



Sampling and Analysis Plan

Santosh Landfill

Groundwater Sampling

Scappoose, Oregon

ECSI No. 1383

Prepared for

Oregon Department of
Environmental Quality

January 9, 2017

150-001-053/Task 2



HARTCROWSER

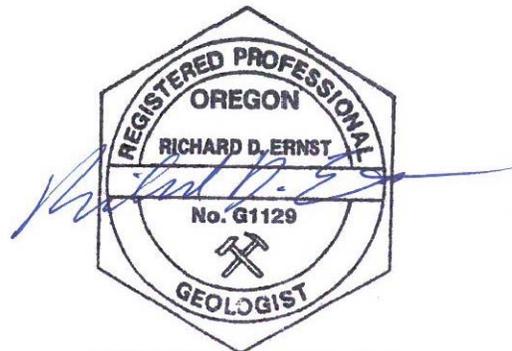
Sampling and Analysis Plan
Santosh Landfill
Groundwater Sampling
Scappoose, Oregon
ECSI No. 1383

Prepared for
Oregon Department of Environmental Quality

January 9, 2017
150-001-053/Task 2

Prepared by
Hart Crowser, Inc.

Christopher W. Martin, PE
Task Order Manager



Expires: 5/31/ 2017

Richard D. Ernst, RG
Program Manager

Contents

1.0 INTRODUCTION	1
2.0 PROJECT TEAM	1
3.0 FIELD AND SAMPLING PROCEDURES	2
3.1 Groundwater Sampling	2
3.2 Decontamination	3
3.3 IDW Management	3
4.0 ANALYTICAL PROGRAM	3
4.1 Chemicals of Potential Concern	3
4.2 Quality Assurance/Quality Control	4
5.0 REPORTING	4
6.0 REFERENCE	5

TABLES

- 1 Anticipated Sample Number and Analyses
- 2 Quality Assurance Samples
- 3 Analytical Methods – Reporting Limit Goals

FIGURES

- 1 Vicinity Map
- 2 Site Plan

Santosh Landfill

Groundwater Sampling

Scappoose, Oregon

ECSI No. 1383

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) presents the proposed field activities, sample collection procedures, and the analytical testing program that Hart Crowser will use to complete groundwater sampling at the Santosh Landfill site in Scappoose, Oregon (Figures 1 and 2). Field and laboratory quality assurance/quality controls (QA/QC) are also discussed. For a more detailed discussion of the site history refer to our Groundwater Monitoring Work Plan dated August 29, 2005 (Hart Crowser 2005).

Data quality objectives (DQOs) for this groundwater sampling event are: to provide a current understanding of groundwater quality at the site by implementing sampling procedures and utilizing appropriate chemical analyses to obtain quality data; and to screen the groundwater data against risk-based criteria (RBC) to assess whether unacceptable risks to human health or the environment might be present. To accomplish these DQOs, the scope of work will consist of the following general tasks:

- Collect groundwater samples from 14 site monitoring wells;
- Analyze groundwater samples for contaminants of potential concern (COPCs; Section 4.1);
- Measure and evaluate groundwater level data and compare results with past monitoring events;
- Manage investigation-derived waste (IDW); and
- Prepare a Groundwater Monitoring Report discussing the analytical results and assessing for potential unacceptable risks at the site.

2.0 PROJECT TEAM

This section outlines the individuals directly involved with this project and their specific responsibilities.

Oregon DEQ Project Officer: Bob Schwarz, PE. Mr. Schwarz is the Oregon Department of Environmental Quality (DEQ) Project Officer and is responsible for obtaining access to the property, reviewing project deliverables, and providing assistance in problem resolution and technical matters.

Hart Crowser Program Manager: Rick Ernst, RG. Mr. Ernst is the Program Manager for Hart Crowser and will maintain primary responsibility for project quality, schedule, and budget; provide final review of all project deliverables; and serve as a technical resource throughout the project. Mr. Ernst will also monitor project QA procedures to ensure compliance with this SAP, and, if any problems or deficiencies are observed, he will facilitate appropriate corrective actions.

Hart Crowser Task Order Manager: Chris Martin, PE. Mr. Martin is the Task Order Manager for this project and will be the primary contact to the DEQ Project Manager. Mr. Martin will oversee field activities, prepare project deliverables, QA review of data, and manage and coordinate field staff.

Hart Crowser Field Manager: Kaylan Smyth, EIT. Mr. Smyth will be responsible for implementing the SAP, including preparing for field activities, implementing the field activities, and maintaining chain of custody with the analytical laboratory. He will also be a backup contact for the Hart Crowser Task Order Manager.

Subcontractors. A subcontractor will be needed to pick up and dispose of IDW generated during field activities. An IDW subcontractor will be solicited and procured in accordance with the terms of ATA #22-13 and, to the extent applicable, state regulations. Solicitation documents will include descriptions of the scope of work and applicable subcontractor requirements. If a subcontractor does not meet the solicitation requirements, they will not be considered for award for the solicited service. The IDW subcontractor will report directly to the Hart Crowser Task Order Manager. Chemical analyses will be performed by ESC Lab Sciences (ESC) of Mt. Juliet, Tennessee, under the State Price Agreement and billed directly to the DEQ.

3.0 FIELD AND SAMPLING PROCEDURES

Groundwater sampling activities will be performed to assess the current groundwater quality at the site. Upon receiving analytical results, we will prepare a Groundwater Monitoring Report and coordinate and oversee IDW pick-up and disposal.

3.1 Groundwater Sampling

A single groundwater sampling event will be conducted in January 2017 to assess groundwater quality at the site. Groundwater samples will be collected from 14 site wells: MW-1S, MW-1D, MW-2S, MW-2D, MW-3S, MW-3D, MW-4S, MW-4D, MW-5S, MW-6S, MW-7S, MW-7D, MW-8S, and MW-8D (Figure 2). These samples will be analyzed for the list of COPCs outlined in Section 4.1. Groundwater samples will be collected using low-flow sampling techniques, as described below.

Measurement of Groundwater Levels. Prior to purging, groundwater levels in the wells will be measured to the nearest 0.01 foot using an electronic probe. The wells will be opened and allowed to equilibrate for about a half hour before measurements are taken. Depth to groundwater in all 14 site wells will be completed prior to sampling. Pairs of shallow and deep wells (i.e., MW-1S and MW-1D) will be measured concurrently to determine vertical gradient.

Purging. After the groundwater levels are measured, each well will be purged at a low flow rate (less than 500 milliliters per minute) using a peristaltic pump connected to disposable tubing dedicated to each well. The tubing inlet will be placed approximately at the middle of the well screen or the middle of the water column, whichever is deeper. To assess the effectiveness of purging, pH, electrical conductivity, temperature, dissolved oxygen (DO), and oxidation-reduction potential (ORP) will be measured by means of a flow-through cell for each liter that is purged. Purging will be considered complete when three casing volumes of water have been removed, the well purges dry, or field

parameters stabilize to within 10 percent for three consecutive readings (whichever is less). If the well is purged dry, it will be allowed to recover to at least 50 percent of its original volume before sampling is performed. Results of these measurements will be included in the field notes. Purge water will be drummed and handled in accordance with Section 3.3.

Sampling. After purging of a well is complete, a groundwater sample will be collected using the same equipment used for purging. Sample container requirements are included in Table 1. For VOC analysis, sample containers will be filled leaving no headspace. Dissolved metals and hardness will be field filtered while sampling using a 0.45-micron filter. For QA/QC purposes, a trip blank and field duplicate will be collected per Section 4.2 and included in Table 2.

Documentation. Observations made during groundwater sampling activities will be documented in field notes. Observations recorded will include, but are not limited to, groundwater levels, purge water characteristics (e.g., color, turbidity, sheen), purge volumes, field parameter measurements, depth to water measurements, and sampling time.

3.2 Decontamination

To prevent cross contamination between sampling locations, clean dedicated sampling equipment (e.g., disposable gloves and groundwater sampling tubing) will be used at each sampling location and discarded after use.

3.3 IDW Management

IDW will consist of purged groundwater from monitoring wells, disposable sampling supplies (e.g., gloves and sample tubing) and personal protective equipment (PPE). Sampling supplies and PPE will be disposed of as solid waste. Purge water generated during the activities will be added to a 55-gallon steel drum pending disposal. IDW will be appropriately disposed of at a permitted disposal or treatment facility.

4.0 ANALYTICAL PROGRAM

Hart Crowser will submit groundwater samples to ESC of Mt. Juliet, Tennessee, for chemical analysis. Testing will be on a standard turnaround time, usually 10 business days.

4.1 Chemicals of Potential Concern

COPCs have been identified based on previous investigations and historical use of the site (Table 1). COPCs at the site and the analytical methods used to test for them are as follows:

- Total petroleum hydrocarbons (TPH) as diesel/oil by Northwest Methodology (NWTPH), specifically TPH as diesel/oil by NWTPH-Dx with a silica gel cleanup;
- Volatile organic compounds (VOCs) by Environmental Protection Agency (EPA) Method 8260B;
- Semi volatile organic compounds (SVOCs) by EPA Method 8270;
- Weak acid dissociable (WAD) cyanide by EPA Method 9012;

- Total cyanide by EPA Method 9012;
- Total and dissolved metals (antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, strontium, thallium, titanium, vanadium, zinc, and zirconium) by EPA Methods 6010B, 6020, and 7470A;
- Hexavalent chromium by EPA Method 7199;
- Ammonia as nitrogen by EPA Method 350.1;
- Nitrate, nitrite, sulfate, and chloride by EPA Method 9056;
- Hardness and dissolved hardness by EPA Method 310.1;
- Chemical oxygen demand (COD) by EPA Method 410.4;
- Total organic carbon (TOC) by EPA Method 9060A;
- Total dissolved solids (TDS) by EPA Method 2540C-2011; and
- Total suspended solids (TSS) by EPA Method 2540D-2011.

4.2 Quality Assurance/Quality Control

The general QA objectives for this project are to develop and implement procedures for obtaining and evaluating data of a specified quality that can be used to determine current water quality conditions and evaluate risks posed to human health and the environment by contamination at the site. To collect such information, analytical data must have an appropriate degree of accuracy and reproducibility, samples collected must be representative of actual field conditions, and samples must be collected and analyzed using unbroken chain of custody procedures.

Field QA/QC. Disposable sampling equipment will be used to minimize or eliminate cross-contamination. All samples will be placed into laboratory-supplied sample containers including preservative, if required. Samples will be labeled with sample-specific identifying information. Chain of custody will be maintained at all times. QA/QC samples are shown on Table 2.

A duplicate groundwater sample will be collected from one of the monitoring wells with previous detections of relatively higher COPCs. The duplicate will be analyzed for all COPCs. For QA/QC purposes, a trip blank will accompany samples during shipment and be analyzed for VOCs.

Laboratory QA/QC. The laboratory will also perform QC analyses (e.g., matrix spikes and method blanks) per the requirements of the analytical method. Detection limits will be consistent with industry standards and, when practicable, below or comparable to promulgated regulatory standards, unless raised due to high analyte concentrations in the sample or matrix effects (Table 3).

5.0 REPORTING

After receipt of analytical results, we will prepare a Groundwater Monitoring Report to present our findings. The report will present general information about the site and nearby vicinity, the

conceptual site model developed for the site, the monitoring activities, groundwater levels and gradient, any changes in groundwater levels and gradient relative to previous monitoring events, the chemical results, any significant changes or trends in chemical results relative to previous monitoring events, and a risk screening of the chemical results to assess whether the site continues to pose an unacceptable risk to human health or the environment. The report will be prepared in general accordance with the following outline:

1. Introduction
 2. Background
 3. Monitoring Activities
 4. Chemical Analyses and Results
 5. Conceptual Site Model
 6. Data Screening
 7. Conclusions
- Appendix
- a. Analytical Laboratory Testing Program and Documentation

The report will initially be prepared as a draft for review by the DEQ. Upon receipt of DEQ's comments, we will issue the report in final form.

6.0 REFERENCE

Hart Crowser 2005. Groundwater Monitoring Work Plan, Santosh Landfill. August 29, 2005.

**Table 1 - Anticipated Sample Number and Analyses
Sampling and Analysis Plan
Santosh Landfill Groundwater Sampling, Scappoose, Oregon**

Sample Matrix and Analysis	Sample Locations	Sample Type	Analyses Requested	Sample Container and Volume	Sample Preservative	Holding Time	Estimated Number of Samples
<i>Water Samples</i>							
TPH as Diesel/Oil	Groundwater Monitoring Wells	Discrete	NWTPH-Dx	100 mL Amber (x2)	Hydrochloric Acid	14 days	14
VOCs	Groundwater Monitoring Wells	Discrete	EPA Method 8260B	40 ml Amber VOA (x2)	Hydrochloric Acid	14 days	14
SVOCs	Groundwater Monitoring Wells	Discrete	EPA Method 8270	100 mL Amber (x2)	None	14 days	14
Weak Acid Dissociable (WAD) cyanide	Groundwater Monitoring Wells	Discrete	EPA Method 9012	250 mL HDPE Amber	Sodium Hydroxide	14 days	14
Total Cyanide	Groundwater Monitoring Wells	Discrete	D 7511-09e2 or EPA Method 9012	250 mL HDPE Amber	Sodium Hydroxide	14 days	14
Total Metals*	Groundwater Monitoring Wells	Discrete	EPA Methods 6010B/6020/7470A	250 ml HDPE	Nitric Acid	180 days (Mercury 28 days)	14
Field Filtered Dissolved Metals*	Groundwater Monitoring Wells	Discrete	EPA Methods 6010B/6020/7470A	250 ml HDPE	Nitric Acid	180 days (Mercury 28 days)	14
Total Zirconium	Groundwater Monitoring Wells	Discrete	EPA Method 6010B	250 ml HDPE	Nitric Acid	180 days	14
Field filtered Dissolved Zirconium	Groundwater Monitoring Wells	Discrete	EPA Method 6010B	250 ml HDPE	Nitric Acid	180 days	14
Hexavalent Chromium	Groundwater Monitoring Wells	Discrete	EPA Method 7199	50 mL HDPE	Buffer	28 days	14
Ammonia	Groundwater Monitoring Wells	Discrete	EPA Method 350.1	250 ml HDPE	Sulfuric Acid	28 days	14
Anions**	Groundwater Monitoring Wells	Discrete	EPA Method 9056	250 ml HDPE	None	48 hours	14
Hardness	Groundwater Monitoring Wells	Discrete	EPA Method 130.1	250 ml HDPE	Nitric Acid	180 days	14
Field filtered Dissolved Hardness	Groundwater Monitoring Wells	Discrete	EPA Method 130.1	250 ml HDPE	Nitric Acid	180 days	14
COD	Groundwater Monitoring Wells	Discrete	EPA Method 410.4	250 ml HDPE	Sulfuric Acid	28 days	14
TOC	Groundwater Monitoring Wells	Discrete	EPA Method 9060A	250 mL Amber	Hydrochloric Acid	28 days	14
TDS	Groundwater Monitoring Wells	Discrete	EPA Method 2540C-2011	250 ml HDPE	None	7 days	14
TSS	Groundwater Monitoring Wells	Discrete	EPA Method 2540D-2011	1 liter HDPE	None	7 days	14

Notes:

1. The number of required sample containers will be determined and supplied by the analytical laboratory.
2. The estimated number of samples does not include quality control samples (see Table 2).
3. * = Metals list includes; antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, strontium, thallium, titanium, vanadium, zinc.
4. ** = Anions list includes; nitrate, nitrite, sulfate, and chloride

Acronyms:

TPH = Total petroleum hydrocarbons.
ml = Milliliter
NWTPH-Dx = Northwest Total Petroleum Hydrocarbons as Diesel and Oil.
EPA = Environmental Protection Agency
VOCs = Volatile Organic Compounds.
SVOCs = Semi-Volatile Organic Compounds
VOA = Volatile Organic Analysis (Bottle)
HDPE = High-Density Polyethylene (Plastic Bottle)
oz. = Ounce

**Table 2 - Quality Assurance Samples
 Sampling and Analysis Plan
 Santosh Landfill Groundwater Sampling, Scappoose, Oregon**

QA Sample Matrix	QA Sample Type	Analyses Requested	Anticipated Number of Samples
Site Collected Groundwater	Field Duplicate	All COPCs	1
Laboratory-Supplied Water	Trip Blank	EPA Method 8260B	1

Acronyms:

QA = Quality Assurance.

COPCs = Contaminants of Potential Concern

NWTPH-Dx = Northwest Total Petroleum Hydrocarbons as Diesel and Oil.

Table 3 - Analytical Methods - Reporting Limit Goals
Sampling and Analysis Plan
Santosh Landfill Groundwater Sampling, Scappoose, Oregon

Method	Analyte	Reporting Limit Goal
		Water [µg/L]
NWTPH-Dx	Diesel- and Oil-range hydrocarbons	100 250
VOCs (EPA 8260B) <i>Risk-Based Decision Making VOCs shown although full list of VOCs will be analyzed</i>	Benzene Toluene Ethylbenzene Xylenes Methyl tert-butyl ether Naphthalene 1,2-Dibromoethane 1,2-Dichloroethane Isopropylbenzene n-Propylbenzene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene	1.0 5.0 1.0 3.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
PAHs (SVOCs; EPA 8270-SIM) <i>Select PAHs shown although full list of SVOCs will be analyzed</i>	Acenaphthene Acenaphthylene Anthracene Benzo(g,h,i)perylene 2-Chloronaphthalene Fluoranthene Fluorene Phenanthrene Pyrene 2-Methylnaphthalene Benz(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Ideno(1,2,3-cd)pyrene 1-Methylnaphthalene	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
Cyanide (D 7511-09e2 or EPA Method 9012)	WAD cyanide Total Cyanide	5.0 5.0
Metals Dissolved (EPA Method 6020)	Antimony Arsenic Barium Beryllium Boron Cadmium Calcium Chromium Cobalt Copper Iron Lead Magnesium Manganese Mercury Nickel Potassium Selenium Silver Sodium Strontium Thallium Titanium Vanadium Zinc Zirconium	10 10 5.0 2.0 200 2.0 1,000 10 10 10 100 5.0 1,000 10 0.1 10 1,000 10 5.0 1,000 10 10 50 20 50 50
Metals Total (EPA Method 1311/6020)	Antimony Arsenic Barium Beryllium Boron	10 10 5.0 2.0 200

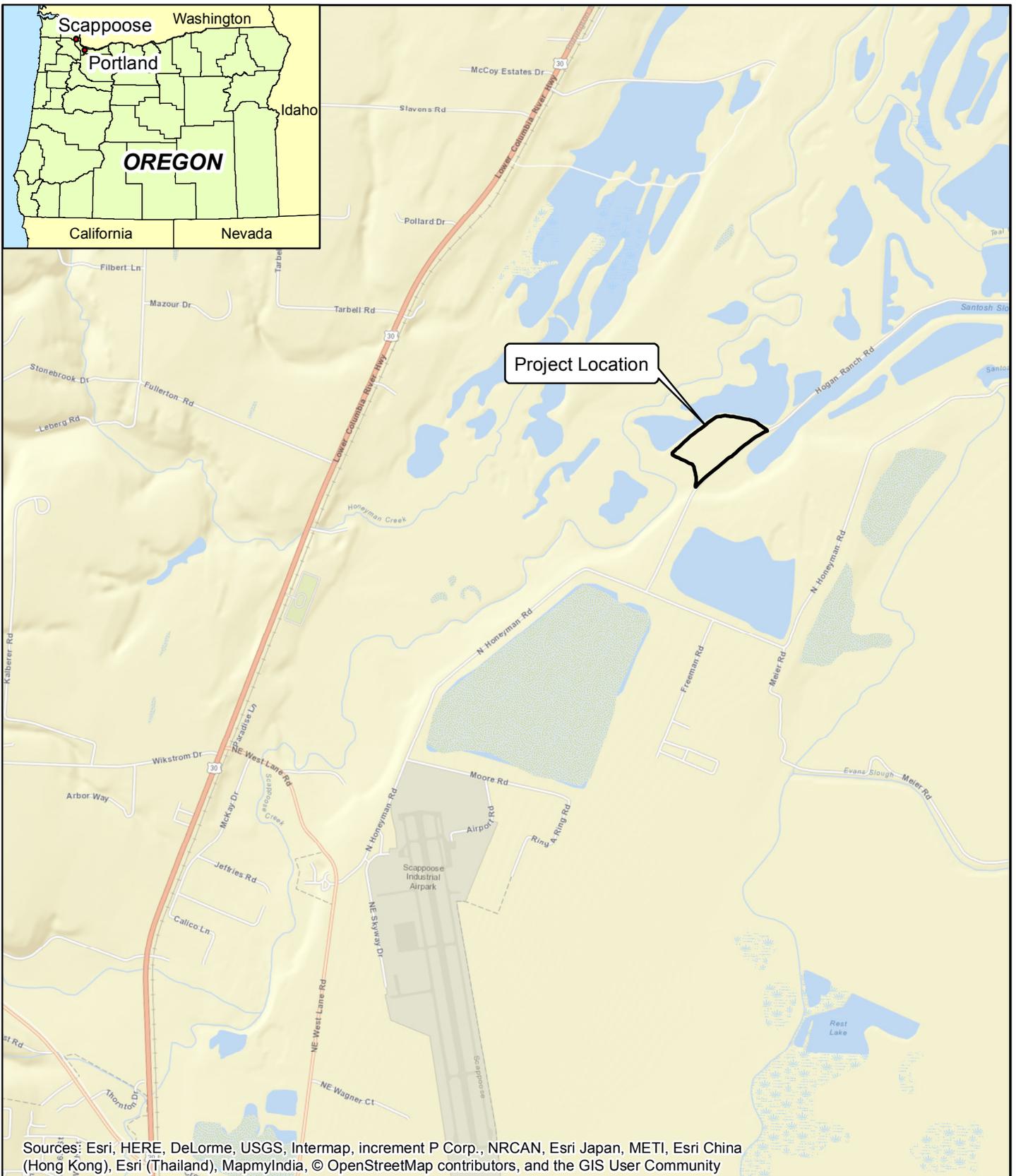
Please see notes on the following page.

Table 3 - Analytical Methods - Reporting Limit Goals
Sampling and Analysis Plan
Santosh Landfill Groundwater Sampling, Scappoose, Oregon

Method	Analyte	Reporting Limit Goal
		Water [µg/L]
Metals Total (cont.) (EPA Method 1311/6020)	Cadmium	2.0
	Calcium	1,000
	Chromium	10
	Cobalt	10
	Copper	10
	Iron	100
	Lead	5.0
	Magnesium	1,000
	Manganese	10
	Mercury	0.1
	Nickel	10
	Potassium	1,000
	Selenium	10
	Silver	5.0
	Sodium	1,000
	Strontium	10
	Thallium	10
	Titanium	50
Vanadium	20	
Zinc	50	
Zirconium	50	
EPA Method 7199	Hexavalent Chromium	5.0
EPA Method 350.1	Ammonia	250
Anions (EPA Method 9056)	Nitrate	100
	Nitrite	100
	Sulfate	5,000
	Chloride	1,000
Hardness (EPA Method 130.1)	Total Hardness	1,250
	Dissolved Hardness	1,250
EPA Method 410.4	Chemical Oxygen Demand	10,000
EPA Method 9060A	Total Organic Carbon	1,000
Solids (EPA Method 2540C/D-2011)	Total Dissolved Solids	10,000
	Total Suspended Solids	2,500

Notes:

1. mg/kg = milligram per kilogram (ppm).
2. µg/L = microgram per liter (ppb).
3. mg/L = milligram per liter.
4. WAD = Weak Acid Dissociable



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



Santosh Landfill
Scappoose, Oregon

Vicinity Map

150-001-053

12/16



Figure

1



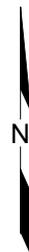
Sources: Base map prepared from a survey prepared by David C. Smith & Associates, dated 6/05. Aerial photograph provided by Microsoft Bing, 2016.

LEGEND

- MW-4S ⊕ Shallow Groundwater Monitoring Well
- MW-4D ⊕ Deep Groundwater Monitoring Well



Note: Feature locations are approximate.



Santosh Landfill
Scappoose, Oregon

Site Plan

150-001-053

12/16



Figure

2