	99999	99999	0	0	0									
1996	11	28	99999	99999	99999	99999	99999	99999	0	0	0									
1996	11	29	99999	99999	99999	99999	99999	99999	0	0	0									
1996	11	30	47	99999	46	99999	99999	99999	0	0	0				65	23			2.83	0.5
1996	12	1	54	38	43	46	0	19	T	0	0									
1996	12	2	47	36	39	42	0	23	0	0	0									
1996	12	3	46	34	34	40	0	25	0.09	0	0									
1996	12	4	44	24	39	34	0	31	0	0	0									
1996	12	5	49	33	41	41	0	24	0.09	0	0									
1996	12	6	47	36	99999	42	0	23	0	0	0									
1996	12	7	48	31	38	40	0	25	0	0	0									
1996	12	8	51	38	44	45	0	20	0.09	0	0									
1996	12	9	46	36	40	41	0	24	0.26	0	0									
1996	12	10	43	37	37	40	0	25	0.43	0	0									
1996	12	11	50	32	32	41	0	24	0.08	0	0									
1996	12	12	50	32	99999	41	0	24	0.08	0	0									
1996	12	13	51	32	99999	42	0	23	0.15	0	0									
1996	12	14	49	32	33	41	0	24	0	0	0									
1996	12	15	48	29	32	39	0	26	0	0	0									
1996	12	16	51	31	31	41	0	24	T	0	0									
1996	12	17	42	19	19	31	0	34	0	0	0									
1996	12	18	26	18	22	22	0	43	0	0	0									
1996	12	19	26	22	25	24	0	41	0	0	0									
1996	12	20	37	25	31	31	0	34	0.06	0	0									
1996	12	21	32	27	27	30	0	35	0.01	0	0									
1996	12	22	29	20	24	25	0	40	0.01	T	T									
1996	12	23	29	23	27	26	0	39	0.02	0.8	1									
1996	12	24	27	24	24	26	0	39	0.03	1.0	2									
1996	12	25	27	24	99999	26	0	39	999.99	9999.9	3									
1996	12	26	99999	13	13	99999	99999	99999	0.85	3.0	6									
1996	12	27	16	13	15	15	0	50	1.00	6.0	9									
1996	12	28	26	-2	1	12	0	53	T	9999.9	9									
1996	12	29	13	1	13	7	0	58	0.46	4.0	11									
1996	12	30	41	13	14	27	0	38	0	0	9									
1996	12	31	52	14	40	33	0	32	0.34	0	6	32.6	39.9	25.3	54	-2	0	959	4.05	14.8

The '*' flags in Preliminary indicate the data has not completed processing and quality control and may contain errors

All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

****T=TRACE. A=Accumulated amount since last measure. B=Accumulated amount includes estimated values. S=Included in a subsequent value. E=Estimated amount.**

This page was dynamically generated on Wed Dec 30 13:18:13 EST 2009 by http://www.ncdc.noaa.gov/dailyform/DlyFORMv2

Station: WHITMAN MISSION
State: WA County: WALLA WALLA Standard Time:

Observation Time Temperature: 0800 Precipitation: 9900
(LST)

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	2006	01	1	53	36	99999	45	0	20	999.99		0		0									
	2006	01	2	52	35	38	44	0	21	0.62	A	0		0									
	2006	01	3	54	29	29	42	0	23	0.06		0		0									
	2006	01	4	48	29	32	39	0	26	0.04		0		0									
	2006	01	5	53	30	31	42	0	23	0		0		0									
	2006	01	6	53	30	31	42	0	23	0		0		0									
	2006	01	7	42	31	40	37	0	28	0.06		0		0									
	2006	01	8	57	37	40	47	0	18	0.07		0		0									
	2006	01	9	51	33	47	42	0	23	T		0		0									
	2006	01	10	58	47	57	53	0	12	0.02		0		0									
	2006	01	11	60	46	46	53	0	12	0.06		0		0									
	2006	01	12	53	37	40	45	0	20	0		0		0									
	2006	01	13	55	40	54	48	0	17	0.09		0		0									
	2006	01	14	57	42	42	50	0	15	0.32		0		0									
	2006	01	15	44	33	34	39	0	26	0.46		0		0									
	2006	01	16	47	33	34	40	0	25	0		0		0									
	2006	01	17	53	33	47	43	0	22	0.34		0		0									
	2006	01	18	53	31	31	42	0	23	0.25		0		0									
	2006	01	19	44	31	37	38	0	27	0.05		0		0									
	2006	01	20	48	37	44	43	0	22	0.02		0		0									
	2006	01	21	52	31	33	42	0	23	0		0		0									
	2006	01	22	49	31	31	40	0	25	0		0		0									
	2006	01	23	53	30	37	42	0	23	0		0		0									
	2006	01	24	59	27	29	43	0	22	0		0		0									
	2006	01	25	43	27	29	35	0	30	0		0		0									
	2006	01	26	38	28	35	33	0	32	0.02		0		0									
	2006	01	27	49	33	38	41	0	24	0		0		0									
	2006	01	28	50	34	45	42	0	23	0.07		0		0									
	2006	01	29	54	36	38	45	0	20	T		0		0									
	2006	01	30	57	38	56	48	0	17	T		0		0									
	2006	01	31	59	40	41	50	0	15	T		0		0	42.8	51.5	34.0	60	27	0	680	2.55	0

The '*' flags in Preliminary indicate the data has not completed processing and quality control and may contain errors

All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

****T=TRACE, A=Accumulated amount since last measure, B=Accumulated amount includes estimated values, S=Included in a subsequent value, E=Estimated amount.**

Station: WHITMAN MISSION
State: WA **County:** WALLA WALLA **Standard Time:**
Observation Time Temperature: 0800 **Precipitation:** 0800 **(LST)**

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	2006	02	1	52	41	46	47	0	18	0.07		0		0									
	2006	02	2	56	40	44	48	0	17	0		0		0									
	2006	02	3	54	40	44	47	0	18	0.07		0		0									
	2006	02	4	60	38	50	49	0	16	0.06		0		0									
	2006	02	5	54	38	39	46	0	19	T		0		0									
	2006	02	6	51	25	28	38	0	27	0		0		0									
	2006	02	7	48	23	24	36	0	29	0		0		0									
	2006	02	8	49	23	29	36	0	29	0		0		0									
	2006	02	9	45	25	28	35	0	30	0.20		0		0									
	2006	02	10	39	18	18	29	0	36	0		0		0									
	2006	02	11	44	17	18	31	0	34	0		0		0									
	2006	02	12	44	18	24	31	0	34	0		0		0									
	2006	02	13	48	24	25	36	0	29	0		0		0									
	2006	02	14	43	24	28	34	0	31	0.14		0		0									
	2006	02	15	43	18	18	31	0	34	0		0		0									
	2006	02	16	38	18	28	28	0	37	0		0		0									
	2006	02	17	41	15	15	28	0	37	0		0		0									
	2006	02	18	27	7	7	17	0	48	0		0		0									
	2006	02	19	29	7	9	18	0	47	0		0		0									
	2006	02	20	38	9	25	24	0	41	0		0		0									
	2006	02	21	45	22	37	34	0	31	0		0		0									
	2006	02	22	53	22	41	38	0	27	0		0		0									
	2006	02	23	52	41	46	47	0	18	0		0		0									
	2006	02	24	57	30	30	44	0	21	0.01		0		0									
	2006	02	25	47	18	19	33	0	32	0		0		0									
	2006	02	26	42	19	28	31	0	34	0		0		0									
	2006	02	27	43	19	36	31	0	34	0.09		0		0									
	2006	02	28	59	36	44	48	0	17	0.33		0		0	35.3	46.5	24.1	60	7	0	825	0.97	0
	2006	03	1	49	30	32	40	0	25	0.05		0		0									
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	2006	03	3	61	24	25	43	0	22	0.01		0		0									
	2006	03	4	46	25	38	36	0	29	0		0		0									
	2006	03	5	56	37	51	47	0	18	0		0		0									
	2006	03	6	55	38	38	47	0	18	0.09		0		0									
	2006	03	7	53	34	37	44	0	21	0.05		0		0									
	2006	03	8	57	37	39	47	0	18	T		0		0									
	2006	03	9	48	34	36	41	0	24	0.10		0		0									
	2006	03	10	48	29	31	39	0	26	T		0		0									
	2006	03	11	51	22	25	37	0	28	0		0		0									
	2006	03	12	52	23	27	38	0	27	0		0		0									
	2006	03	13	50	25	33	38	0	27	0		0		0									

2006	03	14	54	33	42	44	0	21	T	0	0									
2006	03	15	53	28	35	41	0	24	0.02	0	0									
2006	03	16	57	35	49	46	0	19	0	0	0									
2006	03	17	57	39	43	48	0	17	0.32	0	0									
2006	03	18	56	33	35	45	0	20	0.15	0	0									
2006	03	19	54	30	33	42	0	23	0.01	0	0									
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2006	03	21	58	28	33	43	0	22	0	0	0									
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2006	03	23	66	42	44	54	0	11	0	0	0									
2006	03	24	67	44	58	56	0	9	0.01	0	0									
2006	03	25	63	43	44	53	0	12	0.57	0	0									
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2006	03	29	62	42	45	52	0	13	0.01	0	0									
2006	03	30	62	44	49	53	0	12	0	0	0									
2006	03	31	62	45	48	54	0	11	0.08	0	0	44.7	56.0	33.5	67	22	0	620	2.05	0
2006	04	1	65	40	45	53	0	12	0.06	0	0									
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2006	04	26	70	36	43	53	0	12	0	0	0									
2006	04	27	69	40	50	55	0	10	0	0	0									
2006	04	28	71	41	48	56	0	9	0	0	0									
2006	04	29	81	45	53	63	0	2	0	0	0									
2006	04	30	78	38	44	58	0	7	0.01	0	0	50.8	64.0	37.5	81	27	0	420	2.56	0
2006	05	1	64	33	49	49	0	16	0	0	0									
2006	05	2	64	28	36	46	0	19	0	0	0									
2006	05	3	64	27	33	46	0	19	0	0	0									
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2006	05	7	69	50	51	60	0	5	0.03	0	0									
2006	05	8	64	41	43	53	0	12	0.03	0	0									
2006	05	9	62	29	39	46	0	19	0	0	0									
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2006	05	13	68	29	38	49	0	16	0	0	0									

2006	05	14	73	36	46	55	0	10	0	0	0								
2006	05	15	83	44	53	64	0	1	0	0	0								
2006	05	16	86	53	64	70	5	0	0	0	0								
2006	05	17	94	55	67	75	10	0	0	0	0								
2006	05	18	96	58	65	77	12	0	0	0	0								
2006	05	19	98	59	67	79	14	0	0	0	0								
2006	05	20	91	59	60	75	10	0	0.75	0	0								
2006	05	21	74	50	54	62	0	3	0	0	0								
2006	05	22	71	55	57	63	0	2	0.06	0	0								
2006	05	23	74	49	55	62	0	3	0.45	0	0								
2006	05	24	78	49	56	64	0	1	0.02	0	0								
2006	05	25	69	52	54	61	0	4	0.05	0	0								
2006	05	26	65	47	52	56	0	9	0.07	0	0								
2006	05	27	65	46	50	56	0	9	0.03	0	0								
2006	05	28	64	49	50	57	0	8	0.01	0	0								
2006	05	29	67	50	54	59	0	6	0.01	0	0								
2006	05	30	73	41	54	57	0	8	0	0	0								
2006	05	31	83	43	54	63	0	2	0	0	0	58.8	74.0	43.5	98	27	51	234	1.51	0
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2006	06	2	81	52	61	67	2	0	0	0	0								
2006	06	3	81	52	60	67	2	0	0.30	0	0								
2006	06	4	76	59	60	68	3	0	0.16	0	0								
2006	06	5	74	51	63	63	0	2	0.49	0	0								
2006	06	6	81	54	63	68	3	0	0	0	0								
2006	06	7	82	56	62	69	4	0	0	0	0								
2006	06	8	80	54	56	67	2	0	0.06	0	0								
2006	06	9	73	45	55	59	0	6	0	0	0								
2006	06	10	73	50	58	62	0	3	0	0	0								
2006	06	11	78	44	55	61	0	4	0	0	0								
2006	06	12	78	55	61	67	2	0	0	0	0								
2006	06	13	79	56	60	68	3	0	0.07	0	0								
2006	06	14	65	55	56	60	0	5	0.12	0	0								
2006	06	15	73	51	58	62	0	3	0	0	0								
2006	06	16	74	54	62	64	0	1	0	0	0								
2006	06	17	79	51	57	65	0	0	0	0	0								
2006	06	18	75	44	55	60	0	5	0	0	0								
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2006	06	26	96	53	62	75	10	0	0	0	0								
2006	06	27	99	59	67	79	14	0	0	0	0								
2006	06	28	101	58	66	80	15	0	0	0	0								
2006	06	29	95	62	64	79	14	0	0	0	0								
2006	06	30	75	52	62	64	0	1	0.05	0	0	66.3	80.8	51.8	101	44	87	39	1.25	0
2006	07	1	95	62	73	79	14	0	0	0	0								
2006	07	2	97	56	70	77	12	0	0	0	0								
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2006	07	11	89	49	62	69	4	0	0	0	0								
2006	07	12	93	60	67	77	12	0	0	0	0								
2006	07	13	82	60	66	71	6	0	0.04	0	0								

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2006	07	21	101	54	62	78	13	0	0	0	0									
2006	07	22	103	59	71	81	16	0	0	0	0									
2006	07	23	106	62	72	84	19	0	0	0	0									
2006	07	24	108	64	73	86	21	0	0	0	0									
2006	07	25	104	64	74	84	19	0	0	0	0									
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2006	07	30	86	55	61	71	6	0	0	0	0									
2006	07	31	77	44	53	61	0	4	0	0	0	75.5	94.5	56.6	108	44	337	4	0.04	0
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2006	08	3	86	46	54	66	1	0	0	0	0									
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2006	08	31	73	40	44	57	0	8	0	0	0	69.6	89.4	49.9	99	40	164	12	0	0
2006	09	1	79	36	38	58	0	7	0	0	0									
2006	09	2	85	38	40	62	0	3	0	0	0									
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2006	09	6	93	51	53	72	7	0	0	0	0									
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2006	09	8	88	49	52	69	4	0	0	0	0									
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2006	09	10	78	43	44	61	0	4	0	0	0									
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2006	11	25	47	37	38	42	0	23	0.05		0	0									
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2006	11	28	43	15	16	29	0	36	T		T	T									
2006	11	29	20	15	20	18	0	47	T		T	0									
2006	11	30	25	18	24	22	0	43	T		T	T	42.2	51.4	33.0	75	9	4	682	1.94	0
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2006	12	6	31	25	27	28	0	37	0		0	0									
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2006	12	8	34	28	30	31	0	34	0		0	0									
2006	12	9	31	28	28	30	0	35	0		0	0									
2006	12	10	33	28	31	31	0	34	0.10		0	0									
2006	12	11	41	28	33	35	0	30	0.07		0	0									
2006	12	12	56	32	45	44	0	21	0.04		0	0									
2006	12	13	57	40	52	49	0	16	0.13		0	0									
2006	12	14	57	40	41	49	0	16	0.03		0	0									
2006	12	15	65	39	43	52	0	13	0.38		0	0									
2006	12	16	45	22	22	34	0	31	0		0	0									
2006	12	17	42	20	22	31	0	34	0		0	0									
2006	12	18	28	16	16	22	0	43	0		0	0									
2006	12	19	24	15	23	20	0	45	T		9999.9	0									
2006	12	20	25	23	25	24	0	41	0		0	0									
2006	12	21	30	25	30	28	0	37	0.07		T	T									
2006	12	22	43	24	28	34	0	31	0.04		T	T									
2006	12	23	43	28	31	36	0	29	0.09		T	T									
2006	12	24	38	24	27	31	0	34	0.02		0	0									
2006	12	25	46	25	99999	36	0	29	999.99		0	0									
2006	12	26	40	26	33	33	0	32	0.86	A	0	0									
2006	12	27	34	31	31	33	0	32	0.31		0	0									
2006	12	28	39	22	22	31	0	34	0.20		0	0									
2006	12	29	39	18	19	29	0	36	0		0	0									
2006	12	30	29	18	26	24	0	41	0		0	0									
2006	12	31	27	26	27	27	0	38	0		0	0	31.0	37.2	24.8	65	15	0	1044	2.34	0

The '*' flags in Preliminary indicate the data has not completed processing and quality control and may contain errors

All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

****T=TRACE. A=Accumulated amount since last measure. B=Accumulated amount includes estimated values. S=Included in a subsequent value. E=Estimated amount.**

Station: WHITMAN MISSION
State: WA County: WALLA WALLA Standard Time:
Observation Time Temperature: 0800 Precipitation: 9900 (LST)

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	2007	01	1	32	24	99999	28	0	37	999.99		0		0									
	2007	01	2	57	27	57	42	0	23	0.02	A	0		0									
	2007	01	3	57	41	43	49	0	16	0.59		0		0									
	2007	01	4	49	33	34	41	0	24	0.28		0		0									
	2007	01	5	42	27	27	35	0	30	0.02		0		0									
	2007	01	6	48	27	39	38	0	27	T		0		0									
	2007	01	7	47	36	45	42	0	23	0.08		0		0									
	2007	01	8	56	39	42	48	0	17	T		0		0									
	2007	01	9	52	31	32	42	0	23	0		0		0									
	2007	01	10	59	31	31	45	0	20	0		0		0									
	2007	01	11	43	21	23	32	0	33	0		0		0									
	2007	01	12	30	10	10	20	0	45	T		0		0									
	2007	01	13	27	8	8	18	0	47	0		0		0									
	2007	01	14	22	7	18	15	0	50	T		T		T									
	2007	01	15	25	6	6	16	0	49	T		T		0									
	2007	01	16	24	6	12	15	0	50	999.99		T		0									
	2007	01	17	25	12	22	19	0	46	0.01		T		T									
	2007	01	18	24	19	19	22	0	43	T		T		T									
	2007	01	19	26	16	19	21	0	44	T		9999.9		0									
	2007	01	20	34	19	33	27	0	38	T		0		0									
	2007	01	21	47	20	20	34	0	31	0		0		0									
	2007	01	22	45	20	29	33	0	32	0		0		0									
	2007	01	23	51	28	29	40	0	25	0		0		0									
	2007	01	24	47	23	25	35	0	30	0		0		0									
	2007	01	25	31	17	18	24	0	41	0		0		0									
	2007	01	26	47	18	31	33	0	32	0.02		0		0									
	2007	01	27	32	29	30	31	0	34	0.01		0		0									
	2007	01	28	32	30	30	31	0	34	T		T		0									
	2007	01	29	32	29	29	31	0	34	0		0		0									
	2007	01	30	32	27	27	30	0	35	0.01		0		0									
	2007	01	31	31	27	27	29	0	36	0		0		0	30.9	38.9	22.8	59	6	0	1049	1.04	0

The '*' flags in Preliminary indicate the data has not completed processing and quality control and may contain errors

All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

**T=TRACE. A=Accumulated amount since last measure. B=Accumulated amount includes estimated values. S=Included in a subsequent value. E=Estimated amount.

Station: WHITMAN MISSION
State: WA County: WALLA WALLA Standard Time:

Observation Time Temperature: 0800 Precipitation: 0800 (LST)

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	2007	02	1	30	26	26	28	0	37	T		0		0									
	2007	02	2	29	14	15	22	0	43	0		0		0									
	2007	02	3	40	14	22	27	0	38	0		0		0									
	2007	02	4	31	22	29	27	0	38	0.13		T		0									
	2007	02	5	34	29	31	32	0	33	T		0		0									
	2007	02	6	35	31	32	33	0	32	0		0		0									
	2007	02	7	38	32	32	35	0	30	0		0		0									
	2007	02	8	37	32	35	35	0	30	0.07		0		0									
	2007	02	9	54	34	35	44	0	21	0.14		0		0									
	2007	02	10	50	30	33	40	0	25	0.18		0		0									
	2007	02	11	37	33	34	35	0	30	0.24		0		0									
	2007	02	12	43	34	37	39	0	26	0.10		0		0									
	2007	02	13	54	30	31	42	0	23	0		0		0									
	2007	02	14	43	31	34	37	0	28	0		0		0									
	2007	02	15	52	33	46	43	0	22	0.19		0		0									
	2007	02	16	59	32	45	46	0	19	0.16		0		0									
	2007	02	17	60	37	39	49	0	16	0		0		0									
	2007	02	18	72	37	46	55	0	10	T		0		0									
	2007	02	19	53	34	40	44	0	21	0		0		0									
	2007	02	20	53	40	51	47	0	18	0.01		0		0									
	2007	02	21	54	27	27	41	0	24	T		0		0									
	2007	02	22	49	27	34	38	0	27	T		0		0									
	2007	02	23	36	27	33	32	0	33	0.19		0.3		0									
	2007	02	24	48	33	42	41	0	24	0.02		0		0									
	2007	02	25	48	32	32	40	0	25	0.03		0		0									
	2007	02	26	51	30	30	41	0	24	0.19		0		0									
	2007	02	27	51	25	29	38	0	27	0		0		0									
	2007	02	28	51	29	37	40	0	25	T		0		0	38.0	46.1	29.8	72	14	0	749	1.65	0.3
	2007	03	1	47	32	34	40	0	25	0		0		0									
	2007	03	2	42	24	25	33	0	32	0.07		0		0									
	2007	03	3	44	25	34	35	0	30	0.05		0		0									
	2007	03	4	51	27	30	39	0	26	0		0		0									
	2007	03	5	47	30	37	39	0	26	0.01		0		0									
	2007	03	6	55	28	32	42	0	23	T		0		0									
	2007	03	7	55	30	34	43	0	22	0		0		0									
	2007	03	8	61	32	41	47	0	18	0.48		0		0									
	2007	03	9	57	37	39	47	0	18	T		0		0									
	2007	03	10	57	39	47	48	0	17	T		0		0									
	2007	03	11	65	47	59	56	0	9	T		0		0									
	2007	03	12	73	49	58	61	0	4	0		0		0									
	2007	03	13	67	46	46	57	0	8	0.09		0		0									

2007	03	14	57	38	38	48	0	17	0		0		0									
2007	03	15	57	27	27	42	0	23	0		0		0									
2007	03	16	54	27	37	41	0	24	0		0		0									
2007	03	17	66	32	32	49	0	16	0		0		0									
2007	03	18	76	32	51	54	0	11	0		0		0									
2007	03	19	70	39	39	55	0	10	0		0		0									
2007	03	20	69	39	47	54	0	11	0.28		0		0									
2007	03	21	69	30	31	50	0	15	0		0		0									
2007	03	22	54	30	39	42	0	23	0		0		0									
2007	03	23	64	35	36	50	0	15	0.05		0		0									
2007	03	24	64	35	51	50	0	15	0.01		0		0									
2007	03	25	67	48	48	58	0	7	0.20		0		0									
2007	03	26	60	27	28	44	0	21	0.36		0		0									
2007	03	27	49	28	39	39	0	26	0.45		0		0									
2007	03	28	49	33	34	41	0	24	0.08		0		0									
2007	03	29	56	28	29	42	0	23	0		0		0									
2007	03	30	60	29	34	45	0	20	0		0		0									
2007	03	31	68	34	51	51	0	14	0		0		0	46.2	59.0	33.5	76	24	0	573	2.13	0
2007	04	1	63	37	39	50	0	15	0.02		0		0									
2007	04	2	59	33	34	46	0	19	0		0		0									
2007	04	3	54	23	24	39	0	26	0		0		0									
2007	04	4	58	24	42	41	0	24	0		0		0									
2007	04	5	58	31	30	45	0	20	0		0		0									
2007	04	6	69	30	37	50	0	15	0		0		0									
2007	04	7	70	37	41	54	0	11	0		0		0									
2007	04	8	68	41	54	55	0	10	0		0		0									
2007	04	9	71	47	48	59	0	6	0.22		0		0									
2007	04	10	59	38	40	49	0	16	0		0		0									
2007	04	11	57	28	32	43	0	22	0		0		0									
2007	04	12	62	32	43	47	0	18	0		0		0									
2007	04	13	62	32	38	47	0	18	0		0		0									
2007	04	14	69	38	49	54	0	11	0		0		0									
2007	04	15	52	39	41	46	0	19	0.19		0		0									
2007	04	16	60	31	35	46	0	19	0.01		0		0									
2007	04	17	63	35	45	49	0	16	0.32		0		0									
2007	04	18	61	35	40	48	0	17	0		0		0									
2007	04	19	60	37	41	49	0	16	0		0		0									
2007	04	20	60	28	33	44	0	21	0		0		0									
2007	04	21	64	33	40	49	0	16	0		0		0									
2007	04	22	64	40	49	52	0	13	0.11		0		0									
2007	04	23	56	48	47	52	0	13	0.04		0		0									
2007	04	24	70	42	53	56	0	9	0		0		0									
2007	04	25	73	50	52	62	0	3	0		0		0									
2007	04	26	67	38	47	53	0	12	0		0		0									
2007	04	27	68	46	51	57	0	8	0		0		0									
2007	04	28	77	50	59	64	0	1	0		0		0									
2007	04	29	75	42	47	59	0	6	0		0		0									
2007	04	30	73	33	41	53	0	12	0		0		0	50.3	64.1	36.6	77	23	0	432	0.91	0
2007	05	1	69	38	47	54	0	11	0		0		0									
2007	05	2	68	47	51	58	0	7	0.08		0		0									
2007	05	3	60	38	43	49	0	16	0.30		0		0									
2007	05	4	61	34	43	48	0	17	0		0		0									
2007	05	5	62	34	44	48	0	17	0		0		0									
2007	05	6	65	38	47	52	0	13	0		0		0									
2007	05	7	72	47	55	60	0	5	0		0		0									
2007	05	8	81	40	53	61	0	4	0		0		0									
2007	05	9	93	46	55	70	5	0	0.01		0		0									
2007	05	10	78	47	51	63	0	2	0		0		0									
2007	05	11	81	42	54	62	0	3	0		0		0									
2007	05	12	80	45	54	63	0	2	0		0		0									
2007	05	13	81	46	48	64	0	1	T		0		0									

2007	05	14	69	35	42	52	0	13	0	0	0									
2007	05	15	78	39	48	59	0	6	0	0	0									
2007	05	16	86	46	59	66	1	0	0	0	0									
2007	05	17	82	48	56	65	0	0	0	0	0									
2007	05	18	78	47	55	63	0	2	0	0	0									
2007	05	19	81	55	58	68	3	0	0	0	0									
2007	05	20	70	47	52	59	0	6	0	0	0									
2007	05	21	62	45	46	54	0	11	0.01	0	0									
2007	05	22	65	46	47	56	0	9	0.05	0	0									
2007	05	23	70	37	54	54	0	11	0.01	0	0									
2007	05	24	76	54	57	65	0	0	0	0	0									
2007	05	25	78	37	46	58	0	7	0	0	0									
2007	05	26	78	43	51	61	0	4	0	0	0									
2007	05	27	83	51	61	67	2	0	0.06	0	0									
2007	05	28	74	41	49	58	0	7	0	0	0									
2007	05	29	71	39	49	55	0	10	0	0	0									
2007	05	30	81	38	54	60	0	5	0	0	0									
2007	05	31	85	45	52	65	0	0	0	0	0	58.9	74.8	43.1	93	34	11	189	0.52	0
2007	06	1	91	47	64	69	4	0	0	0	0									
2007	06	2	95	56	64	76	11	0	0	0	0									
2007	06	3	98	61	71	80	15	0	0	0	0									
2007	06	4	98	62	69	80	15	0	0	0	0									
2007	06	5	86	56	56	71	6	0	0.38	0	0									
2007	06	6	67	46	49	57	0	8	0.15	0	0									
2007	06	7	66	49	52	58	0	7	0	0	0									
2007	06	8	71	43	50	57	0	8	0	0	0									
2007	06	9	80	50	61	65	0	0	0	0	0									
2007	06	10	75	58	60	67	2	0	0.42	0	0									
2007	06	11	71	53	54	62	0	3	0.02	0	0									
2007	06	12	71	43	54	57	0	8	0	0	0									
2007	06	13	76	53	63	65	0	0	0	0	0									
2007	06	14	76	49	55	63	0	2	0	0	0									
2007	06	15	76	54	57	65	0	0	0	0	0									
2007	06	16	81	54	58	68	3	0	0	0	0									
2007	06	17	76	50	55	63	0	2	0	0	0									
2007	06	18	76	50	55	63	0	2	0	0	0									
2007	06	19	79	42	54	61	0	4	0	0	0									
2007	06	20	89	49	60	69	4	0	0	0	0									
2007	06	21	93	60	67	77	12	0	0	0	0									
2007	06	22	93	56	64	75	10	0	0	0	0									
2007	06	23	79	45	57	62	0	3	0	0	0									
2007	06	24	76	53	59	65	0	0	0	0	0									
2007	06	25	76	47	53	62	0	3	0.10	0	0									
2007	06	26	75	34	47	55	0	10	0	0	0									
2007	06	27	89	45	55	67	2	0	0	0	0									
2007	06	28	89	50	66	70	5	0	0	0	0									
2007	06	29	88	59	62	74	9	0	0	0	0									
2007	06	30	76	50	60	63	0	2	0.23	0	0	65.9	81.1	50.8	98	34	98	62	1.30	0
2007	07	1	81	45	57	63	0	2	0	0	0									
2007	07	2	89	56	62	73	8	0	0	0	0									
2007	07	3	88	55	66	72	7	0	0	0	0									
2007	07	4	93	52	65	73	8	0	0	0	0									
2007	07	5	102	59	64	81	16	0	0	0	0									
2007	07	6	107	65	77	86	21	0	0	0	0									
2007	07	7	97	58	68	78	13	0	0	0	0									
2007	07	8	93	56	69	75	10	0	0	0	0									
2007	07	9	91	55	68	73	8	0	0	0	0									
2007	07	10	95	53	64	74	9	0	0	0	0									
2007	07	11	98	53	64	76	11	0	0	0	0									
2007	07	12	103	59	70	81	16	0	0	0	0									
2007	07	13	98	61	74	80	15	0	0	0	0									

2007	07	14	96	63	74	80	15	0	T	0	0									
2007	07	15	97	61	74	79	14	0	T	0	0									
2007	07	16	95	59	66	77	12	0	0	0	0									
2007	07	17	94	58	66	76	11	0	0	0	0									
2007	07	18	88	58	62	73	8	0	0.04	0	0									
2007	07	19	87	60	63	74	9	0	0.26	0	0									
2007	07	20	84	55	59	70	5	0	0	0	0									
2007	07	21	82	56	68	69	4	0	0	0	0									
2007	07	22	91	57	69	74	9	0	0	0	0									
2007	07	23	96	61	71	79	14	0	0	0	0									
2007	07	24	96	61	69	79	14	0	0	0	0									
2007	07	25	88	49	56	69	4	0	0	0	0									
2007	07	26	96	54	61	75	10	0	0	0	0									
2007	07	27	98	57	68	78	13	0	0	0	0									
2007	07	28	98	56	73	77	12	0	0	0	0									
2007	07	29	96	65	69	81	16	0	0	0	0									
2007	07	30	91	58	62	75	10	0	0	0	0									
2007	07	31	87	48	57	68	3	0	0	0	0	75.1	93.4	56.9	107	45	325	2	0.30	0
2007	08	1	91	45	53	68	3	0	0	0	0									
2007	08	2	98	49	57	74	9	0	0	0	0									
2007	08	3	100	57	68	79	14	0	0	0	0									
2007	08	4	91	54	62	73	8	0	0	0	0									
2007	08	5	86	51	63	69	4	0	0	0	0									
2007	08	6	90	51	57	71	6	0	0	0	0									
2007	08	7	88	57	64	73	8	0	0	0	0									
2007	08	8	84	62	64	73	8	0	0	0	0									
2007	08	9	86	52	60	69	4	0	0	0	0									
2007	08	10	84	53	58	69	4	0	0	0	0									
2007	08	11	82	39	50	61	0	4	0	0	0									
2007	08	12	91	50	65	71	6	0	0	0	0									
2007	08	13	86	47	53	67	2	0	0	0	0									
2007	08	14	90	47	53	69	4	0	0	0	0									
2007	08	15	99	49	54	74	9	0	0	0	0									
2007	08	16	102	54	74	78	13	0	0	0	0									
2007	08	17	89	51	60	70	5	0	0	0	0									
2007	08	18	82	50	61	66	1	0	0	0	0									
2007	08	19	83	57	58	70	5	0	0.04	0	0									
2007	08	20	66	54	56	60	0	5	0.34	0	0									
2007	08	21	69	52	59	61	0	4	0.11	0	0									
2007	08	22	83	48	55	66	1	0	0	0	0									
2007	08	23	87	50	54	69	4	0	0	0	0									
2007	08	24	89	47	51	68	3	0	0	0	0									
2007	08	25	93	51	62	72	7	0	0	0	0									
2007	08	26	89	53	58	71	6	0	0	0	0									
2007	08	27	78	44	49	61	0	4	0	0	0									
2007	08	28	78	41	47	60	0	5	0	0	0									
2007	08	29	86	43	48	65	0	0	0	0	0									
2007	08	30	95	48	63	72	7	0	T	0	0									
2007	08	31	103	63	70	83	18	0	0	0	0	69.1	87.7	50.6	103	39	159	22	0.49	0
2007	09	1	96	50	53	73	8	0	0.10	0	0									
2007	09	2	87	51	55	69	4	0	0	0	0									
2007	09	3	90	53	55	72	7	0	0	0	0									
2007	09	4	91	55	64	73	8	0	0	0	0									
2007	09	5	80	53	57	67	2	0	0	0	0									
2007	09	6	85	52	53	69	4	0	0	0	0									
2007	09	7	83	46	47	65	0	0	0	0	0									
2007	09	8	80	36	39	58	0	7	0	0	0									
2007	09	9	78	36	37	57	0	8	0	0	0									
2007	09	10	84	35	37	60	0	5	0	0	0									
2007	09	11	80	37	40	59	0	6	0	0	0									
2007	09	12	89	40	53	65	0	0	0	0	0									

2007	09	13	89	42	43	66	1	0	0	0	0									
2007	09	14	84	43	47	64	0	1	0	0	0									
2007	09	15	81	47	50	64	0	1	0	0	0									
2007	09	16	82	50	62	66	1	0	0	0	0									
2007	09	17	75	53	54	64	0	1	0	0	0									
2007	09	18	76	52	53	64	0	1	T	0	0									
2007	09	19	68	41	42	55	0	10	0	0	0									
2007	09	20	75	34	35	55	0	10	0	0	0									
2007	09	21	72	35	39	54	0	11	0	0	0									
2007	09	22	76	39	54	58	0	7	0	0	0									
2007	09	23	71	41	42	56	0	9	0	0	0									
2007	09	24	69	37	37	53	0	12	0	0	0									
2007	09	25	72	33	39	53	0	12	0	0	0									
2007	09	26	76	39	41	58	0	7	0	0	0									
2007	09	27	78	35	36	57	0	8	0	0	0									
2007	09	28	81	36	58	59	0	6	0	0	0									
2007	09	29	58	33	38	46	0	19	0.18	0	0									
2007	09	30	65	37	46	51	0	14	T	0	0	60.7	79.0	42.4	96	33	35	155	0.28	0
2007	10	1	63	45	50	54	0	11	0.20	0	0									
2007	10	2	66	49	52	58	0	7	0.03	0	0									
2007	10	3	65	50	50	58	0	7	0.03	0	0									
2007	10	4	64	39	42	52	0	13	0.02	0	0									
2007	10	5	62	37	37	50	0	15	0.03	0	0									
2007	10	6	59	35	45	47	0	18	0	0	0									
2007	10	7	62	40	49	51	0	14	T	0	0									
2007	10	8	74	48	51	61	0	4	0	0	0									
2007	10	9	71	33	33	52	0	13	0	0	0									
2007	10	10	71	33	49	52	0	13	0	0	0									
2007	10	11	61	38	38	50	0	15	0.11	0	0									
2007	10	12	70	38	48	54	0	11	0	0	0									
2007	10	13	62	35	35	49	0	16	T	0	0									
2007	10	14	69	32	33	51	0	14	0	0	0									
2007	10	15	67	32	33	50	0	15	0	0	0									
2007	10	16	63	31	49	47	0	18	0.13	0	0									
2007	10	17	61	36	37	49	0	16	0.28	0	0									
2007	10	18	58	36	41	47	0	18	0.05	0	0									
2007	10	19	60	41	48	51	0	14	0.28	0	0									
2007	10	20	63	36	43	50	0	15	T	0	0									
2007	10	21	57	41	42	49	0	16	T	0	0									
2007	10	22	61	38	43	50	0	15	0	0	0									
2007	10	23	75	37	37	56	0	9	0	0	0									
2007	10	24	69	37	39	53	0	12	0	0	0									
2007	10	25	74	38	42	56	0	9	T	0	0									
2007	10	26	56	20	21	38	0	27	0	0	0									
2007	10	27	53	19	20	36	0	29	0	0	0									
2007	10	28	52	18	23	35	0	30	0	0	0									
2007	10	29	59	22	27	41	0	24	0	0	0									
2007	10	30	60	26	31	43	0	22	0.02	0	0									
2007	10	31	57	21	22	39	0	26	0	0	0	49.1	63.4	34.9	75	18	0	486	1.18	0
2007	11	1	56	21	38	39	0	26	0	0	0									
2007	11	2	58	20	22	39	0	26	0	0	0									
2007	11	3	52	19	27	36	0	29	0	0	0									
2007	11	4	70	27	44	49	0	16	0	0	0									
2007	11	5	70	32	33	51	0	14	0	0	0									
2007	11	6	56	24	25	40	0	25	0	0	0									
2007	11	7	58	25	31	42	0	23	0	0	0									
2007	11	8	57	31	35	44	0	21	0	0	0									
2007	11	9	56	30	36	43	0	22	0	0	0									
2007	11	10	65	36	54	51	0	14	0.06	0	0									
2007	11	11	60	26	45	43	0	22	0.02	0	0									
2007	11	12	60	29	60	45	0	20	0	0	0									

2007	11	13	64	40	40	52	0	13	0.07		0		0									
2007	11	14	55	18	19	37	0	28	0		0		0									
2007	11	15	39	18	36	29	0	36	0.02		0		0									
2007	11	16	53	36	53	45	0	20	0.14		0		0									
2007	11	17	59	48	51	54	0	11	0.37		0		0									
2007	11	18	61	41	42	51	0	14	0.15		0		0									
2007	11	19	44	32	32	38	0	27	0.53		0		0									
2007	11	20	40	32	38	36	0	29	0.07		0		0									
2007	11	21	42	20	21	31	0	34	0		0		0									
2007	11	22	34	18	99999	26	0	39	999.99		0		0									
2007	11	23	33	20	30	27	0	38	0.02	A	0		0									
2007	11	24	33	29	29	31	0	34	0		0		0									
2007	11	25	32	22	28	27	0	38	0		0		0									
2007	11	26	31	28	29	30	0	35	0		0		0									
2007	11	27	41	29	39	35	0	30	0.07		0		0									
2007	11	28	46	26	30	36	0	29	0		0		0									
2007	11	29	47	27	31	37	0	28	0.29		0.3		T									
2007	11	30	33	29	30	31	0	34	0.10		0		T	39.0	50.2	27.8	70	18	0	775	1.91	0.3
2007	12	1	30	25	27	28	0	37	0.04		T		T									
2007	12	2	43	27	43	35	0	30	0.03		T		T									
2007	12	3	55	40	55	48	0	17	0.13		0		0									
2007	12	4	64	49	49	57	0	8	0.01		0		0									
2007	12	5	67	35	37	51	0	14	0		0		0									
2007	12	6	55	35	35	45	0	20	T		0		0									
2007	12	7	40	31	32	36	0	29	0.63		1.0		1									
2007	12	8	34	28	28	31	0	34	0.02		1.0		1									
2007	12	9	34	17	19	26	0	39	0		0		1									
2007	12	10	31	19	26	25	0	40	0.03		T		1									
2007	12	11	29	26	26	28	0	37	0		0		T									
2007	12	12	30	25	30	28	0	37	0		0		T									
2007	12	13	36	26	27	31	0	34	T		T		T									
2007	12	14	33	22	28	28	0	37	0		0		T									
2007	12	15	32	27	32	30	0	35	T		T		T									
2007	12	16	46	28	29	37	0	28	0		0		T									
2007	12	17	47	29	43	38	0	27	0.04		0		T									
2007	12	18	47	33	35	40	0	25	T		0		0									
2007	12	19	54	35	44	45	0	20	0.02		0		0									
2007	12	20	53	40	41	47	0	18	0.02		0		0									
2007	12	21	46	27	28	37	0	28	0.02		0		0									
2007	12	22	44	23	29	34	0	31	0		0		0									
2007	12	23	45	29	32	37	0	28	0.17		0		0									
2007	12	24	50	34	99999	42	0	23	999.99		0		0									
2007	12	25	42	27	99999	35	0	30	999.99		0		0									
2007	12	26	38	28	37	33	0	32	0.31	A	0		0									
2007	12	27	39	29	33	34	0	31	T		0		0									
2007	12	28	40	31	37	36	0	29	0.10		0		0									
2007	12	29	47	30	30	39	0	26	T		0		0									
2007	12	30	44	29	36	37	0	28	0.01		0		0									
2007	12	31	42	32	33	37	0	28	0		0		0	36.3	43.1	29.5	67	17	0	880	1.58	2.0

The '*' flags in Preliminary indicate the data has not completed processing and quality control and may contain errors

All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

****T=TRACE, A=Accumulated amount since last measure, B=Accumulated amount includes estimated values, S=Included in a subsequent value, E=Estimated amount.**

Station: WHITMAN MISSION
State: WA County: WALLA WALLA Standard Time:

Observation Time Temperature: 0800 Precipitation: 9900 (LST)

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	2008	01	1	43	19	99999	31	0	34	999.99		9999.9		99999									
	2008	01	2	33	18	24	26	0	39	0		0		0									
	2008	01	3	30	24	28	27	0	38	0		0		0									
	2008	01	4	57	28	56	43	0	22	T		0		0									
	2008	01	5	59	42	45	51	0	14	T		0		0									
	2008	01	6	52	34	34	43	0	22	0.02		0		0									
	2008	01	7	48	31	34	40	0	25	0.03		0		0									
	2008	01	8	42	27	40	35	0	30	T		0		0									
	2008	01	9	45	32	34	39	0	26	0.02		0		0									
	2008	01	10	45	33	45	39	0	26	0.01		0		0									
	2008	01	11	53	34	47	44	0	21	0.01		0		0									
	2008	01	12	55	32	32	44	0	21	T		0		0									
	2008	01	13	40	28	28	34	0	31	0.11		0		0									
	2008	01	14	34	26	28	30	0	35	0.01		0		0									
	2008	01	15	53	28	31	41	0	24	0.05		0		0									
	2008	01	16	41	17	18	29	0	36	0		0		0									
	2008	01	17	37	18	28	28	0	37	0		0		0									
	2008	01	18	45	22	25	34	0	31	0		0		0									
	2008	01	19	45	24	31	35	0	30	0		0		0									
	2008	01	20	51	28	28	40	0	25	0.09		0		0									
	2008	01	21	32	20	20	26	0	39	0.08		0.3		T									
	2008	01	22	27	5	7	16	0	49	0		0		T									
	2008	01	23	26	6	6	16	0	49	0		0		T									
	2008	01	24	26	5	5	16	0	49	0		0		T									
	2008	01	25	18	4	8	11	0	54	0		0		T									
	2008	01	26	30	8	16	19	0	46	0		0		T									
	2008	01	27	31	16	31	24	0	41	0.09		0		T									
	2008	01	28	32	14	19	23	0	42	1.04		6.8		7									
	2008	01	29	38	19	35	29	0	36	0		0		6									
	2008	01	30	41	31	34	36	0	29	0		0		4									
	2008	01	31	43	33	40	38	0	27	T		0		2	31.6	40.4	22.8	59	4	0	1028	1.56	7.1

The '*' flags in Preliminary indicate the data has not completed processing and quality control and may contain errors

All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

****T=TRACE. A=Accumulated amount since last measure. B=Accumulated amount includes estimated values. S=Included in a subsequent value. E=Estimated amount.**

Station: WHITMAN MISSION
State: WA County: WALLA WALLA Standard Time:
Observation Time Temperature: 0800 Precipitation: 0800 (LST)

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	2008	02	1	43	36	38	40	0	25	0.09		0		T									
	2008	02	2	46	34	37	40	0	25	T		0		T									
	2008	02	3	42	31	31	37	0	28	0.15		1.7		2									
	2008	02	4	34	27	28	31	0	34	0.12		1.0		2									
	2008	02	5	40	24	36	32	0	33	0		0		1									
	2008	02	6	45	34	36	40	0	25	0.08		0		0									
	2008	02	7	47	36	43	42	0	23	0		0		0									
	2008	02	8	48	40	44	44	0	21	0		0		0									
	2008	02	9	50	43	48	47	0	18	0		0		0									
	2008	02	10	58	40	49	49	0	16	0		0		0									
	2008	02	11	55	40	43	48	0	17	0		0		0									
	2008	02	12	54	35	39	45	0	20	0		0		0									
	2008	02	13	58	34	35	46	0	19	0		0		0									
	2008	02	14	51	24	25	38	0	27	0		0		0									
	2008	02	15	49	25	25	37	0	28	0		0		0									
	2008	02	16	54	25	34	40	0	25	0.03		0		0									
	2008	02	17	55	26	26	41	0	24	0		0		0									
	2008	02	18	44	21	25	33	0	32	0		0		0									
	2008	02	19	32	24	25	28	0	37	0		0		0									
	2008	02	20	46	23	25	35	0	30	0		0		0									
	2008	02	21	50	25	26	38	0	27	0		0		0									
	2008	02	22	46	26	30	36	0	29	0		0		0									
	2008	02	23	49	28	30	39	0	26	0		0		0									
	2008	02	24	58	29	36	44	0	21	0.02		0		0									
	2008	02	25	47	36	40	42	0	23	0.05		0		0									
	2008	02	26	54	27	28	41	0	24	0		0		0									
	2008	02	27	52	28	28	40	0	25	0		0		0									
	2008	02	28	55	28	44	42	0	23	0.01		0		0									
	2008	02	29	64	33	36	49	0	16	0		0		0	39.8	49.2	30.4	64	21	0	721	0.55	2.7
	2008	03	1	66	36	41	51	0	14	0.08		0		0									
	2008	03	2	55	27	30	41	0	24	0		0		0									
	2008	03	3	53	28	41	41	0	24	0		0		0									
	2008	03	4	50	39	39	45	0	20	0.02		0		0									
	2008	03	5	54	25	32	40	0	25	0		0		0									
	2008	03	6	56	21	24	39	0	26	0		0		0									
	2008	03	7	63	24	39	44	0	21	T		0		0									
	2008	03	8	59	39	45	49	0	16	0.08		0		0									
	2008	03	9	58	28	29	43	0	22	T		0		0									
	2008	03	10	61	27	99999	44	0	21	0		0		0									
	2008	03	11	60	40	45	50	0	15	0.15		0		0									
	2008	03	12	57	27	29	42	0	23	0		0		0									

2008	03	13	57	29	41	43	0	22	0.15	0	0									
2008	03	14	52	34	43	43	0	22	0.29	0	0									
2008	03	15	56	36	37	46	0	19	0.17	0	0									
2008	03	16	52	37	37	45	0	20	0.05	0	0									
2008	03	17	52	37	41	45	0	20	0.02	0	0									
2008	03	18	55	40	45	48	0	17	0	0	0									
2008	03	19	62	30	30	46	0	19	0.04	0	0									
2008	03	20	47	30	36	39	0	26	0.04	0	0									
2008	03	21	53	33	36	43	0	22	T	0	0									
2008	03	22	52	24	24	38	0	27	0	0	0									
2008	03	23	60	34	34	47	0	18	0	0	0									
2008	03	24	57	34	35	46	0	19	0.01	0	0									
2008	03	25	51	26	29	39	0	26	0	0	0									
2008	03	26	55	26	41	41	0	24	0	0	0									
2008	03	27	54	32	32	43	0	22	0.03	0	0									
2008	03	28	53	21	40	37	0	28	0	0	0									
2008	03	29	47	34	36	41	0	24	0.05	0	0									
2008	03	30	53	32	33	43	0	22	0.10	0	0									
2008	03	31	44	31	31	38	0	27	0.11	T	T	43.0	55.0	31.0	66	21	0	675	1.39	0
2008	04	1	52	22	23	37	0	28	0	0	0									
2008	04	2	53	23	26	38	0	27	0	0	0									
2008	04	3	56	24	26	40	0	25	0	0	0									
2008	04	4	66	26	36	46	0	19	0	0	0									
2008	04	5	53	32	36	43	0	22	0.03	0	0									
2008	04	6	58	36	43	47	0	18	0.03	0	0									
2008	04	7	60	38	38	49	0	16	0	0	0									
2008	04	8	56	33	37	45	0	20	0.01	0	0									
2008	04	9	51	32	35	42	0	23	0.02	0	0									
2008	04	10	58	35	43	47	0	18	0	0	0									
2008	04	11	62	33	38	48	0	17	0	0	0									
2008	04	12	67	31	33	49	0	16	0	0	0									
2008	04	13	78	33	41	56	0	9	0	0	0									
2008	04	14	83	41	45	62	0	3	0.07	0	0									
2008	04	15	59	35	37	47	0	18	0.16	0	0									
2008	04	16	59	34	35	47	0	18	0	0	0									
2008	04	17	61	32	38	47	0	18	0	0	0									
2008	04	18	68	38	43	53	0	12	0	0	0									
2008	04	19	55	33	36	44	0	21	0	0	0									
2008	04	20	53	29	35	41	0	24	0	0	0									
2008	04	21	53	32	33	43	0	22	0	0	0									
2008	04	22	56	32	36	44	0	21	0.01	0	0									
2008	04	23	64	36	42	50	0	15	0.02	0	0									
2008	04	24	59	41	42	50	0	15	0.11	0	0									
2008	04	25	61	36	39	49	0	16	0	0	0									
2008	04	26	58	25	31	42	0	23	0	0	0									
2008	04	27	70	31	40	51	0	14	0	0	0									
2008	04	28	72	40	51	56	0	9	0	0	0									
2008	04	29	77	40	47	59	0	6	0.04	0	0									
2008	04	30	62	38	38	50	0	15	0.01	0	0	47.2	61.3	33.0	83	22	0	528	0.51	0
2008	05	1	58	32	39	45	0	20	0	0	0									
2008	05	2	62	27	36	45	0	20	0	0	0									
2008	05	3	71	36	46	54	0	11	0	0	0									
2008	05	4	66	44	47	55	0	10	0.13	0	0									
2008	05	5	72	41	45	57	0	8	0	0	0									
2008	05	6	76	45	54	61	0	4	0	0	0									
2008	05	7	72	48	49	60	0	5	0.03	0	0									
2008	05	8	68	42	44	55	0	10	0	0	0									
2008	05	9	63	32	42	48	0	17	0	0	0									
2008	05	10	66	37	46	52	0	13	0	0	0									
2008	05	11	70	46	47	58	0	7	0.10	0	0									
2008	05	12	64	37	43	51	0	14	0.01	0	0									

2008	05	13	65	34	45	50	0	15	0	0	0									
2008	05	14	67	45	54	56	0	9	0.26	0	0									
2008	05	15	77	48	54	63	0	2	0.02	0	0									
2008	05	16	83	44	51	64	0	1	0	0	0									
2008	05	17	91	47	60	69	4	0	0	0	0									
2008	05	18	96	60	73	78	13	0	0	0	0									
2008	05	19	91	54	59	73	8	0	0	0	0									
2008	05	20	89	58	63	74	9	0	0	0	0									
2008	05	21	65	47	48	56	0	9	0.32	0	0									
2008	05	22	65	45	47	55	0	10	0.02	0	0									
2008	05	23	66	47	51	57	0	8	0.19	0	0									
2008	05	24	71	44	54	58	0	7	0	0	0									
2008	05	25	76	54	57	65	0	0	0.10	0	0									
2008	05	26	73	49	56	61	0	4	0.04	0	0									
2008	05	27	78	56	58	67	2	0	T	0	0									
2008	05	28	76	55	60	66	1	0	0	0	0									
2008	05	29	68	57	57	63	0	2	0.04	0	0									
2008	05	30	70	50	56	60	0	5	0	0	0									
2008	05	31	78	46	55	62	0	3	0	0	0	59.0	72.7	45.4	96	27	37	214	1.26	0
2008	06	1	82	55	59	69	4	0	0.06	0	0									
2008	06	2	76	50	53	63	0	2	0	0	0									
2008	06	3	73	50	54	62	0	3	0	0	0									
2008	06	4	62	48	50	55	0	10	0.22	0	0									
2008	06	5	69	47	53	58	0	7	T	0	0									
2008	06	6	68	46	48	57	0	8	0.05	0	0									
2008	06	7	61	47	50	54	0	11	0.01	0	0									
2008	06	8	70	45	52	58	0	7	0	0	0									
2008	06	9	76	51	59	64	0	1	0.01	0	0									
2008	06	10	76	44	47	60	0	5	T	0	0									
2008	06	11	56	45	48	51	0	14	0.26	0	0									
2008	06	12	69	47	49	58	0	7	T	0	0									
2008	06	13	79	48	58	64	0	1	0	0	0									
2008	06	14	83	42	50	63	0	2	0	0	0									
2008	06	15	79	42	53	61	0	4	0	0	0									
2008	06	16	83	42	54	63	0	2	0	0	0									
2008	06	17	87	54	62	71	6	0	0	0	0									
2008	06	18	79	45	56	62	0	3	0	0	0									
2008	06	19	77	41	51	59	0	6	0	0	0									
2008	06	20	84	44	52	64	0	1	0	0	0									
2008	06	21	91	52	59	72	7	0	0	0	0									
2008	06	22	89	54	60	72	7	0	0.13	0	0									
2008	06	23	80	46	56	63	0	2	0	0	0									
2008	06	24	80	46	56	63	0	2	0	0	0									
2008	06	25	81	45	54	63	0	2	0	0	0									
2008	06	26	85	54	62	70	5	0	0	0	0									
2008	06	27	82	49	58	66	1	0	0	0	0									
2008	06	28	88	48	59	68	3	0	0	0	0									
2008	06	29	97	53	68	75	10	0	0	0	0									
2008	06	30	103	64	68	84	19	0	0	0	0	63.5	78.8	48.1	103	41	62	100	0.74	0

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All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

****T=TRACE, A=Accumulated amount since last measure, B=Accumulated amount includes estimated values, S=Included in a subsequent value, E=Estimated amount.**

Station: WHITMAN MISSION
State: WA County: WALLA WALLA Standard Time:
Observation Time Temperature: 0700 Precipitation: 0700 (LST)

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	2008	07	1	100	64	65	82	17	0	0		0		0									
	2008	07	2	90	56	60	73	8	0	0.37		0		0									
	2008	07	3	99	60	62	80	15	0	0		0		0									
	2008	07	4	95	61	67	78	13	0	0		0		0									
	2008	07	5	84	59	65	72	7	0	0		0		0									
	2008	07	6	86	63	66	75	10	0	0		0		0									
	2008	07	7	85	51	55	68	3	0	0		0		0									
	2008	07	8	89	51	52	70	5	0	0		0		0									
	2008	07	9	93	52	54	73	8	0	0		0		0									
	2008	07	10	97	54	58	76	11	0	0		0		0									
	2008	07	11	88	38	39	63	0	2	0		0		0									
	2008	07	12	84	38	53	61	0	4	0		0		0									
	2008	07	13	91	48	63	70	5	0	0		0		0									
	2008	07	14	97	54	56	76	11	0	0		0		0									
	2008	07	15	97	56	63	77	12	0	0		0		0									
	2008	07	16	92	49	50	71	6	0	T		0		0									
	2008	07	17	92	49	57	71	6	0	0		0		0									
	2008	07	18	90	54	58	72	7	0	0		0		0									
	2008	07	19	86	47	56	67	2	0	0		0		0									
	2008	07	20	90	48	57	69	4	0	0		0		0									
	2008	07	21	95	53	65	74	9	0	0		0		0									
	2008	07	22	95	60	70	78	13	0	0		0		0									
	2008	07	23	84	58	59	71	6	0	0.01		0		0									
	2008	07	24	81	46	48	64	0	1	0		0		0									
	2008	07	25	91	47	47	69	4	0	0		0		0									
	2008	07	26	92	47	68	70	5	0	0		0		0									
	2008	07	27	90	63	68	77	12	0	0		0		0									
	2008	07	28	84	50	54	67	2	0	0		0		0									
	2008	07	29	87	52	63	70	5	0	0		0		0									
	2008	07	30	81	61	62	71	6	0	0		0		0									
	2008	07	31	81	40	40	61	0	4	0		0		0	71.2	89.9	52.5	100	38	212	11	0.38	0

The '*' flags in Preliminary indicate the data has not completed processing and quality control and may contain errors

All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

****T=TRACE, A=Accumulated amount since last measure, B=Accumulated amount includes estimated values, S=Included in a subsequent value, E=Estimated amount.**

Station: WHITMAN MISSION
State: WA **County:** WALLA WALLA **Standard Time:**

Observation Time Temperature: 0800 **Precipitation:** 0800 **(LST)**

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	2008	08	1	87	40	64	64	0	1	0		0		0									
	2008	08	2	86	61	64	74	9	0	0		0		0									
	2008	08	3	81	45	57	63	0	2	0		0		0									
	2008	08	4	85	44	44	65	0	0	0		0		0									
	2008	08	5	95	43	48	69	4	0	0		0		0									
	2008	08	6	100	47	52	74	9	0	0		0		0									
	2008	08	7	100	47	55	74	9	0	0		0		0									
	2008	08	8	95	54	66	75	10	0	T		0		0									
	2008	08	9	97	58	67	78	13	0	T		0		0									
	2008	08	10	84	53	58	69	4	0	0		0		0									
	2008	08	11	79	47	53	63	0	2	0		0		0									
	2008	08	12	85	48	48	67	2	0	0		0		0									
	2008	08	13	92	47	60	70	5	0	0		0		0									
	2008	08	14	91	53	53	72	7	0	0		0		0									
	2008	08	15	100	53	54	77	12	0	0		0		0									
	2008	08	16	105	53	59	79	14	0	0		0		0									
	2008	08	17	104	54	62	79	14	0	0		0		0									
	2008	08	18	106	62	70	84	19	0	0		0		0									
	2008	08	19	99	61	63	80	15	0	0.14		0		0									
	2008	08	20	82	62	67	72	7	0	0.07		0		0									
	2008	08	21	76	62	62	69	4	0	0.10		0		0									
	2008	08	22	75	43	44	59	0	6	0.01		0		0									
	2008	08	23	83	43	48	63	0	2	0		0		0									
	2008	08	24	92	48	52	70	5	0	0		0		0									
	2008	08	25	92	52	56	72	7	0	0		0		0									
	2008	08	26	69	52	53	61	0	4	0.04		0		0									
	2008	08	27	76	47	64	62	0	3	0		0		0									
	2008	08	28	78	49	56	64	0	1	0		0		0									
	2008	08	29	87	51	54	69	4	0	0		0		0									
	2008	08	30	93	52	58	73	8	0	0		0		0									
	2008	08	31	77	42	48	60	0	5	0		0		0	69.7	88.7	50.7	106	40	181	26	0.36	0
*	2008	09	1	71	43	48	57	0	8	0		0		0									
*	2008	09	2	74	37	39	56	0	9	0		0		0									
*	2008	09	3	77	39	42	58	0	7	0		0		0									
*	2008	09	4	80	42	42	61	0	4	0		0		0									
*	2008	09	5	80	42	42	61	0	4	0		0		0									
*	2008	09	6	82	42	51	62	0	3	0		0		0									
*	2008	09	7	84	43	45	64	0	1	0		0		0									
*	2008	09	8	83	37	38	60	0	5	0		0		0									
*	2008	09	9	83	37	47	60	0	5	0		0		0									
*	2008	09	10	86	37	37	62	0	3	0		0		0									

*	2008	09	11	77	36	38	57	0	8	0	0	0									
*	2008	09	12	86	38	41	62	0	3	0	0	0									
*	2008	09	13	89	38	47	64	0	1	0	0	0									
*	2008	09	14	82	36	38	59	0	6	0	0	0									
*	2008	09	15	86	37	38	62	0	3	0	0	0									
*	2008	09	16	85	38	40	62	0	3	0	0	0									
*	2008	09	17	87	40	41	64	0	1	0	0	0									
*	2008	09	18	85	40	50	63	0	2	0	0	0									
*	2008	09	19	92	48	55	70	5	0	0	0	0									
*	2008	09	20	84	55	99999	70	5	0	999.99	0	0									
*	2008	09	21	64	53	55	59	0	6	0.18	0	0									
*	2008	09	22	70	53	56	62	0	3	0	0	0									
*	2008	09	23	67	35	46	51	0	14	0.01	0	0									
*	2008	09	24	71	35	40	53	0	12	0	0	0									
*	2008	09	25	70	40	46	55	0	10	0	0	0									
*	2008	09	26	75	39	40	57	0	8	0	0	0									
*	2008	09	27	74	39	42	57	0	8	0	0	0									
*	2008	09	28	78	32	33	55	0	10	0	0	0									
*	2008	09	29	81	32	35	57	0	8	0	0	0									
*	2008	09	30	76	34	99999	55	0	10	999.99	0	0	59.6	79.3	39.9	92	32	10	165	0.19	0
	2008	10	1	78	40	44	59	0	6	0	0	0									
	2008	10	2	83	44	53	64	0	1	0	0	0									
	2008	10	3	80	49	52	65	0	0	0.06	0	0									
	2008	10	4	76	52	61	64	0	1	0.32	0	0									
	2008	10	5	67	49	49	58	0	7	0.05	0	0									
	2008	10	6	63	45	49	54	0	11	T	0	0									
	2008	10	7	73	49	58	61	0	4	T	0	0									
	2008	10	8	66	34	35	50	0	15	0	0	0									
	2008	10	9	60	28	29	44	0	21	0	0	0									
	2008	10	10	56	29	35	43	0	22	0.01	0	0									
	2008	10	11	60	30	34	45	0	20	0	0	0									
	2008	10	12	59	19	19	39	0	26	0	0	0									
	2008	10	13	60	19	44	40	0	25	0	0	0									
	2008	10	14	75	44	52	60	0	5	0	0	0									
	2008	10	15	63	25	26	44	0	21	0	0	0									
	2008	10	16	60	25	43	43	0	22	T	0	0									
	2008	10	17	70	37	37	54	0	11	0	0	0									
	2008	10	18	73	36	55	55	0	10	0.01	0	0									
	2008	10	19	69	29	29	49	0	16	0	0	0									
	2008	10	20	62	28	40	45	0	20	0	0	0									
	2008	10	21	61	34	35	48	0	17	0	0	0									
	2008	10	22	60	23	23	42	0	23	0	0	0									
	2008	10	23	58	23	25	41	0	24	0	0	0									
	2008	10	24	64	24	26	44	0	21	0	0	0									
	2008	10	25	65	26	49	46	0	19	0	0	0									
	2008	10	26	67	22	24	45	0	20	0	0	0									
	2008	10	27	58	23	24	41	0	24	0	0	0									
	2008	10	28	58	23	24	41	0	24	0	0	0									
	2008	10	29	56	23	26	40	0	25	0	0	0									
	2008	10	30	60	24	30	42	0	23	0	0	0									
	2008	10	31	53	29	46	41	0	24	0	0	0	48.4	64.9	31.8	83	19	0	508	0.45	0

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****T=TRACE. A=Accumulated amount since last measure. B=Accumulated amount includes estimated values. S=Included in a subsequent value. E=Estimated amount.**

Station: WHITMAN MISSION
State: WA **County:** WALLA WALLA **Standard Time:**
Observation Time Temperature: 0700 **Precipitation:** 0700 **(LST)**

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	2008	11	1	70	34	37	52	0	13	0.04		0		0									
	2008	11	2	59	37	49	48	0	17	0.08		0		0									
	2008	11	3	61	34	34	48	0	17	0.02		0		0									
	2008	11	4	62	34	45	48	0	17	0.19		0		0									
	2008	11	5	52	29	30	41	0	24	0.03		0		0									
	2008	11	6	54	30	39	42	0	23	0.03		0		0									
	2008	11	7	44	39	42	42	0	23	0.07		0		0									
	2008	11	8	47	42	43	45	0	20	0.02		0		0									
	2008	11	9	49	43	45	46	0	19	0.70		0		0									
	2008	11	10	53	43	50	48	0	17	0.02		0		0									
	2008	11	11	58	41	42	50	0	15	0.01		0		0									
	2008	11	12	64	42	64	53	0	12	0.64		0		0									
	2008	11	13	67	50	51	59	0	6	0.10		0		0									
	2008	11	14	59	25	25	42	0	23	0		0		0									
	2008	11	15	59	25	28	42	0	23	0		0		0									
	2008	11	16	53	28	30	41	0	24	0		0		0									
	2008	11	17	49	29	30	39	0	26	0		0		0									
	2008	11	18	48	27	28	38	0	27	0		0		0									
	2008	11	19	55	28	38	42	0	23	T		0		0									
	2008	11	20	41	28	28	35	0	30	0		0		0									
	2008	11	21	51	28	33	40	0	25	0.03		0		0									
	2008	11	22	55	33	44	44	0	21	0.02		0		0									
	2008	11	23	51	22	23	37	0	28	0		0		0									
	2008	11	24	51	21	21	36	0	29	0		0		0									
	2008	11	25	32	21	22	27	0	38	T		0		0									
	2008	11	26	41	22	32	32	0	33	0.02		0		0									
	2008	11	27	38	25	99999	32	0	33	999.99		0		0									
	2008	11	28	38	31	34	35	0	30	0.01	A	0		0									
	2008	11	29	43	34	38	39	0	26	0.07		0		0									
	2008	11	30	43	32	33	38	0	27	0.01		0		0	41.7	51.6	31.9	70	21	0	689	2.11	0

The '*' flags in Preliminary indicate the data has not completed processing and quality control and may contain errors

All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

****T=TRACE. A=Accumulated amount since last measure. B=Accumulated amount includes estimated values. S=Included in a subsequent value. E=Estimated amount.**

Station: WHITMAN MISSION
State: WA **County:** WALLA WALLA **Standard Time:**
Observation Time Temperature: 0800 **Precipitation:** 0800 **(LST)**

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations

Preliminary	Year	Month	Day	Temperature (°F) 24 hrs. ending at observation time Max.	Min.	at Observation	Daily Mean	Daily CDD	Daily HDD	Precipitation (see **) 24 Hour Amounts ending at observation time Rain, melted snow, etc. (Inches & hundredths)	Flag	Snow, ice pellets (Inches & tenths)	Flag	At Observation Time Snow, ice pellets, hail, ice on ground (Inches)	Monthly Temperature (°F) Mean Temp	Mean Max	Mean Min	Highest Temp	Lowest Temp	Monthly CDD	Monthly HDD	Monthly Precipitation Precip	Snowfall
	2008	12	1	39	32	38	36	0	29	0.04		0		0									
	2008	12	2	49	37	46	43	0	22	0.21		0		0									
	2008	12	3	58	34	34	46	0	19	0		0		0									
	2008	12	4	41	24	24	33	0	32	0		0		0									
	2008	12	5	38	20	24	29	0	36	0		0		0									
	2008	12	6	38	24	29	31	0	34	T		0		0									
	2008	12	7	52	29	50	41	0	24	0		0		0									
	2008	12	8	50	36	38	43	0	22	0.25		0		0									
	2008	12	9	49	28	30	39	0	26	T		0		0									
	2008	12	10	49	29	42	39	0	26	T		0		0									
	2008	12	11	59	27	29	43	0	22	0		0		0									
	2008	12	12	36	28	35	32	0	33	0		0		0									
	2008	12	13	49	34	37	42	0	23	0.05		0		0									
	2008	12	14	37	17	17	27	0	38	0.34		2.5		3									
	2008	12	15	19	10	15	15	0	50	0.12		1.8		4									
	2008	12	16	17	-10	-7	4	0	61	0.06		1.5		4									
	2008	12	17	13	-10	8	2	0	63	0		0		4									
	2008	12	18	16	8	16	12	0	53	0.13		2.5		6									
	2008	12	19	18	5	15	12	0	53	0.55		7.0		12									
	2008	12	20	18	-7	5	6	0	59	T		T		10									
	2008	12	21	9	-6	9	2	0	63	0.31		3.2		12									
	2008	12	22	13	-7	-4	3	0	62	0.36		5.7		15									
	2008	12	23	14	-4	13	5	0	60	T		T		13									
	2008	12	24	21	2	3	12	0	53	0		0		12									
	2008	12	25	32	11	99999	22	0	43	999.99		9999.9		99999									
	2008	12	26	25	12	15	19	0	46	0.13	A	2.0	A	12									
	2008	12	27	41	14	41	28	0	37	0.20		0		9									
	2008	12	28	51	37	48	44	0	21	0.03		0		5									
	2008	12	29	51	34	39	43	0	22	0.46		0		2									
	2008	12	30	45	30	33	38	0	27	0.08		0		0									
	2008	12	31	44	31	38	38	0	27	0		0		0	26.5	35.2	17.7	59	-10	0	1186	3.32	26.2

The '*' flags in Preliminary indicate the data has not completed processing and quality control and may contain errors

All 9's (e.g. 999999, 99999.9, etc.) in the data column indicate that the value was not received or is missing

****T=TRACE. A=Accumulated amount since last measure. B=Accumulated amount includes estimated values. S=Included in a subsequent value. E=Estimated amount.**

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SPOKANE, WASHINGTON

NORMALS, MEANS, AND EXTREMES

LATITUDE: 47 Deg. 38 Min. N LONGITUDE: 117 Deg. 32 Min. W ELEVATION: FT. GRND 2356 BARO 2360 TIME ZONE: PACIFIC WBAN: 24157

	(a)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE (Deg. F)														
Normals														
-Daily Maximum		33.2	40.6	47.7	57.0	65.8	74.7	83.1	82.5	72.0	58.6	41.4	33.8	57.5
-Daily Minimum		20.8	25.9	29.6	34.7	41.9	49.2	54.4	54.3	45.8	36.0	28.8	21.7	36.9
-Monthly		27.1	33.3	38.7	45.9	53.9	62.0	68.8	68.4	58.9	47.3	35.1	27.8	47.3
Extremes														
-Record Highest	48	59	63	71	90	96	101	103	108	98	86	67	56	108
-Year		1971	1995	1960	1977	1986	1992	1967	1961	1988	1980	1975	1980	AUG 1961
-Record Lowest	48	-22	-17	-7	17	24	33	37	35	24	10	-21	-25	-25
-Year		1979	1979	1989	1966	1954	1984	1981	1965	1985	1991	1985	1968	DEC 1968
NORMAL DEGREE DAYS														
Heating (base 65 Deg. F)		1175	888	815	57	344	139	30	56	123	549	897	1153	6842
Cooling (base 65 Deg. F)		0	0	0	0	0	49	148	161	40	0	0	0	398
% OF POSSIBLE SUNSHINE	47	28	41	55	61	65	67	80	78	72	55	29	23	55
MEAN SKY COVER(tenths)														
Sunrise - Sunset	48	8.3	7.9	7.3	7.1	6.6	6.1	3.9	4.2	4.8	6.3	8.1	8.4	6.6
MEAN NUMBER OF DAYS:														
Sunrise to Sunset														
-Clear	48	3.1	3.4	4.5	4.5	5.9	7.3	16.1	15.2	12.3	8.0	3.3	2.8	86.4
-Partly Cloudy	48	4.1	4.9	7.8	8.2	10.1	10.3	8.5	8.6	8.3	7.8	5.0	3.9	87.5
-Cloudy	48	23.8	19.9	18.7	17.3	15.0	12.5	6.4	7.3	9.3	15.2	21.7	24.2	191.4
Precipitation														
.01 inches or more	48	13.9	11.1	11.2	8.9	9.4	7.9	4.7	4.9	5.5	7.5	12.6	14.6	112.1
Snow, Ice Pellets, Hail														
1.0 inches or more	48	5.1	2.8	1.5	0.2	0.*	0.0	0.0	0.0	0.0	0.1	2.1	4.9	16.7
Thunderstorms	48	0.*	0.*	0.3	0.7	1.6	2.8	2.4	2.1	0.8	0.3	0.1	0.0	11.2
Heavy Fog Visibility														
1/4 mile or less	48	9.3	7.1	3.0	1.2	0.8	0.5	0.2	0.3	0.8	4.0	8.5	11.7	47.5

Temperature Deg. F														
-Maximum														
90 Deg. F and above	36	0.0	0.0	0.0	0.*	0.3	2.1	8.4	7.1	0.9	0.0	0.0	0.0	18.7
32 Deg. F and below	36	14.1	4.8	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	3.9	13.8	37.6
-Minimum														
32 Deg. F and below	36	26.2	22.3	20.6	10.2	1.6	0.0	0.0	0.0	0.8	9.3	20.2	26.6	137.7
0 Deg. F and below	36	2.3	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.8	4.9
AV. STATION PRES. (mb)	22	933.9	932.9	930.2	931.0	930.5	930.9	931.8	931.5	932.8	933.8	932.7	934.1	932.2
RELATIVE HUMIDITY (%)														
Hour 04	36	86	85	81	77	77	75	65	63	71	79	87	88	78
Hour 10 (Local Time)	36	84	80	69	57	52	49	41	43	51	65	83	86	63
Hour 16	36	79	69	54	44	40	36	28	28	34	49	76	83	52
Hour 22	36	84	81	73	66	63	58	46	46	56	70	85	87	68
PRECIPITATION (in.)														
Water Equivalent														
-Normal		1.98	1.49	1.49	1.18	1.41	1.26	0.67	0.72	0.73	0.99	2.15	2.42	16.49
-Maximum Monthly	48	4.96	3.94	3.81	3.08	5.71	3.06	2.33	1.83	2.05	4.05	5.10	5.13	5.71
-Year		1959	1961	1995	1948	1948	1964	1990	1976	1959	1950	1973	1964	MAY 1948
-Minimum Monthly	48	0.38	0.35	0.31	0.08	0.20	0.16	T	T	T	0.03	0.22	0.60	T
-Year		1985	1988	1965	1956	1982	1960	1994	1988	1990	1987	1976	1976	JUL 1994
-Maximum in 24 hrs	48	1.48	1.11	1.08	1.01	1.67	2.07	1.80	1.09	1.12	1.23	1.41	1.60	2.07
-Year		1954	1963	1995	1982	1948	1964	1990	1959	1973	1994	1960	1951	JUN 1964
Snow, Ice Pellets, Hail														
-Maximum Monthly	48	56.9	28.5	15.3	6.6	3.5	T	0.0	0.0	T	6.1	24.7	42.0	56.9
-Year		1950	1975	1962	1964	1967	1994			1991	1957	1955	1964	JAN 1950
-Maximum in 24 hrs	48	13.0	11.0	6.1	4.9	3.5	T	0.0	0.0	T	6.1	9.0	12.1	13.0
-Year		1950	1993	1989	1964	1967	1994			1991	1957	1973	1951	JAN 1950
WIND														
Mean Speed (mph)	48	8.8	9.2	9.6	10.0	9.2	9.3	8.6	8.3	8.2	8.2	8.7	8.7	8.9
Prevailing Direction														
through 1964		NE	SSW	SSW	SW	SSW	SSW	SW	SW	NE	SSW	NE	NE	SSW
Fastest Mile														
-Direction(!!)	46	SW	SW	SW	SW	W	SW	SW	SW	SW	SW	SW	SW	SW
-Speed(mph)	46	59	54	54	52	49	44	43	50	38	56	54	51	59
-Year		1972	1949	1971	1987	1957	1986	1970	1982	1961	1950	1949	1956	JAN 1972

Peak Gust														
-Direction(!!)	12	SW	S	W	SW	W	SW	SW	W	SW	SW	SW	22	22
-Speed(mph)	12	56	51	52	62	53	49	51	47	47	62	56	63	63
-Date		1986	1987	1988	1987	1986	1989	1989	1993	1987	1991	1990	1995	DEC 1995

(a) - Length of Record in Years, although individual months may be missing.
0.* or * - The value is between 0.0 and 0.05.
Normals - Based on the 1961 - 1990 record period.
Extremes - Dates are the most recent occurrence.
Wind Dir.- Numerals show tens of degrees clockwise from true north. "00" indicates calm.
Resultant Directions are given to whole degrees.

APPENDIX C

Simulation Input

Climate Data Input Whitman Mission 2006
Project Name Sudbury Landfill
Project Number 2009-094-21

January

Day (Month)	Day (Year)	Max. air temp (F)	Min. air temp (F)	Dew. pt temp (F)	Solar Radiation (langleys)	Avg wind speed (MPH)	Avg cloud cover (tenths)	Precipitation (in)
1	1	54	29	23	112.95	8	8.3	0
2	2	40	30	23	112.95	8	8.3	0.62
3	3	62	30	23	112.95	8	8.3	0.06
4	4	56	36	23	112.95	8	8.3	0.04
5	5	41	30	23	112.95	8	8.3	0
6	6	36	27	23	112.95	8	8.3	0
7	7	31	27	23	112.95	8	8.3	0.06
8	8	46	30	23	112.95	8	8.3	0.07
9	9	38	32	23	112.95	8	8.3	0
10	10	43	32	23	112.95	8	8.3	0.02
11	11	52	31	23	112.95	8	8.3	0.06
12	12	60	27	23	112.95	8	8.3	0
13	13	42	26	23	112.95	8	8.3	0.09
14	14	58	27	23	112.95	8	8.3	0.32
15	15	62	44	23	112.95	8	8.3	0.46
16	16	60	46	23	112.95	8	8.3	0
17	17	46	31	23	112.95	8	8.3	0.34
18	18	41	20	23	112.95	8	8.3	0.25
19	19	36	21	23	112.95	8	8.3	0.05
20	20	40	28	23	112.95	8	8.3	0.02
21	21	47	33	23	112.95	8	8.3	0
22	22	41	28	23	112.95	8	8.3	0
23	23	42	29	23	112.95	8	8.3	0
24	24	44	26	23	112.95	8	8.3	0
25	25	42	25	23	112.95	8	8.3	0
26	26	37	20	23	112.95	8	8.3	0.02
27	27	26	18	23	112.95	8	8.3	0
28	28	30	18	23	112.95	8	8.3	0.07
29	29	35	10	23	112.95	8	8.3	0
30	30	15	-7	23	112.95	8	8.3	0

	31	31	-2	-22	23	112.95	8	8.3	0
February	1	32	-4	-21	29	176.01	8	7.9	0.07
	2	33	-2	-20	29	176.01	8	7.9	0
	3	34	-2	-21	29	176.01	8	7.9	0.07
	4	35	6	-13	29	176.01	8	7.9	0.06
	5	36	18	1	29	176.01	8	7.9	0
	6	37	49	18	29	176.01	8	7.9	0
	7	38	57	37	29	176.01	8	7.9	0
	8	39	61	45	29	176.01	8	7.9	0
	9	40	66	48	29	176.01	8	7.9	0.2
	10	41	54	24	29	176.01	8	7.9	0
	11	42	42	24	29	176.01	8	7.9	0
	12	43	45	25	29	176.01	8	7.9	0
	13	44	48	26	29	176.01	8	7.9	0
	14	45	48	25	29	176.01	8	7.9	0.14
	15	46	51	26	29	176.01	8	7.9	0
	16	47	51	26	29	176.01	8	7.9	0
	17	48	54	26	29	176.01	8	7.9	0
	18	49	54	39	29	176.01	8	7.9	0
	19	50	62	44	29	176.01	8	7.9	0
	20	51	57	38	29	176.01	8	7.9	0
	21	52	63	37	29	176.01	8	7.9	0
	22	53	51	33	29	176.01	8	7.9	0
	23	54	49	35	29	176.01	8	7.9	0
	24	55	44	30	29	176.01	8	7.9	0.01
	25	56	41	32	29	176.01	8	7.9	0
	26	57	35	14	29	176.01	8	7.9	0
	27	58	35	15	29	176.01	8	7.9	0.09
	28	59	36	19	29	176.01	8	7.9	0.33
	29	60	43	19	29	176.01	8	7.9	0
	1	61	41	22	32	279.21	9.8	7.3	0.05
	2	62	50	24	32	279.21	9.8	7.3	0
	3	63	61	25	32	279.21	9.8	7.3	0.01
	4	64	62	40	32	279.21	9.8	7.3	0
	5	65	49	32	32	279.21	9.8	7.3	0
	6	66	38	32	32	279.21	9.8	7.3	0.09
	7	67	57	35	32	279.21	9.8	7.3	0.05

March

8	68	47	35	32	279.21	9.8	7.3	0
9	69	45	39	32	279.21	9.8	7.3	0.1
10	70	52	39	32	279.21	9.8	7.3	0
11	71	59	42	32	279.21	9.8	7.3	0
12	72	68	47	32	279.21	9.8	7.3	0
13	73	59	34	32	279.21	9.8	7.3	0
14	74	58	34	32	279.21	9.8	7.3	0
15	75	65	37	32	279.21	9.8	7.3	0.02
16	76	60	31	32	279.21	9.8	7.3	0
17	77	57	32	32	279.21	9.8	7.3	0.32
18	78	60	27	32	279.21	9.8	7.3	0.15
19	79	65	32	32	279.21	9.8	7.3	0.01
20	80	62	33	32	279.21	9.8	7.3	0
21	81	58	27	32	279.21	9.8	7.3	0
22	82	55	32	32	279.21	9.8	7.3	0.02
23	83	58	34	32	279.21	9.8	7.3	0
24	84	58	31	32	279.21	9.8	7.3	0.01
25	85	38	19	32	279.21	9.8	7.3	0.57
26	86	45	23	32	279.21	9.8	7.3	0.53
27	87	50	33	32	279.21	9.8	7.3	0
28	88	54	33	32	279.21	9.8	7.3	0.03
29	89	53	33	32	279.21	9.8	7.3	0.01
30	90	56	36	32	279.21	9.8	7.3	0
31	91	57	37	32	279.21	9.8	7.3	0.08
1	92	47	42	35	398.18	9.1	7.1	0.06
2	93	60	43	35	398.18	9.1	7.1	0.37
3	94	60	29	35	398.18	9.1	7.1	0.02
4	95	59	31	35	398.18	9.1	7.1	0.4
5	96	67	31	35	398.18	9.1	7.1	0.03
6	97	73	39	35	398.18	9.1	7.1	0.68
7	98	77	45	35	398.18	9.1	7.1	0
8	99	81	46	35	398.18	9.1	7.1	0.03
9	100	82	48	35	398.18	9.1	7.1	0.12
10	101	75	47	35	398.18	9.1	7.1	0.43
11	102	65	47	35	398.18	9.1	7.1	0.07
12	103	65	42	35	398.18	9.1	7.1	0.04
13	104	59	42	35	398.18	9.1	7.1	0.01

April	14	105	63	32	35	398.18	9.1	7.1	0
	15	106	74	34	35	398.18	9.1	7.1	0.21
	16	107	73	48	35	398.18	9.1	7.1	0.07
	17	108	70	39	35	398.18	9.1	7.1	0.01
	18	109	63	42	35	398.18	9.1	7.1	0
	19	110	61	33	35	398.18	9.1	7.1	0
	20	111	60	35	35	398.18	9.1	7.1	0
	21	112	61	31	35	398.18	9.1	7.1	0
	22	113	65	36	35	398.18	9.1	7.1	0
	23	114	61	40	35	398.18	9.1	7.1	0
	24	115	66	47	35	398.18	9.1	7.1	0
	25	116	62	44	35	398.18	9.1	7.1	0
	26	117	62	39	35	398.18	9.1	7.1	0
	27	118	62	39	35	398.18	9.1	7.1	0
	28	119	63	31	35	398.18	9.1	7.1	0
	29	120	69	38	35	398.18	9.1	7.1	0
	30	121	70	44	35	398.18	9.1	7.1	0.01
May	1	122	67	45	42	497.37	9.1	6.6	0
	2	123	64	40	42	497.37	9.1	6.6	0
	3	124	60	41	42	497.37	9.1	6.6	0
	4	125	59	40	42	497.37	9.1	6.6	0
	5	126	62	29	42	497.37	9.1	6.6	0
	6	127	65	33	42	497.37	9.1	6.6	0
	7	128	69	43	42	497.37	9.1	6.6	0.03
	8	129	63	31	42	497.37	9.1	6.6	0.03
	9	130	61	29	42	497.37	9.1	6.6	0
	10	131	64	33	42	497.37	9.1	6.6	0
	11	132	68	46	42	497.37	9.1	6.6	0
	12	133	71	49	42	497.37	9.1	6.6	0
	13	134	70	51	42	497.37	9.1	6.6	0
	14	135	72	54	42	497.37	9.1	6.6	0
	15	136	72	55	42	497.37	9.1	6.6	0
	16	137	71	52	42	497.37	9.1	6.6	0
	17	138	71	53	42	497.37	9.1	6.6	0
	18	139	71	46	42	497.37	9.1	6.6	0
	19	140	71	46	42	497.37	9.1	6.6	0
	20	141	66	44	42	497.37	9.1	6.6	0.75

	21	142	67	42	42	497.37	9.1	6.6	0
	22	143	60	48	42	497.37	9.1	6.6	0.06
	23	144	61	38	42	497.37	9.1	6.6	0.45
	24	145	65	38	42	497.37	9.1	6.6	0.02
	25	146	74	40	42	497.37	9.1	6.6	0.05
	26	147	79	45	42	497.37	9.1	6.6	0.07
	27	148	78	49	42	497.37	9.1	6.6	0.03
	28	149	72	46	42	497.37	9.1	6.6	0.01
	29	150	66	44	42	497.37	9.1	6.6	0.01
	30	151	68	39	42	497.37	9.1	6.6	0
	31	152	69	44	42	497.37	9.1	6.6	0
	1	153	74	44	47	562.44	9.3	6.1	0
	2	154	80	57	47	562.44	9.3	6.1	0
	3	155	87	55	47	562.44	9.3	6.1	0.3
	4	156	86	60	47	562.44	9.3	6.1	0.16
	5	157	77	43	47	562.44	9.3	6.1	0.49
	6	158	78	40	47	562.44	9.3	6.1	0
	7	159	88	49	47	562.44	9.3	6.1	0
	8	160	91	57	47	562.44	9.3	6.1	0.06
	9	161	85	49	47	562.44	9.3	6.1	0
	10	162	74	42	47	562.44	9.3	6.1	0
	11	163	78	51	47	562.44	9.3	6.1	0
	12	164	76	40	47	562.44	9.3	6.1	0
	13	165	82	42	47	562.44	9.3	6.1	0.07
June	14	166	85	49	47	562.44	9.3	6.1	0.12
	15	167	83	47	47	562.44	9.3	6.1	0
	16	168	84	42	47	562.44	9.3	6.1	0
	17	169	78	52	47	562.44	9.3	6.1	0
	18	170	66	42	47	562.44	9.3	6.1	0
	19	171	69	38	47	562.44	9.3	6.1	0
	20	172	79	37	47	562.44	9.3	6.1	0
	21	173	82	41	47	562.44	9.3	6.1	0
	22	174	82	51	47	562.44	9.3	6.1	0
	23	175	82	51	47	562.44	9.3	6.1	0
	24	176	71	47	47	562.44	9.3	6.1	0
	25	177	72	46	47	562.44	9.3	6.1	0
	26	178	76	50	47	562.44	9.3	6.1	0

	27	179	81	56	47	562.44	9.3	6.1	0
	28	180	73	51	47	562.44	9.3	6.1	0
	29	181	76	46	47	562.44	9.3	6.1	0
	30	182	81	47	47	562.44	9.3	6.1	0.05
	1	183	88	54	47	599.42	9.1	3.9	0
	2	184	93	54	47	599.42	9.1	3.9	0
	3	185	98	60	47	599.42	9.1	3.9	0
	4	186	91	64	47	599.42	9.1	3.9	0
	5	187	77	44	47	599.42	9.1	3.9	0
	6	188	77	39	47	599.42	9.1	3.9	0
	7	189	88	42	47	599.42	9.1	3.9	0
	8	190	94	47	47	599.42	9.1	3.9	0
	9	191	95	56	47	599.42	9.1	3.9	0
	10	192	90	48	47	599.42	9.1	3.9	0
	11	193	88	46	47	599.42	9.1	3.9	0
	12	194	94	46	47	599.42	9.1	3.9	0
	13	195	94	51	47	599.42	9.1	3.9	0.04
	14	196	101	52	47	599.42	9.1	3.9	0
	15	197	98	60	47	599.42	9.1	3.9	0
July	16	198	100	63	47	599.42	9.1	3.9	0
	17	199	100	60	47	599.42	9.1	3.9	0
	18	200	82	52	47	599.42	9.1	3.9	0
	19	201	75	48	47	599.42	9.1	3.9	0
	20	202	77	48	47	599.42	9.1	3.9	0
	21	203	82	53	47	599.42	9.1	3.9	0
	22	204	88	49	47	599.42	9.1	3.9	0
	23	205	96	48	47	599.42	9.1	3.9	0
	24	206	102	50	47	599.42	9.1	3.9	0
	25	207	100	56	47	599.42	9.1	3.9	0
	26	208	100	47	47	599.42	9.1	3.9	0
	27	209	107	59	47	599.42	9.1	3.9	0
	28	210	101	60	47	599.42	9.1	3.9	0
	29	211	100	68	47	599.42	9.1	3.9	0
	30	212	92	59	47	599.42	9.1	3.9	0
	31	213	97	56	47	599.42	9.1	3.9	0
	1	214	93	52	48	511.7	8.8	4.2	0
	2	215	93	60	48	511.7	8.8	4.2	0

August	3	216	79	46	48	511.7	8.8	4.2	0
	4	217	76	48	48	511.7	8.8	4.2	0
	5	218	81	59	48	511.7	8.8	4.2	0
	6	219	77	45	48	511.7	8.8	4.2	0
	7	220	84	43	48	511.7	8.8	4.2	0
	8	221	95	47	48	511.7	8.8	4.2	0
	9	222	100	51	48	511.7	8.8	4.2	0
	10	223	101	49	48	511.7	8.8	4.2	0
	11	224	104	55	48	511.7	8.8	4.2	0
	12	225	95	45	48	511.7	8.8	4.2	0
	13	226	88	47	48	511.7	8.8	4.2	0
	14	227	94	54	48	511.7	8.8	4.2	0
	15	228	98	56	48	511.7	8.8	4.2	0
	16	229	94	56	48	511.7	8.8	4.2	0
	17	230	92	48	48	511.7	8.8	4.2	0
	18	231	79	49	48	511.7	8.8	4.2	0
	19	232	79	42	48	511.7	8.8	4.2	0
	20	233	86	42	48	511.7	8.8	4.2	0
	21	234	80	40	48	511.7	8.8	4.2	0
	22	235	84	40	48	511.7	8.8	4.2	0
	23	236	92	42	48	511.7	8.8	4.2	0
	24	237	96	44	48	511.7	8.8	4.2	0
	25	238	96	48	48	511.7	8.8	4.2	0
	26	239	98	50	48	511.7	8.8	4.2	0
	27	240	89	55	48	511.7	8.8	4.2	0
	28	241	78	57	48	511.7	8.8	4.2	0
	29	242	83	48	48	511.7	8.8	4.2	0
	30	243	100	53	48	511.7	8.8	4.2	0
	31	244	86	49	48	511.7	8.8	4.2	0
	1	245	80	43	43	379.55	8.1	4.8	0
	2	246	79	42	43	379.55	8.1	4.8	0
	3	247	81	46	43	379.55	8.1	4.8	0
	4	248	82	50	43	379.55	8.1	4.8	0
	5	249	73	52	43	379.55	8.1	4.8	0.02
	6	250	73	48	43	379.55	8.1	4.8	0
	7	251	74	47	43	379.55	8.1	4.8	0
	8	252	82	50	43	379.55	8.1	4.8	0

September	9	253	86	47	43	379.55	8.1	4.8	0
	10	254	85	41	43	379.55	8.1	4.8	0
	11	255	89	44	43	379.55	8.1	4.8	0
	12	256	89	47	43	379.55	8.1	4.8	0
	13	257	82	54	43	379.55	8.1	4.8	0
	14	258	80	56	43	379.55	8.1	4.8	0
	15	259	76	56	43	379.55	8.1	4.8	0
	16	260	70	48	43	379.55	8.1	4.8	0.03
	17	261	70	46	43	379.55	8.1	4.8	0
	18	262	70	41	43	379.55	8.1	4.8	0
	19	263	71	43	43	379.55	8.1	4.8	0.07
	20	264	70	46	43	379.55	8.1	4.8	0
	21	265	70	41	43	379.55	8.1	4.8	0.47
	22	266	68	42	43	379.55	8.1	4.8	0.07
	23	267	65	27	43	379.55	8.1	4.8	0
	24	268	64	29	43	379.55	8.1	4.8	0
	25	269	64	29	43	379.55	8.1	4.8	0
	26	270	71	30	43	379.55	8.1	4.8	0
	27	271	73	41	43	379.55	8.1	4.8	0
	28	272	87	42	43	379.55	8.1	4.8	0
	29	273	90	48	43	379.55	8.1	4.8	0
	30	274	87	42	43	379.55	8.1	4.8	0
ber	1	275	83	35	40	232.49	7.8	6.3	0
	2	276	75	34	40	232.49	7.8	6.3	0
	3	277	69	37	40	232.49	7.8	6.3	0
	4	278	80	40	40	232.49	7.8	6.3	0
	5	279	78	41	40	232.49	7.8	6.3	0.04
	6	280	72	39	40	232.49	7.8	6.3	0
	7	281	75	38	40	232.49	7.8	6.3	0
	8	282	81	40	40	232.49	7.8	6.3	0
	9	283	79	38	40	232.49	7.8	6.3	0.04
	10	284	75	39	40	232.49	7.8	6.3	0
	11	285	79	52	40	232.49	7.8	6.3	0
	12	286	75	44	40	232.49	7.8	6.3	0
	13	287	74	47	40	232.49	7.8	6.3	0
	14	288	61	45	40	232.49	7.8	6.3	0
	15	289	62	43	40	232.49	7.8	6.3	0.01

Octo	16	290	62	37	40	232.49	7.8	6.3	0.3
	17	291	56	23	40	232.49	7.8	6.3	0
	18	292	54	24	40	232.49	7.8	6.3	0
	19	293	55	39	40	232.49	7.8	6.3	0.06
	20	294	55	29	40	232.49	7.8	6.3	0.19
	21	295	54	26	40	232.49	7.8	6.3	0
	22	296	58	28	40	232.49	7.8	6.3	0
	23	297	56	33	40	232.49	7.8	6.3	0
	24	298	56	34	40	232.49	7.8	6.3	0
	25	299	60	38	40	232.49	7.8	6.3	0.02
	26	300	57	35	40	232.49	7.8	6.3	0
	27	301	51	31	40	232.49	7.8	6.3	0
	28	302	64	34	40	232.49	7.8	6.3	0
	29	303	65	38	40	232.49	7.8	6.3	0
	30	304	50	38	40	232.49	7.8	6.3	0
	31	305	44	28	40	232.49	7.8	6.3	0
November	1	306	49	25	36	118.39	7.7	8.1	0
	2	307	50	26	36	118.39	7.7	8.1	0
	3	308	44	28	36	118.39	7.7	8.1	0.11
	4	309	57	41	36	118.39	7.7	8.1	0.12
	5	310	52	37	36	118.39	7.7	8.1	0.05
	6	311	52	38	36	118.39	7.7	8.1	0.2
	7	312	57	32	36	118.39	7.7	8.1	0.04
	8	313	53	36	36	118.39	7.7	8.1	0.26
	9	314	65	29	36	118.39	7.7	8.1	0.2
	10	315	65	29	36	118.39	7.7	8.1	0.02
	11	316	41	33	36	118.39	7.7	8.1	0.05
	12	317	52	28	36	118.39	7.7	8.1	0
	13	318	56	30	36	118.39	7.7	8.1	0.09
	14	319	59	42	36	118.39	7.7	8.1	0.04
	15	320	48	32	36	118.39	7.7	8.1	0.01
	16	321	48	32	36	118.39	7.7	8.1	0.01
	17	322	45	32	36	118.39	7.7	8.1	0
	18	323	48	32	36	118.39	7.7	8.1	0
	19	324	45	31	36	118.39	7.7	8.1	0
	20	325	40	32	36	118.39	7.7	8.1	0.11
	21	326	48	24	36	118.39	7.7	8.1	0

	22	327	48	31	36	118.39	7.7	8.1	0
	23	328	34	28	36	118.39	7.7	8.1	0
	24	329	28	25	36	118.39	7.7	8.1	0.26
	25	330	30	23	36	118.39	7.7	8.1	0.05
	26	331	33	23	36	118.39	7.7	8.1	0
	27	332	46	30	36	118.39	7.7	8.1	0.32
	28	333	46	30	36	118.39	7.7	8.1	0
	29	334	45	29	36	118.39	7.7	8.1	0
	30	335	47	29	36	118.39	7.7	8.1	0
December	1	336	54	38	30	92.02	7.6	8.4	0
	2	337	47	36	30	92.02	7.6	8.4	0
	3	338	46	34	30	92.02	7.6	8.4	0
	4	339	44	24	30	92.02	7.6	8.4	0
	5	340	49	33	30	92.02	7.6	8.4	0
	6	341	47	36	30	92.02	7.6	8.4	0
	7	342	48	31	30	92.02	7.6	8.4	0
	8	343	51	38	30	92.02	7.6	8.4	0
	9	344	46	36	30	92.02	7.6	8.4	0
	10	345	43	37	30	92.02	7.6	8.4	0.1
	11	346	50	32	30	92.02	7.6	8.4	0.07
	12	347	50	32	30	92.02	7.6	8.4	0.04
	13	348	51	32	30	92.02	7.6	8.4	0.13
	14	349	49	32	30	92.02	7.6	8.4	0.03
	15	350	48	29	30	92.02	7.6	8.4	0.38
	16	351	51	31	30	92.02	7.6	8.4	0
	17	352	42	19	30	92.02	7.6	8.4	0
	18	353	26	18	30	92.02	7.6	8.4	0
	19	354	26	22	30	92.02	7.6	8.4	0
	20	355	37	25	30	92.02	7.6	8.4	0
	21	356	32	27	30	92.02	7.6	8.4	0.07
	22	357	29	20	30	92.02	7.6	8.4	0.04
	23	358	29	23	30	92.02	7.6	8.4	0.09
	24	359	27	24	30	92.02	7.6	8.4	0.02
	25	360	27	24	30	92.02	7.6	8.4	0
	26	361	25	13	30	92.02	7.6	8.4	0.86
	27	362	16	13	30	92.02	7.6	8.4	0.31
	28	363	26	-2	30	92.02	7.6	8.4	0.2

29	364	13	1	30	92.02	7.6	8.4	0
30	365	41	13	30	92.02	7.6	8.4	0
31	366	52	14	30	92.02	7.6	8.4	0

Climate Data Input Whitman Mission 2007
Project Name Sudbury Landfill
Project Number 2009-094-21

January

Day (Month)	Day (Year)	Max. air temp (F)	Min. air temp (F)	Dew. pt temp (F)	Solar Radiation (langleys)	Avg wind speed (MPH)	Avg cloud cover (tenths)	Precipitation (in)
1	1	54	29	23	112.95	8	8.3	0
2	2	40	30	23	112.95	8	8.3	0.02
3	3	62	30	23	112.95	8	8.3	0.59
4	4	56	36	23	112.95	8	8.3	0.28
5	5	41	30	23	112.95	8	8.3	0.02
6	6	36	27	23	112.95	8	8.3	0
7	7	31	27	23	112.95	8	8.3	0.08
8	8	46	30	23	112.95	8	8.3	0
9	9	38	32	23	112.95	8	8.3	0
10	10	43	32	23	112.95	8	8.3	0
11	11	52	31	23	112.95	8	8.3	0
12	12	60	27	23	112.95	8	8.3	0
13	13	42	26	23	112.95	8	8.3	0
14	14	58	27	23	112.95	8	8.3	0
15	15	62	44	23	112.95	8	8.3	0
16	16	60	46	23	112.95	8	8.3	0
17	17	46	31	23	112.95	8	8.3	0.01
18	18	41	20	23	112.95	8	8.3	0
19	19	36	21	23	112.95	8	8.3	0
20	20	40	28	23	112.95	8	8.3	0
21	21	47	33	23	112.95	8	8.3	0
22	22	41	28	23	112.95	8	8.3	0
23	23	42	29	23	112.95	8	8.3	0
24	24	44	26	23	112.95	8	8.3	0
25	25	42	25	23	112.95	8	8.3	0
26	26	37	20	23	112.95	8	8.3	0.02
27	27	26	18	23	112.95	8	8.3	0.01
28	28	30	18	23	112.95	8	8.3	0
29	29	35	10	23	112.95	8	8.3	0
30	30	15	-7	23	112.95	8	8.3	0.01

	31	31	-2	-22	23	112.95	8	8.3	0
February	1	32	-4	-21	29	176.01	8	7.9	0
	2	33	-2	-20	29	176.01	8	7.9	0
	3	34	-2	-21	29	176.01	8	7.9	0
	4	35	6	-13	29	176.01	8	7.9	0.13
	5	36	18	1	29	176.01	8	7.9	0
	6	37	49	18	29	176.01	8	7.9	0
	7	38	57	37	29	176.01	8	7.9	0
	8	39	61	45	29	176.01	8	7.9	0.07
	9	40	66	48	29	176.01	8	7.9	0.14
	10	41	54	24	29	176.01	8	7.9	0.18
	11	42	42	24	29	176.01	8	7.9	0.24
	12	43	45	25	29	176.01	8	7.9	0.1
	13	44	48	26	29	176.01	8	7.9	0
	14	45	48	25	29	176.01	8	7.9	0
	15	46	51	26	29	176.01	8	7.9	0.19
	16	47	51	26	29	176.01	8	7.9	0.16
	17	48	54	26	29	176.01	8	7.9	0
	18	49	54	39	29	176.01	8	7.9	0
	19	50	62	44	29	176.01	8	7.9	0
	20	51	57	38	29	176.01	8	7.9	0.01
	21	52	63	37	29	176.01	8	7.9	0
	22	53	51	33	29	176.01	8	7.9	0
	23	54	49	35	29	176.01	8	7.9	0.19
	24	55	44	30	29	176.01	8	7.9	0.02
	25	56	41	32	29	176.01	8	7.9	0.03
	26	57	35	14	29	176.01	8	7.9	0.19
	27	58	35	15	29	176.01	8	7.9	0
	28	59	36	19	29	176.01	8	7.9	0
	29	60	43	19	29	176.01	8	7.9	
	1	61	41	22	32	279.21	9.8	7.3	0
	2	62	50	24	32	279.21	9.8	7.3	0.07
	3	63	61	25	32	279.21	9.8	7.3	0.05
	4	64	62	40	32	279.21	9.8	7.3	0
	5	65	49	32	32	279.21	9.8	7.3	0.01
	6	66	38	32	32	279.21	9.8	7.3	0
	7	67	57	35	32	279.21	9.8	7.3	0

	8	68	47	35	32	279.21	9.8	7.3	0.48
	9	69	45	39	32	279.21	9.8	7.3	0
	10	70	52	39	32	279.21	9.8	7.3	0
	11	71	59	42	32	279.21	9.8	7.3	0
	12	72	68	47	32	279.21	9.8	7.3	0
	13	73	59	34	32	279.21	9.8	7.3	0.09
	14	74	58	34	32	279.21	9.8	7.3	0
	15	75	65	37	32	279.21	9.8	7.3	0
March	16	76	60	31	32	279.21	9.8	7.3	0
	17	77	57	32	32	279.21	9.8	7.3	0
	18	78	60	27	32	279.21	9.8	7.3	0
	19	79	65	32	32	279.21	9.8	7.3	0
	20	80	62	33	32	279.21	9.8	7.3	0.28
	21	81	58	27	32	279.21	9.8	7.3	0
	22	82	55	32	32	279.21	9.8	7.3	0
	23	83	58	34	32	279.21	9.8	7.3	0.05
	24	84	58	31	32	279.21	9.8	7.3	0.01
	25	85	38	19	32	279.21	9.8	7.3	0.2
	26	86	45	23	32	279.21	9.8	7.3	0.36
	27	87	50	33	32	279.21	9.8	7.3	0.45
	28	88	54	33	32	279.21	9.8	7.3	0.08
	29	89	53	33	32	279.21	9.8	7.3	0
	30	90	56	36	32	279.21	9.8	7.3	0
	31	91	57	37	32	279.21	9.8	7.3	0
	1	92	47	42	35	398.18	9.1	7.1	0.02
	2	93	60	43	35	398.18	9.1	7.1	0
	3	94	60	29	35	398.18	9.1	7.1	0
	4	95	59	31	35	398.18	9.1	7.1	0
	5	96	67	31	35	398.18	9.1	7.1	0
	6	97	73	39	35	398.18	9.1	7.1	0
	7	98	77	45	35	398.18	9.1	7.1	0
	8	99	81	46	35	398.18	9.1	7.1	0
	9	100	82	48	35	398.18	9.1	7.1	0.22
	10	101	75	47	35	398.18	9.1	7.1	0
	11	102	65	47	35	398.18	9.1	7.1	0
	12	103	65	42	35	398.18	9.1	7.1	0
	13	104	59	42	35	398.18	9.1	7.1	0

April	14	105	63	32	35	398.18	9.1	7.1	0
	15	106	74	34	35	398.18	9.1	7.1	0.19
	16	107	73	48	35	398.18	9.1	7.1	0.01
	17	108	70	39	35	398.18	9.1	7.1	0.32
	18	109	63	42	35	398.18	9.1	7.1	0
	19	110	61	33	35	398.18	9.1	7.1	0
	20	111	60	35	35	398.18	9.1	7.1	0
	21	112	61	31	35	398.18	9.1	7.1	0
	22	113	65	36	35	398.18	9.1	7.1	0.11
	23	114	61	40	35	398.18	9.1	7.1	0.04
	24	115	66	47	35	398.18	9.1	7.1	0
	25	116	62	44	35	398.18	9.1	7.1	0
	26	117	62	39	35	398.18	9.1	7.1	0
	27	118	62	39	35	398.18	9.1	7.1	0
	28	119	63	31	35	398.18	9.1	7.1	0
	29	120	69	38	35	398.18	9.1	7.1	0
	30	121	70	44	35	398.18	9.1	7.1	0
May	1	122	67	45	42	497.37	9.1	6.6	0
	2	123	64	40	42	497.37	9.1	6.6	0.08
	3	124	60	41	42	497.37	9.1	6.6	0.3
	4	125	59	40	42	497.37	9.1	6.6	0
	5	126	62	29	42	497.37	9.1	6.6	0
	6	127	65	33	42	497.37	9.1	6.6	0
	7	128	69	43	42	497.37	9.1	6.6	0
	8	129	63	31	42	497.37	9.1	6.6	0
	9	130	61	29	42	497.37	9.1	6.6	0.01
	10	131	64	33	42	497.37	9.1	6.6	0
	11	132	68	46	42	497.37	9.1	6.6	0
	12	133	71	49	42	497.37	9.1	6.6	0
	13	134	70	51	42	497.37	9.1	6.6	0
	14	135	72	54	42	497.37	9.1	6.6	0
	15	136	72	55	42	497.37	9.1	6.6	0
	16	137	71	52	42	497.37	9.1	6.6	0
	17	138	71	53	42	497.37	9.1	6.6	0
	18	139	71	46	42	497.37	9.1	6.6	0
	19	140	71	46	42	497.37	9.1	6.6	0
	20	141	66	44	42	497.37	9.1	6.6	0

	21	142	67	42	42	497.37	9.1	6.6	0.01
	22	143	60	48	42	497.37	9.1	6.6	0.05
	23	144	61	38	42	497.37	9.1	6.6	0.01
	24	145	65	38	42	497.37	9.1	6.6	0
	25	146	74	40	42	497.37	9.1	6.6	0
	26	147	79	45	42	497.37	9.1	6.6	0
	27	148	78	49	42	497.37	9.1	6.6	0.06
	28	149	72	46	42	497.37	9.1	6.6	0
	29	150	66	44	42	497.37	9.1	6.6	0
	30	151	68	39	42	497.37	9.1	6.6	0
	31	152	69	44	42	497.37	9.1	6.6	0
June	1	153	74	44	47	562.44	9.3	6.1	0
	2	154	80	57	47	562.44	9.3	6.1	0
	3	155	87	55	47	562.44	9.3	6.1	0
	4	156	86	60	47	562.44	9.3	6.1	0
	5	157	77	43	47	562.44	9.3	6.1	0.38
	6	158	78	40	47	562.44	9.3	6.1	0.15
	7	159	88	49	47	562.44	9.3	6.1	0
	8	160	91	57	47	562.44	9.3	6.1	0
	9	161	85	49	47	562.44	9.3	6.1	0
	10	162	74	42	47	562.44	9.3	6.1	0.42
	11	163	78	51	47	562.44	9.3	6.1	0.02
	12	164	76	40	47	562.44	9.3	6.1	0
	13	165	82	42	47	562.44	9.3	6.1	0
	14	166	85	49	47	562.44	9.3	6.1	0
	15	167	83	47	47	562.44	9.3	6.1	0
	16	168	84	42	47	562.44	9.3	6.1	0
	17	169	78	52	47	562.44	9.3	6.1	0
	18	170	66	42	47	562.44	9.3	6.1	0
	19	171	69	38	47	562.44	9.3	6.1	0
	20	172	79	37	47	562.44	9.3	6.1	0
	21	173	82	41	47	562.44	9.3	6.1	0
	22	174	82	51	47	562.44	9.3	6.1	0
	23	175	82	51	47	562.44	9.3	6.1	0
	24	176	71	47	47	562.44	9.3	6.1	0
	25	177	72	46	47	562.44	9.3	6.1	0.1
	26	178	76	50	47	562.44	9.3	6.1	0

	27	179	81	56	47	562.44	9.3	6.1	0
	28	180	73	51	47	562.44	9.3	6.1	0
	29	181	76	46	47	562.44	9.3	6.1	0
	30	182	81	47	47	562.44	9.3	6.1	0.23
July	1	183	88	54	47	599.42	9.1	3.9	0
	2	184	93	54	47	599.42	9.1	3.9	0
	3	185	98	60	47	599.42	9.1	3.9	0
	4	186	91	64	47	599.42	9.1	3.9	0
	5	187	77	44	47	599.42	9.1	3.9	0
	6	188	77	39	47	599.42	9.1	3.9	0
	7	189	88	42	47	599.42	9.1	3.9	0
	8	190	94	47	47	599.42	9.1	3.9	0
	9	191	95	56	47	599.42	9.1	3.9	0
	10	192	90	48	47	599.42	9.1	3.9	0
	11	193	88	46	47	599.42	9.1	3.9	0
	12	194	94	46	47	599.42	9.1	3.9	0
	13	195	94	51	47	599.42	9.1	3.9	0
	14	196	101	52	47	599.42	9.1	3.9	0
	15	197	98	60	47	599.42	9.1	3.9	0
	16	198	100	63	47	599.42	9.1	3.9	0
	17	199	100	60	47	599.42	9.1	3.9	0
	18	200	82	52	47	599.42	9.1	3.9	0.04
	19	201	75	48	47	599.42	9.1	3.9	0.26
	20	202	77	48	47	599.42	9.1	3.9	0
	21	203	82	53	47	599.42	9.1	3.9	0
	22	204	88	49	47	599.42	9.1	3.9	0
	23	205	96	48	47	599.42	9.1	3.9	0
	24	206	102	50	47	599.42	9.1	3.9	0
	25	207	100	56	47	599.42	9.1	3.9	0
	26	208	100	47	47	599.42	9.1	3.9	0
	27	209	107	59	47	599.42	9.1	3.9	0
	28	210	101	60	47	599.42	9.1	3.9	0
	29	211	100	68	47	599.42	9.1	3.9	0
	30	212	92	59	47	599.42	9.1	3.9	0
	31	213	97	56	47	599.42	9.1	3.9	0
	1	214	93	52	48	511.7	8.8	4.2	0
	2	215	93	60	48	511.7	8.8	4.2	0

August

3	216	79	46	48	511.7	8.8	4.2	0
4	217	76	48	48	511.7	8.8	4.2	0
5	218	81	59	48	511.7	8.8	4.2	0
6	219	77	45	48	511.7	8.8	4.2	0
7	220	84	43	48	511.7	8.8	4.2	0
8	221	95	47	48	511.7	8.8	4.2	0
9	222	100	51	48	511.7	8.8	4.2	0
10	223	101	49	48	511.7	8.8	4.2	0
11	224	104	55	48	511.7	8.8	4.2	0
12	225	95	45	48	511.7	8.8	4.2	0
13	226	88	47	48	511.7	8.8	4.2	0
14	227	94	54	48	511.7	8.8	4.2	0
15	228	98	56	48	511.7	8.8	4.2	0
16	229	94	56	48	511.7	8.8	4.2	0
17	230	92	48	48	511.7	8.8	4.2	0
18	231	79	49	48	511.7	8.8	4.2	0
19	232	79	42	48	511.7	8.8	4.2	0.04
20	233	86	42	48	511.7	8.8	4.2	0.34
21	234	80	40	48	511.7	8.8	4.2	0.11
22	235	84	40	48	511.7	8.8	4.2	0
23	236	92	42	48	511.7	8.8	4.2	0
24	237	96	44	48	511.7	8.8	4.2	0
25	238	96	48	48	511.7	8.8	4.2	0
26	239	98	50	48	511.7	8.8	4.2	0
27	240	89	55	48	511.7	8.8	4.2	0
28	241	78	57	48	511.7	8.8	4.2	0
29	242	83	48	48	511.7	8.8	4.2	0
30	243	100	53	48	511.7	8.8	4.2	0
31	244	86	49	48	511.7	8.8	4.2	0
1	245	80	43	43	379.55	8.1	4.8	0.1
2	246	79	42	43	379.55	8.1	4.8	0
3	247	81	46	43	379.55	8.1	4.8	0
4	248	82	50	43	379.55	8.1	4.8	0
5	249	73	52	43	379.55	8.1	4.8	0
6	250	73	48	43	379.55	8.1	4.8	0
7	251	74	47	43	379.55	8.1	4.8	0
8	252	82	50	43	379.55	8.1	4.8	0

September	9	253	86	47	43	379.55	8.1	4.8	0
	10	254	85	41	43	379.55	8.1	4.8	0
	11	255	89	44	43	379.55	8.1	4.8	0
	12	256	89	47	43	379.55	8.1	4.8	0
	13	257	82	54	43	379.55	8.1	4.8	0
	14	258	80	56	43	379.55	8.1	4.8	0
	15	259	76	56	43	379.55	8.1	4.8	0
	16	260	70	48	43	379.55	8.1	4.8	0
	17	261	70	46	43	379.55	8.1	4.8	0
	18	262	70	41	43	379.55	8.1	4.8	0
	19	263	71	43	43	379.55	8.1	4.8	0
	20	264	70	46	43	379.55	8.1	4.8	0
	21	265	70	41	43	379.55	8.1	4.8	0
	22	266	68	42	43	379.55	8.1	4.8	0
	23	267	65	27	43	379.55	8.1	4.8	0
	24	268	64	29	43	379.55	8.1	4.8	0
	25	269	64	29	43	379.55	8.1	4.8	0
	26	270	71	30	43	379.55	8.1	4.8	0
	27	271	73	41	43	379.55	8.1	4.8	0
	28	272	87	42	43	379.55	8.1	4.8	0
	29	273	90	48	43	379.55	8.1	4.8	0.18
	30	274	87	42	43	379.55	8.1	4.8	0
	1	275	83	35	40	232.49	7.8	6.3	0.2
	2	276	75	34	40	232.49	7.8	6.3	0.03
	3	277	69	37	40	232.49	7.8	6.3	0.03
	4	278	80	40	40	232.49	7.8	6.3	0.02
	5	279	78	41	40	232.49	7.8	6.3	0.03
	6	280	72	39	40	232.49	7.8	6.3	0
	7	281	75	38	40	232.49	7.8	6.3	0
	8	282	81	40	40	232.49	7.8	6.3	0
	9	283	79	38	40	232.49	7.8	6.3	0
	10	284	75	39	40	232.49	7.8	6.3	0
	11	285	79	52	40	232.49	7.8	6.3	0.11
	12	286	75	44	40	232.49	7.8	6.3	0
	13	287	74	47	40	232.49	7.8	6.3	0
ber	14	288	61	45	40	232.49	7.8	6.3	0
	15	289	62	43	40	232.49	7.8	6.3	0

Octo	16	290	62	37	40	232.49	7.8	6.3	0.13
	17	291	56	23	40	232.49	7.8	6.3	0.28
	18	292	54	24	40	232.49	7.8	6.3	0.05
	19	293	55	39	40	232.49	7.8	6.3	0.28
	20	294	55	29	40	232.49	7.8	6.3	0
	21	295	54	26	40	232.49	7.8	6.3	0
	22	296	58	28	40	232.49	7.8	6.3	0
	23	297	56	33	40	232.49	7.8	6.3	0
	24	298	56	34	40	232.49	7.8	6.3	0
	25	299	60	38	40	232.49	7.8	6.3	0
	26	300	57	35	40	232.49	7.8	6.3	0
	27	301	51	31	40	232.49	7.8	6.3	0
	28	302	64	34	40	232.49	7.8	6.3	0
	29	303	65	38	40	232.49	7.8	6.3	0
	30	304	50	38	40	232.49	7.8	6.3	0.02
	31	305	44	28	40	232.49	7.8	6.3	0
November	1	306	49	25	36	118.39	7.7	8.1	0
	2	307	50	26	36	118.39	7.7	8.1	0
	3	308	44	28	36	118.39	7.7	8.1	0
	4	309	57	41	36	118.39	7.7	8.1	0
	5	310	52	37	36	118.39	7.7	8.1	0
	6	311	52	38	36	118.39	7.7	8.1	0
	7	312	57	32	36	118.39	7.7	8.1	0
	8	313	53	36	36	118.39	7.7	8.1	0
	9	314	65	29	36	118.39	7.7	8.1	0
	10	315	65	29	36	118.39	7.7	8.1	0.06
	11	316	41	33	36	118.39	7.7	8.1	0.02
	12	317	52	28	36	118.39	7.7	8.1	0
	13	318	56	30	36	118.39	7.7	8.1	0.07
	14	319	59	42	36	118.39	7.7	8.1	0
	15	320	48	32	36	118.39	7.7	8.1	0.02
	16	321	48	32	36	118.39	7.7	8.1	0.14
	17	322	45	32	36	118.39	7.7	8.1	0.37
	18	323	48	32	36	118.39	7.7	8.1	0.15
	19	324	45	31	36	118.39	7.7	8.1	0.53
	20	325	40	32	36	118.39	7.7	8.1	0.07
	21	326	48	24	36	118.39	7.7	8.1	0

	22	327	48	31	36	118.39	7.7	8.1	0
	23	328	34	28	36	118.39	7.7	8.1	0.02
	24	329	28	25	36	118.39	7.7	8.1	0
	25	330	30	23	36	118.39	7.7	8.1	0
	26	331	33	23	36	118.39	7.7	8.1	0
	27	332	46	30	36	118.39	7.7	8.1	0.07
	28	333	46	30	36	118.39	7.7	8.1	0
	29	334	45	29	36	118.39	7.7	8.1	0.29
	30	335	47	29	36	118.39	7.7	8.1	0.1
December	1	336	54	38	30	92.02	7.6	8.4	0.04
	2	337	47	36	30	92.02	7.6	8.4	0.03
	3	338	46	34	30	92.02	7.6	8.4	0.13
	4	339	44	24	30	92.02	7.6	8.4	0.01
	5	340	49	33	30	92.02	7.6	8.4	0
	6	341	47	36	30	92.02	7.6	8.4	0
	7	342	48	31	30	92.02	7.6	8.4	0.63
	8	343	51	38	30	92.02	7.6	8.4	0.02
	9	344	46	36	30	92.02	7.6	8.4	0
	10	345	43	37	30	92.02	7.6	8.4	0.03
	11	346	50	32	30	92.02	7.6	8.4	0
	12	347	50	32	30	92.02	7.6	8.4	0
	13	348	51	32	30	92.02	7.6	8.4	0
	14	349	49	32	30	92.02	7.6	8.4	0
	15	350	48	29	30	92.02	7.6	8.4	0
	16	351	51	31	30	92.02	7.6	8.4	0
	17	352	42	19	30	92.02	7.6	8.4	0.04
	18	353	26	18	30	92.02	7.6	8.4	0
	19	354	26	22	30	92.02	7.6	8.4	0.02
	20	355	37	25	30	92.02	7.6	8.4	0.02
	21	356	32	27	30	92.02	7.6	8.4	0.02
	22	357	29	20	30	92.02	7.6	8.4	0
	23	358	29	23	30	92.02	7.6	8.4	0.17
	24	359	27	24	30	92.02	7.6	8.4	0
	25	360	27	24	30	92.02	7.6	8.4	0
	26	361	25	13	30	92.02	7.6	8.4	0.31
	27	362	16	13	30	92.02	7.6	8.4	0
	28	363	26	-2	30	92.02	7.6	8.4	0.1

29	364	13	1	30	92.02	7.6	8.4	0
30	365	41	13	30	92.02	7.6	8.4	0.01
31	366	52	14	30	92.02	7.6	8.4	0

Climate Data Input Whitman Mission 2008
Project Name Sudbury Landfill
Project Number 2009-094-21

January

Day (Month)	Day (Year)	Max. air temp (F)	Min. air temp (F)	Dew. pt temp (F)	Solar Radiation (langleys)	Avg wind speed (MPH)	Avg cloud cover (tenths)	Precipitation (in)
1	1	54	29	23	112.95	8	8.3	0
2	2	40	30	23	112.95	8	8.3	0
3	3	62	30	23	112.95	8	8.3	0
4	4	56	36	23	112.95	8	8.3	0
5	5	41	30	23	112.95	8	8.3	0
6	6	36	27	23	112.95	8	8.3	0.02
7	7	31	27	23	112.95	8	8.3	0.03
8	8	46	30	23	112.95	8	8.3	0
9	9	38	32	23	112.95	8	8.3	0.02
10	10	43	32	23	112.95	8	8.3	0.01
11	11	52	31	23	112.95	8	8.3	0.01
12	12	60	27	23	112.95	8	8.3	0
13	13	42	26	23	112.95	8	8.3	0.11
14	14	58	27	23	112.95	8	8.3	0.01
15	15	62	44	23	112.95	8	8.3	0.05
16	16	60	46	23	112.95	8	8.3	0
17	17	46	31	23	112.95	8	8.3	0
18	18	41	20	23	112.95	8	8.3	0
19	19	36	21	23	112.95	8	8.3	0
20	20	40	28	23	112.95	8	8.3	0.09
21	21	47	33	23	112.95	8	8.3	0.08
22	22	41	28	23	112.95	8	8.3	0
23	23	42	29	23	112.95	8	8.3	0
24	24	44	26	23	112.95	8	8.3	0
25	25	42	25	23	112.95	8	8.3	0
26	26	37	20	23	112.95	8	8.3	0
27	27	26	18	23	112.95	8	8.3	0.09
28	28	30	18	23	112.95	8	8.3	1.04
29	29	35	10	23	112.95	8	8.3	0
30	30	15	-7	23	112.95	8	8.3	0

	31	31	-2	-22	23	112.95	8	8.3	0
February	1	32	-4	-21	29	176.01	8	7.9	0.09
	2	33	-2	-20	29	176.01	8	7.9	0
	3	34	-2	-21	29	176.01	8	7.9	0.15
	4	35	6	-13	29	176.01	8	7.9	0.12
	5	36	18	1	29	176.01	8	7.9	0
	6	37	49	18	29	176.01	8	7.9	0.08
	7	38	57	37	29	176.01	8	7.9	0
	8	39	61	45	29	176.01	8	7.9	0
	9	40	66	48	29	176.01	8	7.9	0
	10	41	54	24	29	176.01	8	7.9	0
	11	42	42	24	29	176.01	8	7.9	0
	12	43	45	25	29	176.01	8	7.9	0
	13	44	48	26	29	176.01	8	7.9	0
	14	45	48	25	29	176.01	8	7.9	0
	15	46	51	26	29	176.01	8	7.9	0
	16	47	51	26	29	176.01	8	7.9	0.03
	17	48	54	26	29	176.01	8	7.9	0
	18	49	54	39	29	176.01	8	7.9	0
	19	50	62	44	29	176.01	8	7.9	0
	20	51	57	38	29	176.01	8	7.9	0
	21	52	63	37	29	176.01	8	7.9	0
	22	53	51	33	29	176.01	8	7.9	0
	23	54	49	35	29	176.01	8	7.9	0
	24	55	44	30	29	176.01	8	7.9	0.02
	25	56	41	32	29	176.01	8	7.9	0.05
	26	57	35	14	29	176.01	8	7.9	0
	27	58	35	15	29	176.01	8	7.9	0
	28	59	36	19	29	176.01	8	7.9	0.01
	29	60	43	19	29	176.01	8	7.9	0
	1	61	41	22	32	279.21	9.8	7.3	0.08
	2	62	50	24	32	279.21	9.8	7.3	0
	3	63	61	25	32	279.21	9.8	7.3	0
	4	64	62	40	32	279.21	9.8	7.3	0.02
	5	65	49	32	32	279.21	9.8	7.3	0
	6	66	38	32	32	279.21	9.8	7.3	0
	7	67	57	35	32	279.21	9.8	7.3	0

March

8	68	47	35	32	279.21	9.8	7.3	0.08
9	69	45	39	32	279.21	9.8	7.3	0
10	70	52	39	32	279.21	9.8	7.3	0
11	71	59	42	32	279.21	9.8	7.3	0.15
12	72	68	47	32	279.21	9.8	7.3	0
13	73	59	34	32	279.21	9.8	7.3	0.15
14	74	58	34	32	279.21	9.8	7.3	0.29
15	75	65	37	32	279.21	9.8	7.3	0.17
16	76	60	31	32	279.21	9.8	7.3	0.05
17	77	57	32	32	279.21	9.8	7.3	0.02
18	78	60	27	32	279.21	9.8	7.3	0
19	79	65	32	32	279.21	9.8	7.3	0.04
20	80	62	33	32	279.21	9.8	7.3	0.04
21	81	58	27	32	279.21	9.8	7.3	0
22	82	55	32	32	279.21	9.8	7.3	0
23	83	58	34	32	279.21	9.8	7.3	0
24	84	58	31	32	279.21	9.8	7.3	0.01
25	85	38	19	32	279.21	9.8	7.3	0
26	86	45	23	32	279.21	9.8	7.3	0
27	87	50	33	32	279.21	9.8	7.3	0.03
28	88	54	33	32	279.21	9.8	7.3	0
29	89	53	33	32	279.21	9.8	7.3	0.05
30	90	56	36	32	279.21	9.8	7.3	0.1
31	91	57	37	32	279.21	9.8	7.3	0.11
1	92	47	42	35	398.18	9.1	7.1	0
2	93	60	43	35	398.18	9.1	7.1	0
3	94	60	29	35	398.18	9.1	7.1	0
4	95	59	31	35	398.18	9.1	7.1	0
5	96	67	31	35	398.18	9.1	7.1	0.03
6	97	73	39	35	398.18	9.1	7.1	0.03
7	98	77	45	35	398.18	9.1	7.1	0
8	99	81	46	35	398.18	9.1	7.1	0.01
9	100	82	48	35	398.18	9.1	7.1	0.02
10	101	75	47	35	398.18	9.1	7.1	0
11	102	65	47	35	398.18	9.1	7.1	0
12	103	65	42	35	398.18	9.1	7.1	0
13	104	59	42	35	398.18	9.1	7.1	0

April	14	105	63	32	35	398.18	9.1	7.1	0.07
	15	106	74	34	35	398.18	9.1	7.1	0.16
	16	107	73	48	35	398.18	9.1	7.1	0
	17	108	70	39	35	398.18	9.1	7.1	0
	18	109	63	42	35	398.18	9.1	7.1	0
	19	110	61	33	35	398.18	9.1	7.1	0
	20	111	60	35	35	398.18	9.1	7.1	0
	21	112	61	31	35	398.18	9.1	7.1	0
	22	113	65	36	35	398.18	9.1	7.1	0.01
	23	114	61	40	35	398.18	9.1	7.1	0.02
	24	115	66	47	35	398.18	9.1	7.1	0.11
	25	116	62	44	35	398.18	9.1	7.1	
	26	117	62	39	35	398.18	9.1	7.1	0
	27	118	62	39	35	398.18	9.1	7.1	0
	28	119	63	31	35	398.18	9.1	7.1	0
	29	120	69	38	35	398.18	9.1	7.1	0.04
	30	121	70	44	35	398.18	9.1	7.1	0.01
May	1	122	67	45	42	497.37	9.1	6.6	0
	2	123	64	40	42	497.37	9.1	6.6	0
	3	124	60	41	42	497.37	9.1	6.6	0
	4	125	59	40	42	497.37	9.1	6.6	0.13
	5	126	62	29	42	497.37	9.1	6.6	0
	6	127	65	33	42	497.37	9.1	6.6	0
	7	128	69	43	42	497.37	9.1	6.6	0.03
	8	129	63	31	42	497.37	9.1	6.6	0
	9	130	61	29	42	497.37	9.1	6.6	0
	10	131	64	33	42	497.37	9.1	6.6	0
	11	132	68	46	42	497.37	9.1	6.6	0.1
	12	133	71	49	42	497.37	9.1	6.6	0.01
	13	134	70	51	42	497.37	9.1	6.6	0
	14	135	72	54	42	497.37	9.1	6.6	0.26
	15	136	72	55	42	497.37	9.1	6.6	0.02
	16	137	71	52	42	497.37	9.1	6.6	0
	17	138	71	53	42	497.37	9.1	6.6	0
	18	139	71	46	42	497.37	9.1	6.6	0
	19	140	71	46	42	497.37	9.1	6.6	0
	20	141	66	44	42	497.37	9.1	6.6	0

	21	142	67	42	42	497.37	9.1	6.6	0.32
	22	143	60	48	42	497.37	9.1	6.6	0.02
	23	144	61	38	42	497.37	9.1	6.6	0.19
	24	145	65	38	42	497.37	9.1	6.6	0
	25	146	74	40	42	497.37	9.1	6.6	0.1
	26	147	79	45	42	497.37	9.1	6.6	0.04
	27	148	78	49	42	497.37	9.1	6.6	0
	28	149	72	46	42	497.37	9.1	6.6	0
	29	150	66	44	42	497.37	9.1	6.6	0.04
	30	151	68	39	42	497.37	9.1	6.6	0
	31	152	69	44	42	497.37	9.1	6.6	0
June	1	153	74	44	47	562.44	9.3	6.1	0.06
	2	154	80	57	47	562.44	9.3	6.1	0
	3	155	87	55	47	562.44	9.3	6.1	0
	4	156	86	60	47	562.44	9.3	6.1	0.22
	5	157	77	43	47	562.44	9.3	6.1	0
	6	158	78	40	47	562.44	9.3	6.1	0.05
	7	159	88	49	47	562.44	9.3	6.1	0.01
	8	160	91	57	47	562.44	9.3	6.1	0
	9	161	85	49	47	562.44	9.3	6.1	0.01
	10	162	74	42	47	562.44	9.3	6.1	0
	11	163	78	51	47	562.44	9.3	6.1	0.26
	12	164	76	40	47	562.44	9.3	6.1	0
	13	165	82	42	47	562.44	9.3	6.1	0
	14	166	85	49	47	562.44	9.3	6.1	0
	15	167	83	47	47	562.44	9.3	6.1	0
	16	168	84	42	47	562.44	9.3	6.1	0
	17	169	78	52	47	562.44	9.3	6.1	0
	18	170	66	42	47	562.44	9.3	6.1	0
	19	171	69	38	47	562.44	9.3	6.1	0
	20	172	79	37	47	562.44	9.3	6.1	0
	21	173	82	41	47	562.44	9.3	6.1	0
	22	174	82	51	47	562.44	9.3	6.1	0.13
	23	175	82	51	47	562.44	9.3	6.1	0
	24	176	71	47	47	562.44	9.3	6.1	0
	25	177	72	46	47	562.44	9.3	6.1	0
	26	178	76	50	47	562.44	9.3	6.1	0

	27	179	81	56	47	562.44	9.3	6.1	0
	28	180	73	51	47	562.44	9.3	6.1	0
	29	181	76	46	47	562.44	9.3	6.1	0
	30	182	81	47	47	562.44	9.3	6.1	0
July	1	183	88	54	47	599.42	9.1	3.9	0
	2	184	93	54	47	599.42	9.1	3.9	0.37
	3	185	98	60	47	599.42	9.1	3.9	0
	4	186	91	64	47	599.42	9.1	3.9	0
	5	187	77	44	47	599.42	9.1	3.9	0
	6	188	77	39	47	599.42	9.1	3.9	0
	7	189	88	42	47	599.42	9.1	3.9	0
	8	190	94	47	47	599.42	9.1	3.9	0
	9	191	95	56	47	599.42	9.1	3.9	0
	10	192	90	48	47	599.42	9.1	3.9	0
	11	193	88	46	47	599.42	9.1	3.9	0
	12	194	94	46	47	599.42	9.1	3.9	0
	13	195	94	51	47	599.42	9.1	3.9	0
	14	196	101	52	47	599.42	9.1	3.9	0
	15	197	98	60	47	599.42	9.1	3.9	0
	16	198	100	63	47	599.42	9.1	3.9	0
	17	199	100	60	47	599.42	9.1	3.9	0
	18	200	82	52	47	599.42	9.1	3.9	0
	19	201	75	48	47	599.42	9.1	3.9	0
	20	202	77	48	47	599.42	9.1	3.9	0
	21	203	82	53	47	599.42	9.1	3.9	0
	22	204	88	49	47	599.42	9.1	3.9	0
	23	205	96	48	47	599.42	9.1	3.9	0.01
	24	206	102	50	47	599.42	9.1	3.9	0
	25	207	100	56	47	599.42	9.1	3.9	0
	26	208	100	47	47	599.42	9.1	3.9	0
	27	209	107	59	47	599.42	9.1	3.9	0
	28	210	101	60	47	599.42	9.1	3.9	0
	29	211	100	68	47	599.42	9.1	3.9	0
	30	212	92	59	47	599.42	9.1	3.9	0
	31	213	97	56	47	599.42	9.1	3.9	0
	1	214	93	52	48	511.7	8.8	4.2	0
	2	215	93	60	48	511.7	8.8	4.2	0

August	3	216	79	46	48	511.7	8.8	4.2	0
	4	217	76	48	48	511.7	8.8	4.2	0
	5	218	81	59	48	511.7	8.8	4.2	0
	6	219	77	45	48	511.7	8.8	4.2	0
	7	220	84	43	48	511.7	8.8	4.2	0
	8	221	95	47	48	511.7	8.8	4.2	0
	9	222	100	51	48	511.7	8.8	4.2	0
	10	223	101	49	48	511.7	8.8	4.2	0
	11	224	104	55	48	511.7	8.8	4.2	0
	12	225	95	45	48	511.7	8.8	4.2	0
	13	226	88	47	48	511.7	8.8	4.2	0
	14	227	94	54	48	511.7	8.8	4.2	0
	15	228	98	56	48	511.7	8.8	4.2	0
	16	229	94	56	48	511.7	8.8	4.2	0
	17	230	92	48	48	511.7	8.8	4.2	0
	18	231	79	49	48	511.7	8.8	4.2	0
	19	232	79	42	48	511.7	8.8	4.2	0.14
	20	233	86	42	48	511.7	8.8	4.2	0.07
	21	234	80	40	48	511.7	8.8	4.2	0.1
	22	235	84	40	48	511.7	8.8	4.2	0.01
	23	236	92	42	48	511.7	8.8	4.2	0
	24	237	96	44	48	511.7	8.8	4.2	0
	25	238	96	48	48	511.7	8.8	4.2	0
	26	239	98	50	48	511.7	8.8	4.2	0.04
	27	240	89	55	48	511.7	8.8	4.2	0
	28	241	78	57	48	511.7	8.8	4.2	0
	29	242	83	48	48	511.7	8.8	4.2	0
	30	243	100	53	48	511.7	8.8	4.2	0
	31	244	86	49	48	511.7	8.8	4.2	0
	1	245	80	43	43	379.55	8.1	4.8	0
	2	246	79	42	43	379.55	8.1	4.8	0
	3	247	81	46	43	379.55	8.1	4.8	0
	4	248	82	50	43	379.55	8.1	4.8	0
	5	249	73	52	43	379.55	8.1	4.8	0
	6	250	73	48	43	379.55	8.1	4.8	0
	7	251	74	47	43	379.55	8.1	4.8	0
	8	252	82	50	43	379.55	8.1	4.8	0

September	9	253	86	47	43	379.55	8.1	4.8	0
	10	254	85	41	43	379.55	8.1	4.8	0
	11	255	89	44	43	379.55	8.1	4.8	0
	12	256	89	47	43	379.55	8.1	4.8	0
	13	257	82	54	43	379.55	8.1	4.8	0
	14	258	80	56	43	379.55	8.1	4.8	0
	15	259	76	56	43	379.55	8.1	4.8	0
	16	260	70	48	43	379.55	8.1	4.8	0
	17	261	70	46	43	379.55	8.1	4.8	0
	18	262	70	41	43	379.55	8.1	4.8	0
	19	263	71	43	43	379.55	8.1	4.8	0
	20	264	70	46	43	379.55	8.1	4.8	0
	21	265	70	41	43	379.55	8.1	4.8	0.18
	22	266	68	42	43	379.55	8.1	4.8	0
	23	267	65	27	43	379.55	8.1	4.8	0.01
	24	268	64	29	43	379.55	8.1	4.8	0
	25	269	64	29	43	379.55	8.1	4.8	0
	26	270	71	30	43	379.55	8.1	4.8	0
	27	271	73	41	43	379.55	8.1	4.8	0
	28	272	87	42	43	379.55	8.1	4.8	0
	29	273	90	48	43	379.55	8.1	4.8	0
	30	274	87	42	43	379.55	8.1	4.8	0
	1	275	83	35	40	232.49	7.8	6.3	0
	2	276	75	34	40	232.49	7.8	6.3	0
	3	277	69	37	40	232.49	7.8	6.3	0.06
	4	278	80	40	40	232.49	7.8	6.3	0.32
	5	279	78	41	40	232.49	7.8	6.3	0.05
	6	280	72	39	40	232.49	7.8	6.3	0
	7	281	75	38	40	232.49	7.8	6.3	0
	8	282	81	40	40	232.49	7.8	6.3	0
	9	283	79	38	40	232.49	7.8	6.3	0
	10	284	75	39	40	232.49	7.8	6.3	0.01
	11	285	79	52	40	232.49	7.8	6.3	0
	12	286	75	44	40	232.49	7.8	6.3	0
	13	287	74	47	40	232.49	7.8	6.3	0
ber	14	288	61	45	40	232.49	7.8	6.3	0
	15	289	62	43	40	232.49	7.8	6.3	0

Octo	16	290	62	37	40	232.49	7.8	6.3	0
	17	291	56	23	40	232.49	7.8	6.3	0
	18	292	54	24	40	232.49	7.8	6.3	0.01
	19	293	55	39	40	232.49	7.8	6.3	0
	20	294	55	29	40	232.49	7.8	6.3	0
	21	295	54	26	40	232.49	7.8	6.3	0
	22	296	58	28	40	232.49	7.8	6.3	0
	23	297	56	33	40	232.49	7.8	6.3	0
	24	298	56	34	40	232.49	7.8	6.3	0
	25	299	60	38	40	232.49	7.8	6.3	0
	26	300	57	35	40	232.49	7.8	6.3	0
	27	301	51	31	40	232.49	7.8	6.3	0
	28	302	64	34	40	232.49	7.8	6.3	0
	29	303	65	38	40	232.49	7.8	6.3	0
	30	304	50	38	40	232.49	7.8	6.3	0
	31	305	44	28	40	232.49	7.8	6.3	0
November	1	306	49	25	36	118.39	7.7	8.1	0.04
	2	307	50	26	36	118.39	7.7	8.1	0.08
	3	308	44	28	36	118.39	7.7	8.1	0.02
	4	309	57	41	36	118.39	7.7	8.1	0.19
	5	310	52	37	36	118.39	7.7	8.1	0.03
	6	311	52	38	36	118.39	7.7	8.1	0.03
	7	312	57	32	36	118.39	7.7	8.1	0.07
	8	313	53	36	36	118.39	7.7	8.1	0.02
	9	314	65	29	36	118.39	7.7	8.1	0.7
	10	315	65	29	36	118.39	7.7	8.1	0.02
	11	316	41	33	36	118.39	7.7	8.1	0.01
	12	317	52	28	36	118.39	7.7	8.1	0.64
	13	318	56	30	36	118.39	7.7	8.1	0.1
	14	319	59	42	36	118.39	7.7	8.1	0
	15	320	48	32	36	118.39	7.7	8.1	0
	16	321	48	32	36	118.39	7.7	8.1	0
	17	322	45	32	36	118.39	7.7	8.1	0
	18	323	48	32	36	118.39	7.7	8.1	0
	19	324	45	31	36	118.39	7.7	8.1	0
	20	325	40	32	36	118.39	7.7	8.1	0
	21	326	48	24	36	118.39	7.7	8.1	0.03

	22	327	48	31	36	118.39	7.7	8.1	0.02
	23	328	34	28	36	118.39	7.7	8.1	0
	24	329	28	25	36	118.39	7.7	8.1	0
	25	330	30	23	36	118.39	7.7	8.1	0
	26	331	33	23	36	118.39	7.7	8.1	0.02
	27	332	46	30	36	118.39	7.7	8.1	0
	28	333	46	30	36	118.39	7.7	8.1	0.01
	29	334	45	29	36	118.39	7.7	8.1	0.07
	30	335	47	29	36	118.39	7.7	8.1	0.01
December	1	336	54	38	30	92.02	7.6	8.4	0.04
	2	337	47	36	30	92.02	7.6	8.4	0.21
	3	338	46	34	30	92.02	7.6	8.4	0
	4	339	44	24	30	92.02	7.6	8.4	0
	5	340	49	33	30	92.02	7.6	8.4	0
	6	341	47	36	30	92.02	7.6	8.4	0
	7	342	48	31	30	92.02	7.6	8.4	0
	8	343	51	38	30	92.02	7.6	8.4	0.25
	9	344	46	36	30	92.02	7.6	8.4	0
	10	345	43	37	30	92.02	7.6	8.4	0
	11	346	50	32	30	92.02	7.6	8.4	0
	12	347	50	32	30	92.02	7.6	8.4	0
	13	348	51	32	30	92.02	7.6	8.4	0.05
	14	349	49	32	30	92.02	7.6	8.4	0.34
	15	350	48	29	30	92.02	7.6	8.4	0.12
	16	351	51	31	30	92.02	7.6	8.4	0.06
	17	352	42	19	30	92.02	7.6	8.4	0
	18	353	26	18	30	92.02	7.6	8.4	0.13
	19	354	26	22	30	92.02	7.6	8.4	0.55
	20	355	37	25	30	92.02	7.6	8.4	0
	21	356	32	27	30	92.02	7.6	8.4	0.31
	22	357	29	20	30	92.02	7.6	8.4	0.36
	23	358	29	23	30	92.02	7.6	8.4	0
	24	359	27	24	30	92.02	7.6	8.4	0
	25	360	27	24	30	92.02	7.6	8.4	0
	26	361	25	13	30	92.02	7.6	8.4	0.13
	27	362	16	13	30	92.02	7.6	8.4	0.2
	28	363	26	-2	30	92.02	7.6	8.4	0.03

	29	364	13	1	30	92.02	7.6	8.4	0.46
	30	365	41	13	30	92.02	7.6	8.4	0.08
	31	366	52	14	30	92.02	7.6	8.4	0

Climate Data Input
Project Name Sudbury Landfill 1996 Whitman Mission
Project Number 2009-094-21

January

Day (Month)	Day (Year)	Max. air temp (F)	Min. air temp (F)	Dew. pt temp (F)	Solar Radiation (langleys)	Avg wind speed (MPH)	Avg cloud cover (tenths)	Precipitation (in)
1	1	54	29	23	112.95	8	8.3	0
2	2	40	30	23	112.95	8	8.3	0
3	3	62	30	23	112.95	8	8.3	0
4	4	56	36	23	112.95	8	8.3	0
5	5	41	30	23	112.95	8	8.3	0
6	6	36	27	23	112.95	8	8.3	0.1
7	7	31	27	23	112.95	8	8.3	0
8	8	46	30	23	112.95	8	8.3	0.47
9	9	38	32	23	112.95	8	8.3	0.02
10	10	43	32	23	112.95	8	8.3	0.22
11	11	52	31	23	112.95	8	8.3	0
12	12	60	27	23	112.95	8	8.3	0
13	13	42	26	23	112.95	8	8.3	0
14	14	58	27	23	112.95	8	8.3	0
15	15	62	44	23	112.95	8	8.3	0.1
16	16	60	46	23	112.95	8	8.3	0.01
17	17	46	31	23	112.95	8	8.3	0.14
18	18	41	20	23	112.95	8	8.3	0
19	19	36	21	23	112.95	8	8.3	0.11
20	20	40	28	23	112.95	8	8.3	0.3
21	21	47	33	23	112.95	8	8.3	0.04
22	22	41	28	23	112.95	8	8.3	0
23	23	42	29	23	112.95	8	8.3	0
24	24	44	26	23	112.95	8	8.3	0.5
25	25	42	25	23	112.95	8	8.3	0.07
26	26	37	20	23	112.95	8	8.3	0
27	27	26	18	23	112.95	8	8.3	0.01
28	28	30	18	23	112.95	8	8.3	0.52
29	29	35	10	23	112.95	8	8.3	0.05
30	30	15	-7	23	112.95	8	8.3	0.06

	31	31	-2	-22	23	112.95	8	8.3	0
February	1	32	-4	-21	29	176.01	8	7.9	0
	2	33	-2	-20	29	176.01	8	7.9	0
	3	34	-2	-21	29	176.01	8	7.9	0
	4	35	6	-13	29	176.01	8	7.9	0.17
	5	36	18	1	29	176.01	8	7.9	0
	6	37	49	18	29	176.01	8	7.9	0.18
	7	38	57	37	29	176.01	8	7.9	0.22
	8	39	61	45	29	176.01	8	7.9	0.5
	9	40	66	48	29	176.01	8	7.9	0.12
	10	41	54	24	29	176.01	8	7.9	0
	11	42	42	24	29	176.01	8	7.9	0
	12	43	45	25	29	176.01	8	7.9	0
	13	44	48	26	29	176.01	8	7.9	0
	14	45	48	25	29	176.01	8	7.9	0
	15	46	51	26	29	176.01	8	7.9	0
	16	47	51	26	29	176.01	8	7.9	0
	17	48	54	26	29	176.01	8	7.9	0.05
	18	49	54	39	29	176.01	8	7.9	0.1
	19	50	62	44	29	176.01	8	7.9	0.12
	20	51	57	38	29	176.01	8	7.9	0.03
	21	52	63	37	29	176.01	8	7.9	0.27
	22	53	51	33	29	176.01	8	7.9	0.18
	23	54	49	35	29	176.01	8	7.9	0.18
	24	55	44	30	29	176.01	8	7.9	0
	25	56	41	32	29	176.01	8	7.9	0.04
	26	57	35	14	29	176.01	8	7.9	0.23
	27	58	35	15	29	176.01	8	7.9	0
	28	59	36	19	29	176.01	8	7.9	0
	29	60	43	19	29	176.01	8	7.9	0
	1	61	41	22	32	279.21	9.8	7.3	0
	2	62	50	24	32	279.21	9.8	7.3	0
	3	63	61	25	32	279.21	9.8	7.3	0.06
	4	64	62	40	32	279.21	9.8	7.3	0.03
	5	65	49	32	32	279.21	9.8	7.3	0.19
	6	66	38	32	32	279.21	9.8	7.3	0
	7	67	57	35	32	279.21	9.8	7.3	0

March

8	68	47	35	32	279.21	9.8	7.3	0.21
9	69	45	39	32	279.21	9.8	7.3	0
10	70	52	39	32	279.21	9.8	7.3	0
11	71	59	42	32	279.21	9.8	7.3	0.04
12	72	68	47	32	279.21	9.8	7.3	0.16
13	73	59	34	32	279.21	9.8	7.3	0
14	74	58	34	32	279.21	9.8	7.3	0
15	75	65	37	32	279.21	9.8	7.3	0
16	76	60	31	32	279.21	9.8	7.3	0
17	77	57	32	32	279.21	9.8	7.3	0
18	78	60	27	32	279.21	9.8	7.3	0
19	79	65	32	32	279.21	9.8	7.3	0
20	80	62	33	32	279.21	9.8	7.3	0
21	81	58	27	32	279.21	9.8	7.3	0
22	82	55	32	32	279.21	9.8	7.3	0.12
23	83	58	34	32	279.21	9.8	7.3	0
24	84	58	31	32	279.21	9.8	7.3	0.07
25	85	38	19	32	279.21	9.8	7.3	0
26	86	45	23	32	279.21	9.8	7.3	0
27	87	50	33	32	279.21	9.8	7.3	0
28	88	54	33	32	279.21	9.8	7.3	0
29	89	53	33	32	279.21	9.8	7.3	0
30	90	56	36	32	279.21	9.8	7.3	0
31	91	57	37	32	279.21	9.8	7.3	0.02
1	92	47	42	35	398.18	9.1	7.1	0.54
2	93	60	43	35	398.18	9.1	7.1	0.03
3	94	60	29	35	398.18	9.1	7.1	0
4	95	59	31	35	398.18	9.1	7.1	0
5	96	67	31	35	398.18	9.1	7.1	0
6	97	73	39	35	398.18	9.1	7.1	0
7	98	77	45	35	398.18	9.1	7.1	0
8	99	81	46	35	398.18	9.1	7.1	0
9	100	82	48	35	398.18	9.1	7.1	0
10	101	75	47	35	398.18	9.1	7.1	0.05
11	102	65	47	35	398.18	9.1	7.1	0.03
12	103	65	42	35	398.18	9.1	7.1	0.26
13	104	59	42	35	398.18	9.1	7.1	0

April	14	105	63	32	35	398.18	9.1	7.1	0
	15	106	74	34	35	398.18	9.1	7.1	0
	16	107	73	48	35	398.18	9.1	7.1	0.06
	17	108	70	39	35	398.18	9.1	7.1	0.12
	18	109	63	42	35	398.18	9.1	7.1	0.23
	19	110	61	33	35	398.18	9.1	7.1	0
	20	111	60	35	35	398.18	9.1	7.1	0.29
	21	112	61	31	35	398.18	9.1	7.1	0
	22	113	65	36	35	398.18	9.1	7.1	0
	23	114	61	40	35	398.18	9.1	7.1	0.18
	24	115	66	47	35	398.18	9.1	7.1	0.63
	25	116	62	44	35	398.18	9.1	7.1	0
	26	117	62	39	35	398.18	9.1	7.1	0.03
	27	118	62	39	35	398.18	9.1	7.1	0
	28	119	63	31	35	398.18	9.1	7.1	0
	29	120	69	38	35	398.18	9.1	7.1	0
	30	121	70	44	35	398.18	9.1	7.1	0
May	1	122	67	45	42	497.37	9.1	6.6	0
	2	123	64	40	42	497.37	9.1	6.6	0
	3	124	60	41	42	497.37	9.1	6.6	0
	4	125	59	40	42	497.37	9.1	6.6	0
	5	126	62	29	42	497.37	9.1	6.6	0
	6	127	65	33	42	497.37	9.1	6.6	0
	7	128	69	43	42	497.37	9.1	6.6	0
	8	129	63	31	42	497.37	9.1	6.6	0
	9	130	61	29	42	497.37	9.1	6.6	0
	10	131	64	33	42	497.37	9.1	6.6	0
	11	132	68	46	42	497.37	9.1	6.6	0
	12	133	71	49	42	497.37	9.1	6.6	0
	13	134	70	51	42	497.37	9.1	6.6	0
	14	135	72	54	42	497.37	9.1	6.6	0.44
	15	136	72	55	42	497.37	9.1	6.6	0.24
	16	137	71	52	42	497.37	9.1	6.6	0.12
	17	138	71	53	42	497.37	9.1	6.6	0.07
	18	139	71	46	42	497.37	9.1	6.6	0.38
	19	140	71	46	42	497.37	9.1	6.6	0.2
	20	141	66	44	42	497.37	9.1	6.6	0

	21	142	67	42	42	497.37	9.1	6.6	0
	22	143	60	48	42	497.37	9.1	6.6	0.34
	23	144	61	38	42	497.37	9.1	6.6	0.01
	24	145	65	38	42	497.37	9.1	6.6	0
	25	146	74	40	42	497.37	9.1	6.6	0
	26	147	79	45	42	497.37	9.1	6.6	0
	27	148	78	49	42	497.37	9.1	6.6	0
	28	149	72	46	42	497.37	9.1	6.6	0
	29	150	66	44	42	497.37	9.1	6.6	0
	30	151	68	39	42	497.37	9.1	6.6	0.01
	31	152	69	44	42	497.37	9.1	6.6	0
June	1	153	74	44	47	562.44	9.3	6.1	0
	2	154	80	57	47	562.44	9.3	6.1	0
	3	155	87	55	47	562.44	9.3	6.1	0
	4	156	86	60	47	562.44	9.3	6.1	0
	5	157	77	43	47	562.44	9.3	6.1	0
	6	158	78	40	47	562.44	9.3	6.1	0
	7	159	88	49	47	562.44	9.3	6.1	0
	8	160	91	57	47	562.44	9.3	6.1	0
	9	161	85	49	47	562.44	9.3	6.1	0
	10	162	74	42	47	562.44	9.3	6.1	0
	11	163	78	51	47	562.44	9.3	6.1	0
	12	164	76	40	47	562.44	9.3	6.1	0
	13	165	82	42	47	562.44	9.3	6.1	0
	14	166	85	49	47	562.44	9.3	6.1	0
	15	167	83	47	47	562.44	9.3	6.1	0
	16	168	84	42	47	562.44	9.3	6.1	0
	17	169	78	52	47	562.44	9.3	6.1	0
	18	170	66	42	47	562.44	9.3	6.1	0
	19	171	69	38	47	562.44	9.3	6.1	0
	20	172	79	37	47	562.44	9.3	6.1	0
	21	173	82	41	47	562.44	9.3	6.1	0
	22	174	82	51	47	562.44	9.3	6.1	0
	23	175	82	51	47	562.44	9.3	6.1	0
	24	176	71	47	47	562.44	9.3	6.1	0.14
	25	177	72	46	47	562.44	9.3	6.1	0
	26	178	76	50	47	562.44	9.3	6.1	0

	27	179	81	56	47	562.44	9.3	6.1	0.62
	28	180	73	51	47	562.44	9.3	6.1	0.27
	29	181	76	46	47	562.44	9.3	6.1	0
	30	182	81	47	47	562.44	9.3	6.1	0
	1	183	88	54	47	599.42	9.1	3.9	0
	2	184	93	54	47	599.42	9.1	3.9	0
	3	185	98	60	47	599.42	9.1	3.9	0
	4	186	91	64	47	599.42	9.1	3.9	0
	5	187	77	44	47	599.42	9.1	3.9	0
	6	188	77	39	47	599.42	9.1	3.9	0
	7	189	88	42	47	599.42	9.1	3.9	0
	8	190	94	47	47	599.42	9.1	3.9	0
	9	191	95	56	47	599.42	9.1	3.9	0
	10	192	90	48	47	599.42	9.1	3.9	0
	11	193	88	46	47	599.42	9.1	3.9	0
	12	194	94	46	47	599.42	9.1	3.9	0
	13	195	94	51	47	599.42	9.1	3.9	0
	14	196	101	52	47	599.42	9.1	3.9	0
	15	197	98	60	47	599.42	9.1	3.9	0
July	16	198	100	63	47	599.42	9.1	3.9	0
	17	199	100	60	47	599.42	9.1	3.9	0
	18	200	82	52	47	599.42	9.1	3.9	0.01
	19	201	75	48	47	599.42	9.1	3.9	0
	20	202	77	48	47	599.42	9.1	3.9	0
	21	203	82	53	47	599.42	9.1	3.9	0
	22	204	88	49	47	599.42	9.1	3.9	0
	23	205	96	48	47	599.42	9.1	3.9	0
	24	206	102	50	47	599.42	9.1	3.9	0
	25	207	100	56	47	599.42	9.1	3.9	0
	26	208	100	47	47	599.42	9.1	3.9	0
	27	209	107	59	47	599.42	9.1	3.9	0
	28	210	101	60	47	599.42	9.1	3.9	0
	29	211	100	68	47	599.42	9.1	3.9	0
	30	212	92	59	47	599.42	9.1	3.9	0
	31	213	97	56	47	599.42	9.1	3.9	0
	1	214	93	52	48	511.7	8,8	4.2	0
	2	215	93	60	48	511.7	8.8	4.2	0

August	3	216	79	46	48	511.7	8.8	4.2	0.05
	4	217	76	48	48	511.7	8.8	4.2	0
	5	218	81	59	48	511.7	8.8	4.2	0
	6	219	77	45	48	511.7	8.8	4.2	0
	7	220	84	43	48	511.7	8.8	4.2	0
	8	221	95	47	48	511.7	8.8	4.2	0
	9	222	100	51	48	511.7	8.8	4.2	0
	10	223	101	49	48	511.7	8.8	4.2	0
	11	224	104	55	48	511.7	8.8	4.2	0
	12	225	95	45	48	511.7	8.8	4.2	0
	13	226	88	47	48	511.7	8.8	4.2	0
	14	227	94	54	48	511.7	8.8	4.2	0
	15	228	98	56	48	511.7	8.8	4.2	0
	16	229	94	56	48	511.7	8.8	4.2	0
	17	230	92	48	48	511.7	8.8	4.2	0
	18	231	79	49	48	511.7	8.8	4.2	0
	19	232	79	42	48	511.7	8.8	4.2	0
	20	233	86	42	48	511.7	8.8	4.2	0
	21	234	80	40	48	511.7	8.8	4.2	0
	22	235	84	40	48	511.7	8.8	4.2	0
	23	236	92	42	48	511.7	8.8	4.2	0
	24	237	96	44	48	511.7	8.8	4.2	0
	25	238	96	48	48	511.7	8.8	4.2	0
	26	239	98	50	48	511.7	8.8	4.2	0
	27	240	89	55	48	511.7	8.8	4.2	0
	28	241	78	57	48	511.7	8.8	4.2	0
	29	242	83	48	48	511.7	8.8	4.2	0
	30	243	100	53	48	511.7	8.8	4.2	0
	31	244	86	49	48	511.7	8.8	4.2	0
	1	245	80	43	43	379.55	8.1	4.8	0
	2	246	79	42	43	379.55	8.1	4.8	0
	3	247	81	46	43	379.55	8.1	4.8	0
	4	248	82	50	43	379.55	8.1	4.8	0
	5	249	73	52	43	379.55	8.1	4.8	0
	6	250	73	48	43	379.55	8.1	4.8	0
	7	251	74	47	43	379.55	8.1	4.8	0
	8	252	82	50	43	379.55	8.1	4.8	0

September	9	253	86	47	43	379.55	8.1	4.8	0
	10	254	85	41	43	379.55	8.1	4.8	0
	11	255	89	44	43	379.55	8.1	4.8	0
	12	256	89	47	43	379.55	8.1	4.8	0
	13	257	82	54	43	379.55	8.1	4.8	0.05
	14	258	80	56	43	379.55	8.1	4.8	0.09
	15	259	76	56	43	379.55	8.1	4.8	0.32
	16	260	70	48	43	379.55	8.1	4.8	0
	17	261	70	46	43	379.55	8.1	4.8	0
	18	262	70	41	43	379.55	8.1	4.8	0
	19	263	71	43	43	379.55	8.1	4.8	0.15
	20	264	70	46	43	379.55	8.1	4.8	0.03
	21	265	70	41	43	379.55	8.1	4.8	0
	22	266	68	42	43	379.55	8.1	4.8	0
	23	267	65	27	43	379.55	8.1	4.8	0
	24	268	64	29	43	379.55	8.1	4.8	0
	25	269	64	29	43	379.55	8.1	4.8	0
	26	270	71	30	43	379.55	8.1	4.8	0
	27	271	73	41	43	379.55	8.1	4.8	0
	28	272	87	42	43	379.55	8.1	4.8	0
	29	273	90	48	43	379.55	8.1	4.8	0
	30	274	87	42	43	379.55	8.1	4.8	0
ber	1	275	83	35	40	232.49	7.8	6.3	0
	2	276	75	34	40	232.49	7.8	6.3	0
	3	277	69	37	40	232.49	7.8	6.3	0
	4	278	80	40	40	232.49	7.8	6.3	0
	5	279	78	41	40	232.49	7.8	6.3	0.05
	6	280	72	39	40	232.49	7.8	6.3	0
	7	281	75	38	40	232.49	7.8	6.3	0
	8	282	81	40	40	232.49	7.8	6.3	0
	9	283	79	38	40	232.49	7.8	6.3	0
	10	284	75	39	40	232.49	7.8	6.3	0
	11	285	79	52	40	232.49	7.8	6.3	0
	12	286	75	44	40	232.49	7.8	6.3	0
	13	287	74	47	40	232.49	7.8	6.3	0.06
	14	288	61	45	40	232.49	7.8	6.3	0.06
	15	289	62	43	40	232.49	7.8	6.3	0.14

Octo	16	290	62	37	40	232.49	7.8	6.3	0
	17	291	56	23	40	232.49	7.8	6.3	0
	18	292	54	24	40	232.49	7.8	6.3	0.42
	19	293	55	39	40	232.49	7.8	6.3	0.11
	20	294	55	29	40	232.49	7.8	6.3	0
	21	295	54	26	40	232.49	7.8	6.3	0
	22	296	58	28	40	232.49	7.8	6.3	0.06
	23	297	56	33	40	232.49	7.8	6.3	0.12
	24	298	56	34	40	232.49	7.8	6.3	0.49
	25	299	60	38	40	232.49	7.8	6.3	0.07
	26	300	57	35	40	232.49	7.8	6.3	0
	27	301	51	31	40	232.49	7.8	6.3	0
	28	302	64	34	40	232.49	7.8	6.3	0
	29	303	65	38	40	232.49	7.8	6.3	0.27
	30	304	50	38	40	232.49	7.8	6.3	0.07
	31	305	44	28	40	232.49	7.8	6.3	0
November	1	306	49	25	36	118.39	7.7	8.1	0
	2	307	50	26	36	118.39	7.7	8.1	0
	3	308	44	28	36	118.39	7.7	8.1	0
	4	309	57	41	36	118.39	7.7	8.1	0.03
	5	310	52	37	36	118.39	7.7	8.1	0
	6	311	52	38	36	118.39	7.7	8.1	0.02
	7	312	57	32	36	118.39	7.7	8.1	0.01
	8	313	53	36	36	118.39	7.7	8.1	0
	9	314	65	29	36	118.39	7.7	8.1	0
	10	315	65	29	36	118.39	7.7	8.1	0
	11	316	41	33	36	118.39	7.7	8.1	0.01
	12	317	52	28	36	118.39	7.7	8.1	0
	13	318	56	30	36	118.39	7.7	8.1	0.13
	14	319	59	42	36	118.39	7.7	8.1	0.05
	15	320	48	32	36	118.39	7.7	8.1	0
	16	321	48	32	36	118.39	7.7	8.1	0
	17	322	45	32	36	118.39	7.7	8.1	0.04
	18	323	48	32	36	118.39	7.7	8.1	0.03
	19	324	45	31	36	118.39	7.7	8.1	1.9
	20	325	40	32	36	118.39	7.7	8.1	0.23
	21	326	48	24	36	118.39	7.7	8.1	0.03

	22	327	48	31	36	118.39	7.7	8.1	0.12
	23	328	34	28	36	118.39	7.7	8.1	0
	24	329	28	25	36	118.39	7.7	8.1	0.21
	25	330	30	23	36	118.39	7.7	8.1	0.02
	26	331	33	23	36	118.39	7.7	8.1	0
	27	332	46	30	36	118.39	7.7	8.1	0
	28	333	46	30	36	118.39	7.7	8.1	0
	29	334	45	29	36	118.39	7.7	8.1	0
	30	335	47	29	36	118.39	7.7	8.1	0
December	1	336	54	38	30	92.02	7.6	8.4	0
	2	337	47	36	30	92.02	7.6	8.4	0
	3	338	46	34	30	92.02	7.6	8.4	0.09
	4	339	44	24	30	92.02	7.6	8.4	0
	5	340	49	33	30	92.02	7.6	8.4	0.09
	6	341	47	36	30	92.02	7.6	8.4	0
	7	342	48	31	30	92.02	7.6	8.4	0
	8	343	51	38	30	92.02	7.6	8.4	0.09
	9	344	46	36	30	92.02	7.6	8.4	0.26
	10	345	43	37	30	92.02	7.6	8.4	0.43
	11	346	50	32	30	92.02	7.6	8.4	0.08
	12	347	50	32	30	92.02	7.6	8.4	0.08
	13	348	51	32	30	92.02	7.6	8.4	0.15
	14	349	49	32	30	92.02	7.6	8.4	0
	15	350	48	29	30	92.02	7.6	8.4	0
	16	351	51	31	30	92.02	7.6	8.4	0
	17	352	42	19	30	92.02	7.6	8.4	0
	18	353	26	18	30	92.02	7.6	8.4	0
	19	354	26	22	30	92.02	7.6	8.4	0
	20	355	37	25	30	92.02	7.6	8.4	0.06
	21	356	32	27	30	92.02	7.6	8.4	0.01
	22	357	29	20	30	92.02	7.6	8.4	0.01
	23	358	29	23	30	92.02	7.6	8.4	0.02
	24	359	27	24	30	92.02	7.6	8.4	0.03
	25	360	27	24	30	92.02	7.6	8.4	0
	26	361	25	13	30	92.02	7.6	8.4	0.85
	27	362	16	13	30	92.02	7.6	8.4	1
	28	363	26	-2	30	92.02	7.6	8.4	0

	29	364	13	1	30	92.02	7.6	8.4	0.46
	30	365	41	13	30	92.02	7.6	8.4	0
	31	366	52	14	30	92.02	7.6	8.4	0.34

APPENDIX D

WinUnsat-H

Simulation Output

2006-1.45 (Used in 2007 simulation)
Head Valuse at end of 2006

Day=365	1	0	354.56
Day=365	2	0	354.47
Day=365	3	0	354.38
Day=365	4	0	354.31
Day=365	5	0	354.24
Day=365	6	0	354.18
Day=365	7	0	354.14
Day=365	8	0	354.1
Day=365	9	0	354.06
Day=365	10	1	354.06
Day=365	11	2	354.56
Day=365	12	3	356.06
Day=365	13	4	358.6
Day=365	14	5	362.2
Day=365	15	6	366.92
Day=365	16	7	372.81
Day=365	17	8	379.95
Day=365	18	9	388.44
Day=365	19	10	398.4
Day=365	20	11	409.97
Day=365	21	12	423.32
Day=365	22	13	438.64
Day=365	23	14	456.19
Day=365	24	15	476.25
Day=365	25	16	499.17
Day=365	26	17	525.36
Day=365	27	18	555.31
Day=365	28	19	589.63
Day=365	29	20	629.02
Day=365	30	21	674.35
Day=365	31	22	726.65
Day=365	32	23	787.17
Day=365	33	24	857.37
Day=365	34	25	939.04
Day=365	35	26	1034.22
Day=365	36	27	1145.28
Day=365	37	28	1274.89
Day=365	38	29	1425.84
Day=365	39	30	1600.92
Day=365	40	31	1802.52
Day=365	41	32	2032.14
Day=365	42	33	2289.7
Day=365	43	34	2573.02
Day=365	44	35	2877.36
Day=365	45	36	3195.66
Day=365	46	37	3519.42
Day=365	47	38	3840.09
Day=365	48	39	4150.61
Day=365	49	40	4446.41

2007-1.45 (Used 2008 Simulation)
Head values at end of 2007

Day=365	1	0	203.3
Day=365	2	0	203.2
Day=365	3	0	203.11
Day=365	4	0	203.03
Day=365	5	0	202.96
Day=365	6	0	202.89
Day=365	7	0	202.83
Day=365	8	0	202.77
Day=365	9	0	202.68
Day=365	10	1	202.65
Day=365	11	2	202.68
Day=365	12	3	203.41
Day=365	13	4	204.84
Day=365	14	5	206.99
Day=365	15	6	209.89
Day=365	16	7	213.56
Day=365	17	8	218.05
Day=365	18	9	223.41
Day=365	19	10	229.71
Day=365	20	11	237.01
Day=365	21	12	245.41
Day=365	22	13	255
Day=365	23	14	265.91
Day=365	24	15	278.26
Day=365	25	16	292.2
Day=365	26	17	307.92
Day=365	27	18	325.62
Day=365	28	19	345.52
Day=365	29	20	367.89
Day=365	30	21	393.02
Day=365	31	22	421.24
Day=365	32	23	452.94
Day=365	33	24	488.53
Day=365	34	25	528.5
Day=365	35	26	573.38
Day=365	36	27	623.78
Day=365	37	28	680.36
Day=365	38	29	743.85
Day=365	39	30	815.08
Day=365	40	31	894.94
Day=365	41	32	984.38
Day=365	42	33	1084.47
Day=365	43	34	1196.31
Day=365	44	35	1321.07
Day=365	45	36	1459.99
Day=365	46	37	1614.29
Day=365	47	38	1785.19
Day=365	48	39	1973.83
Day=365	49	40	2181.15

Day=365	50	41	4725.67	Day=365	50	41	2407.8
Day=365	51	42	4988.95	Day=365	51	42	2653.96
Day=365	52	43	5238.38	Day=365	52	43	2919.14
Day=365	53	44	5476.83	Day=365	53	44	3202.04
Day=365	54	45	5707.3	Day=365	54	45	3500.39
Day=365	55	46	5932.45	Day=365	55	46	3810.91
Day=365	56	47	6154.42	Day=365	56	47	4129.38
Day=365	57	48	6374.82	Day=365	57	48	4450.91
Day=365	58	49	6594.69	Day=365	58	49	4770.23
Day=365	59	50	6814.59	Day=365	59	50	5082.2
Day=365	60	51	7034.72	Day=365	60	51	5382.21
Day=365	61	52	7254.96	Day=365	61	52	5666.56
Day=365	62	53	7474.96	Day=365	62	53	5932.64
Day=365	63	54	7694.18	Day=365	63	54	6179.01
Day=365	64	55	7911.96	Day=365	64	55	6405.29
Day=365	65	56	8127.57	Day=365	65	56	6611.93
Day=365	66	57	8340.21	Day=365	66	57	6800.03
Day=365	67	58	8549.08	Day=365	67	58	6971.03
Day=365	68	59	8753.39	Day=365	68	59	7126.54
Day=365	69	60	8952.4	Day=365	69	60	7268.19
Day=365	70	61	9145.42	Day=365	70	61	7397.5
Day=365	71	62	9331.84	Day=365	71	62	7515.83
Day=365	72	63	9511.16	Day=365	72	63	7624.37
Day=365	73	64	9682.99	Day=365	73	64	7724.1
Day=365	74	65	9847.04	Day=365	74	65	7815.88
Day=365	75	66	10003.15	Day=365	75	66	7900.4
Day=365	76	67	10151.28	Day=365	76	67	7978.25
Day=365	77	68	10291.48	Day=365	77	68	8049.95
Day=365	78	69	10423.92	Day=365	78	69	8115.92
Day=365	79	70	10548.85	Day=365	79	70	8176.56
Day=365	80	71	10666.58	Day=365	80	71	8232.23
Day=365	81	72	10777.51	Day=365	81	72	8283.27
Day=365	82	73	10882.07	Day=365	82	73	8330
Day=365	83	74	10980.72	Day=365	83	74	8372.74
Day=365	84	75	11073.94	Day=365	84	75	8411.79
Day=365	85	76	11162.23	Day=365	85	76	8447.45
Day=365	86	77	11246.07	Day=365	86	77	8480.02
Day=365	87	78	11325.95	Day=365	87	78	8509.79
Day=365	88	79	11402.33	Day=365	88	79	8537.04
Day=365	89	80	11475.65	Day=365	89	80	8562.04
Day=365	90	81	11546.32	Day=365	90	81	8585.06
Day=365	91	82	11614.73	Day=365	91	82	8606.34
Day=365	92	83	11681.23	Day=365	92	83	8626.12
Day=365	93	84	11746.14	Day=365	93	84	8644.62
Day=365	94	85	11809.75	Day=365	94	85	8662.02
Day=365	95	86	11872.31	Day=365	95	86	8678.54
Day=365	96	87	11934.06	Day=365	96	87	8694.32
Day=365	97	88	11995.19	Day=365	97	88	8709.55
Day=365	98	89	12055.87	Day=365	98	89	8724.33
Day=365	99	90	12116.24	Day=365	99	90	8738.83
Day=365	100	91	12176.41	Day=365	100	91	8753.13
Day=365	101	92	12236.48	Day=365	101	92	8767.35

Day=365	102	93	12296.51	Day=365	102	93	8781.56
Day=365	103	94	12356.56	Day=365	103	94	8795.84
Day=365	104	95	12416.65	Day=365	104	95	8810.25
Day=365	105	96	12476.81	Day=365	105	96	8824.84
Day=365	106	97	12537.04	Day=365	106	97	8839.65
Day=365	107	98	12597.33	Day=365	107	98	8854.7
Day=365	108	99	12657.66	Day=365	108	99	8870.02
Day=365	109	100	12718	Day=365	109	100	8885.62
Day=365	110	101	12778.3	Day=365	110	101	8901.51
Day=365	111	102	12838.53	Day=365	111	102	8917.68
Day=365	112	103	12898.63	Day=365	112	103	8934.13
Day=365	113	104	12958.54	Day=365	113	104	8950.85
Day=365	114	105	13018.21	Day=365	114	105	8967.82
Day=365	115	106	13077.58	Day=365	115	106	8985.03
Day=365	116	107	13136.58	Day=365	116	107	9002.44
Day=365	117	108	13195.13	Day=365	117	108	9020.04
Day=365	118	109	13253.17	Day=365	118	109	9037.79
Day=365	119	110	13310.63	Day=365	119	110	9055.65
Day=365	120	111	13367.44	Day=365	120	111	9073.61
Day=365	121	112	13423.52	Day=365	121	112	9091.62
Day=365	122	113	13478.82	Day=365	122	113	9109.64
Day=365	123	114	13533.25	Day=365	123	114	9127.62
Day=365	124	115	13586.74	Day=365	124	115	9145.53
Day=365	125	116	13639.23	Day=365	125	116	9163.33
Day=365	126	117	13690.64	Day=365	126	117	9180.98
Day=365	127	118	13740.91	Day=365	127	118	9198.44
Day=365	128	119	13789.97	Day=365	128	119	9215.67
Day=365	129	120	13837.75	Day=365	129	120	9232.62
Day=365	130	121	13884.2	Day=365	130	121	9249.27
Day=365	131	122	13929.24	Day=365	131	122	9265.56
Day=365	132	123	13972.82	Day=365	132	123	9281.47
Day=365	133	124	14014.89	Day=365	133	124	9296.96
Day=365	134	125	14055.38	Day=365	134	125	9311.99
Day=365	135	126	14094.24	Day=365	135	126	9326.52
Day=365	136	127	14131.43	Day=365	136	127	9340.52
Day=365	137	128	14166.88	Day=365	137	128	9353.96
Day=365	138	129	14200.56	Day=365	138	129	9366.81
Day=365	139	130	14232.43	Day=365	139	130	9379.04
Day=365	140	131	14262.44	Day=365	140	131	9390.61
Day=365	141	132	14290.54	Day=365	141	132	9401.51
Day=365	142	133	14316.72	Day=365	142	133	9411.71
Day=365	143	134	14340.92	Day=365	143	134	9421.17
Day=365	144	135	14363.12	Day=365	144	135	9429.89
Day=365	145	136	14383.3	Day=365	145	136	9437.83
Day=365	146	137	14401.42	Day=365	146	137	9444.99
Day=365	147	138	14417.47	Day=365	147	138	9451.35
Day=365	148	139	14431.42	Day=365	148	139	9456.89
Day=365	149	140	14443.25	Day=365	149	140	9461.59
Day=365	150	141	14452.96	Day=365	150	141	9465.46
Day=365	151	142	14460.52	Day=365	151	142	9468.47
Day=365	152	143	14465.92	Day=365	152	143	9470.63
Day=365	153	144	14469.17	Day=365	153	144	9471.93

Day=365	154	144	14469.37	Day=365	154	144	9472.01
Day=365	155	144	14469.56	Day=365	155	144	9472.09
Day=365	156	144	14469.72	Day=365	156	144	9472.15
Day=365	157	144	14469.86	Day=365	157	144	9472.21
Day=365	158	144	14469.98	Day=365	158	144	9472.25
Day=365	159	144	14470.08	Day=365	159	144	9472.29
Day=365	160	144	14470.15	Day=365	160	144	9472.32
Day=365	161	144	14470.21	Day=365	161	144	9472.34
Day=365	162	144	14470.24	Day=365	162	144	9472.36
Day=365	163	145	14470.25	Day=365	163	145	9472.36

2008-1.45 (Used in 1996 simulation)
Head values at end of 2008

Day=365	1	0	202.6
Day=365	2	0	202.51
Day=365	3	0	202.42
Day=365	4	0	202.34
Day=365	5	0	202.26
Day=365	6	0	202.19
Day=365	7	0	202.13
Day=365	8	0	202.07
Day=365	9	0	201.98
Day=365	10	1	201.95
Day=365	11	2	201.98
Day=365	12	3	202.69
Day=365	13	4	204.1
Day=365	14	5	206.22
Day=365	15	6	209.08
Day=365	16	7	212.71
Day=365	17	8	217.15
Day=365	18	9	222.46
Day=365	19	10	228.68
Day=365	20	11	235.91
Day=365	21	12	244.21
Day=365	22	13	253.69
Day=365	23	14	264.46
Day=365	24	15	276.65
Day=365	25	16	290.41
Day=365	26	17	305.92
Day=365	27	18	323.36
Day=365	28	19	342.96
Day=365	29	20	364.97
Day=365	30	21	389.68
Day=365	31	22	417.4
Day=365	32	23	448.5
Day=365	33	24	483.39
Day=365	34	25	522.51
Day=365	35	26	566.38
Day=365	36	27	615.56
Day=365	37	28	670.68
Day=365	38	29	732.42
Day=365	39	30	801.54
Day=365	40	31	878.86
Day=365	41	32	965.26
Day=365	42	33	1061.68
Day=365	43	34	1169.11
Day=365	44	35	1288.59
Day=365	45	36	1421.18
Day=365	46	37	1567.94
Day=365	47	38	1729.87
Day=365	48	39	1907.9
Day=365	49	40	2102.75

Day=365	50	41	2314.86
Day=365	51	42	2544.23
Day=365	52	43	2790.28
Day=365	53	44	3051.7
Day=365	54	45	3326.35
Day=365	55	46	3611.21
Day=365	56	47	3902.49
Day=365	57	48	4195.81
Day=365	58	49	4486.53
Day=365	59	50	4770.08
Day=365	60	51	5042.39
Day=365	61	52	5300.14
Day=365	62	53	5541
Day=365	63	54	5763.62
Day=365	64	55	5967.6
Day=365	65	56	6153.32
Day=365	66	57	6321.7
Day=365	67	58	6474.06
Day=365	68	59	6611.86
Day=365	69	60	6736.6
Day=365	70	61	6849.71
Day=365	71	62	6952.49
Day=365	72	63	7046.08
Day=365	73	64	7131.46
Day=365	74	65	7209.48
Day=365	75	66	7280.81
Day=365	76	67	7346.06
Day=365	77	68	7405.71
Day=365	78	69	7460.2
Day=365	79	70	7509.91
Day=365	80	71	7555.18
Day=365	81	72	7596.32
Day=365	82	73	7633.63
Day=365	83	74	7667.39
Day=365	84	75	7697.88
Day=365	85	76	7725.36
Day=365	86	77	7750.09
Day=365	87	78	7772.32
Day=365	88	79	7792.29
Day=365	89	80	7810.23
Day=365	90	81	7826.36
Day=365	91	82	7840.91
Day=365	92	83	7854.07
Day=365	93	84	7866.03
Day=365	94	85	7876.98
Day=365	95	86	7887.06
Day=365	96	87	7896.45
Day=365	97	88	7905.27
Day=365	98	89	7913.65
Day=365	99	90	7921.71
Day=365	100	91	7929.54
Day=365	101	92	7937.25

Day=365	102	93	7944.9
Day=365	103	94	7952.57
Day=365	104	95	7960.33
Day=365	105	96	7968.21
Day=365	106	97	7976.26
Day=365	107	98	7984.51
Day=365	108	99	7992.99
Day=365	109	100	8001.71
Day=365	110	101	8010.69
Day=365	111	102	8019.93
Day=365	112	103	8029.43
Day=365	113	104	8039.2
Day=365	114	105	8049.22
Day=365	115	106	8059.48
Day=365	116	107	8069.98
Day=365	117	108	8080.68
Day=365	118	109	8091.58
Day=365	119	110	8102.65
Day=365	120	111	8113.86
Day=365	121	112	8125.19
Day=365	122	113	8136.62
Day=365	123	114	8148.11
Day=365	124	115	8159.63
Day=365	125	116	8171.16
Day=365	126	117	8182.65
Day=365	127	118	8194.08
Day=365	128	119	8205.42
Day=365	129	120	8216.64
Day=365	130	121	8227.7
Day=365	131	122	8238.58
Day=365	132	123	8249.23
Day=365	133	124	8259.64
Day=365	134	125	8269.78
Day=365	135	126	8279.61
Day=365	136	127	8289.11
Day=365	137	128	8298.25
Day=365	138	129	8307.01
Day=365	139	130	8315.37
Day=365	140	131	8323.3
Day=365	141	132	8330.78
Day=365	142	133	8337.79
Day=365	143	134	8344.31
Day=365	144	135	8350.32
Day=365	145	136	8355.81
Day=365	146	137	8360.76
Day=365	147	138	8365.17
Day=365	148	139	8369.01
Day=365	149	140	8372.27
Day=365	150	141	8374.96
Day=365	151	142	8377.06
Day=365	152	143	8378.56
Day=365	153	144	8379.46

Day=365	154	144	8379.52
Day=365	155	144	8379.57
Day=365	156	144	8379.62
Day=365	157	144	8379.66
Day=365	158	144	8379.69
Day=365	159	144	8379.71
Day=365	160	144	8379.74
Day=365	161	144	8379.75
Day=365	162	144	8379.76
Day=365	163	145	8379.76

Sudbury Rd LF
WinUnsatH Simulation Summaries

UNSAT-H Version 2.03

SIMULATION SUMMARY

Title: 2006 1.45
Sudbury Rd LF-Alternative Cover Design

Transpiration Scheme is:	=	1	
Potential Evapotranspiration	=	1.6588E+02	[cm]
Potential Transpiration	=	6.2590E+01	[cm]
Actual Transpiration	=	**3.4993E+00**	**[cm]**
Potential Evaporation	=	6.0093E+02	[cm]
Actual Evaporation	=	**2.7696E+01**	**[cm]**
Evaporation during Growth	=	1.2646E+01	[cm]
Total Runoff	=	**4.6084E+00**	**[cm]**
Total Infiltration	=	**3.7378E+01**	**[cm]**
Total Drainage at Base of Profile	=	2.2208E-03	[cm]
Total Applied Water	=	4.1986E+01	[cm]
Actual Rainfall	=	4.1986E+01	[cm]
Actual Irrigation	=	0.0000E+00	[cm]
Total Final Moisture Storage	=	2.7786E+01	[cm]
Mass Balance Error	=	**1.4575E-02**	**[cm]**
Total Successful Time Steps	=	1018681	
Total Attempted Time Steps	=	1018681	
Total Time Step Reductions (DHMAX)	=	5634	
Total Changes in Surface Boundary	=	232909	
Total Time Actually Simulated	=	3.6500E+02	[days]

Total water flow (cm) across different depths at the end of 3.6500E+02 days:

DEPTH	FLOW	DEPTH	FLOW	DEPTH	FLOW
0.000	9.6817E+00	0.050	9.6774E+00	0.150	9.6536E+00
0.250	9.6280E+00	0.350	9.6008E+00	0.450	9.5722E+00
0.550	9.5423E+00	0.650	9.5115E+00	0.800	9.4639E+00
0.950	9.4140E+00	1.500	9.2279E+00	2.500	8.8590E+00
3.500	8.4862E+00	4.500	8.1191E+00	5.500	7.7616E+00
6.500	7.4151E+00	7.500	7.0801E+00	8.500	6.7570E+00
9.500	6.4467E+00	10.500	6.1492E+00	11.500	5.8640E+00
12.500	5.5904E+00	13.500	5.3278E+00	14.500	5.0758E+00
15.500	4.8341E+00	16.500	4.6023E+00	17.500	4.3800E+00
18.500	4.1670E+00	19.500	3.9632E+00	20.500	3.7683E+00
21.500	3.5823E+00	22.500	3.4047E+00	23.500	3.2357E+00
24.500	3.0750E+00	25.500	2.9225E+00	26.500	2.7781E+00

27.500	2.6417E+00	28.500	2.5134E+00	29.500	2.3930E+00
30.500	2.2802E+00	31.500	2.1751E+00	32.500	2.0771E+00
33.500	1.9860E+00	34.500	1.9014E+00	35.500	1.8228E+00
36.500	1.7495E+00	37.500	1.6811E+00	38.500	1.6170E+00
39.500	1.5566E+00	40.500	1.4995E+00	41.500	1.4454E+00
42.500	1.3938E+00	43.500	1.3444E+00	44.500	1.2972E+00
45.500	1.2519E+00	46.500	1.2083E+00	47.500	1.1664E+00
48.500	1.1261E+00	49.500	1.0873E+00	50.500	1.0500E+00
51.500	1.0140E+00	52.500	9.7929E-01	53.500	9.4593E-01
54.500	9.1386E-01	55.500	8.8300E-01	56.500	8.5329E-01
57.500	8.2472E-01	58.500	7.9720E-01	59.500	7.7068E-01
60.500	7.4510E-01	61.500	7.2042E-01	62.500	6.9656E-01
63.500	6.7353E-01	64.500	6.5129E-01	65.500	6.2979E-01
66.500	6.0900E-01	67.500	5.8887E-01	68.500	5.6941E-01
69.500	5.5059E-01	70.500	5.3239E-01	71.500	5.1477E-01
72.500	4.9773E-01	73.500	4.8122E-01	74.500	4.6519E-01
75.500	4.4964E-01	76.500	4.3456E-01	77.500	4.1993E-01
78.500	**4.0573E-01**	79.500	3.9193E-01	80.500	3.7850E-01
81.500	3.6546E-01	82.500	3.5280E-01	83.500	3.4050E-01
84.500	3.2854E-01	85.500	3.1691E-01	86.500	3.0559E-01
87.500	2.9457E-01	88.500	2.8385E-01	89.500	2.7343E-01
90.500	2.6329E-01	91.500	2.5339E-01	92.500	2.4374E-01
93.500	2.3434E-01	94.500	2.2517E-01	95.500	2.1625E-01
96.500	2.0759E-01	97.500	1.9918E-01	98.500	1.9103E-01
99.500	1.8313E-01	100.500	1.7549E-01	101.500	1.6808E-01
102.500	1.6092E-01	103.500	1.5397E-01	104.500	1.4727E-01
105.500	1.4078E-01	106.500	1.3451E-01	107.500	1.2845E-01
108.500	1.2260E-01	109.500	1.1696E-01	110.500	1.1152E-01
111.500	1.0627E-01	112.500	1.0121E-01	113.500	9.6325E-02
114.500	9.1612E-02	115.500	8.7073E-02	116.500	8.2682E-02
117.500	7.8461E-02	118.500	7.4392E-02	119.500	7.0461E-02
120.500	6.6677E-02	121.500	6.3027E-02	122.500	5.9500E-02
123.500	5.6097E-02	124.500	5.2808E-02	125.500	4.9640E-02
126.500	4.6575E-02	127.500	4.3607E-02	128.500	4.0730E-02
129.500	3.7953E-02	130.500	3.5256E-02	131.500	3.2638E-02
132.500	3.0091E-02	133.500	2.7618E-02	134.500	2.5203E-02
135.500	2.2840E-02	136.500	2.0529E-02	137.500	1.8263E-02
138.500	1.6044E-02	139.500	1.3858E-02	140.500	1.1698E-02
141.500	9.5613E-03	142.500	7.4461E-03	143.500	5.3434E-03
144.050	4.1986E-03	144.150	3.9891E-03	144.250	3.7814E-03
144.350	3.5706E-03	144.450	3.3612E-03	144.550	3.1571E-03
144.650	2.9461E-03	144.750	2.7376E-03	144.850	2.5271E-03
144.950	2.3180E-03	145.000	2.2208E-03		

UNSAT-H Version 2.03
SIMULATION SUMMARY

Title:2007-1.45
Sudbury Rd LF-Alternative Cover Design

Transpiration Scheme is:	= 1	
Potential Evapotranspiration	= 1.6588E+02	[cm]
Potential Transpiration	= 6.2590E+01	[cm]
Actual Transpiration	= **4.3346E+00**	**[cm]**
Potential Evaporation	= 6.0093E+02	[cm]
Actual Evaporation	= **2.2334E+01**	**[cm]**
Evaporation during Growth	= 8.8296E+00	[cm]
Total Runoff	= **3.5450E+00**	**[cm]**
Total Infiltration	= **2.9018E+01**	**[cm]**
Total Drainage at Base of Profile	= 5.1422E-03	[cm]
Total Applied Water	= 3.2563E+01	[cm]
Actual Rainfall	= 3.2563E+01	[cm]
Actual Irrigation	= 0.0000E+00	[cm]
Total Final Moisture Storage	= 3.0445E+01	[cm]
Mass Balance Error	= **1.3729E-02**	**[cm]**
Total Successful Time Steps	= 974953	
Total Attempted Time Steps	= 974953	
Total Time Step Reductions (DHMAX)	= 5640	
Total Changes in Surface Boundary	= 258980	
Total Time Actually Simulated	= 3.6500E+02	[days]

Total water flow (cm) across different depths at the end of 3.6500E+02 days:

DEPTH	FLOW	DEPTH	FLOW	DEPTH	FLOW
0.000	6.6835E+00	0.050	6.6810E+00	0.150	6.6683E+00
0.250	6.6535E+00	0.350	6.6368E+00	0.450	6.6184E+00
0.550	6.5985E+00	0.650	6.5774E+00	0.800	6.5439E+00
0.950	6.5077E+00	1.500	6.3709E+00	2.500	6.0805E+00
3.500	5.7822E+00	4.500	5.4917E+00	5.500	5.2166E+00
6.500	4.9586E+00	7.500	4.7186E+00	8.500	4.4971E+00
9.500	4.2917E+00	10.500	4.0999E+00	11.500	3.9198E+00
12.500	3.7498E+00	13.500	3.5888E+00	14.500	3.4359E+00
15.500	3.2902E+00	16.500	3.1513E+00	17.500	3.0185E+00
18.500	2.8914E+00	19.500	2.7698E+00	20.500	2.6534E+00
21.500	2.5419E+00	22.500	2.4354E+00	23.500	2.3335E+00

24.500	2.2362E+00	25.500	2.1435E+00	26.500	2.0554E+00
27.500	1.9717E+00	28.500	1.8924E+00	29.500	1.8176E+00
30.500	1.7471E+00	31.500	1.6810E+00	32.500	1.6192E+00
33.500	1.5619E+00	34.500	1.5089E+00	35.500	1.4602E+00
36.500	1.4157E+00	37.500	1.3753E+00	38.500	1.3389E+00
39.500	1.3063E+00	40.500	1.2774E+00	41.500	1.2519E+00
42.500	1.2298E+00	43.500	1.2107E+00	44.500	1.1944E+00
45.500	1.1806E+00	46.500	1.1690E+00	47.500	1.1594E+00
48.500	1.1516E+00	49.500	1.1452E+00	50.500	1.1398E+00
51.500	1.1352E+00	52.500	1.1311E+00	53.500	1.1272E+00
54.500	1.1235E+00	55.500	1.1197E+00	56.500	1.1156E+00
57.500	1.1112E+00	58.500	1.1063E+00	59.500	1.1009E+00
60.500	1.0949E+00	61.500	1.0883E+00	62.500	1.0811E+00
63.500	1.0732E+00	64.500	1.0646E+00	65.500	1.0554E+00
66.500	1.0455E+00	67.500	1.0351E+00	68.500	1.0242E+00
69.500	1.0127E+00	70.500	1.0008E+00	71.500	9.8844E-01
72.500	9.7568E-01	73.500	9.6258E-01	74.500	9.4923E-01
75.500	9.3567E-01	76.500	9.2189E-01	77.500	9.0796E-01
78.500	8.9389E-01	79.500	8.7969E-01	80.500	8.6542E-01
81.500	8.5106E-01	82.500	8.3663E-01	83.500	8.2215E-01
84.500	8.0766E-01	85.500	7.9315E-01	86.500	7.7859E-01
87.500	7.6407E-01	88.500	7.4955E-01	89.500	7.3504E-01
90.500	7.2057E-01	91.500	7.0611E-01	92.500	6.9169E-01
93.500	6.7732E-01	94.500	6.6301E-01	95.500	6.4876E-01
96.500	6.3454E-01	97.500	6.2038E-01	98.500	6.0624E-01
99.500	5.9222E-01	100.500	5.7826E-01	101.500	5.6435E-01
102.500	5.5051E-01	103.500	5.3670E-01	104.500	5.2293E-01
105.500	5.0925E-01	106.500	4.9561E-01	107.500	4.8203E-01
108.500	4.6841E-01	109.500	4.5484E-01	110.500	4.4127E-01
111.500	4.2778E-01	112.500	4.1433E-01	**113.500**	**4.0091E-01**
114.500	3.8758E-01	115.500	3.7426E-01	116.500	3.6103E-01
117.500	3.4787E-01	118.500	3.3475E-01	119.500	3.2171E-01
120.500	3.0870E-01	121.500	2.9576E-01	122.500	2.8288E-01
123.500	2.7010E-01	124.500	2.5735E-01	125.500	2.4464E-01
126.500	2.3201E-01	127.500	2.1943E-01	128.500	2.0694E-01
129.500	1.9446E-01	130.500	1.8203E-01	131.500	1.6961E-01
132.500	1.5726E-01	133.500	1.4490E-01	134.500	1.3260E-01
135.500	1.2034E-01	136.500	1.0810E-01	137.500	9.5905E-02
138.500	8.3707E-02	139.500	7.1535E-02	140.500	5.9372E-02
141.500	4.7223E-02	142.500	3.5094E-02	143.500	2.2955E-02
144.050	1.6278E-02	144.150	1.5068E-02	144.250	1.3861E-02
144.350	1.2653E-02	144.450	1.1445E-02	144.550	1.0238E-02
144.650	9.0313E-03	144.750	7.8245E-03	144.850	6.6152E-03
144.950	5.4065E-03	145.000	5.1422E-03		

UNSAT-H Version 2.03
SIMULATION SUMMARY

Title:2008-1.45
Sudbury Rd LF-Alternative Cover Design

Transpiration Scheme is: = 1
Potential Evapotranspiration = 1.6588E+02 [cm]
Potential Transpiration = 6.2590E+01 [cm]
Actual Transpiration **= 4.7421E+00 [cm]**
Potential Evaporation = 6.0093E+02 [cm]
Actual Evaporation **= 2.3863E+01 [cm]**
Evaporation during Growth = 8.9559E+00 [cm]
Total Runoff **= 3.5753E+00 [cm]**
Total Infiltration **= 2.8987E+01 [cm]**
Total Drainage at Base of Profile = 6.7432E-03 [cm]
Total Applied Water = 3.2563E+01 [cm]
Actual Rainfall = 3.2563E+01 [cm]
Actual Irrigation = 0.0000E+00 [cm]
Total Final Moisture Storage = 3.0810E+01 [cm]
Mass Balance Error **= 1.0695E-02 [cm]**
Total Successful Time Steps = 981514
Total Attempted Time Steps = 981514
Total Time Step Reductions (DHMAX) = 5652
Total Changes in Surface Boundary = 254433
Total Time Actually Simulated = 3.6500E+02 [days]

Total water flow (cm) across different depths at the end of 3.6500E+02 days:

DEPTH	FLOW	DEPTH	FLOW	DEPTH	FLOW
0.000	5.1242E+00	0.050	5.1254E+00	0.150	5.1200E+00
0.250	5.1125E+00	0.350	5.1031E+00	0.450	5.0919E+00
0.550	5.0793E+00	0.650	5.0654E+00	0.800	5.0428E+00
0.950	5.0174E+00	1.500	4.9200E+00	2.500	4.7007E+00
3.500	4.4728E+00	4.500	4.2523E+00	5.500	4.0468E+00
6.500	3.8583E+00	7.500	3.6873E+00	8.500	3.5346E+00
9.500	3.3978E+00	10.500	3.2745E+00	11.500	3.1625E+00
12.500	3.0606E+00	13.500	2.9673E+00	14.500	2.8818E+00
15.500	2.8031E+00	16.500	2.7306E+00	17.500	2.6634E+00
18.500	2.6012E+00	19.500	2.5435E+00	20.500	2.4897E+00
21.500	2.4396E+00	22.500	2.3929E+00	23.500	2.3491E+00

24.500	2.3081E+00	25.500	2.2695E+00	26.500	2.2332E+00
27.500	2.1988E+00	28.500	2.1662E+00	29.500	2.1353E+00
30.500	2.1056E+00	31.500	2.0772E+00	32.500	2.0499E+00
33.500	2.0235E+00	34.500	1.9980E+00	35.500	1.9734E+00
36.500	1.9494E+00	37.500	1.9259E+00	38.500	1.9030E+00
39.500	1.8805E+00	40.500	1.8583E+00	41.500	1.8364E+00
42.500	1.8147E+00	43.500	1.7933E+00	44.500	1.7720E+00
45.500	1.7509E+00	46.500	1.7299E+00	47.500	1.7090E+00
48.500	1.6883E+00	49.500	1.6676E+00	50.500	1.6471E+00
51.500	1.6266E+00	52.500	1.6062E+00	53.500	1.5858E+00
54.500	1.5655E+00	55.500	1.5453E+00	56.500	1.5250E+00
57.500	1.5047E+00	58.500	1.4845E+00	59.500	1.4644E+00
60.500	1.4442E+00	61.500	1.4241E+00	62.500	1.4039E+00
63.500	1.3839E+00	64.500	1.3638E+00	65.500	1.3438E+00
66.500	1.3239E+00	67.500	1.3040E+00	68.500	1.2842E+00
69.500	1.2644E+00	70.500	1.2447E+00	71.500	1.2250E+00
72.500	1.2053E+00	73.500	1.1857E+00	74.500	1.1662E+00
75.500	1.1467E+00	76.500	1.1272E+00	77.500	1.1078E+00
78.500	1.0885E+00	79.500	1.0692E+00	80.500	1.0501E+00
81.500	1.0310E+00	82.500	1.0119E+00	83.500	9.9301E-01
84.500	9.7414E-01	85.500	9.5535E-01	86.500	9.3661E-01
87.500	9.1798E-01	88.500	8.9945E-01	89.500	8.8105E-01
90.500	8.6275E-01	91.500	8.4453E-01	92.500	8.2645E-01
93.500	8.0848E-01	94.500	7.9061E-01	95.500	7.7287E-01
96.500	7.5525E-01	97.500	7.3773E-01	98.500	7.2034E-01
99.500	7.0309E-01	100.500	6.8595E-01	101.500	6.6891E-01
102.500	6.5200E-01	103.500	6.3521E-01	104.500	6.1849E-01
105.500	6.0193E-01	106.500	5.8544E-01	107.500	5.6907E-01
108.500	5.5282E-01	109.500	5.3664E-01	110.500	5.2053E-01
111.500	5.0449E-01	112.500	4.8849E-01	113.500	4.7257E-01
114.500	4.5669E-01	115.500	4.4091E-01	116.500	4.2518E-01
117.500	4.0952E-01	**118.500**	**3.9393E-01**	119.500	3.7839E-01
120.500	3.6294E-01	121.500	3.4757E-01	122.500	3.3226E-01
123.500	3.1704E-01	124.500	3.0193E-01	125.500	2.8689E-01
126.500	2.7194E-01	127.500	2.5707E-01	128.500	2.4227E-01
129.500	2.2758E-01	130.500	2.1293E-01	131.500	1.9835E-01
132.500	1.8385E-01	133.500	1.6941E-01	134.500	1.5504E-01
135.500	1.4070E-01	136.500	1.2640E-01	137.500	1.1215E-01
138.500	9.7966E-02	139.500	8.3795E-02	140.500	6.9661E-02
141.500	5.5541E-02	142.500	4.1439E-02	143.500	2.7352E-02
144.050	1.9604E-02	144.150	1.8204E-02	144.250	1.6801E-02
144.350	1.5403E-02	144.450	1.3999E-02	144.550	1.2596E-02
144.650	1.1195E-02	144.750	9.7928E-03	144.850	8.3894E-03
144.950	6.9870E-03	145.000	6.7432E-03		

UNSAT-H Version 2.03

SIMULATION SUMMARY

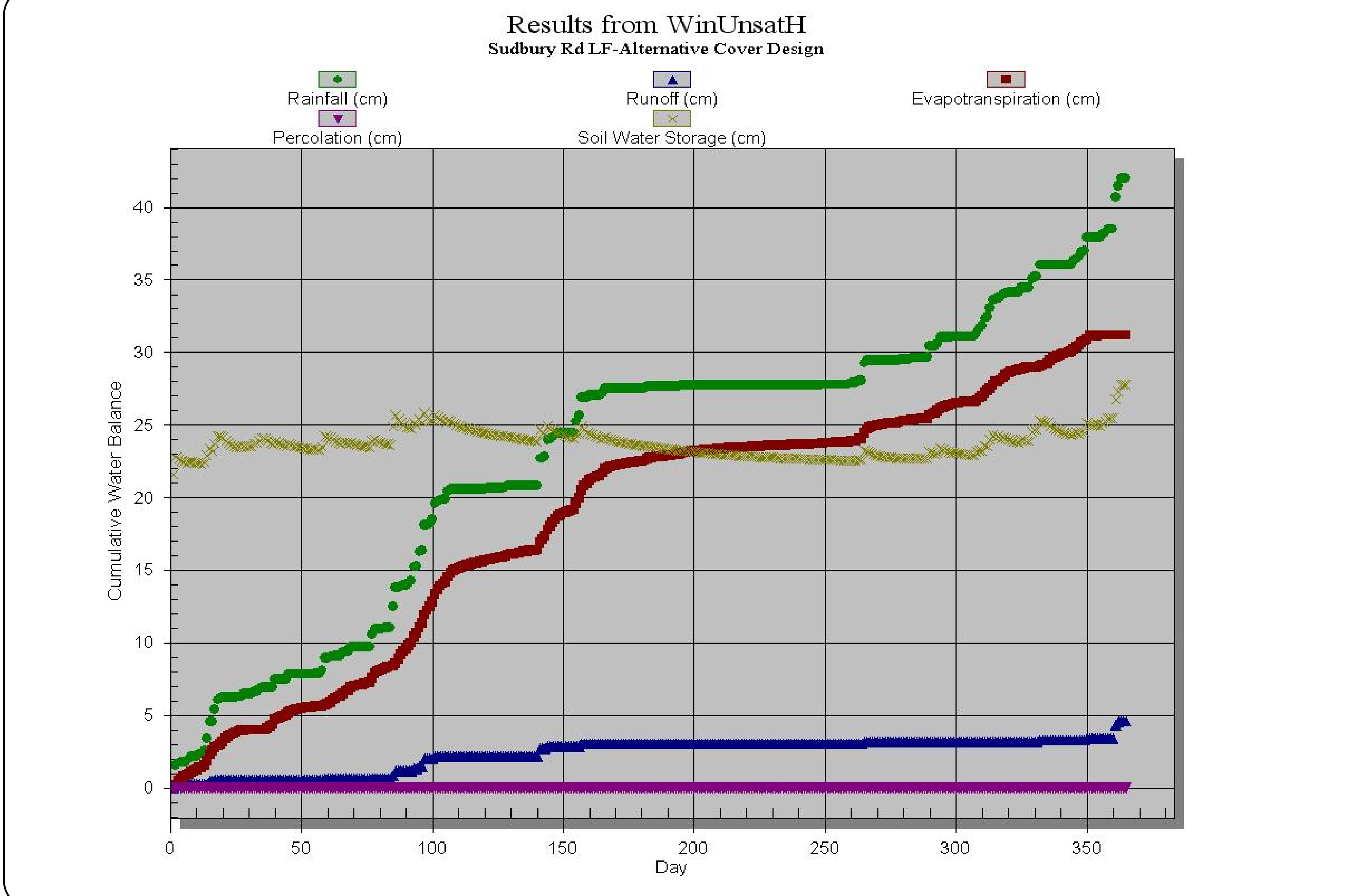
Title: 1996-1.45
Sudbury Rd LF-Alternative Cover Design

Transpiration Scheme is: = 1
Potential Evapotranspiration = 1.6588E+02 [cm]
Potential Transpiration = 6.2590E+01 [cm]
Actual Transpiration = 6.2535E+00 [cm]
Potential Evaporation = 6.0093E+02 [cm]
Actual Evaporation = 3.5009E+01 [cm]
Evaporation during Growth = 1.3424E+01 [cm]
Total Runoff = 8.7299E+00 [cm]
Total Infiltration = 4.3238E+01 [cm]
Total Drainage at Base of Profile = 1.0819E-02 [cm]
Total Applied Water = 5.1968E+01 [cm]
Actual Rainfall = 5.1968E+01 [cm]
Actual Irrigation = 0.0000E+00 [cm]
Total Final Moisture Storage = 3.2779E+01 [cm]
Mass Balance Error = **-4.3351E-03** [cm]
Total Successful Time Steps = 907742
Total Attempted Time Steps = 907742
Total Time Step Reductions (DHMAX) = 5053
Total Changes in Surface Boundary = 190889
Total Time Actually Simulated = 3.6500E+02 [days]

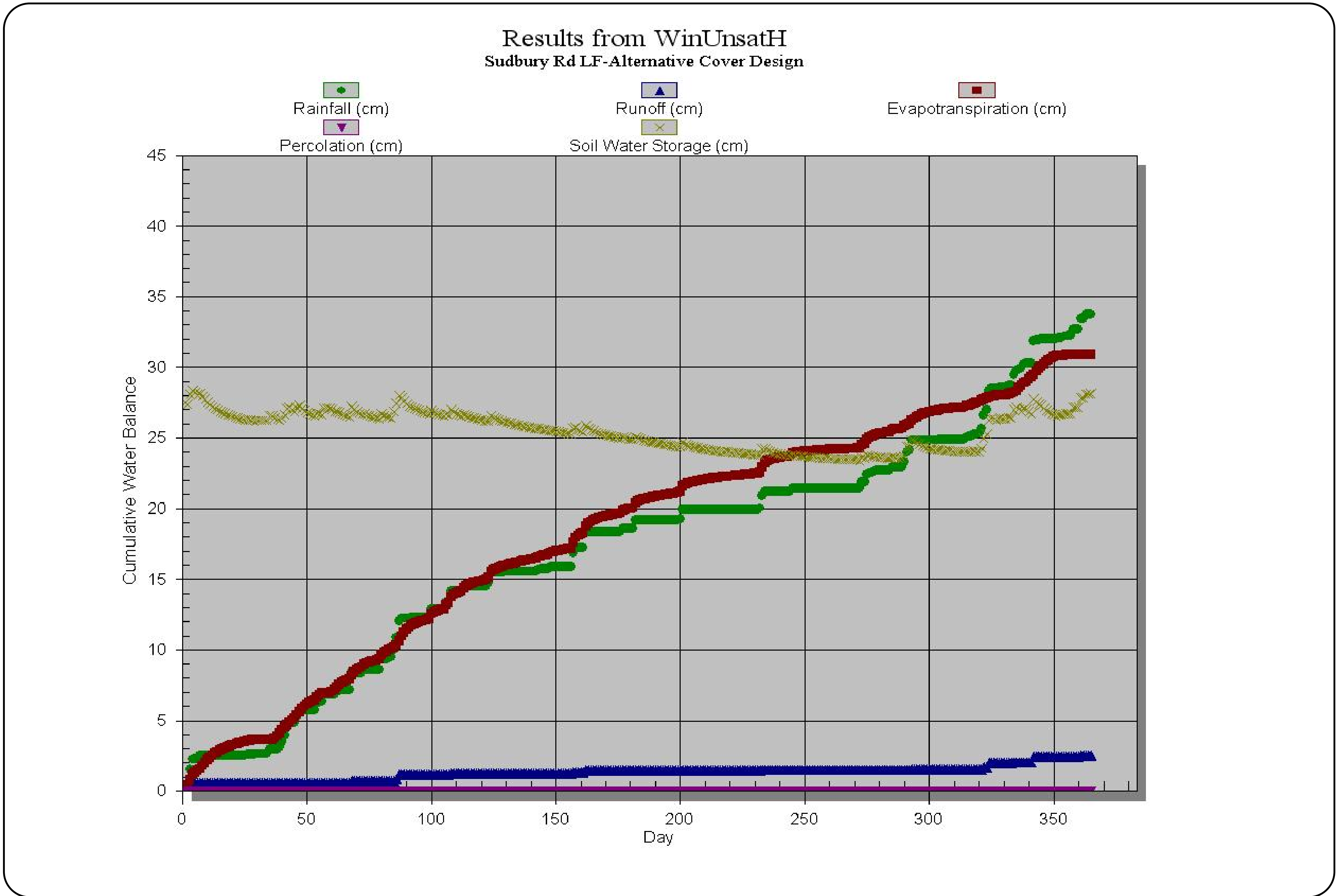
Total water flow (cm) across different depths at the end of 3.6500E+02 days:

DEPTH	FLOW	DEPTH	FLOW	DEPTH	FLOW
0.000	8.2294E+00	0.050	8.2338E+00	0.150	8.2269E+00
0.250	8.2177E+00	0.350	8.2064E+00	0.450	8.1934E+00
0.550	8.1789E+00	0.650	8.1632E+00	0.800	8.1380E+00
0.950	8.1102E+00	1.500	8.0048E+00	2.500	7.7728E+00
3.500	7.5298E+00	4.500	7.2889E+00	5.500	7.0565E+00
6.500	6.8354E+00	7.500	6.6263E+00	8.500	6.4305E+00
9.500	6.2477E+00	10.500	6.0776E+00	11.500	5.9195E+00
12.500	5.7725E+00	13.500	5.6358E+00	14.500	5.5084E+00
15.500	5.3898E+00	16.500	5.2792E+00	17.500	5.1760E+00
18.500	5.0794E+00	19.500	4.9888E+00	20.500	4.9035E+00
21.500	4.8229E+00	22.500	4.7466E+00	23.500	4.6741E+00
24.500	4.6049E+00	25.500	4.5387E+00	26.500	4.4752E+00

27.500	4.4140E+00	28.500	4.3549E+00	29.500	4.2977E+00
30.500	4.2421E+00	31.500	4.1880E+00	32.500	4.1352E+00
33.500	4.0834E+00	34.500	4.0324E+00	35.500	3.9821E+00
36.500	3.9323E+00	37.500	3.8827E+00	38.500	3.8333E+00
39.500	3.7838E+00	40.500	3.7340E+00	41.500	3.6838E+00
42.500	3.6330E+00	43.500	3.5815E+00	44.500	3.5293E+00
45.500	3.4764E+00	46.500	3.4228E+00	47.500	3.3685E+00
48.500	3.3136E+00	49.500	3.2582E+00	50.500	3.2026E+00
51.500	3.1468E+00	52.500	3.0909E+00	53.500	3.0352E+00
54.500	2.9797E+00	55.500	2.9246E+00	56.500	2.8701E+00
57.500	2.8161E+00	58.500	2.7629E+00	59.500	2.7104E+00
60.500	2.6587E+00	61.500	2.6079E+00	62.500	2.5579E+00
63.500	2.5089E+00	64.500	2.4609E+00	65.500	2.4139E+00
66.500	2.3678E+00	67.500	2.3227E+00	68.500	2.2786E+00
69.500	2.2354E+00	70.500	2.1930E+00	71.500	2.1516E+00
72.500	2.1109E+00	73.500	2.0710E+00	74.500	2.0319E+00
75.500	1.9935E+00	76.500	1.9558E+00	77.500	1.9187E+00
78.500	1.8821E+00	79.500	1.8462E+00	80.500	1.8107E+00
81.500	1.7758E+00	82.500	1.7414E+00	83.500	1.7073E+00
84.500	1.6736E+00	85.500	1.6403E+00	86.500	1.6074E+00
87.500	1.5746E+00	88.500	1.5422E+00	89.500	1.5101E+00
90.500	1.4782E+00	91.500	1.4465E+00	92.500	1.4151E+00
93.500	1.3840E+00	94.500	1.3530E+00	95.500	1.3223E+00
96.500	1.2919E+00	97.500	1.2617E+00	98.500	1.2317E+00
99.500	1.2020E+00	100.500	1.1726E+00	101.500	1.1434E+00
102.500	1.1144E+00	103.500	1.0856E+00	104.500	1.0570E+00
105.500	1.0286E+00	106.500	1.0004E+00	107.500	9.7238E-01
108.500	9.4456E-01	109.500	9.1691E-01	110.500	8.8937E-01
111.500	8.6198E-01	112.500	8.3473E-01	113.500	8.0761E-01
114.500	7.8058E-01	115.500	7.5370E-01	116.500	7.2697E-01
117.500	7.0038E-01	118.500	6.7391E-01	119.500	6.4757E-01
120.500	6.2133E-01	121.500	5.9521E-01	122.500	5.6923E-01
123.500	5.4338E-01	124.500	5.1765E-01	125.500	4.9204E-01
126.500	4.6654E-01	127.500	4.4115E-01	128.500	4.1591E-01
129.500	**3.9075E-01**	130.500	3.6570E-01	131.500	3.4072E-01
132.500	3.1584E-01	133.500	2.9107E-01	134.500	2.6637E-01
135.500	2.4175E-01	136.500	2.1718E-01	137.500	1.9267E-01
138.500	1.6820E-01	139.500	1.4378E-01	140.500	1.1940E-01
141.500	9.5054E-02	142.500	7.0726E-02	143.500	4.6436E-02
144.050	3.3089E-02	144.150	3.0670E-02	144.250	2.8250E-02
144.350	2.5835E-02	144.450	2.3416E-02	144.550	2.0998E-02
144.650	1.8580E-02	144.750	1.6162E-02	144.850	1.3744E-02
144.950	1.1326E-02	145.000	1.0819E-02		

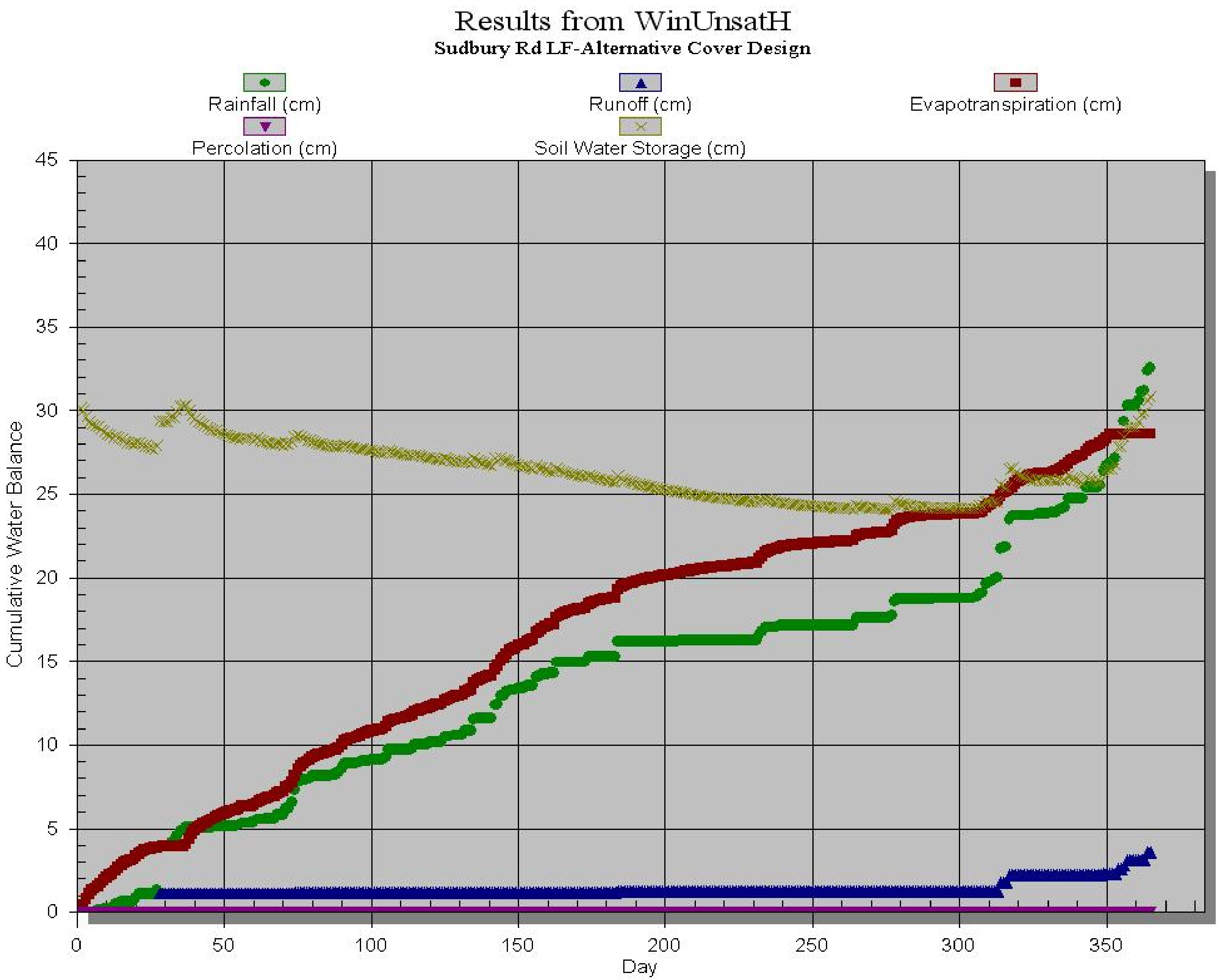


HWA GEOSCIENCES INC.	ANNUAL WATER BALANCE-2006	FIGURE NO. D-1
	ACAP DESIGN AREA 6 FINAL CLOSURE SUDBURY ROAD LANDFILL WALLA WALLA, WASHINGTON	PROJECT NO. 2003-094

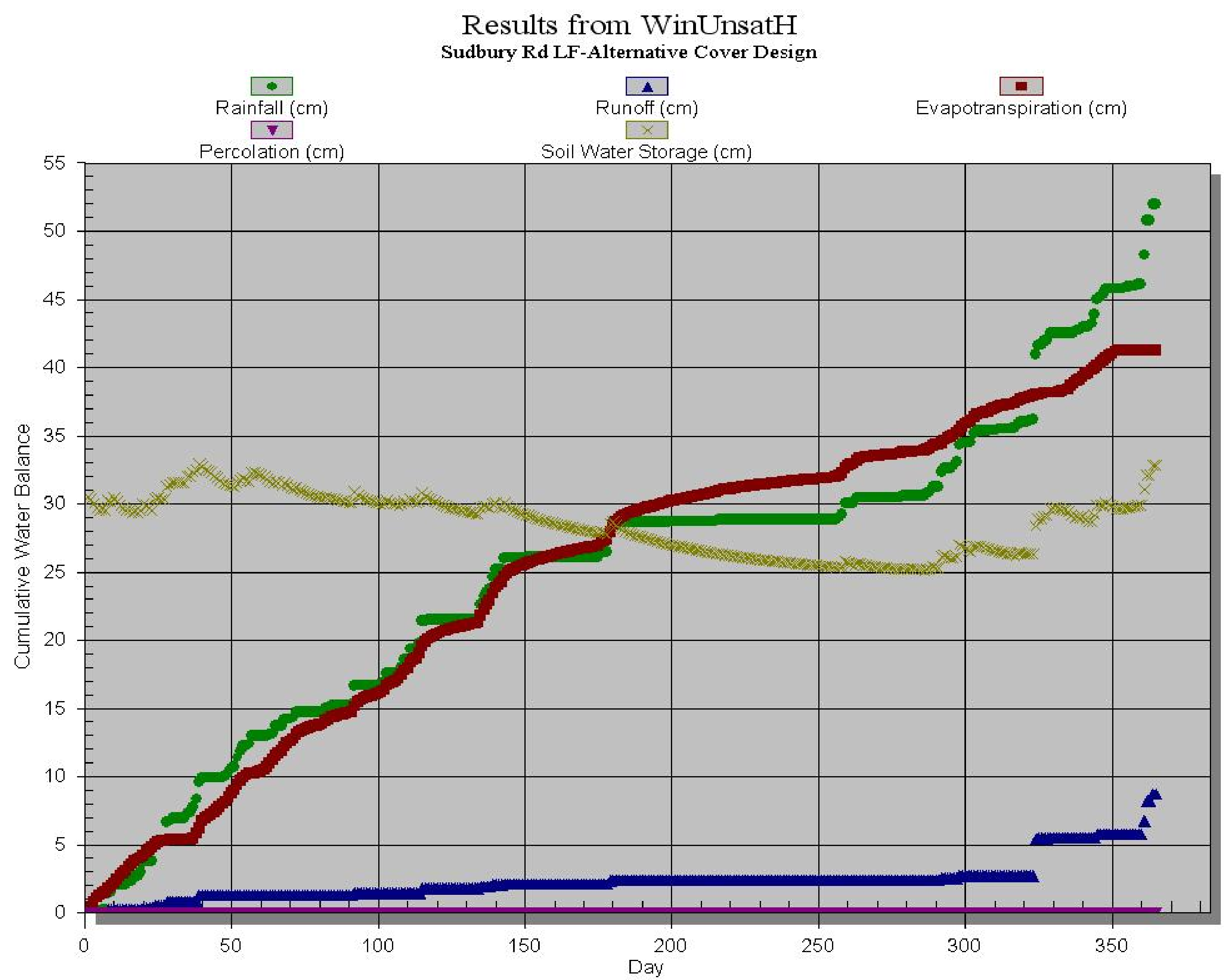


HWA GEOSCIENCES INC.

ANNUAL WATER BALANCE-2007		FIGURE NO. D-2
ACAP DESIGN AREA 6 FINAL CLOSURE SUDBURY ROAD LANDFILL WALLA WALLA, WASHINGTON		PROJECT NO. 2003-094



HWA GEOSCIENCES INC.	ANNUAL WATER BALANCE-2008	FIGURE NO. D-3
	ACAP DESIGN AREA 6 FINAL CLOSURE SUDBURY ROAD LANDFILL WALLA WALLA, WASHINGTON	PROJECT NO. 2003-094



ANNUAL WATER BALANCE-1996

HWA GEOSCIENCES INC.

ACAP DESIGN
AREA 6 FINAL CLOSURE
SUDBURY ROAD LANDFILL
WALLA WALLA, WASHINGTON

FIGURE NO.
D-4

PROJECT NO.
2003-094

APPENDIX I

Remediation Cost Estimates

ENGINEER'S OPINION OF PROBABLE COST

PROJECT:	Sudbury Landfill	DATE:	2/26/2014
PROJECT DESCRIPTION:	ET Cover for Area 2 and Area 5		
CLIENT:	City of Walla Walla		
CLIENT PROJ. NO.	J-U-B PROJ. NO.: 30-11-012-002		

ITEM NO.	DESCRIPTION	SCHEDULE OF VALUES QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	Mobilization	1	LS	$67,000	$67,000
2	Construction Surveying	1	LS	$17,000	$17,000
3	Materials Testing	1	LS	$11,000	$11,000
4	Area 2 Soil Cover	24,200	CY	$4	$96,800
5	Area 5 Soil Cover	104,867	CY	$4	$419,467
6	Settlement Monitoring Station	2	EA	$550	$1,100
7	Area 2 Anti-Erosion Layer	1	LS	$12,000	$12,000
8	Area 5 Anti-Erosion Layer	1	LS	$45,000	$45,000
	SUBTOTAL				$669,367
	WALLA WALLA SALES TAX			8.90%	$59,574
	SUBTOTAL				$728,940
Contingency				30%	$218,682
Engineering and Construction Phase Services				25%	$182,235
				TOTAL ESTIMATED COSTS	$1,129,857

BBH

J-U-B ENGINEERS, INC.

SUITE 201, 2810 WEST CLEARWATER AVE., KENNEWICK, WASHINGTON 99336 (509) 783-2144

ENGINEER'S OPINION OF PROBABLE COST

PROJECT: Sudbury Landfill DATE: 7/15/2014

PROJECT DESCRIPTION: North Ditch Storm Drainage Alternative 1: CIP Concrete

CLIENT: City of Walla Walla

CLIENT PROJ. NO. J-U-B PROJ. NO.: 30-11-012-002

ITEM NO.	DESCRIPTION	SCHEDULE OF VALUES			
		QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	Mobilization	1	LS	$18,000	$18,000
2	6" CIP Concrete	175	CY	$350	$61,250
3	6" Leveling Pea Gravel Base	383	CY	$30	$11,490
4	60-mil HDPE Liner	28,320	SF	$1.80	$50,976
5	HDPE Anchor Trench	2,360	LF	$4	$9,440
6	Earthwork	961	CY	$6	$5,766
7	Erosion Control Mat	1,115	SY	$20	$22,300
	SUBTOTAL				$179,222
	WALLA WALLA SALES TAX			8.90%	$15,951
	SUBTOTAL				$195,173
Contingency				30%	$58,552
Engineering and Construction Phase Services				25%	$48,793
				TOTAL ESTIMATED COSTS	$302,518

BBH

J-U-B ENGINEERS, INC.

SUITE 201, 2810 WEST CLEARWATER AVE., KENNEWICK, WASHINGTON 99336 (509) 783-2144

ENGINEER'S OPINION OF PROBABLE COST

PROJECT: Sudbury Landfill DATE: 7/15/2014

PROJECT DESCRIPTION: North Ditch Storm Drainage Alternative 2:Cable Block

CLIENT: City of Walla Walla

CLIENT PROJ. NO. J-U-B PROJ. NO.: 30-11-012-002

ITEM NO.	DESCRIPTION	SCHEDULE OF VALUES QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	Mobilization	1	LS	$47,000	$47,000
	Armortec 55S Mat	15,906	SF	$11	$174,966
2	16 oz Nonwoven Fabric	36,580	SF	$5	$182,900
3	60-mil HDPE Liner	18,290	SF	$1.80	$32,922
4	HDPE Anchor Trench	2,360	LF	$4	$9,440
5	Earthwork	725	CY	$6	$4,350
6	Erosion Control Mat	1,115	SY	$20	$22,300
	SUBTOTAL				$473,878
	WALLA WALLA SALES TAX			8.90%	$42,175
	SUBTOTAL				$516,053
Contingency				30%	$154,816
Engineering and Construction Phase Services				25%	$129,013
				TOTAL ESTIMATED COSTS	$799,882

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J-U-B ENGINEERS, INC.

SUITE 201, 2810 WEST CLEARWATER AVE., KENNEWICK, WASHINGTON 99336 (509) 783-2144

ENGINEER'S OPINION OF PROBABLE COST

PROJECT: Sudbury Landfill DATE: 7/15/2014

PROJECT DESCRIPTION: North Ditch Storm Drainage Alternative 3:Precast Concrete

CLIENT: City of Walla Walla

CLIENT PROJ. NO. J-U-B PROJ. NO.: 30-11-012-002

ITEM NO.	DESCRIPTION	SCHEDULE OF VALUES			
		QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	Mobilization	1	LS	$38,000	$38,000
2	Split Culvert 5076, Base Only	1,180	LF	$211	$248,980
3	6" Leveling Pea Gravel Base	274	CY	$30	$8,220
4	60-mil HDPE Liner	27,140	SF	$1.80	$48,852
5	HDPE Anchor Trench	2,360	LF	$4	$9,440
6	Earthwork	770	CY	$6	$4,620
7	Erosion Control Mat	1,115	SY	$20	$22,300
	SUBTOTAL				$380,412
	WALLA WALLA SALES TAX			8.90%	$33,857
	SUBTOTAL				$414,269
Contingency				30%	$124,281
Engineering and Construction Phase Services				25%	$103,567
				TOTAL ESTIMATED COSTS	$642,116

LLR

J-U-B ENGINEERS, INC.

SUITE 201, 2810 WEST CLEARWATER AVE., KENNEWICK, WASHINGTON 99336 (509) 783-2144

ENGINEER'S OPINION OF PROBABLE COST

PROJECT: Sudbury Landfill DATE: 7/15/2014

PROJECT DESCRIPTION: Area 5 Stormwater Runoff Erosion Control Berm

CLIENT: City of Walla Walla

CLIENT PROJ. NO. J-U-B PROJ. NO.: 30-11-012-002

ITEM NO.	DESCRIPTION	SCHEDULE OF VALUES QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	Mobilization	1	LS	$2,000	$2,000
2	Erosion Control Mat (1190' x 8.5')	1,124	SY	$20	$22,478
	SUBTOTAL				$24,478
	WALLA WALLA SALES TAX			8.90%	$2,179
	SUBTOTAL				$26,656
Contingency				30%	$7,997
Engineering and Construction Phase Services				25%	$6,664
				TOTAL ESTIMATED COSTS	$41,317

BBH

J-U-B ENGINEERS, INC.

SUITE 201, 2810 WEST CLEARWATER AVE., KENNEWICK, WASHINGTON 99336 (509) 783-2144

ENGINEER'S OPINION OF PROBABLE COST

PROJECT: Sudbury Landfill DATE: 7/15/2014

PROJECT DESCRIPTION: Area 5 Stormwater Runon - Alternative 1

CLIENT: City of Walla Walla

CLIENT PROJ. NO. J-U-B PROJ. NO.: 30-11-012-002

ITEM NO.	DESCRIPTION	SCHEDULE OF VALUES			
		QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	Mobilization	1	LS	$6,000	$6,000
2	Remove Existing Asphalt	590	SY	$10	$5,900
3	Remove Existing 12-inch Concrete Culvert	36	LF	$1	$36
4	Imported Fill	4,430	CY	$6	$26,580
5	12-inch SD Culvert	30	LF	$40	$1,200
6	CSTC	140	Ton	$30	$4,200
7	HMA Pavement	130	Ton	$120	$15,600
	SUBTOTAL				$59,516
	WALLA WALLA COUNTY SALES TAX			8.90%	$5,297
	SUBTOTAL				$64,813
Contingency				30%	$19,444
Engineering and Construction Phase Services				25%	$16,203
				TOTAL ESTIMATED COSTS	$100,460

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J-U-B ENGINEERS, INC.

SUITE 201, 2810 WEST CLEARWATER AVE., KENNEWICK, WASHINGTON 99336 (509) 783-2144

ENGINEER'S OPINION OF PROBABLE COST

PROJECT: Sudbury Landfill DATE: 7/18/2014

PROJECT DESCRIPTION: Area 5 Stormwater Runon - Alternative 2

CLIENT: City of Walla Walla

CLIENT PROJ. NO. J-U-B PROJ. NO.: 30-11-012-002

ITEM NO.	DESCRIPTION	SCHEDULE OF VALUES			
		QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	Mobilization	1	LS	$4,000	$4,000
3	Remove Existing 12-inch Concrete Culvert	36	LF	$1	$36
4	12-inch SD Culvert	36	LF	$35	$1,260
5	Roadway Repair	1	LS	$2,000	$2,000
6	12-inch SD Pipe	483	LF	$35	$16,905
7	Sedimentation Structure	1	EA	$10,000	$10,000
8	Pipe Penetration into Existing HDPE Lagoon Liner	1	LS	$10,000	$10,000
	SUBTOTAL				$44,201
	WALLA WALLA COUNTY SALES TAX			8.90%	$3,934
	SUBTOTAL				$48,135
Contingency				30%	$14,440
Engineering and Construction Phase Services				25%	$12,034
				TOTAL ESTIMATED COSTS	$74,609

BBH

J-U-B ENGINEERS, INC.

SUITE 201, 2810 WEST CLEARWATER AVE., KENNEWICK, WASHINGTON 99336 (509) 783-2144

Table LFG-2. Cost Estimate for LFG Control Systems, Areas 1, 2, and 5 Sudbury LF, Walla Walla, Washington
Preliminary Engineer's Opinion of Probable Cost
Prepared by Herrera Environmental Consultants, Date 2/11/14 by BAC/MMS

Item No.	Description	Quantity	Unit	Unit Price	Extended Amount	Comments
	Extraction Well System Area 1					
1	Extraction well	2	ea	$ 5,555.00	$ 11,110.00	4" HDPE
2	Control valve station	2	ea	$ 350.00	$ 700.00	2" PVC Flo-Wing
3	Gas flow meter	1	ea	$ 4,500.00	$ 4,500.00	FCI GF90 Mass Flow Meter
4	Electrical connection	1	ea	$ 1,500.00	$ 1,500.00	Connect at flare
5	Trench excavation	15	cu yards	$ 12.00	$ 180.00	12" wide x 12" deep x 350'
6	Non-perforated pipe/backfill	350	lft	$ 20.00	$ 7,000.00	4" HDPE
7	Disposal (soil)	25	ton	$ 89.00	$ 2,225.00	Worst case (cover material can be segregated from MSW)
8	Carsonite stakes	8	ea	$ 25.00	$ 200.00	50' spacing
9	System startup and testing	1	ls	$ 5,000.00	$ 5,000.00	
	Subtotal				$ 32,415.00	
	Tax (8.9%)				$ 2,884.94	
	Contingency (30%)				$ 10,589.98	
	Engineering and Construction Phase Services (25%)				$ 8,824.98	
	Total				$ 54,714.90	
	Extraction Well System Area 2					
1	Extraction well	1	ea	$ 5,555.00	$ 5,555.00	4" HDPE
2	Control valve station	1	ea	$ 350.00	$ 350.00	2" PVC Flo-Wing
3	Trench excavation	47	cu yards	$ 12.00	$ 564.00	12" wide x 12" deep x 575'
4	Non-perforated pipe/backfill	1280	lft	$ 20.00	$ 25,600.00	4" HDPE
5	Disposal (soil)	71	ton	$ 89.00	$ 6,319.00	Worst case (cover material can be segregated from MSW)
6	Carsonite stakes	26	ea	$ 25.00	$ 650.00	50' spacing
7	System startup and testing	1	ls	$ 5,000.00	$ 5,000.00	
	Subtotal				$ 44,038.00	
	Tax (8.9%)				$ 3,919.38	
	Contingency (30%)				$ 14,387.21	
	Engineering and Construction Phase Services (25%)				$ 11,989.35	
	Total				$ 74,333.94	
	Active Collector Trench Area 2					
1	Control valve station	1	ea	$ 750.00	$ 750.00	2" PVC Flo-Wing
2	Trench excavation (deep)	741	cu yards	$ 12.00	$ 8,892.00	12" wide x 20' deep x 1,000'
3	Trench excavation (shallow)	42	cu yards	$ 12.00	$ 504.00	12" wide x 12' deep x 430'
4	Non-perforated pipe/backfill	1,000	lft	$ 20.00	$ 20,000.00	4" HDPE
5	Non-perforated pipe/backfill	1135	lft	$ 20.00	$ 22,700.00	4" HDPE
6	Disposal (soil)	1175	ton	$ 89.00	$ 104,575.00	Worst case (cover material can be segregated from MSW)
7	Carsonite stakes	43	ea	$ 25.00	$ 1,075.00	50' spacing
8	System startup and testing	1	ls	$ 5,000.00	$ 5,000.00	
	Subtotal				$ 163,496.00	
	Tax (8.9%)				$ 14,551.14	
	Contingency (30%)				$ 53,414.14	
	Engineering and Construction Phase Services (25%)				$ 44,511.79	
	Total				$ 275,973.07	
	Extraction Well System Area 5					
1	Extraction well	7	ea	$ 5,555.00	$ 38,885.00	4" HDPE
2	Control valve stations	7	ea	$ 350.00	$ 2,450.00	2" PVC Flo-Wing
3	Gas flow meter	1	ea	$ 4,500.00	$ 4,500.00	FCI GF90 Mass Flow Meter
4	Electrical connection	1	ea	$ 6,500.00	$ 6,500.00	Connect power at Area 6 T
5	Trench excavation	78	cu yards	$ 12.00	$ 936.00	12" wide x 12" deep x 2,100
6	Non-perforated pipe/backfill	2,100	lft	$ 20.00	$ 42,000.00	4" HDPE
7	Disposal (soil)	117	ton	$ 89.00	$ 10,413.00	Worst case (cover material can be segregated from MSW)
8	Carsonite stakes	22	ea	$ 25.00	$ 550.00	50' spacing
9	System startup and testing	1	ls	$ 5,000.00	$ 5,000.00	
10	Vent Decommissioning	1	ls	$ 5,000.00	$ 5,000.00	
	Subtotal				$ 116,234.00	
	Tax (8.9%)				$ 10,344.83	
	Contingency (30%)				$ 37,973.65	
	Engineering and Construction Phase Services (25%)				$ 31,644.71	
	Total				$ 196,197.18	

OPINION OF POSSIBLE COST
Sudbury Landfill Remedial Investigation Feasibility Study
City of Walla Walla, Washington

ADMINISTRATION & OVERSIGHT COSTS	QUANTITY	UNIT	UNIT COST	TOTAL COST(a)
Engineering Design Report, Bidding	1	LS	$200,000	$200,000
Construction Close-out Report	1	LS	$50,000	$50,000
Annual Agency Interaction	10	YR	$5,000	$50,000
Ecology Oversight	10	YR	$5,000	$50,000
Assistance with 5-Year Review	2	YR	$25,000	$50,000
TOTAL ADMINISTRATION COSTS				**$400,000**
LONG-TERM COSTS				
Groundwater Monitoring(b)	10	YR	$50,500	$505,000
Off-site Lease Agreements	10	YR	$2,000	$20,000
Off-site Monitoring Well Decommissioning(c)	6	EA	$2,000	$12,000
LFG Monitoring(d)	10	YR	$17,000	$170,000
Operation and Maintenance(e)	10	YR	$5,000	$50,000
TOTAL LONG-TERM MONITORING COST				**$757,000**

Notes:
(a) All cost values are estimates and should not be interpreted as final construction or project costs.
(b) Assumes sampling of 2 wells quarterly for VOCs, 6 wells annually for Appendix III parameters, quarterly and annual reports.
(c) Assumes systems evaluation and minor maintenance.
(d) LFG monitoring of perimeter gas wells quarterly, plus quarterly and annual reports.
(e) Assumes systems evaluation and minor maintenance.
CAP = Cleanup Action Plan
EA = Each
LS = Lump sum
FT = Foot
O&M = Operations and Maintenance
YR = Year

APPENDIX J

Proposed Draft Cleanup Action Plan Text

Schwyn Environmental Services

DISCLAIMER FOR DRAFT CLEANUP ACTION TEXT

The following text and figures are provided by the City for Ecology's use in the preparation of a draft cleanup action plan. The remedial action is based on the preferred alternative described in the RI/FS. Ecology is responsible for the cleanup action selection and the preparation of the cleanup action plan and is neither bound nor required to use any portion of this text.

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TABLE OF CONTENTS

FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AO	Agreed Order No. 8456
ARARs	Applicable or relevant and appropriate requirements
bgl	Below ground level
City	City of Walla Walla, Washington
CAP	Cleanup action plan
CFR	Code of Federal Regulations
COC	Constituent of concern
DCAP	Draft cleanup action plan
Ecology	Washington State Department of Ecology
Freon 11	Trichlorofluoromethane
Freon 12	Dichlorodifluoromethane
FS	Feasibility Study
HHWF	Household Hazardous Waste Facility
LFG	Landfill gas
µg/L	Micrograms per liter
MCL	Maximum contaminant level
MSW	Municipal solid waste
MSWLF	Municipal solid waste landfill
MTCA	Washington State Model Toxics Control Act
PCE	Tetrachloroethene
RCW	Revised Code of Washington
RAO	Remedial action objective
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
Site	Sudbury Road Landfill
TCE	Trichloroethene
TDS	Total dissolved solids
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound
WAC	Washington Administrative Code
WSP	Washington State Penitentiary

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1.0 INTRODUCTION

This Draft Cleanup Action Plan (DCAP) defines cleanup standards and describes a cleanup action for the City of Walla Walla, Washington (City) Sudbury Road Landfill (Site). The Site is an operating municipal solid waste (MSW) landfill generally located at 414 Sudbury Road (now Landfill Road), Walla Walla, Washington (Figure 1). The DCAP has been prepared pursuant to the requirements of the Model Toxics Control Cleanup Act (MTCA) administered by the Washington State Department of Ecology (Ecology) under Chapter 173-340 of the Washington Administrative Code (WAC). This DCAP provides a general description of the cleanup action at the Site and sets forth requirements that the cleanup must meet to achieve the cleanup standards and cleanup action objectives for the Site. The selected cleanup action was identified as the preferred cleanup action for the Site in the *Remedial Investigation/Feasibility Study* [Schwyn Environmental Services, LLC (Schwyn), 2014]

The selected cleanup action is intended to fulfill the requirements of the MTCA. As described in WAC 173-340-380(1)(a) this DCAP includes:

- A general description of the selected cleanup action developed in accordance with WAC 173-340-350 through 173-340-390.
- A summary of the rationale for selecting the proposed alternative.
- A brief summary of other cleanup action alternatives evaluated in the remedial investigation/feasibility study (RI/FS).
- Cleanup standards for each hazardous substance and for each medium of concern at the site.
- The schedule for implementation of the cleanup action plan.
- Institutional controls required as part of the cleanup action.
- Applicable state and federal laws for the cleanup action.
- A preliminary determination by the department that the cleanup action will comply with WAC 173-340-360.
- Where the cleanup action involves on-site containment, specification of the types, levels, and amounts of hazardous substances remaining on site and the measures that will be used to prevent migration and contact with those substances.

1.1 ADMINISTRATIVE DOCUMENTATION

Documents used to develop this DCAP and the decisions contained herein are contained in Ecology's files. The administrative record for this Site is on file and available for public review by appointment at Ecology's Eastern Regional Office, located at 4601 N. Monroe, Spokane, Washington 99205-1295. Documents previously available for public comment are also available at the Walla Walla Public Library. The following documents were used to develop the cleanup action:

- Ecology, 2007. *Washington Administrative Code*. Chapter 173-340, Model Toxics Control Act Cleanup Regulation. Compiled by Ecology's Toxics Cleanup Program. Publication No. 94-06. November.
- Ecology, 1993. *Washington Administrative Code*. Chapter 173-351, Criteria for Municipal Solid Waste Landfills. October.
- J-U-B Engineers, Inc. 2010. *Specifications and Plans, Area 6 Closure, Sudbury Road Landfill*. January.
- Schwyn, 2014. *Remedial Investigation/Feasibility Study, Sudbury Road Landfill, Walla Walla, Washington*. September.

2.0 SUMMARY OF SITE CONDITIONS AND AFFECTED MEDIA

2.1 SITE DESCRIPTION AND SETTING

2.1.1 SITE LOCATION

The Sudbury Road Landfill is generally located at 414 Landfill Road (formerly Sudbury Road), Walla Walla, Washington 99362, about 4 miles west of the city of Walla Walla and 0.25 mile north of Highway 12 (Figure 1). The landfill itself covers approximately 125 acres and is composed of seven active and former disposal areas (Areas 1 through 7). The landfill is located within the western portion of an 828.86-acre City-owned parcel of land that is zoned and used for various waste management purposes (Figure 2). The landfill is located in rural southeastern Washington and entirely surrounded by large expanses of rolling hills used for dry-land wheat farming.

2.1.2 LOCAL POPULATIONS

The Washington State Penitentiary (WSP) and its inmate population are located immediately east of the Site property boundary and more than 1.2 miles east of the landfill itself. Groundwater under the WSP property is hydraulically upgradient of the Site. The WSP is a known hazardous waste site with documented releases of tetrachloroethene (PCE) to groundwater. The closest rural residential populations are located approximately 2,000 feet or more south of the landfill.

Four residential properties located northwest, west, and southwest of the landfill maintain their own domestic wells for water supply (Figure 2) and are, in general, hydraulically downgradient of the landfill:

- The Camp well is located approximately 0.75 mile northwest of the landfill. Low concentrations of PCE [up to 0.88 micrograms per liter (µg/L)], have been detected in groundwater samples collected from the Camp Well.
- The Small well is located approximately 0.75 mile west of the landfill. Low concentrations of volatile organic compounds (VOCs), including chloroform (up to 0.67 µg/L), PCE (up to 1.5 µg/L), and trichloroethene (TCE; up to 0.62 µg/L) have been detected in groundwater samples collected from the Small well.
- The Kinman well is located approximately 1.5 mile west of the landfill. VOCs have not been detected in groundwater samples collected from the Kinman well.
- Two wells are located on the Schmidt property, which is located approximately 1.5 mile southwest of the landfill. One well is 122 feet deep and designated for domestic purposes. The other is 780 feet deep, constructed in basalt, and designated for irrigation purposes. VOCs have not been detected in groundwater samples collected from the Schmidt well that is used for domestic purposes, and the deep basalt well was not sampled for the RI.

2.1.3 SITE GEOLOGY

The Site lies on the northern flank of the Walla Walla Valley. The subsurface geology beneath the landfill consists of (from upper to lower) Palouse silt; reworked lacustrine silt and clay of the Touchet beds; interbedded alluvial gravels in a clayey, silty, or sandy matrix, informally termed the "old gravel and clay"; and Columbia River basalt. The unconsolidated to semi-consolidated deposits overlying the Columbia River basalts may be 600 feet or more in thickness.

Vadose zone soils in the landfill area consist of silt, clayey silt, and fine sandy silt, which are interpreted to be soils of the Palouse Formation and the Touchet beds. These silty soils exhibit laboratory permeabilities in the range of 10^{-6} to 10^{-5} centimeters per second. Underlying the silty soils is a unit consisting of consolidated to semi-consolidated, poorly-graded gravel, silty gravel, and silt, which are interpreted to correlate with the “old gravel and clay” unit.

2.1.4 HYDROGEOLOGY

Groundwater beneath the Site is first encountered at depths from approximately 30 to 87 feet below ground level (bgl) in the lower silt horizon of the Touchet beds and/or the underlying alluvial gravel aquifer. The inferred groundwater flow direction is to the west and southwest, with an approximate horizontal gradient of 0.004 feet per foot beneath the landfill. The calculated groundwater velocity is about 190 feet/year. The groundwater levels in the vicinity of the landfill have been declining, and since 1997, the water level in MW-12 has declined as much as 10 feet.

A second, more regional, deep aquifer is present in the underlying Columbia River basalts. Information from the driller's water well reports, within the vicinity of the Site, indicated that the basalt aquifer had a potentiometric surface in the range of 150 to 200 feet bgl and a positive upward gradient (EMCON 1995).

2.2 LANDFILL AND GROUNDWATER MONITORING HISTORY

The Sudbury Road Landfill is currently operating in accordance with the standards of Chapter 173-351 WAC, Criteria for Municipal Solid Waste Landfills (Ecology 1993) and a Municipal Solid Waste Landfill (MSWLF) Permit issued by the Walla Walla County Health Department (WWCHD). The initial Conforming Permit for the landfill was issued on June 27, 1977, and news publications announced that the “New City Landfill on Sudbury Road” was opened to the public on July 10, 1978 (*Walla Walla Union Bulletin* 1978). Municipal solid waste (MSW), asbestos waste, and medical waste have been placed on the landfill property since that time. Hazardous wastes have never knowingly been accepted at the landfill. MSW has been placed in five separate areas, commonly referred to as Areas 1, 2, 5, 6, and 7. Asbestos waste has been disposed of in two separate cells (4a and 4). A single medical waste cell has been used. In 2006, a temporary composting facility was constructed above the former asbestos and medical waste cells, and a permanent facility that complied with Chapter 173-350 WAC was constructed and opened in 2009. The approximate limits of the refuse disposal areas are shown on Figure 2. The practices used to fill the waste disposal areas are fully described in the RI/FS Report (Schwyn 2014).

Groundwater monitoring has been conducted on a quarterly schedule since July 1978. In July 2001, monitoring well MW-15 was installed in the northwest corner of the landfill to monitor the groundwater quality of the uppermost aquifer immediately downgradient of Area 5. VOCs, including TCE, PCE, trichlorofluoromethane (Freon 11), dichlorodifluoromethane (Freon 12), vinyl chloride, chloroethane, 1,1-dichloroethane, and cis-1,2-dichloroethane, and inorganic constituents, including calcium, sodium, bicarbonate/alkalinity, chloride, and total dissolved solids (TDS), were detected at higher concentrations in MW-15 relative to the concentrations in other Site wells and the area-wide background concentrations of PCE, TCE, and chloroform. Concentrations of all of these constituents in MW-15 except chloride and TDS have exceeded the site-specific Chapter 173-351 WAC compliance levels (prediction intervals) on at least two consecutive occasions. These exceedances prompted further investigation and remedial actions at the Site.

2.3 SUMMARY OF PREVIOUS INVESTIGATIONS AND CLEANUP ACTIONS

2.3.1 ASSESSMENT MONITORING AND DOMESTIC WELL SAMPLING

In September 2002, an assessment monitoring program was initiated in accordance with WAC 173-351-440. Assessment monitoring increases the number of constituents tested from the number routinely tested for during detection monitoring. The tests resulted in only one additional constituent found to be present at concentrations greater than background concentrations – Freon 12. Freon 12 was subsequently added to the routine monitoring program for the landfill.

Groundwater monitoring for VOCs in three domestic wells (Small, Camp, and Kinman) was initiated in 2002. The wells are located hydraulically downgradient, approximately 0.75 to 1.5 mile west and northwest of the landfill. Low concentrations of chloroform, PCE, and TCE were detected in groundwater samples collected from the Small well, and low levels of PCE were detected in groundwater samples collected from the Camp Well. VOCs were not reported in the Kinman well. Periodic sampling continued into 2013. A review of VOC concentrations in the domestic wells by the Washington State Department of Health in 2012 (WDOH 2012) indicated that the concentrations were safe for individuals who use the groundwater for drinking, showering, bathing, and cooking.

2.3.2 INDEPENDENT REMEDIAL INVESTIGATION

Preliminary remedial studies were initiated in 2004 to characterize the MW-15 contamination and fulfill the requirements of WAC 173-351-440(6) (WAC was revised in 2012). A Work Plan was prepared to guide the RI process (LAI 2004). An Independent RI was initiated in 2005 in general accordance with the 2004 RI Work Plan; however, the investigation was stalled in 2006 before all of the tasks had been completed because of a number of factors, including available funding and off-Site access.

2.3.3 Site MTCA Listing and Agreed Order

In January 2010, Ecology submitted an Early Notice Letter to the City. The Early Notice Letter indicated that Ecology was aware that a release of hazardous substances had occurred at the Sudbury Road Landfill, and that the site would be added to the database of known or suspected contaminated sites, with further remedial actions to be taken in accordance with the MTCA. Agreed Order No. 8456 (AO) was subsequently initiated between the City and Ecology and became effective May 26, 2011. The AO required the City to conduct a RI/FS to investigate the nature and extent of contaminants of concern in groundwater associated with the Sudbury Road Landfill.

2.3.4 Interim Actions

Interim actions were initiated at the Site in 2010 consistent with the Revised Interim Action Plan (Schwyn 2010). The interim actions included:

- Area 6 closure design and construction; and
- Design and construction of stormwater controls on the north side of Area 5 and Area 6.

The Area 6 closure consisted of the design and construction of (1) an evapotranspiration (ET) cover that met the requirements of WAC 173-351-500(1)(b) for arid areas (WAC was revised in 2012), (2) a landfill gas (LFG) collector and control system, and (3) a stormwater collector and conveyance system.

Construction of stormwater drainage control located on the north side of Area 5 and 6 (commonly referred to as the north drainage ditch) was needed to prevent stormwater from infiltrating into Area 5 and 6 refuse. The interim action was designed to promote stormwater flow through the valley adjacent to Area 5 and 6 and minimize pooling. The engineering design features of the interim action included (1) a sedimentation basin, (2) filling of depressions in the valley bottom and grading to direct stormwater flow to the west, (3) installation of a culvert under the western perimeter roadway to allow the stormwater to flow off-Site, and (4) installation of erosion control mats in the stormwater channel.

2.3.5 Remedial Investigation

In 2012 and 2013, a RI was conducted in accordance with the AO. The scope of work was detailed in the RI Work Plan (Schwyn 2011). Initial field studies were conducted in April and May 2012, and additional field studies were conducted in August 2012 to achieve the Work Plan objectives. The methods and findings of the RI were presented in the Final Draft RI/FS Report (Schwyn 2014). The RI/FS Report was finalized after a public comment period. The following sections are based on the findings of the RI/FS.

2.4 SUSPECTED SOURCES OF HAZARDOUS SUBSTANCES

Most of the waste disposed of at the Site is MSW transported to the Site by commercial and public garbage disposal service contractors from the City, as well as Walla Walla and Columbia Counties, which are predominantly rural counties with an agricultural economic base and little manufacturing or heavy industry. Permitted waste disposal at the Site has been limited to MSW, asbestos, and medical wastes. The Site has also provided special areas for animal carcass disposal. Hazardous substances have never knowingly been allowed into the landfill based on the available information.

Based on the RI data, the suspected sources of hazardous substances found in groundwater at the landfill include the following

- LFG;
- Direct disposal of MSW in groundwater; and
- Leachate.

2.4.1 LANDFILL GAS

During the RI, LFG was observed in all of the MSW disposal areas. Laboratory analysis of the LFG indicated the presence of VOCs at concentrations that could impact groundwater quality; if not controlled, the LFG has the potential to transfer contaminants to underlying groundwater by means of chemical equilibrium processes. Area 1, 2, and 5 do not have LFG control systems in place. An evaluation of the LFG extraction system in Area 6 indicates that the system is effectively controlling LFG in Area 6.

2.4.2 MUNICIPAL SOLID WASTE IN CONTACT WITH GROUNDWATER

Direct disposal of MSW in groundwater appears to be limited to a small area located within the northern Area 5 disposal trench. VOC and inorganic constituent concentrations in groundwater do not increase significantly downgradient of the MSW in groundwater, and therefore the small area of deposition below the groundwater table is not considered a significant contaminant source. MSW occurrence below the water table was observed only in one soil boring (SB-20); however, wet soils were observed near the base of the MSW in several other borings located along the northern Area 5 disposal trench. The declining elevation of the regional groundwater table is beneficially providing greater separation of the MSW and groundwater with time and, therefore, should provide better protection from the migration of VOCs to groundwater.

2.4.3 LEACHATE

Leachate could be a contributing source of hazardous substances as a result of the following:

- Infiltration of precipitation and stormwater into MSW due to insufficient soil cover. Thin landfill cover soils were observed over most of Area 2 and portions of Area 5.

- Infiltration of stormwater into, or near the MSW, that may saturate or wet the MSW, allowing leachate to percolate downward. There are three areas of concern:
  - An unlined stormwater drainage channel that extends along the north side of Area 5 approximately 30 to 40 feet from where MSW is buried.
  - Stormwater run-on observed in the southwestern portion of Area 5
  - Boggy areas and erosion channels observed in the southwestern portion of the Area 5 cover soil.
- Improper grading of soil cover, which promotes surface water retention and infiltration. Two linear road cuts on the north slope of Area 5 and erosion channels and boggy areas on the west side of Area 5 likely impede stormwater flow and potentially promote infiltration.
- VOCs detected in soil samples collected beneath the MSW in Areas 1, 2, and 5. The VOCs in soil may be an indicator of downward leachate migration or an indicator of LFG impact on soil, or a combination of both.

2.5 CONTAMINATED MEDIA

2.5.1 SOIL

Soil is not a medium in need of cleanup at the Site. No human exposure is possible because contaminated soils are found beneath the permitted landfill cells at depths greater than 15 feet bgl, the areas of contamination are capped, and institutional controls [such as those described in WAC 173-340-440(1)(a)(b)(c) and (d)] are in effect for the landfill as a requirement of the MSWLF Permit.

2.5.2 GROUNDWATER

Based on the RI findings, the environmental medium that requires cleanup is groundwater. Exceedances of the groundwater cleanup levels for PCE and vinyl chloride have been detected at well MW-15, which is located at the downgradient property boundary. Average concentrations of PCE detected during the RI are shown on Figure 3. Vinyl chloride was only detected in MW-15. Off-property migration of contaminants in groundwater has occurred; however, there were not exceedances of the cleanup levels in samples from the off-Site monitoring and domestic wells nearest to MW-15.

2.5.3 LANDFILL GAS

LFG is generated during the decomposition of refuse by anaerobic bacteria and the release of VOCs from the disposed waste products. The LFG studies conducted during the RI indicate that while off-Site methane migration has not occurred, the VOCs found in LFG at Areas 1 and 5 are at high enough concentrations that controls need to be put in place. Area 6 has an LFG control system that is effectively capturing LFG (active since 2010); Areas 1, 2, and 5 do not have LFG control systems. Investigation of soil vapor intrusion into the Household Hazardous Waste Facility (HHWF) did not indicate LFG was at concentrations that posed a risk to workers or customers of the Site at the HHWF.

2.5.4 STORMWATER

Stormwater is not a potentially contaminated medium because there are no pathways for stormwater at the Site to encounter hazardous materials before running off-Site.

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3.0 CLEANUP STANDARDS

The MTCA cleanup regulations provide that a cleanup action must comply with the site-specific cleanup standards described in WAC 173-340-700, which include cleanup levels for hazardous substances at the Site, the locations or points of compliance where the cleanup levels must be met, and applicable or relevant and appropriate requirements (ARARs) based on federal and state laws.

3.1 CONSTITUENTS OF CONCERN

A large number of environmental samples have been collected at the Site. The existing data set was examined for the media of concern. The environmental media sampled at the Site were soil, LFG, and groundwater. Soil and LFG are not considered media for which cleanup levels need to be established because the affected soil lies under capped area and LFG is an accepted and managed element of operating landfills with little potential for human exposure if controlled. Groundwater does show impacts beneath and downgradient of the landfill and therefore, cleanup levels must be established for groundwater.

3.1.1 CHEMICALS IDENTIFIED IN GROUNDWATER

PCE and vinyl chloride were the only chemicals with concentrations that exceeded their respective federal and state screening levels and are the COCs at the Site. The most stringent screening levels for PCE and vinyl chloride in groundwater are listed in the following table.

Constituent of Concern	Screening Level (µg/L)	Maximum Detected Concentration (µg/L)
Tetrachloroethene	5	6.8
Vinyl chloride	0.029	1.2

µg/L = micrograms per liter

The highest concentrations were detected in monitoring well MW-15, with vinyl chloride detected in MW-15 only. The maximum and average concentrations of PCE in the groundwater samples collected from the Site wells were less than the screening levels in all wells except MW-15.

3.2 GROUNDWATER CLEANUP LEVELS

There is a pathway of exposure for groundwater downgradient of the landfill, especially the residential properties who currently use wells for domestic purposes. Therefore, groundwater cleanup levels at the Site were established on the basis of the protection of human health related to drinking water as the highest beneficial use.

MTCA Method B groundwater cleanup levels were developed for the COCs; PCE and vinyl chloride. The cleanup levels were developed as follows:

- The cleanup level for PCE is based on the most stringent of the ARARs and is, therefore, equal to the screening level of 5 µg/L.
- The cleanup level for vinyl chloride was adjusted upward from the screening level of 0.029 µg/L to 0.29 µg/L. In accordance with WAC 173-340-720, groundwater cleanup levels for individual hazardous substances may be adjusted provided that in making these adjustments, (1) the cleanup level is at least as stringent as the most stringent concentration established under applicable state and federal laws [in this case, Maximum Contaminant Levels (MCLs)], and the cleanup level is at least as stringent as the concentrations that protect human health. A concentration is sufficiently protective if the hazard index does not exceed 1 and the total excess cancer risk does not exceed 1 in 100,000 (1×10^{-5}).

The adjusted cleanup level for vinyl chloride is provided in the following table, along with the associated risk. The table indicates that this value, even with the upward adjustment, meets the intent of WAC 173-340-720. The value is less than the state and federal MCL of 2 µg/L and meets the risk requirements with a total excess cancer risk of 1.0×10^{-5} and a hazard index of 0.11 (including the risk posed by PCE).

Constituent of Concern	Cleanup Level (µg/L)	Associated Risk Values	
		Excess Cancer Risk	**Hazard Quotient**
Tetrachloroethene	5.0	2.3×10^{-7}	0.1
Vinyl chloride	0.29	9.9×10^{-6}	0.01
	Total Risk	1.0×10^{-5}	0.11

µg/L = micrograms per liter

3.3 POINTS OF COMPLIANCE

Points of compliance (locations where the cleanup levels must be achieved) are established for each affected medium at the Site. Groundwater is the only identified environmental medium of concern; therefore, the points of compliance are identified for groundwater only.

The standard point of compliance for groundwater under MTCA is “throughout the site from the uppermost level of the saturated zone extending vertically to the lowest depth which could potentially be affected by the site” [WAC 173-340-720(8)(b)]. However, for landfills, a conditional point of compliance is typically used that sets the point of compliance at the downgradient edge of the waste cells, or the landfill boundary, whichever is closer [WAC 173-340-720(8)(c)]. For this Site, the downgradient boundary coincides with the western edge of Area 5; therefore, a conditional point of compliance is set at the western property boundary. Compliance may be monitored by a series of monitoring wells located as close as practical to this boundary; from north to south, the wells are MW-3, MW-15D, MW-15, MW-18, MW-16, and MW-14B.

3.4 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

In accordance with MTCA, all cleanup actions must comply with applicable state and federal laws [WAC 173-340-710(1)]. MTCA defines applicable state and federal laws to include legally applicable requirements and those requirements Ecology determines, based on consideration of the criteria in WAC 173-340-710(4), are relevant and appropriate requirements. Collectively, these requirements are referred to as ARARs. The potential ARARs for this project include the following:

- MTCA Cleanup Regulation (Chapter 173-340 WAC);
- Minimum Functional Standards for Solid Waste Handling (Chapter 173-304, WAC);
- Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC);
- Solid Waste Handling Standards (Chapter 173-350 WAC);
- Dangerous Waste Regulations (Chapter 173-303 WAC);
- State Environmental Policy Act (SEPA) Rules (Chapter 197-11 WAC);
- Safe Drinking Water Act, Primary Drinking Water Regulations [Code of Federal Regulations Title 40, Part 141 (40 CFR 141)]
- State Water Code and Water Rights (Chapters 173-150 and 173-154 WAC);
- Underground Injection Control Program (Chapter 173-218 WAC);
- State Water Pollution Control Act (Chapter 90.48 RCW);
- Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 RCW);
- Washington Clean Air Act (Chapter 70.94 WAC);
- General Regulations for Air Pollution Sources (Chapter 173-400 WAC);
- Operating Permit Regulation (Chapter 173-401 WAC);
- Occupational Safety and Health Act (29 CFR 1910.120);
- Washington Industrial Safety and Health Act (Chapter 49.17 RCW); and
- Accreditation of Environmental Laboratories (Chapter 173-50 WAC).

4.0 SELECTED CLEANUP ACTION AND JUSTIFICATION FOR SELECTION

The cleanup action described in this section was selected based on the evaluation of various alternatives presented in the RI/FS Report (Schwyn 2014). The selected cleanup action complies with the MTCA requirements in WAC 173-340-360. The cleanup action will include active remediation components, compliance monitoring and institutional controls, all of which are described below.

4.1 CLEANUP ACTION ALTERNATIVES CONSIDERED

A range of cleanup action alternatives were considered during the RI/FS process. Initially, candidate remedial technologies applicable for the Site were identified and screened in the remedial action (RA) focusing study (Schwyn 2013a). A list of potential cleanup action technologies was compiled on the basis of the nature and sources of the COCs identified for the Site, the environmental medium of concern (groundwater), and the potential exposure pathway (drinking water). Potentially applicable cleanup action technologies were then screened against the criteria described in WAC 173-340-350(8)(b) and WAC 173-340-360(2)(a)(b) and a condensed set of remedial technologies was identified for detailed evaluation in the FS.

Based on the preliminary screening of technologies in the RA Focusing Study, the following technologies, or combination of technologies, were retained for detailed evaluation in the FS:

- No or limited actions
  - No action
  - Limited action:
    - Institutional controls
    - Long-term monitoring
- In-situ biological, chemical, and physical treatment:
  - Monitored natural attenuation
- Hydraulic containment: groundwater extraction with ex-situ treatment by one of the following methods:
  - Carbon adsorption
  - Evaporation
  - Sprinkler irrigation
- Source elimination or controls:
  - LFG extraction and treatment
  - Leachate controls:
    - Geosynthetic/multimedia cap
    - Low-permeability or evapotranspiration soil cover
    - Manipulation and/or reconstruction of existing soil cover
  - Stormwater controls:
    - Surface regrading
    - Stormwater channel construction
    - Run-on prevention.

In-situ biological, chemical, and physical treatment and hydraulic containment were evaluated in the FS and were eliminated because COCs above the cleanup levels have not been detected in the off-Site monitoring wells. Limited actions, including institutional controls and long-term monitoring were retained and coupled with all engineering control technologies evaluated to fulfil the MTCA expectations for containment sites identified in WAC 173-340-740(6)(f).

4.2 SELECTED CLEANUP ACTION

The selected cleanup action for the Site consists of improved capping of several solid waste cells, capture and destruction of LFG, and controls on stormwater to prevent leachate generation. It also includes provisions for long-term monitoring and institutional controls.

The MTCA defines specific requirements for a selected remedy to be protective of human health and the environment and identifies criteria that must be met by each alternative. In addition, landfill regulations guide the selection of other requirements that must be satisfied for a landfill to be closed in a fashion that reduces or prevents the release of solid waste constituents, leachate, and LFG to the ground, groundwater, surface water, and the atmosphere. The regulations also require that a landfill continue operation and maintenance of the selected remedy and ongoing monitoring of the various media at the landfill.

The components of the selected cleanup action for the Site consist of:

- Landfill cap improvement using an ET cover over Areas 2 and 5, including grading design
- Stormwater controls:
  - Cast-in-place concrete for the north drainage ditch;
  - Erosion control berm for Area 5 runoff; and
  - Diversion of run-on from the southwest side of Area 5.
- Active LFG extraction and destruction in Areas 1, 2, and 5.
- Long-term monitoring of:
  - Groundwater;
  - LFG;
  - Landfill cap; and
  - Stormwater controls.
- Institutional controls.

The components of the selected cleanup action are discussed in Section 5. A summary of how the selected cleanup action meets the MTCA cleanup action requirements is included in the following subsections.

4.3 ATTAINMENT OF REMEDIAL ACTION OBJECTIVES

The remedy was evaluated for its compliance with MTCA cleanup goals, including those for landfill remedies. As described in the following subsections, the selected cleanup action meets the requirements of MTCA and achieves the remedial action objectives (RAOs) established for the Site. Protection of human health and the environment at the Site can be achieved through the fulfillment of the following RAOs:

- Protect groundwater resources by eliminating, reducing, or controlling the suspected sources of COCs (specifically PCE and vinyl chloride) detected in groundwater at the landfill.
- Prevent direct contact with landfill contents to protect human and terrestrial receptors;
- Control of stormwater runoff and run-on, and erosion;
- Control of contaminant leaching to groundwater by minimizing stormwater infiltration at the landfill; and
- Control and destruction of LFG.

4.3.1 COMPLIANCE WITH MTCA REQUIREMENTS

Certain minimum requirements must be met for a selected remedy to comply with the requirements of MTCA. This section discusses how the selected cleanup action meets these requirements.

4.3.1.1 Threshold Requirements

The threshold criteria identified in WAC 173-340-360(2)(a) that must be met by the selected remedy and the reasons that the selected cleanup action meets them are as follows:

- **Protect human health and the environment.** The landfill cap will prevent direct contact with solid waste by people, plants, and terrestrial receptors. The landfill cap and stormwater controls will decrease the amount of generated leachate by limiting the infiltration of stormwater. The stormwater controls will ensure that stormwater will not come in contact with solid waste. The LFG extraction well systems for Areas 1, 2, and 5 will collect VOCs entrained in the LFG and route them through the flare system for destruction, limiting the source of VOCs and minimizing the LFG to groundwater cross-media-contaminant pathway. Source control actions, such as the LFG system, are expected to further improve groundwater conditions. The monitoring and maintenance requirements combined with the environmental covenant will ensure that the cap, stormwater controls and LFG system are maintained over time. The selected cleanup action protects human health and the environment and meets the expectations for the protection of terrestrial receptors in Chapter 173-340 WAC.
- **Comply with cleanup standards (WAC 173-340-700 through 173-340-760).** The landfill cap will allow soil with COC concentrations greater than the cleanup levels to be left in place as long as the requirements for a containment remedy are met. The COC concentrations in groundwater will comply with the MTCA Method B cleanup levels at the point of compliance at the edge of the waste. All COC concentrations in groundwater are already in compliance, with the exception of PCE and vinyl chloride at well MW-15. The concentrations in downgradient off-Site groundwater currently meet the cleanup levels and will be monitored routinely to ensure that the groundwater conditions are improving over time and the COCs are not migrating off-site. The LFG controls will control cross-media contamination of groundwater by VOCs. The presence of LFG will continue indefinitely as long a methane is being produced, and LFG control will be integrated into the overall management of the landfill operations.

- **Comply with applicable local, state, and federal laws (WAC 173-340-710).** The designed landfill cap, in conjunction with the proposed stormwater infrastructure, will ensure compliance with the requirements of WAC 173-340-710(7)(c). The LFG control requirements apply to the specific landfill regulations, as outlined in Section 6.3 (ARARs). The other components of the selected remedial action are consistent with the applicable regulations.
- **Provide for compliance monitoring (WAC 173-340-410 and WAC 173-340-720 through 173-340-760).** Compliance monitoring of LFG and groundwater will be conducted consistent with an agency approved compliance monitoring plan.

WAC 173-340-360(2)(b) specifies three additional criteria that must be satisfied by the selected remedial action. The following list indicates how the remedial action satisfies the criteria:

- **Use permanent solutions to the maximum extent practicable.** The selected cleanup action is permanent to the maximum extent practicable for closed solid waste cells. The landfill cap will prevent direct contact by potential receptors and stormwater controls will limit infiltration. Monitoring and maintenance requirements, along with an environmental covenant, will ensure that the containment remedy will remain protective over time.
- **Provide for a reasonable restoration timeframe.** An ET cover is already in place in Area 6 and is functioning as designed. The ET cover for Areas 2 and 5 will be constructed within 1 to 2 years after Ecology approves the design, a reasonable timeframe. The implementation of the LFG control systems will occur concurrently with the construction of the landfill cap. A significant reduction in COC concentrations in groundwater is expected within several months after the LFG system startup. The COC concentrations in groundwater are expected to be in compliance within a reasonable timeframe, likely within 6.2 years or less after the LFG collection efforts begin.
- **Consider public concerns (WAC 173-340-600).** A public comment period will be held to allow the public and parties affected by the cleanup action an opportunity to provide comment on this cleanup action plan. Public comments and concerns will be addressed in a responsiveness summary and incorporated as appropriate in the final cleanup action plan.

4.3.1.2 Requirements for Landfill Containment Systems

Several additional elements of WAC 173-340-740(6)(f) identify the requirements of a containment remedial action and allow soil and solid waste with concentrations greater than the soil cleanup levels to remain in place. The selected cleanup action meets these requirements in the following ways:

- **Institutional controls are in place.** An environmental covenant will be established to ensure that the components of the cleanup action, including the landfill cap, maintenance and monitoring of the LFG control systems, and groundwater monitoring, are implemented. The landfill is fenced, and maintenance and monitoring of the LFG control systems in Areas 1, 2, and 5 will be performed.
- **Compliance monitoring and periodic reviews are designed to ensure long-term integrity of the system.** Monitoring of the LFG control systems will be implemented and included in the Operations, Maintenance, and Monitoring Plans for the LFG control systems installed in Areas 1, 2, and 5. Likewise, groundwater will continue to be monitored

until it is fully in compliance with the cleanup levels, at which point groundwater monitoring will continue in accordance with the MSWLF Permit for the Site.

- **Types, levels, and amounts of hazardous substances remaining on-site and the description of the measures used to prevent migration and contact are specified in the CAP.** The material remaining within Areas 1, 2, and 5 is MSW. Measures to prevent migration of hazardous substances within the MSW off-Site and contact with the MSW consist of placement of cover over the waste, LFG extraction and destruction, and minimizing production of leachate through stormwater controls, along with institutional controls and compliance monitoring.

4.3.2 COMPLIANCE WITH ARARS

The selected cleanup action complies with the following chemical-, location-, and action-specific ARARs under WAC 173-340-710.

4.3.2.1 Chemical-specific ARARs

The selected cleanup action is predicted to attain concentration-based cleanup levels developed under MTCA for the COCs in groundwater at the Site. A 6 to 7 year restoration time-frame was identified in the RI/FS for attainment of COC in groundwater cleanup levels.

4.3.2.2 Location-specific ARARs

No location-specific ARARs that apply to the selected cleanup action have been identified.

4.3.2.3 Action-specific ARARs

Action-specific ARARs are requirements that define acceptable management practices and are usually specific to certain kinds of activities that occur or are specific to the technologies that are used during the implementation of cleanup actions. The selected cleanup action will comply with the requirements discussed in the following subsections.

Landfill Standards

The selected cleanup action will comply with the standards for landfill closure requirements as identified in Chapters 173-301, 173-304, or 173-351 WAC. Containment of landfill waste is relied on as the remedy for landfills, and, therefore, landfill capping (including stormwater controls) and LFG controls are the selected remedies to comply with the landfill standards and to address contaminated groundwater at the Site. Institutional controls will also be implemented to augment the engineering controls and to protect human health and the environment. Long-term monitoring will be performed to ensure that the components of the preferred remedy are operating as intended.

Federal, State, and Local Air Quality Protection Programs

Regulations promulgated under the federal Clean Air Act (United States Code, Title 42, Section 7401) and the Washington State Clean Air Act (Chapter 70.94 RCW) govern the release of airborne contaminants from point and nonpoint sources. These requirements apply to the Site because the selected cleanup action will extract and destroy LFG, which may require permitting. Additionally, any construction activities associated with the selected cleanup action will need to meet all federal, state, and local air quality requirements for controlling fugitive dust and other emissions.

Federal and State Worker Safety Regulations

The safety of workers implementing remedies at hazardous waste sites are covered by the following regulations:

- Health and Safety for Hazardous Waste Operations and Emergency Response (HAZWOPER), Chapter 296-62 WAC; and Health and Safety, 29 CFR 1901.120;
- Occupational Safety and Health Act; and
- Washington Industrial Safety and Health Act (WISHA), Chapter 296-62 WAC, Chapter 296-155 WAC, and Chapter 49.1 RCW.

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5.0 DESCRIPTION OF THE SELECTED CLEANUP ACTION

The general details for the selected cleanup action are presented below. Additional details will be provided in the Engineering Design Report, which will be prepared by the City of Walla Walla for Ecology review and approval prior to implementation of the selected cleanup action at the Site.

5.1 DESCRIPTION OF SELECTED CLEANUP ACTION

5.1.1 LANDFILL CAP

An ET cover will be constructed over Area 2 and Area 5.

An ET cover was the final cover selection for the Area 6 closure in 2010; therefore, several key aspects of the design have already been completed. As described in a January 2010 memorandum prepared by HWA (provided in RI/FS Report Appendix H), a 4.8-foot-thick layer of native soils loosely compacted in 24-inch lifts at 85 percent of maximum compaction was the design solution for the Area 6 cover. The top foot of the cover incorporated Class B biosolids from the Walla Walla Wastewater Treatment Plant as well as compost from the compost facility at the Site to create an organic topsoil layer in which dry land vegetation would thrive. Follow-up inspections indicate that the Area 6 cover is performing well. Therefore, the same ET cover design will be used at Areas 2 and 5.

To meet the requirements of the ET cover functionality and address overall site drainage, including potential infiltration via the road cuts on the north side of Area 5, a grading design will be prepared. The suitability of the existing Area 5 soil cover, required compaction (or loosening and scarification) efforts, and installation methodology will be described in the engineering design report. The source for soil to be used to complement the existing thin cover on Area 2 will also be identified in the Engineering Design Report.

5.1.2 STORMWATER CONTROLS

Stormwater controls are specifically needed on the north, west, and south sides of Area 5. The stormwater controls include improvement to the north drainage ditch channel, Area 5 stormwater runoff and to repair erosion features in the Area 5 cover, and surface elevation regrading to prevent stormwater run-on to Area 5. Regrading of Areas 2 and 5 will also be performed during the placement of the ET covers. The stormwater controls required for the north drainage ditch and Area 5 runoff and run-on are summarized in the following subsections.

5.1.2.1 North Drainage Ditch

A cast-in-place concrete channel was selected for the improvement of the north drainage ditch. A geomembrane will provide secondary protection underneath the concrete channel. The concrete cast-in-place channel will have a slope at 0.7% toward the west, which will promote a “scouring” velocity that is designed to flush sediments from the ditch flow line.

Although the ditch will be designed to be self-cleaning, the City may wish to occasionally remove sediment and wind-blown debris. Therefore, the cross-sectional shape of the ditch will be rectangular to allow the City’s compact rubber-tired skid steer to be driven within the ditch. The cast-in-place concrete channel design will include reinforced concrete and a pea gravel base to provide the structural support needed for the skid steer. The general design is shown on Figure 4.

The cast-in-place concrete channel will be designed to allow sheet runoff from Area 5 to enter into the ditch. The design will include a strip of geomembrane that is bolted to the top of the concrete channel and covered with an erosion control mat on the south side of the ditch to prevent undermining and rutting as the sheet flow enters the channel (Figure 4).

5.1.2.2 Area 5 Stormwater Run-off

An erosion control berm will be constructed to facilitate the movement of Area 5 surface drainage, address the rutting and soil erosion concerns on the southwest and west sides of Area 5, and impede run-on. The erosion control berm will consist of a V-shaped channel lined with an erosion control mat as shown on Figure 4. The erosion control berm will extend along the entire southern boundary and west side of Area 5 and sloped to convey stormwater runoff from Area 5 to the north drainage ditch, as shown on Figure 4. The total length of the berm will be about 1,500 feet, and it will have a maximum 4 percent slope.

5.1.2.3 Area 5 Stormwater Run-on

The selected alternative for run-on prevention at the southwest side of Area 5 includes the construction of an elevated berm north of the compost facility to prohibit stormwater generated south of Area 5 to flow north, and regrading the surface soil in the valley east of the compost facility to divert stormwater south and west onto the compost pad, and ultimately into the compost facility lagoon. The alternative requires the reconstruction of approximately 200 LF of the existing compost access road in order to raise the grade of the road and prevent runoff from flowing north. The general configuration is shown on Figure 4. The addition stormwater from a 25-year, 24-hour rainfall event diverted into the compost facility lagoon is calculated to cause a 2.8-inch rise in the water level within the lagoon, which the lagoon has capacity to handle in accordance with the surface impoundment standards of chapter 173-350 WAC.. Additionally, daily monitoring and the ability to pump water from the lagoon and use it in the compost process or move excess water to landfill leachate lagoons mitigates any effects that an anomalous storm event could have on pond sizing.

5.1.3 Landfill Gas Controls

LFG controls on Areas 1, 2, and 5 must prevent LFG from impacting groundwater. LFG controls will also protect human health from toxic gases, prevent explosion hazards, and ensure that LFG will not migrate off-site in the future. To date, monitoring has shown that LFG is present only within the boundaries of the Site and is not intruding into the HHWF.

The current LFG extraction and gas treatment system for Area 6 will be expanded to include Areas 1, 2 and 5. The existing flare is currently operating at approximately 45 percent flow capacity, leaving adequate capacity for the estimated additional LFG from Areas 1, 2, and 5. Two extraction wells will be installed in Area 1, one extraction well will be installed in Area 2, and seven extraction wells will be installed in Area 5. The extraction wells will be linked by a header system to the existing flare station for LFG destruction. Refer to Figure 5 for the locations of the proposed landfill gas extraction wells.

At Area 1, one extraction well will be located near GW-11 and a second extraction well will be installed approximately 140 feet northeast of GW-11. Considering the small size of Area 2, one extraction well that is centrally located in the MSW should effectively reduce the volume, toxicity, and mobility of LFG. The locations of the seven Area 5 extraction wells will be spaced with a radius of 150 feet, comparable to the spacing of the extraction wells in Area 6. The extraction wells will be screened throughout the depth of MSW in each area. During the extraction well installation the existing Area 5 gas vent will be decommissioned to prevent short-circuiting of the LFG to surface or intake of surface air. Vent decommissioning will be accomplished by filling the vent from bottom to top with concrete

5.2 COMPLIANCE MONITORING

Compliance monitoring will be conducted in accordance with WAC 173-340-410. Detailed requirements will be described in the Compliance Monitoring Plan which will be a part of the Engineering Design Report The following subsections describe the monitoring requirements for the landfill to ensure that the remedy is effective and provide long-term protection of human health and the environment.

5.2.1 Groundwater

The goal of groundwater monitoring is to confirm that the landfill remedy is performing adequately and that the engineering controls are working and to document that PCE and vinyl chloride concentrations in groundwater are stable or decreasing. Both on-site and downgradient off-Site groundwater will be monitored. The contaminant concentrations in downgradient off-Site groundwater currently meet the cleanup levels; therefore, the groundwater will be monitored to ensure that the conditions are stable or improving over time. On-site monitoring will be conducted to monitor changes in groundwater quality after implementation of the cleanup actions. Periodic monitoring for a broader spectrum of constituents other than VOCs will be conducted to ensure that changes in the environmental conditions do not cause release of other contaminants that could adversely affect groundwater.

Monitoring wells MW-11, MW-12b, MW-14b, and MW-15 are currently being sampled quarterly in accordance with the MSWLF Permit. The groundwater samples are analyzed for Appendix I and II detection monitoring constituents, per WAC 173-351-990, plus Freon 12, in accordance with Chapter 173-50 WAC. Specific details of the groundwater monitoring are included in the Revised Compliance Monitoring Plan (Schwyn 2013b). In addition to the routine landfill compliance sampling, groundwater samples will also be collected quarterly from downgradient off-Site monitoring wells MW-19 and MW-20 and annually from the Small and Camp wells for VOC analysis. Additionally, groundwater samples will be collected annually from MW-11, MW-14b, and MW-15 and analyzed for Appendix III parameters, per WAC 173-351-990.

The original groundwater monitoring plan and SAP for the Site was included in the Hydrogeologic Report (EMCON 1995), and the SAP was subsequently approved during the permitting process required by Chapter 175-351 WAC. Since the SAP approval, several permit modifications have been made (in 1999, 2001, 2007, 2012, and 2013) and approved by the WWCHD. Sampling, analysis, and quality assurance procedures will comply with the Compliance Monitoring Plan in effect at the time.

The groundwater monitoring results will be reported quarterly, with annual summary reports, and the findings will be reviewed at least every 5 years during the 5-year MTCA review process. Modifications to the monitoring locations, analyses, or frequency will be documented at that time. Long-term monitoring of off-site groundwater will occur for a minimum period of 5 years, or at least 2 years after the cleanup levels for groundwater are achieved.

5.2.2 LANDFILL GAS

Typically, LFG collector systems require two types of monitoring: operational and performance. The locations of the gas wells, the frequency of monitoring, and the specific monitoring requirements will be defined in an Operations, Maintenance, and Monitoring Plan to be included as part of the Engineering Design Report.

To optimize the control system, operational monitoring will be required during system startup. Ongoing monitoring will be required, based on the system response after full build-out, to ensure that the LFG control system is operating effectively.

Performance monitoring will be conducted in Area 1 (GW-11) and Area 5 (GW-5 and GW-6), and at the landfill perimeter using existing gas monitoring wells (GW-7S, GW-7D, GW-8, GW-9, GW-10, and GW-12). Performance of the control systems will be based on not exceeding the methane lower explosive limit at the Site boundary and diminishing VOC concentrations in groundwater monitoring wells located downgradient of Areas 1 and 5. LFG monitoring will occur for a minimum period of 5 years, or at least 2 years after the cleanup levels for groundwater are achieved. Mitigating actions associated with LFG control will also take current landfill regulations [WAC 173-351-200(4)] into account, requiring monitoring and compliance with gas control standards.

5.2.3 LANDFILL COVER

Annual landfill cover inspection, maintenance and repair procedures will be conducted to preserve the intended function of the ET covers. The following cover conditions will be observed and documented:

- Appearance and condition of the vegetation;
- Vegetation stress or death due to LFG;
- Deposition of eroded soil at the toe of steep slopes;
- Soil erosion;
- Rills or cracks in the cover;
- Changes in the surface slope and settlement of waste;
- Intrusion by humans or animals;
- Holes of any kind that allow surface runoff to enter the MSW directly;
- Wildlife trails created on the cover; and
- Damage by vehicles or maintenance machines.

Maintenance and repairs will be conducted on an as-needed basis to maintain the integrity of the ET covers. Long term care will continue for at least a 30-year period and until a registered professional engineer certifies to the WWCHD and Ecology that post closure activities are no longer needed. The inspections will likely be combined with the inspections already being conducted per the Post-Closure Plan for Area 6.

5.2.4 STORMWATER CONTROLS

Currently, stormwater monitoring is not conducted at the Site. Previously, the landfill operated under the Statewide General Industrial Stormwater Permit; however, follow-up inspections by Ecology confirmed the relative lack of runoff at the landfill, and the permit was consequentially terminated by Ecology.

Inspection of stormwater controls will be conducted on an annual schedule consistent with the inspection of the ET covers. Inspections will document disturbances that result in erosion, settlement, ponded stormwater, and blockage of ditch flow lines. Maintenance will be conducted on an as needed basis.

5.3 INSTITUTIONAL CONTROLS

In accordance with WAC 173-340-440, MTCA requires that institutional controls such as environmental covenants be imposed on contaminated property whenever the remedial action conducted will result in remaining hazardous substances in soil, groundwater, or other media at concentrations that exceed the applicable cleanup levels, or when Ecology determines that such controls "are required to assure the continued protection of human health and the environment or the integrity of the interim or cleanup action." An environmental covenant is also required on the deed to meet the requirements stipulated in WAC 173-351-500(1)(h). The covenant will describe with specificity the activity or limitations that prohibit uses and activities that:

- Threaten the integrity of any cover, waste containment, stormwater control, gas, leachate, public access control, or environmental monitoring systems;
- May interfere with the operation and maintenance, monitoring, or other measures necessary to ensure the integrity of the landfill and continued protection of human health and the environment; and
- May result in the release of solid waste constituents or otherwise exacerbate exposures.

The purpose of an environmental covenant is to prohibit activities that may interfere with a cleanup action, operation and maintenance, or monitoring or activities that may result in the release of a hazardous substance that was contained as a part of the cleanup action. Environmental covenants must be recorded in order to provide adjoining property owners, future purchasers, and tenants, as well as the general public, notice of the restrictions on use of the property. Property owners are also required to notify Ecology prior to any lease or sale of the restricted property.

To ensure that the components of the remedial action are operated efficiently and continue to be operated and maintained properly, an environmental covenant will be used as a legal measure to provide a clear record of the responsibilities and restrictions for the landfill. The environmental covenant will also ensure that the remedial action remains protective of human health and the environment and that the required landfill maintenance and monitoring are performed as necessary, in coordination with Ecology. The environmental covenant will be developed as part of the Consent Decree.

5.4 PERIODIC REVIEW

WAC 173-340-420 states at sites where a cleanup action requires an institutional control, a periodic review shall be completed no less frequently than every five years after the initiation of a cleanup action. Since the waste materials will remain on-site and institutional controls will be required, periodic reviews shall take place at this Site until the groundwater cleanup levels are achieved at the conditional point of compliance. Monitoring data shall be reviewed on a frequency of every five years to continue to assess the effectiveness of the groundwater contamination treatment.

When the groundwater cleanup levels are achieved at the conditional point of compliance, the acting jurisdictional health department will regulate routine closure and post-closure activities consistent with the role of the jurisdictional health department described in WAC 173-351-460.

5.5 IMPLEMENTATION SCHEDULE

The implementation schedule for the cleanup actions has not been fully determined at this time. There will be a 30-day public comment period for the DCAP, after which Ecology will consider public comments before issuing the Final CAP. Construction of the remedy is expected to occur during the spring and summer of 2016.

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6.0 REFERENCES

EMCON. 1995. *Hydrogeologic Report, Sudbury Road Landfill, Walla Walla County, Washington.* Prepared for the City of Walla Walla. June.

Schwyn Environmental Services, LLC (Schwyn). 2014. *Draft Final Remedial Investigation/Feasibility Study Report, Sudbury Road Landfill, Walla Walla, Washington*. Prepared for the City of Walla Walla. September 15.

———. 2013a. *Remedial Alternatives Focusing Study, Sudbury Road Landfill, Walla Walla, Washington.* Prepared for the City of Walla Walla. November 8.

———. 2013b. *Revised Compliance Monitoring Plan, City of Walla Walla Sudbury Road Landfill.* Letter to Kevin Tureman, R.S., Walla Walla County Health Department. June 28.

———. 2011. *Data Summary and Remedial Investigation Work Plan, Sudbury Road Landfill, Walla Walla, Washington.* With accompanying Sampling and Analysis Plan, Quality Assurance Project Plan, and Health and Safety Plan. Prepared by Schwyn for the City of Walla Walla. 28 December.

———. 2010. *Revised Interim Action Plan, Sudbury Road Remedial Action, Walla Walla, Washington.* Prepared by Schwyn for the City of Walla Walla, Solid Waste Division. March 31.

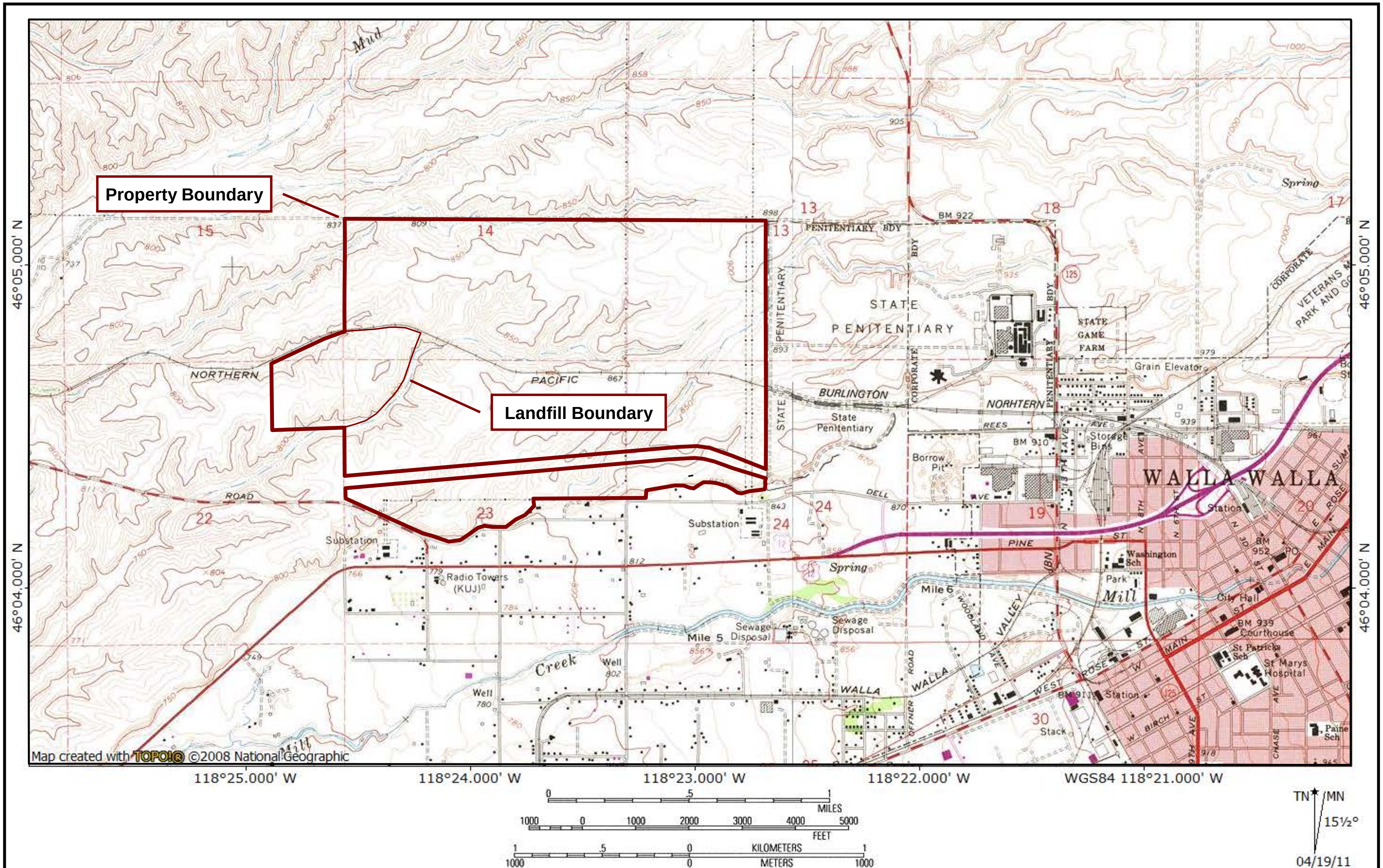
U.S. Environmental Protection Agency (USEPA). 1989. *Risk Assessment Guidance for Superfund.* Volume 1, *Human Health Evaluation Manual (Part A).* Interim Final. EPA/540/1-89/002. Office of Emergency and Remedial Response, Washington, D.C. Available at: http://www.epa.gov/oswer/riskassessment/ragsa/index.htm. December.

Walla Walla Union Bulletin. 1978. New City Landfill on Sudbury Road Opens Monday. Whitman College Penrose Library, microfiche. 9 July.

Washington State Department of Ecology (Ecology). 2007. *Washington Administrative Code.* Chapter 173-340, Model Toxics Control Act Cleanup Regulation. Compiled by Ecology’s Toxics Cleanup Program. Publication No. 94-06. November.

———. 1993. *Washington Administrative Code*. Chapter 173-351, Criteria for Municipal Solid Waste Landfills. October.

Washington State Department of Health (WDOH). 2012. *Private Well Volatile Organic Compound Exposure Near Sudbury Road, Walla Walla, Walla Walla County, Washington.* Letter Health Consultation prepared by the WDOH under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. July 18.



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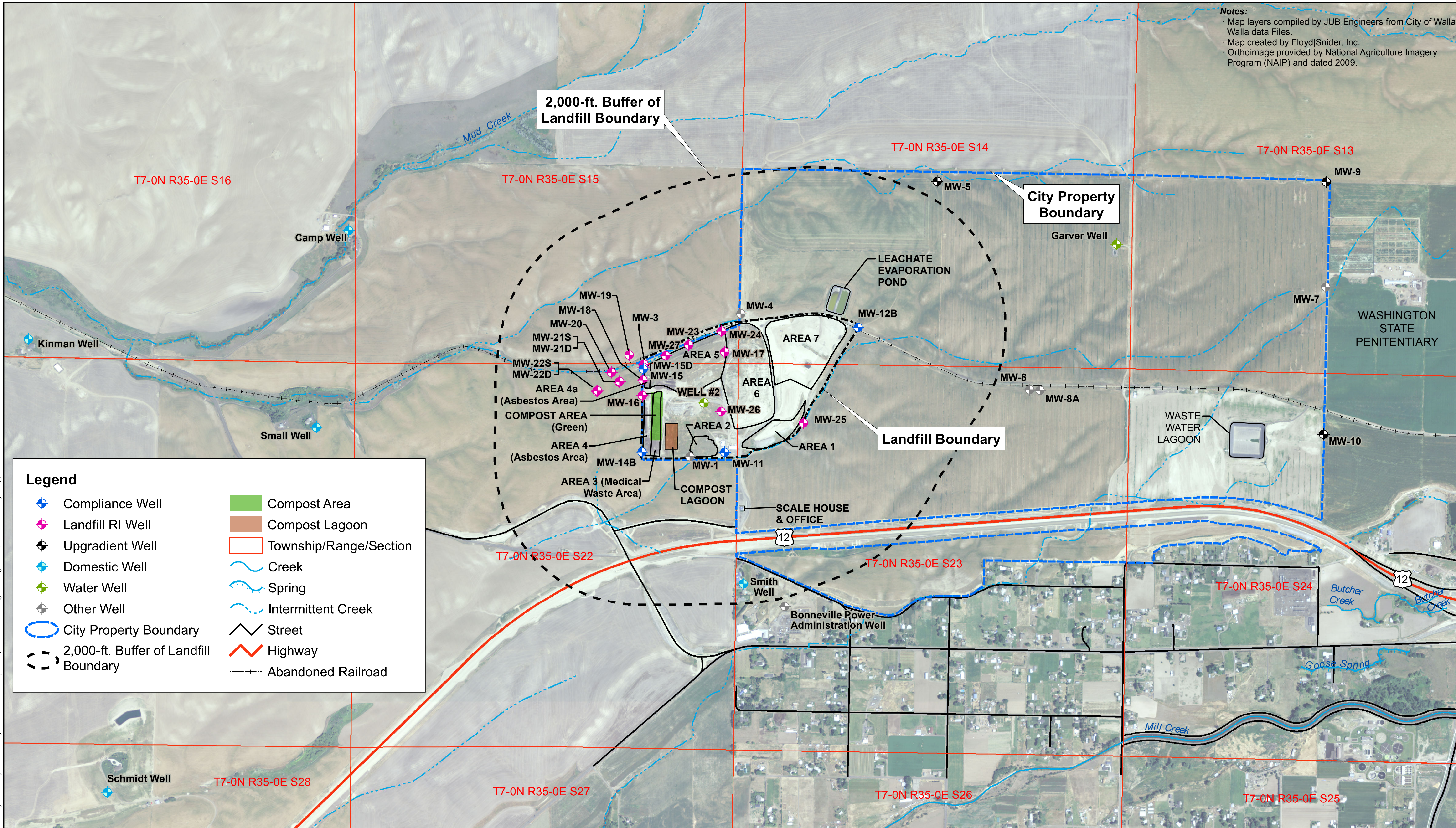
Sudbury Road Landfill
Walla Walla, Washington

Site Location

Figure
1



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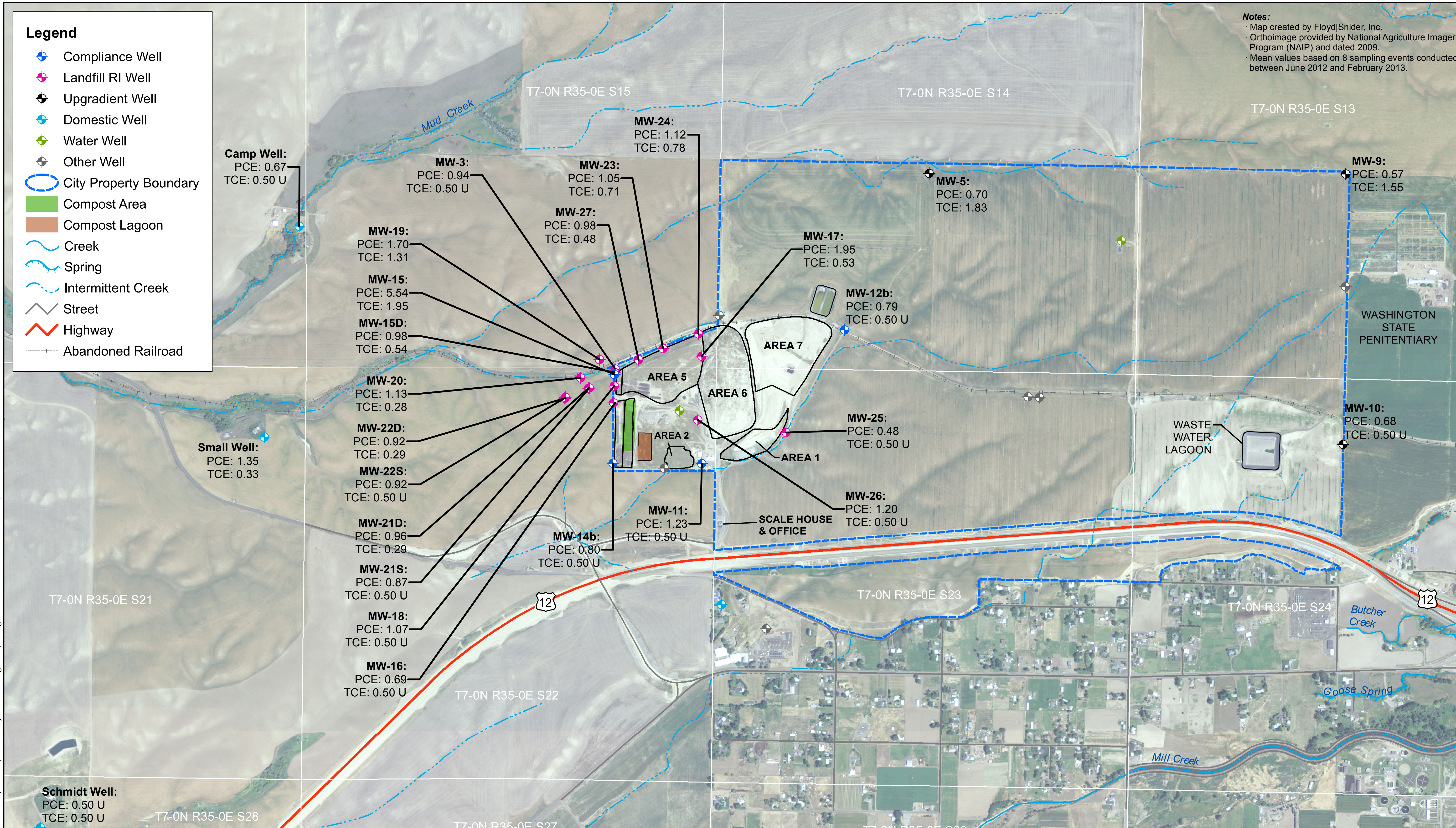
Sudbury Road Landfill
Walla Walla, Washington

Vicinity Map

Figure
2

F:\projects\Schwyn-Sudbury\GIS\MXD\Schwyn Request\2013 RI Figures\Figure 2 (Landfill Vicinity Map).mxd 3/18/2014



I:\GIS\Projects\Schwyn-Sudbury\MXD\CAP\Figure 3 (Average RI Concentration of TCE and PCE).mxd 7/23/2014

Schwyn Environmental Services

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N

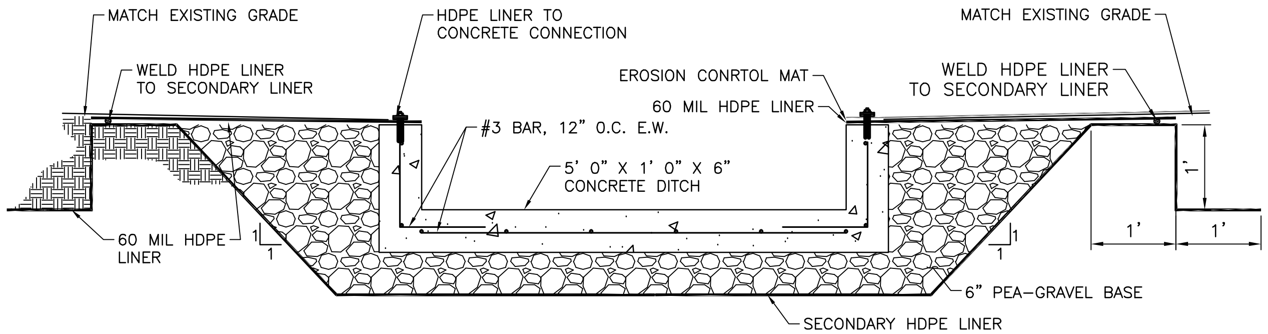
Sudbury Road Landfill
Walla Walla, Washington

Average RI Concentration of TCE and PCE (µg/L)

Figure 3

North Drainage Ditch Alternative

Plate 1: Alternative 1 - Cast–In–Place Concrete Channel



Area 5 Erosion Control Berm

Plate 2: Erosion Control Berm–Typical Section

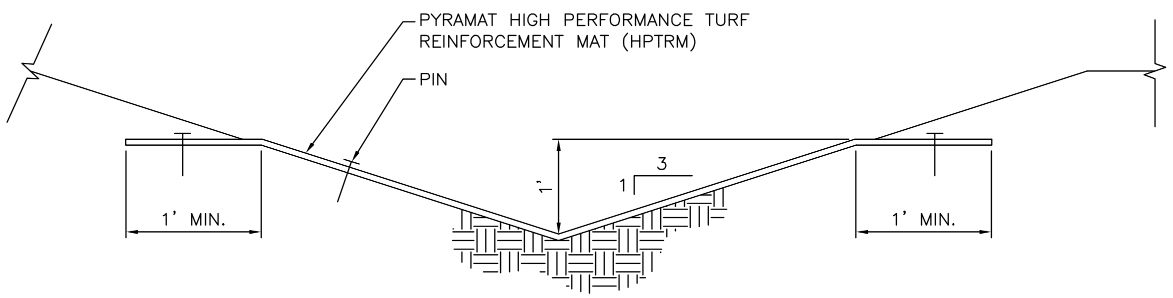
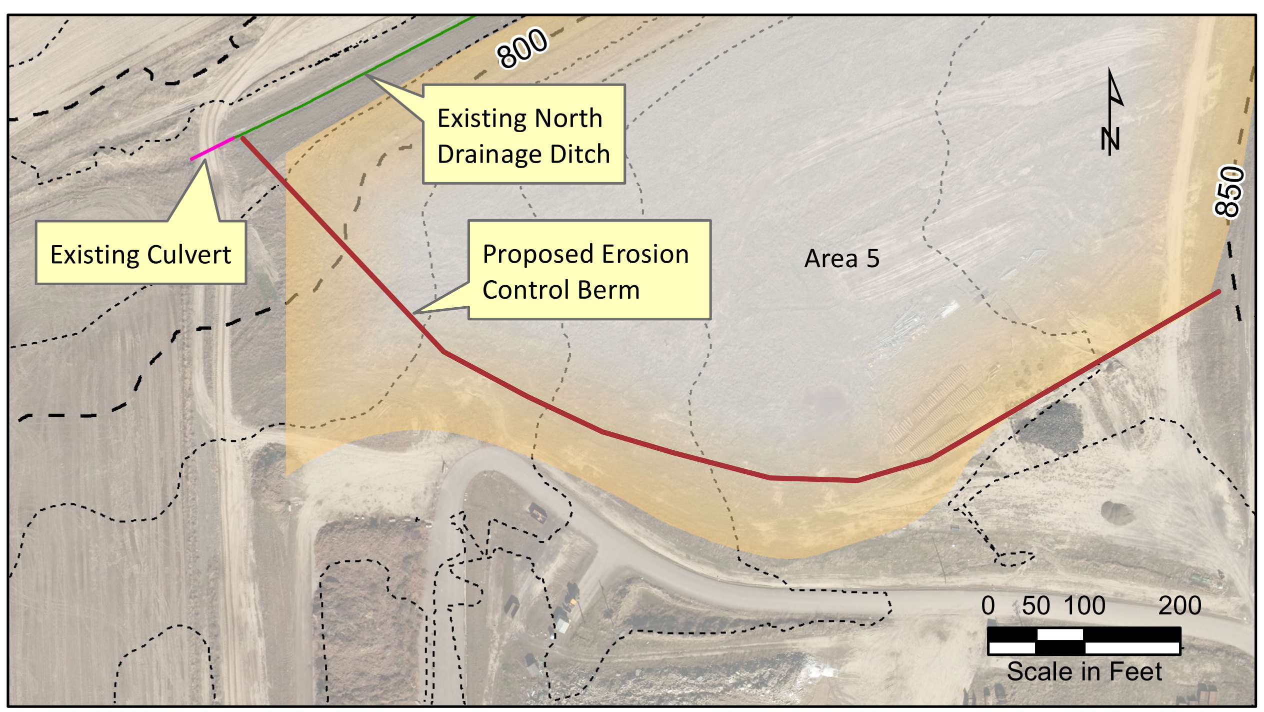
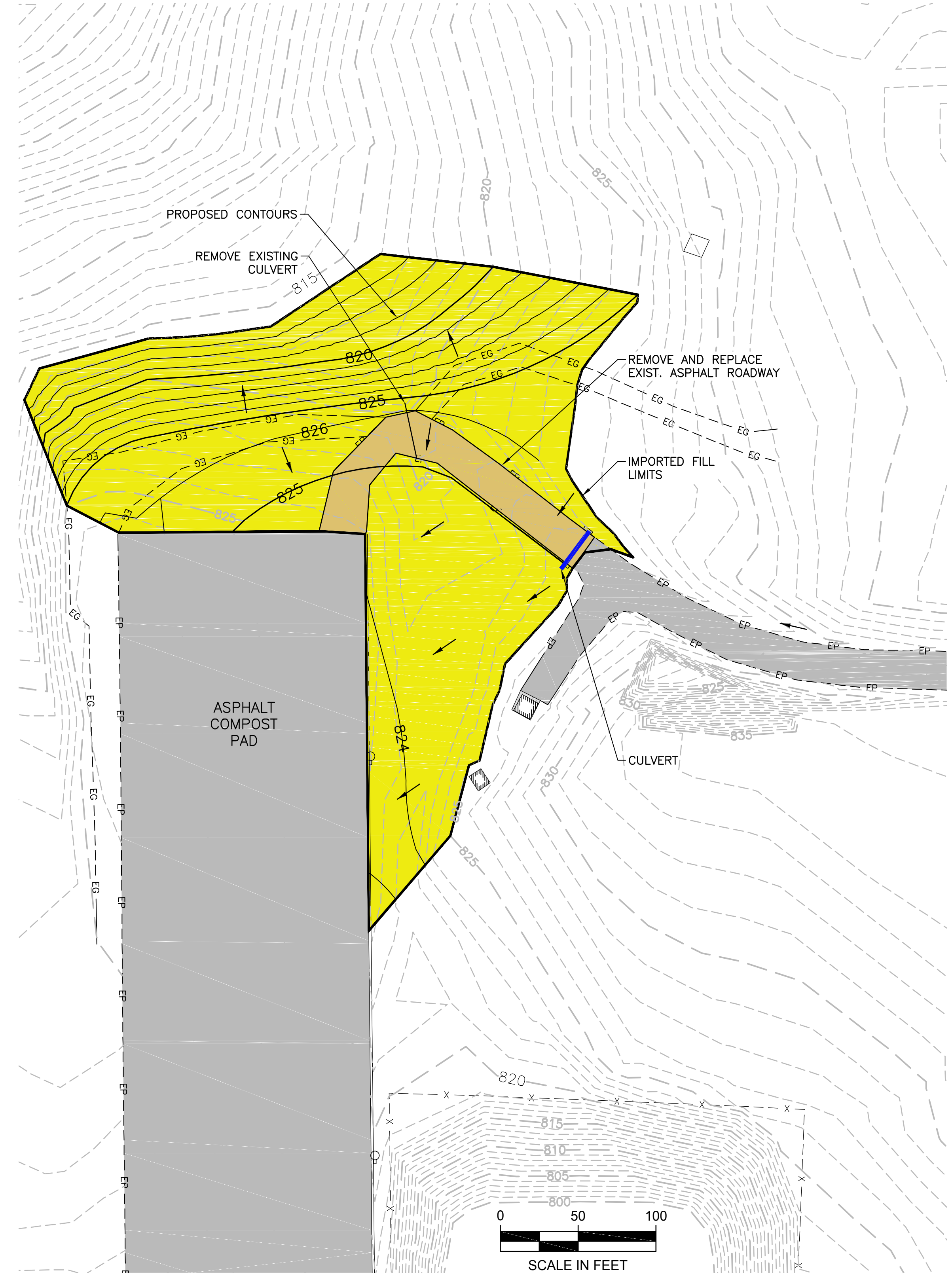


Plate 3: Area 5 Erosion Control Berm–Plan View



Area 5: Stormwater Run-On

Plate 4 – Area 5 Run-On Alternative 1



Schwyn Environmental Services

Notes:
- Design elements provided by J-U-B Engineers, Inc.
- Map created by Floyd|Snider, Inc.
- Orthoimage provided by National Agriculture Imagery Program (NAIP) and dated 2009.

Sudbury Road Landfill
Walla Walla, Washington

Stormwater Control Selected Alternative Plates 1–4

Figure
4

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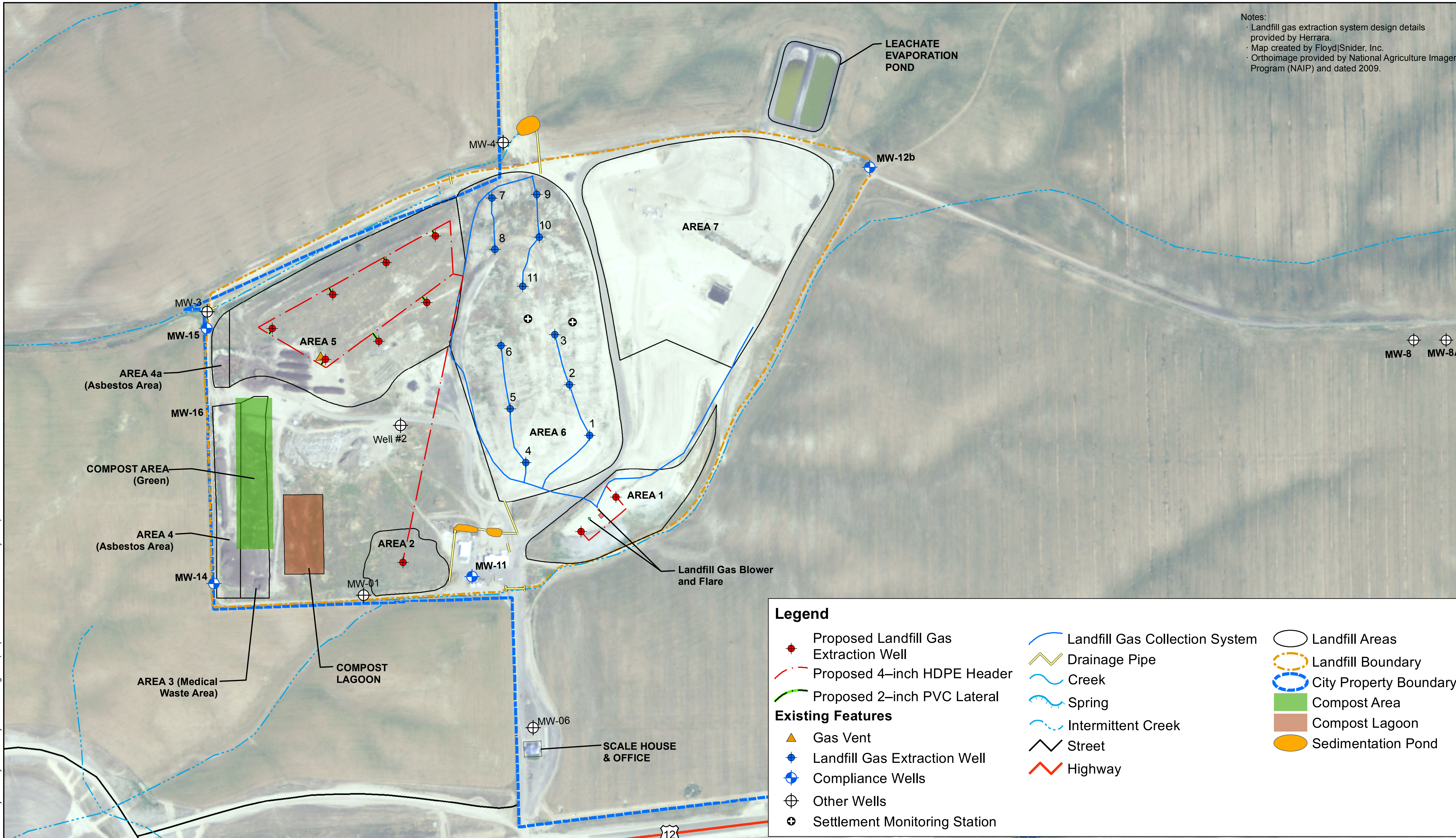

I:\GIS\Projects\Schwyn-Sudbury\MXD\CAP\Figure 5 (Proposed LFG Extraction Well Systems).mxd 7/23/2014

Schwyn Environmental Services

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Sudbury Road Landfill
Walla Walla, Washington

Proposed Landfill Gas Extraction Well Systems Areas 1, 2, and 5

Figure 5