



EPA Region X

START

Superfund Technical Assessment and Response Team

*Wilder Landfill-Hazardous Waste Pit
Preliminary Assessment/Site Inspection
Sampling and Quality Assurance Plan*

TDD: 01-09-0001

EPA Contract: 68-S0-01-02

20 May 2002

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BELLINGHAM FIELD OFFICE



Roy F. Weston, Inc. • 190 Queen Anne Avenue North • Seattle, WA 98109-4926

SAMPLING AND QUALITY ASSURANCE PLAN

Wilder Landfill-Hazardous Waste Pit Preliminary Assessment/Site Inspection
Ferndale, Washington

TDD: 01-09-0001

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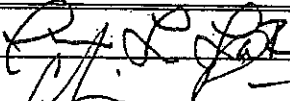
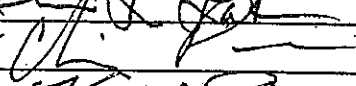
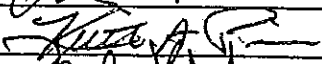
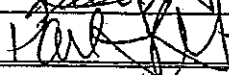
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TABLE OF CONTENTS

1.	PROJECT MANAGEMENT	1-1
1.1	PROJECT/TASK ORGANIZATION.....	1-1
1.1.1	Purpose.....	1-1
1.1.2	Roles and Responsibilities.....	1-1
1.2	PROBLEM DEFINITION/BACKGROUND.....	1-3
1.2.1	Site Background.....	1-3
1.2.2	Site Operations and Source Characteristics.....	1-5
1.2.3	Site Characterization.....	1-5
1.3	PROJECT/TASK DESCRIPTION AND SCHEDULE.....	1-20
1.3.1	Project Description.....	1-20
1.3.2	Schedule.....	1-21
1.4	QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA.....	1-21
1.4.1	DQO Data Categories.....	1-21
1.4.2	Data Quality Indicators (DQIs).....	1-21
1.5	SPECIAL TRAINING REQUIREMENTS/CERTIFICATION.....	1-24
1.6	DOCUMENTATION AND RECORDS.....	1-24
2.	MEASUREMENT/DATA ACQUISITION	2-1
2.1	SAMPLING PROCESS DESIGN (EXPERIMENTAL DESIGN).....	2-1
2.1.1	Sample Locations.....	2-1
2.1.2	Stratigraphy.....	2-4
2.1.3	Geophysical Methods (EM and GPR Survey).....	2-4
2.1.4	Global Positioning System.....	2-5
2.1.5	Logistics.....	2-5
2.1.6	Cooler Return.....	2-5
2.1.7	Coordination with Federal, State, and Local Authorities.....	2-5
2.2	SAMPLING METHODS REQUIREMENTS.....	2-6
2.2.1	Sampling Methodologies.....	2-6
2.2.2	Sampling Equipment Decontamination.....	2-9
2.2.3	Investigation-Derived Wastes.....	2-9
2.3	SAMPLE HANDLING AND CUSTODY REQUIREMENTS.....	2-10
2.3.1	Sample Identification.....	2-10
2.3.2	Custody Procedures.....	2-14
2.4	ANALYTICAL METHODS REQUIREMENTS.....	2-16
2.5	QUALITY CONTROL REQUIREMENTS.....	2-16
2.6	INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS.....	2-16
2.7	INSTRUMENT CALIBRATION AND FREQUENCY.....	2-17
2.8	INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES.....	2-17
2.9	DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS).....	2-17
2.10	DATA MANAGEMENT.....	2-17
2.10.1	Analytical Data Loading.....	2-18

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Page</u>
2.10.2 Data Pre-Processing	2-18
2.10.3 Primary Dataset Development	2-19
2.10.4 Data Post Processing	2-19
2.10.5 Analytical Dataset Development.....	2-19
2.10.6 Data Analysis and Reporting	2-19
3. ASSESSMENT/OVERSIGHT	3-1
3.1 ASSESSMENTS AND RESPONSE ACTIONS	3-1
3.2 REPORTS TO MANAGEMENT	3-1
4. DATA VALIDATION AND VERIFICATION.....	4-1
4.1 DATA VALIDATION.....	4-1
4.2 DATA VERIFICATION.....	4-2
4.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES	4-2
5. REFERENCES.....	5-1
APPENDICES	
A Standard Operating Procedures	
B Supplemental Forms	
C Sample Documentation and Chain-of-Custody Forms	
D Commercial Laboratory Statement of Work	

LIST OF TABLES

Table

- 1-1 Groundwater Drinking Water Population Within a 4-mile Radius
- 1-2 Populations Within a 1-Mile Radius
- 1-3 Populations and Wetland Acreage Within a 4-mile Radius
- 2-1 Sample Information Summary
- 2-2 Sample Analyses Summary
- 2-3 QA/QC Analytical Summary and Fixed Laboratory Analytical Methods
- 2-4 Sample Coding

LIST OF FIGURES

Figure

- 1-1 Project Organization Chart
- 1-2 Site Location Map
- 1-3 Site Vicinity Diagram
- 1-4 Ecology 1986 PA/SI Sampling Locations
- 1-5 4-TDL Mile Map
- 1-6 15-TDL Mile Map
- 2-1 Site Sample Location Diagram
- 2-2 Regional Sample Location Diagram
- 2-3 Proposed Geophysical Survey Grid

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START TDD File	File			X	X
Susan FitzGerald	START Site Leader	X		X	X

LIST OF ACRONYMS AND ABBREVIATIONS

<u>Acronym</u>	<u>Definition</u>
AA	Atomic Absorption Furnace Technique
bgs	below ground surface
CLP	Contract Laboratory Program
CLPAS	Contract Laboratory Program Analytical Service
CRDL	Contract Required Detection Limit
CRQL	Contract-Required Quantitation Limit
°C	degrees Celsius
Dup.	duplicate
ECD	Electron Capture Detection
EPA	United States Environmental Protection Agency
FOWP	Field Operations Work Plan
GCS	Gas Chromatographic Separation
GPS	Global Positioning System
HCl	Hydrochloric Acid
HNO ₃	Nitric Acid
HRS	Hazard Ranking System
ICP	Inductively Coupled Plasma
IDW	Investigation Derived Waste
ILM	Inorganic Laboratory Method
L	Liter
MD	Mass Spectrometric Detection
MEL	Manchester Environmental Laboratory
MHz	megahertz

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

<u>Acronym</u>	<u>Definition</u>
mg/kg	milligrams per kilogram
mL	milliliter
MS/MSD	matrix spike/matrix spike duplicate
NA	Not Applicable
NPL	National Priorities List
OLM	Organic Laboratory Method
oz	ounce
PA	Preliminary Assessment
PCBs	polychlorinated biphenyls
PM	Project Manager
ppb	parts per billion
PPE	probable point of entry
ppm	parts per million
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QMP	Quality Management Plan
RPD	relative percent difference
RSCC	Regional Sample Control Coordinator
SI	Site Inspection
SOPs	Standard operating procedures
SQAP	Sampling and Quality Assurance Plan
START	Superfund Technical Assessment and Response Team

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

<u>Acronym</u>	<u>Definition</u>
SVOCs	semivolatile organic compounds
TAL	target analyte list
TAT	Technical Assistance Team
TDD	Technical Direction Document
TM	Task Monitor
TOC	Total organic carbon
USGS	United States Geologic Survey
VOCs	volatile organic compounds

(TRC) here beginning in 1975 (EPA 1990a; Whatcom County 1979a). Wilder sold the TRC facility property in 1985, while retaining ownership of the current property to the north, including the site of the former landfill (Whatcom County Tax Assessor 2001).

1.2.2 Site Operations and Source Characteristics

In 1976, TRC was granted permission to operate a disposal site for hazardous materials under its solid waste permit (Ecology 1987). Disposal of materials at the hazardous waste landfill began that summer (Ecology 1987).

Wastes deposited in the landfill were described by the Wilder Construction Company Solid Waste Manager as, "approximately 1,000 partially full oil and resin drums, solvents, asbestos, catalyst beads from the refineries, lignosite from Georgia-Pacific ..., pentathol from Crossarm and Bailey Lumber" (EPA 1979). Insecticide from the highway department was also reportedly placed in the landfill (E&E 1981). A letter from Ecology to Whatcom County mentions "parathion and mercuric pesticides" disposed of in an "industrial waste disposal area," which likely refers to the Wilder Landfill-Hazardous Waste Pit (Ecology 1977b).

Lignosite is a wood pulp product that was mixed with metal plating sludge to make a drilling mud additive (Ecology 1980a). A sample of this mixture, packaged in bags labeled "Q-Broxin manufactured for Baroid Petroleum Services by Georgia Pacific" was collected from the TRC facility by Ecology personnel; it was found to contain total chromium concentrations as high as 27 milligrams per gram (mg/g), or 2.7 percent (Ecology 1980a). TRC reportedly received up to 1.5 tons of lignosite per week; the volume of lignosite buried in the Wilder Landfill-Hazardous Waste Pit is not known (E&E 1981).

Contaminants of concern at the site associated with these operations include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), chlorinated pesticides/polychlorinated biphenyls (pesticides/PCBs), Target Analyte List (TAL) metals, and hexavalent chromium.

1.2.3 Site Characterization

This section summarizes previous site investigations (Section 1.2.3.1); discusses migration/exposure pathways and targets (Section 1.2.3.2), and describes areas of potential contamination (Section 1.2.3.3).

1.2.3.1 Previous Site Investigations

Numerous investigations have been conducted previously at the TRC facility, including investigations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Following "site discovery," when the site was brought to EPA's attention in 1979, a CERCLA PA of TRC (CERCLA information system site ID WAD078207362) was completed in 1986, followed by a SI in 1988, and a site reassessment that was completed in 2000. None of the previous investigations at TRC adequately addressed conditions at the Wilder Landfill-Hazardous Waste Pit. The following is a summary of investigation results that relate to the former landfill.

1.2.3.1.1 Whatcom County Inspection, Spring 1979

Dennis Larson of the Bellingham & Whatcom County Health District Department of Public Health (the County) conducted a site inspection in the spring of 1979. He found the hazardous waste landfill nearly full of waste, and full of standing water to the point of "nearly overflowing" (EPA 1979). The conditions reported by Larson violated the terms of Wilder's operating permit, and the Health Board revoked its approval of the hazardous waste landfill that spring as a result of his inspection and recommendations (Whatcom County 1979b; EPA 1979). No closure requirements were made for the landfill closure with the revocation order (EPA 1979). TRC notified the County that the landfill was closed as of 1 May 1979, with a cover that consisted of a layer of ash covered by a layer of "dirt" (TRC 1979). The ash layer is estimated to have been three to four feet thick; the surface layer, derived from nearby soil, is estimated to have been five feet thick (Zurline 2002).

1.2.3.1.2 Ecology Preliminary Field Investigation, August 1979

Ecology, EPA, and County personnel visited the TRC site and met with Frank "Moose" Zurline, then the Solid Waste Manager for Wilder Construction Company (EPA 1979). Zurline estimated the dimensions as 60 feet by 100 feet by 12 feet deep (EPA 1979). When they toured the area, the investigators stated that its dimensions appeared to be closer to 150 feet by 500 feet (EPA 1979). A clay berm was visible along the eastern border of the landfill (EPA 1979).

Zurline described the waste in the landfill as, "approximately 1,000 partially full oil and resin drums, solvents, asbestos, catalyst beads from the refineries, lignosite from Georgia-Pacific ..., pentathol from Crossarm and Bailey Lumber" (EPA 1979). Inspectors observed, "A drainage ditch along the south side of the pit was stained dark black; the discoloration originated from an open area of the pit (approximately 40' by 50') which contained 50 pound sacks of lignosite in a black mushy liquid. The ditch was discolored as far as could be observed, to near the Burlington-Northern Railroad tracks" (EPA 1979). Based on their observations, Ecology and County personnel expressed interest in investigating organics concentrations in nearby Claypit Pond (EPA 1979).

1.2.3.1.3 EPA Investigation, February 1980

During an investigation in February 1980, EPA sampled surface water at three locations: at a culvert near Labounty Road upgradient of the site, at the culvert under the railroad track, and in the stream flowing from Claypit Pond (E&E 1981). The culvert beneath the railroad track was receiving runoff from two drainage areas, one of which included the former Wilder Landfill-Hazardous Waste Pit property as well as extended areas to the north, and the other which included the TRC facility and extended areas to the south. The surface water samples were analyzed for heavy metals and organic priority pollutants (E&E 1981). No organic priority pollutants were detected. The results of the inorganics analyses are presented below; concentrations are listed in units of micrograms per liter ($\mu\text{g/L}$), which is equivalent to parts per billion (ppb; E&E 1981).

SECTION 1

PROJECT MANAGEMENT

1.1 PROJECT/TASK ORGANIZATION

1.1.1 Purpose

Pursuant to U.S. Environmental Protection Agency (EPA) Superfund Technical Assessment and Response Team (START) Contract No. 68-S0-01-02 and Technical Direction Document (TDD) No. 01-09-0001, Roy F. Weston, Inc. (WESTON®) will perform a Preliminary Assessment/Site Inspection (PA/SI) of the Wilder Landfill-Hazardous Waste Pit, located in Ferndale, Washington. The Wilder Landfill-Hazardous Waste Pit was brought to EPA's attention by the Whatcom County Health Department, which requested that EPA consider conducting an assessment of this site.

The PA/SI will consist of limited sampling at potential contaminant source and target areas for site characterization purposes. This document outlines the technical and analytical approaches WESTON will employ during PA/SI fieldwork.

This document is a combined Field Operations Work Plan (FOWP) and site-specific Quality Assurance Project Plan (QAPP) for field sampling activities. The combined FOWP/QAPP, hereafter called the Sampling and Quality Assurance Plan (SQAP), includes a brief site summary, project objectives, sampling and analytical procedures, and QA requirements that will be used to obtain valid, representative field samples and measurements. The SQAP is intended to be combined with information presented in WESTON's Quality Management Plan (QMP) for Region 10 START. Copies of the QMP and the site-specific Health and Safety Plan (prepared for the PA/SI) are available in WESTON's office located at 190 Queen Anne Avenue North, Suite 200, Seattle, Washington 98109-4926.

1.1.2 Roles and Responsibilities

This section lists the individuals directly involved with the Wilder Landfill-Hazardous Waste Pit project and their specific responsibilities. Lines of communication are shown in the Project Organization Chart (Figure 1-1). Work performed under this SQAP will be in cooperation with Whatcom County Health and Human Services to assist the site assessment program.

The following are the Key Project Personnel:

- EPA Task Monitor: Joanne LaBaw, EPA, Seattle, WA
- START Site Leader: Susan FitzGerald, WESTON, Seattle, WA
- START Program Manager: Frank Monahan, WESTON, Seattle, WA
- START Project Manager: Keith Pine, WESTON, Seattle, WA
- START QA Officer: Paul Swift, WESTON, Seattle, WA

1.1.2.1 EPA Region 10 Task Monitor (TM)

The EPA TM for this project is Joanne LaBaw. Ms. LaBaw is the overall project coordinator, decision maker, primary point of contact for general project problem resolution, and has approving authority for the project. She will review and approve the site-specific SQAP and subsequent revisions in terms of project scope, objectives, and schedules. She will also ensure that the site-specific SQAP is properly implemented.

1.1.2.2 EPA Region 10 Quality Assurance (QA) Manager

The EPA Region 10 QA Manager is Barry Towns. The QA Manager reviews and approves the site-specific SQAP and revisions. The QA Manager may also conduct assessments of field activities.

1.1.2.3 EPA Region 10 Regional Sample Control Coordinator (RSCC)

The EPA Region 10 Regional Sample Control Coordinator is Laura Castrilli. Ms. Castrilli coordinates sample analyses performed through the EPA Contract Laboratory Program (CLP) and/or the EPA Region 10 Manchester Environmental Laboratory (MEL) and provides sample identification numbers.

1.1.2.4 WESTON START Project Manager (PM)

The WESTON START PM is Keith Pine. Mr. Pine has the responsibility for the overall performance of the START team. He will review and approve the site-specific SQAP. He makes the ultimate decisions for the implementation of START projects and ensures that the implementation of the project is performed in accordance with the specifications of the SQAP and WESTON's QMP and SOPs. Mr. Pine has overall responsibility for maintaining project budget and schedule. In the absence of the START PM, the START Site Leader will assume the PM's responsibilities.

1.1.2.5 WESTON Site Leader

The WESTON START Site Leader is Susan FitzGerald. Ms. FitzGerald is the primary contact point with the EPA TM, provides overall coordination of fieldwork, and oversees the preparation of the site-specific SQAP. She will ensure that the final approved version of the site-specific SQAP is implemented correctly and will record any deviations from it. Ms. FitzGerald will receive the CLP/Region 10 laboratory information from the RSCC and is the primary START point of contact for technical problems. She will be responsible for the execution of decisions and courses of action deemed appropriate by the EPA TM.

1.1.2.6 WESTON START QA Officer

The WESTON START QA Officer is Paul Swift. Dr. Swift will review and approve the site-specific SQAP, will conduct in-house audits of field operations, and will be responsible for auditing and reviewing the field activities, final deliverables, and if necessary, for approving corrective actions for nonconformities.

Analyte	Surface Water Sample Concentration (µg/L)		
	Upstream	Culvert to Claypit Pond	Outlet from Claypit Pond
Antimony	<2.0	<2.0	<2.0
Arsenic	<2.0	3.1	<2.0
Beryllium	<0.3	<0.3	<0.3
Cadmium	0.5	4.1	1.1
Chromium	9.0	483.0	137.0
Copper	12.0	23.0	11.0
Lead	31.0	142.0	52.0
Mercury	0.78	0.91	0.78
Nickel	15.0	24.0	11.0
Selenium	<2.0	8.0	2.0
Silver	<0.3	<0.3	<0.3
Thallium	<2.0	<2.0	<2.0
Zinc	40.0	300.0	20.0

Modified from E&E 1981.

Relative to the upgradient sample, concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc were elevated in the sample from the culvert leading to Claypit Pond. Elevated cadmium, chromium, and lead concentrations in the pond effluent are also likely a result of the input from the culvert (E&E 1981). The source of these concentrations can not be specifically identified based on the three samples collected.

1.2.3.1.4 Ecology Water Quality Survey, April and July 1980

Ecology conducted an investigation in 1980 that included the collection of surface water samples from sixteen locations: ten from the TRC facility, two from locations upgradient of the former Wilder Landfill-Hazardous Waste Pit, one from the culvert draining into Claypit Pond, and three locations in the pond (E&E 1981).

The samples were analyzed for heavy metals and chlorides. The analytical results are presented in the table below, in concentration units of µg/L:

Sample Location/ Station #	Surface Water Sample Concentration (µg/L)										
	Cadmium	Chlorides	Chromium (total)	Chromium VI	Copper	Lead	Mercury (May)	Mercury (June)	Nickel	Zinc	
BK	2	NA	16,000	NA	NA	NA	NA	<0.2	NA	NA	NA
	3	<10	170,000	<10	<50	<10	50	1.9	<0.2	NA	<10
TRC	5	40	NA	11000	NA	50	220	NA	NA	220	360
	6	<10	3,500,000	7200	<50	<10	100	0.8	NA	NA	190
	7	<10	5,800,000	<10	<50	<10	100	4.0	1.2	NA	30
	8	NA	4,400,000	NA	NA	NA	NA	NA	<0.2	NA	NA
	9	NA	7,100,000	NA	NA	NA	NA	NA	<0.2	NA	NA
	10	NA	1,400,000	NA	NA	NA	NA	NA	<0.2	NA	NA
	11	NA	6,400,000	NA	NA	NA	NA	NA	0.8	NA	NA
	12	NA	1,100,000	NA	NA	NA	NA	NA	0.48	NA	NA
	13	NA	21,000,000	NA	NA	NA	NA	NA	NA	NA	NA
Culvert	14	<10	1,200,000	80	<50	<10	<50	0.8	NA	NA	30
Claypit Pond	15	<10	640,000	200	<50	<10	<50	1.1	NA	NA	80
	16	<10	570,000	200	<50	<10	<50	0.64	NA	NA	20
	17	<10	600,000	200	<50	<10	<50	0.48	<0.2	NA	<10

Notes:

Modified from E&E 1981

BK: Background

NA: Not analyzed

TRC: Thermal Reduction Company facility sampling locations

The analytical data indicates that concentrations of total chromium, and zinc in the culvert and pond were elevated compared to the upgradient samples (E&E 1981). The relatively high chloride values at Station 3 were attributed to a nearby salt pile present on the Friese Hide and Tallow property (E&E 1981). A salt pile was also present on the TRC property at the time, and these two sources were considered responsible for the elevation of Claypit Pond levels to approximately 600 parts per million (ppm; E&E 1981).

Three samples of fish tissue were collected from Claypit Pond and were analyzed for mercury. All fish tissue concentrations were determined to be within FDA limits for safe human consumption (E&E 1981).

1.2.3.1.5 Ecology Lignosite Sample

In response to the findings of elevated (31 mg/L) chromium concentrations in leachate from the TRC ash disposal area, lignosite from the ROW facility was analyzed for heavy metals (Ecology 1980a). Lignosite analytical results are reproduced in the table below.

Analyte	Lignosite Sample Concentration (ppm)
Cadmium (total)	<5
Chromium VI	8,000
Chromium (total)	27,000
Copper (total)	<5
Iron (total)	7,000

Analyte	Lignosite Sample Concentration (ppm)
Lead (total)	40
Manganese (total)	280
Nickel (total)	40
Zinc (total)	3,000

Modified from E&E 1981

1.2.3.1.6 Ecology Phase I and II PA/SI, August and September, 1986

Ecology performed a Phase I PA/SI of the TRC facility in August 1986, during which no samples were collected (Ecology 1987). The Phase II PA/SI was conducted in October (Ecology 1987); samples collected included (see Figure 1-4):

- One sediment and one water sample from the ditch draining the area north of the railroad culvert, including the Wilder Landfill-Hazardous Waste Pit property (Stream #1)
- One sediment and one water sample from the ditch draining the area south of the railroad culvert, including the TRC facility (Stream #2)
- A water sample from the near the southern shoreline of Claypit Pond
- A leachate sample from the TRC facility's leachate pond

The samples were analyzed for priority pollutants, VOCs, Base/Neutral/Acid extractable compounds (BNAs, also called SVOCs), and Pesticides/PCBs. No VOCs or Pesticides/PCBs were detected in any of the samples (Ecology 1987). SVOCs detected were generally phthalates, at concentrations < 20 $\mu\text{g/L}$ in water samples, and approximately 0.2 milligrams per kilogram (mg/kg) or less in the sediment samples (Ecology 1987). Mg/kg is equivalent to ppm.

Elevated metals concentrations were detected in sediment and water samples downgradient of both the Wilder Landfill-Hazardous Waste Pit and the TRC facility. The metals concentrations ($\mu\text{g/L}$) in the surface water samples, and the drinking water standards for the parameters listed are summarized in the following table (Ecology 1987):

Analyte	Surface Water Sample Concentration ($\mu\text{g/L}$)				
	Stream #1	Leachate Pond	Stream #2	Brennan (Claypit) Pond	Drinking Water Standards
Arsenic	11		30		50
Beryllium			1.3		
Cadmium	1.3		12.4	0.5	10
Chromium	42	22	1083	2	50
Copper	10		742		
Lead		15	282		50
Thallium	1	7	2	1	
Nickel	18	10	403		10,000
Silver		0.2	8.6		50
Zinc	168	26	3120	53	
Antimony			7		
Selenium			3		10
Mercury	0.15	0.15	2.55	0.15	2

Notes:

Modified from Ecology 1987.

Blank spaces indicate metal concentration was below limit of detection (Ecology, 1987).

The metals concentrations (mg/kg, dry weight) in the sediment samples are summarized in the following table:

Analyte	Sediment Sample Concentration (mg/kg)	
	Stream #1	Stream #2
Arsenic	2.6	6.1
Beryllium	0.53	0.71
Cadmium	0.6	1.7
Chromium	100.9	87.2
Copper	52.1	57.3
Lead	14.8	33.5
Thallium		
Nickel	82.1	75.3
Silver	0.22	0.30
Zinc	286	320
Antimony		
Selenium	0.3	0.4
Mercury	0.10	0.05

Notes:

Modified from Ecology 1987.

Blank spaces indicate metal concentration was below limit of detection (Ecology 1987).

Except for chromium and nickel in the sediment samples, concentrations in samples from the area of the former hazardous waste pit were lower than those from the area of TRC.

Based on the Phase II PA/SI analytical results, Ecology concluded:

- "...chromium in the sediments of stream #1 may indicate chronic leaching from the hazardous waste pit."
- "Lateral migration of leachate from the hazardous waste pit (now closed) occurred in the past and may still occur, although not as prolifically."

Ecology recommended that the site be scored under the Hazard Ranking System (HRS), that the cover of the Wilder Landfill-Hazardous Waste Pit be repaired with cover materials, that surface water be diverted around the landfill location, and that a determination be made as to whether the materials in the landfill were "sufficiently contained" (Ecology 1987).

1.2.3.1.7 Ecology Sampling, January and March 1988

Two surface water samples from the drainage culvert on the southwest corner of the Wilder property (downgradient of the former Wilder Landfill-Hazardous Waste Pit) were collected by Ecology personnel in early 1988 (Ecology 1988). Limited results of the metals concentrations ($\mu\text{g/L}$) in these samples were included in an Ecology memorandum, and are presented in the table below (Ecology 1988):

Sample Date	Surface Water Sample Concentration ($\mu\text{g/L}$)		
	Chromium	Nickel	Copper
January 1988	150	160	60
March 1988	180	100	59

Modified from Ecology 1988

1.2.3.1.8 Ecology Toxics Investigation Section Study, June 1988

Ecology's Toxics Investigation Section conducted an investigation on metals concentrations sediment and fish tissue in Claypit Pond (Ecology 1989b). Twelve sediment stations were sampled and analyzed for metals, total organic carbon (TOC), and grain size distribution. The analytical results from the twelve sediment samples collected by Ecology, as well as reference samples cited in the report, are presented in the table below; clay and TOC concentrations are reported as percentages, while metals concentrations are reported as micrograms per gram ($\mu\text{g/g}$) or parts per million (Ecology 1989b).

Sample ID	Location Description	Sediment Sample Concentration							
		%		µg/g					
		Clay	TOC	As	Cr	Cu	Hg	Ni	Zn
1	Hazardous waste landfill drainage	0.4	0.4	2.6	98	25	0.040	54	72
2	Friese Hide & Tallow	18.9	0.6	9.9	75	69	0.035	71	128
3	Upstream end of railroad culvert	25.7	6.9	17.9	740	52	0.60	59	347
4	Stream outside TRC berm	47.4	11.0	23.6	201	99	0.67	151	813
5	Stream downgradient of railroad culvert	23.6	1.4	1.9	74	30	0.027	43	104
6	Claypit Pond	33.1	2.3	5.9	265	47	0.048	68	166
7	Claypit Pond	37.4	2.1	8.3	277	50	0.051	75	176
8	Claypit Pond	38.1	1.1	7.4	100	44	0.040	65	115
10	Outlet Claypit Pond	37.5	0.5	6.4	69	51	0.043	73	104
11	Silver Creek above highway	21.3	2.4	5.9	98	44	0.044	114	113
12	Silver Creek above mouth	26.4	3.1	8.1	64	48	0.030	95	110
13	Silver Creek mouth	6.5	1.3	8.6	86	41	0.043	157	98
E	Silver Creek mouth ¹	3.1	NA	7.5	66	43	0.044	156	82
A	Silver Creek tributary	10.8	NA	4.1	49	31	0.027	38	83
B	Nooksack River "control"	4.3	0.4	5.2	38	26	NA	109	62
F	Whatcom Creek	3.1	1.0	3.3	24	22	0.049	27	110
G	Whatcom Creek	0.7	0.4	3.1	26	13	0.042	21	72
H	Whatcom Creek	3.4	4.0	6.1	40	47	0.071	35	170
I	Whatcom Creek	2.2	0.8	4.9	25	12	0.040	23	45

Notes:

Modified from Ecology 1989b

¹Unpublished data from joint EPA/Lummi Tribe sampling

NA: Not analyzed/not available

The highest concentrations of all parameters except chromium were found in sediments in the drainage ditch alongside the TRC facility (Ecology 1989b). A statistical evaluation of the analytical results indicated that "onsite" chromium and copper concentrations (indicated by numeric sample IDs) were significantly higher than those of the reference samples (indicated by alphabetic sample IDs; Ecology 1989b). Ratios calculated to compare chromium concentrations to other metals (arsenic, copper, nickel, and zinc) in each sample indicated "chromium concentrations were highest in the pond and the streams that feed the pond from Thermal Reduction Company's active and inactive waste sites" (Ecology 1989b).

Metals concentrations in fish caught from Claypit Pond were determined to be below legal limits set by the USA and Canada (Ecology 1988).

1.2.3.1.9 EPA Phase 1 of TRC, November 1988

The Technical Assistance Team (TAT) performed a Phase I sampling investigation of TRC for EPA in November 1988 (E&E 1989). Twenty seven field samples were collected: six ash samples from the TRC ash pile, six surface water samples and six sediment samples from surface water drainage routes in the vicinity, and nine groundwater samples from wells present on the TRC property. Surface water, sediment, and groundwater samples were analyzed for VOCs, SVOCs, Pesticides, PCBs, metals, and cyanide. Three surface sampling stations are considered

relevant to the Wilder Landfill-Hazardous Waste Pit; one from upgradient of the landfill; one from downgradient of the landfill; and one from south of the culvert under the railroad tracks, which includes drainage from and south of the TRC facility. The water sample analytical results ($\mu\text{g/L}$) from these stations are summarized in the table below (modified from E&E 1989):

Analyte	Surface Water Sample Concentration ($\mu\text{g/L}$)		
	Upgradient of Hazardous Waste Landfill	Downgradient of Hazardous Waste Landfill	South of Railroad Culvert
Aluminum	100.00 UJ	100.00 UJ	787.00 J
Antimony	R	R	R
Arsenic	R	R	R
Beryllium	40.00 U	40.00 U	58.80
Cadmium	68.00	61.70	62.00
Calcium	28200.00	27600.00	33300.00
Chromium	14.30	18.60	9.00 J
Cobalt	4.00 U	4.00 U	10.20 J
Copper	31.50	43.80	79.90
Iron	828.00 J	1060.00 J	3620.00 J
Lead	R	R	R
Magnesium	12900.00	12400.00	13700.00
Manganese	87.00 J	103.00 J	1610.00 J
Mercury	0.60	0.30	0.20 U
Nickel	8.00 UJ	8.00 UJ	8.00 UJ
Potassium	7300.00	6800.00	5900.00
Selenium	R	R	R
Silver	R	R	R
Sodium	66300.00	60500.00	63400.00
Thallium	R	R	R
Vanadium	12.00 U	12.00 U	12.00 U
Zinc	13.80 J	19.80 J	314.00 J

Notes:

Modified from E&E 1989.

R: Data rejected due to deficient quality control criteria.

U: The analyte was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit.

J: The associated numerical value is an estimated quantity because the reported concentrations were less than the contract required detection limits or quality control criteria were not met.

The sediment sample analytical results (mg/kg) from the three stations relevant to the Wilder Landfill-Hazardous Waste Pit are summarized in the table below (modified from E&E 1989):

Analyte	Sediment Sample Concentration (mg/kg)		
	Upgradient of Hazardous Waste Landfill	Downgradient of Hazardous Waste Landfill	South of Railroad Culvert
Aluminum	21000.00	27000.00	21300.00
Antimony	R	R	R
Arsenic	R	R	R
Barium	148.00	85.80	163.00
Beryllium	1.10 J	1.40 J	1.10 U
Cadmium	4.20 J	2.30 J	4.50 U
Calcium	6220.00	4340.00	4200.00
Chromium	53.00 J	50.20 J	69.30 J
Cobalt	14.50 J	10.90 J	13.50 J
Copper	57.60 J	65.20 J	68.40 J
Iron	29300.00	23500.00	37700.00
Lead	R	R	R
Magnesium	6470.00	5060.00	9800.00
Manganese	506.00 J	654.00 J	337.00 J
Mercury	0.06 J	0.10 J	0.06 J
Nickel	28.50	73.50	44.30
Potassium	243.00 J	350.00 J	1060.00 J
Selenium	R	R	R
Silver	R	R	R
Sodium	1070.00 J	846.00 J	1110.00 J
Thallium	2.00 U	1.70 U	2.90 U
Vanadium	56.80	66.40	64.50
Zinc	142.00 J	308.00 J	148.00 J
Cyanide	10.00 U	10.00 U	10.00 U

Notes:

Modified from E&E 1989.

R: Data rejected due to deficient quality control criteria.

U: The analyte was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit.

J: The associated numerical value is an estimated quantity because the reported concentrations were less than the contract required detection limits or quality control criteria were not met.

The TAT data showed that the water sample from north of the railroad culvert contained concentrations of chromium, copper, iron, manganese, and zinc above those in the background sample. The sediment sample from north of the railroad culvert contained concentrations of aluminum, beryllium, copper, manganese, mercury, nickel, potassium, vanadium, and zinc above those in the background sample. Nickel and zinc values were twice as high as the background concentrations.

No VOCs other than acetone were detected in any of the sediment samples. No VOCs were detected in sediments from downgradient of the Wilder Landfill-Hazardous Waste Pit. Eleven SVOC and one PCB Aroclor were detected in the sediment sample downgradient of the Wilder Landfill-Hazardous Waste Pit; none were detected in the sample upgradient of the waste landfill. The concentrations (ppb) of compounds detected in the sediment sample downgradient of the landfill are summarized in the table below:

Analyte	Sediment Sample Concentration (ppb)
Acenaphthene	1200
Fluorene	820
Phenanthrene	9200
Fluoranthene	22000
Pyrene	18000 J
Benzo(a)anthracene	12000
Chrysene	21000
Benzo(b)fluoranthene	36000
Benzo(k)fluoranthene	35000 E
Benzo(a)pyrene	18000
Indeno(1, 2, 3-cd)pyrene	22000 J
Arochlor 1248	5700

Notes:

Modified from E&E 1989.

J: The associated numerical value is an estimated quantity because the reported concentrations were less than the contract required detection limits or quality control criteria were not met.

E: Indicates a compound whose concentration exceeded the calibration range of the instrument.

Based on their data, the TAT stated that leachate from the Wilder Landfill-Hazardous Waste Pit is a possible source of these contaminant concentrations (E&E 1989).

1.2.3.1.10 TRC Quarterly Monitoring, 1988–2002

Quarterly monitoring of groundwater and surface water stations began at the ROW facility in 1988 (Vasey Engineering 1994). Surface water stations include the railroad culvert draining to Claypit Pond, and the streams draining to the culvert from the north and the south. Occasional exceedances of inorganic surface water criteria were reported at various surface water stations in the first decade of sampling, but recent data indicates no ongoing surface water issues (Dodd 2002a).

1.2.3.1.11 Ecology, 1991

Personnel from Ecology's Toxics Cleanup Program (TCP) collected two surface water samples from the surface water discharge areas on the northwest and southwest corners of the former Wilder Landfill-Hazardous Waste Pit on 27 March 1991 (Ecology 1991). The samples were analyzed for metals, VOCs, and pesticides/herbicides (Ecology 1999). Certain metals were the only constituents detected (Ecology 1991). The concentrations reported by Ecology in ppm were converted to ppb and are shown in the table below (Ecology 1991):

Analyte	Concentration (ppb)
Barium	59.1
Copper	19.0
Manganese	696
Zinc	21.0
Aluminum	2180
Calcium	40.0
Iron	32.3
Magnesium	16.4
Sodium	78.4
Strontium	230
Titanium	111

Based on these results, given Ecology's limited resources and the existence of higher priority sites, no further action regarding the former Wilder Landfill-Hazardous Waste Pit was recommended at the time (Ecology 1991).

1.2.3.1.12 Ecology, 1999 Site File Evaluation

Ecology personnel performed a review of pertinent files regarding the former Wilder Landfill-Hazardous Waste Pit in 1999. In the evaluation, Ecology pointed out the lack of cleanup activities at the site, and the lack of future plans for investigation and monitoring, and the lack of groundwater information at the waste pit. It was concluded that the former waste pit, "is a source of hazardous wastes including DNAPLs (Dense Non-Aqueous Phase Liquids)...may be affecting groundwater and surface water quality."

1.2.3.2 Migration/Exposure Pathways and Targets

This section discusses the groundwater migration, surface water migration, soil exposure, and the air migration pathways and potential targets within the site's range of influence (Figures 1-5 and 1-6).

1.2.3.2.1 Groundwater Migration Pathway

The Wilder Landfill-Hazardous Waste Pit is located in Ferndale, Washington. The site is within the Bellingham Basin, a structural basin formed during the early part of the Tertiary Age (Golder 1988).

Three geologic units are considered most relevant to the Wilder Landfill-Hazardous Waste Pit: the Sumas Outwash; the Bellingham Drift; and the Kulshan Drift (Golder 1988). The Sumas Outwash, characterized by coarse- to fine-grained sand and silt with trace amounts of gravel and clay, appears in the vicinity of the site as a "bench" or escarpment (approximately 10 to 15 feet high) trending northeast-to-southwest on the eastern portions of the Wilder and ROW properties (Vasey Engineering 1994; Golder 1988). The Sumas Outwash sediments were deposited by streams of meltwater originating from northern glaciers approximately 10,000 to 11,000 years ago (Golder 1988).

The Sumas Outwash is apparently not present on the western portion of the Wilder property where the former landfill is located. Natural surface soils at the surrounding the landfill are

derived from the glaciomarine deposits of the Bellingham Drift (Golder 1988). The Bellingham Drift deposits underlying the Sumas Outwash are described as soft to firm, olive gray, silty clay, with traces of shell material and localized zones of fine to coarse sand with traces of gravel (Vasey Engineering 1994; Golder 1988). In borings collected at the ROW facility, Bellingham Drift sediments have been identified to depths of at least 60 feet MSL (30 feet bgs; Golder 1988). The Bellingham Drift is underlain by a similar unit of glaciomarine deposits known as the Kulshan Drift. Both the Bellingham and Kulshan drift units were deposited on the seabed between 10,000 to 13,000 years ago (Golder 1988). Similarities between the two units make it very difficult to distinguish between them, but the contact is reported to exist at approximately 50 feet bgs (Vasey Engineering 1994).

Monitoring wells have been installed at the ROW facility during various studies conducted at that site. There have been groundwater quality contaminant exceedances but they have been attributed to relic marine water and naturally occurring elements (Dodd 2002b). The characteristics of the groundwater obtained in the studies are representative of the groundwater upgradient of the Wilder Landfill-Hazardous Waste Pit.

Three water-bearing zones have been discovered at the ROW facility, based on data from the monitoring wells (Golder 1988). A shallow zone exists in the Sumas Outwash, an intermediate zone in the Bellingham Drift, and a deeper zone in the Kulshan and Bellingham Drift. A perched water table is found in the Outwash deposits, and springs have been noted in the vicinity of the site at the foot of the deposit at the contact with the underlying fine-grained Bellingham Drift (Vasey Engineering 1994; E&E 1989).

The second groundwater zone exists in the Bellingham soils from approximately 16 feet to 35 feet bgs. "This zone is characterized as alternating layers of sandy silt, sand and silt, and silty sand within a deposit composed primarily of clay and silt," (Golder 1988). The third water-bearing zone exists in the Kulshan and Bellingham Drift between 54 and 90 feet bgs (Golder 1988). This zone is pressurized due to the low permeability of the soil under the water table. Samples from undisturbed silt and clay deposits of the Bellingham Drift were tested for permeability; the results showed a very low vertical permeability of 10^{-8} centimeters per second (Golder 1988). All three water-bearing zones produce little water and have very low flow rates. ROW monitoring wells have a very slow groundwater recharge rate. Golder noted that wells could be emptied with a hand bailer, and that recovery of the wells to static water levels took greater than 24 hours.

The results of the quarterly monitoring at the ROW facility suggests the groundwater flow is generally west northwest (Dodd 2002a). There is a divide in the vertical groundwater gradient that runs diagonally from northeast to southwest across the Recomp Facility; the vertical groundwater gradient is upward to the west of this divide and downward to the east (Golder 1988). Based on the location and trend direction of this divide, an upward groundwater gradient may exist in the vicinity of the Wilder Landfill-Hazardous Waste Pit.

Bellingham soils are the most relevant soil type at the site. The effective vegetation rooting depth is limited by a seasonal high water table, located at or near the surface from November through April. Runoff is usually very slow and water may be ponded over surface soils during the winter (National Cooperative Soil Survey 1992). Very little irrigated acreage lies within one mile of the site (Ecology 1987).

The Whatcom County Health and Human Services provided the location and description of drinking water wells in Whatcom County. The private well population was estimated based on the average number of 2.6 residents per household for Whatcom County (EPA 1990b). The municipal well population was based on information obtained from the Washington State Department of Health Water System Data (2001). No drinking wells are located directly on the Wilder Landfill-Hazardous Waste Pit. The closest domestic drinking water well is located 0.4 miles south of the site and is privately serving two people. Within the 4-mile TDL, there are approximately 249 private wells serving approximately 649 people and 34 municipal wells serving approximately 9,715 people. Populations using groundwater wells for drinking water within four miles of the site are summarized in Table 1-1.

1.2.3.2.2 Surface Water Migration Pathway

Topography across the Wilder Landfill-Hazardous Waste Pit property generally slopes from the east to the west. The drainage ditches to the south and northwest of the landfill and along the railroad track provide overland flow pathways to the discharge point of the railroad culvert, which is likely the probable point of entry (PPE) of contaminants to surface water. Claypit Pond is an eleven-acre artificial pond located west of the site along the west side of the railroad. The pond was formed by a dredging operation that removed clay for making bricks; it filled with runoff after quarry activities ceased. The maximum depth of the pond is approximately 30 feet (Ecology 1987). Claypit Pond drains at its southwestern tip into a small ditch that flows westward approximately 70 feet to Tennant Lake Creek. Tennant Lake Creek flows south for approximately one mile, where it converges with Silver Creek. Silver Creek flows south for about 1.3 miles before reaching the Nooksack River delta in Bellingham Bay. The remainder of the TDL extends as an arc approximately 13 miles into Bellingham Bay (Figure 1-5).

Claypit Pond is owned and operated by the Washington State Department of Fish and Wildlife (WDFW) and was stocked with a variety of fish species including yellow perch (*Perca flavescens*) and largemouth bass (*Micropterus salmoides*; Ecology 1980b). The WDFW undertook an investigation of Claypit Pond in June of 1988 and showed the area was also utilized by cutthroat trout (*Oncorhynchus clarki clarki*), bullhead, pumpkinseed, and coho salmon (WDFW 1988). Duck and pheasant hunting occur at Claypit Pond and an abundance of wildlife utilize the area, including waterfowl such as mallard, teal, Canadian geese, trumpeter and whistling swans (Johnson 1988). Otters, beavers, muskrats, weasels, and raccoons inhabit the area at and around Claypit Pond (Johnson 1988). The National Wetland Inventory (NWI) map shows that approximately 400 acres of wetlands exist within 4-miles downstream of the Wilder Landfill-Hazardous Waste Pit toward Bellingham Bay (USFWS 1987).

Ecology conducted a fish survey at Claypit Pond in June and July of 1980. The fish survey indicated that there were signs of a fish kill in 1979 because the young age class of largemouth bass and yellow perch were missing (Ecology 1989a). Ecology contributed the loss of fish population to elevated mercury and salt concentrations (Ecology 1980b). The Recomp Facility was deemed responsible for the contamination and paid a fine of \$1,132.30 in 1980 for destroying a public recreational area (Ecology 1996). The pond was closed in late 1988 due to high levels of heavy metals in the water and sediment that resulted in decreasing fish populations (WDFW 1989).

The nearest weather station is located at the Washington State Nursery in Bellingham approximately four miles southeast of the site. The mean annual precipitation over a 50-year period (1915-1965) was 33.6 inches, with an estimated potential evapotranspiration of 24.6 inches (Ecology 1987). This results in an annual surplus of at least nine inches of rain for this period. According to the Western Regional Climate Center (WRCC), the 2-year, 24-hour rainfall for the area is 3.3 inches (WRCC 2001). The Bellingham soils in the area, composed of silty clay, have slow permeability and a high capacity for water. As a result, runoff is very slow and ponding tends to occur at the site (National Cooperative Soil Survey 1992). The area is periodically flooded during heavy rain periods (USFWS 1987).

The Nooksack River is used as a source for drinking water; however, the two domestic surface water intakes on the Nooksack River are upgradient from the Wilder Landfill-Hazardous Waste Pit (WCHHS 2001).

1.2.3.2.3 Soil Exposure Pathway

The Wilder Landfill-Hazardous Waste Pit is a large open field with no buildings or structures built directly on the site. The landfill is unpaved and covered with vegetation. The NWI map of the area does not designate any wetland area on the landfill (USFWS 1987).

Friese Hide and Tallow is a cattle hide curing facility located down gradient and approximately 80 feet from the northwest corner of the landfill (Ecology 1989a). Twenty-five employees work at the facility (Friese Hide and Tallow 2002). There are no boundaries limiting access to the site from Friese Hide and Tallow, such as a fence or trees. The 20-acre ROW facility is located approximately 100 feet south of the waste landfill. Approximately 19 people work at the Recomp Facility (Moscone 2001). A chain-link fence surrounding Recomp limits access to the Wilder Landfill-Hazardous Waste Pit. About 3 people reside approximately 0.4 miles from the landfill and approximately 62 people live within one mile of the site (PCGEMS 1995). Table 1-2 details the resident population living within four miles of the landfill. There are no schools or day care facilities within 200 feet of the landfill.

1.2.3.2.4 Air Migration Pathway

The Wilder Landfill-Hazardous Waste Pit does not contain any buildings or structures and there are no individuals living or working on the site. The soil is wet and vegetated so air born dust is unlikely to occur. The nearest workers are approximately 80 feet from the landfill at the Friese Hide and Tallow Facility. A total of 12,070 people live within 4 miles of the site (PCGEMS 1995). The landfill is located approximately 300 feet from Claypit Pond, which was used for recreational fishing until 1988 (Ecology 1989a). The presence of sensitive environments have been discussed previously in Subsections 1.2.3.2.2 and 1.2.3.2.3.

1.2.3.3 Areas of Potential Contamination

Sampling under the PA/SI will be conducted at the areas considered the potential contamination source (the former landfill) and at areas that may have been contaminated through the migration of hazardous substances from the source. Based on a review of background information and discussions with site representatives, the potential hazardous substance release sources and

targets identified for inspection under the Wilder Landfill-Hazardous Waste Pit PA/SI are outlined below.

1.2.3.3.1 Potential Sources

- **Landfill surface soil and water.** Available records indicate that the adequacy of the cover material on the landfill has not been evaluated (EPA 1982; Ecology 1987). Previous inspections determined that leachate generation may be possible at the landfill (Whatcom County 1982). If leachate generation has occurred since the landfill was covered, surface soils covering the landfill may have become contaminated by the possible release of leachate. Standing water has been observed on the landfill cover (Whatcom County 1982), which may also have become contaminated by any release of leachate. Contaminants of concern include TAL metals, hexavalent chromium, SVOCs, Pesticides, and PCBs.
- **Landfill waste.** The landfill waste will be sampled directly for characterization. Based on previous statements regarding the contents of the landfill, contaminants of concern are known to include TAL metals, hexavalent chromium, SVOCs, VOCs, Pesticides, and PCBs.

1.2.3.3.2 Potential Targets

- **Groundwater.** The protection of groundwater from migration of hazardous substances in the landfill, based on the fine-grained nature of the subsurface soils in the area, has been assumed (Ecology 1987) but no records exist of samples confirming this assumption. The Potential contaminants of concern include TAL metals, hexavalent chromium, SVOCs, VOCs, Pesticides, and PCBs.
- **Surface sediment.** Previous investigations have indicated that contaminants possibly attributable to the landfill may have impacted sediment in the surface water drainage pathway, including Claypit Pond - a former fishery closed due to elevated contaminant levels - and streams downgradient of Claypit pond (Ecology 1989a). Contaminants of concern include TAL metals, hexavalent chromium, SVOCs, Pesticides, and PCBs.

1.3 PROJECT/TASK DESCRIPTION AND SCHEDULE

This section provides the project description (Section 1.3.1) and proposed schedule (Section 1.3.2).

1.3.1 Project Description

This section defines the objectives and scope for performing the PA/SI activities at the Wilder Landfill-Hazardous Waste Pit site. The main goals for the PA/SI activities are as follows:

- Collect and analyze samples to characterize the potential sources discussed in Section 1.2.3.3.
- Determine off-site migration of contaminants.
- Provide the EPA with adequate information to determine whether the site is eligible for placement on the National Priorities List (NPL).

- Document a threat or potential threat to public health or the environment posed by the site.

1.3.2 Schedule

The following schedule for implementing the Wilder Landfill-Hazardous Waste Pit PA/SI is intended to be used as a guide. Adjustments to the implementation dates and the estimated project duration may be necessary to account for variable unforeseen or unavoidable conditions that the field team may encounter. Examples include the inability to obtain permission for site access, inclement weather, difficulties in accessing a sampling site, or additional time needed to complete a task. Significant schedule changes that arise in the field will be discussed with the TM at the earliest possible convenience. The proposed schedule of project work is as follows:

Activity	Start	Complete
Geophysical Survey	6/17/2002	6/18/2002
Mobilize to Site	7/8/2002	7/8/2002
Sample Collection Activities	7/8/2002	7/12/2002
Laboratory Receipt of Samples	7/9/2002	7/13/2002
Demobilization from Site	7/12/2002	7/13/2002
Laboratory Analysis	7/9/2002	8/6/2002
Receipt of Data from Laboratory	7/11/2002	8/9/2002
Data Validation	7/12/2002	9/23/2002
Writing of Project Report	9/24/2002	11/19/2002
Target Project Completion Date	Not Applicable	12/31/2002

1.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The project data quality objectives are to provide valid data of known and documented quality to characterize sources, determine off-site migration of contaminants at or above levels specified in Table 2-3, determine whether the site is eligible for placement on the NPL, and document threat(s) or potential threat(s) to public health or the environment posed by the site. The DQO process applied to this project followed that described in the EPA document, *Guidance for the Data Quality Objectives Process* (EPA 1994b).

1.4.1 DQO Data Categories

All samples collected under this SQAP will be analyzed using definitive analytical methods. All definitive analytical methods employed for this project will be methods approved by the EPA. The data generated under this project will comply with the requirements for this data category as defined in *Data Quality Objective Process for Superfund* (EPA 1993).

1.4.2 Data Quality Indicators (DQIs)

DQI precision, accuracy, representativeness, comparability, and completeness goals for this project were developed following guidelines presented in the EPA *Guidance for Quality Assurance Project Plans* (EPA 1998).

The basis for assessing each of the elements of data quality is discussed in the following subsections. Table 2-3 presents the QA objectives for measurement of analytical data and QC guidelines for precision and accuracy. Other DQI goals are included in the individual Standard Operating Procedures (SOPs) in Appendix A and in the laboratory Statement of Work (SOW) in Appendix D.

1.4.2.1 Representativeness

Representativeness is a measure of the degree to which data accurately and precisely represent a population, including a sampling point, a process condition, or an environmental condition. Representativeness is the qualitative term that should be evaluated to determine that measurements are made and physical samples collected at locations and in a manner resulting in characterizing a matrix or media. Subsequently, representativeness is used to ensure that a sampled population represents the target population and an aliquot represents a sampling unit. This SQAP will be implemented to establish representativeness for this project.

Further, all sampling procedures detailed in the SQAP will be followed to ensure that the data will be representative of the media sampled. The SQAP describes the sample location, sample collection and handling techniques to avoid contamination or compromise sample integrity, and proper chain of custody. Additionally, the sampling design presented in the SQAP will ensure that there are a sufficient number of samples and level of confidence that analysis of these samples will detect the chemicals of concern, if present.

1.4.2.2 Comparability

Comparability is the qualitative term that expresses the measure of confidence that two data sets or batches can contribute to a common analysis and evaluation. Comparability with respect to laboratory analyses pertains to method type comparison, holding times, stability issues, and aspects of overall analytical quantitation. The following items are evaluated when assessing data comparability:

- Determining if two data sets or batches contain the same set of parameters.
- Determining if the units used for each data set are convertible to a common metric.
- Determining if similar analytical procedures and quality assurance were used to collect data for both data sets.
- Determining if the analytical instruments used for both data sets have approximately similar detection levels.
- Determining if samples within data sets were selected and collected in a similar manner.

To ensure comparability of data collected during this investigation to other data that may have been or may be collected for the site, standard collection and measurement techniques will be used.

1.4.2.3 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not rejected through data validation. The requirement for completeness is 90% for aqueous samples and 90% for soil/sediment samples.

The following formula is used to calculate completeness:

$$\% \text{ completeness} = \frac{\text{number of valid results for samples analyzed}}{\text{number of possible results for all samples}} * 100$$

For this investigation, all samples are considered critical. Therefore, standard collection and measurement methods will be used to achieve the completeness goal.

1.4.2.4 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. *Analytical* precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. The laboratory control sample (LCS) determines the precision of the analytical method. The comparison is not between a sample and a duplicate sample analyzed in the same batch. Rather, the comparison is between the sample and samples analyzed in previous batches.

Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and sample matrix duplicate spiked samples shall be analyzed to assess field and analytical precision, and the precision measurement is determined using the relative percent difference (RPD) between the duplicate sample results.

The following formula is used to calculate precision:

$$RPD = (100) \times \frac{(S_1 - S_2)}{(S_1 + S_2)/2}$$

where:

S_1 = normal sample value
 S_2 = duplicate sample value

1.4.2.5 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random uncertainty (variability due to imprecision) and systemic uncertainty. It reflects the total uncertainty associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS or MS/MSD sample to a control limit. For VOCs and SVOCs, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed. Analysis of performance evaluation samples also may be used to provide additional information for assessing the accuracy of the analytical data being produced.

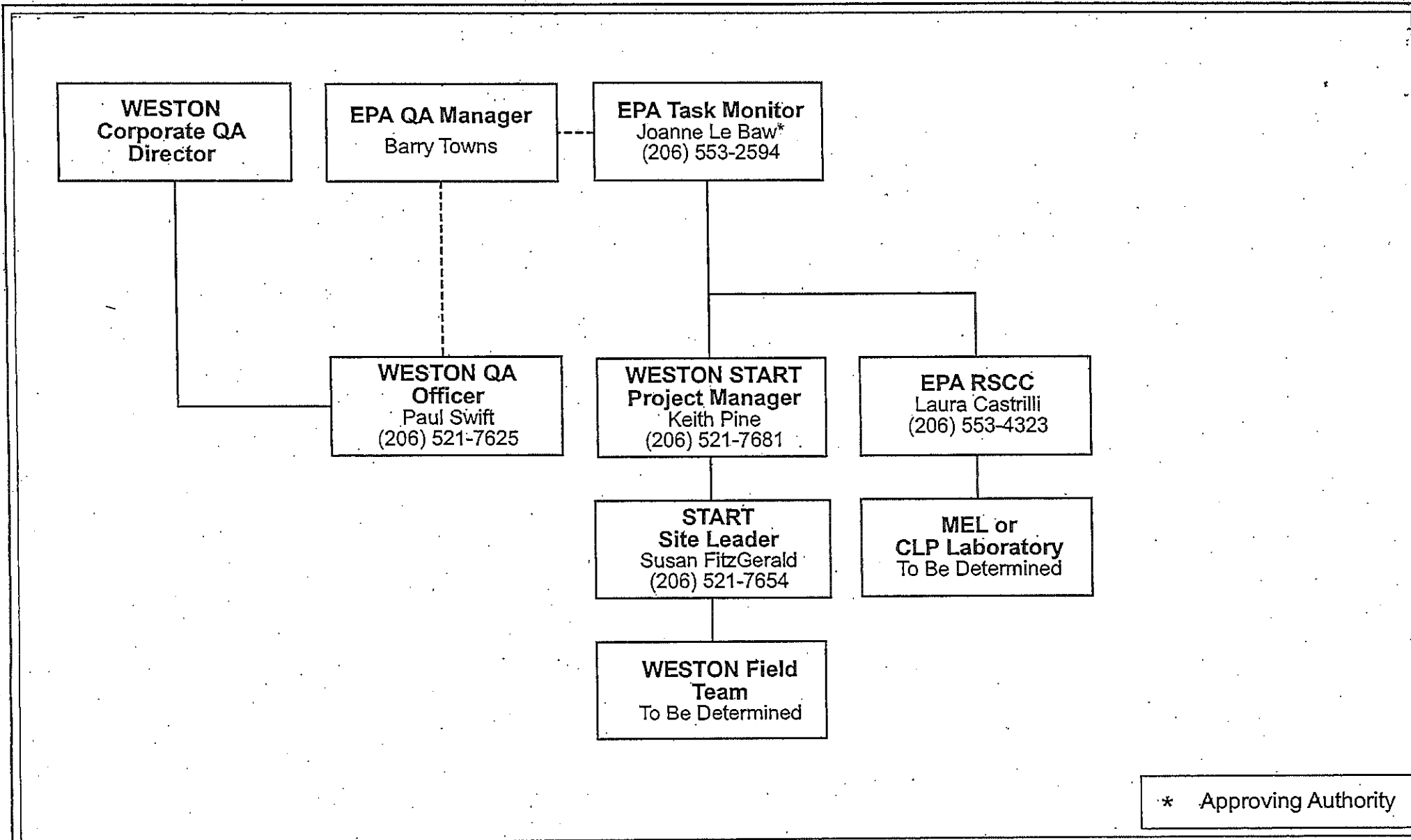
1.5 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

No special training requirements or certifications are required for this project except for the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) class and annual refreshers. Health and safety procedures for WESTON personnel are addressed in the WESTON site-specific health and safety plan. As previously discussed (Section 1.2), copies of this document are maintained in WESTON's Seattle office and at the project site. Included in the plan are descriptions of anticipated chemical and physical hazards, required levels of protection, health and safety monitoring requirements and action levels, personal decontamination procedures, and emergency procedures. All field personnel and subcontractors are required to read and comply with the plan.

1.6 DOCUMENTATION AND RECORDS

This document is meant to be combined with information presented in WESTON's QMP (WESTON 2001) for Region 10 START. This information is covered by Section 2.3 of this SQAP (Sample Handling and Custody Requirements), the SOPs found in Appendix A, the Supplemental Forms found in Appendix B, the Commercial and CLP Laboratory Statements of Work, and the commercial laboratory Quality Assurance Manual, which has been previously reviewed by WESTON and EPA. A copy of the START QMP is available in WESTON's Seattle office. Standards contained in the SOPs and the QMP will be used to insure the validity of data generated by WESTON for this project.

Following the completion of fieldwork and the receipt of analytical data, a report summarizing project findings will be prepared. Project files including work plans, reports, analytical data packages, correspondence, chain-of-custody documentation, original logbooks, corrective action forms, referenced materials, and photographs will be provided to the EPA TM at the close of the project, as needed. Further, a CD-ROM deliverable containing a portable document format (:pdf) file of the PA/SI report, database files of sample analytical results, and sample location coordinates also will be provided.

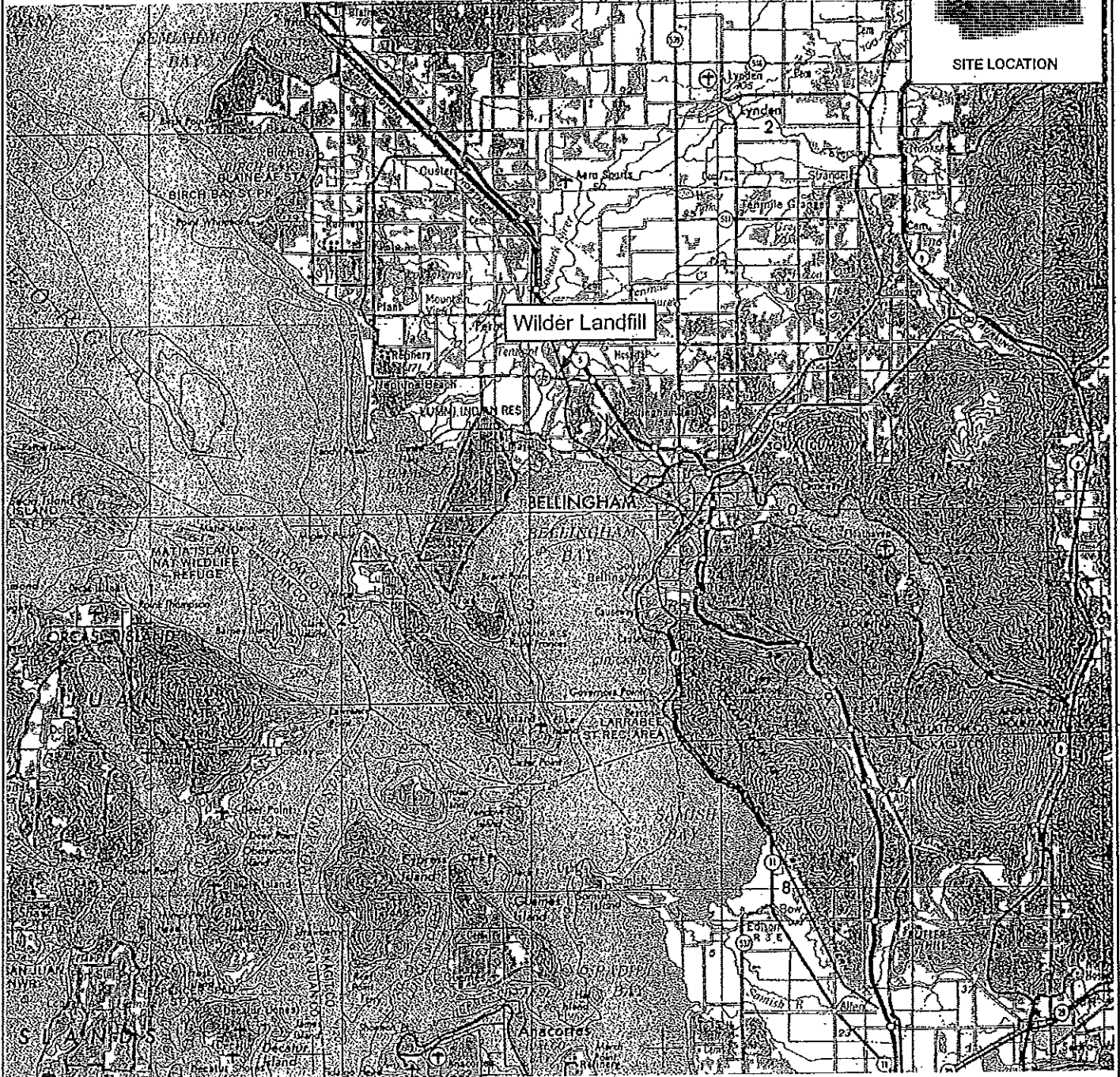


Project Organization Chart
 Wilder Landfill-Hazardous Waste Pit PA/SI
 Ferndale, Washington

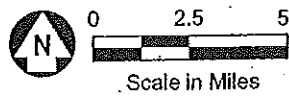
WASHINGTON



SITE LOCATION



Source: USGS 1:250,000 Series Topo of Victoria, B.C., Canada; Washington, U.S. 1957 (1974)



Scale in Miles

Site Location Map Wilder Landfill-Hazardous Waste Pit PA/SI Ferndale, Washington

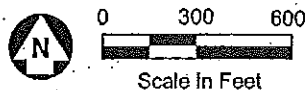


Figure

1-2

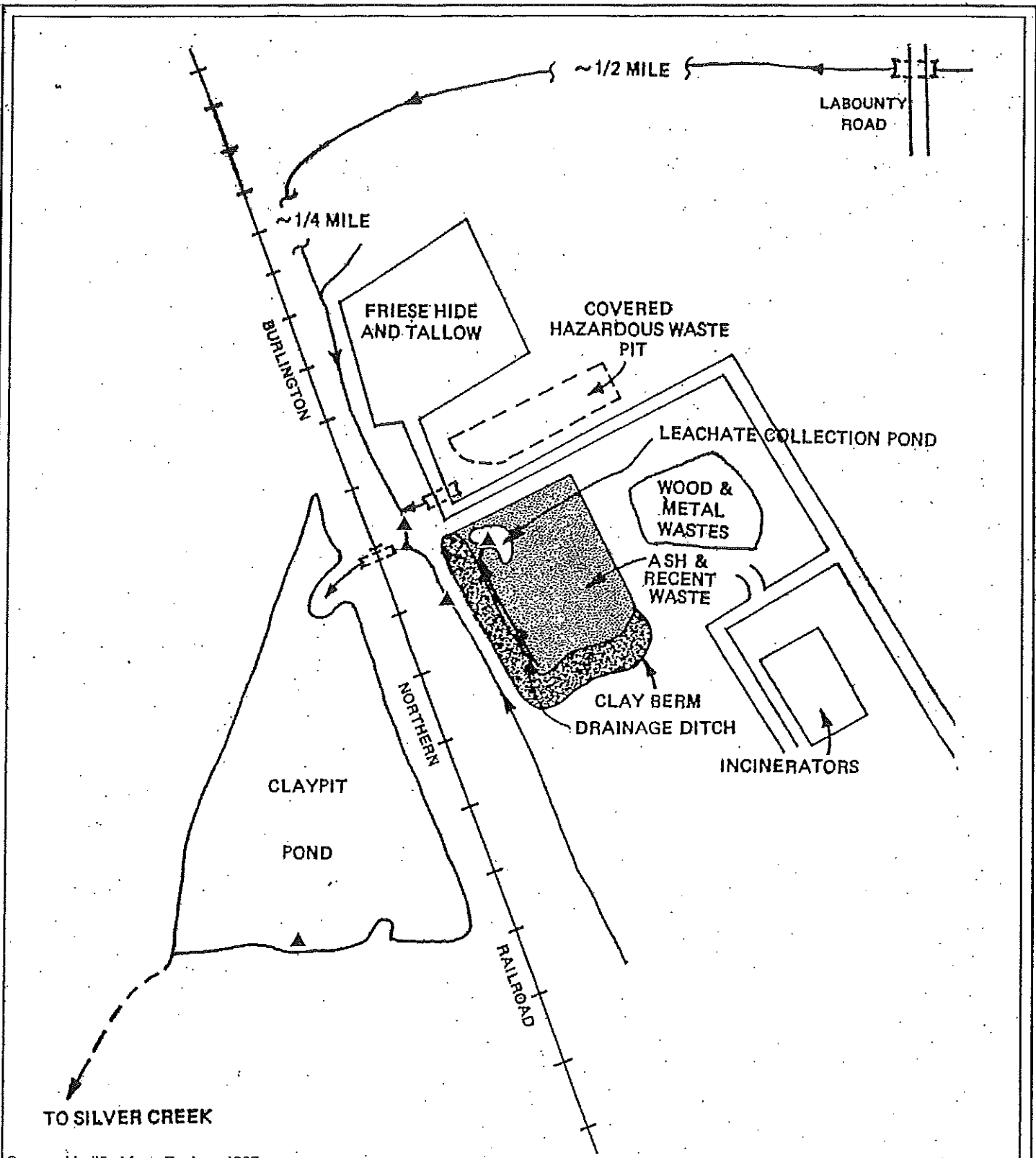


Source: Walker and Associates Aerial Photograph, 9 August 2001.




Site Vicinity Diagram Wilder Landfill-Hazardous Waste Pit PA/SI Ferndale, Washington

Figure
1-3



Source: Modified from Ecology 1987.

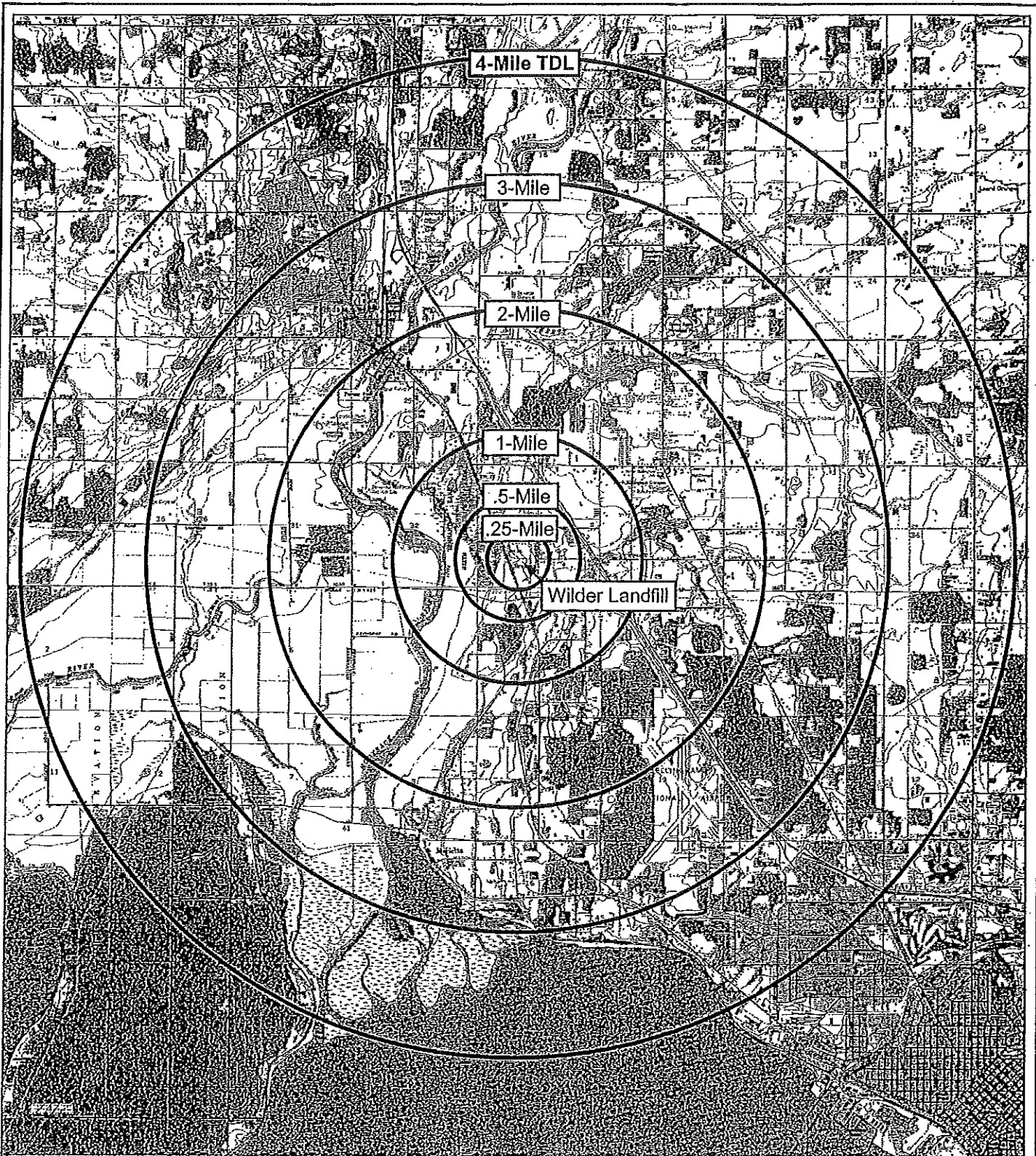
Ecology 1986 PA/SI Sampling Locations Wilder Landfill-Hazardous Waste Pit PA/SI Ferndale, Washington

 Not to Scale



 Ecology Sampling Location

Figure
1-4



Source: USGS 7.5' Series Topo map of Bellingham North, WA 1954 (1994), and Ferndale, WA 1952 (1994).

4-Mile Target Distance Limit (TDL) Map Wilder Landfill-Hazardous Waste Pit PA/SI Ferndale, Washington

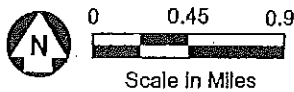
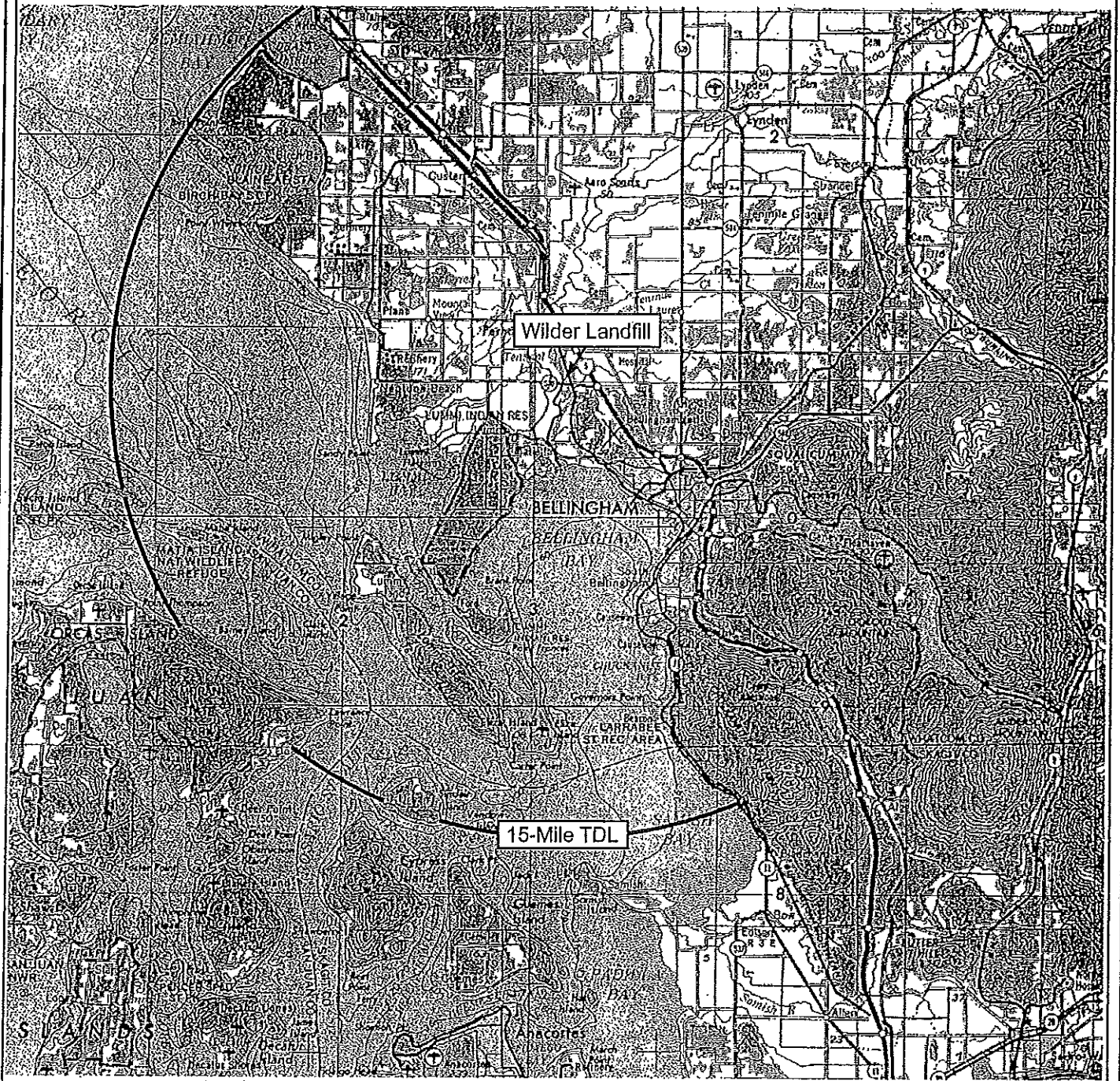
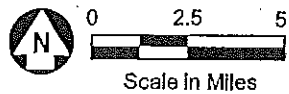


Figure
1-5



Source: USGS 1:250,000 Series Topo of Victoria, B.C., Canada; Washington, U.S. 1957 (1974)



15-Mile Target Distance Limit (TDL) Map Wilder Landfill-Hazardous Waste Pit PA/SI Ferndale, Washington



Figure

1-6

**Table 1-1—Populations Within a 4-Mile Radius
Wilder Landfill
Ferndale, Washington**

Distance Ring	Population
0 to ¼ mile	4
¼ to ½ mile	16
½ to 1 mile	42
1 to 2 mile	1,483
2 to 3 mile	5,720
3 to 4 mile	4,805
Total	12,070

Notes:
Source: PCGEMS 1995.

**Table 1-2—Groundwater Drinking Water Population Within a 4-Mile Radius
Wilder Landfill
Ferndale, Washington**

Distance (miles)	Well Identification	Well Population	Total Groundwater Drinking Population Per Distance Ring*
0 to ¼	Domestic	0	0
	Municipal	0	
¼ to ½	Domestic	5	7
	Municipal	2	
½ to 1	Domestic	63	151
	Municipal	88	
1 to 2	Domestic	185	960
	Municipal	775	
2 to 3	Domestic	146	8,689
	Municipal	8,543	
3 to 4	Domestic	250	557
	Municipal	307	
Total			10,364

Notes:

Sources:

Domestic and municipal well information was obtained from WCHHS, 2001.

Municipal Well population was based on Washington State Department of Health, 2001.

Domestic well population was estimated based on the average number of persons per household for Whatcom County of 2.6 people (EPA, 1990b).

SECTION 2

MEASUREMENT/DATA ACQUISITION

2.1 SAMPLING PROCESS DESIGN (EXPERIMENTAL DESIGN)

During the PA/SI, samples will be collected from locations or features considered potential contamination sources, from selected potential hazardous substance migration pathways, and from potential targets in those pathways. The locations to be sampled have been determined based on information derived from a review of background information and interviews with site representatives. Table 2-1 provides sample information regarding the sampling design and whether the measurement is considered critical or non-critical.

At the time of sampling, site-specific conditions (i.e., topography or visual evidence of contamination) will be evaluated and incorporated, when applicable, into the placement of sampling locations. Other conditions potentially contributing to deviations from the projected sampling locations include new observations or information obtained in the field that warrant an altered sampling approach, difficulty in reaching a desired soil sampling depth caused by adverse soil conditions or obstructions, or limited access to a sampling location. Significant deviations from the planned sampling locations or number of samples to be collected will be discussed with the EPA TM before implementation and will be documented on a Sample Plan Alteration form. A sample form is included in Appendix B. Every attempt will be made to collect representative samples with the equipment being used. This section will describe sample locations (Section 2.1.1); the global positioning system (Section 2.1.2); logistics (Section 2.1.3); cooler return (Section 2.1.4); coordination with Federal, State, and local authorities (Section 2.1.5); and the proposed schedule (Section 2.1.6).

2.1.1 Sample Locations

Sample locations have been selected to achieve the objectives discussed in Section 1.3.1. All samples will be submitted for off-site fixed laboratory analysis for TAL metals [Contract Laboratory Program Analytical Service (CLPAS) ILM04.1 and/or EPA SW-846 Methods 6010/6020/7000 Series/EPA 200 Series], hexavalent chromium (EPA Method 7196A or SM 3500-CrD), SVOCs (CLPAS OLM04.2 and/or EPA SW-846 Method 8270), and Pesticides/PCBs (CLPAS OLM04.2 and/or EPA SW-846 Methods 8081/8082). In addition, subsurface soil samples and groundwater samples will be analyzed for VOCs (CLPAs OLM04.2 and/or EPA SW-846 Method 8260), and waste samples will be analyzed for RCRA hazard categorization. Table 2-2 presents the anticipated number and types of samples, analytical methods, specific requirements for sample container size and type, sample preservation and holding times, and special handling requirements for samples expected to be collected at the site. Table 2-3 summarizes the number of QA/quality control (QC) samples to be submitted according to the method requirements. Proposed sample locations are illustrated on Figure 2-1. A summary of sampling locations and rationale is provided below.

2.7.1.1 Source Area Sampling

The landfill is the only identified source in this investigation. The anticipated samples associated with the landfill are as follows:

- **Surface soils.** Available records indicate that the adequacy of the cover material on the landfill has not been evaluated (EPA 1982). Surface water has been observed ponding on the cover material, and it is considered possible that leachate may be generated (Whatcom County 1982), by flooding of the landfill through the infiltration of surface run-on. If this has occurred, surface soils covering the landfill may have become contaminated by the possible release of leachate, and may in turn have become a source of contaminants. Up to four soil samples will be collected from the landfill cover material (Figure 2-1). If possible, the samples will be located where surface anomalies are observed (i.e., leachate seeps, stained or discolored surface soil, stressed vegetation; EPA 1991). The soil samples will be collected from an interval ranging from 0 to 2.0 feet below the ground surface (bgs), and will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.
- **Surface water.** Surface water that may collect on the landfill cover material may also be impacted by possible leachate and/or contaminated soil. One sample of surface water will be collected from standing water observed on the landfill cover material, if sufficient quantity is present. The surface water sample will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.
- **Landfill waste.** Up to six samples of the material in the landfill will be collected at the direction of the EPA TM. These samples will be collected from test pits excavated within the landfill area. The samples will be submitted for TAL metals, hexavalent chromium, SVOC, VOC, and Pesticide/PCB analyses, as well as RCRA hazard categorization analyses.

2.1.1.2 Target and Attribution Samples

- **Subsurface soil.** Four subsurface soil samples will be collected from locations downgradient and across-gradient of the landfill, at depths of 10 feet and 20 feet bgs (Figure 2-1). These samples will be submitted for TAL metals plus hexavalent chromium, SVOC, VOC, and Pesticide/PCB analyses.
- **Groundwater.** Groundwater flow in the area is to the north-northwest (Dodd 2002a). The fine-grained nature and low permeability of the subsurface soil indicate a low likelihood that groundwater may be sampled at the site; however, if possible, one groundwater sample will be collected from the water table at a location downgradient of the landfill (Figure 2-1). This groundwater sample will be submitted for TAL metals, hexavalent chromium, SVOC, VOC, and Pesticide/PCB analyses. If the water table is not encountered within 40 feet of the surface, no sample will be collected.
- **Overland flow pathway sediment/soil.** Drainage ditches are located to the northwest and south of the landfill. Sediment may or may not be present in the ditches in sufficient quantity for sampling, however, because possibly contaminated surface water runoff would impact the ditch soil, samples from the ditches may be comprised of surface sediment and/or soil. One target sediment/soil sample will be collected from each of these drainage

ditches at locations downgradient of the landfill (Figure 2-1). The ditches near the landfill each drain through culverts leading to another drainage ditch that runs north-south along the eastern bank of the BNR railroad grade. This north-south-flowing ditch in turn discharges to Claypit Pond through a culvert that runs beneath the railroad tracks. Another target sediment/soil sample will be collected from the ditch along the railroad tracks at a location just north of the railroad culvert (Figure 2-1). The target samples will provide information on possible contaminants in the ditches that potentially originate at the landfill. The railroad culvert also receives flow from a ditch flowing from the south; an attribution sample will be collected from the ditch south of the railroad culvert, which will provide information on possible contaminants originating from properties south of the landfill (Figure 2-1). Three target and one attribution surface sediment/soil samples are anticipated. These samples will be collected from an interval ranging from 0 - 0.5-foot bgs to limit the period of depositional history potentially incorporated into the samples. The samples will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.

- **Claypit Pond sediment.** Claypit Pond receives surface water drainage from the vicinity of the landfill. One surface sediment sample will be collected from Claypit Pond near the influent point of the railroad culvert (Figure 2-1). This sample will be collected from an interval ranging from 0 - 0.5-foot bgs, to limit the period of depositional history incorporated into the samples. The sample will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.
- **Claypit Pond outlet stream sediment.** One surface sediment sample will be collected from the unnamed stream draining Claypit Pond (Figure 2-2). This sample will be collected from an interval ranging from 0 - 0.5-foot bgs to limit the period of depositional history incorporated into the samples. The sample will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.
- **Tenant Lake Creek.** One surface sediment sample will be collected from Tenant Lake Creek that receives the flow draining from Claypit Pond (Figure 2-2). This sample will be collected from an interval ranging from 0 - 0.5-foot bgs to limit the period of depositional history incorporated into the samples. The sample will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.

2.1.1.3 Background Samples

- **Surface Soil.** One representative background surface soil sample having similar characteristics to the samples of the hazardous landfill cover material will be collected from an upgradient location on the Wilder property (Figure 2-1). This sample will be collected from an interval ranging from 0 to 2.0 feet below the ground surface (bgs), and will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.
- **Subsurface Soil.** Two background subsurface soil samples will be collected from a location upgradient of the landfill (Figure 2-1). These samples will have similar characteristics to the subsurface soil samples collected downgradient of the landfill, and will be collected from similar depths. The background subsurface soil samples will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.

- **Surface Water.** One representative surface water sample will be collected from a body of standing water located upgradient of the landfill (Figure 2-1). This sample will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.
- **Groundwater.** One representative groundwater sample will be collected, if possible, from the water table at a location upgradient of the landfill (Figure 2-1). This groundwater sample will be submitted for TAL metals, hexavalent chromium, SVOCs, VOCs, and Pesticide/PCB analyses.
- **Overland Flow Pathway Sediment/Soil.** Three representative surface sediment/soil samples will be collected from locations upgradient of the Wilder Landfill-Hazardous Waste Pit, one from each of two the drainage ditches near the landfill, and one from the ditch along the railroad tracks (Figure 2-1). Each of these surface sediment/soil samples will be collected from intervals ranging from 0 - 0.5 foot bgs. The samples will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.
- **Claypit Pond sediment.** One representative background surface sediment sample will be collected from Claypit Pond (Figure 2-2). This sample will be collected in the southeastern corner of the pond, the area considered least likely to have been impacted by potential contaminants entering through the railroad culvert, and at a similar depth as the pond's potential target sample. This sample will be collected from an interval ranging from 0 - 0.5 foot bgs, and will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses. Alternatively, background concentrations for Claypit Pond may be derived from previously published data (e.g., as given in Ecology 1989b).
- **Tenant Lake Creek.** One representative background surface sediment sample will be collected from Tenant Lake Creek, from a location upgradient of the drainage stream from Claypit Pond (Figure 2-2). This sample will be collected from an interval ranging from 0 - 0.5 foot bgs, and will be submitted for TAL metals, hexavalent chromium, SVOC, and Pesticide/PCB analyses.

2.1.2 Stratigraphy

A cross-section of the subsurface in the vicinity of the former landfill was presented in a previous investigation (E&E 1981), but the boring logs were not provided. To document the subsurface deposits into which the former landfill was built, one direct-push probe will be advanced on each side of the landfill (Figure 2-1). Estimates of the maximum depth of the landfill range from 12 feet (EPA 1979) to approximately 20 feet (Ecology 1999), therefore, the borings will be advanced to at least 25 feet. Subsurface soil and groundwater samples for chemical analysis will be collected from the push probes, as described above. Otherwise, soil samples will be examined continuously for classification purposes only to a depth of 25 feet, then every 10 feet thereafter, if applicable.

2.1.3 Geophysical Methods (EM and GPR Survey)

An electromagnetic (EM) and ground penetrating radar (GPR) geophysical survey will be conducted at the former landfill prior to conducting the subsurface push-probe sampling, to identify the boundaries of the former landfill and locations in it where drums may be buried.

Initially, an EM survey will be conducted over a grid measuring approximately 250 feet by 550 feet (Figure 2-3). The EM survey will be run at a 10-foot grid spacing, with readings taken from two boom orientations (at 90 degrees at the maximum deviation from normal) at each data point. A Geonics EM-31 or equivalent instrument will be used to complete the EM survey. An EM-31 data point covers an ellipse of approximately 8 feet by 6 feet. It is anticipated that the EM data will produce some overlap between data points because of the 10-foot grid spacing with two boom orientations. Subsurface anomalies identified by the EM survey will be scanned using GPR to determine the nature of the anomaly. A GPR instrument with either a 500 megahertz (MHz) or 300 MHz antenna will be used depending on the achievable depth of penetration. Subsurface soil, groundwater, and potential waste sample locations may be adjusted based on the information obtained from these surveys.

2.1.4 Global Positioning System

Global positioning system (GPS) readings from a Trimble GeoExplorer will be used to record the coordinates of every sample location as well as to delineate the boundaries of the potential source area. The data will be stored in location specific individual files, the names of which will be noted on the appropriate field sampling record (Appendix B). Differential corrections (DGPS) of the GPS data to improve location accuracy will be performed by Mr. Matt Gubitosa of the EPA through post-processing following the field effort. DGPS coordinates will be provided in the final SI report as an appendix.

2.1.5 Logistics

The Wilder Landfill-Hazardous Waste Pit is accessible by paved and unpaved roads. The field effort is scheduled to begin in mid-June 2002. START personnel and equipment will be driven to the site from Seattle. Any access issues will be resolved before PA/SI field activities begin.

Sample aliquots collected for fixed laboratory analysis will be delivered to the EPA Region 10 MEL or an alternative laboratory as directed by the EPA. All samples will be shipped daily from Bellingham for express delivery. Sample control and shipping are discussed in Section 2.3.

2.1.6 Cooler Return

WESTON will provide the laboratory with a completed shipping label, placed in the chain-of-custody bag taped to each cooler's inside lid, to facilitate the return of sample coolers to WESTON. The labels will be marked for ground economy service and will contain the appropriate WESTON work order number for accounting.

2.1.7 Coordination with Federal, State, and Local Authorities

The START Site Leader will keep the TM apprised of field event progress and issues that may affect the schedule or outcome of the PA/SI, discuss problems encountered, inform the EPA of unusual contacts with the public or the media, and obtain technical direction from the EPA regarding project activities when required. Additionally, START field personnel will notify the EPA RSCC with changes to the sampling schedule for MEL and/or CLP analyses and provide shipping information on every sample shipment within 24 hours of shipment or before noon on

Friday for Saturday delivery. All samples will be shipped to the laboratory within 24 hours of sample collection if possible.

Before initiation of the PA/SI field activities, the START will provide notification to Short Cressman & Burgess PLLC, representing Charles Wilder, Ms. Mindy Miller of Whatcom County Health and Human Services, Mr. Tom Reed of the Washington Department of Fish and Wildlife, the operators of Friese Hide and Tallow, Mr. Frank Moscone of Recomp of Washington, and Burlington Northern Railroad.

2.2 SAMPLING METHODS REQUIREMENTS

This section describes sampling methodologies (Section 2.2.1); sampling equipment decontamination (Section 2.2.2); and investigation-derived wastes (Section 2.2.3).

2.2.1 Sampling Methodologies

The START Site Leader and EPA TM will be responsible for ensuring that appropriate sample collection procedures are followed and will take appropriate actions to correct the deficiencies. All sample containers used by WESTON will be "QC Grade" with the corresponding certificates of analysis maintained in the project file. All samples collected will be maintained under chain-of-custody and will be stored and shipped in iced coolers.

2.2.1.1 Surface Soil Sampling

Surface soil (0 to 2.0 foot bgs) grab samples will be collected in accordance with WESTON SOP RFW/R10-001, with the exception that no field duplicates will be collected (Appendix A). The samples will be collected using decontaminated hand tools such as a shovel, stainless steel hand auger, and/or a stainless steel spoon or trowel. The sample material will be placed in a decontaminated stainless steel bowl. Samples for VOC analysis will be transferred directly from the bowl into the appropriate pre-labeled sample container. The remaining material will be described and classified by a WESTON geoscientist according to the Unified Soil Classification System (USCS; ASTM 2488-00), and the description will be recorded on a standardized field sampling form such as shown in Appendix B, or an equivalent soil description log form. The sample material will then be homogenized and distributed among the appropriate pre-labeled sample containers for the remaining analyses. Any excess sample material collected will be returned to the sampling location.

2.2.1.2 Surface Water Sampling

Surface water samples will be collected in accordance with WESTON SOP RFW/R10-004, with the exception that no field duplicates will be collected (Appendix A). The samples will be collected from bodies of standing water using dedicated polyethylene tubing and a peristaltic pump, to minimize the disturbance of submerged soil or sediment. The surface water samples will be described regarding their color, clarity, possible odor, etc. on a standardized field sampling form such as shown in Appendix B. Pre-labeled sample containers will be filled by priority of analysis, in the following order: TAL metals, hexavalent chromium, SVOCs, VOCs, pesticides/PCBs. To minimize disturbance and volatilization of constituents, the sample volume

for VOC analysis will be drawn into the sample tubing, then "backed" into the sample containers by reversing the direction of flow before the sample reaches the pump mechanism.

2.2.1.3 Subsurface Soil Sampling

Subsurface soil will be sampled using direct push technology (push-probe). A push-probe is a truck-mounted, hydraulically powered hammer/ram sampling device. The unit drives 3-foot hollow steel rods into the ground for collection of subsurface samples. Push-probe explorations will be advanced in accordance with the State of Washington Minimum Construction Standards WAC 173-160 and SOP RFW/R10-001, which are provided in Appendix A. An exception to SOP RFW/R10-001 is that no field duplicates will be collected. Other changes to the SOPs based upon site conditions, equipment limitations, or mitigating circumstances, will be documented in field notes.

The push-probe sampler will be advanced to a desired sampling depth and the drive point of the sampler will be retracted. Once retracted, the push-probe will be advanced an additional 24 inches, thereby allowing soil to enter a 24-inch-long, 1-inch (inside diameter) acetate liner housed inside the casing of the sampler. After the sampler is retrieved from the boring, the soil liner will be extruded from casing and the liner will be split using a razor knife. Subsurface soil samples will be collected in accordance with WESTON SOP RFW/R10-001, with the exception that no field duplicates will be collected (Appendix A). The samples will be collected from push-probes advanced near the upgradient and downgradient sides of the former landfill. The push-probe sampler will be advanced to the desired sampling depths (10 feet and 20 feet bgs) and the drive point of the sampler will be retracted. Once retracted, the push-probe will be advanced an additional 24 inches, thereby allowing soil to enter a 24-inch-long, 1-inch (inside diameter) acetate liner housed inside the casing of the sampler. After the sampler is retrieved from the boring, the soil liner will be extruded from casing and the liner will be split using a razor knife. The sample material will be placed in a decontaminated stainless steel bowl. Samples for VOC analysis will be transferred directly from the bowl into the appropriate pre-labeled sample containers using a decontaminated stainless steel spoon or trowel. The remaining material will be described and classified by a WESTON geoscientist according to the Unified Soil Classification System (USCS; ASTM 2488) and the description will be recorded on a standardized field sampling form such as shown in Appendix B, or an equivalent soil description log form. The sample material will then be homogenized, and distributed among the appropriate pre-labeled sample containers for the remaining analyses.

After the samples are collected, the push-probe rod will be withdrawn and the hole back-filled with liquid grout in accordance with the State of Washington Minimum Construction Standards WAC 173-160 and WESTON SOP RFW/R10-001.

2.2.1.4 Groundwater Sampling

If encountered, groundwater samples will be collected in accordance with SOP RFW/R10-007, with the exception that no field duplicates will be collected (Appendix A). Groundwater samples will be collected using a direct push sampling device or push-probe fitted with a groundwater sampler. The push probe groundwater sampler is designed to obtain groundwater samples from a discrete 4-foot sampling profile. For the purposes of collecting a discrete groundwater sample, the push probe sampler will be configured with a 4-foot stainless-steel, screened sampling

chamber. This screened sampling chamber is housed inside a protective sleeve that restricts groundwater from entering the chamber. Once the groundwater sampling chamber is advanced by the push probe to a desired sampling depth, the protective sleeve will be retracted to allow groundwater to enter the chamber. Dedicated polyethylene tubing will be deployed down the center of the casing and fitted to a peristaltic pump at the surface to collect a groundwater sample. Pre-labeled sample containers will be filled by priority of analysis, in the following order: TAL, metals, hexavalent chromium, SVOCs, VOCs, pesticides/PCBs. To minimize disturbance and volatilization of constituents, the sample volume for VOC analysis will be drawn into the sample tubing, then "backed" into the sample containers by reversing the direction of flow of the pump before the sample reaches the pump mechanism. The groundwater samples will be described regarding their color, clarity, possible odor, etc. on a standardized field sampling form such as shown in Appendix B.

2.2.1.5 Creek/Ditch Sediment/Soil Sampling

Sediment/soil samples in accordance with SOP RFW/R10-003, with the exception that no field duplicates will be collected (Appendix A). Samples from the creeks and drainage ditches will be collected inches using a decontaminated stainless steel spoon or trowel. The sample material will be placed in a decontaminated stainless steel bowl, and examined by a geoscientist who will compile a physical description and record it on a surface sediment field sampling record (Appendix B). The physical description will include estimated grain size proportions (percent clay, silt, sand, and gravel), organic content, color, odor, etc. The collected sediment will be homogenized thoroughly and placed into pre-labeled sample containers. Any excess sample material collected will be returned to the sampling location.

2.2.1.6 Claypit Pond Sediment Sampling

Sediment samples in accordance with SOP RFW/R10-003, with the exception that no field duplicates will be collected (Appendix A). Samples from Claypit Pond will be collected from an interval ranging from 0 to 6 inches using a non-dedicated stainless steel petit ponar bottom grab sampler. Material not in contact with the sampler will be collected into a decontaminated stainless steel bowl using a decontaminated spoon. More than one grab is likely to be necessary to collect the required sediment volume for all anticipated analytes. The sample material will be examined by a geoscientist who will compile a physical description and record it on a surface sediment field sampling record (Appendix B). The physical description will include estimated grain size proportions (percent clay, silt, sand, and gravel), organic content, color, odor, etc. The collected sediment will be homogenized thoroughly in a decontaminated stainless steel bowl and placed into pre-labeled sample containers. Any excess sample material collected will be returned to the sampling location.

2.2.1.7 Landfill Waste Sampling

If required for source characterization, test pits will be carefully excavated into the landfill using a backhoe, in accordance with FLD 28 (Appendix A). Material from the pit will be collected from the bucket of the backhoe using decontaminated hand tools such as a shovel and/or a stainless steel spoon or trowel. The sample material will be placed in a decontaminated stainless steel bowl. Samples for VOC analysis will be transferred directly from the bowl into the appropriate pre-labeled sample container. A description of the remaining material will be

recorded on a standardized field sampling form such as shown in Appendix B, or an equivalent soil description log form. The sample material will then be homogenized and distributed among the appropriate pre-labeled sample containers for the remaining analyses. Any excess sample material collected will be returned to the sampling location.

Records indicate that approximately 1,000 drums of resin were placed in the landfill (EPA 1979). No drums will be sampled directly or removed from the landfill. Wastes removed from a test pit during excavation will be staged near the excavation, and returned to the test pit after sample collection from that pit is complete. If necessary, each test pit will be backfilled with a bentonite mixture to the original grade level. All excavation, and backfilling activities associated with test pit sampling will be conducted by a qualified WESTON subcontractor.

2.2.2 Sampling Equipment Decontamination

To the greatest extent possible, disposable and/or dedicated personal protective and sampling equipment will be used to avoid cross-contamination. When required, decontamination will be conducted in a central location, upwind and away from suspected contaminant sources. The following procedures are to be used for all nondedicated sampling equipment used to collect routine samples undergoing trace organic or inorganic constituent analyses:

1. Clean with tap water and nonphosphate detergent using a brush if necessary to remove particulate matter and surface films. Equipment may be steam cleaned (soap and high pressure hot water) as an alternative to brushing. Sampling equipment that is steam cleaned should be placed on racks or sawhorses at least two feet above the floor of the decontamination pad. PVC or plastic items should not be steam cleaned.
2. Rinse thoroughly with tap water.
3. Rinse thoroughly with analyte free water.
4. Rinse with 10 percent nitric acid
5. Rinse thoroughly with analyte free water.
6. Solvent rinse (methanol).
7. Rinse thoroughly with analyte free water.
8. Air dry the equipment completely, if possible.
9. Remove the equipment from the decontamination area and cover with plastic. Equipment stored overnight should be wrapped in aluminum foil and covered with clean, unused plastic.

2.2.3 Investigation-Derived Wastes

START field team members will make every effort to minimize the generation of investigation-derived wastes (IDW) throughout the field event. Attempts will be made to evaporate wastewater from decontamination operations on site. Any soil cuttings, or wastewater that cannot be evaporated, will be contained in sealed 55-gallon drums or 5-gallon buckets, labeled, and disposed of at an approved facility following receipt of the analytical results associated with the IDW. Disposable personal protective clothing and sampling equipment generated during

and disposed of at an approved facility following receipt of the analytical results associated with the IDW. Disposable personal protective clothing and sampling equipment generated during field activities will be rendered unusable by tearing (when appropriate), bagged in opaque plastic garbage bags, and disposed of at an approved solid waste disposal facility.

2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

This section describes sample identification and chain-of-custody procedures that will be used for the Wilder Landfill-Hazardous Waste Pit PA/SI field activities. The purpose of these procedures is to ensure that the quality of samples is maintained during collection, transportation, storage, and analysis. All chain-of-custody requirements comply with WESTON's SOPs for sample handling. All sample control and chain-of-custody procedures will follow the *Contract Laboratory Program Guidance for Field Samplers* (EPA 2001).

Examples of sample documents used for custody purposes are provided in Appendix C and include the following:

- Sample identification numbers
- Sample tags or labels
- Custody seals
- Chain-of-custody and traffic report records
- Field logbooks
- Sample collection forms
- Analytical request forms
- Analytical records

During the field effort, the Site Leader or delegate is responsible for maintaining an inventory of these sample documents. This inventory will be recorded in a cross-referenced matrix of the following:

- Sample location
- Sample identification number
- Analyses requested and request form number(s)
- Chain-of-custody record numbers
- Bottle lot numbers
- Air bill numbers

Brief descriptions of the major sample identification and documentation records and forms are provided below.

2.3.1 Sample Identification

All samples will be identified using the sample numbers assigned by the EPA RSCC. Each sample label will be affixed to the jar and covered with Mylar tape. A sample tracking record will be kept as each sample is collected. The following will be recorded: location, matrix, sample number, observations, and depth.

In addition to the EPA sample numbers, all samples collected will be assigned a unique WESTON identification code based on a consistent sample designation scheme that will be used internally by WESTON and in the final report. The sample designation scheme is designed to suit the needs of the field staff, data management and data users and will not be provided to the analytical laboratory.

All samples will consist of four components separated by a dash. These components are site ID, media code, station code, and sample type. Table 2-4 summarizes the sample tracking code and location. The sample designation scheme is as follows:

Site ID	Media Code	Station Code	Sample Type
SS	MM	SSsss	t [ddd]

The four components are described in the following sections.

Site ID

The site ID component is a two-digit code that designates the specific EPA/SI sample. This is based on the WESTON project phase code. The Site ID code assigned to this investigation is WL for Wilder Landfill-Hazardous Waste Pit.

Media Code

The media code is a two-character code that defines the media type of the sample. The media codes designated for this project are as follows:

- GW — Groundwater
- SB — Subsurface Soil
- SD — Sediment
- SS — Surface Soil
- SW — Surface Water
- WS — Landfill Waste
- WT — Water (other)

Station Code

The station code component is a four-character code that uniquely identifies each sampling station. The station code component has two parts: a two letter station designation XX indicating the area where the sample was collected followed by a three number sequential component (i.e., 001, 002, 003). The station codes designated for this project are as follows:

- LF — Landfill
- SD — Sediment
- IW — Investigation-derived waste

Sample Type

The sample type component has two parts: a sample type field "t" and a sample depth field "ddd." The single character "t" indicates a sample type having one of the following two values:

- 0### — Field sample
- 2### — VOC trip blank
- 4### — Equipment Rinsate Blank
- 5### — Split Sample

and a three-character field to indicate depth in tenths of feet to the top of the sample:

- #000 — 0 foot (surface)
- #050 — 5 feet
- #125 — 12.5 feet

Sample depth determinations will be made to the nearest 0.5-foot.

Examples

Examples of complete sample numbers with descriptions are as follows:

- WL-GW-LF004-0100: A field groundwater sample collected from push-probe station LF004 at a depth of 10.0 feet bgs.
- WL-SS-LF003-5000: A split surface soil sample collected from station LF003.
- WL-SD-SD002-4000: A rinsate blank collected from the sampling equipment used for collecting the surface sediment sample from station SD002.
- WL-SB-LF005-2200: A VOC trip blank included in the sample cooler containing the subsurface soil sample collected from push-probe station LF005 at 20.0 feet bgs.
- WL-WS-LF003-0145: The third field sample of landfill waste, collected from 14.5 feet bgs.
- WL-WT-IW001-0000: A sample of decontamination waste water from the decontamination station.

Under the sample designation method described above, the identifier will be unique (i.e., no two samples will have the same identifier), and informative (i.e., will show method of collection, location, sample type, and depth interval). This designation scheme will facilitate data management and tracking during the evaluation and reduction of PA/SI data.

Since the proposed sample designation scheme contains a great deal of specific sample information, the sample number will not be entered on laboratory chain-of-custody forms. Only EPA sample numbers will be used to identify samples. WESTON will maintain a cross-reference of the proposed sample designation scheme numbers and EPA sample numbers.

2.3.1.1 *Sample Tags and Labels*

Sample tags attached to or fixed around the sample container will be used to identify all samples collected in the field. The sample tags will be placed on bottles so as not to obscure any QA/QC lot numbers on the bottles, and sample information will be printed legibly. Field identification will be sufficient to enable cross-reference with the project logbook/sample record forms. For

chain-of-custody purposes, all QA/QC samples will be subject to the same custodial procedures and documentation as site samples.

To minimize handling of sample containers, labels will be completed before sample collection to the extent possible. In the field the label will be filled out completely using waterproof ink, then attached firmly to the sample containers and protected with Mylar tape. The sample label will provide the following information:

- Sample number
- Sample location number
- Date and time of collection
- Analysis required
- pH and preservation (when applicable)
- Sampler's initials

2.3.1.2 Custody Seals

Custody seals are preprinted gel-type seals, designed to break into small pieces if the seals are disturbed. Sample shipping containers (e.g., coolers, drums, and cardboard boxes, etc., as appropriate) will be sealed in as many places as necessary to ensure security. Seals will be signed and dated before use. Clear tape will be placed over the seals to ensure that seals are not broken accidentally during shipment. Upon receipt at the laboratory, the custodian will check (and certify by completing the package receipt log) that seals on shipping containers are intact.

2.3.1.3 Chain-of-Custody Records and Traffic Reports

For samples to be analyzed at a CLP laboratory, the chain-of-custody record and analytical traffic report forms will be completed as described in the *Contract Laboratory Program Guidance for Field Samplers* (EPA 2001). The chain-of-custody record and analytical traffic reports will be completed fully at least in duplicate by the field technician designated by the Site Leader as responsible for sample shipment to the appropriate laboratory. Information specified on the chain-of-custody record will contain the same level of detail found in the site logbook, except that the on-site measurement data will not be recorded. The custody record will include the following information:

- Name and company or organization of person collecting the samples
- Date samples were collected
- Type of sampling conducted (composite or grab)
- Sample number (using those assigned by the EPA RSCC)
- Number and type of containers shipped
- Analysis requested
- Signature of the person relinquishing samples to the transporter, with the date and time of transfer noted and signature of the designated sample custodian at the receiving facility

If samples require rapid laboratory turnaround, the person completing the chain-of-custody record will note these or similar constraints in the remarks section of the custody record. Specific notation also will be made on the chain-of-custody if samples are suspected to contain high levels of contaminants or biohazards.

The relinquishing individual will record all shipping data (e.g., air bill number, organization, time, and date) on the original custody record, which will be transported with the samples to the laboratory and retained in the laboratory's file. Original and duplicate custody records, together with the air bill or delivery note, constitute a complete custody record. It is the Site Leader's responsibility to ensure that all records are consistent and that they become part of the permanent project file.

2.3.1.4 *Field Logbooks and Data Forms*

Field logbooks (or daily logs) and data forms are necessary to document daily activities and observations. Documentation will be sufficient to enable participants to reconstruct events that occurred during the project accurately and objectively at a later time. All entries will be made in waterproof ink, dated, and signed. No pages will be removed for any reason. If corrections are necessary, these corrections will be made by drawing a single line through the original entry (so that the original entry is legible) and writing the corrected entry alongside. The correction will be initialed and dated. Corrected errors may require a footnote explaining the correction.

2.3.1.5 *Photographs*

Photographs will be taken as directed by the field team leader. Documentation of a photograph is crucial to its validity as a representation of an existing situation. The following information will be noted in the project or task log concerning photographs:

- Date, time, and location where photograph was taken
- Photographer
- Description of photograph taken
- Sequential number of the photograph and the film roll number
- Camera lens system used
- Compass direction

2.3.2 **Custody Procedures**

The primary objective of chain-of-custody procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from collection to completion of all required analyses. A sample is in custody when it is:

- In someone's physical possession,
- In someone's view,
- Locked up, or
- Kept in a secured area that is restricted to authorized personnel.

2.3.2.1 Field Custody Procedures

The following guidance will be used to ensure proper control of samples while in the field:

- As few people as possible will handle samples.
- Coolers or boxes containing cleaned bottles will be sealed with a custody tape seal during transport to the field or while in storage before use. Sample bottles from unsealed coolers or boxes, or bottles that appear to have been tampered with, will not be used.
- The sample collector will be responsible for the care and custody of collected samples until they are transferred to another person or dispatched properly under chain-of-custody rules.
- The sample collector will record sample data in the field logbook or sampling record.
- The site team leader will determine whether proper custody procedures were followed during the fieldwork and will decide if additional samples are required.
- All coolers will be accompanied by a temperature blank.
- Packaging, marking, labeling, and shipping of samples will comply with all regulations promulgated by the U.S. Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171-177 and International Air Transport Association (IATA) regulations.

When transferring custody (i.e., releasing samples to a shipping agent), the following will apply:

- The coolers in which the samples are packed will be sealed and accompanied by two copies of the chain-of-custody records. When transferring samples, the individuals relinquishing and receiving them must sign, date, and note the time on the chain-of-custody record. This record will document sample custody transfer.
- Samples will be dispatched to the laboratory for analysis with separate chain-of-custody records accompanying each shipment. Shipping containers will be sealed with custody seals for shipment to the laboratory. The chain-of-custody records will be signed by the relinquishing individual, and the method of shipment, name of courier, and other pertinent information will be entered in the chain-of-custody record before placement in the shipping container.
- All shipments will be accompanied by chain-of-custody records identifying their contents. The original custody records kept in a sealed Ziploc[®] bag and taped inside the lid of the cooler will accompany the shipment. The other copies will be distributed appropriately to the Site Leader and Project Manager.
- If sent by common carrier, a bill of lading will be used. Freight bills and bills of lading will be retained as part of the permanent documentation.

2.3.2.2 Laboratory Custody Procedures

A designated sample custodian at the laboratory will accept custody of the shipped samples from the carrier and enter preliminary information about the package into a package or sample receipt log, including the initials of the person delivering the package and the status of the custody seals on the coolers (i.e., broken versus unbroken). The custodian responsible for sample log-in will

follow the laboratory's SOP for opening the package, checking the contents, and verifying that the information on the chain-of-custody agrees with samples received. The laboratory will check the temperature blank inside the cooler and document it in the sample log-in form. Should the temperature be greater than what is required by the SOW or the method, the sample custodian will inform the Region and proceed to follow the course of actions stipulated in the SOW or specified by the regional EPA QA Manager. The commercial laboratory will follow its internal chain-of-custody procedures as stated in the laboratory QA Manual and notify the WESTON QA Officer of any non-compliance.

2.4 ANALYTICAL METHODS REQUIREMENTS

Analysis of samples collected during the PA/SI will be performed by the EPA Region 10 MEL, or an alternative laboratory designated by the EPA, with the exception of the sample aliquots for hexavalent chromium analysis, which will be analyzed by a commercial laboratory under subcontract to WESTON. The analyses to be applied to samples sent to the laboratory are listed in Table 2-2. These analyses were selected based on the probable hazardous substances used or potentially released to the environment, given the known or suspected site usage.

EPA and/or CLP laboratory analyses will take place under the standard three-week turnaround time period. START-subcontracted laboratory analyses will take place under the standard four-week turnaround time period. Table 2-3 summarizes laboratory instrumentation and methods to be used for the PA/SI.

2.5 QUALITY CONTROL REQUIREMENTS

QC checks for sample collection will be accomplished by a combination of Chain-of-Custody protocols and laboratory quality assurance as prescribed in the sampling or analytical methods. No QC samples (i.e., double blind performance evaluation samples) are planned for this activity outside of normal laboratory QC criteria outlined in the analytical methods. These QC measures include analysis, rinsate, trip, and method blanks, matrix, surrogate, and internal standards spikes recovery, serial dilution calibration check samples; results from these samples will be compared to QC requirements listed in Section 4.1. All of the analyses that will be performed for this project will produce definitive data. Data Quality Indicator targets for this project are specified in Section 1.4 and are summarized in Table 2-3. Bias on estimated flagged data shall be determined by the validation process. The laboratories' DQOs for completeness and the field team's ability to meet the DQO for representativeness are set at 90% for sediment/soil and 90% for water. Precision and accuracy requirements are outlined in Table 2-3.

2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

The field equipment used during this project includes a GPS unit. Testing, inspection, and maintenance of this instrument will be performed in accordance with the manufacturer's recommendations.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

All instruments and equipment used during fixed laboratory sample analyses will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations, as well as criteria set forth in the applicable analytical methodology references and/or in accordance with the laboratory's QA Manual and SOPs.

2.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

This information is covered by the SOPs and the START QMP (WESTON 2001). Standards contained in these documents will be used to ensure the validity of data generated by WESTON for this project. Sample jars are pre-cleaned by the manufacturer; certification documenting this is enclosed with each box of jars. The START will include this documentation as part of the project file. Non-dedicated equipment is demonstrated to be uncontaminated by the use of rinsate blanks.

2.9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

Historical TRC records regarding the materials and substances placed in the landfill may be used to characterize the source. Data from published sources (e.g., Ecology 1989b) may be used to derive background concentrations for Claypit Pond sediment.

2.10 DATA MANAGEMENT

Hardcopy results from the EPA and/or CLP laboratories will be delivered to the EPA upon completion of each sample delivery group. Electronic results from the EPA and/or CLP laboratories will be delivered to the EPA upon project completion. Hardcopy and electronic data results from the START-subcontracted commercial laboratory will be delivered to WESTON upon completion of each sample delivery group. A full documentation data deliverable (raw and final data) will be submitted by the subcontract laboratory; data validation will be performed as listed in Section 4.1. Data tracking, storage, and retrieval are tracked through the TDD "blue sheet", which records where the paper and electronic data are located. All paper data are stored in locked file cabinets; access to these files is restricted to key START personnel. Electronic data are archived by TDD (i.e., by WESTON work order number).

WESTON will use Microsoft Access software and the following procedures to compile and manage two major but related types of data; GIS (or location) data and chemical analysis data.

GIS data are collected as required by a given project. When GIS data are collected, the following fields are captured as appropriate:

- Station Identifier
- Station Alternate or Previous Ids
- Station Type Description
- Station Coordinates

- Station Horizontal Datum (if applicable)
- Method for determining Station Location
- Station Coordinate Units
- Station Elevation
- Station Vertical Datum (if applicable)
- Method for determining Station Elevation

and appropriate Station Attributes such as:

- Well Depth
- Well Screening Interval
- Depth of Water
- Sediment or Soil Sampling Interval

The major data items captured to create a complete chemical analytical dataset are as follow:

- Station Identifier
- Sample Identifier
- Sample Description (Primary, Field, Duplicate, Replicate...)
- Sample Date
- Full name of analytical parameter, observation or compound analyzed
- CAS number when available or appropriate
- Analytical result concentration value
- Data validation qualifier
- Units
- Analytical method reference
- Sample Media
- Sample Media modifier

2.10.1 Analytical Data Loading

The process of entering sample analytical data into a data management system is called analytical data loading. There are two primary strategies for loading analytical data; automated loading of Electronic Data Deliverables (EDDs), and direct hand entry from paper results. In general, EDDs are created by analytical laboratories and delivered with hard-copy (paper) results as a standard part of sample analysis.

Data management procedures will accommodate manual data validation, or for loading data on data sets that have been validated before they are delivered to WESTON. In the case of WESTON-validated data, no automated tools are needed to effect data validation changes, and an audit will lead to hard-copy laboratory results with validation changes noted and signed by qualified staff.

2.10.2 Data Pre-Processing

Before data entry, a hard-copy form of the data will be generated if not provided. Large volumes of source data are divided into manageable data entry groups. Each data entry group is supplied

with a standard coversheet and assigned a sequential, unique data entry group ID. The data entry group ID serves as the basis for filing all data groups, and as the means of quickly tracking any data point to the data entry group from which it came.

2.10.3 Primary Dataset Development

The Environmental Data Management System (EDMS) will be used to capture and build a complete sample analysis dataset that matches source materials *exactly*. This dataset is complete when all inventoried sample analysis information has been received and entered, or if missing, has been properly accounted for. This complete dataset is called the *primary dataset*.

As it is the function of the primary dataset to represent source materials exactly, and is not appropriate for analysis, the primary dataset is maintained without modification. All post-processing is performed on copies of the primary dataset using a post-processing module. A copy of the primary dataset made for data analysis purposes is called an *analytical dataset*.

2.10.4 Data Post Processing

Several post-processing procedures are available, the major steps are to:

- Standardize reporting units
- Reassign analytical groups as necessary
- Detect and manage co-located data points
- Create compound totals (e.g., LPAHs, HPAHs)
- Total organic carbon normalization, as necessary
- Perform data comparisons to reference values
- Calculation of sample quantitation limits, as necessary

2.10.5 Analytical Dataset Development

The analytical dataset is complete once all appropriate post-processing steps are completed. The completed analytical dataset is used for all data analysis and for exporting to external analysis software such as GIS.

2.10.6 Data Analysis and Reporting

Data analysis will be performed exclusively on the post-processed analytical dataset. Statistical software will be used to define data analysis queries by selecting a sample and analysis selection set and determining the statistical and data listing parameters to be applied to the data. Predefined queries may be executed individually or in batches. Once queries have been executed, additional batch processing software is used to generate report-quality data listings and statistical summaries.



Note: Actual sample locations will be determined in the field.
 Source: Wilder and Associates aerial photograph, 8 August 2001.



WESTON
 CONSULTANTS

- Surface Sediment Sample
- ▲ Surface Soil Sample
- Possible Surface Water Sample
- Waste Samples
- △ Subsurface Soil & Groundwater Samples
- Subsurface Soil Samples

- Fencing
- Burlington Northern Railroad
- Surface Water Flow Direction
- Background Sample
- PPE Potential Point of Entry

Site Sample Location Diagram Wilder Landfill-Hazardous Waste Pit PA/SI Ferndale, Washington

Figure
2-1



Source: Walker and Associates aerial photograph, 5 August 2011.



- Burlington Northern Railroad
- - - - - Fencing
- Surface Water Flow Direction



Proposed Geophysical Survey Grid Wilder Landfill-Hazardous Waste Pit PA/S Ferndale, Washington

**Table 2-1—Sample Information Summary
Wilder Landfill
Ferndale, Washington**

Project Sampling Schedule ^a	Parameter/Limits	Design Rationale	Sampling Design Assumptions	Sample Selection Procedures	Measurement Classification (Critical/Noncritical)	Nonstandard Method Validation
Surface Soil Samples	TAL Metals/CRQL; Hexavalent Chromium/ 2 mg/kg; SVOC/CRQL; Pest/PCB/ CRQL	Determine if contaminants are present in on-site soils.	Contaminants were released to the soil.	Samples will be collected from surface cover material and/or stained soil.	Critical	NA
Subsurface Soil Samples	TAL Metals/CRQL; Hexavalent Chromium/ 2 mg/kg; VOC/CRQL; SVOC/CRQL; Pest/PCB/ CRQL	Determine if contaminants are present in downgradient subsurface soils.	Contaminants were released to the subsurface soil.	Samples will be collected from subsurface soil downgradient of landfill, at 10 feet and 20 feet bgs.	Critical	NA
Surface Water Samples	TAL Metals/CRQL; Hexavalent Chromium/ 5 µg/L; SVOC/CRQL; Pest/PCB/CRQL	Determine if contaminants are present in on-site surface water.	Contaminants were released to the surface water.	Samples will be collected from body of standing water that has accumulated atop the landfill.	Critical	NA
Ground Water Samples	TAL Metals/CRQL; Hexavalent Chromium/ 5 µg/L; VOC/CRQL; SVOC/CRQL; Pest/PCB/ CRQL	Determine if contaminants have migrated to ground water.	Contaminants reached groundwater.	Samples will be collected from the water table at a location downgradient of the landfill.	Critical	NA

**Table 2-1—Sample Information Summary
Wilder Landfill
Ferndale, Washington**

Project Sampling Schedule ^a	Parameter/Limits	Design Rationale	Sampling Design Assumptions	Sample Selection Procedures	Measurement Classification (Critical/Noncritical)	Nonstandard Method Validation
Surface Sediment Samples	TAL Metals/ CRQL; Hexavalent Chromium/ 2 mg/kg; SVOC/ CRQL; Pest/PCB/ CRQL	Determine if contaminants are impacting surface sediments.	Contaminants were released to the sediment.	Samples will be collected from potentially contaminated areas ^b .	Critical	NA
Landfill Waste Samples	TAL Metals/ CRQL; Hexavalent Chromium/ 2 mg/kg; SVOC/ CRQL; Pest/PCB/ CRQL; Hazard Categories/ RCRA Limits	Determine concentrations and hazard characteristics of landfill contents.	Landfill contains hazardous waste.	Up to six samples from two test pits.	Critical	Follow Hazard Categorization SOP.

Notes:

^a All samples will be collected during the field event.

^b As indicated from past investigations at the site and from on-site observations.

CRDL: Contract Required Detection Limit.

CRQL: Contract Required Quantitation Limit.

Critical: Required to achieve project objectives or limits on decision errors.

NA: Not Applicable.

Noncritical: For informational purposes only or needed to provide background information.

RCRA: Resource Conservation and Recovery Act.

SOP: Standard Operating Procedure.

**Table 2-2—Sample Analyses Summary
Wilder Landfill
Ferndale, Washington**

Matrix	Location and Number of Samples ^a	Analytical Parameters and Method	Sample Preservation	Technical Holding Time ^b	Sample Container(s)
Soil/ Sediment	Surface Soil (5 samples)	TAL metals (CLPAS) ILM04.1	Cool to 4° C ± 2° C	180 days from collection (28 days for mercury)	One 8-oz. wide-mouth glass jar with Teflon-lined lid
		Hexavalent chromium 3060A prep 7196A SM 3500 Cr D analysis	Cool to 4° C ± 2° C	Extract within 30 days of collection; analyze within 168 hours	One 4-oz. wide-mouth glass jar with Teflon-lined lid
	Surface Sediment (12 samples)	SVOCs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 14 days of collection; analyze within 40 days of extraction	One 8-oz. wide-mouth glass jar with Teflon-lined lid
		Pesticides/PCBs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 14 days of collection; analyze within 40 days of extraction	One 8-oz. wide-mouth glass jar with Teflon-lined lid
Subsurface Soil	Perimeter of landfill (8 samples)	TAL metals (CLPAS) ILM04.1	Cool to 4° C ± 2° C	180 days from collection (28 days for mercury)	One 8-oz. wide-mouth glass jar with Teflon-lined lid
		Hexavalent chromium 3060A prep 7196A SM 3500 Cr D analysis	Cool to 4° C ± 2° C	Extract within 30 days of collection; analyze within 168 hours	One 4-oz. wide-mouth glass jar with Teflon-lined lid
		SVOCs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 14 days of collection; analyze within 40 days of extraction	One 8-oz. wide-mouth glass jar with Teflon-lined lid
		VOCs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	14 days from collection	Two 4-oz. glass jars with Teflon-lined lids
		Pesticides/PCBs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 14 days of collection; analyze within 40 days of extraction	One 8-oz. wide-mouth glass jar with Teflon-lined lid
Surface Water	Standing water bodies. (2 samples)	TAL metals (CLPAS) ILM04.1	HNO ₃ to pH ≤ 2; Cool to 4° C ± 2° C	180 days from collection (28 days for mercury)	One 1-L polyethylene bottle with polyethylene-lined lid
		Hexavalent chromium 7196A SM 3500 Cr D analysis	Cool to 4° C ± 2° C	24 hours from collection	One 1-L polyethylene bottle with polyethylene-lined lid
		SVOCs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 7 days of collection; analyze within 40 days of extraction	Two 1-L amber glass jars with Teflon-lined lids
		VOCs (CLPAS) OLM04.2	HCl to pH ≤ 2; Cool to 4° C ± 2° C	14 days from collection	Two 40-mL vials with Teflon-lined septa
		Pesticides/PCBs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 7 days of collection; analyze within 40 days of extraction	Two 1-L amber glass jars with Teflon-lined lids
Groundwater	Downgradient and upgradient of landfill (2 samples)	TAL metals (CLPAS) ILM04.1	HNO ₃ to pH ≤ 2; Cool to 4° C ± 2° C	180 days from collection (28 days for mercury)	One 1-L polyethylene bottle with polyethylene-lined lid
		Hexavalent chromium 7196A SM 3500 Cr D analysis	Cool to 4° C ± 2° C	24 hours from collection	One 1-L polyethylene bottle with polyethylene-lined lid
		SVOCs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 7 days of collection; analyze within 40 days of extraction	Two 1-L amber glass jars with Teflon-lined lids
		VOCs (CLPAS) OLM04.2	HCl to pH ≤ 2; Cool to 4° C ± 2° C	14 days from collection	Two 40-mL vials with Teflon-lined septa
		Pesticides/PCBs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 7 days of collection; analyze within 40 days of extraction	Two 1-L amber glass jars with Teflon-lined lids

Matrix	Location and Number of Samples ^a	Analytical Parameters and Method	Sample Preservation	Technical Holding Time ^b	Sample Container(s)
Landfill Waste	Two test pits (up to 6 samples)	TAL metals (CLPAS) ILM04.1	Cool to 4° C ± 2° C	180 days from collection (28 days for mercury)	One 8-oz. wide-mouth glass jar with Teflon-lined lid
		Hexavalent chromium 3060A prep 7196A analysis SM 3500 Cr D	Cool to 4° C ± 2° C	Extract within 30 days of collection; analyze within 168 hours	One 4-oz. wide-mouth glass jar with Teflon-lined lid
		SVOCs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 14 days of collection; analyze within 40 days of extraction	One 8-oz. wide-mouth glass jar with Teflon-lined lid
		VOCs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	14 days from collection	Two 4-oz. glass jars with Teflon-lined lids
		Pesticides/PCBs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 14 days of collection; analyze within 40 days of extraction	One 8-oz. wide-mouth glass jar with Teflon-lined lid
		Hazard Categorization / SOP	Cool to 4° C ± 2° C	Not Applicable	One 4-oz. wide-mouth glass jar with Teflon-lined lid
QC Water Samples	Trip Blank (7 trip blanks)	VOCs (CLPAS) OLM04.2	HCl to pH ≤ 2; Cool to 4° C ± 2° C	14 days from collection	Two 40-mL vials with Teflon-lined septa
	Rinsate Blank (3 rinsates)	TAL metals (CLPAS) ILM04.1	HNO ₃ to pH ≤ 2; Cool to 4° C ± 2° C	180 days from collection (28 days for mercury)	One 1-L polyethylene bottle with polyethylene-lined lid
		SVOCs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 7 days of collection; analyze within 40 days of extraction	Two 1-L amber glass jars with Teflon-lined lids
		VOCs (CLPAS) OLM04.2	HCl to pH ≤ 2; Cool to 4° C ± 2° C	14 days from collection	Two 40-mL vials with Teflon-lined septa
		Pesticides/PCBs (CLPAS) OLM04.2	Cool to 4° C ± 2° C	Extract within 7 days of collection; analyze within 40 days of extraction	Two 1-L amber glass jars with Teflon-lined lids

Notes:

^a The number of samples presented is an estimate; the actual number of samples to be collected will be determined in the field.

^b Technical holding times have been established only for water matrices. Water technical holding times were applied to sediment, soil, and product samples where applicable; in some cases, recommended sediment/soil holding times are listed.

C: Celsius.

CLPAS: Contract Laboratory Program Analytical Service.

HCl: Hydrochloric acid.

HNO₃: Nitric Acid.

L: Liter.

mL: Milliliter.

oz: Ounce.

PCBs: Polychlorinated Biphenyls.

Pesticides: Chlorinated Pesticides.

SVOCs: Semivolatile Organic Compounds.

TAL: Target Analyte List.

VOCs: Volatile Organic Compounds.

**Table 2-3—QA/QC Analytical Summary and Fixed Laboratory Analytical Methods
Wilder Landfill
Ferndale, Washington**

Laboratory	Matrix	Parameters/Method	Method Description/ Detection Limits	Total Field Samples ^a / Containers	QA/QC Sample Summary Analyses/Containers				Total Field and QA/QC Analyses/ Containers ^e	Precision and Accuracy
					Organic MS/MSD ^b	Inorganic MS/Dup ^b	Rinsate Blanks ^c	Trip Blanks ^d		
EPA Region 10 or CLP Laboratory	Soil/ Sediment	TAL Metals/ (CLPAS) ILM04.1	AA & ICP/CRDL	25/25	NA	2/0	3/3	NA	30/28	75% - 125% +/- 35%
		Hexavalent Chromium/7196A/ SM 3500 Cr D	Alkaline digestion/ colorimetric/2 mg/kg	25/25	NA	2/0	NA	NA	30/28	Per Method
		SVOCs (CLPAS) OLM04.2	GCS & MD/ CRQL	25/25	2/0	NA	3/6	NA	30/31	OLM04.2/ OLM04.2
		VOCs (CLPAS) OLM04.2	GCS & MD/ CRQL	8/16	1/2	NA	1/2	2/4	11/22	OLM04.2/ OLM04.2
		Pesticides/PCBs (CLPAS) OLM04.2	GCS & ECD/ CRQL	25/25	2/0	NA	3/6	NA	29/29	OLM04.2/ OLM04.2
	Water	TAL Metals/ (CLPAS) ILM04.1	AA & ICP/ CRDL	4/4	NA	1/1	1/1	NA	6/6	75% - 125% +/- 20%
		Hexavalent Chromium/7196A/ SM 3500 Cr D	Colorimetric/5 mg/kg	4/4	NA	1/0	NA	NA	6/6	75% - 125% +/- 20%
		SVOCs (CLPAS) OLM04.2	GCS & MD/ CRQL	4/8	1/2	NA	1/2	NA	6/12	OLM04.2/ OLM04.2
		VOCs (CLPAS) OLM04.2	GCS & MD/ CRQL	4/8	1/2	NA	1/2	2/4	8/16	OLM04.2/ OLM04.2
		Pesticides/PCBs (CLPAS) OLM04.2	GCS & ECD/ CRQL	4/8	1/2	NA	1/2	NA	6/12	OLM04.2/ OLM04.2
	Landfill Waste	TAL Metals/ (CLPAS) ILM04.1	AA & ICP/CRDL	6/6	NA	1/0	NA	NA	7/6	75% - 125% +/- 35%
		Hexavalent Chromium/7196A/S M 3500 Cr D	Alkaline digestion/ colorimetric/2 mg/kg	6/6	NA	1/0	NA	NA	7/6	Per Method
		SVOCs (CLPAS) OLM04.2	GCS & MD/ CRQL	6/6	1/0	NA	NA	NA	7/6	OLM04.2/ OLM04.2
		VOCs (CLPAS) OLM04.2	GCS & MD/ CRQL	6/12	1/0	NA	NA	1/2	8/14	OLM04.2/ OLM04.2
		Pesticides/PCBs (CLPAS) OLM04.2	GCS & ECD/ CRQL	6/6	1/0	NA	NA	NA	7/6	OLM04.2/ OLM04.2
		Hazard Categorization/ SOP	Per SOP	6/6	NA	NA	NA	NA	6/6	NA

Laboratory	Matrix	Parameters/Method	Method Description/ Detection Limits	Total Field Samples ^a / Containers	QA/QC Sample Summary Analyses/Containers				Total Field and QA/QC Analyses/ Containers ^e	Precision and Accuracy
					Organic MS/MSD ^b	Inorganic MS/Dup ^b	Rinsate Blanks ^c	Trip Blanks ^d		
EPA Region 10 or CLP Laboratory	Decon- tamination Water (analyses for disposal purposes only) ^f	TAL Metals/ (CLPAS) ILM04.1	AA & ICP/ CRDL	1/1	NA	NA	NA	NA	1/1	75% - 125% +/- 20%
		SVOCs (CLPAS) OLM04.2	GCS & MD/ CRQL	1/2	NA	NA	NA	NA	1/2	OLM04.2/ OLM04.2
		VOCs (CLPAS) OLM04.2	GCS & MD/ CRQL	1/2	NA	NA	NA	2/4	1/2	OLM04.2/ OLM04.2
		Pesticides/PCBs (CLPAS) OLM04.2	GCS & ECD/ CRQL	1/2	NA	NA	NA	NA	1/2	OLM04.2/ OLM04.2

Notes:

^a Total number of field samples is estimated.

^b No extra volume is required for soil/sediment or product samples; for water samples, triple volume is required for organic analyses, and double volume is required for inorganic analyses. Sample numbers are based on 1 matrix spike/matrix spike duplicate (MS/MSD) per 20 samples per matrix.

^c The total number of rinsate samples could vary depending on the total number of samples collected. The sample numbers are based on one rinsate per 20 samples per nondedicated sampling device per media. Note that rinsate blanks consist of water aliquots for both soil and water field samples.

^d The total number of trip blanks could vary depending on the total number of sample shipments. This number is based on the estimated number of shipping containers. Note that trip blanks consist of water aliquots for both soil and water field samples.

^e Total analyses and containers includes both field and QA/QC aliquots to be submitted for fixed laboratory analysis. Note that trip blanks and rinsate blanks consist of water aliquots for both soil and water field samples.

^f One sample of decontamination water is anticipated to be collected upon completion of the field effort.

AA: Atomic Absorption Furnace Technique.

CLP: Contract Laboratory Program.

CLPAS: Contract-Laboratory Program Analytical Service.

CRDL: Contract-Required Detection Limit.

CRQL: Contract Required Quantitation Limit.

ECD: Electron Capture Detection.

GCS: Gas Chromatographic Separation.

ICP: Inductively Coupled Plasma.

ILM: Inorganic Laboratory Method.

MD: Mass Spectrometric Detection.

MS/MSD: Matrix Spike/Matrix Spike Duplicate.

NA: Not Applicable.

OLM: Organic Laboratory Method.

PCBs: Polychlorinated Biphenyls.

Pesticides: Chlorinated Pesticides.

QA: Quality Assurance.

QC: Quality Control.

SVOCs: Semivolatile Organic Compounds.

TAL: Target Analyte List.

VOCs: Volatile Organic Compounds.

**Table 2-4—Sample Coding
Wilder Landfill
Ferndale, Washington**

Digits	Descriptions	Code Example
1,2	Site ID	WL (Wilder Landfill)
3,4	Media Code	GW (Groundwater)
		SB (Subsurface Soil)
		SD (Sediment)
		SS (Soil)
		SW (Surface Water)
		WS (Landfill Waste)
		WT (Water)
5,6	Station Code	LF (Landfill)
		SD (Sediment)
		IW (Investigation-derived Waste)
7,8,9	Consecutive Sample Number	001 (First Sample of Station Code)
10	Sample Type	0 (Field Sample)
		2 (VOC Trip Blank)
		4 (Equipment Rinsate Blank)
		5 (Split Sample)
11,12,13	Sample Depth (feet bgs)	000 (0 ft bgs = surface sample)
		125 (12.5 ft bgs)

SECTION 3

ASSESSMENT/OVERSIGHT

3.1 ASSESSMENTS AND RESPONSE ACTIONS

The EPA QA Manager or designee may conduct an audit of the field activities for this project. The auditor will have the authority to issue a stop work order upon finding a significant condition that would adversely affect the quality and usability of the data. The EPA TM will have the responsibility for initiating and implementing response actions associated with findings identified during the site audit. The actions taken may also involve the EPA Project Officer, Contracting Officer, and/or QA Manager. Once the response actions have been implemented, the EPA QA Manager or designee may perform a follow-up audit to verify and document that the response actions were implemented effectively. In-house audits performed by the START may be conducted in accordance with the START QMP (WESTON 2001). No audits are planned for the Wilder Landfill-Hazardous Waste Pit PA/SI.

If major deviations from the QA requirements of the project and the CLP SOW were observed during the data validation process, the EPA QA Manager will contact the CLP laboratory to correct the problem. If the laboratory will not be responsive to the request, the QA Manager will inform the Regional CLP Project Officer and the TM of the situation. A brief narrative will be written explaining the contract deviations and recommendations will be given based on the quality of the submitted data. Reduced payment and/or re-analysis at the laboratory's expense shall be pursued by the Regional CLP Project Officer. Re-sampling and subsequent re-analysis will be decided by the TM. Response actions associated with WESTON-contracted Laboratories are defined in the WESTON START QMP (WESTON 2001).

Additional sampling for corrective actions and/or any addendum to this SQAP shall be documented using the Corrective Action Form and the Sample Alteration Form (Appendix B).

3.2 REPORTS TO MANAGEMENT

Debriefing of the EPA TM occurs by the START Site Leader on a daily basis. Laboratory deliverables will be as specified in the CLP Organic and Inorganic Statements of Work (OLM04:2 and ILM04.1, respectively) for CLP, and/or CLP-like for MEL data, and as specified in the laboratory subcontract bid specification package for commercial laboratory analyses. Once the project is complete and the resulting data is obtained, the START PM will assist the START Site Leader in preparation of a final project report. The report will include a summary of the activities performed during the project and the resulting data (along with any statements concerning data quality). The report will be approved by the EPA TM prior to forwarding to the individuals identified in the distribution list located in the Table of Contents section of this SQAP.

The START corrective action program is addressed in Section 3 of the QMP. Corrective actions will be conducted in accordance with these QMP specifications.

SECTION 4

DATA VALIDATION AND VERIFICATION

The data validation review of data packages will include an evaluation of: the information provided on the analytical data sheets and required support documentation for all sample analyses; the supporting sample collection documentation, including chain-of-custody; and field instrument calibration, results, and/or performance check documentation (if required by the method). The QA review will also examine adherence to the procedures as described in the cited SOPs and the specified analytical methods in the SQAP.

4.1 DATA VALIDATION

Analytical data generated through the CLP contract will be validated by Region 10 QA Office or its designee, data generated by MEL will be validated by MEL or its designee and data generated through subcontract laboratories by WESTON will be validated by WESTON. The data validations will be performed on a regular three-week turn around time that starts upon receipt of the complete analytical data package from the laboratory. All of the data validations will be performed in accordance with the QA/QC requirements specified in the SQAP, the technical specifications of the analytical methods and the

- EPA CLP National Functional Guidelines for Inorganic Data Review (1994a)
- EPA CLP National Functional Guidelines for Organic Data Review (1999)

Validation deliverables will include a QA memo discussing QA conformance and deviations issues that may have affected the quality of the data. Data usability and the bases of application of qualifiers will also be discussed in the QA memo. Forms I (Analysis Data Sheet) with the applied validation qualifiers and bias determination for estimated-qualified values also will be a part of the validation deliverables. The following qualifiers shall be used in the data validation:

- U — The compound was analyzed for, but not detected.
- UJ — The compound was analyzed for, but was not detected; the associated quantitation limit is an estimate because quality control criteria were not met.
- J — The analyte was positively identified, but the associated numerical values is an estimate quantity because quality control criteria were not met or because concentrations reported are less than the quantitation limit or lowest calibration standard.
- NJ — The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
- R — Quality control indicates that data are unusable (compound may or may not be present). Resampling and reanalysis are necessary for verification.
- B — Detected concentration is below the method reporting limit/Contract Required Detection Limit (CRDL) but is above the instrument detection limit (inorganics only).
- H — High bias.

- K — Unknown bias.
- L — Low bias.
- Q — Detected concentration is below the method reporting limit/Contract Required Quantitation Limit (CRQL) but is above the method detection limit (organics only).

4.2 DATA VERIFICATION

Data validation deliverables will be submitted to WESTON for verification. Using the QA memo, the Forms I with validation qualifiers and the EDDs from the laboratories, WESTON will ensure that consistency exists among three documents. WESTON will ensure that the appropriate validation and bias qualifiers are applied to the affected values on the Forms I and EDDs as specified on the QA memo submitted by the validator.

4.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The data quality indicators' targets for this project are discussed in Section 1.4 of this SQAP. The data validation will be used as a tool to determine whether these targets were met. Also, using the compiled data, WESTON and TM will determine variability and soundness of the data and the data gaps that will need to be filled to meet the objectives of the project. Preliminary ranking of the site also will be determined if additional sampling is needed for the site.

SECTION 5

REFERENCES

- Bader, Dave, 2002, formerly of Bellingham & Whatcom County District Department of Public Health, telephone conversation with Susan FitzGerald, Roy F. Weston, Inc., Seattle, Washington, 12 February 2002.
- Bubanich, Tom, 2002, administrator, IMS General Partnership, personal communication with Susan FitzGerald, Roy F. Weston, Inc., Seattle, Washington, 6 December 2001.
- Dodd, Kyle, 2002a, Environmental Health Specialist, Whatcom County Health and Human Services, telephone conversation with Susan FitzGerald, Roy F. Weston, Inc., Seattle, Washington, 13 February 2002.
- Dodd, Kyle, 2002b, Environmental Health Specialist, Whatcom County Health and Human Services, email communication with Susan FitzGerald, Roy F. Weston, Inc., Seattle, Washington, 21 March 2002.
- E&E, 1989, Technical Assistance Team, Phase 1 Sampling Summary Report for: Thermal Reduction Company, Whatcom County, Washington, TDD T10-8810-047, February 1989.
- E&E, 1981, Field Investigations of Uncontrolled Hazardous Waste Sites, FIT Project, Task Report to the Environmental Protection Agency Contract No. 68-01-6056, Wilder's Landfill, Ferndale Washington, draft final report, TDD10-8006-03, October 1981.
- Ecology, 1999, Site Evaluation, Wilder Landfill-Hazardous Waste Pit Site Hazard Ranking Category - 1, prepared by Barbara Trejo, Washington State Department of Ecology.
- Ecology, 1996, Hazardous Ranking System Worksheet for Wilder Landfill-Hazardous Waste Pit, 1996.
- Ecology, 1991, Memorandum from Brian S. Sato to Gail Colburn through Ching-Pi Wang, regarding recommendation for No Further Action Wilder Landfill-Hazardous Waste Pit Site, Whatcom County, Washington. 30 August 1991.
- Ecology, 1989a, Preliminary Assessment Report, Friese Hide and Tallow, Ferndale, Whatcom County, Washington, WAD027267723, June 1989.
- Ecology, 1989b, Metals Concentrations in Sediments of Claypit Pond Area Including a Review of Metals Levels Found in Water Samples, Jim Cabbage, Washington State Department of Ecology, Toxics Investigations/Ground Water Monitoring Section, Olympia, Washington, 98504-6811, January 1989.
- Ecology 1988, Memorandum from Jim Cabbage, Water Quality Investigation Section, to All Interested Parties, regarding a summary of heavy metal levels in waters near Thermal Reduction Company (TRC) near Ferndale, WA. 13 May 1988.

Ecology, 1987, Site Inspection Report, Thermal Reduction Company, Ferndale, Whatcom County, Washington, Washington State Department of Ecology Preliminary Assessment/Site Inspection Unit, Hazardous Waste Cleanup Program, October 1987.

Ecology, 1980a, Memorandum from John H. Glynn to Dave Nunnallee, Robert McCormick, Bruce Johnson and Files, regarding Georgia Pacific Manufactured Drilling Mud Addition, 20 May 1980.

Ecology, 1980b, Memorandum from Lew Kittle to Robert McCormick, regarding Claypit (Brennan) Pond Survey and FRDA, 24 October 1980.

Ecology, 1977a, Letter from John G. Glynn, District Inspector, Environmental Quality, to Bert Brainard, Bellingham-Whatcom County Health District, 13 April 1977.

Ecology, 1977b, Letter from John G. Glynn, District Inspector, Environmental Quality, to Bert Brainard, Bellingham-Whatcom County Health District, 28 February 1977.

EPA, 2001, Contract Laboratory Program Guidance for Field Samplers, EPA/540/R-00/003.

EPA, 1999, Contract Laboratory Program National Functional Guidelines for Organic Data Review.

EPA, 1998, Guidance for Quality Assurance Project Plans, EPA 600/R-98/018.

EPA, 1996, Using Qualified Data to Document an Observed Release and Observed Contamination, EPA/540/F-94/028.

EPA, 1994a, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.

EPA, 1994b, Guidance for the Data Quality Objectives Process, EPA QA/G-4, Office of Research and Development, Washington, D.C., EPA/600/R-96/055.

EPA, 1993, Data Quality Objectives Process for Superfund, Interim Final Guidance, EPA/540/R-93/071.

EPA, 1991, Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites, EPA/540/P-91/001. February 1991.

EPA, 1990a, Hazardous Waste Fact Sheet, Thermal Reduction Company, Ferndale, Washington, 7 March 1990.

EPA, 1990b, Landview III, Version 1.0, Bureau of the Census, NOAA, USGS, 2002.

EPA, 1982, Comments on Wilders Landfill Final Report (TDD-10-8006-03), from Neil Thompson, Facilities Management Section, to Bill Schmidt, Chief Field Operations, 3 February 1982.

EPA, 1979, Preliminary Field Investigation Report, "Wilder" Landfill, Bellingham, WA, 15 August 1979.

Friese Hide and Tallow, 2002, Receptionist, Friese Hide and Tallow, telephone conversation with WESTON personnel, 14 February 2002.

Golder Associates, 1988, Technical Memorandum to Thermal Reduction Company, Preliminary Hydrological Investigation, Bellingham, Washington, June 1988.

Harding Lawson Associates, 1990, First Quarter Water Quality Sampling report to Recomp of Washington. 2 November 1990.

Johnson, James, 1988, Notes to File: KGMI "Impact" TRC Pollution, 30 March 1988.

Moscone, Frank, 2001, Owner, Recomp Facility, personal communication with Susan FitzGerald and Adrienne Barnes, Roy F. Weston, Inc., Seattle, Washington 6 December 2001.

National Cooperative Soil Survey, 1992, Soil Survey of Whatcom County Area, Washington, 1992.

PCGEMS, 1995, PCGEMS Version 2.03: Beta-Test Version, 28 June 1995.

Roy F. Weston, Inc., 2001, Region 10 START Quality Management Plan, U.S. Environmental Protection Agency, Contract No. 68-S0-01-02, TDD No. 01-04-0001, Seattle, Washington.

TRC, 1979, Letter from Frank "Moose" Zurline to Dr. Phillip Jones, Bellingham/Whatcom County Health District, regarding Thermal Reduction Hazardous Waste Site. 2 May 1979.

USFWS, 1987, Ferndale Quadrangle, Washington-Wetland Inventory Map, 1987.

USGS, 1952, Ferndale Quadrangle, Washington - Whatcom County 7.5 Minute Series (Topographic), photorevised 1981.

Vasey Engineering, 1994, Water Quality at Recomp Ash Monofill, prepared for Recomp of Washington, Ferndale, Washington, 7 April 1994.

Whatcom County Tax Assessor, 2001, online real property search, available at <http://www.co.whatcom.wa.us/assessor/home.htm>, Whatcom County Tax Assessor 2001.

Whatcom County, 1982, letter from Janice Gedlund, Environmental Health Specialist, Bellingham & Whatcom County District Department of Public Health, to Neil Thompson, Environmental Evaluation Branch, EPA, regarding review of "Wilder's Landfill Report". 6 January 1982.

Whatcom County, 1979a, Bellingham & Whatcom County Department of Public Health Sanitation Section Permit No. 790093, expiration date 31 December 1979.

Washington State Department of Health Water System Data, 2001, http://www.doh.wa.gov/ehp/dw/Our_Main_Pages/data_download.htm.

WCHHS, 2001, Geographical Information System (GIS) Drinking Water Well Information and Surface Water Intakes for Whatcom County, 2001.

WDFW, 1989, Memorandum from Chuck Phillips to Paul Mongillo, regarding Claypit Pond, 22 February 1989.

WDFW, 1988, Washington Department of Fish and Wildlife, North Puget Sound Region in La Conner, Washington, file field notes.

Western Region Climate Center, 2001, online, available at <http://www.wrcc.dri.edu/cgi-bin/climain.pl?wabell>.

Whatcom County, 1979b, letter from Dennis Larson, Environmental Health Specialist, Bellingham & Whatcom County District Department of Public Health, to Frank Zurline, Thermal Reduction Co., Inc. transmitting 1979 operating permit. 4 April 1979.

Wilder Construction Co., Inc., 1990, letter to Ms. Barb Smith, Washington Department of Ecology, regarding a material spill at the Thermal Reduction Ash Storage Facility, Ferndale, Washington, 12 March 1990.

Zurline, Frank, Sr., 2002, telephone conversation with Susan FitzGerald, Roy F. Weston, Inc., Seattle, Washington, 4 March 2002.

APPENDIX A

STANDARD OPERATING PROCEDURES

1. R10-001 Standard Operating Procedure for Surface and Subsurface Soil Sampling
2. R10-003 Standard Operating Procedure for Sediment Sampling
3. R10-004 Standard Operating Procedure for Surface Water Sampling
4. R10-007 Standard Operating Procedure for Collection of Soil, Soil Gas, and Groundwater Samples Using a Direct Push Sampling System
5. FLD 28 Excavating and Trenching