Quality Assurance Project Plan

Addendum to the Operation and Maintenance Manual of the Treatment Lagoon, Palermo Wellfield Superfund Site

by
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THROUGH: Darrel Anderson, Unit Supervisor, Environmental Assessment Program
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FROM: Pam Marti, Hydrogeologist, Environmental Assessment Program

SUBJECT: **ADDENDUM TO THE OPERATION AND MAINTENANCE MANUAL OF THE TREATMENT LAGOON, PALERMO WELLFIELD SUPERFUND SITE**

The Environmental Assessment Program (EA Program) has been requested by the Toxics Cleanup Program (SWRO) to perform the long-term monitoring and sampling operations of the treatment system at the Palermo Wellfield Superfund Site. This memo outlines the work to be performed by the EA Program. Detailed descriptions of the procedures to be followed in the monitoring, sampling, and quality assurance are discussed in two documents: the Operation and Maintenance Manual (USEPA 2002) and the Draft Final Operation and Maintenance Plan (USEPA 2000). The relevant portions of each document which discuss the monitoring, sampling, and quality assurance requirements are attached. The combined information meets the EA Program's Quality Assurance Project Plan requirements.

The Palermo Wellfield Superfund Site lies within the city limits of Tumwater, Washington (Figure 1). The site includes the Palermo Wellfield and Palermo neighborhood, located within the Deschutes River Valley. Groundwater contaminated with tetrachloroethene (PCE) and trichloroethene (TCE) migrated from an upland commercial area to the Palermo Wellfield. Shallow groundwater containing PCE and TCE was found to surface at the base of the Palermo bluff and pond as surface water in the yards and crawlspaces of some of the homes in the Palermo neighborhood. A subdrain system was constructed in 2000 to lower the groundwater table at the base of the bluff to prevent the contaminated groundwater from collecting in crawlspaces below the residences along Rainier Avenue.

The subdrain system includes a subgrade perforated piping network installed around seven houses along Rainier Avenue (Figure 2). The subdrain system consists of “finger drains” between the houses and is connected to a “trunk drain” aligned through the backyards of the houses. Water collected by the subdrain system is routed to an unperforated “tightline” piping aligned beneath Rainier Avenue and M Street. The water then drains and is collected in a treatment lagoon located at the City of Tumwater Municipal Golf Course. Three aerators in the lagoon remove PCE and TCE from the water and transfer the contaminants into the air where they disperse and degrade naturally.

The EA Program will perform the long-term monitoring and sampling portion of the operation and maintenance for the subdrain system and treatment lagoon. Activities to operate, maintain, and monitor the system are described in detail in the Operation and Maintenance Manual (USEPA 2002). The section of the Operation and Maintenance Manual discussing the specific monitoring and sampling procedures has been included as an attachment.

Monitoring and sampling of the subdrain system and treatment lagoon will be conducted semiannually (October/April) and will include:

- Measure depth to water in 12 piezometers.

- Measure total depth in eight trunk drain cleanouts (CO-1 through CO-8), three catch basins (CB-1 through CB-3), and three cross sections in the treatment lagoon.

- Flow rate measurements and water sampling for chemical analysis will be collected from three drain cleanouts (CO-1, CO-4, and CO-6), three outfalls to the treatment lagoon (the end of the tightline, M Street catch basin, and M Street storm drain), and two surface water (upstream of the lagoon and treatment lagoon effluent). Estimated lab costs for the eight samples, including quality assurance, are $2000 which reflects the 50% discount for Manchester Lab.

Results of the monitoring and sampling of the subdrain system will be used to assess if the system is meeting the requirements of the remediation goals and the systems operating parameters, which are shown in the attached tables. The data will be used as follows:

- Depth to water measurements will be used to prepare groundwater contour maps for evaluating groundwater flow conditions around the subdrain system and to show if there is a sufficient reduction in the groundwater elevations, in compliance with the overall system objectives.

- Total depth measurements in the cleanouts, catch basins, and treatment lagoon will be used to assess accumulation of sediment and debris in the subdrain system and to schedule cleaning.

- Laboratory analysis of water samples from locations within the subdrain system for PCE and TCE will be used to assess performance of the system and compliance with remediation goals.

- Water flow rates through the subdrain system at various locations will be used to assess the performance of the system and the effect the system has on surface water flows.

Quality assurance procedures for the monitoring and sampling of the subdrain system and treatment lagoon are described in detail in the Quality Assurance Project Plan (QA Project Plan) previously prepared for this site as part of the Draft Final Operation and Maintenance Plan (USEPA 2000). The QA Project Plan has been included as an attachment.

At the completion of each sampling event, all field data and laboratory analytical data will be compiled and evaluated against the project remediation goals. At the completion of the spring monitoring, an annual technical memorandum will be prepared in June and will include the following:

- Abbreviated project background, operation and maintenance objectives, performance criteria, remediation goals, and scope during the monitoring period.
- Maps of the study area showing sample sites.
- Descriptions of field and laboratory methods.
- Discussion of data quality and the significance of any problems encountered in the analyses.
- Summary tables of field and chemical data as well as groundwater contour maps.
- Discussion and comparison of the monitoring period results to pre-existing conditions, remediation goals, and previous project results.
- Conclusions will be provided based on the system's performance and recommendations will be made regarding any changes to operating and maintaining the system procedures.

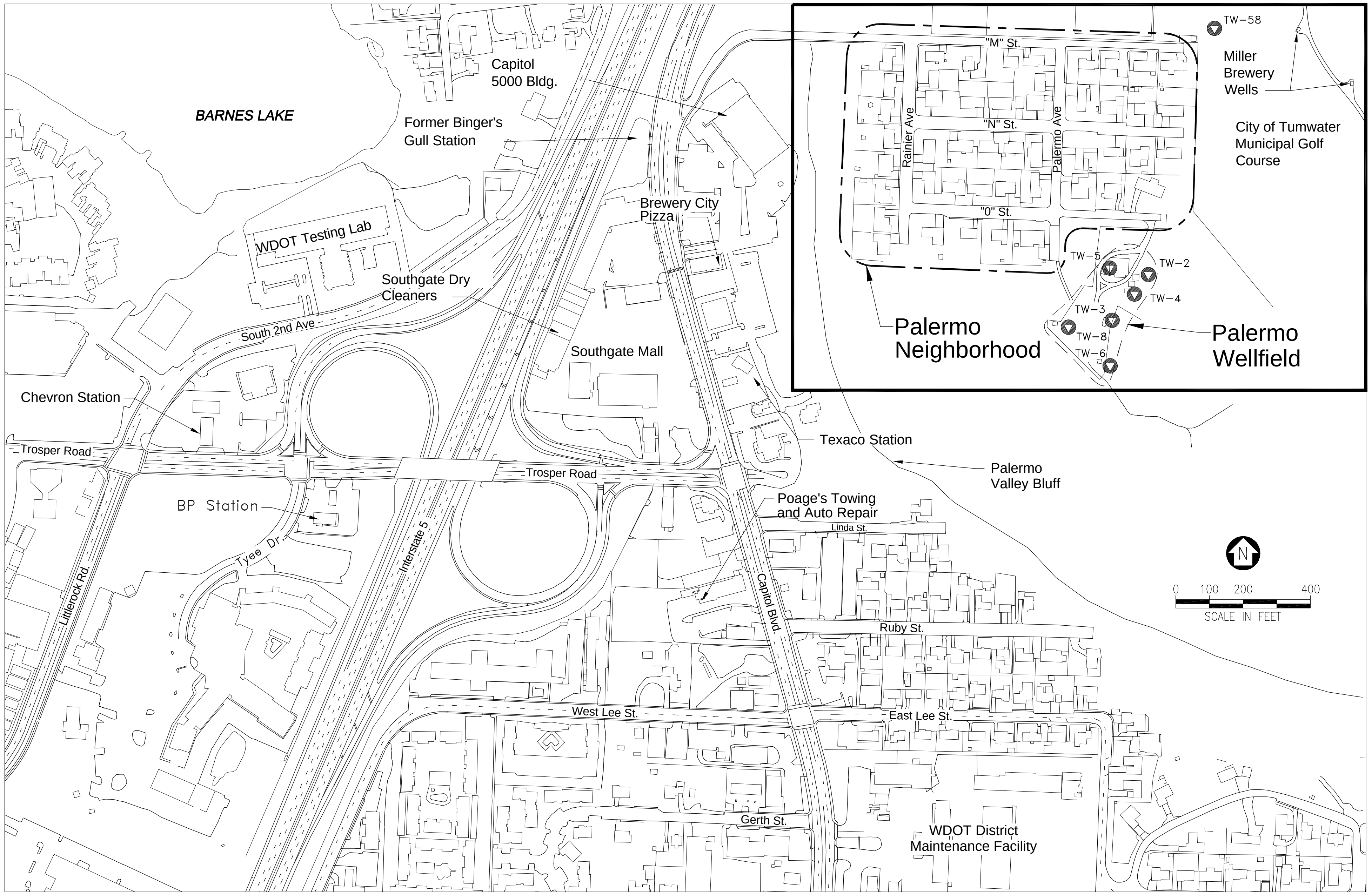
Data suitable for archiving will be transitioned annually to the Environmental Information Management (EIM) database by June of each sample year.

PM:cn
Attachments

References

U.S. EPA, 2000. *Draft Final Operation and Maintenance Plan, Subdrain System and Treatment Lagoon, Palermo Wellfield Superfund Site, Tumwater, Washington.* Prepared by URS Greiner, Inc., for EPA Region 10 under RAC No. 68-W-98-228. Seattle, Washington. December 26, 2000.

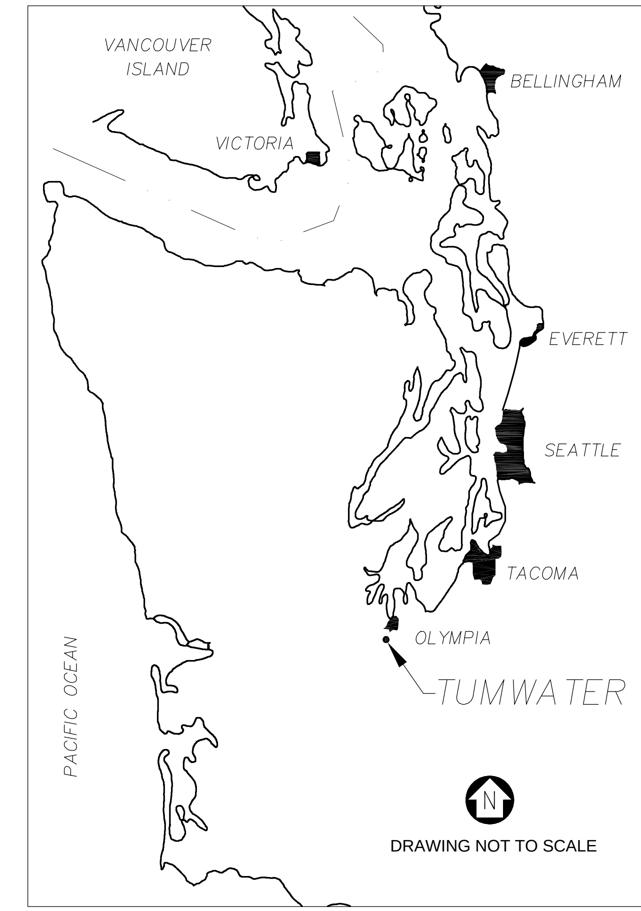
U.S. EPA, 2002. *Operation and Maintenance Manual, Subdrain System and Treatment Lagoon, Palermo Wellfield Superfund Site, Tumwater, Washington.* Prepared by URS Greiner, Inc., for EPA Region 10 under RAC No. 68-W-98-228. Seattle, Washington. August 30, 2002.



PALERMO NEIGHBORHOOD BOUNDARY

PROJECT LOCATION BOUNDARY

APPROXIMATE AREA OF PALERMO WELLFIELD SUPERFUND SITE



VICINITY MAP

Figure 1-1
Project Area
Location Map

EPA REGION 10

080-RA-RA-104K
Palermo Wellfield Superfund Site
SUBDRAIN SYSTEM AND
TREATMENT LAGOON

Figure 1.

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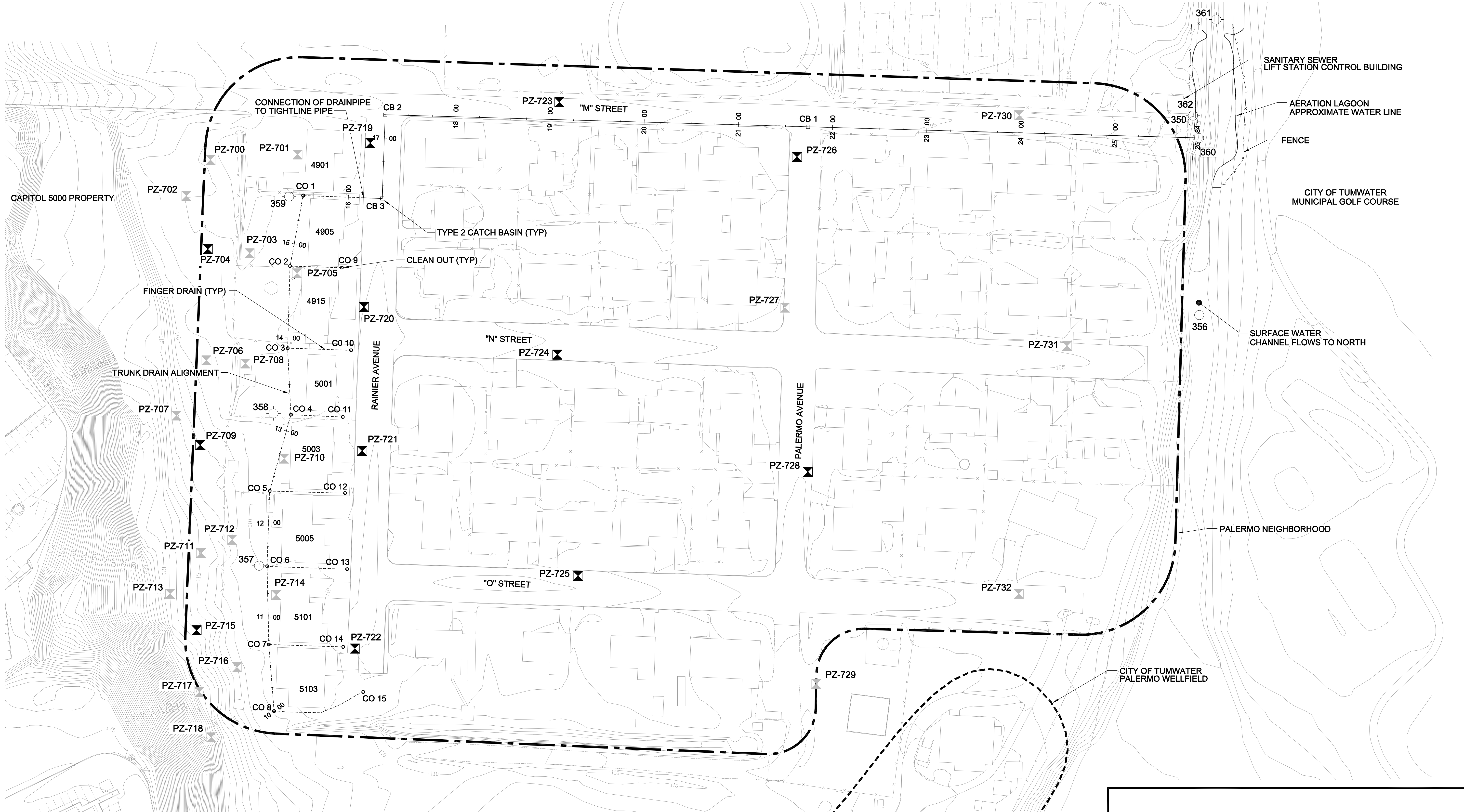

LEGEND

- PZ-722 Piezometer Location
- PZ-716 Location of Piezometer Abandoned June 2002
- 353 Water Sampling Station
- Tightline Pipe
- Perforated Drainpipe

Sampling Station Descriptions

350 M Street Storm Drain Outfall
356 Watercourse Cross Section Upstream of Lagoon
357 Cleanout CO-6
358 Cleanout CO-4
359 Cleanout CO-1
360 Tightline Pipe Outfall
361 Lagoon Effluent
362 M Street Terminus Catch Basin Outfall (Rarely Flows)

N

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SCALE IN FEET

Figure 5-1
O&M Water Sampling Stations

EPA
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Palermo Wellfield Superfund Site
SUBDRAIN SYSTEM AND
TREATMENT LAGOON

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Figure 2.

Summary of Remedial Action Objectives and Remediation Goals for Surface Water as Established in the Record of Decision

Matrix	Remedial Action Objective	Chemical of Concern	Remediation Goal	Source of Remediation Goal	Point of Compliance
Groundwater ponding as surface water	Prevent discharge of groundwater containing chemicals of concern to the Deschutes River at concentrations in excess of Applicable or relevant and appropriate requirements or resulting in ecological hazard index greater than 1.	PCE	0.8 ug/L	National Toxics Rule[b] for consumption of water and organisms.	Point of discharge to Deschutes River.
		TCE	2.7 Ug/L		

[b]Federal Clean Water Act - National Toxics Rule 40 CFR 131.36(b)(1) Human Health (10^{-6} cancer risk)

System Operating Parameters

Parameter	Representative Value	Comments
Flow rate from drain to lagoon	110 to 215 gpm	Average of 158 gpm; some low seasonal variation.
Flow rate in watercourse through lagoon	130 to 1470 gpm	High seasonal variation.
Chemicals of concern in water from drain to lagoon	PCE: 11.3 to 24.7 ug/L TCE: 18.7 to 26.5 ug/L	Overall decrease over performance validation period.
Chemicals of concern in water leaving lagoon	PCE: 0.5U to 1.1 ug/L TCE: 0.5U to 1.5 ug/L	With at least two aerators running.
Influence of drain on groundwater	Predicted: 3 feet of drawdown 35 feet away. Actual: 0.5 to 5.5 feet of drawdown, influence at 150 to 250 feet.	"Influence" refers to downgradient of drain. Actual is greater than predicted; however, near southern end of drain, effect is small (less than 1 foot of drawdown).

OPERATION AND MAINTENANCE MANUAL
SUBDRAIN SYSTEM AND TREATMENT LAGOON
PALERMO WELLFIELD SUPERFUND SITE
TUMWATER, WASHINGTON

CERCLIS ID No. WAD0000026534

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Work Assignment No. 080-RA-RA-104K

URSG DCN 8000.65

5.0 SYSTEM MONITORING AND SAMPLING

5.1 SUMMARY OF MONITORING AND SAMPLING

The objectives of monitoring and sampling of the system are the following:

- To demonstrate ongoing compliance with the ARARs discussed in Section 3.3
- To assess the need for system maintenance and to ensure continued effectiveness

Monitoring and sampling of the system will consist of the following types:

- Measurement of depth to water
- Measurement of total depth
- Water sampling and chemical analysis
- Measurement of water flow rate
- Observations of system components

A summary of monitoring and sampling activities is included in Table 5-1. A summary of data types and uses is included in Table 5-2. The quality assurance procedures to be followed during sampling are described in the QAPP, which is included in the *Draft Final Operation and Maintenance Plan* (USEPA 2000).

The data generated by monitoring and sampling activities will be compared to data collected during the performance validation period and reported in the status reports (USEPA 2002, 2001a, 2001b, 2001c). Decisions made on the basis of this comparison will result in following potential actions:

- Continued monitoring and sampling to document ongoing acceptable performance
- Augmentation of the system to enhance performance
- Performance of specific maintenance activities (such as lagoon dredging)

5.2 DETAILED MONITORING AND SAMPLING BY TASK

5.2.1 Periodic Depth-to-Water Measurement

During the design phase of the project, 33 piezometers were installed throughout the Palermo neighborhood. At the end of the 1-year performance validation period, it was determined that 21 of the 33 were not required for long-term monitoring of the system, and they were abandoned. Concurrently with abandonment field activities, flush-mounted well monuments were reconstructed for five of the remaining piezometers. The top-of-casing elevations for these five piezometers were resurveyed after the reconstruction. Revised top-of-casing elevations for all the remaining piezometers are listed in Table 5-5.

During long-term monitoring, depth to water will be measured semiannually in the remaining 12 piezometers shown in Figure 5-1. Depth to water will be measured using either an electronic water-level indicator or water-finding paste. Both methods will use a measuring tape marked in increments of 100ths (0.01) of a foot. The measurement will be made from the surveyed mark at the top of the piezometer casing or the catch basin or cleanout frame. Before the measurement at each location, the measurement equipment will be decontaminated using an Alconox wash, tap water rinse, and a final rinse with deionized water. Decontamination water will be handled as described in Section 5.2.5.

At some locations (such as piezometers installed in the back yards of the Rainier Avenue residences and in the Rainier Avenue right-of-way), shallow groundwater may be ponding as surface water, above the elevation of top of the piezometer casing. In such cases, the casing will be temporarily extended using a fixed length of PVC pipe with carefully squared ends butted flush against the top of casing and secured with a PVC coupler or rubber boot (Furnco or equivalent). The length of the PVC pipe will be noted in the field notes. After installing a riser pipe, the field crew will wait at least 30 minutes before measuring depth to groundwater, to allow stabilization.

Any future piezometer abandonment will be performed in accordance with WAC 173-160 by filling the casing from the bottom to top with grout or bentonite slurry, removing the surface monument, backfilling the monument hole, and restoring the area to match the existing ground surface.

5.2.2 Total Depth Measurement

The total depth of trunk drain cleanouts CO-1 through CO-8, catch basins CB-1 through CB-3, and the aeration lagoon (Figure 5-1) will be measured semiannually. Cleanout and catch basin measurements will be made from the surveyed elevation mark on the catch basin or cleanout frame, using a rigid measurement stick marked in increments of 100ths (0.01) of a foot. Between measurement locations, the measurement stick will be decontaminated in accordance with the procedure described in Section 5.2.1.

The total depth measurement in the aeration lagoon will consist of measuring three cross sections through the lagoon from a reference elevation. Cross sections will be measured between the three sets of mooring posts for the lagoon aerators, and referenced as the "north," "central," and "south" cross sections. The procedures for cross section measurements are as follows:

- Shut down, lock out, and tag out the three aerators and allow the lagoon to become quiescent.
- Check the boat being used for lagoon maintenance (a boat must be provided by the field crew) to ensure that it is watertight and has proper flotation.
- Wear an approved personal flotation device.
- String a taut measuring tape between two mooring posts across the lagoon at the reference elevation hub set near each post.
- Position the lagoon maintenance boat in the water adjacent to the aerator mooring cable at the measurement location, and clip the bow and stern of the boat to the mooring cable using the carabiners provided.
- Enter the boat and pull the boat along the mooring cable by hand.
- As the boat moves across the lagoon, measure the distance from the measuring tape to the soft top of the lagoon floor at 2-foot intervals using a surveyor's rod, recording the measurements in the field book.

Note that this procedure is similar to that used to measure a stream cross section, as described in Appendix C.

5.2.3 Water Sampling and Chemical Analysis

Water samples will be collected semiannually from the eight sampling stations listed in Table 5-1 and shown in Figure 5-1. These sampling locations have been chosen to provide chemical concentration data on the discrete influents to the aeration lagoon, the lagoon effluent, and the distribution of TCE and PCE along the subdrain alignment. At some times of the year, there may be no water flow at some sampling stations.

One discrete influent to the aeration lagoon will not be sampled: the outfall pipe from the Miller Brewery well catch basin nearest the aeration lagoon. The nearby Miller Brewery well locations are shown in Figure 1-1. This catch basin drains precipitation and discharge-to-waste water from the well. If the piping between the catch basin and the aeration lagoon has leaks, this pipe may also collect shallow groundwater at certain times of the year. This discrete influent to the aeration lagoon cannot feasibly be sampled because the outfall invert is well below the static water level in the aeration lagoon.

Sampling Procedures

Water samples will be collected either with a dipper sampling device or by collecting flow directly into the sample containers from the flowing water stream. When a dipper is used to collect samples, the dipper will be decontaminated in accordance with the procedures described in Section 5.2.1. One rinsate sample of the decontaminated dipper will be collected during each sampling event.

Analytical Procedures

The water samples will be analyzed by the EPA Manchester laboratory according to EPA Method 8260B. Data review, validation, management, and verification will be performed in accordance with the QAPP (USEPA 2000, Appendix A). Sample quantities, collection, handling, and analysis are summarized in Tables 5-3 and 5-4. A standard turnaround time will be requested for the laboratory analysis and validation.

5.2.4 Water Flow Rate Measurement

Measurements of flow velocity and depth will be made at all of the water sampling stations discussed in Section 5.2.3. Flow rate measurements will be made whenever a water sample is collected at these stations, on a semiannual basis.

Flow depth and velocity will be measured using an electronic turboprop meter and staff gauge. In pipe outfalls, the cross-sectional area of flow data will be calculated based on the inside diameter of the pipe. In open channels, the irregular channel cross section will have to be measured to allow calculation of flow rate. Wherever possible, the flow measurement will be taken in a culvert or other structure that provides a regular cross section. If an irregular channel section must be used, the measurement procedure will be in accordance with standard stream gauging techniques, as summarized in Appendix C.

The results of the performance validation period showed that the flow rate is rarely measurable immediately upstream or downstream of the lagoon. The lagoon has created a wide, slow-moving area of the watercourse that makes flow rate measurement difficult. To compensate, overall flow through the watercourse was typically measured at an alternate station downstream of the lagoon, where the flow is concentrated through two parallel culverts. The flow depth and velocity in each culvert were typically measured and summed to arrive at an overall flow value for the watercourse. Current plans are to remove the set of parallel culverts to enhance fish habitat in the watercourse. If this plan is implemented, an alternate flow measurement location may need to be established. As the flow measurement location is moved farther from the lagoon, the measured flow values become less representative of the actual flow through the lagoon.

5.2.5 System Inspections and Troubleshooting

The system components will be inspected quarterly to assess their integrity and performance. Inspections will include walking the piping alignments and looking for evidence of any of the following:

- Settlement over the drain or tightline piping alignment
- Piping (subsurface erosion) of soil into the drainpipe or the backfill surrounding the drainpipe
- Planting, excavation, or construction precluded by the requirements listed in Sections 4.2.1 and 4.2.2

Inspections will also include visual inspection of conditions at the aeration lagoon including the following:

- Operating aerators
- Water level elevation in the lagoon
- Amount of slack on aerator anchor cable and electrical cable (see next paragraph)

- Presence of debris within the lagoon
- Amperage draw of each of the operating aerator motors

The water level elevation in the lagoon can be measured while the aerators are operating, using the fixed-staff gauge located in a relatively quiescent portion of the lagoon. The aerators require a minimum water depth of 4 feet. The aerators should not be operated if the water elevation shown on the staff gauge is 95.00 feet or less. A greater water level elevation may be required if siltation in the lagoon has increased the floor elevation.

The anchor cables should be tight enough to prevent the aerator from rotating significantly during operation. Rotation should be less than 90° during full operation. Neither anchor cables nor electrical cables should be tight enough to affect the aerator submergence depth. To ensure that the electrical cable does not get sucked into the aerator intake, no large loops of electrical cable should be located near the aerator. All cables should be adjusted to ensure the above described conditions.

Amperage draw should be measured at the motor control starter enclosure located within the lift station control building. Measurement is conducted by opening the motor control enclosure and attaching a clamp-on ampere meter around each of the three conductors supplying the motor. Amperage should be recorded for each phase (each wire) for each motor. **WARNING: This must be done with the motor circuit energized; therefore, personnel must have an electrical background and must be properly trained in this procedure. Two people must be on site during the amperage draw measurement.** A rubber floor mat designed to protect against electrical shock is provided in front of the aerator motor starters. This mat should remain in place.

Troubleshooting of the aerators is necessary if any of the aerators are found to be not operating during a site visit, turn off unexpectedly, or fail to restart after being turned off. The most common cause of an aerator not operating is a power failure or "brown out." Following a "brown out," one, two, or all three aerators may shut off. Aerators that shut off because of brown outs or power failures will not restart automatically. They must be restarted manually by pressing the "start" button on the motor starter.

In general, if an aerator is found to be not operating when it should be operating, the following procedure should be followed:

1. Confirm that no personnel are working near the aerator.

2. Visually confirm that there is no obvious physical impediment to the aerator operation (such as debris caught in the aerator).

3. Press the "start" button on the aerator motor starter.

4. Observe the aerator operation.

5. If the aerator operates normally for at least 2 minutes, allow continued operation and measure and record the operating amperage draw.

6. If the amperage draw is within the normal range (see Table 3-2), allow continued operation—the aerator probably shut down because of a power failure.

7. If the amperage draw is outside the normal range, contact the manufacturer—the aerator motor may require reconditioning by the manufacturer.

8. If the aerator does not restart or does not operate for at least 2 minutes after the "start" button is pressed, attempt to measure and record the amperage draw of the aerator immediately after pressing the "start" button. Contact the manufacturer—the aerator motor may require reconditioning by the manufacturer.

During troubleshooting, the phase of the electrical power should never be changed (through means such as temporarily rewiring the aerator power supply). Phase changes that reverse the motor rotation will cause the propeller to spin off the motor shaft and will cause the motor to overheat and burn out.

5.2.6 Investigation-Derived Waste

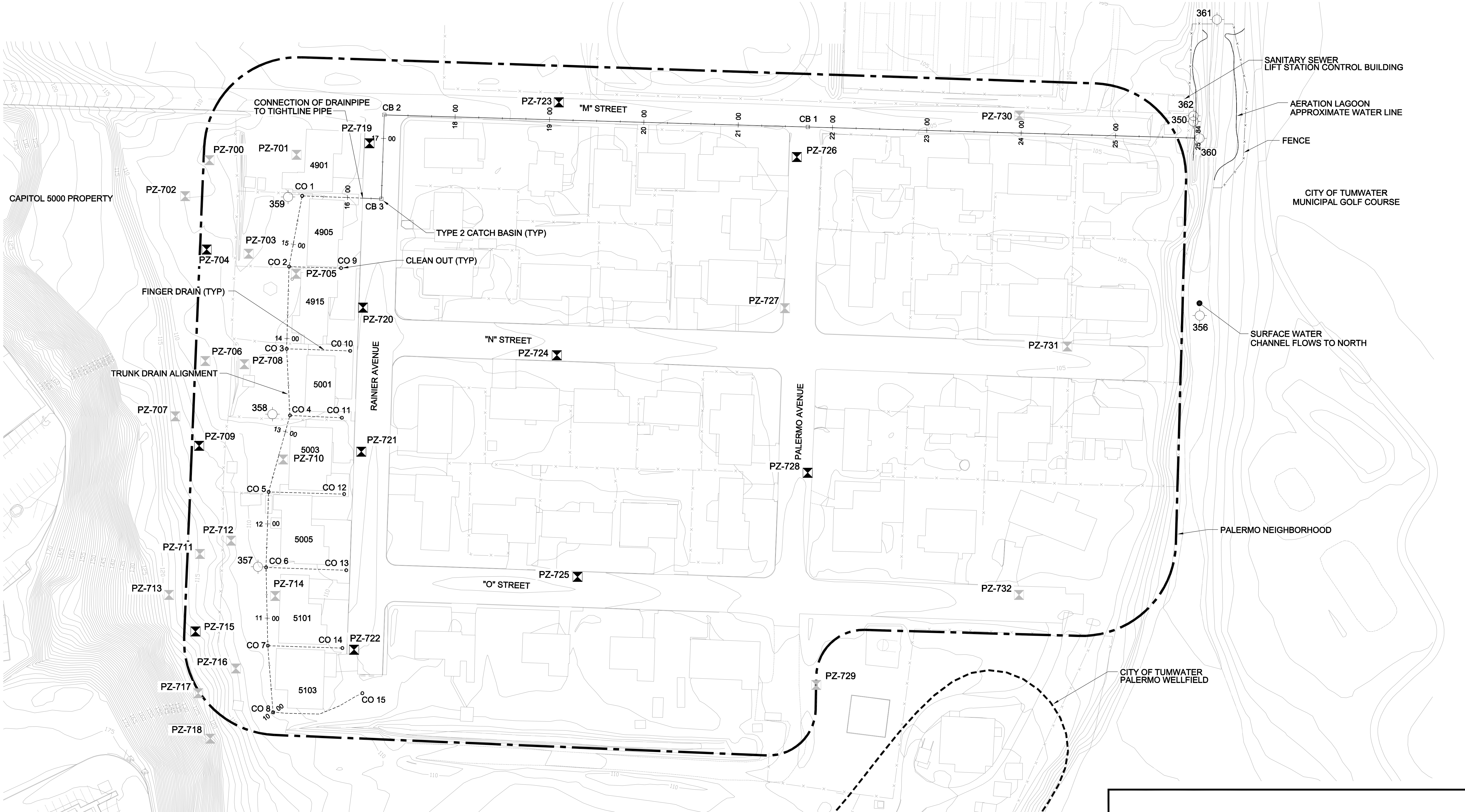
Disposable sampling equipment will be used as much as possible to minimize investigation-derived waste (IDW). IDW expected to be generated during operation, maintenance, monitoring, and sampling of the subdrain system and treatment lagoon is expected to consist entirely of decontamination water. Approximately 20 gallons of decontamination water are expected to be generated during each sampling and depth-to-groundwater measurement event.

The decontamination water will be temporarily contained on site in 55-gallon drums and discharged to the wet well at the sanitary sewer lift station. The results of historical characterization indicate that the decontamination water can be safely disposed of in the sanitary sewer. Discharge approval and access to the wet well must be coordinated with the City Public Works Operations Department for each disposal event.

Drums containing IDW that are to be temporarily stored on site must be labeled with the following information:

- Site name
- Sequential drum number
- Date of collection
- Source and type of waste
- Generator
- Contact name and phone number

All such information must be recorded in field books. Drummed decontamination water should be stored within the fenced compound surrounding the lift station control building at the eastern end of M Street.



LEGEND

- Piezometer Location (PZ-722)
- Location of Piezometer Abandoned June 2002 (PZ-716)
- Water Sampling Station (353)
- Tightline Pipe
- Perforated Drainpipe

Sampling Station Descriptions

350 M Street Storm Drain Outfall
356 Watercourse Cross Section Upstream of Lagoon
357 Cleanout CO-6
358 Cleanout CO-4
359 Cleanout CO-1
360 Tightline Pipe Outfall
361 Lagoon Effluent
362 M Street Terminus Catch Basin Outfall (Rarely Flows)

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Figure 5-1
O&M Water Sampling Stations

EPA REGION 10

080-RA-RA-104K
Palermo Wellfield Superfund Site
SUBDRAIN SYSTEM AND
TREATMENT LAGOON

Table 5-1
Operation, Maintenance, and Monitoring Summary

Task	Location	Frequency/Schedule	No. of Locations
Regular Maintenance			
Cleaning of cleanouts and catch basins	Cleanouts and catch basins	As needed (estimated every 5 years)	18
Dredging of lagoon	Aeration lagoon	As needed (estimated every 5 years)	1
Reconditioning of aerator motors	Aeration lagoon	As needed (estimated every 2 years)	3
Clearing of debris from lagoon	Aeration lagoon	As needed (estimated once per year)	1
Plant watering, fertilizing, pruning, mowing, weeding, pest control, and replanting	Aeration lagoon and downstream of lagoon	As needed based on horticultural best management practices	2
Monitoring and Sampling			
Depth-to-water measurement	Piezometers	Semiannually	
Total depth measurement	Cleanouts (CO-1 through CO-8)	Semiannually	8
	Catch basins (CB-1 through CB-3)		3
	Aeration lagoon		3
Flow rate measurement and water sampling for chemical analysis	Cleanouts CO-1, CO-4, and CO-6 (stations 359, 358, and 357)	Semiannually	3
	Tightline outfall (station 360)		1
	M Street storm drain outfall (station 350)		1

Table 5-1 (Continued)
Operation, Maintenance, and Monitoring Summary

Task	Location	Frequency/Schedule	No. of Locations
Monitoring and Sampling (Continued)			
Flow rate measurement and water sampling for chemical analysis	M Street terminus catch basin outfall (station 362)	Semiannually	1
	Watercourse upstream of lagoon (station 356)		1
	Aeration lagoon effluent (station 361)		1
System inspections	Piping alignments	Quarterly	1
	Lagoon (debris in and around; and water level)		1
	Aerators—operating, with proper cable slack		3
	Aerators—motor amperage draw		3

Table 5-2
Summary of Data Types and Uses

Data Type	Use
Depth to water in piezometers and cleanouts	Prepare groundwater contour maps for evaluating groundwater flow conditions around the drain to show sufficient reduction in groundwater elevation, in compliance with the overall system objective (Section 3.2)
Total depth in cleanouts, catch basins, and aeration lagoon	Assess accumulation of sediment and debris in system and schedule cleaning
Laboratory analysis of water samples from locations within system for PCE and TCE	Assess performance of system and compliance with remediation goals
Water flow rate through system at various locations	Assess performance of system and effect of system on surface water flows
System inspections	Assess need for system maintenance and repair

Notes:
PCE - tetrachloroethene
TCE - trichloroethene

Table 5-3
Environmental and Quality Control Sample Quantities for Typical 1-Year O&M Period

Medium	Chemical	Analytical Method (Reference)	Environmental Samples	Quality Control Samples				
				Field Duplicates	Equipment Rinsates	MS/MSDs	Trip Blanks	Total Samples
Water	VOCs	8260B (USEPA 1997)	22	2	2	2/2	2	32

Notes:
MS/MSD - matrix spike/matrix spike duplicate
VOC - volatile organic compound

Table 5-4
Sample Collection and Laboratory Analysis Specifications

Chemical	Medium	Analytical Method	Reference	Method Detection Limit	Sample Container Type	Required Volume	Sample Preservation	Holding Time
VOCs	Water	8260B	USEPA 1997	1 µg/L[a]	2 x 40-mL AGV with Teflon-lined septum	25 mL	pH <2 w/HCl Cool to 4ºC	14 days

[a]Special requirement: to allow comparison to remediation goal values, the method detection limit for tetrachloroethene and trichloroethene must be 0.5 µg/L.

Notes:
AGV - amber glass vial
°C - degree Celsius
HCl - hydrochloric acid
µg/L - microgram per liter or part per billion
mL - milliliter
VOC - volatile organic compound

Table 5-5
Top-of-Casing Elevations for Remaining Piezometers

Piezometer Identification	Top-of-Casing Elevation (feet)
704	110.61
709	114.27
715	117.79
719	107.13
720	107.75
721	108.32
722	108.82
723	106.34
724	106.45
725	108.22
726	105.39
728	105.27

Note: Elevations shown for piezometers 720, 723, 724, 725, and 728 have been revised from the original survey data because the casings for these piezometers were shortened during monument reconstruction in June 2002.

APPENDIX C

Area-Velocity Method of Measuring Streamflow

There are three methods that may be used for measuring surface water flow or discharge: (1) area-velocity, (2) permanently installed or portable flumes or V-notch weirs, or (3) volumetric method (time and volume or time and distance). During this project the area-velocity method will be used. The stream gauging and surface water sampling procedures are discussed in the following paragraphs.

Measurement Procedure

Streamflow measurements will be made following the recommendations for standard U.S. Geologic Survey (USGS) stream gauging methods. The field team will collect streamflow measurements using a Global brand Flow Probe (or equivalent) electromagnetic portable flow meter. The user will follow the operation manual and read the basic instructions for setup and calibration of the unit.

The procedure for conducting streamflow measurements consists of the following steps:

1. At the beginning of each day, calibrate the flow meter according to the manufacturer's instructions.

2. Find the gauging/sampling stream location previously established or as determined by the project manager. Existing locations are shown on the site map. Mark new locations on the map when they are established in the field.

3. Stretch a surveyor's tape across the stream (perpendicular to the flow) and make the tape taut by anchoring the other side with a rock or another stake. Be sure the even foot increments are visible from the top.

4. Select a starting point at either the left edge of water (LEW) or the right edge of water (REW). The LEW and REW are determined when facing downstream. Measure the stream width in feet. Subdivide the stream into a series of subsections. Table C-1 provides guidelines for the number of subsections that should be used for varying stream widths.

Table C-1
Number of Subsections Based on Stream Width

Approximate Stream Width (feet)	Approximate Number of Subsections	Approximate Distance Between Subsections (feet)
<2	8 - 10	0.2 - 0.3
2 - 4	10 - 12	0.3 - 0.4
4 - 10	12 - 15	0.4 - 0.7
10 - 20	15 - 20	0.7 - 1.0
>20	20 - 25	1.0 - 2.0

5. Note the distance from the initial point to the beginning edge of water. The initial point is an arbitrary point on the tape, preferably 0, which lies on the shoreside of the stream. All station locations are recorded as distances from the initial point (see Figure C-1).

6. On the Global Flow Probe, the velocity meter and staff gauge are part of the same instrument. Follow the manufacturer's instructions for collecting flow velocity and depth readings.

7. Proceed to the first subsection beyond the edge of water. Record in the logbook the distance from the initial point to the first subsection. Record the flow velocity and depth.

8. If the stream depth in the subsection is 2 feet or less, a single measurement of velocity taken at 0.6 of the depth below the surface accurately results in mean velocity in the vertical (Rantz et al. 1982). If the stream depth in the subsection is greater than 2 feet, then stream velocity readings will be collected at 0.2 and 0.8 foot from the surface. The final velocity for this predetermined distance will be an average of the two velocities in the final calculations of flow.

9. Proceed to the next subsection. Repeat the procedures described in steps 6 through 8 until the opposite bank is reached.

10. After recording the flow measurement at the last subsection, record in the logbook the time at which the ending edge of water is reached. Note the velocity and depth at the edge of water as 0.

11. After completing the flow measurements and prior to leaving the site, determine the total velocity in cubic feet per second. As a general approximation, each subsection measured will account for no more than 10 percent of the total flow. It is better to discover oversights at the gauging/sampling location so the problem can be corrected before the flow stage has changed.

12. The procedure for calculating the total flow is as follows:

    a. Use the distances from the initial point on the shoreside (an arbitrary position beyond the edge of water as shown in Figure C-1) to compute the width for each subsection. The first width is computed by subtracting the first distance (edge of water) from the second distance and dividing the distance by 2. The second width will be the difference between the third distance and the first distance, divided by 2. For each subsequent width, subtract the previous subsection distance from the following subsection distance, and divide by 2. The final width is calculated as the difference between the final distance and the second-to-last distance divided by 2. Sum the width column and check that the width equals the distance between the REW and LEW.

    b. Multiply the width by the depth for each subsection to determine its area. Sum the areas to determine the total area.

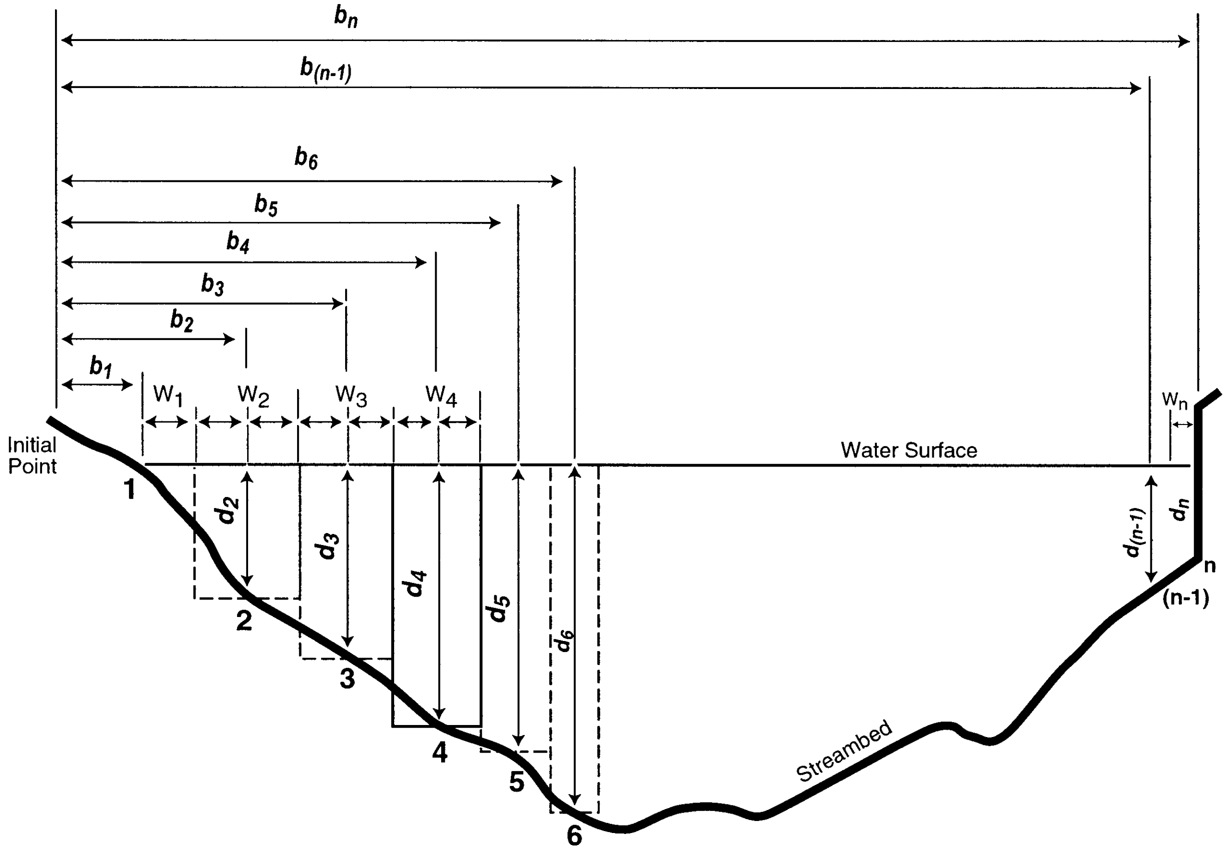
    c. Multiply the velocity by the area for each subsection to obtain its discharge measurement.

    d. Sum the discharge measurements for each subsection to determine total discharge, and record the value.

Reference

Rantz, S.E. et al. 1982. *Measurement and Computation of Stream Flow, Measurement of Stage and Discharge*. U.S. Geological Survey Water-Supply Paper 2175. U.S. Government Printing Office, Washington, D.C.

53F400800003-1



EXPLANATION

1,2,3 ....*n*	Observation verticals
$b_1,b_2,b_3,$................b_n	Distance, in feet or meters, from the initial point to the observation vertical
$d_1,d_2,d_3,$................d_n	Depth of water, in feet or meters, at the observation vertical
Dashed Lines	Boundaries of subsections; one heavily outlined is discussed in text
$W_1,W_2,W_3,$.............W_n	Width of each section calculated as follows: $W_1 = (b_2 - b_1)/2$; $W_2 = (b_3 - b_1)/2$; $W_3 = (b_4 - b_2)/2$ $W_5 = (b_6 - b_4)/2$; .... $W_{n-1} = (b_n - b_{n-2})/2$; $W_n = (b_n - b_{n-1})/2$

Figure C-1
Definition Sketch of Midsection Method of Computing Cross-Section Area for Discharge Measurements

Source: Geological Survey Water Supply Paper 2175, 1982

URS

APPENDIX D

Example Monitoring Checklist

Example Monitoring Checklist
Remediation Goals and Overall System Performance,
_________, 200_
(Date)

Monitoring Data Type	Remediation Goal or Performance Criterion	Data Value	Data Comparison Notes
Remediation Goals			
Depth-to-water measurement	18 inches below floor of crawlspaces		Requires interpolation from contour maps, with consideration of flow rate variations within the subdrain system.
Lagoon effluent PCE concentration	0.8 µg/L		
Lagoon effluent TCE concentration	2.7 µg/L		
Indoor air PCE concentration	4.38 $\mu g/m^3$		Raw data values must be interpreted based on crawlspace results and possible sources of PCE and TCE in the home other than shallow groundwater.
Indoor air TCE concentration	1.46 $\mu g/m^3$		
Overall System Performance			
Drain flow rate (station 360)	Average monthly value from first year was 158 gpm		Decreasing flow rate may indicate drain clogging.
Lagoon residence time[a]	Design residence time of 83 minutes typical actual residence time was 3 hours		Varies slightly seasonally. Variations are allowable as long as effluent RGs are met. During very high flow months, minimum observed residence time was 77 minutes.
Aerator amperage draw, A1-A[b]	4.6 to 5.0		Changes in amperage draw are indicative of motor wear. Consult manufacturer for interpretation of amperage draw changes.
Aerator amperage draw, A1-B[b]	4.5 to 5.0		
Aerator amperage draw, A1-C[b]	4.4 to 5.1		
Aerator amperage draw, A2-A[b]	4.6 to 5.0		

Example Monitoring Checklist (Continued)
Remediation Goals and Overall System Performance,
_________, 200_
(Date)

Monitoring Data Type	Remediation Goal or Performance Criterion	Data Value	Data Comparison Notes
Aerator amperage draw, A2-B[b]	4.6 to 5.0		
Overall System Performance (Continued)			
Aerator amperage draw, A2-C[b]	4.5 to 5.0		
Aerator amperage draw, A3-A[b]	4.1 to 4.7		
Aerator amperage draw, A3-B[b]	4.1 to 4.6		
Aerator amperage draw, A3-C[b]	4.0 to 4.7		
PCE and TCE concentrations and flow rate within and around the system (stations 350, 356 through 362)	Compare to historical data set	See status reports prepared during performance validation	Quantitive data comparisons will be used to assess changes in contaminated water removal from portions of the drained area. Changes may reveal clogging of portions of the drain, and changes in in situ contaminant concentrations or flow characteristics.
Other system inspections	Compare to as-built conditions	See separate documentation	Triggers system cleaning or repair as discussed in the text of Section 4.2.

[a]Residence time is calculated as the lagoon volume (gallons) divided by the sum of the measurable input flow rates in gallons per minute (stations 350, 356, 360, and 362).
[b]Notation "A1-A" indicates the "A" voltage leg of aerator A1.

Example Monitoring Checklist (Continued)
Remediation Goals and Overall System Performance,
_________, 200_
(Date)

Notes:
gpm - gallon per minute
µg/L - microgram per liter
µg/m^3 - microgram per cubic meter
PCE - tetrachloroethene
RG - remediation goal
TCE - trichloroethene

DRAFT FINAL OPERATION AND MAINTENANCE PLAN
SUBDRAIN SYSTEM AND TREATMENT LAGOON
PALERMO WELLFIELD SUPERFUND SITE
TUMWATER, WASHINGTON

CERCLIS ID No. WAD0000026534

Prepared by
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Prepared for
U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101
Contract No. 68-W-98-228
Work Assignment No. 070-RA-RA-104L

URSG DCN 7000.65

December 26, 2000

PROJECT MANAGEMENT (Element A)
TITLE AND APPROVAL SHEET (Element A1)

QUALITY ASSURANCE PROJECT PLAN
SAMPLING AND ANALYSIS FOR
OPERATION AND MAINTENANCE
SUBDRAIN SYSTEM AND TREATMENT LAGOON
PALERMO WELLFIELD SUPERFUND SITE
TUMWATER, WASHINGTON

Work Assignment No. 070-RA-RA-104L
URSG DCN 2200.71

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Contract No. 68-W-98-228
Revision: 0
Date: December 2000

Submitted to Work Assignment Manager:
Robert Kievit
Office of Environmental Cleanup
U.S. Environmental Protection Agency
Region 10
Seattle, Washington

Approvals			
Name	**Title**	**Signature**	**Date**
Robert Kievit	EPA WAM		
Robert Melton	EPA QA Office		
Chris Hall	EPA RSCC		
Michael Meyer	URSG SM		
Lori Raschke	URSG RAC QAO		

TABLE OF CONTENTS (Element A2)

TABLES

A3 - DISTRIBUTION LIST

Data Distribution					
		Validated Data		Preliminary Data	
Name	Title	Hard Copy	Electronic	Hard Copy	Electronic
Robert Kievit	EPA WAM	X			
Robert Melton telephone 553-2147	EPA QAO	X		X fax 553-8210	
Michael Meyer telephone 674-1804	URSG SM	X	X	X fax 674-1801	

Anyone who receives preliminary data must include telephone and fax numbers in the table.

Notes:
EPA - U.S. Environmental Protection Agency
QA - Quality Assurance
SM - Site Manager
URSG - URS Greiner, Inc.
WAM - Work Assignment Manager

INTRODUCTION

This document constitutes the quality assurance project plan (QAPP) for sampling and analysis during operation and maintenance (O&M) of the subdrain system and treatment lagoon at the Palermo Wellfield Superfund Site in Tumwater, Washington (see Section A5). The U.S. Environmental Protection Agency (EPA) performed the investigations of contamination at the site and installed the selected remedy. The selected remedy was documented in the Record of Decision (ROD), dated October 1999 (USEPA 1999a). This QAPP was prepared by URS Greiner, Inc. (URSG) under EPA Response Action Contract (RAC) No. 68-W-98-228, as defined by Work Assignment No. 070-RA-RA-104L. This QAPP has been prepared in accordance with EPA QA/R-5 (USEPA 1999b) requirements and EPA Region 10 expanded guidance (USEPA 1998).

This QAPP has been prepared to describe quality assurance procedures to be used for sample collection and analysis activities to be conducted during the performance validation period (first year) of O&M. After the performance validation period, this QAPP will be revised based on procedures to be used after O&M responsibilities are transferred from EPA to the Washington State Department of Ecology. Sample collection and analysis to be conducted under this QAPP generally consist of periodic surface water and indoor air sampling from the area of the Palermo neighborhood (see Section A5). The entire scope of O&M activities to be conducted during the performance validation period is described in detail in the Draft Final Operation and Maintenance Plan (O&M Plan), to which this QAPP is appendicized.

Concurrent, related activities will be ongoing at the site during performance of O&M activities. These concurrent activities are discussed in detail under separate cover and are summarized in Section A5.4 herein.

This QAPP, the O&M Plan, the site-specific health and safety plan, and the referenced standard operating procedures (SOPs) constitute the project plans for operation and maintenance of the subdrain system and treatment lagoon at the Palermo Wellfield Superfund Site.

A4 PROJECT/TASK ORGANIZATION

A4.1 Purpose of Section

The purpose of Section A4 is to provide EPA and other involved parties with a clear understanding of the role that each party plays in sampling and analysis during O&M and to provide the lines of authority and reporting for the project.

A4.2 Roles and Responsibilities

This section summarizes the past and future roles of public agencies and the current EPA contractor at the site. Project contacts are listed in Table A-1.

Table A-1
Project Contacts

Key Role	Name	Telephone
U.S. Environmental Protection Agency		
EPA Contracting Officer	Lowell Toole	(913) 551-7639
EPA Project Officer	Maureen Bagocius	(206) 553-8209
EPA Work Assignment Manager	Bob Kievit	(360) 753-9014
EPA Quality Assurance Officer	Robert Melton	(206) 553-2147
EPA Regional Sample Control Coordinator	Chris Hall	(206) 553-0521
EPA Data Validation Manager	Gerald Dodo	(360) 871-8728
RAC Contractor for EPA		
URSG RAC Region 10 Program Manager	Vivianne Knight	(206) 674-1871
URSG Site Manager (Remedial Action)	Michael Meyer	(206) 674-1978
URSG Site Manager (Site Assessment)	Bill Rohrer	(206) 674-1904
URSG Quality Assurance Officer	Lori Raschke	(206) 674-1800
URSG Health and Safety Manager	Mary Lou Sullivan	(206) 674-1920
City of Tumwater		
City of Tumwater Public Works Operations Director	Dave Barclift	(360) 754-4151
City of Tumwater Parks and Recreation Director	Chuck Denny	(360) 754-4160
City of Tumwater Environmental Program Manager	Kathy Callison	(360) 754-4140
Ecology		
Ecology Project Manager	Martha Maggi	(360) 407-6248

Notes:
RAC - Response Action Contract
URSG - URS Greiner, Inc.

A4.2.1 Environmental Protection Agency

EPA was the lead agency during the investigations performed at the site and continued as lead agency through remedy installation and performance validation. Following 1 year of successful performance validation of the last remedy component (the subdrain system and treatment lagoon), EPA will transfer the lead agency role for remedy operation and maintenance to the Washington State Department of Ecology (Ecology). EPA will remain involved with the site, performing ongoing long-term monitoring until the site is delisted from the National Priorities List (NPL). As the RAC contractor for EPA in Region 10, URSG will perform the sampling and analysis activities described in this plan, at the direction of EPA. Laboratory analytical work will be performed by an EPA laboratory, and a commercial laboratory selected by URSG through the competitive bidding process.

Lines of Authority and Communication Between EPA and RAC

Contract issues (scope of work amendments and subcontracting issues) will be coordinated or otherwise negotiated between the EPA Contracting Officer (CO) and the URSG Program Manager (PM) and/or the URSG Site Manager (SM). Technical direction will be provided by the EPA Work Assignment Manager (WAM) to the URSG SM. Recommendations, feedback, or other site-specific observations will be presented to the EPA WAM via the URSG SM. Field observations, procedural variations, and other reportable activities will be conferred from the field to the EPA WAM via the URSG SM. The URSG SM will maintain communication with the URSG Quality Assurance (QA) Manager. The URSG SM will also coordinate QA of all technical deliverables, including calculations, data evaluation, and interpretation. The URSG Quality Assurance Officer (QAO) will review QA documentation and provide QA support as needed.

The URSG SM will request project code, account code, and sample numbers from the Regional Sample Control Coordinator (RSCC) prior to initiation of field work. URSG will also request direction as to the analytical laboratory selected by EPA and shipping information. For resolution of problems regarding sample receipt and sample analysis, the initial point of contact for the RSCC is the EPA WAM.

For air samples being analyzed by a commercial laboratory contracted by URSG, the URSG Analytical Services Coordinator (ASC) will prepare the bid package, evaluate bids, select the laboratory, and coordinate analysis and third-party data validation.

Description of Responsibilities for EPA Team Members

The EPA WAM is responsible for coordinating all project-related activities on behalf of EPA. A major component of this position involves directing the URSG SM in the execution of the work and the submission of deliverables as scheduled. Specific responsibilities of the EPA WAM are as follows:

- Provide oversight of all project activities.
- Initiate the data quality objective (DQO) process, providing DQO framework to the URSG SM.
- Review and approve this QAPP and any future modifications.
- Ensure that this QAPP and future modifications are transmitted to the EPA QAO.
- Transmit comments on QA from the EPA to the URSG SM regarding QA plans and laboratory performance.
- Ensure that the URSG SM addresses EPA review comments and takes appropriate action.
- Initiate conductance of field and laboratory audits and management system reviews.

The EPA QAO or designee is responsible for ensuring that the project has an appropriate QA program. The specific responsibility of this position is to support the EPA WAM on QA issues.

The EPA RSCC is responsible for coordinating and scheduling analytical work to be performed by the EPA Manchester Laboratory or Contract Laboratory Program (CLP) laboratories.

Description of Responsibilities for URSG Team Members

The URSG SM reports to and obtains technical direction and assistance from the EPA WAM and is responsible for monitoring and documenting the quality of all work produced by the project team, which includes the field staff and subcontractors. The fundamental goal of this position is to produce a quality work product within the allotted schedule and budget. Duties include executing all phases of the project and efficiently applying the full resources of the project team in accordance with the project plans. Specific responsibilities of the URSG SM are as follows:

- With the assistance of the EPA WAM, determine DQOs.

- Prepare and implement this QAPP and prepare deliverables.
- Ensure that the QAPP and SOPs are available and in use for activities that affect product quality and that assigned staff have been trained in their implementation.
- Inspect and accept supplies and consumables.
- Ensure that appropriate sampling, testing, and analysis procedures are followed and that correct lab quality control (QC) checks are implemented.
- Monitor sample preservation, handling, transport, and custody throughout the project.
- Coordinate the appropriate disposition of investigation-derived waste.
- Ensure that the proper number and type of environmental and control samples are collected, identified, tracked, and sent to the laboratory for analysis.
- Coordinate and schedule sample shipment to analytical laboratories to meet holding times and analytical procedures specifications.
- Monitor team and pool subcontractors for compliance with both project and data quality requirements records, costs, and progress of the work; and replan and reschedule work tasks as appropriate.
- Review and approve calculations to ensure that data reduction is performed in a manner that produces quality products.
- Verify data quality, test results, equipment calibrations, and QC documentation; and maintain and regularly review all QC records.
- Ensure that all key decisions and project deliverables are subjected to independent technical review by qualified personnel within the timeframe of the project schedule.
- Prepare and send notice of sampling to the RSCC for any laboratory arrangements with the EPA Manchester laboratory or the CLP laboratory.
- Relay project information, such as case numbers, sample numbers, etc., to the assigned field staff.

- Coordinate data collection activities to be consistent with information requirements.
- Ensure that data are correctly reported.
- Oversee evaluation of data received from the laboratory in accordance with the project requirements.
- Report any QA problems to the URSG QAO.
- Coordinate the assessment of data based upon criteria established in DQOs.
- Supervise the compilation of field data and laboratory analytical results.
- Prepare or oversee the preparation of portions of the final report that summarize data results and present conclusions.

The URSG QAO oversees QA activities and reviews QA documentation to ensure that complete peer reviews are performed for all technical deliverables, calculations, data evaluation, and interpretation. Additional QAO responsibilities include the following:

- Serve as the official contact with EPA WAM for all QA matters.
- Respond to QA needs, resolve problems, and answer requests for guidance or assistance.
- Provide guidance to the SM in the development of project plans, including the QAPP.
- Review and approve the project plans.
- Together with the SM, assign competent, qualified Independent Reviewers to review the technical adequacy of deliverables.
- Track the progress and completion of the review and approval process.
- Ensure that EPA protocols and procedures, as well as SOPs, are being followed.
- Review the implementation of sampling plans and the adequacy of the data or products generated based on quality objectives.

- Initiate conductance of field and laboratory audits and management system reviews.

- Authorize, coordinate, and conduct internal and subcontractor audits of selected projects for adherence to the project plans.

- Submit notice of any laboratory and field systems audits prior to their occurrence and in a timely manner to the EPA QAO who has the option to attend.

- Review audit and nonconformance reports to determine areas of poor quality or failure to adhere to established procedures.

- Confer with the audited entity on the steps to be taken for corrective actions and track nonconformance until it has been corrected; evaluate the adequacy and completeness of the action taken; confer with the SM to resolve an inadequate corrective action; and confirm the adequacy and the implementation of the response action.

- Suspend or stop work with the concurrence of the URS Program Manager and the EPA upon detection and identification of an immediate adverse condition affecting the quality of results.

- Provide training on QA policies, procedures, and methodology.

The ASC reports functionally to the SM but receives technical and QA/QC direction from the URSG QAO. The ASC position is filled by one of the URSG staff chemists. Backup service for the ASC is provided by other staff chemists.

The ASC is responsible for managing any project task requiring the specialized chemical expertise and the assessment and reporting of related analytical data. Specific responsibilities are as follows:

- Provide technical direction to the SM and technical staff in the specific area of expertise.

- Qualify and procure laboratories for analysis of samples for projects not handled by the RSCC.

- Relay project information such as case numbers, sample numbers, etc., to the SM.

- Coordinate data collection activities to be consistent with information requirements.

- Resolve problems with sample receipt and or analysis.

- Oversee evaluation of data received from the laboratory in accordance with the project requirements, including procurement of third-party data validation.

- Coordinate the assessment of data based upon criteria established in DQOs.

- Supervise the compilation of field data and laboratory analytical results.

- Assure that data are correctly reported.

- Prepare or oversee the preparation of portions of the final report that summarize data results and present conclusions.

Under the direction of the URSG SM, the field staff are responsible for the planning, coordinating, performing, and reporting of specific technical tasks. Responsibilities of the field staff are as follows:

- Implement the project plans under direction of the SM.
- Prepare and maintain field forms, logbooks, and equipment.
- Implement technical procedures applicable to tasks.
- Report to SM any problems or deviations from project plans.

A4.2.2 Washington State Department of Ecology

Ecology reviewed and concurred with the actions taken by EPA on the site during the investigation and remedial action phases. Based on field inspections, reviews of project documents, and review of performance validation results, Ecology anticipates accepting the remedy components for the subdrain system and aeration lagoon constructed by EPA. Following acceptance, Ecology will be the lead agency for operation and maintenance of these remedy components. In some cases, Ecology will transfer operation, maintenance, and sampling activities to the City of Tumwater (as is currently the case for the air stripping system at the Palermo Wellfield). Specific responsibilities for Ecology have not been determined.

A4.2.3 City of Tumwater

The City reviewed and concurred with the actions taken by EPA on the site during the investigation and remedial action phases. The City accepted the air stripping system at the Palermo Wellfield and now has primary responsibility for operation, maintenance, and sampling of the system. The City may take over operation and maintenance of other remedy components, such as the subdrain system and treatment lagoon, based on discussions with Ecology. Specific responsibilities for the City have not been determined.

A5 PROBLEM DEFINITION/BACKGROUND

A5.1 Purpose of Section

The purpose of this section is to state the problem to be solved, decision(s) to be made, and outcome to be achieved. This section also provides historical, scientific, regulatory, and legal background for the project and describes other activities that are occurring or have occurred at the site.

A5.2 Problem Statement and Background

A5.2.1 Problem Statement

Sampling and analysis during operation and maintenance are necessary for these reasons:

- To demonstrate the effectiveness of the subdrain system and treatment lagoon as part of the overall remedy for the site, including meeting applicable or relevant and appropriate requirements (ARARs) for indoor air quality

- To demonstrate ongoing compliance with ARARs for discharge of treated water from the treatment process

A5.2.2 Background

The Palermo Wellfield Superfund Site lies within the city limits of Tumwater in the Puget Sound basin of western Washington (Figure 1-1 of the O&M Plan). The site includes the Palermo Wellfield and Palermo neighborhood located within the Deschutes River Valley, and the adjacent uplands area to the west. The uplands area is approximately 60 feet higher in elevation than the river valley. The Deschutes River Valley trends north-south with river flow to the north-northwest toward Puget Sound.

The Palermo Wellfield Superfund Site consists of mixed commercial and residential development within the city limits of Tumwater. Detailed descriptions of the physical characteristics, contaminant sources, contaminant concentrations, contaminant distribution, and cleanup alternatives evaluated for the Palermo Wellfield Superfund Site as a whole are included in the remedial investigation (RI) (USEPA 1999c) and feasibility study (FS) (USEPA 1999d) reports for the site. The RI found that the primary site contaminants were tetrachloroethene (PCE) and trichloroethene (TCE). The sources for these contaminants are several facilities located in the uplands area, including the Southgate Dry Cleaners, the Washington State Department of Transportation (WDOT) Materials Testing Laboratory, and the area of the Chevron retail gasoline station (Figure 1-1 of the O&M Plan). PCE and TCE were found to have migrated in the direction of groundwater flow from the upland area to the Palermo Wellfield, where they impacted the municipal water supply. In spring 1999, EPA began operation of an air-stripping treatment system at the Palermo Wellfield to remove PCE and TCE contamination from the water supply. It was concluded in the FS that this air-stripping system would eventually remediate the contaminated groundwater at the site.

In addition to the presence of PCE and TCE at the Palermo Wellfield, shallow groundwater containing PCE and TCE was found to surface at the base of the Palermo bluff and pond as surface water in the yards and crawlspaces of some of the homes in the Palermo neighborhood. The most substantial ponding was documented at the western side of the neighborhood, closest to the bluff. Some of this surface water drained through a drainage ditch immediately west of the neighborhood, to the M Street storm drain, and then to a second drainage ditch located at the golf course immediately east of the neighborhood (Figure 1-2 of the O&M Plan). This second ditch eventually discharged to the Deschutes River.

A5.3 Selected Remedy

The selected remedy for the site is described in the ROD (U.S. EPA 1999a) and summarized in Section 2.2 of the O&M Plan. This QAPP is focused on sampling and analysis during O&M of the subdrain system and treatment lagoon at the site. This component of the remedy consists of installation of a subdrain system west of the residences on Rainier Avenue to collect groundwater containing PCE and TCE that is surfacing at the base of the Palermo bluff. The purpose of the subdrain system is to lower the groundwater table so that water containing volatile contaminants will not collect in the crawlspaces below the residences along Rainier Avenue. Ponded water in the crawlspaces poses a risk to human health (based on theoretical calculations), because PCE and TCE volatilize from the water into the homes. The collected water is transported to the City of Tumwater Municipal Golf Course through a newly constructed pipe and treated in a constructed lagoon using aeration. The treated water is discharged to the Deschutes River via an existing ditch. The subdrain system may be supplemented by the installation of ventilation systems for the crawlspaces if future analysis determines such systems are necessary. The system is described in detail in Section 3 of the O&M Plan.

In summary, the system includes a subgrade perforated piping network (subdrain system) installed around the southernmost seven houses located along the western side of Rainier Avenue (hereafter referred to as the "residences" or the "residential properties"). The subdrain system consists of "finger drains" between houses connected to a "trunk drain" aligned through the backyards of the residences. The subdrain system is constructed of buried perforated piping wrapped in a filter fabric, with the piping trench backfilled with filter sand.

Water collected by the subdrain system is routed to unperforated "tightline" piping aligned beneath Rainier Avenue and M Street. The tightline piping conveys the collected water to the eastern terminus of M Street and into an aeration lagoon at the golf course (Figure 1-2 of the O&M Plan). The aerators in the lagoon remove PCE and TCE from the water and transfer the contaminants into the air where they disperse and break down into less harmful compounds.

A5.4 Concurrent Related Monitoring

The monitoring described in this QAPP will be conducted concurrently with other monitoring at the Palermo Wellfield Superfund Site performed for related purposes. The concurrent monitoring activities that are related to the monitoring described in this plan are the following:

- Monitoring of air stripper performance at the Palermo Wellfield: This monitoring activity is performed by the City under City guidelines.

- Monitoring and upkeep of the restoration plantings installed following construction of the subdrain system and treatment lagoon described in Section 2.2 of the O&M Plan: This monitoring and upkeep is performed by the City under City guidelines.

- Long-term monitoring of the Palermo Wellfield Superfund Site as a whole: Long-term monitoring will be conducted by EPA in accordance with the QAPP for long-term monitoring (USEPA 2000).

A6 PROJECT/TASK DESCRIPTION AND SCHEDULE

A6.1 Purpose of Section

The purpose of Section A6 is to provide a summary-level understanding of sampling and analysis to be conducted during O&M at the site, including the types of activities to be conducted, the samples that will be taken, and the associated QA/QC goals, procedures, and timetables for collecting the samples.

A6.2 Description of Work to Be Performed

Sampling and analysis to be performed during O&M to demonstrate the effectiveness of the subdrain system and treatment lagoon will include the following:

- Collection of periodic water samples from within the subdrain and lagoon system and from surface water inputs to the lagoon

- Collection of two sets of air samples from within crawlspaces and living spaces of certain residences within the Palermo neighborhood

Sampling and analysis to be performed during O&M to demonstrate ongoing compliance with ARARs for discharge of treated water from the treatment process will consist of periodic water samples collected from the surface water channel immediately downstream of the treatment lagoon.

Sampling is expected to be conducted according to the schedule presented in Table A-2.

The numerical RG values for comparison to ongoing monitoring data of treated water from the aerated lagoon are 0.8 and 2.7 μg/L for PCE and TCE, respectively. The numerical values for comparison to air sample data are 1.46 $\mu g/m^3$ for TCE and 4.38 $\mu g/m^3$ for PCE.

The project records that will be required will include the following:

- Field operations records
- Laboratory records
- Data reporting packages
- Quarterly monitoring reports

The QA assessment tools that will be used will include the following:

- Field duplicates
- Field rinsate blanks
- Ambient air samples
- Trip blanks
- Matrix spikes
- Matrix spike duplicates

Table A-2
Estimated Sampling Schedule

Water Sampling Date Range	Air Sampling Date Range
January 8-12, 2001	--
February 5-9, 2001	--
March 5-9, 2001	March 4-8, 2001
April 2-6, 2001	--
May 7-11, 2001	--
June 4-8, 2001	--
July 2-6, 2001	--
August 6-10, 2001	August 6-10, 2001
September 3-10, 2001	--
October 1-5, 2001	--
November 5-9, 2001	--
December 3-7, 2001	--

Notes:
-- No sampling
Laboratory analytes for water include tetrachloroethene (PCE) and trichloroethene (TCE) using EPA Method 8260B. Laboratory analytes for air include PCE and TCE using method TO14A. The requested data turnaround time will be 30 days. The requested validation turnaround time will be 30 days. Samples will be delivered to the laboratory overnight by FedEx or will be hand-delivered by field staff.

A6.3 Project Constraints

Performance of the O&M scope of work is constrained by climatic factors, site conditions, and scheduling logistics that could affect the sampling schedule or methods. Possible factors that could influence performance of the O&M scope of work include the following:

- Severe weather conditions that impair or preclude field work
- Lack of water at certain surface water sampling stations during seasonally dry periods.
- Lack of access to homes for air sampling, or presence in the home of contaminant sources that could bias air sampling
- Changes to site conditions, such as paving over or removing piezometers without the consent of the project team
- Scheduled sampling dates that conflict with work by other parties, such as paving by the City of Tumwater
- Scheduled sampling dates that are unacceptable to involved parties, such as Ecology, such that their participation or oversight would be precluded

A6.4 Investigation-Derived Waste

Disposable sampling equipment will be used as much as possible to minimize investigation-derived waste (IDW). IDW expected to be generated during operation, maintenance, monitoring, and sampling of the subdrain system and treatment lagoon is expected to consist entirely of decontamination water. Approximately 20 gallons of decontamination water is expected to be generated during each sampling and depth-to-groundwater measurement event.

A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

It is the goal of the EPA and the regulated community to collect data of sufficient quantity and quality to support defensible decisionmaking. At the same time, it is necessary to minimize expenditures related to data collection by eliminating unnecessary, duplicative, or overly precise data. The most efficient way to accomplish both of these goals is to begin each project by defining project data quality objectives and measurement performance criteria.

The EPA supports the implementation of the DQO process to ascertain the type, quality, and quantity of data necessary to address project-specific problems (USEPA 1994c). It is the responsibility of the SM, in conjunction with the QAO, to implement the DQO process as part of the project planning activities. Sampling and analysis for O&M of the subdrain system and treatment lagoon relies on a limited application of the DQO process. The QA requirements, identified as a result of the DQO process, will be used at the following three stages in the project:

- Project inception—to present the plans for project execution from a QA viewpoint, including the type and quality of environmental data to be collected

- During the project—to act as a guide for QA implementation, review, and audits and as the specifications for assessing the quality of data generated

- Project completion—to serve as a basis for determining whether the project has attained established goals

A7.1 Data Categories

Descriptive data categories (screening, definitive data, and screening data with definitive confirmation) have been developed for the Superfund program. According to the EPA's *Guidance for the Data Quality Objectives Process* (USEPA 1994c), these categories are associated with specific QA and QC elements and may be generated using a wide range of analytical methods. The goal is to ensure that all data produced by field activities are of known quality and can thus be used for more general purposes than originally intended.

Definitive data will be generated for the sample analyses conducted during the O&M activities. Definitive data are generated using rigorous analytical methods, such as approved EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Table A-3 summarizes the QC criteria for definitive data.

A7.2 Data Assessment Parameters

This section presents five data assessment parameters that have been identified by the EPA. Table B-4 in Section B4 presents quantitative quality criteria/indicators for three of the five project data assessment parameters (precision, accuracy, and completeness). Table B-4 also presents the analytical reporting limits required to meet the project goals.

At project completion, data are reconciled with stated objectives by calculation of precision (analytical and/or total measurement error determination), accuracy, and completeness, as well as statements on representativeness and comparability.

The five data assessment parameters are described in the following paragraphs.

Precision is a measure of mutual agreement among replicate (or between duplicate) or collocated sample measurements of the same analyte. The closer the numerical values of the measurements are to each other, the more precise the measurement. Precision is determined through calculation of analytical and/or total measurement error.

Table A-3
Superfund Data Categories

Quality Assurance/ Quality Control Levels[a]	Definitive Data
Data uses	Data useful for enforcement, litigation, risk assessment, and most other uses
Typical uses	• Enforcement • Litigation • Risk assessment
Quality assurance type	Data of *known* quality
Quality assurance elements	• Definitive identification • Definitive quantification • Error determination
Validation	Validation of 10 percent of the results in each of the samples, calibrations, and quality control analyses
Quality control elements	• Instrument quality control • Field quality control • Analyst training • Quality control within method parameters • Document detection limits
Sampling plan/QAPP	Mandatory
Typical volatile analyses	• EPA Method 8260B; EPA TO14A; data report; replicates; blanks and spikes

[a]Error determination: screening data with 10 percent definitive confirmation requires measurement of analytical error (screening sample replicates) unless total measurement error (collocated samples) is determined during the confirmation analyses. Error determination is optional for QA2. The project-specific project plans may state that error determination is not necessary if it can be qualitatively shown that the data quality objectives do not require it; e.g., concentrations in the percent range are expected to be found, yet the action level is in the parts per billion (ppb) range.

Analytical error (required for screening with 10 percent definitive confirmation data, unless total measurement error is determined during confirmation analyses) is determined by taking an appropriate number of replicate aliquots from one thoroughly homogenized screening sample. The replicate samples are analyzed and standard laboratory QC parameters (such as variance, mean, and coefficient of variation) are calculated and compared to method-specific performance criteria. Total measurement error (required for definitive confirmation data, if analytical error is not determined) is calculated using an appropriate number of collocated samples for each matrix under investigation, independently collected from the same location and analyzed. Standard laboratory QC parameters, such as variance, mean, and coefficient of variation, are calculated and compared to established measurement error goals. For data to be definitive, either analytical or total measurement error must be determined.

Accuracy is a measure of bias in a measurement system. The closer the value of the measurement agrees with the true value, the more accurate the measurement. Accuracy is expressed as the percent recovery of the surrogate or spike analyte from a sample or standard. Accuracy is dependent on traceability of instrumentation, standards, samples, and data; methodology; blanks; surrogates; reference or spiked samples; performance samples; and equipment calibration.

Completeness is a measure of the number of valid measurements obtained in relation to the total number of measurements planned. The closer the numbers are, the more complete the measurement process. Completeness is expressed as the percentage of valid-to-planned measurements. A sufficient volume of sample material is collected to complete the required analyses, so that samples represent all possible contaminant situations under investigation, as well as background and control areas. Completeness is influenced by environmental conditions, potential for change with respect to time and location, equipment maintenance, data records, sampling location, sample volume, QC samples, and sample representativeness. In general, a completeness greater than 85 percent will fulfill the data quality objectives.

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. The comparability goal is achieved through the use of SOPs to collect and analyze representative samples, by reporting analytical results in appropriate and consistent units and reporting limits. The goal is also achieved by maintaining consistency in sampling conditions, selection of sampling procedures, sample preservation methods, and analytical methods.

Representativeness is a qualitative parameter that expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. The design of and rationale for the sampling program (in terms of the purpose for sampling: selection of sampling locations, the number of samples to be collected, the ambient conditions for sample collection, the frequencies and timing for sampling, and the sampling techniques) ensures that environmental conditions have been sufficiently represented. Representativeness is evaluated, in part, by examining the chain-of-custody paperwork and verifying that the sample analyses were performed within holding time.

A8 TRAINING REQUIREMENTS

The field effort will be performed by individuals who have successfully completed the required Occupational Safety and Health Administration (OSHA) 40-hour hazardous waste operations health and safety training program. Additionally, these individuals will have completed an annual 8-hour refresher training within the previous year. The field crew will be experienced with the use of the specific monitoring and sampling equipment used to complete the sampling event (e.g., summa canisters). The field crew will follow SOPs, instructions from the laboratory, and this QAPP when performing field activities.

In the event of generation of IDW that must be disposed of off site, disposal will be performed in compliance with Subtitles C and D (as applicable) of the Resource Conservation and Recovery Act (RCRA) and U.S. Department of Transportation (DOT) regulations (49 CFR 173). Shipments of IDW will comply with DOT regulations and be coordinated by a field person who has completed the appropriate DOT training.

A9 DOCUMENTATION

Section A9 describes the documentation that will be prepared for sampling and analysis during O&M. Defined in this section are the records critical to the project, the information to be included in reports, the data reporting format, and the document control procedures to be used. Documentation types include the following:

- SOPs (by reference in this QAPP)
- Field operations records
- Data reporting packages including laboratory records
- Data validation reports
- Quarterly monitoring reports

The following URSG field operation SOPs are attached by reference:

1. General Field Operations
3. Field Logbook Use and Maintenance

4. Sample Collection Information and Recording
5. Monitoring/Sampling Location Recording
6. Sample Control, Documentation and Tracking
7. Equipment Calibration, Operation and Maintenance
8. Water Quality Monitoring Equipment
9. Field Parameter Measurement
27. Water Level Measurement
35. Surface Water Sampling
36. Streamflow Measurement
39. Sample Containers and Preservation
40. Sample Handling, Labeling, Packaging and Shipping
41. Equipment Decontamination
42. Field and Laboratory Quality Control Sample Collection
43. Investigative-Derived Waste Containerization
44. Container Drum Sampling

A9.1 Field Operations Records

Field sampling operations important to QA include documentation of field activities and documentation of sample information (i.e., sample location). All field activities will be documented in the field notebook by the field team leader. The field notebook will be weatherproof, bound, and paginated. Each page of the field notebook will be dated and signed by the field team leader or designee. This documentation will include the following:

- Personnel present during field operations
- Procedures used for sampling (including any deviations from this plan and reasons for deviations)
- Date and time of sample collection
- Description of sample locations, including sample identification
- Number and types of sample containers filled at each sample location and analyses requested
- Conditions or other observations during sampling (e.g., weather), especially conditions that could affect analytical results

Each sample will be assigned a unique sample identification number. For samples to be analyzed by an EPA laboratory, the sample numbers will be assigned in advance of the field effort by the Regional Sample Control Coordinator (RSCC). For commercial laboratories, the ASC will assign unique URSG sample numbers in advance of the field effort. The sample numbers will be used to prepare sample labels and chain-of-custody forms for each container to be used. The sample label will contain the following information:

- Sample identification number (entered in advance)
- Date and time of sample collection (entered in field)
- Sample location (entered in field)
- Sample type (e.g., grab or composite) and sample matrix (entered in advance)
- Required analysis and preservatives (entered in advance)
- Name of sampler (entered in field)

Labels will be attached to each container before entering the field. Field information will be entered on the labels using waterproof ink. After the label is completed, it will be covered with waterproof, transparent tape.

All original data recorded in the field notebook, chain-of-custody records, and other forms are written with permanent, waterproof ink; data will not be erased. If an error is made on a document, the individual making the entry will correct the document by crossing a single line through the error, entering the correct information, and dating and initialing the correction. Any subsequent error discovered on a document will be corrected in the same manner (i.e., crossed through, initialed, and dated).

A9.2 Data Reporting Package Format and Documentation Control

Laboratory data will be presented in a CLP-equivalent format that includes sample identification, analysis date, parameter values, and detection limits. The data report will contain tabulated results of QC sample analyses, all raw data, all instrument printouts, prep logs, and a project summary narrative that includes deviations from requested analytical methods, problems with analysis, and corrective actions. Laboratory data will be reported electronically and in hard copy. URSG will assign a document control number (DCN) to each data package when it is received, and will archive the data package in the project file.

A9.3 Data Reporting Package Archiving and Retrieval

The laboratory data reports will be archived in URSG's project file. The electronic data will be incorporated into and archived in the URSG's technical data management (TDM) system. The laboratory data can then be sorted electronically, with customized data reports generated as needed to achieve the goals of project deliverables.

A9.4 Quarterly Monitoring Reports

The results of operation, maintenance, monitoring, and sampling of the subdrain system and treatment lagoon will be documented in quarterly reports during the first year and in yearly reports thereafter. The content of these reports is discussed in detail in Section 6 of the O&M Plan.

B MEASUREMENT/DATA ACQUISITION

B1 SAMPLING PROCESS DESIGN (EXPERIMENTAL DESIGN)

B1.1 Purpose of Section

The purpose of Section B1 is to describe the rationale for the sampling design and a description of the specific sampling requirements.

B1.2 Sampling Activities

A summary of the sampling locations and rationales is included in Table B-1. The expected project sample identifications, locations, types, and matrices are summarized in Table B-2. Sampling locations are shown on Figure 5-4 of the O&M Plan.

B1.3 Rationale for the Design

Sampling of water inflows and outflows from the treatment lagoon is necessary to allow evaluation of the effectiveness of the treatment process. Sampling of the water outflow from the lagoon is also necessary to document compliance with ARARs for discharge to ambient surface water downstream. Sampling of water within the subdrain system is necessary to evaluate the effectiveness of the drain at collecting contaminated water and to evaluate changes in contaminant concentrations within the conveyance piping from the drain to the lagoon.

Three water sampling stations have been selected at cleanouts within the drain piping at approximately equally spaced points along the trunk drain alignment. Water sampling stations at the lagoon have been selected at all accessible inflows to the lagoon and at the lagoon outfall.

The contaminants of concern for this project are PCE and TCE. The selected minimum analyte list for water samples therefore consists of only PCE and TCE. However the laboratory will be requested to report results for their standard low-level analyte list for Method 8260B. The numerical values for analytes other than PCE and TCE will be used qualitatively by the project team to consider chemical and biologic breakdown of PCE and TCE within the treatment train.

Air sampling within residences is necessary to demonstrate compliance with indoor air quality remediation goals (RGs) established in the ROD and to provide peace of mind to homeowners within the Palermo neighborhood. Sampling locations within the living space and within the crawlspace are necessary to help differentiate between contaminants volatilizing from shallow groundwater and other household sources of those same contaminants.

Table B-1
Sampling Locations and Rationale

Matrix	Location Description	Location ID	Rationale
Water	Subdrain system	357	Demonstrate the effectiveness of the subdrain system and treatment lagoon
		358	
		359	
	Tightline outfall	360	
	M Street storm drain outfall	350	
	M Street terminus catch basin outfall	362	
	Watercourse upstream of lagoon	356	
	Treatment lagoon effluent	361	Evaluate ongoing compliance with applicable or relevant and appropriate requirements for discharge from treatment lagoon
Air	Residential indoor air at selected residences	800-899[a]	Assess system effectiveness with regard to meeting applicable or relevant and appropriate requirements for indoor air quality

[a] Air sampling stations cannot be assigned until the Palermo neighborhood residents have been given the opportunity to request sampling at their home. Location IDs from the numerical range shown will be assigned by the Site Manager prior to field work, based on the number and location of residences to be sampled (15 locations assumed).

Residences to be sampled specifically for compliance with RGs are those seven residences for which drains were installed as part of the remedy (those residences found to have an unacceptable risk from potentially contaminated indoor air). Other residences within the neighborhood are to be sampled at the request of the residents to provide peace of mind. Two air sampling events are planned to help evaluate seasonal effects on analytical results.

An ambient air sample will be collected during each sampling event to help distinguish between contaminants present in ambient air from sources other than shallow groundwater beneath residences. Because numerous household sources of VOCs could be present during sampling, the analysis of air samples will be limited to the contaminants of concern, PCE and TCE. To minimize the bias of samples collected within residences, the homeowners will be provided with written instructions regarding household products and activities that should be avoided during sampling.

Table B-2
Sample Design Checklist

Sample Location ID	Sample Type	Field Parameters			Analyses			Quality Control Samples			
		Temp	pH	Cond	VOCs[a]	PCE Only	TCE Only	Dup	Spike	Ambient	Blank
350	Water				X						
356	Water				X						
357	Water				X						
358	Water				X				X		
359	Water				X						
360	Water				X						
361	Water				X						
362	Water				X						
800-899	Air					X	X				
901	Water trip blank										X
357	Water field duplicate							X			
902	Water rinsate blank										X
903	Air ambient (outdoor) sample									X	
904	Air trip blank										X
800, 807	Air field duplicate							X			

[a] The minimum analyte list for water is PCE and TCE, reported at the quantitation limits shown in Table B-4. However the laboratory will be requested to report results for their standard low-level analyte list for Method 8260B. The numerical values for analytes other than PCE and TCE will be used qualitatively by the project team to consider chemical and biologic breakdown of PCE and TCE within the treatment train.

Table B-2 (Continued)

Sample Design Checklist

Notes:
Cond - condition
Dup - duplicate
PCE - tetrachloroethene
TCE - trichloroethene
VOC - volatile organic compound

The data generated by the O&M program are critical, because they are required in order to achieve project objectives and will be used to identify or evaluate potential danger to human health or the environment.

B2 SAMPLING METHODS REQUIREMENTS

B2.1 Purpose of the Section

The purpose of Section B2 is to describe the procedures to be used during sampling.

B2.2 Water Sample Collection, Preparation, and Decontamination Procedures

Water samples will be collected from the sampling stations listed in Table 5-1 and shown on Figure 5-4 of the O&M Plan. These sampling stations are on either private residential property, or City property. Advance notice to private property owners and work within easement limitations must be performed in accordance with Section 3.4 of the O&M Plan. At some times of the year, there may be no water flow at some sampling stations. In such cases, "no flow" will be recorded in the field notes, and the EPA RSCC will be notified in a change in the number of samples being submitted.

Water samples will be collected either by using a polypropylene dipper or directly by hand from the flowing water stream. When a dipper is used to collect samples, the dipper will be decontaminated between sampling locations using an Alconox wash, tap water rinse, and a final rinse with deionized water. One rinsate sample of the decontaminated dipper will be collected during each sampling event.

The decontamination water will be temporarily contained on site in 55-gallon drums and discharged to the sanitary sewer system following characterization. Characterization will be performed by sampling the collected decontamination water and analyzing the sample according to EPA Method 8260B. Characterization and disposal of decontamination water will be conducted in conjunction with sampling of purge and decontamination water generated during long-term monitoring activities (see the long-term monitoring plan [USEPA 2000]). Characterization samples are therefore not included in this QAPP.

Any drums containing IDW will be labeled with the following information:

- Site name
- Sequential drum number
- Date of collection
- Source and type of waste

All such information will be recorded in field books. Drummed decontamination water will be stored within the fenced compound surrounding the lift station control building at the eastern end of M Street.

B2.3 Air Sample Collection

Sampling will be conducted over a 24-hour period, using evacuated "summa" canisters equipped with timed or "integrated" sampling devices. The exact type of summa canister and timed sampling device will be determined during the required competitive laboratory procurement process following EPA's authorization of URSG to perform the O&M activities. The selected laboratory will provide instructions for the calibration and use of the brand and model of timed sampling device provided. Field personnel will review these instructions in advance of sampling, and will have the opportunity to have any questions answered by the laboratory. For the purposes of this QAPP, a copy of an instruction booklet is provided as Appendix A. This booklet describes the procedures that will be used to collect samples using summa canisters, and the timed or "integrated" sampling devices. The equipment and procedures described in Appendix A may vary slightly, based on the actual laboratory selected. However, the techniques and equipment are quite standardized, and the procedures provided are considered to be very representative. Sampling will be conducted using a vacuum gauge and 24-hour metering orifice as described in Appendix A.

The field sampling team will visit each residence where sampling is to be conducted, make contact with the resident, and gain access to the house interior. One summa canister will be placed inside the crawlspace, as far from the crawlspace entrance as practical without requiring entry of the crawlspace by field personnel. The crawlspaces within the Palermo neighborhood are typically 18 inches from soil floor to the bottom of the floor joists, with a manway penetrating the concrete continuous-wall foundation that defines the perimeter of the crawlspace. The field crew will open the manway, reach into the crawlspace to place the summa canister on the soil floor, start the timed sampling device, and then close the manway.

A second summa canister will be placed on the floor within the home in a central location within the main living space. Sampling will be begun by setting the timed sampling device for 24 hours. Sampling will be started in the crawlspace and living space as close to the same time as practical.

When sampling at half of the residences selected for sampling has been begun, the outdoor ambient sample will be begun. This sample will be collected from an outdoor location central to the residences being sampled and protected from the weather. Two field duplicates will be collected from one residential sampling location, with an extra summa canister placed both in the crawlspace and the living space. After starting sampling at the last residence, the field team will leave the site.

When the 24-hour sampling period has ended, the field team will return to each residence in the same order as sampling was begun and terminate sampling in accordance with Appendix A. Sampling should be terminated before the summa canisters reach atmospheric pressure (while a vacuum remains in the canister), as evidenced by the vacuum gauge provided on the canister. If a summa canister is discovered to have reached atmospheric pressure during sampling, that sample will be rejected in the field and not analyzed.

Following sampling, the summa canisters will be shipped by FedEx to the commercial analytical laboratory.

B2.4 Support Facilities for Sampling Methods

Basic sampling supplies are maintained on the project site in a storage box at the City's sanitary sewer lift station control building located at the eastern terminus of M Street (Figure 5-4 of the O&M Plan). An inventory of supplies will be maintained by the URSG SM and additional supplies will be ordered as needed for each sampling event. Purge and decontamination water will be stored at this facility.

B2.5 Sampling/Measurement System Failure Response and Corrective Action Process

If any of the sampling or measurement procedures described in this QAPP fail, the team member identifying the failure will observe the following response and corrective action procedures:

- For EPA team members, notification will be made to the EPA WAM.
- For URSG team members, notification will be made to the URSG SM, who will then notify the WAM and the URSG QAO.
- For Ecology or City reviewers and team members, notification can be made to either the EPA WAM or the URSG SM.

- Notification will include a description of the failed procedure, the nature of the failure, and any recommendations for alternative procedures or procedure modifications that could prevent a recurrence of the failure.

- Corrective action will be selected by the EPA WAM and URSG SM prior to the next measurement or sampling event and will consist of modifications to the existing procedure or implementation of an alternative procedure.

The URSG SM may at times be required to adjust the field program and deviate from this QAPP to accommodate site-specific needs. Such deviations might include, for example, adding or deleting a sampling location, using less inert sampling devices, or collecting smaller sample volumes. When it becomes necessary to modify a program, the URSG SM will first seek the concurrence of the EPA WAM, and will document the approved changes. If the change is time-critical and the EPA WAM is not available, the URSG SM will make the necessary change, document the change made, and notify the EPA WAM as soon as practicable.

B3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Procedures to help ensure that quality objectives are met and can be documented will be followed for sample custody and documentation of sampling operations. Described below are field activities related to sample chain-of-custody (COC) procedures, documentation, and corrections to documentation.

Sample COC refers to the process of tracking the possession of a sample from the time it is collected in the field until laboratory analysis is completed. Following COC procedures is important to ensure that analytical results are valid. In order for a sample to be considered under a person's custody, one of the following requirements must be met:

- The sample must be in the physical possession of the person.

- The sample must be in view of the person after he or she has taken possession.

- The sample must be secured by the person in possession so that no one can tamper with it.

- The sample must be secured by the person in possession in an area that is restricted to authorized personnel.

Sample possession will be recorded on a COC form. The COC form also provides a record of the analyses requested for each sample. Each time possession of the sample or sample container is transferred between individuals, both the sender and receiver sign and date the COC form.

Containers that are certified clean by the container provider will be used for all sampling activities. Preservation methods and holding times for the samples to be collected are summarized in Section B4. Samples will be delivered or shipped to the laboratory in a timely manner to ensure that holding time limits are not exceeded.

Equipment decontamination procedures are described in Section B2. QA/QC sample quantities are summarized in Section B4 together with sample containment procedures and requirements.

EPA Region 10 chain-of-custody and VOC analysis request forms will be completed and included with each water sample delivery. Samples will be shipped in a custody-sealed cooler to the EPA Region 10 Manchester laboratory. Delivery will be overnight by FedEx unless the samples are hand delivered the day following sampling by URSG field staff. A trip blank consisting of high-purity, low-conductivity water will be prepared in a 40-milliliter (mL) amber glass vial with a Teflon-lined septum. The trip blank will be kept with the samples during handling and shipment. A laboratory-supplied temperature blank will also be kept with the samples during handling and shipment. The laboratory address is as follows:

EPA Region 10 Laboratory
7411 Beach Dr. E.
Port Orchard, Washington 98366
Attention: Rebecca Ochs
(360) 871-8723

For air samples, the URSG ASC will assign six-digit unique sample control numbers for each sample. URSG chain-of-custody forms will be completed and included with each air sample delivery. Samples will be shipped to the laboratory in their original containers at ambient temperature, overnight by FedEx. The laboratory address and contact person will be defined in the finalized laboratory contract, which will be provided to the URSG field staff.

B4 ANALYTICAL METHODS REQUIREMENTS

All water samples will be analyzed for PCE and TCE in accordance with EPA Method 8260B (Table B-3). Although the requested minimum analyte list is PCE and TCE (reported at the quantitation limits shown in Table B-4), the laboratory will be requested to report results for their standard low-level analyte list for Method 8260B. The numerical values for analytes other than

Table B-3
Yearly Analyses

Analyte and Method	Matrix	No. of Env. Samples[a]	Lab QC		Field QC				Preservation	Number and Container Type	Holding Time (From Collection)
			MS	MSD	Dup	TB	RB	PE			
Individual Water Sampling Event Totals (Monthly)											
PCE and TCE[b] SW8260B[c]	Water	8	1	1	1	1	1	0	pH<2 w/HCl, Cool to 4°C	2 x 40-mL, AGV, Teflon-lined septum	14 days
Yearly Water Sampling Totals											
PCE and TCE[b] SW8260B[c]	Water	96	12	12	12	12	12	0	pH<2 w/HCl, Cool to 4°C	2 x 40-mL, AGV, Teflon-lined septum	14 days
Individual Air Sampling Event Totals (Semi-annually)											
PCE and TCE TO-14A[d]	Air	30	0	0	2	2[e]	0	0	Ambient temperature	One summa canister	14 days
Yearly Air Sampling Totals											
PCE and TCE TO-14A[d]	Air	60	0	0	4	4[e]	0	0	Ambient temperature	One summa canister	14 days

[a]Estimated number of environmental (i.e., not collected for quality control) samples
[b]For water samples, the minimum analyte list is PCE and TCE, reported at the quantitation limits shown in Table B-4. However the laboratory will be requested to report results for their standard low-level analyte list for Method 8260B. The numerical values for analytes other than PCE and TCE will be used qualitatively by the project team to consider chemical and biologic breakdown of PCE and TCE within the treatment train.
[c]USEPA 1997
[d]USEPA 1988
[e]For air samples, an ambient air blank will be collected at the site, in addition to a trip blank

Notes:
AGV - amber glass vial
Dup - field duplicate
HCl - hydrochloric acid
MS - matrix spike
MSD - matrix spike duplicate
PCE - tetrachloroethene
PE - performance evaluation samples
QC - quality control
RB - rinsate blank
TB - trip blank
TCE - trichloroethene
VOCs - volatile organic compounds

Table B-4
Summary of Quantitative Goals for Accuracy, Precision, and Completeness

Medium	Analysis	Quantitation Limit	Precision (RPD)	Accuracy (% recovery)	Completeness (%)
Water	VOC	0.5 µg/L	±20	75-125	90
Air	PCE, TCE	1.0 µg/m^3	±25	70-120	90

Notes:
VOC - volatile organic compound
µg/L - micrograms per liter or parts per billion
µg/m^3 - micrograms per cubic meter
RPD - relative percent difference
PCE - tetrachloroethene
TCE - trichloroethene

PCE and TCE will be used qualitatively by the project team to consider chemical and biologic breakdown of PCE and TCE within the treatment train. All air samples will be analyzed for PCE and TCE only in accordance with EPA Method TO-14A.

Water samples collected during remedial design activities were analyzed for volatile organic compounds (VOCs) by EPA's Environmental Services Assistance Team using a field methodology. Because EPA will relinquish sampling and analysis responsibilities after the 1-year performance validation period (the first year of O&M), EPA Method 8260B has been selected for VOC analysis of water samples. This method is commonly performed by commercial laboratories that are likely to be contracted by Ecology after EPA's involvement ends.

Air sample analysis will be performed by a commercial laboratory contracted by URSG. The URSG ASC will prepare a performance-based bid package and solicit bids from multiple, pre-qualified laboratories in accordance with the Federal Acquisition Requirements. URSG pre-qualifies laboratories based on one or more of the following:

- Audits by URSG staff
- Published audits by other entities (e.g. U.S. Navy, Army Corp of Engineers, EPA)
- Successful prior performance by the laboratory on URSG projects, as defined by independently validated data packages and on-time deliverables

The bid package prepared by the URSG ASC will include a requirement for the laboratory to provide cut sheets and instructions for the timed sampling devices they propose, to aid URSG in selecting the most suitable laboratory.

The contract with the laboratory will require a 15 percent fee retainage, to be released upon accepted third-party validation of the data package and based on adherence to deliverable schedules. The contract will also require a CLP-equivalent data package.

Project quantitation limits and goals for accuracy, precision, and completeness are summarized in Table B-4.

B5 QUALITY CONTROL REQUIREMENTS

QC checks of both field sampling and laboratory sample analysis are used to assess and document data quality and to identify discrepancies in the measurement process that need correction. QC samples are used to determine the representativeness of the environmental samples, the precision of sample collection and handling procedures, the thoroughness of the field decontamination procedures, and the accuracy of the laboratory analysis.

Table B-2 identifies field and laboratory QC samples that will be collected. Table B-3 presents the total number of QC samples that will be collected. Table B-4 defines the acceptance criteria for data quality criteria and indicators. Section D3 provides procedures used to reconcile analytical data with project data assessment parameters.

B5.1 Field Quality Control

The following paragraphs describe the types of field QC samples that will be collected.

Field blanks are used to indicate the presence of external contaminants that may have been introduced into the samples during collection. These blanks may also become contaminated during transport, but this condition is assessed by the use of trip blanks, as discussed below. Field blanks are prepared on site during the sampling event by pouring American Society for Testing and Materials (ASTM) Type I organic-free water into randomly selected sample containers. At least one field blank is analyzed for each group of 20 samples of a similar matrix type and concentration.

Trip blanks are used to assess contamination introduced into the sample containers by volatile organics through diffusion during sample transport and storage. One trip blank is prepared off site and is included in each shipping container with samples scheduled only for analysis of volatile organic compounds, regardless of environmental medium. When sample bottles are provided by the laboratory, trip blanks are prepared at the laboratory using ASTM Type I organic-free water, transported to the sampling site with the other sample containers, and returned to the testing laboratory for analysis, together with the samples collected during the sampling event. The trip blanks remain unopened throughout the transportation and storage processes and are analyzed with the associated environmental samples. Trip blanks are analyzed and reported as water samples, even though the associated environmental samples may be from a medium such as soil, tissue, product, etc.

Rinsate blanks (equipment decontamination rinsates) are used to assess the adequacy of practices to prevent cross-contamination between sampling locations and samples. Rinsate samples are collected daily only for sampling equipment used repetitively to collect environmental samples and not for dedicated sampling equipment or drilling equipment. At least one equipment blank is analyzed for each group of 20 samples of a similar matrix type and concentration. Rinsate (organic-free) water is collected following the final decontamination rinse of sampling equipment (such as a bailer, sampling pump, or mixing bowl) and then dispensed into sample containers. Specified sample containers and sample volumes are collected for each type of analysis to be conducted by the laboratory. The equipment decontamination rinsates are handled and analyzed in the same manner as all environmental samples.

Field replicates (or duplicates) are collected at selected locations to provide estimates of the total sampling and analytical precision. At least one replicate sample is analyzed from each group of 20 samples of a similar matrix type and concentration. The field replicates are handled and analyzed in the same manner as all environmental samples.

B5.2 Laboratory Quality Control

The analytical laboratory uses a series of QC samples specified in each standard analytical method to assess laboratory performance. Analyses of laboratory QC samples are performed for samples of similar matrix type and concentration and for each sample batch. The types of laboratory QC samples are method blank, laboratory control standard, duplicate, matrix spike, and matrix spike duplicate. Other technical QC requirements may be project specific, for example, second column confirmation for a gas chromatography analysis of pesticides.

The analytical laboratory will also report noncompliant occurrences, such as poor analysis replication, poor spike recovery, instrument calibration problems, blank contamination, etc. Corrective action is taken at any time during the analytical process when deemed necessary based on analytical judgment or when QC data indicate a need for action. Corrective actions include, but are not limited to, the following:

- Reanalysis
- Recalculation
- Instrument recalibration
- Preparation of new standards/blanks
- Re-extraction/digestion
- Dilution
- Application of another analysis method
- Additional training of analysts

Noncompliant incidents are documented so that corrective action may be taken to set the system back "in control." These incidents constitute a corrective action report, are signed by the laboratory director and the laboratory QA contact, and include the following information:

- Where the noncompliant incident occurred
- When the incident occurred and was corrected
- Who discovered the noncompliant incident
- Who verified the incident
- Who corrected the problem
- Who verified the correction

B6 INSTRUMENT/EQUIPMENT MAINTENANCE AND CALIBRATION

Guidelines for preventive maintenance of instruments and equipment have been established by the manufacturers. Preventive maintenance is implemented on a schedule based on the type and stability of the instruments and equipment, required accuracy, intended use, and environmental factors. Preventive maintenance minimizes downtime and ensures the accuracy, precision, sensitivity, and traceability of data collected while using the instruments and equipment . Maintenance is conducted by trained technicians, using service manuals or through service agreements with qualified maintenance contractors. Instruments and equipment that are identified to be out of calibration or malfunctioning are removed from operation until they are recalibrated or repaired. In addition, backup for instruments/equipment and critical spare parts are maintained to quickly correct malfunctions.

B7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

Equipment and instrumentation calibration ensures that accurate and reliable measurements are obtained. All instruments and equipment used on the project are calibrated and adjusted to operate within manufacturers' specifications and with a frequency stipulated by the maintenance schedule or by analytical method. At a minimum, field instruments and equipment that require calibration will be calibrated at the beginning and end of each day. In addition, one-point calibrations will be made at planned intervals, when sampling conditions change, when sample matrix changes, and/or if the instrument readings are unstable.

For this project, the only field instrument that will be used for sampling will be the timed sampling device provided with the summa canisters used for air sampling. This device uses a fixed orifice to regulate sample collection rate. This instrument is factory-calibrated and requires no field calibration (see Appendix A).

B7.1 Laboratory Instrument Maintenance and Calibration

The procedures for maintenance and calibration used by the analytical laboratories are included in their laboratory QA plans and analytical methods. All calibration standards are traceable to the National Institute of Standards and Technology or other primary standards. Methods and intervals of calibration are based on the type of equipment, stability characteristics, required accuracy, intended use, and environmental conditions.

B7.2 Calibration and Maintenance Records

Calibration and maintenance schedules and records are maintained for laboratory instruments and URS-owned field equipment. Both equipment and equipment records are located in a controlled-access facility when not in use. This is done to minimize equipment damage, theft, and tampering that may jeopardize either field or laboratory measurements and, ultimately, data quality.

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

URSG has established a system for inspecting, accepting, and tracking all supplies and consumables that may affect the quality of the project or task. The SM is responsible for inspecting, accepting, and tracking all supplies and consumables that may affect the quality of the project or task. The SM is also responsible for ensuring that supplies and consumables that have not been tested, have expired, or do not meet acceptance criteria are not used for the project.

For this project, supplies and consumables necessary for sampling generally include preserved, clean sample containers certified by the vendor; a water-sampling dipper; decontamination supplies; reagent-grade water; and miscellaneous supplies such as field notebooks, pens, and paper towels.

B9 NONDIRECT MEASUREMENTS

During environmental data acquisition activities, data may be obtained from nonmeasurement sources, such as computer printouts and literature searches. Users of data from nonmeasurement sources will record the origin of the data and will assess the quality of the data to determine if the data are consistent with project objectives and are appropriate for supporting a specific decision. Usability or limitations of data, such as representativeness, bias, and precision will be discussed and any uncertainty will be assessed prior to inclusion of the data in the decisionmaking processes. The quality of nonmeasurement electronic data generated by URSG is described in Section C1.

Sampling and analysis data generated during O&M activities will be compared to data previously collected during the RI/FS phase of the project (USEPA 1999c, 1999d). These data were collected under EPA-approved sampling plans and QAPPs.

B10 DATA MANAGEMENT

The management of data includes all mathematical operations and analyses performed on data as collected to change their form, location, quantity, or dimension. The URSG QA procedures manual, Section 8, Technical Data Management, and the URSG SOP Electronic Deliverables of Environmental Data provide guidance for all aspects of data management. Data management includes the following:

- Ensuring that data encoding and entry into databases is correct, including data validation/review criteria and overall project data validation
- Converting data into related values, including the conversion of calibration readings into an equation that can be applied to measurement readings
- Transmitting data, either hard copy or electronic, without error
- Reducing data (including calculations) with an associated loss of detail or number

- Analyzing data by applying statistics, standard errors, confidence intervals, model parameters
- Tracking the flow of the data through the data processing system
- Securing storage and timely retrieval of data

C ASSESSMENT/OVERSIGHT

Assessments are utilized to increase the user's understanding of the activity being assessed and to provide a basis for improving that activity. Assessments may be conducted by URSG staff or independent subcontractors. All assessments are planned and documented based on project requirements. Both self-assessments and independent assessments use one or more assessment tools, such as reviews, surveillances, formal audits, and technical documentation reviews. Assessment responsibilities, planning, tools, and responses are summarized below and are fully presented in the QA SOPs.

C1 RESPONSIBILITY FOR ASSESSMENTS

QA/R-5 requires that assessments be conducted by personnel who have sufficient authority, access to work areas, and organizational freedom to:

- Identify quality problems
- Identify and cite practices that may be shared with others to improve the quality of their operations and products
- Propose recommendations for resolving quality problems
- Independently confirm implementation and effectiveness of solutions
- Provide documented assurance to line management that, when problems are identified, further work performed is monitored carefully until the problems are suitably resolved
- Suspend or stop work, with the concurrence of the PM and EPA, upon detection and identification of an immediate adverse condition affecting the quality of results

This authority and organizational freedom is provided by an independent reporting pathway through the QAO, who is responsible to the URSG corporate QA Director, as opposed to the Program Manager.

C2 IMPLEMENTATION OF ASSESSMENTS

Approaches used for the assessments vary with the objectives of the assessment and the status of the project, but are of two basic types:

- Management and technical self-assessment: the qualitative assessment of a management or technical system by those immediately responsible for overseeing and/or performing the work

- Management and technical independent assessment: the qualitative assessment of management or technical system by someone other than the group performing the work

Assessments are scheduled by the URSG QAO in consultation with the SM, but may be requested by the other project personnel. The schedule for either management or technical assessments is based on the status, risk, and activities in progress and is documented in project-specific plans. In addition to scheduled assessments, technical personnel conduct routine, informal assessments of their work and may request a formal assessment to clarify or document unusual or complex activities.

The planning process for assessments includes one or more of the following:

- Reviewing project-specific requirements identified within project plans

- Defining acceptance criteria

- Developing an outline or checklist of critical technical functions and procedural requirements

- Defining the responsibility and authority of the person(s) conducting the assessment

- Assuring that the personnel scheduled to conduct the assessment have adequate training and experience. The capability of personnel conducting assessments is determined by review of their training, certification, and experience with the program, project, or system being assessed. Assessor qualifications must be equivalent to or higher than the individual whose activity is to be assessed. Independent assessments must have no real or perceived conflict of interest.

Assessment findings, recommendations, and corrective actions are documented in reports that contain some or all of the following:

- Names of the parties responsible for the assessment
- A copy of guidelines developed for the assessment
- Brief description of the activity assessed
- Description of any quality problems
- Recommendations for resolving any quality problems
- Suggestions for sharing of noteworthy practices.

C3 MECHANISMS FOR ASSESSMENT

The tools for assessment will include the following:

- Independent technical reviews and peer reviews
- Data reduction assessment
- Data quality assessments

C3.1 Independent Technical Review and Peer Review

An independent technical review is a documented critical review of work of a substantive nature or identified as a deliverable. A peer review is a documented critical review of work, generally beyond the state of the art or characterized by the existence of potential uncertainty. These reviews are conducted by experienced and qualified personnel to ensure the quality and integrity of tasks and products by allowing the work and/or deliverable to undergo objective, critical scrutiny. The QAO and SM are responsible for ensuring that reviewers are independent from actual work or decisionmaking on the tasks or activities being reviewed and possess technical qualifications sufficient for conducting the in-depth review. Documentation requirements for these reviews are outlined in the QA SOP Independent Technical Review. A written record of the review and resolution of the review findings is incorporated into the project files.

The independent technical review and peer review process is used as a management tool to assess the following:

- Soundness of a technical approach or result
- Application of complicated problem-solving techniques
- Changes in the scope of a project
- Transition between phases of a sampling event
- Problems identified in a project or report

- Major decisions made at the planning stage or during the course of a project
- Potential for erroneous assumptions, data, calculations, methods, or conclusions
- Basis of design criteria and calculations
- Construction cost estimates
- Constructibility of design

Independent technical reviews and peer reviews are conducted for (but are not limited to) all of the following:

- Work plans
- QAPPs
- Reports of sampling events
- Draft and final project reports
- SOPs

As needed, based on project DQOs, independent technical reviews and peer reviews may be conducted for the following:

- Technical approaches
- Technical memoranda
- Studies and investigations
- Design criteria
- Cost estimates
- Plans and specifications
- Subcontract scopes of work

C3.2 Data Reduction Assessment

The following section outlines the procedures for verifying the accuracy of the data reduction process, the methods used to ensure that data transfer is error-free (or has an admissible error rate), that no information is lost in the transfer process, and that the output is completely recoverable from the input. In order to reduce the risks associated with data transfer, this process is kept to a minimum. Data are reduced either manually on calculation sheets or by computer on formatted print-outs. The following responsibilities are delegated in the data reduction process:

- Technical personnel document and review their own work and are accountable for its correctness.

- Major calculations receive both a method and an arithmetic check by an independent checker. The checker is accountable for the correctness of the checking process.

- An independent technical review is conducted to ensure the consistency and defensibility of the concepts, methods, assumptions, calculations, etc., as scheduled by the SM.

- The SM is responsible for ensuring that data reduction is performed in a manner that produces quality data through review and approval of calculations.

Hand Calculations must be legibly recorded on calculation sheets and in logical progression with sufficient descriptions. Major calculations are checked by an engineer or scientist of professional level equal to or higher than that of the originator. After completing the check, the checker signs and dates the calculation sheet immediately below the originator. Both the originator and checker are responsible for the correctness of calculations. A calculation sheet contains the following, at a minimum:

- Project title and brief description of the task
- Task number and date performed
- Signature of person who performed the calculation
- Basis for calculation
- Assumptions made or inherent in the calculation
- Complete reference for each source of input data
- Methods used for calculations
- Results of calculations, clearly annotated

Computer Analysis includes the use of models, programs, and data management systems, etc. For published software with existing documentation, test case runs are periodically performed to verify that the software is performing correctly. Both systematic and random error analysis are investigated and appropriate corrective action measures taken.

Documentation for project-specific, in-house developed models and programs is reviewed by the PM/SM prior to use. This documentation is prepared in accordance with computer program verification procedures and contains the following at a minimum:

- Description of methodology and engineering basis
- Major mathematical operations
- Flow chart presenting the organization of the model or program
- Test case(s), sufficiently comprehensive to test all model or program operations

QC procedures for checking models (or programs) involves reviewing the documentation, running the test case, and manually checking selected mathematical operations. Each computer run has a unique number, date, and time associated with it appearing on the printout. All QC measures are documented as referenced in applicable procedures.

C3.3 Data Quality Assessment

Data quality assessments are prepared to document the overall quality of data collected in terms of the established quality criteria/indicators. The data assessment parameters calculated from the results of the field measurements and laboratory analyses are reviewed to ensure that all data used in subsequent evaluations are scientifically valid, of known and documented quality, and, where appropriate, legally defensible. In addition, the performance of the overall measurement system is evaluated in terms of the completeness of the project plans, effectiveness of field measurement and data collection procedures, and relevance of laboratory analytical methods used to generate data as planned. Finally, the goal of the data quality assessment is to present the findings in terms of data usability.

The major components of a data quality assessment are presented below and show the logical progression of the assessment leading to determination of data usability:

- Summary of the individual data validation reports for all sample delivery groups by analytical method: Systematic problems, data generation trends, general conditions of the data, and reasons for data qualification are presented.

- Description of the procedures used to further qualify data caused by dilution, reanalysis, and duplicate analysis of samples: Examples of the decision logic are provided to illustrate the methods by which qualifiers are applied.

- Evaluation of QC samples, such as field blanks, trip blanks, equipment rinsates, field replicates, and laboratory control samples to assess the quality of the field activities and laboratory procedures

- Assessment of the quality of data measured and generated in terms of accuracy, precision, and completeness through the examination of laboratory and field control samples in relation to objectives established and correct application of statistical methods. A further discussion of the evaluation of data quality is presented in Section 5.2.

- Summary of the usability of data, based upon the assessment of data conducted during the previous four steps: Sample results for each analytical method are qualified as acceptable, rejected, estimated, biased high, or biased low.

C4 RESPONSE TO ASSESSMENTS

The SM and Program Manager review and respond to assessment findings in a timely manner in accordance with QA SOPs. This response will depend upon the potential impact and/or time-critical nature of the quality problem. In all cases, it is the responsibility of the QAO to confirm the implementation and effectiveness of the response action.

- **Time-Critical, Significant Impact.** Example: A field audit finds that a subcontractor is using an inappropriate analytical procedure. The assessor notifies the SM and QAO from the field, discusses alternatives, attempts to take immediate corrective action, and, if necessary, stops work with concurrence of the Program Manager and the EPA.

- **Time-Critical, Minor Impact.** Example: A field audit finds that sample labels are messy but information is usable. The assessor notifies the SM and documents the finding.

- **Not Time-Critical, Possible Major Impact.** Example: A management assessment determines that a procedure for sampling is in error. The assessor incorporates a description and recommendation into a report to the SM and QAO. The SM establishes a schedule for corrective action, designates a responsible person, and determines what documentation of the corrective action is required; the QAO follows up to confirm that the corrective action has been implemented.

- **Not Time-Critical, Minor Impact.** Example: A management assessment determines that the numbering system for the procedures is obsolete. The assessor describes the problem, discusses a solution with the responsible person, and reports to the SM that the issue has been resolved; the QAO follows up to confirm that the corrective action has been implemented.

C5 NONCONFORMANCE AND CORRECTIVE ACTION

The project plans, supplementary procedures, SOPs, and training establish the baseline for assessing the quality system. Management and technical staff follow these plans and procedures during the course of any project activity. However, on occasion, nonconformances do occur. Each nonconformance is documented by project personnel or a subcontractor employee observing the nonconformance. Examples of nonconforming work include the following:

- Items that do not meet the contractual requirements by a subcontractor supplier

- Errors made in following work instruction or improper work instruction

- Unforeseen or unplanned circumstances that result in services that do not meet quality/contractual/technical requirements

- Unapproved or unwarranted deviations from established procedures

- Errors in craftsmanship or trade skills

- Nonvalidated or nonverified computer programs

- Sample chain of custody missing or deficient

- Data falling outside established DQO criteria

Results of QA reviews and audits typically identify the requirement for a corrective action. The QAO is responsible for reviewing all audit and nonconformance reports to determine areas of poor quality or failure to adhere to established procedures. Nonconformances are formally reported by the QAO to the SM. The SM is responsible for evaluating all reported nonconformances, determining the root cause, conferring with the QAO on the steps to be taken for correction, and executing the corrective action as developed and scheduled. Corrective action measures are selected to prevent or reduce the likelihood of future occurrences and address the root causes to the extent identifiable. Selected measures are appropriate to the seriousness of the nonconformance and are realistic in terms of the resources required for implementation.

In summary, corrective action involves the following steps:

- Discovery of a nonconformance
- Identification of the responsible party
- Determination of root causes
- Plan and schedule of corrective/preventive action
- Review of the corrective action taken
- Confirmation that the desired results were produced

The QA SOP Nonconformances and Corrective Action describes the criteria to be applied for identifying a nonconformance, the actions to be taken to respond to and document a nonconformance, and the methods to develop and schedule an appropriate corrective action.

Upon completion of the corrective action, the QAO evaluates the adequacy and completeness of the action taken. If the action is found to be inadequate, the QAO and SM confer to resolve the problem and determine any further actions. Implementation of any further action is scheduled by the SM. The QAO will issue a suspend or stop work notice with the concurrence of the SM and the EPA in cases where significant problems continue to occur or a critical situation requires work to prevent further discrepancies, loss of data, or other problems. When the corrective action is found to be adequate, the QAO notifies the SM of the completion of the audit.

The QAO maintains a log of nonconformances in order to track their disposition until correction and for trend analysis as necessary. All documentation associated with a nonconformance is entered into the project files and QA administrative files.

D DATA VALIDATION AND USABILITY

D1 DATA REVIEW, VALIDATION, AND VERIFICATION

The purpose of the review/validation process is to eliminate unacceptable analytical data and to designate a data qualifier for any data quality limitation discovered. In some instances, the analytical data may be used only for approximation purposes. Definitive data require data validation for 10 percent of the results reported in each of the samples, calibrations, and QC analyses. The results are evaluated for all of the QA elements listed in Table A-3.

D1.1 Field Data Validation

Field data validation is conducted to eliminate data that are not collected or documented in accordance with specified protocols outlined in the project plans and listed below. In some instances, the field data are used only for approximation purposes and do not require validation. In all cases, validation of field data is performed on two separate levels. First, all field data are validated at the time of collection by reviewing the procedures outlined in the SOPs. Second, the SM reviews the field data documentation to identify discrepancies or unclear entries. Field data documentation are validated against the following criteria:

- Sample location and adherence to the plan
- Field instrumentation calibration
- Sample collection protocol
- Sample volume
- Sample preservation
- Blanks collected and submitted with each respective sample set
- Duplicates collected and submitted with each respective sample set
- Sample documentation protocols
- Chain-of-custody protocol
- Sample handling and shipment

D1.2 Analytical Data Validation

For air sample data generated by a commercial laboratory, the analytical data validation will be conducted by a specialty contractor not involved with the actual generation of data. All data generated will be recorded on standard CLP Statement of Work (SOW) forms, or their equivalent. This requirement includes both CLP and non-CLP analyses such as standard EPA analytical methods not specifically covered by the CLP. The data report is then validated in accordance with the criteria contained in EPA guidance documents modified for the analytical method used (USEPA 1994a, 1994b). Data validation reports are filed with the data and describe the usability of the data for further technical interpretations.

The validation report provides a list of all samples being validated, a narrative summarizing each validation topic (e.g., calibration, hold times, etc.), flagged form 1s, worksheets, and any data resubmitted by the laboratory at the request of the validator.

Data validation for water samples analyzed by the EPA Manchester laboratory will be validated by the laboratory in accordance with the criteria contained in EPA guidance documents modified for the analytical method used (USEPA 1994a, 1994b).

D2 RECONCILIATION WITH DATA QUALITY OBJECTIVES

In the final report for each project, all data generated for the project are reconciled with the DQOs presented in the project plans. The final report describes initial project DQOs, and summarizes any changes made to the DQOs as the project progressed. The rationale for the changes is discussed along with any consequences of these changes. The report describes limitations on the use of the data and how issues were resolved. The report also summarizes procedures used to define data usability, i.e., data reviews or validation reports, and the results of these procedures.

Analytical data are assessed for accuracy, precision, completeness, representativeness, and comparability. The data assessment criteria for each of these parameters are described in Section A7.2 of this QAPP. This section establishes the methods for calculating accuracy, precision, and completeness and for evaluating representativeness and comparability using the methods described by EPA guidance. Generally, data that do not meet the established acceptance criteria are cause for resampling and reanalysis. However, in some cases, data that do not meet acceptance criteria are usable with specified limitations. Data that are indicated as usable with limitations are included in the project reports, but are clearly indicated as having limited usability. Indicators of data limitations include data qualifiers, quantitative evaluations, and narrative statements regarding potential bias.

D2.1 Precision

Precision examines the spread of data about their mean. The spread presents how different the individual reported values are from the average reported values. Precision is thus a measure of the magnitude of errors and will be expressed as the relative percent difference (RPD) or the relative standard deviation (RSD). The lower these values are, the more precise that data. These quantities are defined as follows:

$$\textbf{RPD}\ (\%) = 100 \times \frac{|S - D|}{(S + D)/2}$$

$$\boldsymbol{RSD}\ (\%) = \frac{100}{\sqrt{2}} \times \frac{2|S - D|}{(S + D)}$$

where S = Analyte concentration in a sample
D = Analyte concentration in a duplicate sample

or

$$\textbf{RSD}\ (\%) = 100\ \left(\frac{s}{\overline{X}}\right)$$

where s = Standard deviation of replicate measurements
$\overline{X}$ = Mean of replicate measurements

D2.2 Accuracy

Accuracy measures the average or systematic error of an analytical method. This measure is defined as the difference between the average of reported values and the actual value. Accuracy will be expressed as the percent bias for standard reference samples. The closer this value is to zero, the more accurate the data. This quantity is defined as follows:

$$\textbf{Bias}\ (\%) = \frac{MC - KC}{KC} \times 100$$

where KC = Known analyte concentration
MC = Measured analyte concentration

In cases where accuracy is determined from spiked samples, accuracy will be expressed as the percent recovery. The closer these values are to 100, the more accurate the data. Surrogate recovery will be calculated as follows:

$$\textbf{Recovery}\ (\%) = \frac{\text{MC}}{\text{SC}} \times 100$$

where SC = Spiked concentration
MC = Measured concentration

Matrix spike percent recovery will be calculated as follows:

$$\textbf{Recovery}\ (\%) = \frac{\text{MC} - \text{USC}}{\text{SC}} \times 100$$

where: *SC* = Spiked concentration
MC = Measured concentration
USC = Unspiked sample concentration

In instances where data can be adjusted to correct for systematic errors before data evaluation, the correction factor and rationale for correction will be fully documented and presented in the report that summarizes the data.

D2.3 Completeness

Completeness establishes whether a sufficient number of valid measurements were obtained. The closer this value is to 100, the more complete the measurement process. This quantity will be calculated as follows:

$$\textbf{Completeness}\ (\%) = \frac{\text{V}}{\text{P}} \times 100$$

where V = Number of valid measurements
P = Number of planned measurements

D2.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent the environmental condition. Following a determination of precision, a statement on representativeness will be prepared noting the degree to which data represent the environmental and contaminant conditions under investigation.

D2.5 Comparability

Comparability expresses the confidence with which one set of data can be compared to another. Following the determination of both precision and accuracy, a statement on comparability will be prepared citing the acceptance criteria established in relation to use of the data sets in further evaluations and modeling of the environmental and contaminant conditions under investigation. A statement on comparability will also be prepared when the data collected are used with data reported from another or previous study.

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