Operations And Maintenance Plan

Colbert Landfill
Colbert, Washington

December 15, 1999

Prepared for

Spokane County

Prepared by

LANDAU ASSOCIATES, INC.

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1.0 INTRODUCTION

This operations and maintenance plan was prepared for the Colbert Landfill remediation action groundwater interception, conveyance, treatment, and discharge facilities. The facilities include 10 groundwater extraction wells, a piping network to convey the contaminated groundwater to the treatment facility, a treatment facility for removal of chlorinated organic solvents, and piping to convey treated groundwater to the discharge outfield. The key process system at the treatment facility is a single, once-through, air stripping tower. Ancillary process systems include a scale control system and a batch cleaning system for recirculating various cleaning solutions through the tower to remove accumulated scale, biological growth, or other fouling material from the packed media of the air stripper. Treated water is discharged to the Little Spokane River immediately west of the facility.

With proper operation and maintenance, these facilities will intercept landfill-affected groundwater, convey it to the treatment facility, and consistently produce water conforming with the performance standards of the project consent decree (U.S. District Court 1989). This plan provides physical descriptions of processes, equipment, and controls, and sets forth recommended procedures for operation and maintenance of facility processes and equipment.

Planning and implementation of operation, testing, and maintenance activities will be enhanced by having the following documents available for reference:

- Facility as-built drawings and specifications
- Facility construction completion report
- Operations and maintenance manuals of equipment manufacturer's literature.

This plan describes the procedures and protocols that shall be used for day-to-day operations and maintenance activities. It also serves as a reference document for use in training operators. It is not intended to be a detailed text on the fundamentals of process theory and practice. This plan does present unique features of the facility and the process variations available for operating and maintaining the facility under a wide range of conditions.

This plan has been prepared to conform with the requirements of the State of Washington Administrative Code WAC 173-240-150.

1.1 BACKGROUND AND GENERAL DESCRIPTION

The Colbert Landfill is an inactive 40-acre municipal solid waste landfill located approximately 10 miles north of Spokane, Washington. Groundwater in the vicinity of the landfill is contaminated with chlorinated volatile organic solvents over an area of approximately 2.5 square miles as a consequence of landfill disposal activities.

In September 1987, a record of decision (ROD; EPA 1987b) for interim and final remedial action at the Spokane County Colbert Landfill Superfund site was signed by the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology). The Colbert Landfill ROD was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by Superfund Amendments and the Reauthorization Act of 1986 (SARA). On March 1, 1989, Spokane County agreed to the requested remedial action by signing Consent Decree No. C-89-033RJM (U.S. District Court 1989).

The remedial action facilities were constructed and shall be operated in compliance with the Consent Decree, which defines site remediation requirements. The site is being remediated under the requirements of CERCLA, SARA, and the National Oil and Hazardous Substances Contingency Plan (NCP) (40 CFR Part 300), as well as other applicable or relevant and appropriate requirements (ARARs). Detailed environmental regulatory compliance information is presented in Appendix A.

Pursuant to Section 121(e) of CERCLA, a National Pollutant Discharge Elimination System (NPDES) permit is not required to allow discharge of the treated groundwater to the Little Spokane River. However, the facility must meet the substantive requirements equivalent to those that would be contained in a conventional NPDES permit. A copy of the substantive discharge requirements is provided in Appendix B of this plan. Effluent sampling and analysis requirements are described in Section 8.0.

2.0 NAMES AND PHONE NUMBERS OF RESPONSIBLE INDIVIDUALS

Colbert Landfill Air Stripping Treatment Facility
22515 North Elk-Chattaroy Road
Colbert, WA 99005
Telephone No. (509) 238-6607
ADAS Telephone 238-6802
Fire and Security Alarm 238-6812
Report Computer Modem (future) _____

Steven Anderson
Treatment Facility Operator
Telephone No. (509) 990-9476
Home Telephone No. (509) 489-9135

Debra Geiger
Treatment Facility Operator
Telephone No. (509) 990-9476
Home Telephone No. 838-5296

Mr. Bill Wedlake
Spokane County Utilities Department
Telephone No. (509)456-3604
Home Telephone No. (509) 535-9830

3.0 GENERAL DESCRIPTION OF FACILITY

3.1 PLANT LOCATION

The Colbert Landfill remedial action treatment facility is located near the southwest corner of the Colbert Landfill. The landfill is located approximately 10 miles north of Spokane, Washington and approximately 3 miles north of the town of Colbert, Washington, as illustrated on Figure 3-1.

3.2 PLANT TYPE

The plant is a counter-current, forced-draft air stripping system that removes volatile organic solvents from extracted groundwater. The air stripping system is capable of treating groundwater at rates of up to 1,600 gallons per minute.

3.3 INFLUENT SOURCE

The influent source is groundwater that is extracted from upper and lower aquifers located within the remedial action area.

3.4 TREATED GROUNDWATER DISCHARGE LOCATION

Treated groundwater is conveyed from the air stripper clear well through an underground, gravity flow, 12-inch diameter PVC pipeline to the Little Spokane River. An underground energy dissipation vault located just upstream of the outfall absorbs velocity energy to minimize erosion impacts at the outfall.

3.5 UTILITIES

3.5.1 ELECTRICAL

3.5.1.1 Treatment Facility

The treatment facility electrical process is supplied by Washington Water Power. A single 225-kVA service is provided. The electrical transformer and service meter are located at the southeast corner of the treatment facility building. The facility electrical systems provide for 460-volt three-phase a.c., 240-volt single-phase a.c., and 120-volt single-phase a.c. power.

3.5.1.2 Well Vaults

Each groundwater extraction well is provided with a dedicated electrical service from Washington Water Power. The main disconnect is located above-grade adjacent to each well vault providing power service of 480-volt, three-phase power, with the exception of CP-E2, which has 240-volt, three-phase power. All well vaults also have 120-volt, single-phase power that is tapped from the 480-volt power system.

3.5.2 TELEPHONE

Four dedicated telephone service lines are installed at the treatment facility. Telephone service is provided by U.S. West Communications. One phone is dedicated for the facility fire/security alarm system, one line is dedicated for the process and groundwater extraction system automatic dialing alarm system (ADAS), and one line is reserved for dedication as a computer modem/network line with Spokane County offices.

3.5.3 POTABLE WATER

Potable water is provided by the Whitworth Water District via a 4-inch diameter service line. The potable water service meter is located in an underground vault just outside the treatment facility entrance gates. Back flow prevention devices are installed to prevent contamination of the potable water system from industrial water uses.

3.5.4 SANITARY

A 1,000-gallon, multiple compartment, septic tank and drain field located west of the treatment facility building provides for treatment and disposal of sanitary wastewater generated at the facility.

3.5.5 LABORATORY DRAIN

The laboratory sink drains to the sanitary system. A sign is posted at the laboratory sink warning that laboratory chemicals, solvents, oils, untreated groundwater, discarded samples, and other chemical wastes must not be released to the laboratory drain and sanitary system. A dilution trap is provided on the laboratory sink drain to intercept/dilute inadvertent disposal of chemical solutions.

3.5.6 SAMPLE SINK AND FLOOR DRAIN SYSTEM

Floor drains and the sample sink in the process area drain through a polyethylene pipe drain system that discharges to a below-grade, double-contained sump located inside the building. The collected water is then pumped to the air stripping tower influent pipe. NOTE: Laboratory chemicals, concentrated solvents, oils, and concentrated acids or bases must not be released to the floor drain system.

3.6 PLANT SYSTEMS

3.6.1 GROUNDWATER/INTERCEPTION EXTRACTION SYSTEM

Ten groundwater extraction wells are installed in the vicinity of the landfill, as shown on Figure 3-2. Each groundwater extraction well pump is driven through adjustable frequency drives to allow efficient means for increasing or decreasing the groundwater extraction rate. The groundwater extraction system can operate in a constant flow mode or in a constant drawdown (i.e., water level) mode.

3.6.2 GROUNDWATER CONVEYANCE SYSTEM

Groundwater is extracted from the interception wells to the treatment facility through a series of interconnecting pipelines, as shown on Figure 3-2.

3.6.3 AIR STRIPPING TREATMENT SYSTEM

The volatile organics (i.e., constituents of concern) that affect the groundwater in the remediation area are removed using air stripping technology. The air stripper is designed for a hydraulic loading rate of 2.4 million gallons per day (1,600gpm). The air stripper is the forced-draft once-through counter-current packed bed type approximately 10 ft in diameter and 70 ft in height.

3.6.4 SCALE CONTROL CHEMICAL INJECTION SYSTEM

A nonphosphate, polyacrylate scale control chemical is injected to reduce or prevent the buildup of calcium carbonate scale inside the air stripping tower and discharge piping. Scale control chemical is automatically injected into the influent groundwater on a flow proportional basis prior to the air stripping process.

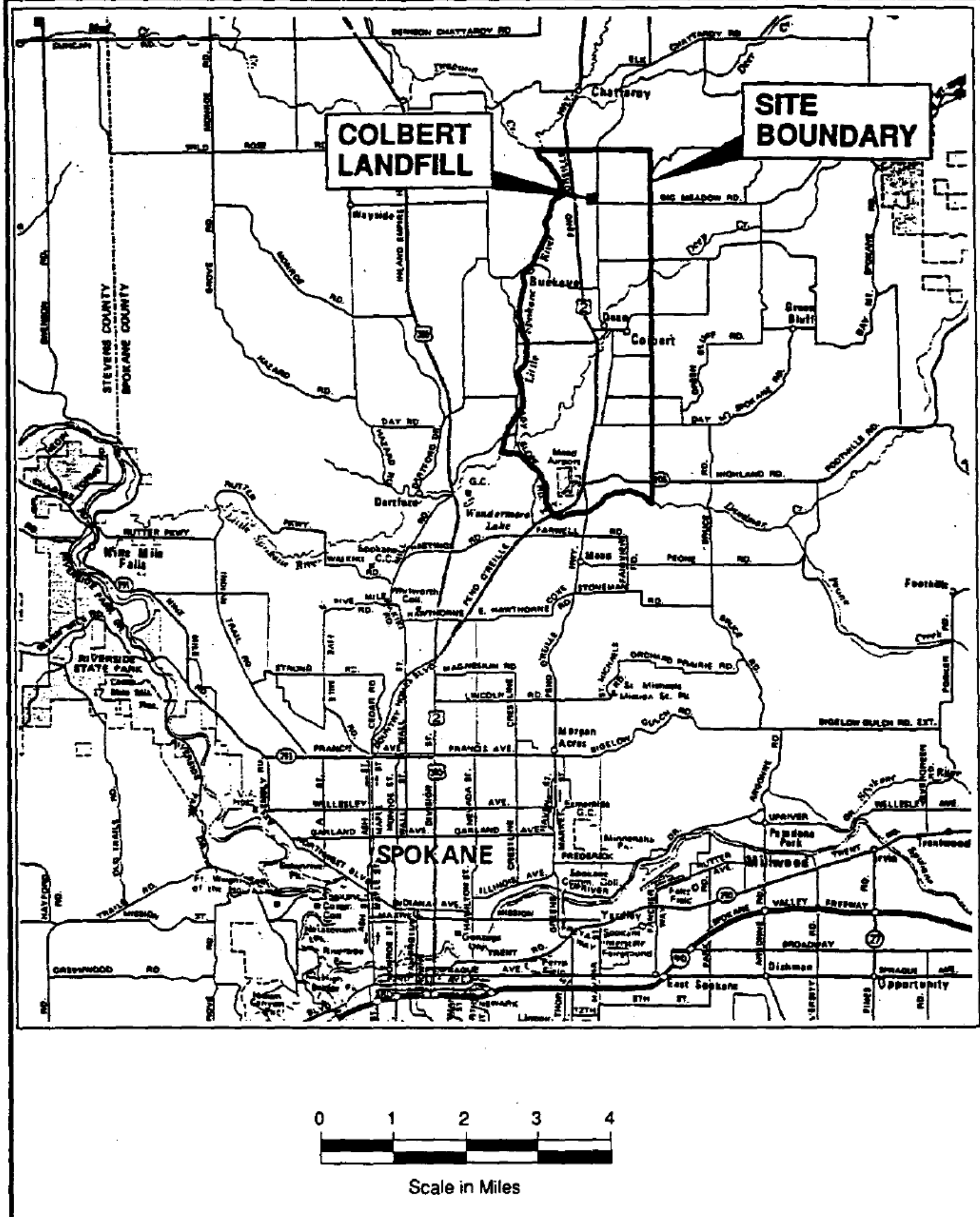
3.6.5 BATCH CLEANING SYSTEM

The treatment facility features an ancillary process system for batch cleaning of the air stripper internals. A 9,000-gallon fiberglass-reinforced plastic storage tank, tank T-3, is provided for temporary storage of spent batch cleaning solution. Spent cleaning solution must be characterized and disposed of in accordance with state and federal regulations. The equipment and materials are suitable for closing and recirculating various cleaning solutions, including hydrochloric acid and hydrogen peroxide, through the air stripping tower to remove aberrant scale or biological growth, respectively.

Tank T-3 is presently being used to contain condensate from the landfill gas collection system. Operation of the groundwater treatment system, thus far, has not required batch cleaning of the air stripper. Should tank T-3 be needed for batch cleaning operations in the future, all condensate should be removed from the tank and the tank should be cleaned out, if necessary, prior to adding the batch treatment chemicals.

3.6.6 SPENT BATCH CLEANING SOLUTION DISPOSAL SYSTEM

Spent hydrochloric acid cleaning solution (brine) and other spent cleaning solutions must be disposed of offsite at an approved facility. Properly neutralized batch cleaning chemicals should not require classification as Dangerous Waste. However, information regarding the proper procedure for classification and management of Dangerous Waste is contained in Appendix A, Environmental Regulatory Compliance.



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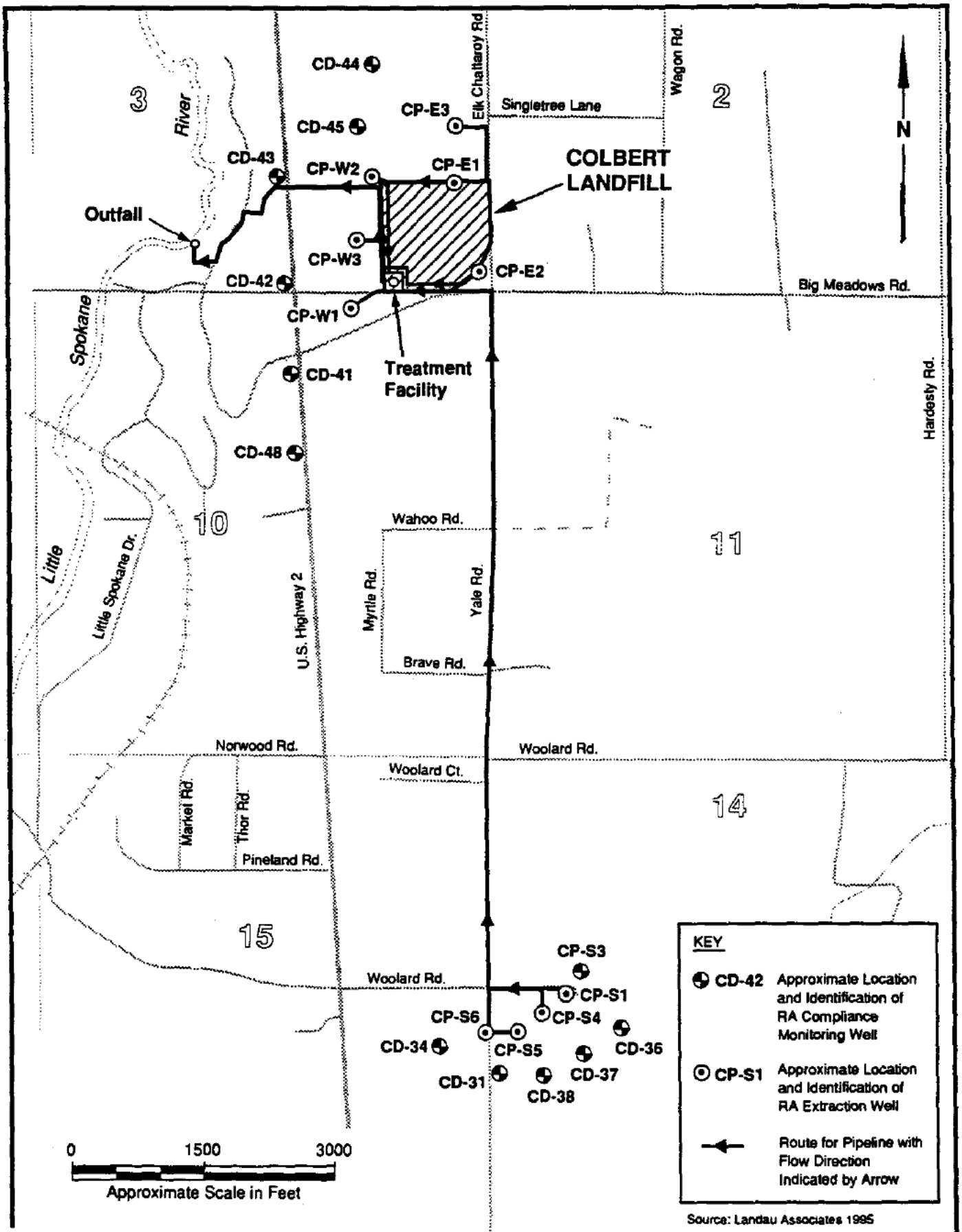
Regional Location Map

Figure 3-1



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Remediation Action System Components

Figure 3-2

4.0 DESIGN CRITERIA

4.1 GROUNDWATER INTERCEPTION/EXTRACTION SYSTEM

The groundwater extraction system is comprised of 10 wells. Submersible vertical turbine pumps are installed in each well. Well screens are wire wound, 304 stainless-steel, and well casings are steel. Pump riser pipes have threaded couplings. Riser pipes less than 4 inches in diameter are Schedule 40 stainless-steel. Riser pipes 4 inches or greater in diameter are epoxy coated and lined Schedule 40 steel. A ball check valve is provided at the discharge of the pump and a swing check valve is installed at the top of the wellhead. The discharge flow rate from each extraction pump is monitored by a dedicated magnetic flow meter.

Well	Well Screen Type	Pump	Extraction Pump Size (Horsepower)	Designed Pump Capacity (gpm)	Casing ID (inch)	Elevation of "Normal" Water Level	Elevation of Maximum Drawdown
CP-S1	pipe-size	P101	10	90	6	1,760	1,665
CP-S4	pipe-size	P103	10	90	6	1,759	1,665
CP-S5	pipe-size	P104	7.5	90	6	1,757	1,660
CP-S6	pipe-size	P105	7.5	90	6	1,758	1,661
CP-E1	Telescoping	P106	20	200	8	1,671	1,453
CP-E2	No screen	P107	0.75	6	6	1,719	1,547
CP-E3	Telescoping	P108	20	200	8	1,670	1,462
CP-W1	Telescoping	P109	30	250	8	1,671	1,409
CP-W2	Telescoping	P110	30	250	8	1,670	1,441
CP-W3	Telescoping	P111	30	250	8	1,670	1,453

4.2 GROUNDWATER CONVEYANCE SYSTEM

The groundwater conveyance pipeline was constructed in two phases. A schematic diagram of the Phase I conveyance pipeline is shown on Figure 4-1. Phase I was constructed in 1990 and consists of four sections of pipeline constructed of bell and spigot Class 160 PVC, 160 psig rated, with nitrile butyl rubber (NBR) seals: 1) along Woolard Road between well CP-S1 and Yale Road, 2) between well CP-E1 and the treatment facility, 3) between well CP-W1 and the pipeline section described in item 2, and 4) the discharge pipeline from near the treatment facility to the outfall at the Little Spokane River. Phase II construction was accomplished in 1993 and consists of the

remaining system pipelines, Figure 4-2. The Phase II pipelines were constructed of bell and spigot Class 200 PVC, 200 psig rated, styrene butyl rubber (SBR) seals. Table 4-1 lists the design criteria, including maximum design flow discharge, pipeline diameter, and design velocity, for the pipeline segments shown on Figure 4-3. Table 4-2 presents the estimated maximum operating pressures, water hammer pressures, and total pressures for the pipelines. Air/vacuum release valves are located at wellheads and along pipeline at periodic intervals and high points. The pipeline burial depth is 4.5 to 6 ft below ground surface.

4.3 AIR STRIPPING TREATMENT SYSTEM

4.3.1 PHYSICAL DESIGN PARAMETERS

Groundwater treatment rates: 600 to 1,600 gallons per minute.

Influent water design pressure: 150 psig.

Air to water ratio: 100 vol/vol.

Fan air flow rate: 22,000 cfm maximum at system pressure.

Fan motor rating: 50 hp.

Tower and ductwork pressure range: -5 to +14 inches of water column.

Fan inlet filter allowable pressure drop before cleaning: 0.5 inch water.

Tower allowable incremental pressure drop before cleaning: 1 inch water.

Maximum scale (calcium carbonate) loading: 0.02 inch thickness.

Packing media: Rauschert 3½ inch hi-flow rings.

Packing media surface area: 19.8 ft^2/ft^3.

Packing media bulk density: 2.7 lbs/ft^3.

Packing media liquid holdup at maximum flow conditions: 3.8%.

Cleaning solutions: 5 percent sodium hydroxide (up to 8 hours per month) may be used to neutralize residual acid concentration to reduce neutral spent solution; up to 37 percent hydrochloric acid (up to 8 hours per month); and up to 35 percent hydrogen peroxide (up to 8 hours per month). Material Safety Data Sheets for chemicals used at the facility are included in Appendix C.

4.3.2 AIR STRIPPER VOLATILE ORGANIC COMPOUND PERFORMANCE STANDARDS

The air stripper volatile organic compound design concentrations and performance standards, design concentrations for conventional parameters, and design hydraulic loadings are as follows:

Parameter	Influent Peak Flow/Average Concentration Design Condition	Influent Peak Concentration/ Average Flow Design Conditions	Influent Minimum Flow Design Conditions	Effluent Performance Standards (All Influent Conditions)
Constituent of Concern[a]				
Methylene chloride	625	1,300	625	2.5
1,1,1-Trichloroethane	1,100	2,500	1,100	200
1,1-Dichloroethene	300	300	300	7.0
1,1-Dichloroethane	180	180	180	4,050
Trichloroethene	580	580	580	5.0
Tetrachloroethene	3	3	3	0.7
Conventional Parameters[b]				
Total suspended solids	10	10	10	NA[c]
Chemical oxygen demand	10	10	10	NA
Biological oxygen demand	10	10	10	NA
Phosphorus (as P)	5	5	5	NA
pH (pH units)	5-8	5-8	5-8	NA
Temperature (°F)	50	50	50	NA
System Flow Rate (gpm)	1,600	1,000	600	NA

(a) µg/L (ppb).
(b) mg/L, unless indicated otherwise.
(c) NA = not applicable.

4.4 SCALE CONTROL CHEMICAL INJECTION SYSTEM

4.4.1 SCALE CONTROL CHEMICAL FEED PUMPS (P22-1, P22-2)

Design flow rate: 0.1 to 1 gallon per hour at 100 psig.

4.4.2 SCALE CONTROL CHEMICAL STORAGE TANK (T-1)

Materials of construction: HDPE.

Dimensions: 6 ft 0 inches diameter by 7 ft 9 inches height.

Capacity: 1,625 gallons.

Volume per foot: approximately 210 gallons.

4.4.3 SCALE CONTROL CHEMICAL TRANSFER PUMP (P22-3)

Design flow rate: 40 gallons per hour at 40 ft head, 60 ft shutoff head.

4.4.4 SCALE CONTROL CHEMICAL DESIGN PROPERTIES

pH: 4 to 12.

Solids: None.

Density: 10.2 lb/gallon.

Viscosity: 60 cp.

4.5 BATCH CLEANING SYSTEM

4.5.1 BATCH CLEANING SOLUTION TANK (T-3)

Materials of construction: fiberglass-reinforced plastic, vinyl ester resin.

Dimensions: 10 ft 0 inches diameter x 16 ft 0 inches height.

Capacity: 9,000 gallons.

Volume per foot: 587 gallons.

4.5.2 BATCH CLEANING RECIRCULATION SOLUTIONS

37 percent hydrochloric acid, HCl, in water.

5 percent sodium hydroxide, NaOH, in water.

35 percent hydrogen peroxide, H_2O_2, in water.

4.5.3 BATCH CLEANING SOLUTION RECIRCULATION PUMP

Design flow rate: 200 gpm at 100-ft head.

Materials of construction: fiberglass-reinforced plastic.

4.5.4 BATCH CLEANING SOLUTION PIPING

Materials of composition: Schedule 80 PVC.

Gaskets: Viton or TFE.

4.6 OTHER EQUIPMENT

4.6.1 BUILDING SUMP (T-2)

Dimensions: 60 inches x 48 inches x 36 inches height.

Volume: 500 gallons.

Material of construction: HDPE, ½ inch thick.

Special construction features: Secondary contained with annular space monitor.

Secondary containment type: Reinforced concrete with 100 mil HDPE liner.

Pump capacity: 10 gpm at 83 ft TDH.

Pump shutoff head: 80 ft.

Pump type: Submersible pump.

4.6.2 AIR STRIPPER CONTAINMENT SUMP

Dimensions: 36 inches x 48 inches x 42 inches deep.

Volume: 314 gallons.

Material of construction: Reinforced concrete with 100 mil HDPE liner.

Special construction features: Submersible heater freeze protection.

Pump capacity: 10 gpm at 73 ft TDH.

Pump shutoff head: 80 ft.

Pump type: Recessed impeller submersible pump.

4.6.3 BATCH CLEANING SOLUTION STORAGE TANK CONTAINMENT SUMP

Dimensions: 36 inches x 48 inches x 42 inches deep.

Volume: 314 gallons.

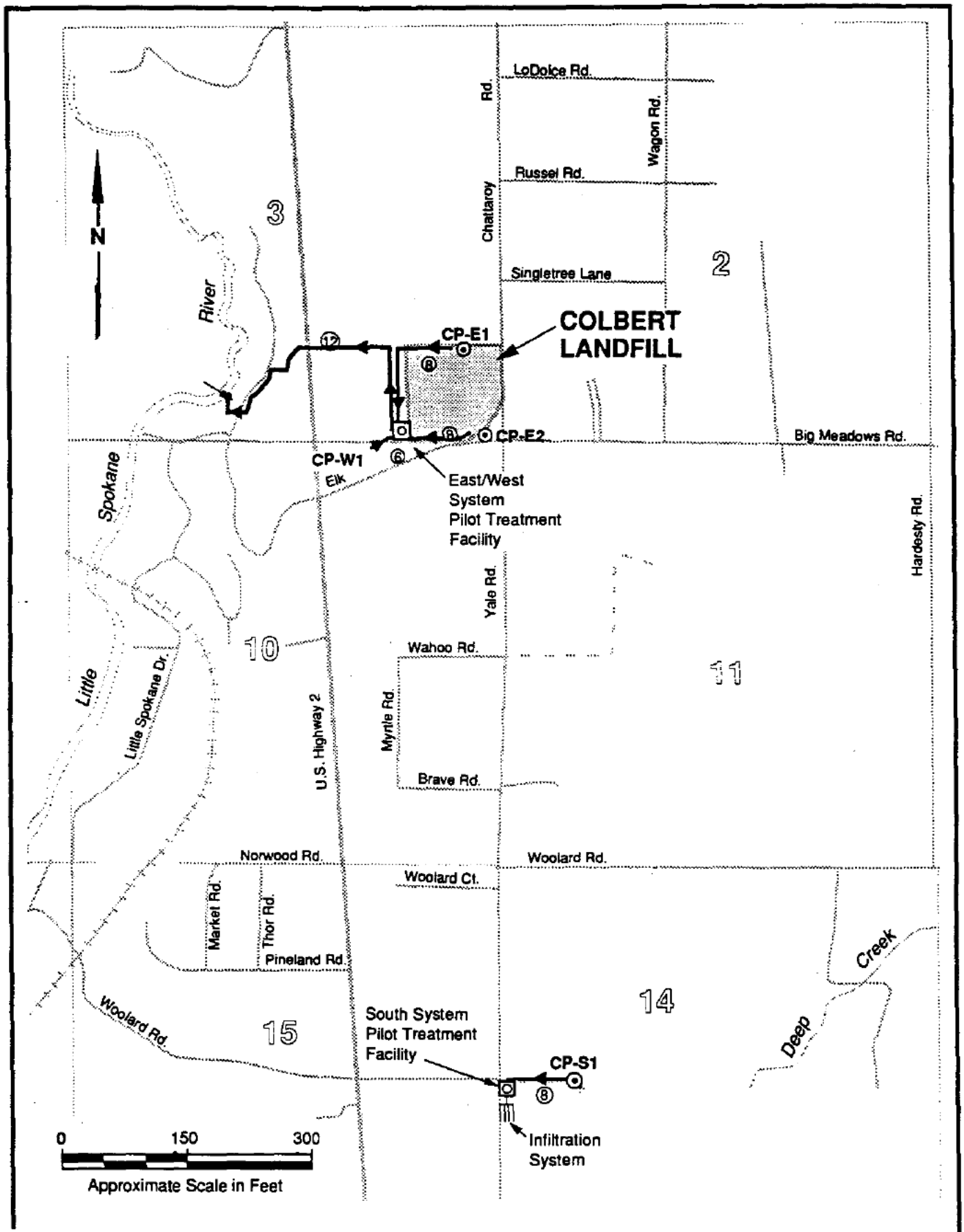
Material of construction: Reinforced concrete with 100 mil HDPE liner.

Special construction features: Submersible heater freeze protection.

Pump capacity: 10 gpm at 73 ft TDH.

Pump shutoff head: 80 ft.

Pump type: Recessed impeller submersible pump.



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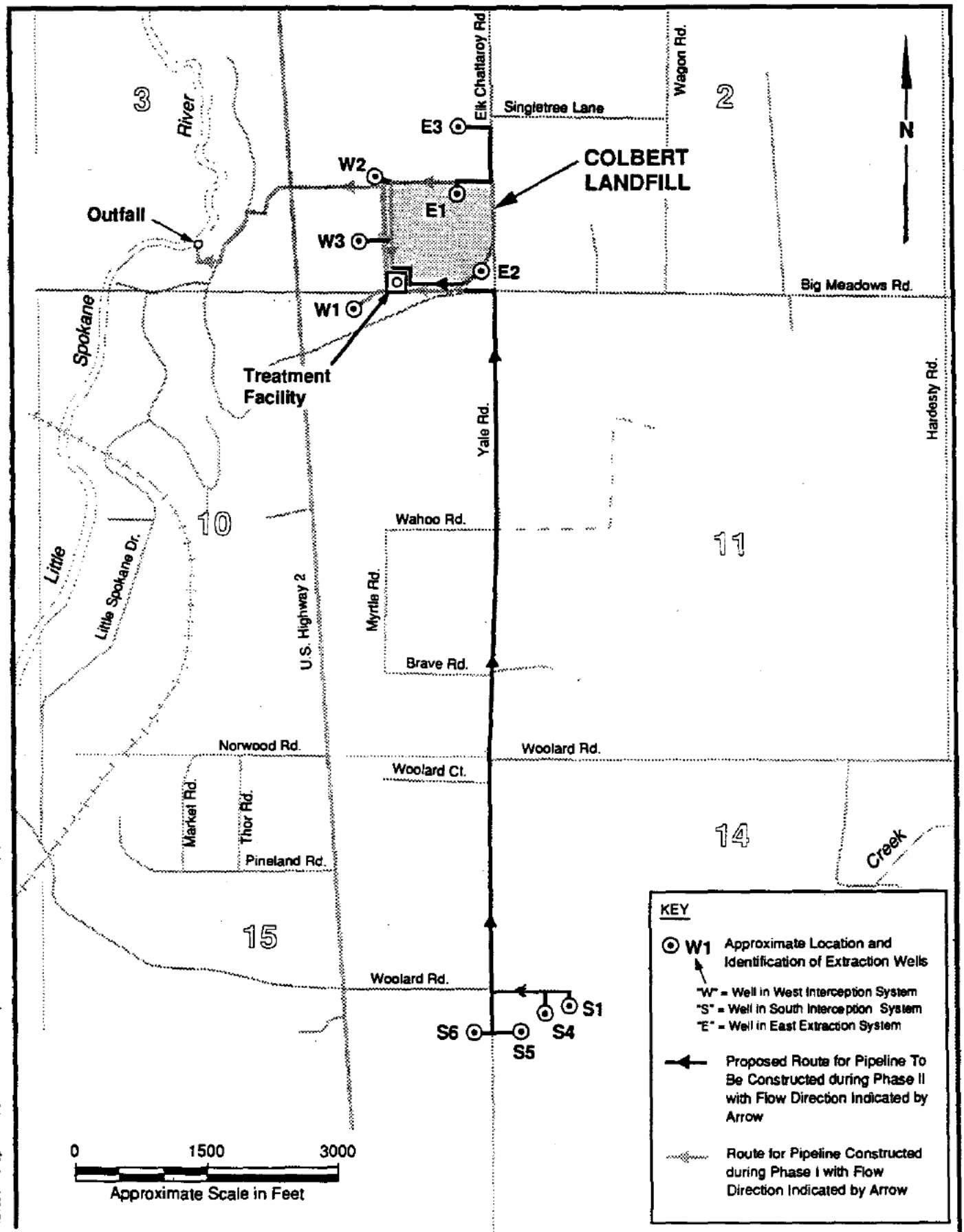
Phase I Treatment and Discharge System Schematic

Figure 4-1



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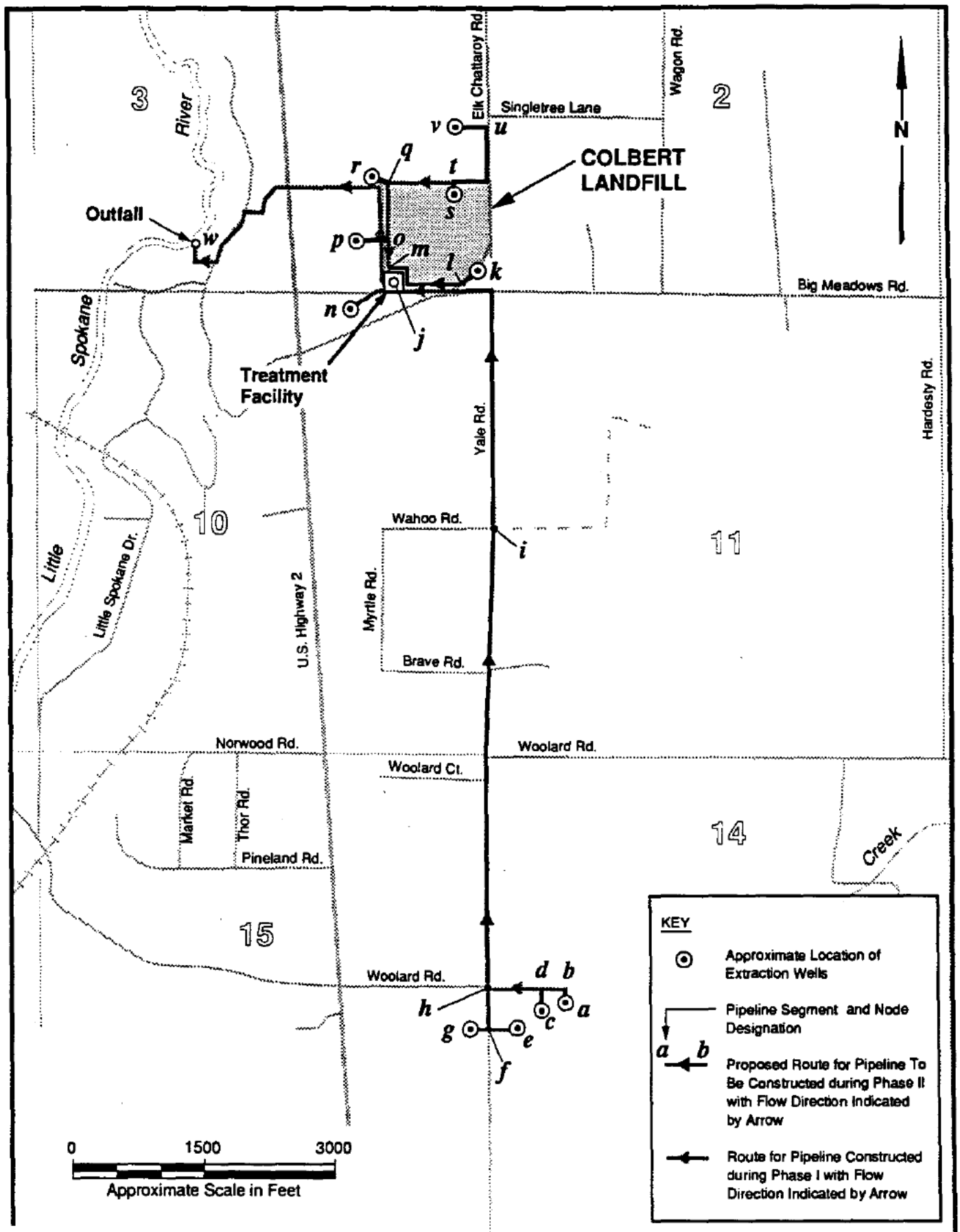
Phase II Extraction Well Schematic

Figure 4-2



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Phase II Pipeline Design Schematic

Figure 4-3

TABLE 4-1

PHASE II PIPELINE DESIGN DIAMETERS AND VELOCITIES

Pipeline Segment	Maximum Design Discharge (gpm)	Pipeline Design Diameter (inches)	Design Velocity[a] (ft/sec)
a-b	150	4	4.2
b-d[b]	300	8	2.0
c-d	150	4	4.2
d-h[b]	400	8	2.7
e-f	100	4	2.8
g-f	100	4	2.8
f-h	400	6	4.5
h-i	400	8	2.7
i-j[c]	700	8	4.8
k-l[b]	4	2	0.4
l-m	200	6	2.3
n-j[b]	350	6	4.0
m-j	1050	10	4.8
o-m[b]	850	8	5.8
p-o	350	6	4.0
q-o[b]	850	8	5.8
r-q	250	6	2.8
t-q[b]	700	8	4.8
s-t	200	4	5.7
u-t	500	8	3.4
v-u	200	6	2.3
j-w	1600	12	4.5

(a) Design velocity = (maximum design discharge)/(pipeline cross sectional area).

(b) Pipeline constructed during Phase I.

(c) Pipeline segment from Elk-Chattaroy Road to treatment facility constructed during Phase I.

TABLE 4-2

ESTIMATED MAXIMUM OPERATING, WATER HAMMER, AND TOTAL PIPE PRESSURES

Pipeline	Estimated Maximum Operating Pressure (psi)	Estimated Maximum Water Hammer Pressure (psi)	Estimated Maximum Total Pipe Pressure (psi)
CP-S1, CP-S4, CP-S5, CPS6	70	65	135
CP-E1, EP-E2, CP-E3, CP-W2, CP-W3	70	79	149
CP-W1	40	57	97

5.0 PROCESS DESCRIPTION AND FLOW SCHEMATIC

Detailed process descriptions of the treatment system's major components and processes are presented in this section. General design criteria for these processes are presented in Section 4.0. As an aid to understanding the material presented herein, it is suggested that the operator refer to the: 1) Process Flow Schematic, Figure 5-1; 2) construction plans and specifications; and 3) manufacturers' operation manuals for individual equipment items. The plant consists of six major process systems. These are:

1) Groundwater interception/extraction system
2) Groundwater conveyance system
3) Scale control chemical injection system
4) Air stripping treatment system
5) Air stripping tower batch cleaning system
6) Ancillary systems to provide flexibility for injecting alternative chemical additives or utilizing alternative batch cleaning solutions
7) Sump management system.

The purposes of the groundwater extraction and treatment system are to protect public health and the environment by:

- Intercepting groundwater contaminated by landfill leachate containing volatile organic compounds (contaminants of concern) by creating drawdown at the extraction wells to inhibit migration of contaminated groundwater into previously unaffected areas
- Treating the affected groundwater to reduce the concentration of the contaminants of concern to acceptable levels.

Contaminated groundwater is intercepted and extracted through operating the groundwater extraction wells. Groundwater is conveyed from the extraction wells through a buried network piping system to the treatment facility. At the treatment facility, the extracted groundwater is conveyed to the air stripping tower to remove the contaminants of concern from the groundwater and achieve the performance standards. Treated groundwater is discharged to the Little Spokane River through a gravity flow pipeline.

5.1 GROUNDWATER EXTRACTION SYSTEM

The groundwater extraction system intercepts groundwater from two aquifers, as discussed in Section 7.0 (Aquifer Management Plan) referred to as the upper and lower aquifers. The extraction wells are grouped into three areas known as the south, east, and west systems. Currently, there are ten groundwater extraction wells, as shown on Figure 3-2, but the number of actively used wells could increase or decrease in the future depending upon the effectiveness of the interception system design and whether additional areas of contaminated groundwater are identified. The south system consists of four extraction wells to intercept contaminated groundwater in the upper aquifer. The east system is principally for source control and consists of three wells: two in the lower aquifer and one in the upper aquifer. The west system consists of three wells to intercept contaminated groundwater in the lower aquifer. Each well is outfitted with an electric submersible pump. Each pump is outfitted with a variable frequency drive and programmable logic controller, which can provide pump operation in either of two modes: constant flow with variable groundwater drawdown or constant drawdown with variable flow. Section 7.0 describes the hydrogeologic structure of the site area and presents a plan for aquifer management. Boring logs and well completion diagrams are available in Appendix D.

5.2 GROUNDWATER CONVEYANCE SYSTEM

The groundwater conveyance system consists of approximately 5 miles of buried PVC pressure pipe to convey extracted groundwater to the treatment facility building, as shown on Figure 3-2. The system contains six test connections to allow for pressure testing of the pipeline to assess leakage. Combination air and vacuum release valves are installed at each wellhead, at grade breaks, and at 1,500-ft intervals along the pipeline as indicated Drawings C-1 through C-15 of the Construction As-Built Drawings. The treated groundwater discharge piping system is a gravity flow pipeline, constructed of 12-inch diameter Class 160 PVC pipe, and features an energy dissipation outfall structure near the terminus, as shown on Figure 5-2.

5.3 GROUNDWATER TREATMENT SYSTEM

The groundwater treatment system consists of a single pass through, counter-current packed air stripping tower (10 ft diameter, 70 ft tall) with a 50 hp fan that has capabilities for the following:

- Normal treatment

- Air stripping tower bypass
- Potable water flushing
- Chemical cleaning.

The tower has an inlet liquid distributor system, two intermediate liquid redistributors, a mist eliminator, and 47-ft total packing depth (in three separate sections: two at 17 ft 3 inches and one at 12 ft 3 inches). The packing is nominally 3.5-inch diameter and fabricated from polyethylene. The geometric surface area of the packing is 19.8 ft^2 per cubic ft.

Untreated groundwater is conveyed to the top of the air stripping tower. An internal weir trough distributes water evenly over the cross section of the tower. The groundwater trickles downward through the tower onto the packing media, where it contacts upwardly flowing air supplied into the tower by the fan. The contaminants of concern volatilize from the water to the air. The purpose of the packing media is to increase the effective contact surface area between the air and the water and, thereby, enhance the removal of the contaminants from the water. Treated water drains from the packing to the clear well at the base of the tower, where it flows into the discharge pipeline that conveys the treated water by gravity to the outfall at the Little Spokane River. Air containing contaminants removed from the groundwater passes through a mist eliminator (to reduce the moisture content of the air) and then exits the tower through the stack to the atmosphere.

Scale control chemical is added at the treatment facility, as needed, upstream of the air stripping tower to reduce or eliminate the buildup of mineral scale (principally calcium carbonate) in the air stripping tower.

The performance of the air stripping treatment system can be adjusted by changing the relative ratio of air flow to water flow. For a given groundwater pumping rate, higher air flows will increase the removal of contaminants and lower air flows will decrease removal of contaminants. Similarly, for a given air flow rate, higher groundwater pumping rates will decrease the removal of contaminants, and lower groundwater pumping rates will increase the removal of contaminants.

System performance may degrade over time due to the buildup of mineral scale (e.g., calcium carbonate), biological growth, or other fouling by causing restriction or reduction in air flow. Deposition of mineral scale can be reduced or eliminated through the use of scale control chemicals. Accumulated fouling can be removed through the use of the appropriate batch cleaning solution, as described later in this section. Theoretically, the potential for scale accumulation is

greatest at the bottom of the tower. Scale accumulation can be observed by removing the scale coupon located at the base of the tower. Biological growth may be most significant in the mist eliminator located at the top of the tower. Biological growth on the mist eliminator can be removed by pressure washing. Pressure washing can be performed with the mist eliminator either in-place or after its disassembly and removal from the tower.

Excessive scaling or fouling increases the air pressure drop through the tower and, therefore, is undesirable because it increases energy and maintenance requirements. Excessive accumulation of scale has the potential to cause structural damage to the tower and media support structures due to the weight of scaling. The tower packing media has a very high surface area, so even a thin layer (i.e., a few millimeters) of fouling might overload the tower.

5.4 SCALE CONTROL CHEMICAL INJECTION SYSTEM

Scale control chemical can be injected into the groundwater immediately upstream of the air stripping tower to reduce or prevent the buildup of calcium carbonate scale inside the air stripping tower. The recommended scale control chemical is a polyacrylate dispersant that functions as a calcium sequestering agent. It is anticipated that an approximate concentration of 10 to 20 mg/L in the influent groundwater (0.5 to 1.0 gallon per hour input to 1,000 gallons per minute groundwater flow rate) will effectively prevent scale buildup. Scale control chemical is stored in tank T-1 in the treatment facility process area. Material safety data sheets (MSDSs) for the scale control chemical are available in Appendix C.

5.5 BATCH CLEANING SYSTEM

The batch cleaning system allows recirculation of various cleaning solutions, including hydrochloric acid and hydrogen peroxide, through the air stripping tower to remove scale or biological growth, respectively. Hydrochloric acid cleaning solution is brought to the site in a tanker truck and input to the base of the air stripping tower via one of the facility truck unloads. The acid is diluted with water and recirculated through the air stripping tower where it reacts with scale, which neutralizes the acid and forms a brine solution. After the acid solution has been recirculated for 1 to 4 hours, the solution is tested for pH to determine whether the scale has been removed or the acid solution has been neutralized. If the pH testing indicates the solution is only mildly acidic (approximately pH 4 or higher), then the scale has been removed and the solution must be further neutralized with sodium hydroxide to a pH of approximately 6 to 8. If the pH is

only mildly acid or is basic (pH > 6), then the process must be repeated with fresh acid to remove the remaining scale. Removal and evaluation of the scale coupon at the bottom of the air stripping tower will also be helpful in assessing scale removal.

Spent, neutralized solutions are transferred from the air stripping tower to the batch cleaning storage tank (T-3) for later offsite disposal. Tank T-3 has a 9,000 gallon capacity and is constructed of fiberglass-reinforced plastic. The batch cleaning system includes a defoamer feed subsystem to inject a defoaming agent to reduce foaming during batch cleaning with hydrochloric acid.

Other batch cleaning solutions are stored in and input from 55-gallon drums or other commercially available containers. Spent solutions must be disposed of offsite.

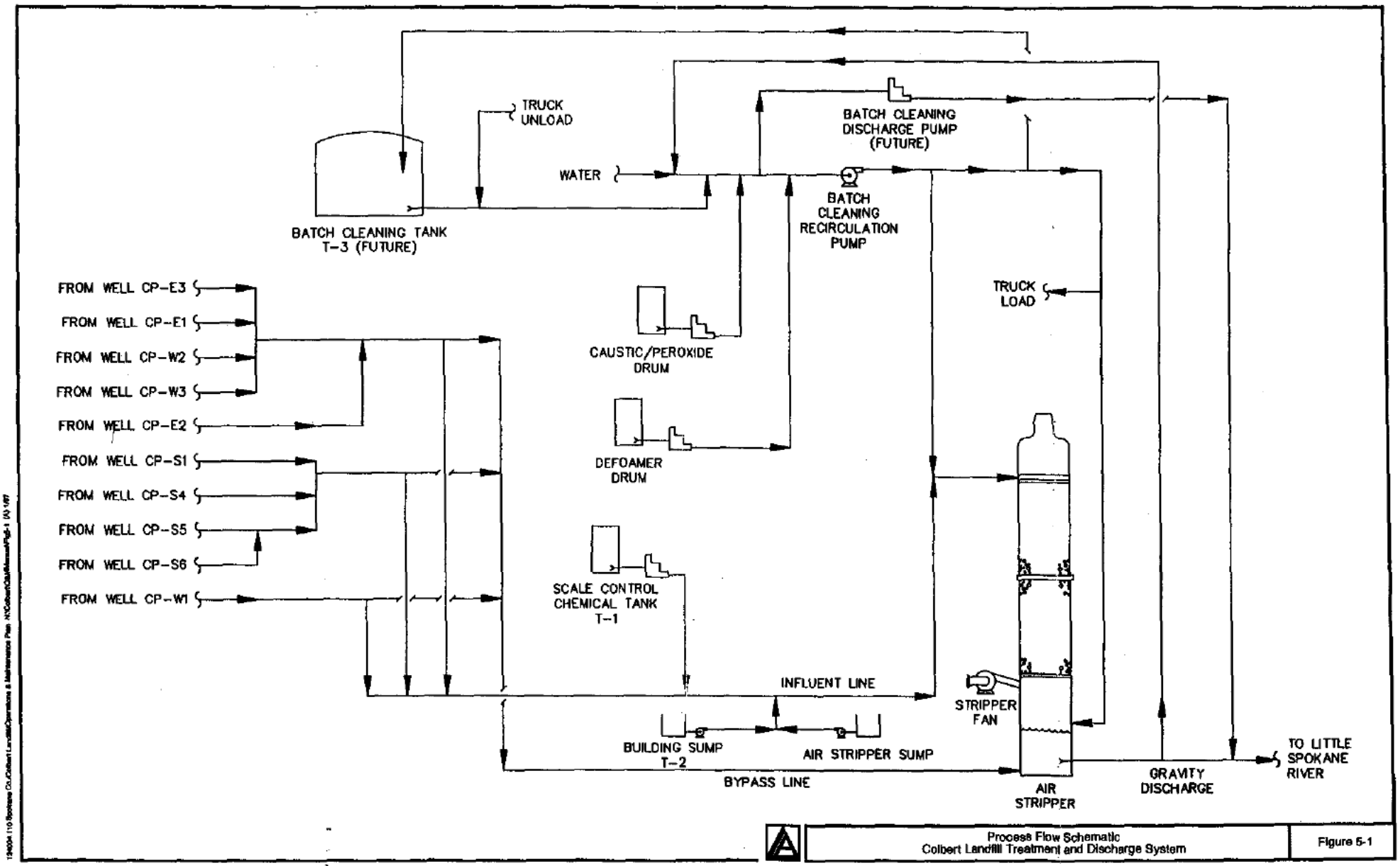
The anticipated quantities of cleaning solutions and dilution water are listed in Table 5-1. These values are estimates based on facility design criteria. These estimates should be evaluated by the facility operator and, based on experience with the facility, adjusted depending upon the severity of the scale buildup or fouling. Adjustments must also be made to the recommended quantities if the concentration of the chemical solutions used is different than listed in Table 5-1. It should be noted that if a hazardous chemical is present at the site in quantity equal to or greater than 10,000 pounds (including dilution water) then certain regulations apply. Volumes of chemicals listed in Table 5-1 (including dilution water) should ensure that quantities remain less than 10,000 pounds.

As mentioned in Section 3.6.5, at the time of completion of this document, tank T-3 is being used to contain condensate from the landfill gas collection system. Operation of the air stripper, thus far, has not required batch cleaning. If, in the future, batch cleaning is required, tank T-3 should be emptied of condensate and cleaned, as necessary, prior to containment of batch treating chemicals.

5.6 SPENT BATCH CLEANING SOLUTION DISPOSAL SYSTEM

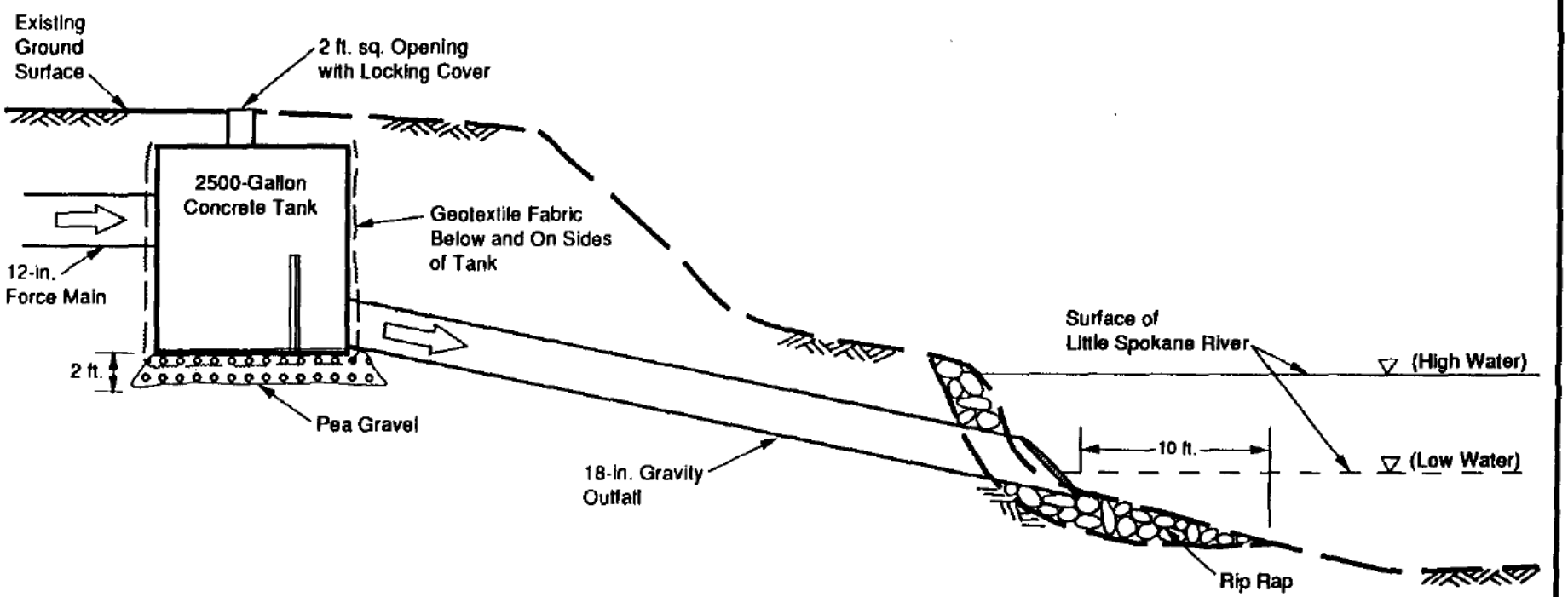
Spent batch cleaning solutions accumulated in tank T-3 must be disposed of at an offsite location. Disposal options are contingent on residual acidity, alkalinity, total dissolved solids, toxicity, etc. Properly neutralized batch cleaning chemicals should not require classification as dangerous waste.

However, information regarding the proper procedure for classification and management of dangerous waste is contained in Appendix A, Environmental Regulatory Compliance.



Process Flow Schematic
Colbert Landfill Treatment and Discharge System

Figure 5-1



Not to Scale

Source: Taylor Engineering, 1991.

Little Spokane River Outfall Section

Figure 5-2

TABLE 5-1

SUMMARY OF ANTICIPATED BATCH CLEANING SOLUTION PARAMETERS

Problem	Batch Cleaning Chemical	Recommended Quantity (gallons)	Dilution Water (gallons)	Application Remarks
Calcium carbonate scale	Hydrochloric acid (37 percent solution)	500	500	Add water to clearwell, then add acid. Recirculate. Transfer to tank T-3. Repeat as necessary.
	Sodium hydroxide (5 percent solution)	100 (use as needed)	None	Use for neutralizing excess acid prior to transfer to tank T-3.
Biological fouling	Hydrogen peroxide (35 percent solution)	100	800	Defoamer solution not required.

6.0 STANDARD OPERATING PROCEDURES

The purpose of this section is to provide practical operating procedures for the proper operation of the various systems. This section also recommends settings for facility hand valves, provides tables of standard operating procedures, describes the fail-safe control mechanisms of the system, and provides an overview of the facility control system.

6.1 RECOMMENDED SETTINGS

For convenience, all hand valves, as well as all other valves and monitoring instruments, have a unique identification code (e.g., HV 20-1) consisting of a two- or three-letter device identification code (i.e., HV for hand valve), followed by a two-digit system code (i.e., 20 for the influent system), followed by a sequence number for designation between similar elements within a system (i.e., 1 for the first hand valve in system 20). All coded components in the facility have engraved tags indicating their identification codes. System codes are summarized in Table 6-1. The recommended normal operating position of hand valves contained in the more frequently operated systems are summarized in Tables 6-2 to 6-7. Device identification codes, process equipment and valve symbols, and instrumentation legends are described on Drawing K-1 of the plans for construction.

The facility control systems in YIC 1 at the main control panel contain numerous preset, but operator adjustable, control and monitoring parameters. Many of these parameters are adjustable from the OIT screens within a limited range of values. Table 6-8 lists both the recommended value and the allowed range of values for these parameters.

Table 6-8 also identifies the OIT screen that the parameter is accessed from and the security level code required for adjustment of each control parameter. Three levels of system access protection exist, each requiring a different password for access. The first level code allows access to the system to scroll through a series of system operation screens. The second level code allows access to edit a limited number of control parameters. Finally, a third level code allows access to edit all adjustable parameters. Passwords are required to access system levels two and three; the passwords should be carefully controlled to ensure that only personnel with appropriate qualifications, level of experience, and understanding of the consequences of altering parameter values can enter the different system levels. Selection of inappropriate parameter values, either singly or by altering multiple related parameters, even within the allowed ranges, have the potential

to upset system operation, possibly resulting in equipment or facility damage. The range of values that the system will accept is limited.

6.2 STANDARD OPERATING PROCEDURES

Standard operating procedures (SOPs) for the facilities are described in Tables 6-10 through 6-38, as summarized in Table 6-9. Piping and instrumentation diagrams for each applicable system are referred to in the SOPs to aid the operator in understanding the location of the equipment involved. Drawing K-1 of the plans for construction presents the device identification codes, process equipment and valve symbols, and instrumentation legends for use in interpreting these diagrams. Each SOP contains the step procedures necessary to perform a specific operation on a specific system. At a minimum, the following procedures are detailed for each system described in this section: pre-start and safety check, startup, routine operation, abnormal operation, and shutdown procedures.

Execution of the step procedures for any activity will likely involve a combination of manual operation of hand valves and equipment and computer-directed operations implemented through the control system at the main control panel. However, nearly all automated equipment are equipped with hand-off-automatic controls that allow local manual operation. Detailed instructions for use of the computer control system at the main control panel can be found in the control system user's manual.

6.3 FAIL-SAFE PROCEDURES

The various systems contain numerous fail-safe control mechanisms to prevent damage to the systems' components in the event of extreme conditions or conditions nearing design criteria. A large number of these mechanisms can be adjusted by the system operator (see Table 6-8). The fail-safe control mechanisms are briefly summarized below. They are implicitly identified in Section 6.4, which describes the instrumentation and control systems, and also in the instrumentation and control user's manual.

- Interconnection of control system for vital system components (groundwater extraction system, air stripping treatment system, security system for treatment facility and well vaults, and safety system including sensored safety showers) with automatic telephone dialing system to immediately alert appropriate facility oversight personnel to problems

- Interconnection of air stripping system fan status, vibration, temperature, air flow, pressure, etc. with fan and overall system controls to automatically initiate shut down of the groundwater extraction and treatment equipment in the event of alarm conditions during operation or startup

- Interconnection of air stripping treatment system and groundwater extraction system via radio frequency modem to coordinate treatment and automatically initiate system shut down in the event of problems

- Interconnection of air stripping treatment system with groundwater extraction system to maintain treatment parameters (i.e., air to water ratio) at present values despite varying groundwater flow rates

- Interconnection of groundwater extraction pump controls with water flow rate or groundwater drawdown depths to maintain optimal remedial operations

- Interconnection of well vault security controls with main control panel to detect unauthorized access

- Interconnection of level sensors in tanks, sumps, and the air stripping tower clear well with valves, pumps, and flow control systems to prevent overfills

- Interconnection of piping pressure and flow meters with pumps and flow control valves to prevent excess pressures and flow and automatically initiate system shut down in the event of problem

- Inclusion of automatic self-regulating heat cable system on certain exterior piping to prevent freeze damage in the event of low ambient temperatures

- Interconnection of temperature sensors and valves to automatically drain certain exterior above-grade piping to prevent freeze damage in the event of low air stripping tower clear well temperatures

- Inclusion of automatic air/vacuum release valves in the groundwater conveyance pipeline

- Inclusion of automatic pressure relief valves in all systems to prevent damage to piping, valves, or pumps in the event of overpressures

- Interconnection of interior building drain sump with building ventilation system to prevent elevated concentrations of chemical vapors in the treatment facility building

- Interconnection of the control system for the groundwater extraction system and air stripping treatment system with the scale control chemical injection system to automatically initiate shut down of all systems if the scale control chemical level in tank T-1 falls below a minimum level, of if scale control chemical feed pumps are disabled

- Interconnection of the control system for the groundwater extraction system and air stripping treatment system with the pH measurement system on the air stripping tower discharge line to automatically initiate shut down of all systems if the pH is outside allowable limits

- Interconnection of the control system for influent line automatic valves with the controls for batch cleaning to automatically isolate influent lines from batch cleaning solutions.

6.4 SUMMARY OF CONTROLS

This section describes in general terms the instrumentation and controls for the groundwater extraction wells, the treatment facility, radio telemetry system, and the automatic telephone dialing alarm system. For detailed information about specific equipment, instruments, and control hardware and software, refer to the manufacturers' literature in the supplemental operations and maintenance manuals.

6.4.1 WELLHEAD INSTRUMENTATION AND CONTROLS

Automatic operation and monitoring of the wellhead equipment (Systems 101 - 111) is accomplished using programmable logic controllers (YICs) installed at the wellhead pump control panels (PCPs). All wells utilize the same control strategy. The discussion presented below is for System 101 at well CP-S1 and it is exemplary of all well systems.

Submersible well pumps are used to pump the groundwater from each well and convey it to the treatment facility through a series of interconnecting pipelines. The quantity of groundwater pumped from each well is monitored by a magnetic flow meter (e.g., FE 101-1). Flow rate (e.g., FIT 101-1) and total accumulated flow (e.g., FQI 101-1) are indicated locally and transmitted to YIC 101. These flow measurements are transmitted by YIC 101 via a radio telemetry system to YIC 1 located at the treatment plant and indicated on the operator interface terminal (OIT) at the main control panel (MCP) on the "Well S-1" screen as FI 101-2 and FQI 101-2, respectively. The water level in the well is monitored and transmitted to a local indicator mounted on the front panel of the PCP and to YIC 101. YIC 101 then transmits to YIC 1 by a radio telemetry system (see Section 6.4.3), which allows the OIT on the well S-1 screen to be indicated as LI 101-2.

The submersible well pump is controlled by a manual-automatic switch, HS 101-1, which is located at the variable frequency drive (VFD) keypad. With this switch in manual mode (control panel), the pump operates continuously from the keypad controls on the VFD panel without regard to automatic interlock controls. In automatic mode, the pump is controlled by YIC 101 based on

either a flow or level control strategy. Pump operation is indicated at the PCP by a green operating light, OL 101-1, and is indicated at treatment plant MCP on the system overview screen as a green "on" light at well S-1 (OL 101-3). Power on is indicated by illumination of an amber light at the PCP as OL 101-2. Motor overload or system failure is indicated at the PCP by illumination of a red alarm light, OA 101-1, and is a red tail light at the MCP on the "system overview" screen. Pump running time is indicated in total cumulative hours at running time meter, KQI 101-1.

YIC 101 controls pump discharge by modulating the input signal to the VFD, which varies the speed of the pump to achieve a preset level of water in well or a preset constant flow. Pump speed is transmitted from the VFD to YIC 101, which in turn transmits to YIC 1 located at the treatment plant. Pump discharge pressure is monitored by PIT 101-1, which sends a signal to YIC 101. Set points for low or high pressure conditions are established at YIC 101 and are interlocked with operation of pump. YIC 101 stops the pump after a preset, but operator adjustable time period, if the pressure is below the low pressure set point or above the high pressure set point. Low and high pressure failure signals are indicated at the PCP by PAL 101-1 and PAH 101-1, respectively. If the pump system fails for high or low pressure, motor overload, or low water level in well, respective alarm lights shall remain illuminated until failure is cleared by pressing the reset switch, HMS 101-1; activation of any of these system failures shall cause YIC 101, through the telemetry system, to activate the general operation alarm, OA 101-2, at the treatment plant MCP for the groundwater extraction well. If a pump operation is interrupted due to power failure, the well pump shall remain off until restarted from the MCP.

The following describes the normal sequence of operation. Assume pump P 101-1 is initially off and HS 101-1 is in auto position, and liquid level in well is above pump stop level. When HS 101, located at the MCP (OIT) at screen 39, located from the level 1 wells screen, is placed into start position, the pump starts at the operator adjustable but preset minimum speed. After a preset time period (adjustable at YIC), and if the discharge pressure is above the low pressure set point (i.e., located at screen 5, well settings) as sensed by PIT 101-1, then YIC 101 signals the VFD to increase the speed of the pump at a preset but operator adjustable rate until liquid level in well reaches preset but operator adjustable level as monitored by LIT 101-1. A proportional integral differential (PID) control strategy is used to adjust the rate and degree speed changes. The level signal is transmitted to the treatment plant and level indicated at MCP as LI 101-2. Levels are indicated as feet above the top of the respective pump. YIC 101 modulates the pump speed to maintain a constant water level in the well according to the set point defined on OIT screen 5. If the

liquid level in well falls below level set point, YIC 101 gradually decreases the speed of the pump at a preset but operator adjustable rate until the liquid level in well reaches the set point liquid level. Additionally, if the level in the well continues to fall, triggering LSL 101-1, YIC 101 energizes the low-level alarm light, LAL 101-1, stops the pump after an operator adjustable but preset time period, and causes YIC 1 to activate red fail light OA 101-2 at the MCP on the system overview screen and a low water level light on well screen 9 at MCP (OIT). An audible alarm is also initiated for the condition. If the alarm is not acknowledged within a preset time period, then YIC 1 will trigger the ADAS to commence alarm notification by telephone.

The groundwater extraction pump process control system features another mode of automatic control based on maintaining a constant groundwater flow rate. Selection of the level or flow mode for automatic control is made through a selector switch located at the PCP. The target flow rate is established at YIC 101 through YIC 1 at the level 1 settings available from the respective well screen. The set point flow rate is operator adjustable. Selection of the mode of operation (i.e., flow or level) and target flow or water level set points is displayed on the well screen. When a groundwater extraction pump is operated in the flow control mode, YIC 101 modulates the speed of the pump through the VFD to maintain constant flow based on the signal received from the in-line groundwater flow meter at the wellhead.

YIC 101 monitors the proper functioning of the variable frequency drive. Specifically, YIC 101 monitors a relay contact (YS 101-2) at the VFD for P 101, which indicates when the VFD is at speed. If YS 101-2 is not triggered within an operator adjustable but preset time period established at YIC 101, YIC 101 activates operation alarms OA 101-1 at the PCP and OA 101-2 at the MCP. YIC 101 also monitors a second relay contact YS 101-3 at the VFD, which signals YIC 101 in the event of a VFD alarm condition. If YS 101-3 is triggered, YIC 101 stops P 101 and activates operation alarms OA 101-1 at the PCP and OA 101-2 at the MCP.

Access doors to the well vault are continuously monitored by YIC 101 to detect both authorized and unauthorized access. A limit switch located on the primary access door to the vault signals YIC 101 whenever the access door is opened. If the opening of the doors is authorized, then a red intruder alarm light is indicated on the respective well screen at the MCP. If the entry is unauthorized, YIC 101 shall stop the pump and signal YIC 1 to activate audible and visual alarms. If the alarm is not acknowledged at the MCP within an operator adjustable but preset time period, YIC 1 triggers the ADAS located at the MCP. The operator interface at the MCP on level 2 of the respective well screen allows the operator to disable the wellhead intruder alarm detection system.

Disabling of the wellhead intruder alarm detection system requires a password and must be implemented on a well-by-well basis.

The floor sump in the well vault is continuously monitored for accumulation of water by a magnetic reed float switch, LSH 101-1. If water accumulates in the vault sump above the set point level, LSH 101-1 signals YIC 101 by a switch contact closure. In turn, YIC 101 activates the high water alarm light LAH 101-1 at the PCP. YIC 101 then stops the pump and signals the MCP of the alarm condition by causing a red fail light OA 101 to be energized on the system overview screen and a red light, LAH 101-2, labeled high sump level to be energized at the MCP at the respective well screen.

6.4.2 TREATMENT FACILITY INSTRUMENTATION AND CONTROLS

This section describes the instrumentation and controls systems for facility systems 20 to 29. Refer to Table 6-1 for identification of these systems. Also, the reader's understanding of the system descriptions will be enhanced if the facility piping and instrumentation drawings are concurrently reviewed.

6.4.2.1 System 20 - Groundwater Influent to Treatment Facility

Groundwater flow to the treatment facility from the conveyance system is monitored by magnetic-type flow meters, FE 20-1, FE 20-2, and FE 20-3, which transmit a flow proportional signal to the programmable logic controller (YIC 1) at MCP. Flow rate (FI) and accumulated total accumulated flow (FQI) are indicated locally and also displayed on the OIT screen 24, influent system. YIC 1 compares the flow rate measured by each flow meter at the treatment facility with the sum of the respective individual flow rates measured by the wellhead flow meters. YIC 1 determines if there is a significant difference in the pumped and received flow rate by comparison to an operator adjustable but preset value. If the difference in the flow rates exceeds the operator adjustable but preset value (e.g., 5 percent), then YIC 1 will shut down those wells conveying water into the pipeline in question and activates flow failure alarms for the affected wells at the MCP. If the alarm condition is not acknowledged within an operator adjustable but preset time period, YIC 1 signals the ADAS of the respective well(s) failure.

YIC 1 sums the flow rates for FE 20-1, FE 20-2, and FE 20-3 and subtracts any measured flow by FE 21-1 to compute the flow conveyed to the air stripping tower. Flow and accumulated flow

conveyed to the tower are indicated at the MCP as plant flow (FI 20-4) and totalized flow (FQI 20-4) on OIT screen 24, "Influent System."

A flow control valve, FCV 20-1, is provided on influent pipeline to regulate the flow of groundwater to the air stripper and to prevent flooding of air stripping tower clear well. Operation of FCV 20-1 is controlled through YIC 1, which modulates the position of FCV 20-1 to maintain adequate free board in the air stripper clear well. The position of FCV 20-1 is indicated at the MCP on OIT screen 24,"Influent System", as ZI 20-1. If the level in the clear well rises above the operator adjustable but preset level established at YIC 1 (OIT screen 25, "Influent Settings"), YIC 1 sends a signal to flow control valve positioner ZC 20-1 to close the valve at an operator adjustable but preset rate until the flow rate is within a defined normal operating range. Position switches on flow control valve signal YIC 1 when the valve is fully open (ZSH 20-1) and fully closed (ZSL 20-1). Liquid level with air stripper clear well is monitored by LE/LT 24-1 and displayed. Pressure upstream of FCV 20-1 is locally indicated and monitored by PIT 20-1, and indicated at the MCP on OIT screen 24, influent system. If the pressure in influent pipeline increases above an operator adjustable but preset value established at YIC 1 OIT screen 25, "Influent Settings" (pipe max press), YIC 1 activates audible and visual alarm, PAH 20-1. If the alarm condition exists after an operator adjustable but preset time delay set on OIT screen 25, "Influent Settings" (over press shutdn), YIC 1 initiates shutdown of the groundwater extraction system and air stripping treatment system, and activates the ADAS.

6.4.2.2 System 21 - Groundwater Bypass System

Operation of the bypass system is governed by the consent decree. DO NOT OPERATE WITHOUT REGULATORY APPROVAL. A bypass pipeline is provided to allow groundwater not requiring treatment to be diverted through the treatment facility and discharged directly into the air stripping tower clear well. Flow through the bypass line is manually controlled and flow rate, if any, is monitored by magnetic flow meter, FE 21-1. A flow proportional signal is transmitted from flow meter transmitter FT 21-1 to YIC 1. Flow rate and accumulated total flow are indicated locally and at MCP as FI 21-1 and FQI 21-1, respectively. Operational graphics for the bypass system are indicated on OIT screen 26. All flow of groundwater bypassing the air stripping tower is recorded by the data logger.

Level control valve LCV 21-1 is provided on bypass pipeline to prevent flooding of air stripping tower clear well. Operation of LCV 21-1 is controlled by YIC 1, which modulates the

position of LCV 21-1 to maintain the liquid level in the clear well as measured by LE 24-1 within a preset but operator adjustable range; the system works in a manner similar to that descried for FCV 20-1. The position of LCV 21-1 is indicated on OIT screen 26, "Bypass System." If the level in the clear well rises above the operator adjustable but preset liquid level YIC 1 signals the level control valve positioner, ZC 21-1, to close the valve at an operator adjustable but preset rate until the liquid level in the clear well is within its defined normal operating range. Position switches on the bypass level control valve signal YIC 1 when the valve is fully open (ZSH 21-1) and fully closed (ZSL 21-1). Pressure upstream of LCV 21-1 is locally indicated and monitored by PIT 21-1. Operating pressure is also indicated on OIT screen 26, "Bypass System." If pressure in bypass pipeline increases above the operator adjustable but preset value established at YIC 1 OIT screen 27, then YIC 1 activates an audible and visual alarm, PAH 21-1. If the alarm condition exists after an operator adjustable but preset time delay, YIC 1 initiates shutdown of the groundwater extraction system and the air stripping treatment system and activates the ADAS.

6.4.2.3 System 22 - Scale Control Chemical Injection System

Scale control chemical is added to the influent water to air stripping treatment systems to inhibit formation of mineral scale composed primarily of calcium carbonate. The scale control chemical injection system consists of a 1,200-gallon scale control chemical storage tank, T-1; duplex metering pumps P 22-1 and P 22-2 for injection of scale control chemical; and scale control chemical transfer drum pump, P 22-3, for bulk transfer of scale control chemical to the storage tank. Status of the scale control system is indicated on OIT screen 28, "Chemical Scale System."

A selector switch, located at MCP on OIT screen 29, "Chemical Scale Settings", controls selection of duty and standby status for scale control chemical injection pumps, P 22-1 and P 22-2. When no duty pump selected, neither pump is operable in the automatic mode. When P 22-1 is selected the duty pump, P 22-2 automatically is assigned as the standby pump in case of failure of the duty pump; similarly, when HS 22-2 is in position 2, P 22-2 is the duty pump with P 22-1 as standby.

An Internal/Off/External selector switch located on the front panel of each scale control chemical injection pump controls the operation of the pump. Operation of each respective scale control chemical feed pump is controlled by HOA switches, HS 22-1 and HS 22-2, respectively, located at the motor starter panel (MSP-1), located in the electrical room. Operating lights and alarm lights are provided for each pump on OIT screen 28, "Chemical Scale System." In hand

position, pump output can be controlled locally at the pump by the stroke frequency and stroke length controls provided with the pump when the selection switch on the pump is set on internal. In auto position, pump output is controlled by YIC 1, which sends a 4-20 mA signal (i.e., proportional to flow rate, as measured by FE 20-4) to the current to frequency converter supplied with each metering pump. The converter sends a pulsed output signal to the pump varying in frequency from 0 to 100 pulses per minute in proportion to input signal.

Flow in the discharge line is monitored by flow switch, PSL 22-1. If the duty pump fails, a drop in pressure in the chemical injection pipeline will occur, triggering low pressure switch PSL 22-1; YIC 1 monitors the switch and activates the pump fail light when PSL 22-1 is triggered, then deactivates the duty pump and starts the standby pump. Operation of the standby pump is similar to that previously described for the duty pump; however, if the standby pump fails after an operator adjustable but preset time delay (i.e., established at OIT screen 29, "Chemical Scale Settings"), YIC 1 initiates shut down of the groundwater extraction system and air stripping treatment system and activates the ADAS.

The level of scale control chemical solution in scale control chemical storage tank T-1 is monitored by level element LE 22-1. Liquid level is indicated locally as percent of tank fullness . Liquid level in tank T-1 is also indicated at the MCP on OIT screen 28, "Chemical Scale System." At an operator adjustable but preset value corresponding to a low liquid level in the tank (LSL 22-1) (i.e., established at OIT screen 29, "Low Tank Level Setpt"), YIC 1 activates level alarm light LAL 22-1 on OIT screen 28, "Chemical Scale System." If the alarm condition is not cleared within an adjustable but preset time period, YIC 1 initiates shut down of groundwater extraction system and air stripping treatment system.

During filling of the tank T-1, at an operator adjustable but preset value corresponding to a high liquid level in the tank (LSH 22-1), YIC 1 activates an audible and visual alarm at the MCP.

The bulk scale control chemical transfer pump, P 22-3, is manually controlled by an ON/OFF hand-switch (HS 22-4) located adjacent to the pump.

6.4.2.4 System 23 - Process Piping Drain System

Two process piping drain valve systems are located at low points on the air stripping treatment system influent and bypass piping to permit draining of the exposed pipelines extending outside the building for freeze protection. The drain system is displayed at the MCP or OIT screen 30. The theory of the operation and control system for each respective drain valve system

is identical. The following description is exemplary of the operation and control system for air stripper treatment system influent drain valve, FV 23-1.

Operation of valve FV 23-1 is controlled by manual-automatic hand switch, HS 23-1, located at the valve. When HS 23-1 is in manual position, the drain valve is manually operable. When HS 23-1 is in the auto position, the position of the valve is controlled by the MCP. In the auto mode and when the valve is fully open, position switch ZSL 23-1 is triggered, thus activating red alarm light OA 23-1 located at the MCP on the drain system screen. Similarly, when HS 23-1 is in the auto position, and YIC 1 causes the valve to close to the degree established by an adjustable stop on the valve, then position switch ZSH 23-1 is triggered activating green operating light OL 23-1 at the MCP on the drain system screen. YIC 1 closes FV 23-1 when either the groundwater extraction system or the air stripping treatment system is operating. If YIC 1 initiates shutdown of the groundwater extraction system and the air stripping treatment system, then YIC 1 opens FV 23-1 after an operator adjustable but preset time period, which is established as "Freeze Protect" hours on OIT screen 51, "Drain System Settings." In case of power failure, FV 23-1 fails open, which is accomplished by interconnection with the UPS power system.

6.4.2.5 System 24 - Air Stripper Treatment System

The air stripping treatment system removes the volatile organic constituents from the influent groundwater over a range of flow rates ranging from 600 to 1,600 gpm. Air to the air stripping tower is supplied from a centrifugal fan powered by variable frequency drive (VFD). The air stripping control system is designed to maintain a constant but operator adjustable air to water ratio when the air stripping treatment system is operated in the COMPUTER controlled mode; as influent groundwater flow rate increases or decreases, as measured by FE 20-4, YIC 1 proportionally increases or decreases the air flow rate supplied to the air stripping tower, as measured by FE 24-1, by signaling the VFD to speed up or slow down the fan. Air output from the fan is adjustable though its variable frequency drive. When hand switch, HS 24-1 (located on the front panel of the VFD), is in computer controlled position, control of fan motor speed is controlled by YIC 1 as function of influent groundwater flow rate to the air stripping treatment system, as measured by FE 20-4. YIC 1 controls the speed of the fan to obtain the operator adjustable but preset ratio of air flow rate to water flow rate as measured by FE 24-1 and FE 20-4, respectively.

When hand switch HS 24-1 is in LOCAL position, fan speed is controlled by the key pad, HIK 24-1, located at the VFD panel. Operating status parameters for the air stripping system are

indicated at the MCP on OIT screen 31. Operating light, OL 24-1, is provided at the MCP. The speed of the fan is locally indicated at the VFD panel by SI 24-1 and at the MCP. Air flow from the fan is confirmed by the in-line vane-type flow switch, FS 24-1. If the flow switch for the fan is not triggered after the fan has been in an operation for operator adjustable but preset time period, then YIC 1 stops the fan, energizes operation alarm OA 24-1, and immediately initiates shutdown of groundwater extraction system and air stripping treatment system and activates the ADAS. Air flow is measured by FE 24-1 and indicated as rate (FI 24-1) and accumulated total flow (FQI 24-1) at the MCP.

Vibration of fan is monitored by vibration switch, VS 24-1, and if triggered, sends a signal to YIC 1, which immediately stops the fan and energizes alarm light, VA 24-1, at the MCP. Vibration switch must be manually reset at the switch.

Differential pressure across air intake filter unit to fan is monitored by differential pressure element, PDE 24-1, and is locally indicated and transmitted to YIC 1 by indicator/transmitter, PDIT 24-1, and indicated at the MCP as PDI 24-1 on OIT screen 47, "Air Stripper System." If differential pressure across filter unit rises above operator adjustable but preset value (e.g., 0.7 W.C.) established at YIC 1 (i.e., at OIT screen 48, "Filter Differ Press Setpt"), then YIC 1 energizes audible and visual alarm PDAH 24-1 at MCP on OIT screen 31, "Air Stripper System.

Temperature of water in clear well of air stripping tower is monitored by temperature transmitter TT 24-1, which sends a temperature proportional signal to YIC 1. Temperature is indicated at the MCP as TI 24-1 on OIT screen 47, "Air Stripper System." At preset but operator adjustable low temperature (i.e., at OIT screen 48, "Cwell Low Temp Setpt"), YIC 1 activates alarm TAL 24-1 at MCP.

Differential pressure across air stripper tower packing is determined by YIC 1 based on signals received from pressure elements PT 24-2 and PIT 24-1. Differential pressure is indicated at the MCP as PDI 24-2 on OIT screen 47, "Air Stripper System" (i.e., DP A.S.). If differential pressure rises to above an operator adjustable but preset value (PDSH 24-1) established at YIC 1 (i.e., at OIT screen 48, "Airstp Differ Press Setpt"), then at PDIT 24-2, YIC 1 energizes audible and visual alarm PDAH 24-2 at the MCP.

Liquid level in air stripping tower clear well is monitored by LE/LT 24-1 and the signal is transmitted to YIC 1. The liquid in the clear well is indicated at the MCP as LI 24-1 on OIT screen 31,"Water Level." If level in clear well rises above the high level setting LSH 24-1, YIC 1 activates LAH 24-1 at MCP on OIT screen 31, "Cwell #", and reduces bypass flow rate as described for System

21, if bypass line is in service; if bypass system is not in service, YIC 1 reduces influent flow rate as described for System 20. If alarm condition exists after operator adjustable but preset time delay, YIC 1 initiates shutdown of groundwater extraction system and air stripping treatment system and activates the ADAS. The high level set point corresponding to LSH 24-1 is operator adjustable from OIT screen 48, "Cwell High Level Setpt."

Liquid level detection switch LSH 24-2 is provided at the allowable high water level in the liquid distributor at the top of air stripping tower. If water (or foam) level in the distributor rises above maximum allowable level, LSH 24-2 triggers YIC 1 to activate high level alarm light, LAH 24-2, at MCP on OIT screen 31, then YIC 1 shuts down the groundwater extraction system and air stripping treatment system after operator adjustable but preset time delay.

The pH of water leaving air stripper tower clear well is monitored by two independent pH analysis elements, AE 24-1 and AE 24-2, respectively. pH as measured by each of these elements is locally displayed by AIT 24-1 and AIT 24-2 and indicated at the MCP. YIC 1 monitors the difference between pH values as measured by the two pH sensors and activates alarm, ADA 24-1, at the MCP if measured difference exceeds an operator adjustable but preset value for an operator adjustable but preset time period, both established at YIC 1 at OIT screen 48, "Air Stripper Settings." If the pH, as measured by either analysis element, exceeds operator adjustable but preset value established at OIT screen 48 ("High pH Set Point"), then YIC 1 activates a high pH alarm, AAH 24-1, at the MCP on OIT screen 31. Similarly, if pH as measured by either analysis element is less than operator adjustable but preset value established at YIC 1, YIC 1 activates low alarm AAL 24-1 at the MCP on screen 31. If after operator adjustable but preset time period the alarm condition is not cleared, YIC 1 shuts down groundwater extraction systems and air stripping treatment system and activates the ADAS.

6.4.2.6 System 25 - Batch Cleaning System

Operation of air stripper treatment system may result in formation of calcium carbonate and/or biological growth on air stripper tower packing. Such scale and biological growth, if allowed to accumulate, will impair the performance of air stripper treatment equipment system. The batch cleaning system is used to remove these accumulated materials from the air stripping tower packing. During batch cleaning process, the groundwater extraction system must be off. Air stripping fan, if operated, shall only be operated in the manual mode.

Operation of batch cleaning pump, P 25-1, is controlled by HOA hand switch HS 25-1 located at the MCP on OIT screen 34. Operation light, OL 25-1, and alarm light, OA 25-1, are provided to indicate pump status at MCP. When HS 25-1 is in hand position, P 25-1 operates without regard to control interlocks provided by YIC 1. When HS 25-1 is placed in auto position, operation of pump P 25-1 is controlled by YIC 1. When HS 25-1 is placed into the auto position, YIC 1 closes FCV 20-1 and LCV 21-1 and receives verification of valve closure by receiving signals from position switches ZSL 20-1 and ZSL 21-1, respectively. YIC 1 will not allow pump P 25-1 to operate in auto mode until these valves are fully closed. If level in clear well as measured by LE 24-1 is within operator adjustable but preset level range (i.e., between the Cwell low level setpt and Cwell high level setpt) established at OIT screen 34, then operator may start the pump by pressing the start, PS 25-1, button on OIT screen 34. YIC 1 shall start pump P 25-1 causing recirculation flow of cleaning solution through air stripping tower. Priming of P 25-1 can be accomplished by adding potable water through operation of HV 29-3. If level in clear well falls below operator adjustable but preset level set point for P 25-1, YIC 1 stops P 25-1.

Successful recirculation system is indicated to YIC 1 by triggering of pressure switch, PS 25-1. If after operator adjustable but preset time period of operation of P 25-1 and PS 25-1 fails to signal YIC 1, then YIC 1 will stop the pump, and activate operation alarm light OA 25-1 on OIT screen 33 at the MCP.

Recirculation flow rate is manually controlled by throttling valve HV 25-3 located on discharge pipeline from pump P 25-1. Recirculated solution flow rate is monitored by FE 25-1 with the resulting flow signal transmitted to YIC 1 by FIT 25-1. YIC 1 indicates the flow rate and calculates the total accumulated flow and displays the resultant as FQI 25-1 at the MCP on OIT screen 33.

YIC 1 through FE 25-1 also serves to assist the operator in controlling the rate and quantity of potable water added to the air stripping tower for both preparation of batch cleaning solution or for system flushing. For both of these conditions, the operator may enter at the MCP a predetermined volume of water to be added to the air stripper tower. After YIC 1 determines that the operator set volume of water has been conveyed to the air stripping tower as calculated from the FT 25-1 signal, YIC 1 initiates an audible and visual alarm at the MCP.

Batch cleaning chemical addition can be accomplished through operation of chemical addition system 26. Batch cleaning defoaming agent can be injected into batch cleaning solution by operation of System 27.

The time required for batch cleaning must be empirically determined. The operator has the option of controlling the batch cleaning cycle based on either the total volume to be recirculated as compared to FQI 25-1 or total time for the solution to be recirculated.

After batch cleaning is determined complete by the operator, operator must manually turn off all batch cleaning chemical addition systems that may have been used during the batch cleaning cycle by placing appropriate hand switches for Systems 26 and 27 in off position. Spent batch cleaning solution may be pumped by P 25-1 from air stripping tower discharge drain pipeline to truck load connection or to batch cleaning tank, T-3. Spent batch cleaning solution may be conveyed by operation of P 25-1 in hand mode to allow the level in the clear well to be pumped below the low clear well level set point. Residual batch cleaning solution must be flushed from the air stripping tower and batch cleaning recirculation piping and appurtenances through manual activation of potable water flush system by operation of HV 29-3. The used flush water should be combined with the residual batch cleaning solution.

Storage tank T-3 is provided as part of the batch cleaning system for accumulation of residual batch cleaning solution. Liquid level in tank is monitored by LE 25-1 and level proportional signal is transmitted by LIT 25-1 to YIC 1. Level in the tank is indicated by LI 25-1 at the MCP on OIT screen 33. Another level sensing device (LSH 25-1) is provided at the batch cleaning storage tank to detect high level condition in the tank caused by foam or liquid. If level in tank rises to level established for LSH 25-1 or other level alarm set point established at YIC 1 for LI 25-1, then both audible and visual alarms (LAH 25-1) are triggered at MCP and YIC 1 stops batch cleaning recirculation pump, P 25-1. Audible alarm is silenced by operator acknowledging alarm condition at MCP; however, alarm light, LAH 25-1, remains energized until alarm condition is cleared.

Spent batch cleaning solution in batch cleaning tank T-3 may be disposed of by transporting to approved disposal facility. Spent batch cleaning solution may be pumped directly from tank truck load connection or through tank truck load connection located on discharge piping from P 25-1 at HV 25-5. Pump 25-1 may be used to convey spent batch cleaning solution to truck by operation of P 25-1 in hand mode; however, use of the portable air diaphragm pump is the preferred means for transferring residual batch cleaning solution from T-3. When HS 25-1 is in hand position, P 25-1 shall operate regardless of signals received at YIC 1; therefore, extreme caution must be exercised by operator to prevent unintentional discharge of spent batch cleaning solution and pump damage. When HS 25-1 is in auto position, P 25-1 shall operate only if YIC 1 signals that liquid level in the

batch cleaning storage tank as measured by LE 25-1 is within operator adjustable but preset range established for operation of P 25-1.

6.4.2.7 System 26 - Batch Cleaning Chemical Feed System

Batch cleaning chemical feed system operates in conjunction with the batch cleaning system described under system 25, if necessary, depending upon the selected chemical composition of the cleaning solution used. Batch cleaning solution chemicals shall be added to batch cleaning solution piping on the suction side of pump P 25-1. Operation of drum pump P 26-1, is controlled through hand switch, HS 26-1, located at pump. Extreme caution shall be exercised by the operator when handling concentrated chemical cleaning solutions. Refer to material safety data sheets, included in Appendix C, for additional personnel and environmental precautions.

6.4.2.8 System 27 - Batch Cleaning Defoamer Feed System

Batch cleaning defoamer feed system operates in conjunction with the batch cleaning system described under System 25, if desired by operator. Batch cleaning defoamer is injected into batch cleaning solution piping on suction side of pump P 25-1. Operation of P 27-1 is controlled through a HOA hand switch HS 27-1 located at unit control panel 27 mounted adjacent to P 27-1. Operating lights, OL 27-1 and OL 27-2, are energized at UCP and MCP (i.e., at OIT screen 33), respectively, when pump is operating. When HS 27-1 is in hand position, P 27-1 operates regardless of any signal received at UCP by YIC 1. When HS 27-1 is in auto position, P 27-1 operates only if YIC 1 signals that P 25-1 is in operation. Flow from batch cleaning defoamer feed pump is monitored by FS 27-1; if YIC 1 fails to detect activation of FS 27-1, as indicated by the flow status indicator on OIT screen 33, after adjustable but preset time period, then YIC 1 stops P 27-1 and activates alarm light OA 27-1 at MCP. YIC 1 stops P 27-1 immediately whenever P 25-1 is OFF, stopped, failed, or in alarm status. Defoamer injection flow rate by P 27-1 shall be manually controlled with the local stroke and pulse frequency controls provided on defoamer feed pump. Defoamer is pumped directly from the defoamer chemical drum. Defoamer level in drum is locally monitored and indicated by LI 27-1.

6.4.2.9 System 28 - Sump Pump System

Sump pump system consists of three separate pumping systems: building drain sump pump (P 28-1); air stripping tower containment area sump pump (P 28-2); and batch cleaning tank

containment sump pump (P 28-3). Building drain sump collects water from several sources within the building and the water is pumped to the air stripping treatment system influent pipeline. Air stripping tower and batch cleaning tank containment area sumps collect rainwater, as well as other water collected in sumps, and conveys it to air stripping treatment system influent pipeline.

Building drain sump system utilizes a submersible sump pump, P 28-1, which is controlled by HOA switch, HS 28-1, located at the motor starter panel (MSP-1) in the electrical room and an off/auto switch on OIT screen 57. When HS 28-1 is placed into the hand position, pump operates without regard to level switch interlocks. When HS 28-1 is placed in the to auto position and the switch at OIT screen 57 is in auto position, P 28-1 operates in response to triggering of a wide angle float level switch. When level of water in building drain sump rises to adjustable but preset level, LS 28-1 is triggered, which in-turn starts pump P 28-1. Pump P 28-1 operates continuously until LS 28-1 signals YIC 1 that level in sump is low; YIC 1 then stops P 28-1. A second level switch, LS 28-2, monitors water level in sump and activates LAL 28-1 if water level falls below preset liquid level or LAH 28-1 if water rises above preset liquid level. If alarm condition due to high water level exists after operator adjustable but preset time delay, YIC 1 shuts down extraction system and air stripping treatment system and activates the ADAS.

A truck unload connection is provided outside the treatment building to accommodate the treatment of well development and purge water that might be transported to the facility by tanker truck for disposal. A motor-actuated valve FCV 28-1 is controlled by YIC 1 through open-close hand switch HS 28-7 located on OIT screen 57 at the MCP. When HS 28-7 is placed into the closed position, YIC 1 sends a signal to valve position controller ZC 28-1 to close the valve. When the valve is fully closed, position switch ZSL 28-1 signals YIC 1; YIC 1 then energizes closed lights: OA 28-2 at MCP on OIT screen 54 and OA 28-3 at UCP 28, which is located outside the treatment building near the truck load connection. When HS 28-7 is placed in the open position, YIC 1 signals ZC 28-1 to open FCV 28-1; position switch ZSH 28-1 signals YIC 1 when FCV 28-1 is open; then YIC 1 energizes OL 28-2 at the MCP and OL 28-3 at UCP 28 indicating to the operator that the truck unload station is ready to receive flow. Operation of FCV 28-1 is interlocked with both HS 28-1 and LS 28-2. If HS 28-1 is not in the auto position or YIC 1 detects a failure of P 28-1 then YIC 1 closes FCV 28-1 and prevents opening of FCV 28-1 if already closed. If YIC 1 detects a high liquid level in the sump as triggered by LS 28-1 (LA 28-1), then YIC 1 closes FCV 28-1.

A leak detection switch AS 28-1 is installed in the annular space beneath and around building drain sump tank T-2 and signals YIC 1 if liquid is detected; Upon receiving leak signal, YIC 1 energizes alarm light AA 28-1 at MCP.

Off-gas from building sump is controlled by operation of exhaust fan EF 28-1 using a hand-off-auto hand switch HS 28-11 located at the MCP on OIT screen 57. A local lock-out-stop hand switch HS 28-10 located on the wall of the building adjacent to the sump prevents power from being applied to fan regardless of position of HS 28-11. When HS 28-11 is in hand position EF 28-1 operates independent of system interlocks. When HS 28-11 is in auto position, EF 28-1 operates on an operator adjustable but present time interval and for an operator adjustable but preset duration established at OIT screen 49. In addition, when HS 28-11 is in the auto position, YIC 1 operates the fan continuously whenever P 28-1 is operating. Operation of the fan is monitored by YIC 1 and indicated at the MCP as OL 28-6 on OIT screen 54; YIC 1 detects fan motor failure and in event of such failure indicates failure at MCP as OA 28-6.

Operation and control of the air stripping tower containment area sump and the batch cleaning tank containment area sump is identical. The former system is described below and is exemplary of both systems.

Air stripping tower containment area sump has submersible sump pump P 28-2 which is controlled by a HOA switch, HS 28-3, located at MSP-1 located in the electrical room and an off/auto switch located on screen 57. In hand position, pump operates without regard to level switch interlocks. When both switches are in the auto position, P 28-2 operates in response to triggering of level switches. When level of water in air stripping tower containment area sump rises to a preset level, LS 28-3 is triggered, which in-turn starts P 28-2. P 28-2 operates continuously until LS 28-3 signals YIC 1 that level in sump is low; YIC 1 then stops P 28-2. A second level switch, LS 28-4, monitors the water level in sump and activates LAL 28-2 if the level in sump falls below or rises above preset liquid levels. If alarm condition due to high water level exists after operator adjustable but preset time delay, YIC 1 shuts down the groundwater extraction system and the air stripping treatment system and activates ADAS.

The temperature of the water in the air stripper tower sump is monitored by temperature transmitter TT 28-1, which sends a signal proportional to temperature to YIC 1. Temperature of the monitored liquid is indicated at the MCP as TI 28-1 on OIT screen 57. An electric-powered submersible unit heater IH 28-1 is installed in the sump to prevent freezing of the residual water in the sump. Operation of the heater is controlled though a hand-off-auto hand switch HS 28-7

located at the MCP. A local lock-out-stop hand switch HS 28-8 interrupts power to the heater if placed in off position. When HS 28-7 is in the hand position, the heater operates without regard to the temperature and level interlocks; however, YIC 1 interrupts the power supply to the heater after a preset time period; if the heater is operated in the hand mode and the timer at YIC 1 times-out, then YIC 1 interrupts the power supply to the heater until the operator resets the system by placing the HS 28-7 in the off position. When HS 28-7 is in the auto position, operation of the heater is controlled by YIC 1 based on the monitored temperature of the liquid in the sump relative to the heater set point temperature established at OIT screen 49. Assuming HS 28-7 is in the auto position, YIC 1 allows IH 28-1 to be energized only if the temperature of the water in the sump is less than the low temperature set point established at OIT screen 49 and the liquid level in the sump is as monitored by LS 28-4 is at or above the pump shut off level. YIC 1 maintains the temperature of the liquid in the sump at the operator adjustable but preset temperature. If the temperature of the liquid in the sump falls 3 degrees below the temperature set point, then YIC 1 activates a low temperature alarm TAL 28-1 at the MCP. If the water level in the sump is below the low water alarm level, then YIC 1 does not energize the heater.

Water accumulation in the floor sump separating the control room from the process area is monitored by a liquid level float switch LSH 28-1. The sump is outfitted with a gravity drain that discharges outside the building onto the paved area on the south side of the building. If water accumulates in the sump, LSH 28-1 signals YIC 1 that the process area is flooded and causes LAH 28-1 to be activated at MCP. If after an operator adjustable but preset time period the alarm condition is not acknowledged at the MCP, YIC 1 shuts down the groundwater extraction system and air stripping treatment system and activates the ADAS.

6.4.2.10 System 29 - Potable and Industrial Water Systems

The potable water system is manually controlled and distributed to several locations within the treatment plant. A cross connection to the potable water system with a reduced pressure double back flow prevention system provides the source water for the industrial water system. Flushing connections are provided from the industrial water system to certain process piping.

Three emergency showers and eye wash units are provided, one in the process area, one in the air stripper tower containment area, and one in the batch cleaning tank containment area. The water supply to each eye wash is monitored by a flow switch, FS 29-1, FS 29-2, and FS 29-3. Flow switches are monitored by YIC 1. If a flow switch is activated, YIC 1 activates an alarm FA 29-1 at

the MCP. If after an operator adjustable but preset time period, the alarm is not acknowledged, YIC 1 activates the ADAS and the security/fire alarm system.

Hose bibs for general industrial water use are provided at numerous locations around the interior and exterior of the treatment facility. Water from these hose bibs originates from the potable water system, but is considered industrial water that is not potable. DO NOT DRINK THIS WATER! Drinking water can be obtained from the facility laboratory sink faucet and toilet room sink faucet.

6.4.3 RADIO TELEMETRY SYSTEM

The radio telemetry system provides for communication of the programmable logic controller at each wellhead (YIC 101 - 111) with the programmable logic controller at the MCP. The system utilizes very high frequency (VHF) radio communication equipment to send control instructions, monitoring data, and status messages between each of the extraction well sites and the treatment facility. Operation of the system is regulated by the Federal Communications Commission (FCC), and the County has a license from the FCC to operate the system; a copy of the license is presented in Appendix E. The system must not be modified without prior approval of the FCC. All antennas serving the well sites are located on dedicated wood utility poles, except for the antenna for well CP-W3, which is located on a light pole in the transfer station. The antennas for the four south extraction wells are mounted on a single common pole. The antennas for wells CP-E1 and CP-E3 are also mounted on a single common pole. All other antennas are individually located. The antenna at the treatment facility for YIC 1 is located at the top of the air stripping tower.

The main telemetry unit (MTU) at the treatment facility interrogates each of the remote telemetry units (RTU) at the wells on a fixed sequence. The MTU makes a preset number of attempts to establish a communication link with each of the respective RTUs. If the link is successful, then the MTU transfers all the set points for that specific well to the RTU, then the RTU transfers the appropriate monitoring data (e.g., pump on/off, flow rate, total accumulated flow, pressure, water level, level or flow mode of control, variable frequency drive output, and any existing alarm conditions) to the MTU. After the data transfer is complete, the MTU sequences to the next RTU in the interrogation sequence. If the communication link is not successful after completing the preset number of attempts, then the MTU records the failed communication attempt and proceeds to the next well site RTU in the interrogation sequence. The MTU continues to

establish a link with each well on each cycle through the interrogation sequence. Once a communication link is successfully made between MTU and RTU, all recorded counts of previously failed communication attempts are cleared. If a communication link cannot be made after a preset number of interrogation cycles, the YIC 1 signals that there is a communication system failure at the respective well. The programmable controller at each well site starts a timer after each communication link with the MTU. If a communication link has not been successfully made after the preset time period established at each respective well site YIC, then the YIC at the well stops the pump.

A radio communication survey for the system was completed prior to its installation and, based on this survey, operating frequencies for the radio telemetry system were selected. This survey indicated that the selected frequencies were not used at the time of the survey in the areas of the wellheads and treatment facility and, therefore, the radio telemetry system would not interfere or conflict with any existing uses of these frequencies or with existing electrical or communications equipment. However, the potential exists that intermittent users of these frequencies were not detected by the radio survey or that new users may attempt to use these frequencies without authorization. Also, randomly generated noise could also affect the system and/or emissions from the system could affect other existing electrical or communications equipment.

The operator should be alert for any communication difficulties and should respond to any citizen complaints of interference. Communications difficulties and interferences, if they occur, will likely be intermittent and beyond the capability of the operator to identify and correct. In the event of difficulties, it is recommended that the operator consult with Electronic System Technology, Kennewick, Washington, who is the equipment manufacturer.

6.4.4 AUTOMATED TELEPHONE DIALING ALARM SYSTEM

The control systems for the groundwater extraction and air stripping treatment systems are designed to allow the systems to operate without continuous operator oversight at the facility. Nevertheless, problems related to these systems or site security may arise that will require prompt attention by qualified personnel. Therefore, the facility is equipped with an ADAS to automatically call into 16 pre-programmed telephone numbers to notify appropriate personnel when problems arise. When activated by YIC 1 at the main control panel in the treatment facility, the ADAS calls the first programmed telephone number and plays appropriate prerecorded messages for the alarm

conditions. If a busy signal or no answer is obtained, the ADAS aborts the call and proceeds to call the next telephone number on the pre-established list of telephone numbers. If the call is answered, the ADAS plays the appropriate prerecorded message and waits for acknowledgment from the person called. If acknowledgment is not received, the ADAS system continues to call the remaining programmed telephone numbers until a call is properly acknowledged. The system then waits a preset but operator adjustable time period. If the problem or alarm condition is not corrected within this time period, the ADAS system initiates the notification cycle again starting with the first phone number on the selected list.

TABLE 6-1

SYSTEM CODES

System Code	Description
20	Influent from groundwater extraction system
21	Air stripping tower bypass system
22	Scale control chemical injection system
23	Automated freeze protection drain system
24	Air stripping treatment fan system
25	Batch cleaning system
26	Miscellaneous chemical feed systems
27	Defoamer feed system
28	Building and contaminant sump systems
29	Potable water system
101	Well CP-S1
103	Well CP-S4
104	Well CP-S5
105	Well CP-S6
106	Well CP-E1
107	Well CP-E2
108	Well CP-E3
109	Well CP-W1
110	Well CP-W2
111	Well CP-W3

TABLE 6-2

SUMMARY OF VALVE SETTINGS FOR ROUTINE OPERATION OF GROUNDWATER EXTRACTION SYSTEM

Valve	Description/Location	Status
HV X-1	Wellhead sample collection valve	Closed
HV X-2	Wellhead pressure indicator isolator	Open
HV X-3	Wellhead discharge	Open

TABLE 6-3

SUMMARY OF VALVE SETTINGS FOR ROUTINE OPERATION OF AIR STRIPPING TREATMENT SYSTEM

Valve	Description/Location	Status
HV 20-1, HV 20-2, HV 20-3	Influent line shut-off	Open
FCV 20-1	Influent line flow control valve	Motorized, automatic operation, normally open
HV 20-4, HV 20-6, HV 20-8, HV 20-10, HV 21-4	Sample line isolation valve	Closed
HV 20-5, HV 20-7, HV 20-9, HV 20-11, HV 21-5, HV 24-2	Sample collection valve	Open
HV 20-12, HV 21-6	Pressure transmitter isolation valve	Open
HV 21-1, HV 21-2, HV 21-3	Bypass isolation valve	Closed
LCV 21-1	Bypass flow control valve	Motorized, automatic operation, normally closed
HV 22-10	Truck unload isolation valve	Closed
HV 22-12	Scale control chemical injection system isolation valve (see Table 6-4 for valve settings for remainder of scale control chemical injection system)	Open
FV 23-1	Air stripper influent pipeline drain (for maintenance and freeze protection)	Motorized, automatic operation, normally closed
FV 23-2	Air stripper bypass pipeline drain (for maintenance and freeze protection)	Motorized, automatic operation, normally closed
HV 24-1	Truck load from air stripping tower	Closed
HV 24-3	Treated groundwater discharge	Open
HV 24-4	Air stripper clear well drain valve	Closed
H 24-5, HV 24-6	pH sensor loop isolation valve	Open
HV 25-5, HV 25-8, HV 25-11	Truck load/unload isolation valve	Closed
HV 25-1, HV 25-2	Batch cleaning recirculation isolation valve	Closed

TABLE 6-3

SUMMARY OF VALVE SETTINGS FOR ROUTINE OPERATION OF AIR STRIPPING TREATMENT SYSTEM

Valve	Description/Location	Status
HV 25-3	Batch cleaning recirculation isolation valve	Closed
HV 25-6	Batch cleaning recirculation isolation valve	Closed
HV 25-7, HV 25-9	Batch cleaning storage tank isolator (see Table 6-5 for valve settings for batch cleaning system)	Closed
HV 25-12	Spare injection/sample port	Closed
HV 25-6	Clear well recirculation system isolation valve	Closed
HV 26-1	Chemical feed system isolation valve	Closed
HV 27-4	Defoamer system isolator (see Table 6-7 for valve settings for defoamer system)	Closed
HV 28-1, HV 28-2, HV 28-3	Sump discharge control (to air stripping tower or truck unload)	Directed to air stripping tower
HV 28-4	Sump discharge isolation valve	Open
HV 29-3	Potable water system isolation valve	Closed

TABLE 6-4

SUMMARY OF VALVE SETTINGS FOR ROUTINE OPERATION OF SCALE CONTROL CHEMICAL INJECTION SYSTEM

Valve	Description/Location	Status
HV 22-1	Tank T-1 discharge	Open
HV 22-2	Scale control chemical calibration cylinder isolation valve	Closed
HV 22-3, HV 22-4, HV 22-5, HV 22-6	Pump P22-1, P22-2 isolation valve	Open
HV 22-7, HV 22-8	Scale control chemical system drain/flush	Closed
HV 22-9	Drum unload isolation valve	Closed
HV 22-10	Truck unload isolation valve	Closed
HV 22-11	Tank fill isolation valve	Closed
HV 22-12	Influent line isolation valve	Open
HV 22-13	Drum unload isolation valve	Closed

TABLE 6-5

SUMMARY OF VALVE SETTINGS FOR BATCH CLEANING SYSTEM

Valve	Description/Location	Status During Routine Operation of Air Stripping Treatment System	Status During Batch Cleaning Startup	Status During Batch Cleaning Routine Operation (Recirculation)
HV 25-1	Air stripping tower discharge line isolator	Closed	Open	Open
HV 25-2	Pump P25-1 upstream shutoff	Closed	Closed	Open
HV 25-3	Influent line isolator	Closed	Closed	Open
HV 25-4	Isolator from air stripping tower discharge line	Closed	Open	Closed
HV 25-5	Truck load isolator	Closed	Closed	Closed
HV 25-6	Clear well return isolator	Closed	Open	Closed
HV 25-7	Tank T-3 isolator	Closed	Closed	Closed
HV 25-8	Truck unload isolator	Closed	Closed	Closed
HV 25-9	Tank T-3 inlet isolator	Closed	Closed	Closed
HV 25-10	Tank T-3 discharge	Closed	Closed	Closed
HV 25-11	Tank T-3 Truck load	Closed	Closed	Closed
HV 25-17, HV 25-18	Pump P25-1 seal flush	Open	Open	Open
HV 25-19	Pump P25-1 seal flush flow control	Open	Adjust as required	Adjust as required

TABLE 6-6

SUMMARY OF VALVE SETTINGS FOR BATCH CLEANING SOLUTION DISPOSAL SYSTEM

Valve	Description/Location	Status During Routine Operation of Air Stripping Treatment System (without BC Solution Disposal)	Status During Spent Batch Cleaning Solution Disposal Startup and Routine Operation
HV 25-1, HV 25-2	Recirculation isolators	Closed	Closed
HV 25-7, HV 25-10	Tank T-3 discharge	Closed	Open
HV 25-12	Isolator, inlet from recirculation line	Closed	Open
HV 25-13	Calibration cylinder isolator	Closed	Closed
HV 25-14	System inlet drain/flush	Closed	Closed
HV 25-15	System discharge drain	Closed	Closed
HV 25-16	Isolator, discharge to air stripping tower discharge line	Closed	Open

TABLE 6-7

SUMMARY OF VALVE SETTINGS FOR ROUTINE OPERATION OF THE DEFOAMER FEED SYSTEM

Valve	Description/Location	Status During Routine Operation of Air Stripping Treatment System	Status During Batch Cleaning
HV 27-1	Drum unload isolator	Closed	Open
HV 27-2	System drain/flush	Closed	Closed
HV 27-3	System drain	Open	Closed
HV 27-4	Recirculation isolator	Closed	Open

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
101 (CP S-1)	Groundwater extraction rate [well flow setpt)	1	38	0 - 90	gpm	90
	Groundwater level set point [well level setpt]	1	38	1 - 19.8	ft	3
	Intruder alarm delay [ack intrdr alarm]	1	38	0 - 300	sec	60
	Start well [start S1]	1	39	--	--	--
	Stop well [stop S1]	1	39	--	--	--
	Radio communication system [reset S1]	1	56	failed/ reset	--	--
	Time delay for alarm on startup [press shtoff pump]	2	5	0 - 300	sec	20
	Pump start speed [pump start speed]	2	5	50 - 100	%	50
	Level PID gain [level pump gain]	2	5	0 - 255	none	5
	Level PID reset [level pump reset]	2	5	0 - 255	resets per minute	10
	Flow PID gain [flow pump gain]	2	5	0 - 255	none	5
	Flow PID reset [flow pump reset]	2	5	0 - 255	resets per minute	20
	Low water level alarm [low water level cutoff]	2	5	1 - 13	ft	1
	High pressure alarm [high press setpt]	2	5	0 - 100	psi	600
	Low pressure alarm [low press setpt]	2	5	0 - 150	psi	10
	Intruder alarm control [well S1 armed]	2	52	armed/ unarmed	--	armed

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
103 (CP S-4)	Groundwater extraction rate [well flow setpt]	1	38	0 - 90	gpm	15
	Groundwater level set point [well level setpt]	2	38	1 - 15.8	ft	2
	Intruder alarm delay [ack intrdr alarm]	1	38	0 - 300	sec	60
	Start well [start S1]	1	39	--	--	--
	Stop well [stop S1]	1	39	--	--	--
	Radio communication system [reset S1]	1	56	failed/ reset	--	--
	Time delay for alarm on startup [press shtoff pump]	2	5	0 - 300	sec	20
	Pump start speed [pump start speed]	2	5	50 - 100	%	50
	Level PID gain [level pump gain]	2	5	0 - 255	none	1
	Level PID reset [level pump reset]	2	5	0 - 255	resets per minute	70
	Flow PID gain [flow pump gain]	2	5	0 - 255	none	1
	Flow PID reset [flow pump reset]	2	5	0 - 255	resets per minute	70
	Low water level alarm [low water level cutoff]	2	5	1 - 9	ft	1
	High pressure alarm [high press setpt]	2	5	0 - 100	psi	60
	Low pressure alarm [low press setpt]	2	5	0 - 150	psi	10
	Intruder alarm control [well S1 armed]	2	52	armed/ unarmed	--	armed

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
104 (CP S-5)	Groundwater extraction rate [well flow setpt]	1	38	0 - 90	gpm	50
	Groundwater level set point [well level setpt]	1	38	1 - 14.8	ft	2
	Intruder alarm delay [ack intrdr alarm]	1	38	0 - 300	sec	60
	Start well [start S1]	1	39	--	--	--
	Stop well [stop S1]	1	39	--	--	--
	Radio communication system [reset S1]	1	56	failed/ reset	--	--
	Time delay for alarm on startup [press shtoff pump]	2	5	0 - 300	sec	20
	Pump start speed [pump start speed]	2	5	50 - 100	%	50
	Level PID gain [level pump gain]	2	5	0 - 255	none	1
	Level PID reset [level pump reset]	2	5	0 - 255	resets per minute	70
	Flow PID gain [flow pump gain]	2	5	0 - 255	none	1
	Flow PID reset [flow pump reset]	2	5	0 - 255	resets per minute	70
	Low water level alarm [low water level cutoff]	2	5	1 - 9	ft	1
	High pressure alarm [high press setpt]	2	5	0 - 100	psi	60
	Low pressure alarm [low press setpt]	2	5	0 - 150	psi	10
	intruder alarm control [well S1 armed]	2	52	armed/ unarmed	--	armed

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
105 (CP S-6)	Groundwater extraction rate [well flow setpt]	1	38	0 - 90	gpm	60
	Groundwater level set point [well level setpt]	1	38	1 - 14.8	ft	5
	Intruder alarm delay [ack intrdr alarm]	1	38	0 - 300	sec	60
	Start well [start S1]	1	39	--	--	--
	Stop well [stop S1]	1	39	--	--	--
	Radio communication system [reset S1]	1	56	failed/ reset	--	--
	Time delay for alarm on startup [press shtoff pump]	2	5	0 - 300	sec	20
	Pump start speed [pump start speed]	2	5	50 - 100	%	50
	Level PID gain [level pump gain]	2	5	0 - 255	none	5
	Level PID reset [level pump reset]	2	5	0 - 255	resets per minute	10
	Flow PID gain [flow pump gain]	2	5	0 - 255	none	5
	Flow PID reset [flow pump reset]	2	5	0 - 255	resets per minute	10
	Low water level alarm [low water level cutoff]	2	5	1 - 9	ft	1
	High pressure alarm [high press setpt]	2	5	0 - 100	psi	60
	Low pressure alarm [low press setpt]	2	5	0 - 150	psi	10
	Intruder alarm control [well S1 armed]	2	52	armed/ unarmed	--	armed

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
106 (CP E-1)	Groundwater extraction rate [well flow setpt]	1	38	0 - 200	gpm	160
	Groundwater level set point [well level setpt]	1	38	1 - 42.8	ft	24
	Intruder alarm delay [ack intrdr alarm]	1	38	0 - 300	sec	60
	Start well [start S1]	1	39	--	--	--
	Stop well [stop S1]	1	39	--	--	--
	Radio communication system [reset S1]	1	56	failed/ reset	--	--
	Time delay for alarm on startup [press shtoff pump]	2	5	0 - 300	sec	20
	Pump start speed [pump start speed]	2	5	50 - 100	%	50
	Level PID gain [level pump gain]	2	5	0 - 255	none	5
	Level PID reset [level pump reset]	2	5	0 - 255	resets per minute	10
	Flow PID gain [flow pump gain]	2	5	0 - 255	none	5
	Flow PID reset [flow pump reset]	2	5	0 - 255	resets per minute	20
	Low water level alarm [low water level cutoff]	2	5	1 - 32	ft	15
	High pressure alarm [high press setpt]	2	5	0 - 100	psi	60
	Low pressure alarm [low press setpt]	2	5	0 - 150	psi	10
	Intruder alarm control [well S1 armed]	2	52	armed/ unarmed	--	armed

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
107 (CP E-2)	Groundwater extraction rate [well flow setpt]	1	38	0 - 8	gpm	4
	Groundwater level set point [well level setpt]	1	38	1 - 40.8	ft	5
	Intruder alarm delay [ack intrdr alarm]	1	38	0 - 300	sec	60
	Start well [start S1]	1	39	--	--	--
	Stop well [stop S1]	1	39	--	--	--
	Radio communication system [reset S1]	1	56	failed/ reset	--	--
	Time delay for alarm on startup [press shtoff pump]	2	5	0 - 300	sec	20
	Pump start speed [pump start speed]	2	5	50 - 100	%	50
	Level PID gain [level pump gain]	2	5	0 - 255	none	5
	Level PID reset [level pump reset]	2	5	0 - 255	resets per minute	50
	Flow PID gain [flow pump gain]	2	5	0 - 255	none	5
	Flow PID reset [flow pump reset]	2	5	0 - 255	resets per minute	20
	Low water level alarm [low water level cutoff]	2	5	1 - 31	ft	2
	High pressure alarm [high press setpt]	2	5	0 - 100	psi	60
	Low pressure alarm [low press setpt]	2	5	0 - 150	psi	10
	Intruder alarm control [well S1 armed]	2	52	armed/ unarmed	--	armed

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
108 (CP E-3)	Groundwater extraction rate [well flow setpt]	1	38	0 - 200	gpm	65
	Groundwater level set point [well level setpt]	1	38	1 - 32.8	ft	17
	Intruder alarm delay [ack intrdr alarm]	1	38	0 - 300	sec	60
	Start well [start S1]	1	39	--	--	--
	Stop well [stop S1]	1	39	--	--	--
	Radio communication system [reset S1]	1	56	failed/ reset	--	--
	Time delay for alarm on startup [press shtoff pump]	2	5	0 - 300	sec	20
	Pump start speed [pump start speed]	2	5	50 - 100	%	50
	Level PID gain [level pump gain]	2	5	0 - 255	none	5
	Level PID reset [level pump reset]	2	5	0 - 255	resets per minute	10
	Flow PID gain [flow pump gain]	2	5	0 - 255	none	5
	Flow PID reset [flow pump reset]	2	5	0 - 255	resets per minute	20
	Low water level alarm [low water level cutoff]	2	5	1 - 24	ft	5
	High pressure alarm [high press setpt]	2	5	0 - 100	psi	60
	Low pressure alarm [low press setpt]	2	5	0 - 150	psi	10
	Intruder alarm control [well S1 armed]	2	52	armed/ unarmed	--	armed

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
109 (CP W-1)	Groundwater extraction rate [well flow setpt]	1	38	0 - 250	gpm	125
	Groundwater level set point [well level setpt]	1	38	1 - 95.8	ft	80
	Intruder alarm delay [ack intrdr alarm]	1	38	0 - 300	sec	60
	Start well [start S1]	1	39	--	--	--
	Stop well [stop S1]	1	39	--	--	--
	Radio communication system [reset S1]	1	56	failed/ reset	--	--
	Time delay for alarm on startup [press shtoff pump]	2	5	0 - 300	sec	20
	Pump start speed [pump start speed]	2	5	50 - 100	%	50
	Level PID gain [level pump gain]	2	5	0 - 255	none	5
	Level PID reset [level pump reset]	2	5	0 - 255	resets per minute	10
	Flow PID gain [flow pump gain]	2	5	0 - 255	none	5
	Flow PID reset [flow pump reset]	2	5	0 - 255	resets per minute	20
	Low water level alarm [low water level cutoff]	2	5	1 - 85	ft	20
	High pressure alarm [high press setpt]	2	5	0 - 100	psi	60
	Low pressure alarm [low press setpt]	2	5	0 - 150	psi	10
	Intruder alarm control [well S1 armed]	2	52	armed/ unarmed	--	armed

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
110 (CP W-2)	Groundwater extraction rate [well flow setpt]	1	38	0 - 250	gpm	130
	Groundwater level set point [well level setpt]	1	38	1 - 55.5	ft	53
	Intruder alarm delay [ack intrdr alarm]	1	38	0 - 300	sec	60
	Start well [start S1]	1	39	--	--	--
	Stop well [stop S1]	1	39	--	--	--
	Radio communication system [reset S1]	1	56	failed/ reset	--	--
	Time delay for alarm on startup [press shtoff pump]	2	5	0 - 300	sec	20
	Pump start speed [pump start speed]	2	5	0 - 100	%	50
	Level PID gain [level pump gain]	2	5	0 - 255	none	5
	Level PID reset [level pump reset]	2	5	0 - 255	resets per minute	10
	Flow PID gain [flow pump gain]	2	5	0 - 255	none	5
	Flow PID reset [flow pump reset]	2	5	0 - 255	resets per minute	20
	Low water level alarm [low water level cutoff]	2	5	1 - 57	ft	5
	High pressure alarm [high press setpt]	2	5	0 - 100	psi	60
	Low pressure alarm [low press setpt]	2	5	0 - 150	psi	10
	Intruder alarm control [well S1 armed]	2	52	armed/ unarmed	--	armed

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
111 (CP W-3)	Groundwater extraction rate [well flow setpt]	1	38	0 - 250	gpm	175
	Groundwater level set point [well level setpt]	1	38	1 - 55.8	ft	42
	Intruder alarm delay [ack intrdr alarm]	1	38	0 - 300	sec	60
	Start well [start S1]	1	39	--	--	--
	Stop well [stop S1]	1	39	--	--	--
	Radio communication system [reset S1]	1	56	failed/ reset	--	--
	Time delay for alarm on startup [press shtoff pump]	2	5	0 - 300	sec	20
	Pump start speed [pump start speed]	2	5	0 - 100	%	50
	Level PID gain [level pump gain]	2	5	0 - 255	none	5
	Level PID reset [level pump reset]	2	5	0 - 255	resets per minute	10
	Flow PID gain [flow pump gain]	2	5	0 - 255	none	5
	Flow PID reset [flow pump reset]	2	5	0 - 255	resets per minute	20
	Low water level alarm [low water level cutoff]	2	5	1 - 43	ft	10
	High pressure alarm [high press setpt]	2	5	0 - 100	psi	60
	Low pressure alarm [low press setpt]	2	5	0 - 150	psi	10
	Intruder alarm control [well S1 armed]	2	52	armed/ unarmed	--	armed

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
20	Wells to treatment facility [flow error; %]	1	25	0 - 100	%	3
	ADAS notification delay [ack flow error]	1	25	0 - 3600	sec	
	Influent pressure alarm [pipe max pressure]	1	25	1 - 100	psi	
	Time delay for overpressure [over press shutdn]	1	25	0 - 3600	sec	
	maximum water in clear well [cwell level setpt]	1	25	0 - 5	ft	
21	Maximum water in clear well [cwell level setpt]	1	27	0 - 5	ft	
	Bypass pressure alarm [over press setpt]	1	27	0 - 100	psi	
	System shutdown acknowledge [ack system shutdn]	1	27	0 - 3600	sec	
	Time delay for overpressure [enable bypass system]	1	27	0 - 3600	sec	
22	Start/stop scale control P22-1 [start/stop P22-1)	1	29	start/ stop	none	start
	Start/stop scale control P22-2 [start/stop P22-2]	1	29	start/ stop	none	stop
	Duty pump selection [P22-1/P22-2]	1	29	no duty/ P22-1/ P22-2	none	P22-1
	Time delay on ADAS for duty and S.B. failure [ack standby fail]	1	29	0 - 1000	hr	72
	Time delay before TF shutdown if chem low [ack no chem scale avail]	1	29	0-7200	min	7200

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
22 (cont.)	[low tank level setpt]	1	29	0 - 10	ft	2
	[high tank level setpt]	1	29	0 - 10	ft	5
23	Influent drain valve [manual/automatic]	1	51	manual/ auto	none	auto
	Influent drain manual close [manual drain valve close]	1	51	close	none	NA
	influent drain manual open [manual drain valve open]	1	51	open	none	NA
	Bypass drain valve [manual/auto]	1	51	manual/ auto	none	auto
	Bypass drain manual close [manual drain valve close]	1	51	close	none	NA
	Bypass drain manual open [manual drain valve open]	1	51	open	none	NA
	Time delay after system shutdown to drain [freeze protect]	1	51	0 - 100	hr	4 (winter) 100 (summer)
24	Air to water ratio set point [air to water ratio]	2	32	20 - 300	none	100
	Enable/disable VFD [enable/disable]	1	48	enable/ disable	none	enable
	Start/stop fan [start/stop]	1	48	start/ stop	none	start
	Time delay to stop - no air flow [shutdown no air flow]	1	48	1 - 300	sec	60
	Air filter different press alarm set point [filter differ press setpt]	1	48	1 - 5	inch water	2
	Clear well low temp set point [cwell low temp setpt]	1	48	32 minimum		

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
24 (cont.)	Air stripper differ press alarm set point [airstp differ press setpt]	1	48			
	Clear well level high shutdown delay [shutdn cwell depth setpt]	1	48	0 - 300	sec	5
	Clear well level high alarm setpt [cwell high level setpt]	1	48	1 - 5	ft	
	Distribution tray high alarm shutdown delay [shutdn high tray]	1	48	0 - 300	sec	
	Different pH alarm set point [excess differ pH setpt]	1	48	1 - 20	0.1 pH units	
	Different pH alarm time delay [excess differ pH duration]	1	48	1 - 1440	minutes	
	High pH alarm set point [high pH setpt]	1	48	7 - 12	pH units	
	Low pH alarm set point [low pH setpt]	1	48	2 - 7	pH units	
	Time delay for system shutdown pH [shutdn pH error]	1	48	1 - 100	hr	
	pH alarm system enabled/disabled [pH system enabled/disabled]	1	48	enabled/ disabled	NA	enabled
	Fan VFD failure reset [reset VFD]	1	48	reset	NA	NA
	Extraction and treatment system shutdown [reset system shutdn]	3	50	reset	NA	NA
	Audible alarms on/off [audible alarms on/off]	3	50	on/off	NA	on

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
25	Clear well high level alarm set point [cwell high level setpt]	1	34	0 -	ft	5
	Low pump discharge press time delay [shutof if no line press]	1	34			
	Total volume for batch cleaning set point [volume solutn setpt]	1	34		gal	
	Batch clean time duration set point	1	34		hr	
	Maximum allowable run time in manual mode [shutof recirc pump manual]	1	34			
	Clear well low level alarm set point [cwell low level setpt]	1	34			
	Batch clean mode volume/time [volume select][time select]	1	34	gal/hr	none	time
	Batch cleaning pump control [P25-1 manual][P25-1 off][P25-1 auto]	1	34	manual/ off/auto	none	off
	Batch clean pump start/stop [start/stop P25-1]	1	34	start/ stop	none	stop
	Batch cleaning tank high level set point [T-3 high level setpt]	1	34	1 - 16	ft	
	Batch cleaning tank low level set point [T-3 low level setpt]	1	34	1 - 16	ft	
27	Time delay - no defoamer flow [defoamer pump alarm time]	1	34	0 - 300	sec	

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
28	Facility shutdown-air strip sump high [shutdn a sump high water]	1	36	0 - 3600	sec	
	Facility shutdown-control room sump high [shutdn water control room]	1	36	0 - 300	sec	
	Facility shutdown batch clean sump high [shutdn BC sump high water]	1	36	0 - 3600	sec	
	Air strip sump heater run time manual [shtoff a sump heater]	1	36	0 - 3600	sec	
	Batch clean sump heater run time manual [shtoff BC sump heater]	1	36	0 - 3600	sec	
	Facility shutdown-building sump high [shutdn B sump high water]	1	49	0 - 3600	sec	
	Building sump exhaust fan run interval [sump ex fan intrvl]	1	49	0 - 240	0.1 hr	
	Building sump exhaust fan run duration [sump ex fan duratn]	1	49	0 - 240	0.1 hr	
	Set point temp for air stripper sump heater [a sump temp heater setpt]	1	49	32 - 70	°F	
	Set point temp for BC sump heater [BC sump temp heater setpt]	1	49	32 - 70	°F	
	Batch cleaning sump pump control [P28-3 off/P28-3 auto]	1	57	off/auto	NA	auto
	Batch cleaning sump heater control [IH 28-2 manual][IH 28-2 off][IH 28-2 auto]	1	57	manual/ off/auto	--	off

TABLE 6-8

LIST OF OPERATOR ADJUSTABLE PARAMETERS

System	Description	Operator Security Level	Operator Interface Screen Number	Range of Values	Units	Recommended Default Value
28 (cont.)	Air stripper sump pump control [P28-2 off/P28-2 auto]	1	57	off/auto	--	auto
	Air stripper sump heater control [IH 28-1 manual][IH 28-1 off][IH 28-1 auto]	1	57	manual/ off/auto	--	off
	Building sump pump control [P28-1 off][P28-1 auto]	1	57	off/auto	--	auto
	Building jump truck load valve [truck valve open/closed]	1	57	open/ closed	--	closed
	Building sump exhaust fan control [EF 28-1 manual][EF 28-1 off][EF 28-1 auto]	1	57	manual/ off/auto	--	auto
29	Time delay to acknowledge safety showed use	1	57	1 - 300	sec	60

TABLE 6-9

INDEX TO STANDARD OPERATING PROCEDURES

Standard Operating Procedure	Table Number
Groundwater extraction system	
Prestart and safety check	6-10
Startup procedure	6-11
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Abnormal operation	6-13
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TABLE 6-9

INDEX TO STANDARD OPERATING PROCEDURES

Standard Operating Procedure	Table Number
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Prestart and safety check	6-33
Startup procedure	6-34
Routine operation	6-35
Abnormal operation	6-36
Shutdown procedure	6-37
Spent batch cleaning solution disposal	6-38

TABLE 6-10

STANDARD OPERATING PROCEDURE
GROUNDWATER EXTRACTION SYSTEM
PRESTART AND SAFETY CHECK

CAUTION: System contains automatic equipment. Do not attempt any repair unless power is off, locked, and tagged out. Enter well vaults only in strict conformance with confined space health and safety procedures.

REFERENCE: Drawings K-2, M-6, and M-7 from Plans for Construction

NOTE: The groundwater extraction system controls and pumps operate automatically. The automatic controls and pumps should only be adjusted by trained and authorized personnel.

Step	Procedure	Information and Details
1	Disable intruder alarm for wells at MCP	Record date and time
2	Complete prestart and safety check for air stripper	Refer to Table 6-21
3	Complete prestart and safety check for conveyance system	Refer to Table 6-15
4	Check equipment and turn on power	Verify that there is no standing water in vault. Do not energize power if ponded water is observed. Remove ponded water with portable air diaphragm pump before entering. Turn on power at WWP meter box. At panel RP-EW energize: a. Programmable logic controller (YIC) UPS b. Telemetry transmitter/receiver (RFM) c. Flow indicating transmitter (FIT) At VFD turn main switch to on: a. Verify VFD setup (refer to Toshiba manual) b. Verify that there are no faults c. Verify cooling fan operating d. Verify air filters are clean

TABLE 6-10

STANDARD OPERATING PROCEDURE
GROUNDWATER EXTRACTION SYSTEM
PRESTART AND SAFETY CHECK

Step	Procedure	Information and Details
5	Verify PCP is energized	a. Amber power indication light illuminated b. No faults (red lights on PCP panel off; if faults record then press reset button c. Open PCP and verify no fault on YIC d. Verify radio power supply is on e. Verify panel fan is operating f. Verify panel fan air filters are clean g. Verify RFM setup code and transmit/receive lights h. Close and latch PCP door
6	Verify valve position	Refer to Table 6-2
7	Check level indicating transmitter	Measure depth to water with manual instrument, record value. Verify calibration of LIT, record differential error; if greater than ±5%, recalibrate probe
8	Check pressure indicating transmitter	Pressure should be greater than zero; if no pressure close groundwater discharge isolation valve from vault. Place VFD in panel mode, increase speed of pump very gradually to pressurize system. (Make sure air tower fan is running if this procedure is done.) Verify PIT operation. If not functioning, complete PIT calibration and validation. Open groundwater discharge isolation valve.
9	Check flow indicating transmitter	Verify setup options; verify that meters read zero. Record total accumulated flow for both direction of flow. If backflow is greater than 10 gallons from prior record, check valve may require cleaning or PSV valve may need adjusting.
10	Check pressure at PIT	If pressure is greater than 2 psi, system is ready. If pressure is 2 psi or less, air must be purged from the conveyance pipeline before starting. Start fan at treatment plant, operate pump VFD in panel control mode at VFD; do not operate pump greater than 50 Hz. Operate pump until discharge pressure is at least 15 psi, stop VFD, place VFD in remote control mode (refer to Toshiba operational manual for details).
11	Secure well vault	Close and lock vault entry doors and main breaker electrical box. Activate intruder alarm at MCP. Verify communication system normal.

TABLE 6-11

STANDARD OPERATING PROCEDURE
GROUNDWATER EXTRACTION SYSTEM
STARTUP PROCEDURE

CAUTION: Do not start more than one groundwater extraction well pump on any respective conveyance pipeline without allowing flow rate to stabilize. Failure to follow the startup procedure will cause extreme water hammer conditions that can severely damage treatment plant and conveyance piping.

Step	Procedure	Information and Details
1	Complete prestart and safety checks for groundwater extraction system	Refer to Table 6-10
2	Verify mode of operation selected for each extraction well flow or level mode	Refer to appropriate extraction well graphics screen at OIT for verification (if mode is incorrect, select on switch at appropriate well PCP to change to desired mode)
3	Verify that appropriate well is normal and scale control and air stripper system is on and normal	Refer to MCP system overview (screen 3) at OIT
4	Set/verify level 2 extraction well control parameters (skip this set if level 2 password is not known; proceed to step 5)	Refer to MCP well settings (screen 5) at OIT. Select appropriate well. Compare values with default setting listed in Table 6-8. Unless operating requirements necessitate, change default values. Record all settings
5	Set/verify level 1 extraction well control parameters	Refer to MCP well settings (screen 38) at OIT. Select well. If flow mode, verify well flow set point. If level mode, verify level set point. Check intruder alarm delay. Refer to Table 6-8 for default settings.
6	Start groundwater extraction pumping	Set OIT 2 to influent graphics (screen 24). From OIT 1 select a well graphics screen go to "wells level 1 settings," OIT screen 38, enter level 1 password; go to "wells controls" OIT screen 39, press "start" button

TABLE 6-11

STANDARD OPERATING PROCEDURE
GROUNDWATER EXTRACTION SYSTEM
STARTUP PROCEDURE

Step	Procedure	Information and Details
7	Monitor extraction well operations functions, compare respective	Set OIT #1 to appropriate extraction well graphics screen. Observe discharge pressure, water level drawdown, and flow rate. Verify that discharge flow rate at the well is being consistently received at the plant as observed from OIT screen 24. The sum of the well flows on each trunk line should be consistently (2 minutes) within 95 percent of the respective trunk line flow rate measured at the treatment plant.
8	Verify air stripper from control is responding to increased groundwater flow and air flow rate is adequate	Calculate required air flow rate using the equation: $Q_{air} = q_{water} \cdot R \cdot 0.134$ where: q_{air} = required air flow rate, cfm q_{water} = groundwater flow rate to air stripper, gpm (FT 20-4) [OIT screen 24] R - air to water ratio (gpm/cfm) [OIT screen 32] 0.134 = conversion factor gpm to cfm Do not start additional groundwater extraction well pumping until air flow rate to air stripper, as observed from OIT screen 31 air stripper system graphics, is greater than 95 percent of calculated air flow requirements.
9	Start additional extraction wells	Complete steps 4 through 7 above for each respective well.

TABLE 6-12

STANDARD OPERATING PROCEDURE
GROUNDWATER EXTRACTION SYSTEM
ROUTINE OPERATION

CAUTION: Failure to disable intruder alarm at MCP prior to entry for each respective well will cause well to automatically shutdown and initiate an alarm condition and alarm record at the treatment plant.

Well vault is a confined space. Use confined space entry procedures. Do not enter well vault alone. Presence of another qualified person with appropriate equipment is required.

Step	Procedure	Information and Details
1	Well vault security	Maintain intruder alarm system in the armed condition (OIT screen 52). Except when operation and maintenance activities require access to well vault.
2	Monthly (unless severe weather conditions) inspect condition at each well vault	a. Disable intruder alarm for each well prior to inspection to avoid well shutdown and alarm condition. b. Inspect air and vacuum relief valve. If leaking, isolate and clean valve in accordance with manufacturers installation (O&M manual equipment volume J). c. Check groundwater extraction rate and total accumulated flow on flow meter at each well; record data on inspection form. d. Check pump discharge pressure transmitter record reading. e. Check pressure relief valve to ensure that flow is not being released down well casing. Valve should have a set point of 60 psi (begins to open at 60 psi). f. Check vault sump for accumulation of groundwater. If water in sump, determine source and take immediate corrective action. g. Ensure all electrical, instrument, and control panels are properly closed and secure. h. Lock well vault covers and arm intruder alarm system when complete.

TABLE 6-12

STANDARD OPERATING PROCEDURE
GROUNDWATER EXTRACTION SYSTEM
ROUTINE OPERATION

Step	Procedure	Information and Details
3	Monthly	a. Perform all biweekly procedures. b. Check calibration of water level indicators using manual probe; record all data. c. Visually observe conditions of each radio telemetry antenna. Use binoculars to perform inspection from ground level. d. Clean or replace air filters on VFD and PCP panels. e. Check operating and exercise UPS power supply at well.

TABLE 6-13

STANDARD OPERATING PROCEDURE
GROUNDWATER EXTRACTION SYSTEM
ABNORMAL OPERATION

Step	Procedure	Information and Details
1	Power failure at treatment facility	All wells should automatically shut down; check alarm printer, or view alarm summary log on PC.
2	Communication failure	Communication failure can occur due to interference from atmospheric and weather conditions, and equipment failure. a. Reset communications at MCP. Verify that communication link is made before attempting to start well (normally 2 minutes is adequate time to wait; depends on setting of timer for poling frequency). b. Check radio modem at well site for proper operation and sensitivity settings; reset and retry. c. Check all radio and power box connections in PCP. d. Check radio antenna at well site for damage. Repair damage and retry. e. Replace radio modem with spare model. Configure replacement modem for specific well site and communication protocol (see O&M manual, equipment volume VI). If successful, send failed radio modem for repair. If not, check software file in YIC (maybe download a copy, file could be corrupted).
3	Low water level alarm	This alarm should only occur when the extraction well is operated in the flow mode and may be an indication of reduction in specific capacity of the well (scale encrustation of well screen, fouling of well or formation), regional subsidence in ground water levels, or failure of the automated level monitoring system. a. Verify low water level alarm set point (OIT screen 5). b. Check linearity and calibration of water level with manual level monitoring instrument before and after starting groundwater extraction pump. c. Reduce groundwater flow rate or operate in level mode. d. Verify PID control parameters gave and reset on pump settings screen (OIT screen 5).

TABLE 6-13

STANDARD OPERATING PROCEDURE
GROUNDWATER EXTRACTION SYSTEM
ABNORMAL OPERATION

Step	Procedure	Information and Details
4	Low pressure alarm	a. Check settings at MCP. b. Check well vault piping for failure. c. Check setting on pressure relief valve. d. Check air/vacuum relief valves. e. Check conveyance piping and appurtenances. f. Check air relief valves.
5	High pressure alarm	a. Check settings at MCP. b. Inspect well vault. c. Reset alarm at PCP. d. Check isolation valve exiting vault to ensure open. e. Verify that all conveyance pipeline valves are open. f. Check calibration of pressure transmitter with test gauge. g. Check water level in air stripper sump and flow control valve (FCV 20-1) at treatment facility. h. Review WinTrend database. i. Verify that treated water discharge valve is open.
6	Sump level high	a. Check well vault for water and leaks in piping. b. Reset alarm at PCP by pressing reset button. c. Start well in manual mode at well to observe source of leak. d. Do not start well in automatic mode until system is verified to be tight (nonleaky). e. Check sump drain, clean if necessary with water vacuum to remove accumulated silt.
7	Intruders	a. Inspect well for unauthorized access. b. Disable intruder alarm at treatment facility and reset alarm at PCP by pressing reset button. c. Inspect intruder alarm limit switch on vault hatch cover. d. Test limit switch if system fails to reset.

TABLE 6-13

STANDARD OPERATING PROCEDURE
GROUNDWATER EXTRACTION SYSTEM
ABNORMAL OPERATION

Step	Procedure	Information and Details
8	VFD at speed failure/VFD failure	a. Inspect VFD at well. b. Verify that power supply is on. c. Check error code on VFD panel. d. Check/clean air filter. e. Verify VFD cabinet A/C unit is actually operating and cooling cabinet. f. Verify that recirculating fans in VFD cabinet are working. g. Operate VFD in panel mode. h. Check/Verify VFD setup parameters. i. Refer to VFD O&M manual.
9	No groundwater flow measured by extraction well flow meter	a. Check that power is on to flow meter. b. Check readout on flow meter. c. Verify well communications and software perfomance at YIC. d. Verify that local water level in well is above top of pump (use manual water level indicator). e. Operate well in local manual (control panel) mode through VFD to verify operation of flow meter. f. Observe pressure and flow if neither pressure or flow change are observed then pump screen or pump could be fouled or riser pipe is disconnected. If pressure and flow respond to manual operation of pump, reset pump to operate in auto mode and check PID setup parameters for respective mode of well operation (flow or level).
10	Flow error	See abnormal operations for groundwater conveyance system.

TABLE 6-14

STANDARD OPERATING PROCEDURE
GROUNDWATER EXTRACTION SYSTEM
SHUTDOWN PROCEDURE

WARNING: Do not shut down groundwater extraction wells simultaneously. Allow sufficient time between successive well shutdown on the same trunk line so that pump discharge pressures and flow rates at the wells and plant are consistent.

Step	Procedure	Information and Details
1	Shutdown groundwater extraction pump	a. Record well discharge flow rate prior to shutting down. b. Record flow rate at respective flow meter at treatment plant. c. Subtract flow rate (a) from (b) and record. d. Enter well controls screen at OIT (screen 39). Locate specific well and press stop button. e. Monitor flow rate on respective trunk line flow meter. f. When flow rate from (e) is consistently approximately within 5 percent (1 minute) of expected rate (c), then proceed with shut down of additional wells on the same trunk line, as necessary. If only one well is operating on the system, it is advisable to lower the flow rate set point to prevent triggering of the low discharge pressure alarm. EMERGENCY: In an emergency situation it is permissible to stop wells simultaneously. However, this practice is very stressful to the piping installation and should be avoided when feasible. Low pressure alarms are likely to be triggered at some or all of the wells if the routine procedure is not followed.
2	Prolonged shut down of wells	a. Close the well installation gate valve (located in the respective well vault) if it is necessary to shut down the well or more than 2 days. b. Open drain valve HV X-1 to drain retained water that might freeze during winter causing instrument, piping, and valve damage. Close HV X-1 after draining is complete. Record flow meter readings, date, time, and reasons for shut down.

TABLE 6-15

STANDARD OPERATING PROCEDURE
GROUNDWATER CONVEYANCE SYSTEM
PRESTART AND SAFETY CHECK

CAUTION: The groundwater extraction and conveyance system contains automatic pumping equipment. Do not shut valves or attempt any repair unless power to affected pumps is off, locked, and tagged out, and appropriate system isolation valves are closed.

REFERENCE: Drawings K-1, and C-1 through C-16 from the Plans for Construction

Step	Procedure	Information and Details
1	Check facilities	Manholes and test connects (including stop and waste drain valves). Report any inconsistencies to responsible personnel.
2	Pressure test pipeline (as necessary)	Refer to Table 6-18 for pressure testing procedures.
3	Check conveyance system isolation valves	System contains both direct burial valves operable by T-bar and handwheel operated valves in manholes. Open all line valves. Verify that all test connection valves and stop and waste drain valves are closed.
4	Check system air/vacuum valves	Inspect valves for proper operation, that isolation valves are open.
5	Check other systems	Check that groundwater extraction system, air stripping treatment system, scale control chemical injection system are ready for service.

TABLE 6-16

STANDARD OPERATING PROCEDURE
GROUNDWATER CONVEYANCE SYSTEM
STARTUP PROCEDURE

Step	Procedure	Information and Details
1	Fill pipeline with water	a. Fill pipeline with potable water through test connection or by operating a single groundwater extraction pump in manual mode. A minimum of three operations personnel are required for this procedure: two at extraction well, one at MCP monitoring. Fill pipeline slowly to avoid potential drainage to piping system components and pump cavitation. Verify air release values are functioning properly.
2	Set flow error limits	a. Input allowable difference (as percentage) between the sum of measured flows and conveyed by the extraction wells with the measured flow at the treatment facility for each respective trunk line. An initial set point for flow error at 3 percent is reasonable. $Flow\ error = \frac{\lvert \sum Q_i - Q_T \rvert}{\sum Q_i}$ $\sum Q_i$ = the sum of the individual flow rates of all the groundwater extraction wells on a respective trunk line, gpm. Q = flow rate as measured at the treatment facility by the respective trunk line flow meter.

TABLE 6-17

STANDARD OPERATING PROCEDURE
GROUNDWATER CONVEYANCE SYSTEM
ROUTINE OPERATION

Step	Procedure	Information and Details	
1	Inspect facilities	Monthly:	inspect and test connections and manholes for leaking piping. Record.
2	Track conveyance system leakage (flow error)	Weekly:	Utilize data in WinTrend database for tracking flow error. Exclude days where system shut down occurs. Follow the procedures outlined below. Select starting date and enter WinTrend database file ACxxxxxx.dbf (xxxxxx = year, month, day). Select the first totalized flow record for the day commencing with column "L." Close the file. Add column "L" through "O" and record value. Add column "P" through "R" plus "T" and "U" and record value in column "S." Close file. Open file AFxxxxxx.dbf for the same day, select column "B" and multiply by 1000, then add column "G" divided by 10. The resultant value is in thousands of gallons (Kgal). Record this value. Subtract values calculated from "AF" files from values calculated from "AC" files, then divide the resultant by the "AC" value; multiply by 100 and the resultant is the flow error in percent. This process of calculating flow errors for each of the trunk line has been automated and is incorporated as a Microsoft Excel V5 macro named "flower.xls."
		Semi annually:	Exercise isolation valves on test connection, main conveyance pipeline, and appurtenance.

TABLE 6-18

STANDARD OPERATING PROCEDURE
GROUNDWATER CONVEYANCE SYSTEM
PRESSURE TESTING PROCEDURE

Step	Procedure	Information and Details
1	Shut down affected systems	Groundwater extraction wells that feed the segment of pipeline to be tested must be shut down. Nonaffected segments of the groundwater extraction system and groundwater conveyance system, as well as all systems at the treatment facility building, can remain in operation.
2	Isolate segment of pipeline	Use pipeline isolation valves in manholes and at buried shutoff accessible using T-bar to isolate the segment of pipeline to be tested (maximum test length is approximately 1,500 ft). Note: Pressure test will be greatly facilitated by testing pipeline before allowing it to drain or allowing air to enter line.
3	Pressurize pipeline segment	Connect small positive displacement-type pump fitted with pressure gauge and isolation valve to pipeline test connection and discharge pressure relief valve (see Drawings C-1 through C-15 in the Plans for Construction). Provide water supply to pump in bucket. Mark water level and cover bucket with plastic to prevent loss of water by evaporation. Pressurize pipeline to 150 psig (Phase II pipeline can be pressurized to 200 psig) by adjusting pressure relief valve to desired pressure. Let pump run continuously. Recover water by hose or piping from relief valve in bucket.
4	Conduct pressure test	Monitor pipeline pressure each hour for 6 hours. Monitor water level in bucket. If necessary, add measured volume of additional water to bucket. At end of test, verify system is at test pressure and determine quantity of water added over entire 6-hour test.

TABLE 6-18

STANDARD OPERATING PROCEDURE
GROUNDWATER CONVEYANCE SYSTEM
PRESSURE TESTING PROCEDURE

Step	Procedure	Information and Details
5	Calculate acceptable leakage rate	$L = \frac{N \times D \times P^{1/2}}{1{,}850}$ Where: L = allowable leakage rate (gallons/hour) N = number of pipe joints (assume every 20 ft) D = nominal pipe diameter (inches) P = test pressure (psig) For example: Assume 1,000 ft of 8-inch diameter pipeline is tested at 150 psig. Assuming a joint every 20 ft yields 50 joints (1,000/20). The allowable leakage rate is: $L = \frac{50 \times 8 \times 150^{1/2}}{1{,}850} = 2.65$ *gallons per hour*
6	Determine pass/fail	If measured leakage rate as determined by water in bucket as applied through pump is less than allowable leakage rate, pressure test passes. Otherwise, test fails.
7	Corrective action for failed test	Verify isolation valves are fully closed and sealed (listen to valve when one side of pipeline is pressurized). Look and listen for leaks at air release valves, block isolation valves, or at test connections. Isolate these components if possible. Repair or replace. Repeat test once to verify leakage rate. If test still fails, notify project manager. DO NOT operate affected groundwater conveyance pipeline and associated extraction pump until problem is corrected.
8	Drain test connection piping	Open stop and waste valve to protect test connection piping from freezing.

TABLE 6-19

STANDARD OPERATING PROCEDURE
GROUNDWATER CONVEYANCE SYSTEM
ABNORMAL OPERATION

Step	Procedure	Information and Details
1	Flow error at MCP	a. Verify that power is on to flow meters at treatment facility. b. Verify communications system between wells and treatment facility. c. Verify that isolation valves are closed at extraction wells that are shut down. d. Check accumulated backflow at extraction wells; check valves may be leaking. e. Check pressure relief valve at wellhead for proper pressure relief setting and proper seating (shut off at normal operating pressures). f. Check air and vacuum relief valves at wellhead and in manholes along pipeline alignment for proper seating; clean or replace leaky air/vacuum valves. g. Field verify pipeline integrity.
2	Reduced flow rates or elevated pressures	a. Verify system shutoff valves are fully open. b. Verify air/vacuum release valves are operative at wells and manholes. c. Pressure test pipeline. Refer to Table 6-18 for pressure testing procedures. d. Check instrumentation and ICM System for malfunction.
3	Elevated flow rates or reduced pressures	a. Check piping in well vaults and manholes for leaks. b. Verify air/vacuum release valves are operative. c. Pressure test pipeline. Refer to Table 6-18 for pressure testing procedures. d. Check instrumentation and ICM System for malfunction.
4	Unequal flow rates at wellheads and treatment facility	a. Check piping in manholes and well vaults for leaks. b. Pressure test pipeline. Refer to Table 6-18 for pressure testing procedures. c. Check instrumentation and ICM System for malfunction.

TABLE 6-19

STANDARD OPERATING PROCEDURE
GROUNDWATER CONVEYANCE SYSTEM
ABNORMAL OPERATION

Step	Procedure	Information and Details
5	Water in manholes	a. Check piping in manholes for leaks. If excessive, shut down pumps to affected section of line and close flow control valves to isolate section until corrective action is completed. If minor, increase inspection frequency and correct at next scheduled maintenance period.

TABLE 6-20

STANDARD OPERATING PROCEDURE
GROUNDWATER CONVEYANCE SYSTEM
SHUTDOWN PROCEDURE

Step	Procedure	Information and Details
1	Brief shutdown	None
2	Prolonged shutdown or preparation for system repair that requires opening pipeline	a. Drain wellhead piping (close well vault isolation valve HV X-3, if necessary. Open drain valve HV X-1. Close HV X-1 when line has finished draining. b. Isolate appropriate trunk line at treatment facility by closing HV 20-1, HV 20-2, HV 20-3, HV 21-1, HV 21-2, and HV 23-3. IMPORTANT: Continuously visually monitor pipeline draining process at each well to ensure well vault does not flood. Clean well vault drainage sump before commencing drainage.

TABLE 6-21

STANDARD OPERATING PROCEDURE
AIR STRIPPING TREATMENT SYSTEM
PRESTART AND SAFETY CHECK

CAUTION: System contains automatic equipment. Do not attempt any repair unless power is off, locked, and tagged out.

REFERENCE: Drawings K-2, K-3, K-4, M-1 through M-4 and M-11 from the Plans for Construction

NOTE: The system controls operate automatically. The automatic controls should only be adjusted by a representative of the manufacturer.

Step	Procedure	Information and Details
1	Check facilities	Treatment facility control room and process area, air stripping tower and containment area, fan room, sumps, louvered inlets, fan ducting, etc. Report any inconsistencies to responsible personnel.
2	Inspect and lubricate fan	Check fan belt for wear. Check fan belt tension; adjust as necessary. Check fan impeller for corrosion and pits. Lubricate fan motor, drive shaft, and bearings. Refer to Section 10.6.
3	Clean fan inlet filter	Remove filters from housing, wash with water, drain, dry, and reinstall. Replace damaged filter elements.
4	Check equipment and turn on power	Fan, fan VFD drive, building exhaust fans, valves, piping, heat tracing (in season), sump pumps (verify sump floats operating), influent flow meters, scale control chemical tank level probe, air stripper sump level probe, MCP.
5	Verify valve settings	See Table 6-3.
6	Verify readiness of other systems	Groundwater extraction system, groundwater conveyance system, scale control chemical injection system.
7	Calibrate pH probes	Record calibration data in facility log.
8	Verify air stripper influent pipeline drain valve system	Valves are closed and in automatic mode.
9	Initiate report generating computer software	Load WinLinks, WinTrend, and Runview, start logging under WinTrend.

TABLE 6-22

STANDARD OPERATING PROCEDURE
AIR STRIPPING TREATMENT SYSTEM
STARTUP PROCEDURE

Step	Procedure	Information and Details
1	Set air to water ratio	Typically this value shall be set at 100 unless testing proves that a lower value will provide adequate treatment. Air to water ratio set point is located on OIT screen 32, which requires the level 2 password.
2	Verify sump pump systems are ready for operation	Sump pump systems are set in automatic mode and are operational. See sump pump systems procedures (Table 6-3 through 6-8).
3	Verify position of influent flow control valve FCV 20-1	Position of valve may be observed from OIT screen 24; valve should be open 100 percent.
4	Verify scale control chemical injection system is ready	Complete startup procedure for scale control chemical system (Table 6-28).
5	Settings for air stripper system are appropriate	Verify settings on OIT screen 48 "air stripper settings" (refer to Table 6-8 for assistance in selecting default values)
6	Complete startup procedure at OIT screen 48	a. Press stop button. b. Press disable button. c. Press VFD reset button. d. Press enable button. e. Press start button. f. Observe that fan is operating from OIT screen 31, Air Stripper System
7	Verify the following:	Observe status of following at OIT screen 31, Air Stripping System: a. Fan is on. b. Fan vibration is normal. c. VFD is at speed. d. VFD output equals 50 percent. e. Air flow is greater than 10,000 cfm. f. Air stripper differential pressure normal. g. Inlet air filter differential pressure normal. h. Distribution tray level is normal. i. Water level in clear well is 0.0.

TABLE 6-22

STANDARD OPERATING PROCEDURE
AIR STRIPPING TREATMENT SYSTEM
STARTUP PROCEDURE

Step	Procedure	Information and Details
8	Start groundwater extraction systems as appropriate	Follow startup procedure for groundwater extraction system (Table 6-11).
9	Start scale control chemical system	Follow startup procedure for scale control chemical system (Table 6-29). Verify/set chemical feed rate after flow rate stabilizes.
10	Check instrument readings and operational status of systems	Verify that system is responding as expected; stop/correct system if alarm conditions occur or are threatened. Observe system frequently during first hour of operation. Verify that data logger is on.

TABLE 6-23

STANDARD OPERATING PROCEDURE
AIR STRIPPING TREATMENT SYSTEM
ROUTINE OPERATION

Step	Procedure	Information and Details
1	Inspect system	Each visit: piping, valves, fan, fan VFD, sumps, air stripping tower
2	Check system monitoring parameters	Each visit: Verify parameter values are stable and within acceptable limits: air flow, fan inlet differential pressure, duct pressure, stack pressure, clear well level, clear well temperature, etc.
3	Check scale buildup	Monthly: Look in clear manway on air stripping tower, remove and evaluate scale coupon.
4	Sample influent and effluent	See Section 8.0 for sampling locations and frequencies and sample analysis procedures.
5	Lubricate equipment	See Section 10.6.
6	Turn on/off heat cable system	Seasonally, as necessary depending upon exterior temperatures.
7	Briefly shut down system for inspection of concealed system elements.	Semiannual. Check fan blade, fan belt, inlet filter and louver, tower liquid distributor, mist eliminator. Clean and adjust as necessary.

TABLE 6-24

STANDARD OPERATING PROCEDURE
AIR STRIPPING TREATMENT SYSTEM
AIR STRIPPING TOWER BYPASS

NOTE: Directs groundwater to air stripping tower clear well instead of top of air stripping tower. No treatment of groundwater is effected. Bypassed groundwater drains to outfall. Bypass of groundwater with contaminant concentrations in excess of allowable discharge limits is not allowed.

Step	Procedure	Information and Details
1	Open bypass shutoff valves	HV 21-1, HV 21-2, HV 21-3
2	Open bypass flow control valve	LCV 21-1
3	Close influent line shutoff valves	HV 20-1, HV 20-2, HV 20-3
4	Other procedures	See Table 6-23 for routine operation

TABLE 6-25

STANDARD OPERATING PROCEDURE
AIR STRIPPING TREATMENT SYSTEM
POTABLE WATER FLUSHING OF AIR STRIPPING TOWER

NOTE: This procedure is for flushing air stripping tower with potable water after routine operation. This procedure is necessary prior to opening or entering tower for maintenance or repair activities. See Section 11.7.5 for air stripping tower entry procedures.

Step	Procedure	Information and Details
1	Shut down all systems	Groundwater extraction system, air stripping treatment system, scale control chemical injection system; or spent batch cleaning solution disposal system
2	Turn on power to pump P25-2	
3	Start seal flushing system for pump P25-2	Connect hose to flushing inlet connection and industrial water hose bib. Open valves HV 25-17, HV 25-18. Set PCV 25-1 to 10 psig. Open industrial water hose bib. Adjust valve HV 25-19 to obtain approximately 0.1 gpm flow. Monitor flow rate and pressure.
4	Close influent valves	HV 20-1, HV 20-2, HV 20-3
5	Close bypass valves	HV 21-1, HV 21-2, HV 21-3
6	Close discharge isolation valve	HV 25-1
7	Open potable water isolation valve	HV 29-3
8	Start pump P25-2	
9	Monitor water flow rate, total water added, line pressure, clear well level	Flush approximately 15 minutes
10	Stop pump P25-2	Turn off power, turn off seal flushing water.
11	Close valves	HV 29-3

TABLE 6-26

STANDARD OPERATING PROCEDURE
AIR STRIPPING TREATMENT SYSTEM
ABNORMAL OPERATION

Step	Procedure	Information and Details
1	Power failure at treatment facility	Automated telephone dialing alarm system (ADAS) will provide notification. Main control panel (MCP) and report generating computer will function for approximately 15 minutes on battery backup (depends on load). Operator interface will not function. Groundwater extraction system will automatically shut down since discharge limits will not be achieved without air flow from fan.
2	Power failure at one or more wells	See Table 6-13 for groundwater extraction system.
3	Fan failure	Shut down all systems. Check fan VFD, attempt to reset if tripped. Check recent air flow rate data and vibration switch data. If within acceptable limits, attempt to restart fan. Visually observe fan operation for vibration noise. If reset is unsuccessful or fan continues to fail, shutdown fan and turn off power at main electrical panel. Consult manufacturer.
4	Insufficient air flow rate and/or excessive pressure drop through inlet filter and/or tower	Shut down all systems. Check fan belt and bearings. Check fan inlet louvers for proper setting, adjust if necessary. Check fan inlet filter, clean if necessary. Check fan inlet ducting and duct expansion joints for defects, correct as necessary. Check scale coupon, perform batch cleaning if necessary. Check mist eliminator, pressure wash if fouled. Check instruments and ICM system for malfunction. In cold weather check for icing in tower (packing material, mist eliminator, etc.) and icing of filters/louvers).
5	Elevated air flow rate or abnormally low pressure drop at inlet and/or tower	Check VFD drive for proper operation. Check fan inlet filter and inlet ducting for holes. Check outlet ducting and duct expansion joints for defects, correct as necessary. Check nozzles and blind flanges for loose or leaking connections, correct as necessary. Check instruments and ICM system for malfunction.
6	Water in process area or containment area	Check piping for leaks. Check recent pressure data for line overpressures. If leakage is excessive, shut down all systems until corrective action is completed. If minor, increase inspection frequency and correct at next scheduled maintenance period. Correct all leaks prior to batch cleaning.

TABLE 6-26

STANDARD OPERATING PROCEDURE
AIR STRIPPING TREATMENT SYSTEM
ABNORMAL OPERATION

Step	Procedure	Information and Details
7	Effluent limits not achieved	a. VOCs: insufficient air flow to remove VOCs. Check setting for air to water ratio. Increase if necessary. Check fan operation, instruments, and ICM system. Check tower for scale or fouling. b. Other constituents: air stripping tower does not remove or alter non-VOC constituents. Sample individual wells to determine the well(s) contributing to the exceedance, and reduce the pump rate(s) of the well(s).
8	Water leaking from fan or duct expansion joints	Air stripping tower operated without running fan; always run fan when pumping water through air stripping tower (even when not required for VOC removal; for example, during potable water flushing).
9	No flow through pH and/or other effluent monitoring instrument piping	Verify shutoff valves to instrument piping are open. Close valve HV 24-3 slightly to achieve full flow in effluent pipe. Clean flow through piping for pH meters. Caution: Closing valve HV 24-3 too much will restrict drainage from air stripping tower clear well causing system shutdown due to high water level in clear well.
10	Water level in air stripping tower clear well too high (>2½ ft)	a. Open effluent valve HV 24-3 (verify monitoring instrument piping to pH and other sensors still have flow). b. Check effluent piping to outfall for damage and/or proper operation of air/vacuum release valves. Check outfall and outfall sediment tank for damage. c. Check air stripping tower clear well, drain, and valve HV 24-3 for sludge/debris.
11	Water level in air stripping tower clear well to high (>2½ ft) and/or fluctuating excessively	Check motorized flow control valve FCV 20-1 for proper operation.

TABLE 6-27

STANDARD OPERATING PROCEDURE
AIR STRIPPING TREATMENT SYSTEM
SHUTDOWN PROCEDURE

Step	Procedure	Information and Details
1	Prior to shutdown (for an extended shutdown period only)	Use all scale control chemical if possible. Pump all water out of the building sump, batch cleaning containment area sump, and air stripper sump to the air stripper for treatment.
2	Shutdown secondary systems	Scale control chemical injection system, spent batch cleaning solution disposal system
3	Shutdown groundwater extraction pumps	See Table 6-14.
4	Turn off power	Turn off power to fan and other equipment if it will not be used for an extended period of time.
5	Prepare system for extended shutdown, if necessary	Arrange for offsite disposal of spent batch cleaning solution, if necessary. Shut down all secondary systems other than those noted in step 6. Dispose of all drummed chemicals at offsite facility. Drain and/or flush with potable water, as appropriate, all secondary systems (piping, pumps, valves, etc.). Pump building sump and batch cleaning containment area sump to storage container if not down previously by manually operating sump pumps (use air operated pump if necessary for final pump out). Shut down all systems. Close valves HV 20-1, HV 20-2, HV 20-3, HV 21-1, HV 21-2, and HV 21-3. Drain influent line and bypass line by opening valves FV 23-1 and FV 23-2. Building sump must then be pumped out into large container to hold until tower is operational again or disposed of property. Clean and lubricate all equipment. Clean fan inlet filters and louvers. Shut off potable water system at HV 29-1, HV 29-3, and unnumbered shutoff at lavatory sink, shower, toilet, laboratory sink, and sample sink. Shut off water to eye washes and emergency showers and drain exterior portions of lines. Shut off water to industrial water line to air stripping tower upper platform; drain exterior portion of line. If extended shutdown during rainy/snowy weather then sump heaters need to be removed if pumps are not operational so heater terminals will not be submerged.

TABLE 6-27

STANDARD OPERATING PROCEDURE
AIR STRIPPING TREATMENT SYSTEM
SHUTDOWN PROCEDURE

Step	Procedure	Information and Details
6	Equipment to remain operative during extended shutdown	HVAC system, heating system: adjust to low setting Building process area exhaust fan system Electric sump heaters (in season) Piping heat tracing (as necessary for undrained lines) Instrumentation and control system (security/fire protection systems only)

TABLE 6-28

STANDARD OPERATING PROCEDURE
SCALE CONTROL CHEMICAL INJECTION SYSTEM
PRESTART AND SAFETY CHECK

CAUTION: Scale control chemical is used to inhibit the deposition of calcium carbonate scale. Review the material safety data sheet for this chemical (see Appendix C) and review the safety procedures in Section 11.0 prior to operating this system.

REFERENCE: Drawings K-3, K-4, M-1 through M-5, and M-9 of the Construction As-Built Drawings

Step	Procedure	Information and Details
1	Inspect facilities	Tank T-1, pumps P22-1 and P22-2, piping, valves, containment structures, sumps, spill response materials
2	Obtain scale control chemical	Polyacrylate scale inhibitor: Allied Colloid DP26 2696 (diluted 1:1 with water), Nalco Chemical Company No. 8357 or equivalent. Store in tank T-1. See Appendix D for material safety data sheets.
3	Verify valve settings	See Table 6-4.
4	Fill tank T-1 with scale control chemical	Close valve HV 22-1. If filling tank from truck, attach hose from tuck unload at valve HV 22-10. Open valve HV 22-10 and verify HV 22-9 is closed. If filling tank from drums, place hose into drum, open valve HV 22-9 and verify valve HV 22-10 is closed. Open valve HV 22-11. Turn on power to pump P22-3. Start pump. Verify positive flow to tank. Monitor fill process as there is no automated overfill protection. Change drums, as necessary, if applicable. If using Allied Colloid or other scale inhibitor that requires dilution with water, attach hosing to pump (P22-3) and drop into tank. Run the pump (approximately 15-20 minutes to mix 1:1 chemical/water ratio). If water was not used for dilution then pump 20 gallons of potable water through system and into tank. Close valves HV 22-9, HV 22-10, and HV 22-11.
5	Verify valve settings	See Table 6-4.

TABLE 6-28

STANDARD OPERATING PROCEDURE
SCALE CONTROL CHEMICAL INJECTION SYSTEM
PRESTART AND SAFETY CHECK

Step	Procedure	Information and Details
6.	Determine scale control chemical input rate	Calculate input rate by: $$Q_{sc} = \frac{Q_l \left(\frac{60\ min}{hr}\right)\left(\frac{3.78\,L}{gal}\right) D_{sc}}{\rho_{sc}\left(\frac{450{,}000\ mg}{lb}\right)}$$ where: Q_{sc} = scale control chemical input rate [gallons per hour (gph)] ρ_{sc} = density of scale control chemical (lb per gallon) Q_l = Flow rate of groundwater through air stripping tower (gpm) D_{sc} = Dosage of scale control chemical per volume water (mg/L)]

TABLE 6-28

STANDARD OPERATING PROCEDURE
SCALE CONTROL CHEMICAL INJECTION SYSTEM
PRESTART AND SAFETY CHECK

Step	Procedure	Information and Details
7	Calibrate feed pumps, P22-1, P22-1, if necessary	Note: Groundwater extraction system and air stripping treatment system must be operating when calibrating feed pumps. Close valves HV 22-5 and HV 22-6. Turn on power to pump P22-1. Run pump for 5 minutes to warm up or longer as necessary (up to 15 minutes) to prime system if it was previously drained. Adjust pump control to achieve desired flow rate for calibration test. Adjust controls to achieve approximately 80 psi backpressure on four-function discharge valve on pump. Stop pump. Fill calibration cylinder by briefly opening valve HV 22-2. Close valve HV 22-1. Start pump and record start time. Monitor drop of fluid level in calibration cylinder. Monitor line pressure at PI 22-1 (20-50 psig is typical). After sufficient time to obtain representative reading from calibration cylinder, stop pump and record stop time. Calculate flow rate by: Flow Rate (cc/sec) = (CalCyl1 - CalCyl2) / time where CalCyl1 and CalCyl2 are the initial and final calibration cylinder values in cubic centimeters (cc) and time is in seconds. Flow Rate (gal/hr) = 0.96 x (CalCyl1 - CalCyl2) / time Repeat for pump P22-1. If results are within 5 percent of initial results, calibration is complete; otherwise repeat third time. If erratic results are obtained, check for proper system configuration and consult manufacturer. Close valves HV 22-3 and HV 22-4. Open valves HV 22-5 and HV 22-6. Repeat calibration test using pump P22-2. Turn off power to pumps.
8	Verify valve settings	See Table 6-4.
9	Pressurize pulsation dampeners	Use compressed air to pressurize to 50 psi.

TABLE 6-29

STANDARD OPERATING PROCEDURE
SCALE CONTROL CHEMICAL INJECTION SYSTEM
STARTUP PROCEDURE

Step	Procedure	Information and Details
1	Start air stripping treatment system and groundwater extraction system	
2	Turn on power to pumps P22-1, P22-2	
3	Start one of the two pumps	Set to automatic operation mode.
4	Monitor flow and pressure	

TABLE 6-30

STANDARD OPERATING PROCEDURE
SCALE CONTROL CHEMICAL INJECTION SYSTEM
ROUTINE OPERATION

Step	Procedure	Information and Details
1	Inspect facilities	Daily or each site visit. Check pumps, piping, valves, and tanks for leaks or deterioration.
2	Check pump status	Daily, or each site visit. In event of pump failure, system controller automatically shuts down first pump and actives second pump. In event of second pump failure, system controller automatically shuts down all systems after preset time delay.
3	Check scale control chemical level, obtain additional as needed.	Weekly, check tank T-1. Consumption of scale control chemical is approximately one tank per 2 months at 1 gallon per hour injection, continuous use.
4	Alternate pump use	Every 2 weeks, shut off active pump and turn on inactive pump.
5	Check pump calibration	Quarterly. See Table 6-28 for calibration procedure.
6	Check piping and tank	Annually. Lines between scale tank and influent need to be cleaned. Tank may also require cleaning.

TABLE 6-31

STANDARD OPERATING PROCEDURE
SCALE CONTROL CHEMICAL INJECTION SYSTEM
ABNORMAL OPERATION

Step	Procedure	Information and Details
1	Reduced pump discharge pressure	Check valve PSV 22-1 or PSV 22-2 as applicable. If valve is stuck open, fluid may circulate back to pump inlet.
2	Elevated pump discharge pressure, reduced flow rate	Check influent line pressure. If pump discharge line pressure is substantially greater than influent line pressure, problem is in scale control chemical injection system piping. Check that valves between tank and influent line are set per Table 6-4. Adjust valve FCV 22-1. Check valve XV 22-1; swing arm may be stuck closed.
3	Pump failure	Check power at circuit breaker. Try other pump to confirm system is properly configured. Check head on failed pump, clean if necessary. If not successful, consult manufacturer.

TABLE 6-32

STANDARD OPERATING PROCEDURE
SCALE CONTROL CHEMICAL INJECTION SYSTEM
SHUTDOWN PROCEDURE

Step	Procedure	Information and Details
1	If for brief shutdown, stop pump	P22-1 or P22-2, as applicable.
2	If not operating for extended time period, secure system prior to shutdown of air stripping treatment system.	Place drum unload stinger connecting at valve HV 22-13 into 5 gallon bucket of water. Stop pump. Close valve HV 22-1. Open valve HV 22-13. Start pump and operate for 15 minutes. Stop pump and close pump isolation valves. Open isolation valves to second pump. Start second pump and operate for 5 minutes. Stop pump. Close valve HV 22-12. Open isolation valves to both pumps. Open valves HV 22-7 and HV 22-8 to drain system. Briefly open pressure relief valves PSV 22-1 and PSV 22-2 as necessary. Elevate and invert drum unload stinger to promote drainage. Close valves HV 22-7 and HV 22-8.

TABLE 6-33

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
PRESTART AND SAFETY CHECK

CAUTION: Batch cleaning requires the use of concentrated, hazardous chemicals including one or more of the following: hydrochloric acid, sodium hydroxide (caustic soda), and hydrogen peroxide. Review the material safety data sheets for these chemicals (see Appendix C) and review the safety procedures in Section 11.0 prior to performing batch cleaning.

REFERENCE: Drawings K-2 through K-4, M-1, M-2, and M-9 from the Construction As-Built Drawings

NOTE: This procedure description is for batch cleaning using hydrochloric acid. Cleaning using hydrogen peroxide or other chemicals is similar, except much less chemical solution is needed and therefore the chemicals will be input to the air stripping tower clear well from drums using system 26. See Section 5.5 for additional details.

Step	Procedure	Information and Details
1	Inspect facilities	Tanks, pumps, piping, valves, containment structures, sumps, spill response materials
2	Obtain batch cleaning chemicals	Hydrochloric acid (see Table 5-1). Arrange delivery in tanker truck just prior to batch cleaning. Transfer acid from tanker truck in small batches (maximum 500 gallons) and only transfer additional acid if and when the previous batch of acid has been completely spent by reaction with the scale. The tanker truck should remain at the facility during batch cleaning to ensure that adequate acid is available and to haul back unused acid.
3	Store chemicals properly	Allowable storage duration is limited. See Appendix A.
4	Check other systems	Air stripping treatment system.
5	Arrange for disposal of batch cleaning solutions	Spent hydrochloric acid solution or any other spent cleaning solutions must be disposed of offsite in accordance with applicable environmental regulations.

TABLE 6-33

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
PRESTART AND SAFETY CHECK

Step	Procedure	Information and Details
6	Clean pump P25-1 inlet strainer	Close valves HV 25-1 and HV 25-2 prior to opening strainer.
7	Verify valve settings for batch cleaning system startup	See Table 6-5.

TABLE 6-34

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
STARTUP PROCEDURE

Step	Procedure	Information and Details
1	Shut down all systems	
2	Close discharge valve	HV 24-3
3	Close pH monitoring loop isolation valves	HV 24-5, HV 24-6
4	Close influent and bypass isolation valves	HV 20-1, HV 20-2, HV 20-3 HV 21-1, HV 21-2, HV 21-3
5	Close influent and bypass flow control valves	FCV 20-1 LCV 21-1
6	Close isolation valves to other systems	FV 23-1, FV 23-2, HV 24-1, HV 26-1, HV 27-4
7	Add potable water to clear well	Fill clear well with 500 gallons of water (approx. 1.7 ft deep) by temporarily opening valve HV 29-3 from potable water system. Open valve HV 25-2. Close valve HV 29-3. Start pump P25-1 to recirculate water through clear well. Check thoroughly for leaks; if any are present - fix before proceeding. Stop pump. Close valve HV 25-4. Open valve HV 25-3. Start pump to recirculate water through tower. Check thoroughly for leaks; if any are present - fix before proceeding. Stop pump.

TABLE 6-34

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
STARTUP PROCEDURE

Step	Procedure	Information and Details
8	Unload a maximum of 500 gallons of hydrochloric acid from tanker truck into air stripping tower clear well	NOTE: Total quantity of cleaning solution and water must not exceed clear well capacity of 3,000 gallons (equivalent to a clear well depth of approximately 5 ft). Use truck unload at valve HV 25-8 in air stripping containment area. Close valve HV 25-3. Open valve HV 25-4. Put on protective clothing (see Section 11.5.2). Connect truck hose to truck unload at valve HV 25-8. Two procedures are available for unloading tanker truck (see below). Procedure 1: Use pump P25-1 to unload truck. Connect industrial water hose to pump flushing inlet connection and industrial water hose bib. Open valves HV 25-17, HV 25-18. Open industrial water hose bib. Set PCV 25-1 to 10 psig. Adjust valve HV 25-19 to obtain approximately 0.1 gpm flow. Monitor seal flushing water flow rate and pressure. Close valve HV 25-1. Open valve HV 25-7 and HV 25-8. Turn on power to pump P25-1. Start pump. Monitor flow rate, line pressure, and clear well level. Check continuously for leakage and terminate fill immediately if detected. When desired quantity of acid is transferred, stop pump. Close valve HV 25-8. Procedure 2: If tanker truck is fitted with pump, use truck load connection at valve HV 25-5. Close valve HV 25-4. Connect truck hose to facility piping. Open valve HV 25-5. Unload acid. Close valve HV 25-5. Alternatively, use truck load connection at valve HV 24-1. connect truck hose to facility piping. Open valve HV 24-1. Unload acid. Close valve HV 24-1.

TABLE 6-35

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
ROUTINE OPERATION

Step	Procedure	Information and Details
1	Verify valve settings for recirculation	See Table 6-5.
2	Verify valve settings for defoamer feed system	See Table 6-7.
3	Start defoamer feed system	Place stinger in drum of defoamer solution. Open valves HV 27-1 and HV 27-4. Start pump P27-1 and adjust to desired flow rate.
4	Recirculate batch cleaning solution	Use pump P 25-1 with seal flush. Set quantity or duration at MCP. Pump will stop automatically. Stop defoamer feed system when pump P25-1 stops.
5	Monitor system parameters	Clear well level and temperature, recirculation flow rate, line pressure, inlet strainer differential pressure, sump levels, pump seal flushing water flow rate and pressure, air stripping tower foam level in liquid distributor, etc.
6	Inspect facilities	Check continuously for leakage and terminate process immediately if detected. Check pump, piping, valves, air stripping tower and containment area, sumps, etc.
7	Prior to pump P 25-1 shutoff, monitor pH.	Open valves HV 24-5 and HV 24-6. Read pH values (allow 2 minutes for readings to stabilize). Check pH periodically until pump P 25-1 stops. Continue recirculation until pH is approximately 4.

TABLE 6-35

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
ROUTINE OPERATION

Step	Procedure	Information and Details
8	Neutralize solution, if necessary	Desired pH of final solution is 6 - 8. Achieving this pH by recirculating batch cleaning solution will take excessively long. Therefore, add sodium hydroxide to solution in clear well to achieve a pH of 6 - 8. NOTE: Add sodium hydroxide periodically in small quantities and allow to recirculate and mix thoroughly before adding more. Complete mixing of sodium hydroxide with clear well solution may take an hour or more. If excess sodium hydroxide is added and pH exceeds 8, add additional acid to neutralize solution. Lesser quantities of sodium hydroxide will cause greater changes to pH value as pH increases from 5 to 7. To add sodium hydroxide, use system 26. Close valve HV 25-3. Open valves HV 25-4 and HV 25-6. Start pump P25-1 in HAND mode. Open valve HV 26-1. Put Pump P26-1 in drum and start pump. Visually monitor liquid level in drum and shutoff pump when desire quantity has been input. Monitor closely; pump capacity is approximately 12 gallons per minute. Continue recirculating clear well solution for 1 hour (or as necessary based on experience) until pH readings stabilize. Add additional sodium hydroxide as needed to achieve desired pH. When pH has been properly adjusted, close valve HV 26-1.
9	Transfer neutralized batch cleaning solution in clear well to tank T-3	Use pump P25-1 in HAND mode with seal flush. Close valves HV 24-5, HV 24-6, and HV 25-6. Open valve HV 25-9. Start pump. Monitor tank liquid level to prevent overfilling. When clear well is mostly empty (approximately 1 ft remaining), stop pump. Close valve HV 25-9.

TABLE 6-35

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
ROUTINE OPERATION

Step	Procedure	Information and Details
10	Repeat startup procedure and routine operation procedures as necessary with additional inputs of water, acid, and sodium hydroxide.	Add 500 gallons of water to the clear well (less water is needed than previously due to solution remaining in clear well from first cleaning). Add acid (500 gallons maximum). After addition of last quantity of acid, flush truck unload line (see step 11). Recirculate solution while adding defoamer. Monitor pH. Adjust pH as necessary with sodium hydroxide. Transfer neutralized solution to tank T-3. NOTE: Prior to transfer of last quantity of solution to tank T-3, flush chemical feed system (see step 12).
11	Flush truck unload line	Note: Have industrial water hose available and ready for operation when handling or servicing acid containing equipment. Wear protective clothing. After acid is transferred and pump P 25-1 is stopped, close valve HV 25-8. Close valves HV 25-7, HV 25-8, and HV 29-3. Disconnect truck hose from truck and place end in air stripping tower containment area sump. Close valves HV 25-1 and HV 25-2. Open valve HV 29-3. Open valve HV 25-8 as necessary to rinse truck unload (collect acidic water in sump). Do not overfill sump. Disconnect hose and rinse hose and hose bib with industrial water. Return to step 10. NOTE: Sump pump P28-2 will automatically pump acidic water to air stripping tower.
12	Flush chemical feed system	Fill empty drum half full of water. Open valve HV 26-1. While operating pump P 25-1, put pump P 26-1 in drum and start pump. Pump drum almost dry. Stop pump. Close valve HV 26-1.

TABLE 6-36

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
ABNORMAL OPERATION

Step	Procedure	Information and Details
1	Elevate differential pressure at basket strainer on pump P25-1 inlet	Clean basket strainer. If concentrated acid in line, attempt to flush first with potable water. Close valves HV 25-1, HV 25-2 and HV 25-7 prior to opening strainer. Use extreme caution and wear protective clothing including respirator with acid gas cartridges. See Section 11.5.2.
2	Pump P27-1 failure	Check circuit breaker. Check operation in hand mode. Check head, clean if necessary. If not successful, consult manufacturer.
3	Pump P25-1 failure	Check circuit breaker. Check operation in hand mode. Check inlet basket strainer, clean if necessary (see symptom 1). If not successful, consult manufacturer.
4	Facility power failure	Turn off power to all equipment. Shut isolation valves as necessary, depending upon activity at time of power failure. When power is restored, restart computer control system and verify proper operation before proceeding. When verified, open isolation valves and restart system at appropriate step.

TABLE 6-37

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
SHUTDOWN PROCEDURE

Step	Procedure	Information and Details
1	Connect hose to pump clear well dry	Connect hose at valve HV 24-4. Fill hose with industrial water (pump P25-1 is not self priming). Connect hose at valve XV 26-1. Open valves HV 24-4, HV 26-1, and HV 25-9. Start pump P25-1. Stop pump immediately at first sign of lost of prime (approximately 1 ft depth in clear well). Close valve HV 26-1.
2	Add potable water to tower for final rinse.	Close valve HV 25-2. Open valve HV 29-3. Fill clear well with 1,000 gallons of water (approximately 1.7 ft deep). Close valve HV 29-3. Open valve HV 25-2.
3	Recirculate water through tower	Close valve HV 25-4. Open valve HV 25-3. Start pump P 25-1 and operate for 15 minutes. Stop pump.
4	Flush defoamer feed system	Place stinger into 5-gallon bucket of water. Start pump P 27-1 and operate for 15 minutes. Stop pump. Close valve HV 27-4. Open valves HV 27-2 and HV 27-3 to drain system. Briefly open pressure relief valve PSV 27-1 as necessary. Elevate and invert drum unload stinger to promote drainage. Close valves HV 27-1 and HV 27-2.
5	Recirculate water through clear well	Close valve HV 25-3. Open valve HV 25-4 and HV 25-6. Start pump P25-1 and operate for 5 minutes.
6	Transfer rinse water to tank T-3.	Use pump P 25-1 in hand mode with seal flush. Close valve HV 25-3 and HV 25-6. Open valve HV 25-9. Start pump. Monitor tank liquid level to prevent overfilling. Before prime is lost, close valve HV 25-1 and open valve HV 26-1. Start pump. Partially close valve HV 25-4 as necessary to reduce flow to delay loss of prime. Stop pump when prime is lost. Stop pump P25-1 seal flushing. Close valves HV 24-4 and HV 26-1. Open valve HV 25-4.
7	Flush pump P 25-1	Close valve HV 25-1. Open valve HV 29-3. Start pump for one minute. Monitor tank liquid level to prevent overfilling. Stop pump. Close valve HV 29-3.

TABLE 6-37

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
SHUTDOWN PROCEDURE

Step	Procedure	Information and Details
8	Turn off power to pump P25-1.	
9	Disconnect hose from HV 24-4 to XV 26-1	Drain and rinse hose to floor drain.
10	Verify closure of shutoff to potable water system	Close HV 29-3.
11	Open valves to drain piping for freeze protection.	HV 25-8.

TABLE 6-38

STANDARD OPERATING PROCEDURE
BATCH CLEANING SYSTEM
SPENT BATCH CLEANING SOLUTION DISPOSAL

Step	Procedure	Information and Details
1	Identify type of waste contained in tank T-3. Select appropriate waste hauler	The facility operator should identify if the spent batch cleaning solution is a dangerous or hazardous waste and coordinate with an appropriate waste hauler to provide for proper truck placarding, manifesting, transportation, and disposal of the waste. The proper procedure for classification and management of dangerous waste is contained in Appendix A.
2	Ensure protective clothing is worn	Facility operator(s) and solution disposal truck driver(s) should wear proper protective clothing. If spent solution is hydrochloric acid that has not been neutralized to pH > 4, protective clothing should include air-purifying respirators with acid gas cartridges.
3	Connect hose from waste hauling truck to tank T-3	Have the waste hauling vacuum truck connect to tank T-3 at the truck load connection, at HV-11, which is located on the north side of tank T-3.
4	Open tank valve	Open HV 25-11
5	Transfer waste solution	Open the appropriate valve(s) on waste hauling truck and vacuum out the spent batch cleaning solution.
6	Wash out residual waste	Industrial water may be used to attempt to rinse out all residual waste solution from the bottom of the tank. To do this, open valves HV 29-3, HV 25-2, HV 25-4, and HV 25-9. Turn on the batch cleaning solution recirculation pump, P 25-1 to pump water into the tank.
7	Stop rinse water	Stop pump P 25-1. Close valves HV 29-3, HV 25-4, and HV 25-9.
8	Remove rinse water	Continue to pump out tank T-3 to transfer out as much rinse water as possible to the waste hauling truck.
9	Close valve and disconnect hose	When tank T-3 has been emptied, close truck load valve HV 25-11. Disconnect the vacuum hose from the truck load connection. Ensure that waste solution remaining in the hose is not spilled and that all waste solution is transferred into the waste hauling truck.

7.0 AQUIFER MANAGEMENT PLAN

This section presents the aquifer management plan for operation of the Colbert Landfill RA. This section provides an explanation of aquifer conditions, the aquifer hydraulic controls needed to meet the project consent decree requirements, the recommended initial operational settings, and the recommended approach to evaluating system performance and implementing system adjustments.

7.1 SUMMARY OF HYDROGEOLOGIC CONDITIONS AND THE EXTENT OF CONTAMINATION

7.1.1 HYDROGEOLOGIC CONDITIONS

The hydrogeologic system in the vicinity of the landfill contains four aquifers (two primary and two secondary) and three aquitards:

- The Upper Sand/Gravel Unit (Unit A) forms the Upper Sand/Gravel Aquifer when underlain by the Lacustrine Unit (Unit B), and is considered a primary aquifer.

- The Lacustrine Unit (Unit B) is the low-permeability unit that separates the Upper Sand/Gravel Unit from the Lower Sand/Gravel Unit and is referred to as the Lacustrine Aquitard. However, the Lacustrine Aquitard contains interbedded, saturated sand layers that appear to be hydraulically connected with the Upper Sand/Gravel Aquifer.

- The Lower Sand/Gravel Unit (Unit C) forms the Lower Sand/Gravel Aquifer, which is a primary aquifer, as well as the regional aquifer for the site.

- The Latah Formation (Unit D), and the Weathered Latah Subunit (Unit D_1), serve as the aquitard underlying the Lower Sand/Gravel Aquifer at most locations and (in combination) are referred to as the Latah Aquitard. However, some low-yield private wells are installed in the Latah Aquitard east of the landfill, where the Upper and Lower Sand/Gravel Aquifers are not present.

- The Basalt Unit (Unit E) forms a secondary aquifer interbedded with the Latah Aquitard and is referred to as the Basalt Aquifer.

- The Granite Unit (Unit F) serves as the lower boundary (aquitard) to the regional flow system, although some low-productivity wells are installed in the upper portion of this unit.

- The Fluvial Unit associated with the Little Spokane River forms the Fluvial (secondary) Aquifer. The Fluvial Aquifer receives recharge from the Upper Sand/Gravel Aquifer.

Units C, D, E, and F are collectively referred to as the "Lower Aquifers" for evaluating regional groundwater flow and contaminant distribution, although the Lower Sand/Gravel Aquifer (Unit C) appears to be the only one of these units capable of sustained yield at high discharge rates.

The Upper Sand/Gravel Aquifer is unconfined, with a depth to water about 90 ft below ground surface in the landfill vicinity. The thickness of the Upper Sand/Gravel Aquifer varies from about 8-20 ft along its north-south trending centerline and decreases as it extends toward the western bluff and eastern hills. Upper Sand/Gravel Aquifer groundwater flow is predominantly toward the south with velocities ranging from 5-7 ft/day (Landau Associates 1991). A groundwater elevation contour map for the Upper Sand/Gravel Aquifer is shown on Figure 7-1.

The Lower Sand/Gravel Aquifer is generally confined west of the landfill and unconfined from the west landfill boundary to the east. The potentiometric surface of the Lower Sand/Gravel Aquifer is about 180 ft below ground surface, and saturated thickness varies from 0 ft east of the landfill to over 200 ft near U.S. Highway 2. Groundwater in the Lower Sand/Gravel Aquifer flows predominantly toward the west at velocities ranging from 0.3 to 0.6 ft/day (Landau Associates 1991).

East of the Lower Sand/Gravel Aquifer, groundwater flow occurs primarily as perched groundwater at the Lower Sand/Gravel Unit interface with the underlying Latah Aquitard and within the Basalt (secondary) Aquifer, although some domestic wells are screened within the Latah and Granite Aquitards. A groundwater elevation contour map for the combined Lower Aquifers is shown on Figure 7-2.

Sections 4.1 and 4.2 of the Phase I Engineering Report (Landau Associates 1991) should be reviewed for a more thorough discussion of Project hydrogeologic conditions.

7.1.2 CONSTITUENT DISTRIBUTION

The Upper Sand/Gravel Aquifer, Fluvial Aquifer, and shallow sand interbeds of the Lacustrine Aquitard are collectively referred to as the Upper Aquifers for assessing the distribution of Constituents of Concern in groundwater. The Lower Sand/Gravel Aquifer, Basalt Aquifer, Latah Aquitard, and Granite Aquitard are similarly referred to as the Lower Aquifers for constituent

distribution evaluation. Figures 7-3 and 7-4 show the distribution of the TCA (the most widely distributed Constituent of Concern) for the Upper and Lower Aquifers, respectively. These figures are based on a supplemental groundwater sampling event conducted by Spokane County in March 1995 and represent the areal extent over which TCA (or one of the other Constituents of Concern) was detected and the area over which TCA (or one of the other Constituents of Concern) exceeded the Performance Standards.

Section 4.3 of the Phase I Engineering Report (Landau Associates 1991) should be reviewed for a more thorough discussion of project water quality conditions.

7.2 INTERCEPTION/EXTRACTION SYSTEM DESIGN

The Phase II South and West Interception Systems design included determining the spacing and discharge rates of extraction wells required to create an effective hydraulic barrier to groundwater contaminant migration in the Upper and Lower Sand/Gravel Aquifers, respectively. East Extraction System design included selecting the location and discharge rates of extraction wells to provide effective groundwater extraction for source control in the Lower Sand/Gravel and Basalt Aquifers.

7.2.1 DESIGN METHOD

Because of the complex hydrogeologic conditions present in the landfill vicinity [see Sections 4.1 and 4.2 of the Phase I Engineering Report (Landau Associates 1991) for a detailed discussion of hydrogeologic conditions], analytical analyses were considered inadequate for South and West Interception System design. MODFLOW (McDonald and Harbaugh 1988), a finite-difference numerical groundwater flow model developed by the U.S. Geological Survey, was utilized to develop separate groundwater flow models for the Upper and Lower Sand/Gravel Aquifers for interception and extraction system design.

Following development of the steady-state (nonpumping) groundwater flow models, extraction well locations were selected for the South and West Interception Systems and the East Extraction System (Figure 7-5).

The capture zones for the interception/extraction systems were estimated using a program that simulated the release of a series of particles upgradient of the extraction wells and perpendicular

to the direction of groundwater flow. Each capture zone was estimated as the zone within which particles are captured by the extraction wells. The well spacing and/or pumping rates were adjusted until the zone of capture for the system was adequate and particles did not escape the system between adjacent extraction wells.

Four extraction wells were required for the South Interception System to achieve adequate plume capture, based on the capture zone analysis previously described and hydrogeologic conditions encountered during Phase II well construction. Model-predicted system pumping rates vary from about 200 gpm to 230 gpm. The model-predicted capture zone for the South Interception System is shown on Figure 7-6, and is based on the upper bound pumping rate of 230 gpm. Estimates of individual and system flow rates are provided in Table 7-1. Estimated prepumping water elevation, minimum water elevation, well drawdown, and available drawdown are provided in Table 7-2.

Because of their interaction, contaminant capture zones for the West Interception and East Extraction Systems were evaluated as a single system. The West Interception and the East Extraction Systems each include three extraction wells, although only two of the East Extraction wells are screened in the Lower Sand/Gravel Aquifer (Extraction Well CP-E2 is screened in the Basalt Aquifer). Model-predicted pumping rates required to obtain capture within the portion of the Lower Sand/Gravel Aquifer impacted by the Constituents of Concern are estimated to vary from about 435 gpm to 745 gpm for the combined flow of the West Interception and East Extraction Systems. The model-predicted capture zone for the West Interception and East Extraction Systems is shown on Figure 7-7, and is based on the estimated upper bound pumping rate of about 745 gpm. Estimates of individual well and system pumping rates are provided in Table 7-1. Estimated extraction well prepumping water elevation, well drawdown, minimum water elevation, and available drawdown are presented in Table 7-2.

7.2.2 REGIONAL DRAWDOWN

Operation of the Phase II Interception and Extraction Systems will result in aquifer drawdown (i.e., lowering the water table or piezometric surface) over a large (regional) area. This regional drawdown has the potential to impact available drawdown for private wells in the vicinity of the RA.

Drawdowns for the Upper and Lower Sand/Gravel Aquifers were estimated using the MODFLOW groundwater flow models developed for interception/extraction system design. Model-estimated regional drawdown resulting from Phase II operation for the Upper and Lower Sand/Gravel Aquifers is presented on Figures 7-8 and 7-9, respectively. Although these estimated drawdowns provide a reasonable approximation of anticipated values, the accuracy of these estimates may decrease as the model boundaries are approached; it is anticipated that observed drawdowns may exceed the predicted values near the model boundaries.

7.3 CONSENT DECREE REQUIREMENTS

The project consent decree specifies the groundwater quality criteria that must be achieved during operation, and to demonstrate completion, of the RA. The consent decree also contains criteria identifying the concentrations at which the need for adjustment or modification of the RA interception/extraction system must be evaluated, as well as providing for reduction in operation requirements if certain conditions are achieved for a specified period of time. These criteria, developed for the Constituents of Concern, are concentration-based and include the project performance standards, evaluation criteria, and operational and adjustment control criteria, defined below.

7.3.1 CONSENT DECREE PERFORMANCE STANDARDS AND EVALUATION CRITERIA

The performance standards are the health-based criteria that must be achieved throughout the aquifers to demonstrate that the RA is complete. The evaluation criteria are the same as the performance standards, except that the criteria for PCE and methylene chloride are higher to address the difficulty in quantifying these constituents at their performance standard concentrations. The evaluation criteria are the criteria specified in the consent decree as the direct or indirect bases for

evaluating performance of the RA interception/extraction system during operation. The performance standards and evaluation criteria are shown in Table 7-3.

7.3.2 CONSENT DECREE OPERATIONAL AND ADJUSTMENT CONTROL CRITERIA

It is recognized in the consent decree that the interception systems may not achieve 100 percent capture. However, the regulatory agencies did not consider the exceedence of project performance standards in downgradient compliance monitoring wells adequately conservative criteria to trigger adjustment or modification to the interception systems. As a result, operational and adjustment control criteria were specified as the basis for adjusting or modifying the interception systems, if these criteria are exceeded in downgradient compliance monitoring wells.

The project consent decree specifies that operational and adjustment control criteria be developed, and once developed, requires that the South and West interception systems be adjusted or modified if these criteria are not achieved in selected downgradient compliance monitoring wells.

Operational and adjustment control criteria are defined in the Consent Decree as follows:

> **Operational Control Criteria:** the chemical criteria that, if exceeded, requires adjustment to the existing interception system. Adjustment may include increasing pumping rates or other adjustments to the existing system to improve interception system efficiency.
>
> **Adjustment Control Criteria:** the chemical criteria that, if exceeded, requires modification to the existing interception system. Modifications may include increasing pumping rates, adding extraction wells to the system, or other methods of correcting interception system deficiencies.

Operational control criteria only apply to TCA and DCA, and only apply to the South Interception System and the portion of the West Interception System that is monitored by the Set A monitoring wells (per Section V.C.2.b of the Consent Decree scope of work). The consent decree specifies that the operational control criteria will be equal to the lesser of 30 percent of the evaluation criteria for TCA and DCA, or 15 percent of the evaluation criteria plus the baseline groundwater concentration (whichever is less).

Adjustment control criteria apply to the indicator compounds specified in the Consent Decree (TCA, DCA, DCE, and TCE) for the South and West Interception Systems. The Consent Decree specifies that the adjustment control criteria will be equal to 65 percent of the evaluation criteria for

the indicator compounds, or 50 percent of the evaluation criteria plus the baseline groundwater concentration (whichever is less)

Operational and adjustment control criteria were calculated as specified in the consent decree, and are presented in Tables 7-8 and 7-9 for the Upper and Lower Sand/Gravel Aquifers, respectively. In all instances, the operational control criteria were calculated as 15 percent of the evaluation criteria, plus the baseline concentration or PQL (as applicable). The adjustment control criteria were calculated as 50 percent of the evaluation criteria, plus the baseline concentration or PQL (as applicable), for TCA, DCA, and DCE. The adjustment control criterion for TCE was calculated as 65 percent of the evaluation criterion.

In all instances, the baseline concentration was greater than the PQL for TCA and the PQL was greater than the baseline concentration for all other indicator compounds (DCA, DCE, and TCE). The PQL was that for EPA Method 8010, as presented in Ecology guidance (Ecology 1995).

For the purposes of this O&M plan, the operator should compare analytical results to the operational and adjustment control criteria. Exceedence of any concentration-based criteria for compliance monitoring wells (i.e., operational or adjustment control criteria) should be identified to the Spokane County project manager for evaluation of appropriate action. Operator-initiated adjustments to the interception/extraction system should be limited to those adjustments described in Section 7.4.2.

The following section presents the development of the baseline groundwater concentrations used for development of operational and adjustment control criteria.

7.3.3 DEVELOPMENT OF BASELINE GROUNDWATER CONCENTRATIONS

As discussed in the previous section, the Consent Decree requires that baseline groundwater concentrations be determined for performance monitoring wells downgradient of the South and West Interception Systems.

The baseline groundwater concentrations provide a mechanism for incorporating the groundwater quality conditions in the vicinity of the performance monitoring wells into the development of the operational and adjustment control criteria. The consent decree specifies that the baseline groundwater concentration for applicable indicator compounds is equal to average of the time-averaged concentrations after the data associated with any gradual changes following

system start up are eliminated (Consent Decree scope of work Sections V.A.2.b and V.C.2.b). The consent decree further states that if the resulting baseline concentration is below the practical quantitation limit (PQL), the PQL will be used as the baseline concentration.

All performance monitoring wells were used in determining baseline concentrations. Monitoring wells CD-31, CD-36, CD-37, and CD-38 were used in determining baseline groundwater concentrations for the Upper Sand/Gravel Aquifer. The three monitoring wells at each of the six West System performance monitoring locations (CD-41, CD-42, CD-43, CD-44, CD-45, and CD-48) were used in determining baseline groundwater concentrations for the Lower Sand/Gravel Aquifer. Monitoring well locations are shown on Figure 7-5.

Baseline groundwater concentrations were developed using the approximately 2 years of monthly groundwater monitoring data collected between June 1994 and April 1996, subsequent to RA system start up in June 1994. These data for the RA downgradient compliance monitoring wells are presented in Tables 7-4 through 7-7 for TCA, DCA, DCE, and TCE (the Consent Decree indicator compounds). As illustrated by these data, none of the indicator compounds were detected in 8 of the 22 downgradient compliance monitoring wells.

Other than detections of DCE and DCA in samples collected from CD-37A1 during the first year of post-RA start up monitoring, TCA is the only Constituent of Concern detected in any downgradient compliance monitoring well on more than one occasion. TCA data for the 2-year monitoring period are plotted on Figures 7-10 through 7-12 for all downgradient compliance monitoring wells in which TCA was detected.

Post-RA start up groundwater quality data were qualitatively inspected for trends in concentrations indicative of short-term conditions following system start up that should not be incorporated into the baseline concentration calculations (per the Consent Decree). TCA data for CD-37A1 (June 1994 through May 1995) and CD-42C2 (June 1994 through March 1995) were excluded from baseline concentration calculations because of short-term concentration trends. Also excluded were DCA data (June 1994 through June 1995) and DCE data (June 1994 through March 1995) for CD-37A1. It is important to recognize that excluding data reduces the baseline concentration, which results in operational and adjustment control criteria that are lower (and thus, more protective of human health and the environment).

Baseline concentrations were calculated by dividing the sum of all the applicable data by the number of data points (i.e., an arithmetic average) excluding those data eliminated because of short-term concentration trends (as previously discussed). For instances where a constituent was not detected, half the detection limit was used for baseline concentration calculations. Calculated baseline concentrations for the indicator compounds are presented in Tables 7-8 and 7-9 for the Upper and Lower Sand/Gravel Aquifers, respectively. As specified in the consent decree, separate baseline concentrations were calculated for Set A (CD-41, CD-42, and CD-48 monitoring locations) and Set B (CD-43, CD-44, and CD-45 monitoring locations) wells.

7.3.4 CONSENT DECREE MONITORING, OPERATION, AND SHUTDOWN CRITERIA

The consent decree specifies a number of criteria that affect monitoring, operation, and shutdown of the RA. Although the decision to adjust or modify the operation of the RA based on exceedence or achievement of these criteria (as applicable) should be made by the Spokane County project manager (in conjunction with EPA and Ecology), it is important that the operator understand the decision process for these activities so that operational adjustments are consistent with the consent decree requirement. Figure 7-13 illustrates the decision logic for groundwater monitoring for the South and West Interception Systems associated with the consent decree. Figure 7-14 illustrates the decision logic for operation and shutdown of the South and West Interception Systems as specified in the consent decree.

The decision logic presented on Figures 7-13 and 7-14 is for illustrative purposes only. Many of the decisions require technical analyses, and some decisions require the concurrence of EPA and Ecology prior to implementation. As a result, the operator should not implement any of the decisions identified on Figures 7-13 and 7-14 without direction from the Spokane County project manager.

7.3.5 ACTIONS REQUIRING REGULATORY REVIEW AND APPROVAL

As described in the previous section, the Consent Decree specifies a number or requirements and optional actions for Spokane County related to monitoring, operation, and shutdown of the RA. The intent of this section is to identify those activities that require notification and (in some instances) approval of EPA and Ecology. Any condition or activity that requires notification of, or

review and approval by, EPA and Ecology requires the involvement of both regulatory agencies. Reportedly, this requirement may change in the future, and Ecology will be the only regulatory agency administering the Consent Decree. Until written notice is received from EPA and Ecology informing Spokane County of this administrative revision, Spokane County should assume that the notification and approval requirements specified in the Consent Decree are applicable.

The remainder of this section identifies the activities that require the review and approval of EPA and Ecology, and activities that require prior notification of EPA and Ecology (but not approval). These activities and conditions are presented by system (South, East, and West), consistent with the order presented in the Consent Decree.

7.3.5.1 South System

A number of operations-related activities at the South System require the review and approval of EPA and Ecology prior to implementation. Most of these activities are associated with required responses to criteria exceedences. Section V.A.2 of the Consent Decree scope of work should be reviewed for a complete discussion of the bases for decision for the South System.

Actions requiring EPA and Ecology prior review and approval for the South System consist of:

- Determination of whether continued sampling and analysis of downgradient and outboard performance monitoring wells is needed if no exceedences of operational control criteria occur in the first five years of monitoring

- A monitoring program to address a confirmed exceedence of operational or adjustment control criteria (based on average concentration in South System performance monitoring wells), or an exceedence of the Evaluation Criteria (based on an individual well basis)

- A proposal for adjustment of the South System to address a confirmed exceedence of the operational control criteria

- A proposal for modification of the South System to address a confirmed exceedence of the adjustment control criteria for two consecutive quarters

- A proposal for modification of the South System to address a confirmed exceedence of the evaluation criteria in an individual downgradient performance monitoring well for two consecutive quarters

- An evaluation of the operation of the South System to address anomalous concentrations or concentration trends that are projected to lead to a long term exceedence of adjustment control criteria

- A proposal (developed at Spokane County's discretion) to accelerate cleanup by the addition of upgradient extraction wells

- Procedures for pulse pumping if implemented once constituent concentrations in extraction wells decrease to below the evaluation criteria (the decision to implement pulse pumping is at Spokane County's discretion, only the procedures are subject to review and approval by EPA and Ecology)

- Improve or adjust the treatment facility to address a discharge exceedence of the evaluation criteria.

The Consent Decree also specifies a number of actions that can be taken at Spokane County's discretion if certain conditions or criteria are met. Although these actions do not require EPA or Ecology approval, sufficient documentation to demonstrate that the applicable condition or criteria have been achieved and sufficient time for review of the documentation must be provided to the regulatory agencies prior to implementation.

Actions that require regulatory review (but not approval) for the South System are:

- Reducing of sampling and analysis frequency for South System monitoring wells from quarterly to annual following 12 consecutive quarters of results with concentrations below the operational control criteria

- Discharge of extracted groundwater without treatment for extraction wells that meet the operational control criteria for 2 consecutive quarters

- Discontinuation of operation of an extraction well that meets the adjustment control criteria

- Initiation of pulse pumping of extraction wells that meet the evaluation criteria (pulse pumping procedures require the review and approval of EPA and Ecology).

7.3.5.2 East System

The East System provides source control for the RA, and as a result, no performance monitoring is required. The lesser groundwater monitoring requirements associated with the East System (versus the South and West Systems) result in fewer criteria that must be achieved and fewer optional actions that require either the review and concurrence or the notification of EPA and Ecology. Section V.b.2 of the Consent Decree scope of work should be reviewed for a complete discussion of the bases for decisions for the East System.

Actions requiring EPA and Ecology review and approval for the East System consist of:

- Procedures for pulse pumping (pulse pumping is at Spokane County's discretion, only the procedures are subject to review and approval by EPA and Ecology)

- Discontinuation of operation of an extraction well if the well is not yielding at least 20 gpm
- Discontinuation of operation of an extraction well if operation is no longer cost effective

- Improve or adjust to the treatment facility to address a discharge exceedence of the evaluation criteria.

The Consent Decree also specifies a limited number of actions that can be taken at Spokane County's discretion if certain conditions or criteria are met. Although these actions do not require EPA or Ecology approval, sufficient documentation to demonstrate that the applicable condition or

criteria has been achieved, and sufficient time for review of the documentation, must be provided to the regulatory agencies prior to implementation.

Actions that require regulatory review (but not approval) for the East System are:

- Adding an extraction well to the lower aquifer monitoring program whose operation was discontinued due to yield or cost effectiveness considerations
- Discharging extracted groundwater without treatment for extraction wells that meet the operational control criteria for 2 consecutive quarters
- Initiating pulse pumping (pulse pumping procedures require the review and approval of EPA and Ecology).

7.3.5.3 West System

A number of operations-related activities at the West System require the review and approval of EPA and Ecology prior to implementation. Most of these activities are associated with required responses to criteria exceedences and are similar to those previously described for the South System. However, many of the criteria for the West System are less stringent than for the South System because of the lower potential to impact supply wells. Section V.C.2 of the Consent Decree scope of work should be reviewed for a complete discussion of the bases for decision for the West System.

Actions requiring EPA and Ecology prior review and approval for the West System consist of:

- A program to address a confirmed exceedence of adjustment control criteria (based on average concentrations in West System performance monitoring wells)
- A proposal for adjustment of the West Interception System to address a confirmed exceedence of the operational control criteria (applicable to Set A monitoring wells only)
- A proposal for modification of the West Interception System to address a confirmed exceedence of the adjustment control criteria for two consecutive quarters.
- A proposal for modification of the West Interception System to address a confirmed exceedence of the evaluation criteria in an individual downgradient performance monitoring well for two consecutive quarters (applicable to Set A monitoring wells only)

- Evaluate the operation of the West Interception System to address anomalous concentrations or concentration trends that are projected to lead to a long term exceedence of adjustment control criteria (applicable to Set A monitoring wells only)

- A proposal (developed at Spokane County's discretion) to accelerate cleanup by the addition of upgradient extraction wells

- Procedures for pulse pumping, if implemented once constituent concentrations in extraction wells decrease to below the evaluation criteria (the decision to implement pulse pumping is at Spokane County's discretion, only the procedures are subject to review and approval by EPA and Ecology)

- Improve or adjust the treatment facility to address a discharge exceedence of the evaluation criteria.

The Consent Decree also specifies a number of actions that can be taken at Spokane County's discretion if certain conditions or criteria are met. Although these actions do not require EPA or Ecology approval, sufficient documentation to demonstrate that the applicable condition or criteria has been achieved, and sufficient time for review of the documentation, must be provided to the regulatory agencies prior to implementation.

Actions that require regulatory review (but not approval) for the West System are:

- Determination of whether continued sampling and analysis of downgradient and outboard performance monitoring wells is needed if no exceedence of operational control criteria occur in the first five years of monitoring

- Reduction sampling and analysis frequency for West System monitoring wells from quarterly to annual following 12 consecutive quarters of results with concentrations below the adjustment control criteria

- Discharge of extracted groundwater without treatment for extraction wells that meet the operational control criteria for 2 consecutive quarters
- Discontinuation of operation of an extraction well that meets the adjustment control criteria

- Initiation of pulse pumping of extraction wells that meet the evaluation criteria (pulse pumping procedures require the review and approval of EPA and Ecology).

7.3.6 CONFIRMING AND REPORTING CRITERIA EXCEEDENCES

The Consent Decree specifies a procedure for confirming an exceedence of operational control, adjustment control or evaluation criteria. The procedure requires that follow up samples be collected after a single exceedence of an applicable criteria, and a criteria must be exceeded in three consecutive sampling rounds conducted on two week intervals to be considered a confirmed exceedence. As such, it is important for the operator to evaluate analytical data immediately upon receipt of preliminary lab results and initiate resampling as soon as possible once a criteria exceedence is identified. Subsequent sampling and analysis must be scheduled to provide three rounds of samples collected on two week intervals. However, it is important to remember that if the second round of sampling does not result in a criteria exceedence, it is not necessary to conduct the third sampling round.

The Spokane County project manager is responsible for communications with EPA and Ecology related to criteria exceedences. As a result, it is important that the operator inform the project manager immediately if analytical data indicate a potential criteria exceedence. Any criteria exceedence detected in a single well should be reported to EPA and Ecology as soon as data are reported from the laboratory, and final, validated data should be provided within two weeks of receipt of final laboratory results for each sampling round. In general, the preliminary results for the third sampling round should be available and provided to EPA and Ecology within six weeks of receipt of preliminary results for the first sampling round.

It is important to recognize that exceedence of operational or adjustment control criteria is based on average concentrations for applicable performance monitoring wells. Consequently, an exceedence of these criteria in an individual well may be indicative of a potential groundwater quality issue, but it does not necessarily indicate a criteria exceedence.

7.3.7 REGULATORY AGENCY NOTIFICATION/APPROVAL PROCESS

Section 7.3.5 identifies a number of activities specified in the Consent Decree that require either notification of, or review and approval by, EPA and Ecology. However, the Consent Decree does not specify the manner in which these interactions with the regulatory agencies are to occur. This section provides general procedures for submitting a planned action or evaluation that requires regulatory approval to EPA and Ecology, procedures to notify EPA and Ecolgoy of actions that do

not require regulatory approval, and general guidance for interim actions implemented prior to written agency concurrence.

7.3.7.1 Procedures for Actions Requiring Regulatory Approval

For actions that require the review and approval of EPA and Ecology prior to implementation, documentation beyond that required for notification will typically be required. For instance, if a confirmed exceedence of the operational control criteria occurs, Spokane County must submit a proposal for adjustment of the interception system to correct the exceedence. The proposal must:

- Identify the exceedence, and the probable cause of the exceedence
- Describe the proposed adjustment to the system
- Present an evaluation that demonstrates the adjustment is likely to correct the exceedence, along with supporting data and analysis (as needed)
- Provide procedures and a schedule for implementation of the corrective action.

The time required for review and approval by EPA and Ecology for an action requiring such involvement on the part of the regulatory agencies will depend on the complexity of the planned action and the ability of the regulatory agencies to respond in a timely manner. Most actions under the Consent Decree that require agency review and approval prior to implementation result from criteria exceedences, and as such, it is in the interests of all parties to respond expeditiously. In most instances, regulatory review within 30 days is a reasonable expectation. Written approval from EPA and Ecology should always be obtained prior to implementing any actions that are based on submittal of a written proposal or evaluation.

7.3.7.2 Procedures for Actions Requiring Regulatory Notification

EPA and Ecology must be provided sufficient notification by Spokane County for planned actions allowed under the Consent Decree to evaluate those actions for consistency with the Consent Decree requirements. For actions that do not require EPA and Ecology approval, notification must

provide sufficient information to allow the regulatory agencies to conclude that the relevant Consent Decree provision has been satisfied. Sufficient information must include, at a minimum:

- Reference to the appropriate section of the Consent Decree
- The data necessary to demonstrate that the relevant condition specified in the Consent Decree has been achieved
- A schedule for implementation of the action
- Any new procedures, or modifications to existing procedures, needed to implement or maintain the new action.

Thirty days notice for those actions not requiring EPA and Ecology approval should be sufficient for the regulatory agencies to determine whether Spokane County has correctly interpreted the Consent Decree, or to identify that additional time for review is necessary. It is desirable, but does not appear to be a requirement, for Spokane County to obtain written concurrence from EPA and Ecology for those actions allowed under the Consent Decree that do not specifically require approval.

7.3.7.3 Procedures for Interim Actions

In some instances it may be appropriate to implement interim corrective actions to expedite response (such as increasing the pumping rate for an extraction well) based on verbal discussions with EPA and Ecology. However, if interim corrective actions are implemented, confirmatory correspondence should be prepared by Spokane County to document the concurrence of the regulatory agencies. This correspondence should be followed by a written document that addresses the requirements under the Consent Decree.

7.4 OPERATIONAL CONTROL

The goals of operational control for the groundwater extraction system are to prevent further migration of the Constituents of Concern in the aquifers, to provide source control, and to minimize the impact of the RA on the beneficial use of affected aquifers. Achieving these three goals requires careful management of RA groundwater extraction rates.

7.4.1 INITIAL OPERATIONAL SETTINGS

Although the goal of the extraction system is to achieve the groundwater performance criteria described in Section 7.3.1, normal operation of the system will be based on optimizing aquifer drawdowns for effective hydraulic control and interception of contaminated groundwater. The initial operational settings for South and West Systems extraction wells were the model-predicted upper bound flow rates needed to capture the contaminated groundwater plumes, as presented in Table 7-1. Although these flow rates provided an initial setting for system operation (a starting point), a better measure of the effectiveness of the South and West Systems is whether they create sufficient drawdown to achieve hydraulic control while minimizing regional drawdown and groundwater extraction. The model-predicted drawdown (target drawdown) and approximate prepumping groundwater elevations for compliance monitoring wells, as well as other wells that will be used to evaluate RA hydraulic performance, are provided in Table 7-10. The location of these wells are shown on Figure 7-5.

7.4.2 OPERATIONAL ADJUSTMENTS

Operational adjustments may be required to optimize system performance, or to address exceedence of the concentration-based performance criteria discussed in Section 7.3. The primary operational adjustment for the interception/extraction systems will be modification of extraction well pumping rates The discussion within this section is limited to operational adjustments to optimize system performance (based on hydraulic analysis). Adjustments to address exceedence of concentration-based criteria are discussed in Section 7.6.

Prior to start up of the RA, it was intended that the target drawdowns and reference elevations presented in Table 7-10 would be used as a basis for determining whether operational adjustments were needed to optimize system performance, independent of (and in addition to) any adjustments required as a result of exceedence of the concentration-based criteria described in Section 7.3.2. The planned use of target drawdowns based on prepumping groundwater elevations as an appropriate means for evaluating the need for operational adjustments was predicated on the limited groundwater fluctuations observed in the Upper and Lower Sand/Gravel Aquifers prior to start up of the RA. Unfortunately, significant fluctuations in groundwater elevation have occurred

within and beyond the area of influence of the RA interception system as a result of higher than normal precipitation. As a result, this intended method for evaluating the need for operational adjustment is not valid, and an alternative method was required. This section describes the method recommended for evaluating the need for operational adjustment to optimize hydraulic performance.

The most direct method for evaluating hydraulic performance is the development of a groundwater elevation contour map, with associated groundwater flow lines, as shown on Figures 7-15 and 7-16 for the Upper and Lower Sand/Gravel Aquifers, respectively. Although somewhat imprecise, this type of flow line analysis allows the physical delineation of the capture zone based on where flow lines deflect toward, or away from, the extraction system. As shown on Figure 7-15, groundwater concentrations do not exceed the performance standard for TCA (or other Constituents of Concern), and the South Interception System is intercepting all groundwater where Constituents of Concern exceed the detection limit, and thus is achieving more than adequate capture. As shown on Figure 7-16, the capture zone for the Lower Sand/Gravel Aquifer extends well beyond the TCA performance standard (and the performance standards for all other Constituents of Concern) and, thus, is achieving more than adequate capture. Because performance standards are already being achieved in the Upper Sand/Gravel Aquifer, the discussion in this Section will focus primarily on operational adjustments for the Lower Sand/Gravel Aquifer.

It is recommended that flow line analysis be performed quarterly using the hydraulic data collected during the more extensive round of groundwater elevation monitoring described in Section 7.5.2. If system adjustment is required based on flow line analysis, adjustments should be made to extraction wells that most directly affect (i.e., are in the closest proximity to) the monitoring well or wells where hydraulic adjustment is desired. Adjustments may increase pumping rates (in response to high aquifer recharge rates) or decrease pumping rates (in response to low aquifer recharge during dry periods). If other considerations are equal, adjustments should be made such that more highly contaminated water is extracted. It should be recognized that when pump flow controls are set to maintain a constant drawdown, the system will automatically adjust the extraction well flow rate in response to changes in aquifer recharge, and adjustments should only be required in response to extreme (dry or wet) conditions or if "fine tuning" is required to optimize system performance.

The relationship between extraction rate and drawdown will vary depending on site specific conditions. Under ideal conditions, a linear relationship exists between pumping rate and drawdown for steady state conditions. However, steady-state conditions are rarely achieved or maintained for significant periods of time because of seasonal fluctuations in groundwater recharge. As a result, seasonal adjustments may be required to "fine tune" system performance.

Adjustment of pumping rates in response to flow line analysis will likely be an iterative process. That is, it may require three or four (sequentially smaller) adjustments to achieve the intended result. When an adjustment is made, sufficient time should be allowed prior to evaluating the effectiveness of the adjustment. Based on observed aquifer response to pumping, 2 to 4 weeks should be adequate to achieve about 90 percent of the aquifer response resulting from a change in extraction well setting for the Lower Sand/Gravel Aquifer. However, if an adjustment results in an aquifer response that is greater than intended, it may be appropriate to reduce the adjustment prior to system stabilization. The recommended procedure for implementing a system flow rate adjustment is as follows:

1. Perform a flow line analyses using groundwater elevation data collected during the quarterly supplemental round of groundwater elevation monitoring described in Section 7.5.2.

2. Determine whether a system adjustment (increased or decreased pumping rate) is needed to optimize system performance.

3. Select the magnitude and location of the adjustment. It is recommended that adjustments be made with extraction wells in level control mode, and that initial adjustments do not exceed more than about 0.5 ft in the extraction well. Adjustments should generally be made in extraction wells that are located in closest proximity to the portion of the aquifer where adjustment is desired, but consideration should also be given to extracted water quality (i.e., it is desirable to extract groundwater with high contaminant concentrations). It is also desirable, at least for initial adjustments, to only adjust one extraction well at a time so that a correlation can be developed between the adjustment of a given extraction well and aquifer response.

4. Monitor aquifer response to the adjustment. Hydraulic monitoring of four to six monitoring wells should be adequate; typically one monitoring well in the vicinity of the pumping well (if present) and three to five compliance monitoring wells. It is recommended that monitoring wells screened in the C2 zone be used for monitoring Lower Sand/Gravel Aquifer adjustments. Water level measurements should be made

immediately prior to system adjustment, about 1 day following adjustment, and then periodically until water levels stabilize.

5. Once water elevations have stabilized, collect a supplemental round of groundwater levels and perform a flow line analysis as previously described. However, the round of water level measurements can be more focused than the quarterly supplemental measurements described in Section 7.5.2. For the Lower Sand/Gravel Aquifer, it is not necessary to collect water levels east of Yale/Elk Chattaroy Road or south of Wahoo Road. Additionally, water level measurements at well clusters can be limited to wells screened in the C2 zone.

6. Make further adjustments (if needed) based on the results of the flow line analysis. The measured response to the initial adjustment should be used as a basis for selecting the magnitude of subsequent adjustments.

7. Repeat the process described in steps 1 through 6 until the desired adjustment is achieved.

It is recommended that a hydrogeologist perform or supervise the flow line analysis, and be consulted prior to implementation of any subsequent operational adjustments. The flow line analysis, and data associated with any associated operational adjustments, should be incorporated into the quarterly status report that addresses the period in which the activities were performed. These reports are the format for informing EPA and Ecology of extraction system performance (including "fine tuning" adjustments) and, as such, sufficient information must be incorporated to provide the regulatory agencies a basis for assessing the appropriateness and adequacy of the analysis and associated adjustments (if any).

It is recommended that aquifer response to operational adjustments be retained and compiled as additional data are generated. Data should include extraction well level adjustment, change in extraction rate resulting from adjustment, change in water level (or elevation) at monitored observation wells in response to adjustment. After a number of adjustments have been made, it should be possible for the operator to predict aquifer response to adjustments in the extraction system with reasonable accuracy.

7.5 AQUIFER MONITORING REQUIREMENTS

Aquifer monitoring requirements include the water quality monitoring requirements specified by the Consent Decree or required for operational purposes, and the groundwater elevation data needed to evaluate whether the South and West Interception Systems are achieving adequate drawdowns to demonstrate hydraulic control. Specific water quality monitoring requirements are

fully described in the Field Sampling Plan (Appendix F) and the Quality Assurance Project Plan (Section 8.0). Groundwater elevation monitoring requirements are described in Section 7.5.2.

7.5.1 WATER QUALITY MONITORING

Downgradient and outboard compliance monitoring wells are to be sampled and analyzed for the four indicator compounds (TCA, DCA, DCE, and TCE) of the six Constituents of Concern identified in Table 7-3. Outboard monitoring wells and downgradient monitoring wells (following the first 2 years of monthly sampling, which has already been completed) must be sampled and analyzed for the four indicator compounds quarterly for at least 3 years. All six Constituents of Concern must be analyzed for annually, for at least the first 5 years of operation. After 3 years of quarterly monitoring, the project consent decree allows a reduction in sampling frequency, and ultimately cessation of monitoring if adjustment control criteria are not exceeded.

Compliance monitoring wells have been identified for the RA. The compliance monitoring system for the South Interception System consists of four downgradient monitoring wells (CD-31A, CD-36A, CD-37A, and CD-38A) and two outboard monitoring wells (CD-34A and CP-S3). The downgradient compliance monitoring system for the West Interception System consists of 18 wells at six locations (a three-well cluster at each location; CD-41, CD-42, CD-43, CD-44, CD-45, and CD-48). The consent decree further specifies that these six monitoring locations for the West Interception System be subdivided into two groups (Set A and Set B) and identifies different performance criteria for each set of monitoring wells (see SOW, Section V, for additional description of Sets A and B performance criteria). The outboard monitoring system for the West Interception System consists of the six wells at two of the downgradient compliance monitoring locations (CD-45 and CD-48). The South and West Systems compliance monitoring wells are identified in Table 7-11, and the well locations are shown on Figure 7-5.

7.5.2 GROUNDWATER ELEVATION MONITORING

Groundwater elevation monitoring is needed to evaluate whether the extraction system is achieving hydraulic control and to periodically evaluate the regional impact of the RA on groundwater levels. It is important to recognize that evaluation of hydraulic control based on groundwater elevations is a secondary basis for evaluating system performance, and that the ultimate

determination of adequate system performance will be based on achieving the concentration-based criteria specified in the Consent Decree. Groundwater elevations should be measured monthly for the monitoring wells identified in Table 7-4 for at least the first three years of RA operation, except that only wells screened in the C2 zone should be monitored for well clusters completed in the Lower Sand/Gravel Aquifer. Monthly groundwater elevation measurements should be compared to elevations compiled for the most recent supplemental quarterly water level measurement round used to perform the flow line analysis discussed in Section 7.4.2 to track changes in aquifer hydraulic conditions. In general, monthly monitoring is intended for tracking aquifer response to pumping and seasonal recharge conditions. However, if significant changes in groundwater elevation are observed (greater than about 1 ft), and these changes are not the result of the extraction system being off-line, implementation of a supplemental flow line analysis should be considered. If system adjustment is needed, based on the results of the supplemental flow line analysis, the procedures identified in Section 7.4.2 to implement system operational adjustment should be followed.

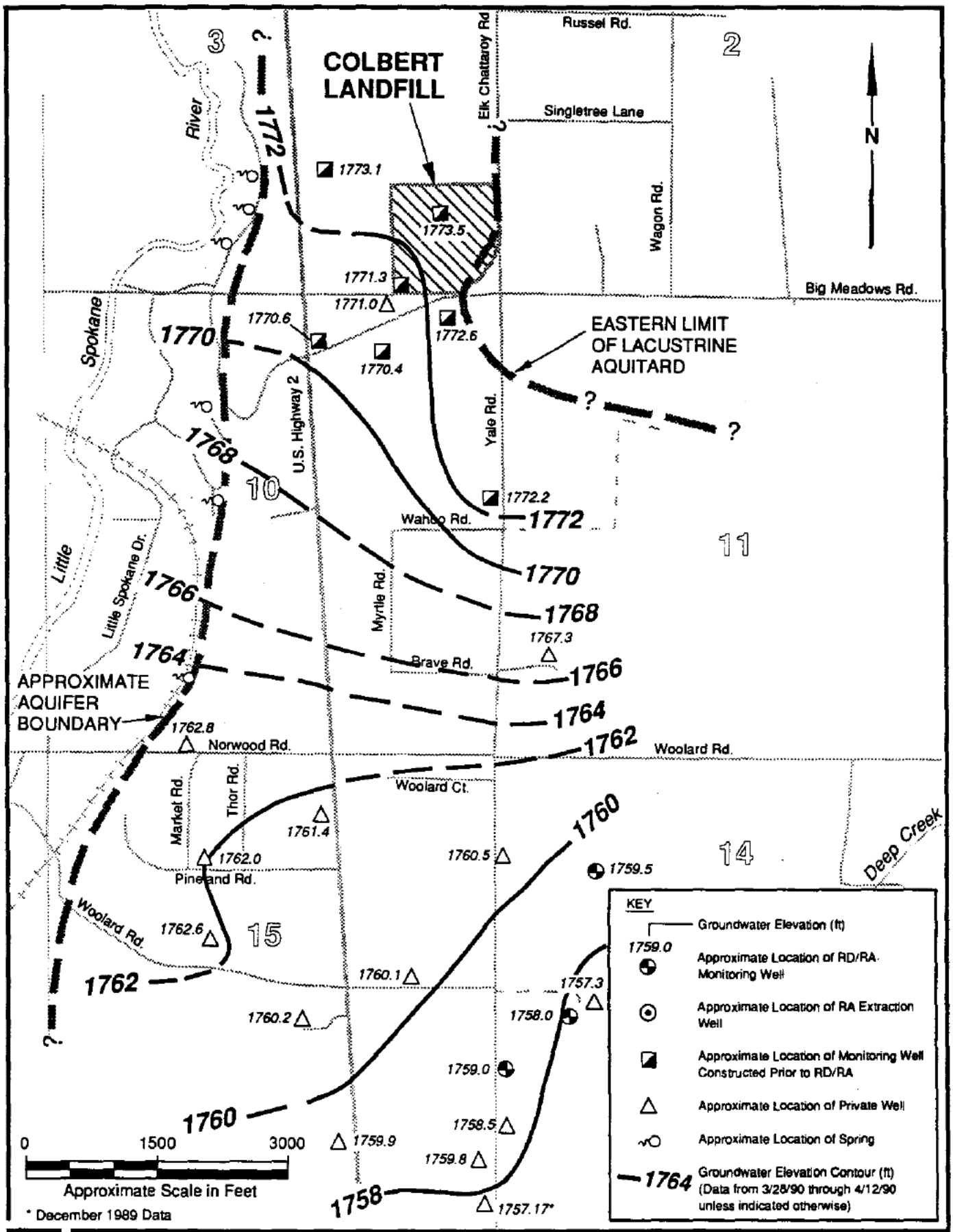
It is recommended that more extensive water level measurements be collected periodically, and drawdown estimated, to evaluate the regional impact of the RA. Tables 7-12 and 7-13 provide reference elevations and approximate prepumping groundwater elevations for wells screened in the Upper and Lower Aquifers, respectively. The locations of these wells are shown on Figures 7-17 and 7-18 for the Upper and Lower Aquifers, respectively. Water levels should be collected from these wells to provide the data needed for the flow line analysis described in Section 7.4.2 and for assessing the regional impact of the RA. It is recommended that measurements be collected, and regional drawdown be evaluated, quarterly for at least the first 4 years of RA operation. The frequency of future measurements should be determined based on the results of this initial 4-year monitoring effort.

7.6 SYSTEM ADJUSTMENT/MODIFICATIONS

As previously described, it may be necessary to adjust the interception/extraction systems to optimize hydraulic performance, and procedures for these operational adjustments are described in this O & M plan. However, if extraction system adjustment or modification is needed because of exceedence of the groundwater quality criteria specified in the project consent decree (and

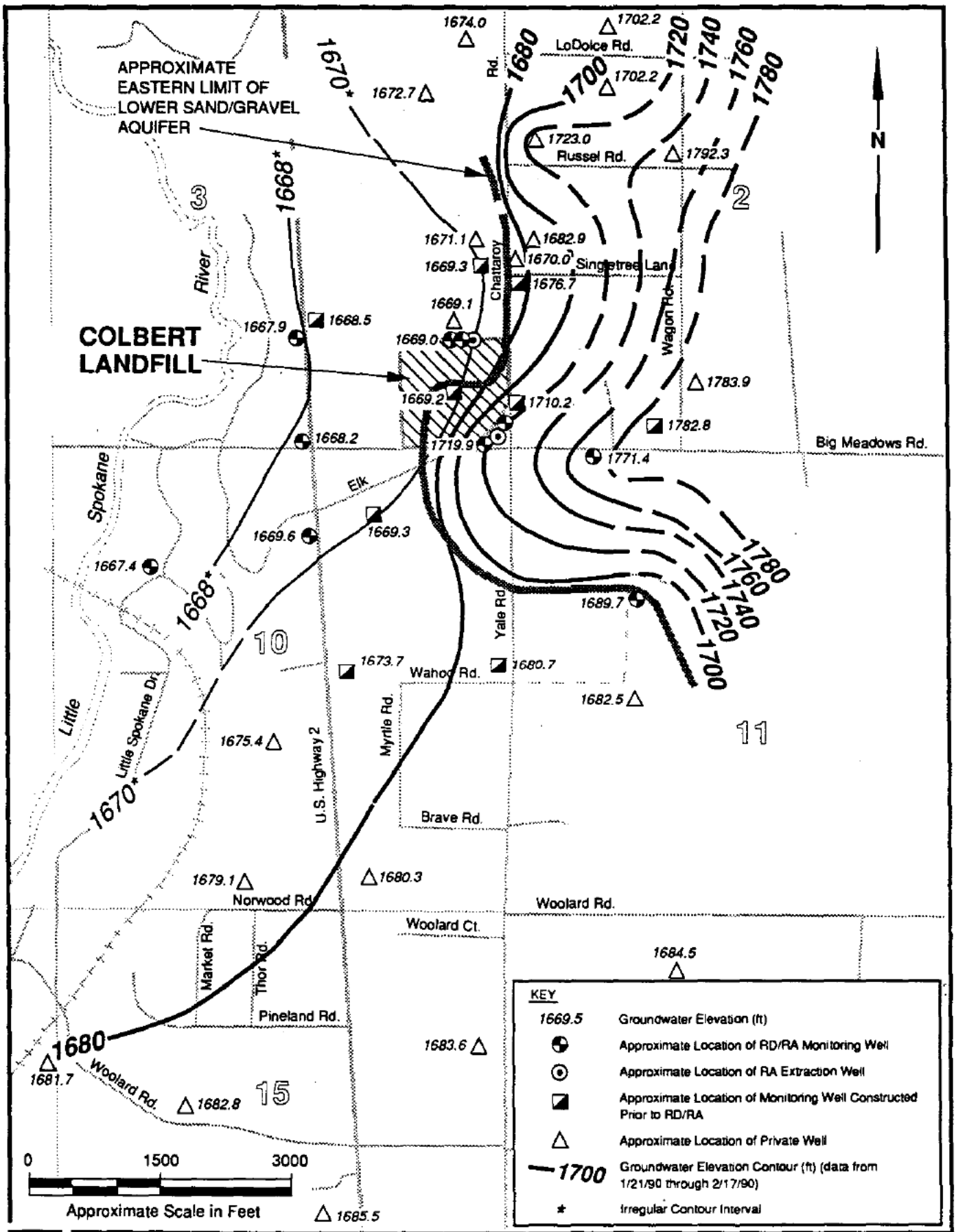
described in Section 7.3 of this plan), or if an adjustment of greater than about ±50 percent of the model-predicted pumping rate is required, for system optimization (based on flow-line analysis) additional evaluation should be performed prior to preceding with the adjustment or modification. The nature and scope of the additional evaluation(s) required to address these conditions will be dependent on the specific condition encountered, and cannot be identified at this time.

If additional evaluation indicates that interception/ extraction system modification is needed to optimize operation hydraulic performance or to achieve consent decree performance requirements, modifications may consist of installation of higher capacity pumps in existing wells, or the construction of new extraction wells. These system modifications would require additional engineering design. Implementation of detailed hydrogeologic analysis or system adjustment or modification beyond that described in Section 7.4.2, is beyond the scope of this O & M plan. If operational conditions are encountered that indicate these actions may be warranted, the operator should inform the Spokane County project manager of the situation. It will then be the project manager's responsibility, in conjunction with EPA and Ecology, to determine appropriate further actions.



Upper Sand/Gravel Aquifer
Pre RA Groundwater Elevation Contours

Figure 7-1



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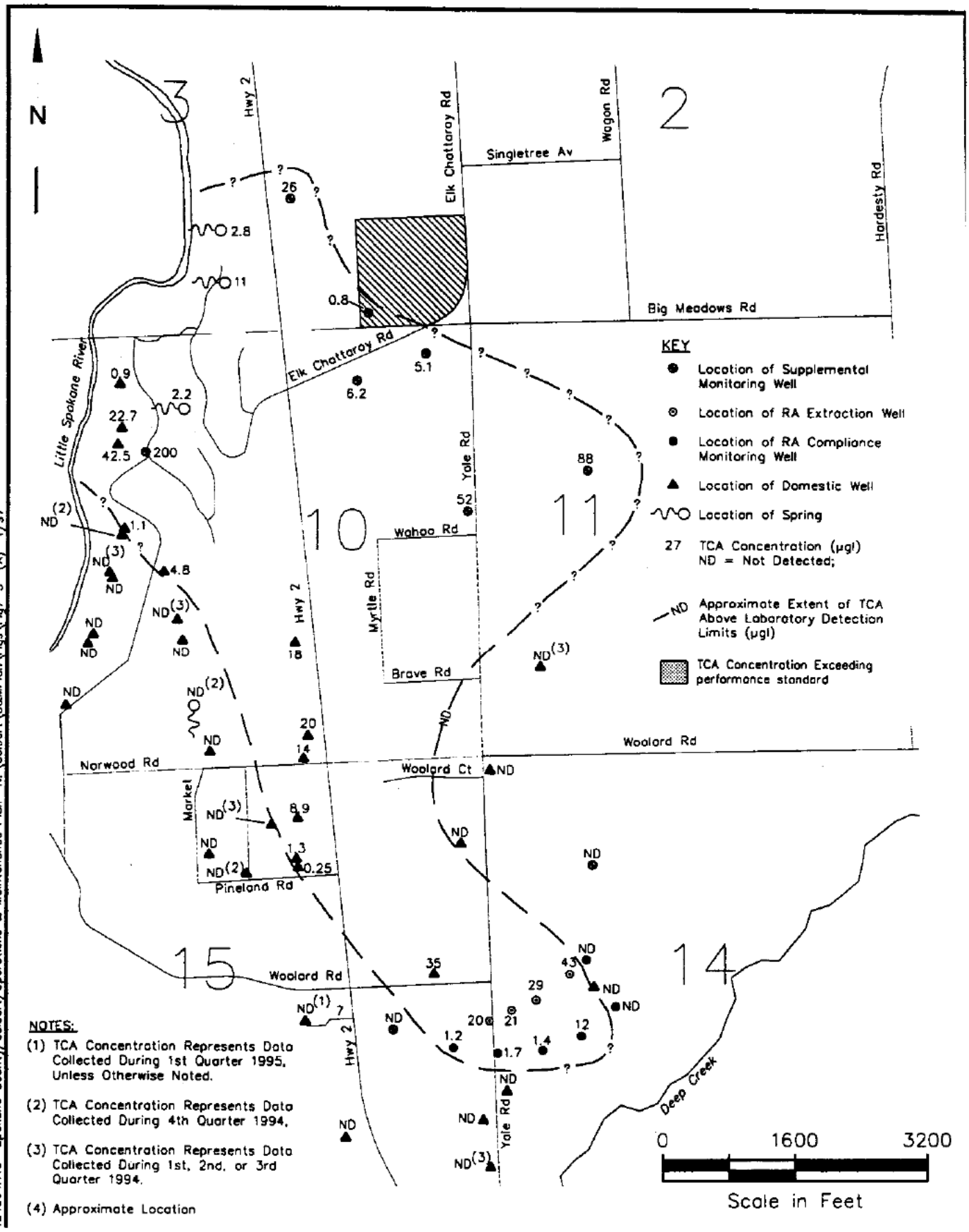
Lower Aquifers
Pre RA Groundwater Elevation Contours

Figure 7-2



NOTES:

(1) TCA Concentration Represents Data Collected During 1st Quarter 1995, Unless Otherwise Noted.

(2) TCA Concentration Represents Data Collected During 4th Quarter 1994.

(3) TCA Concentration Represents Data Collected During 1st, 2nd, or 3rd Quarter 1994.

(4) Approximate Location

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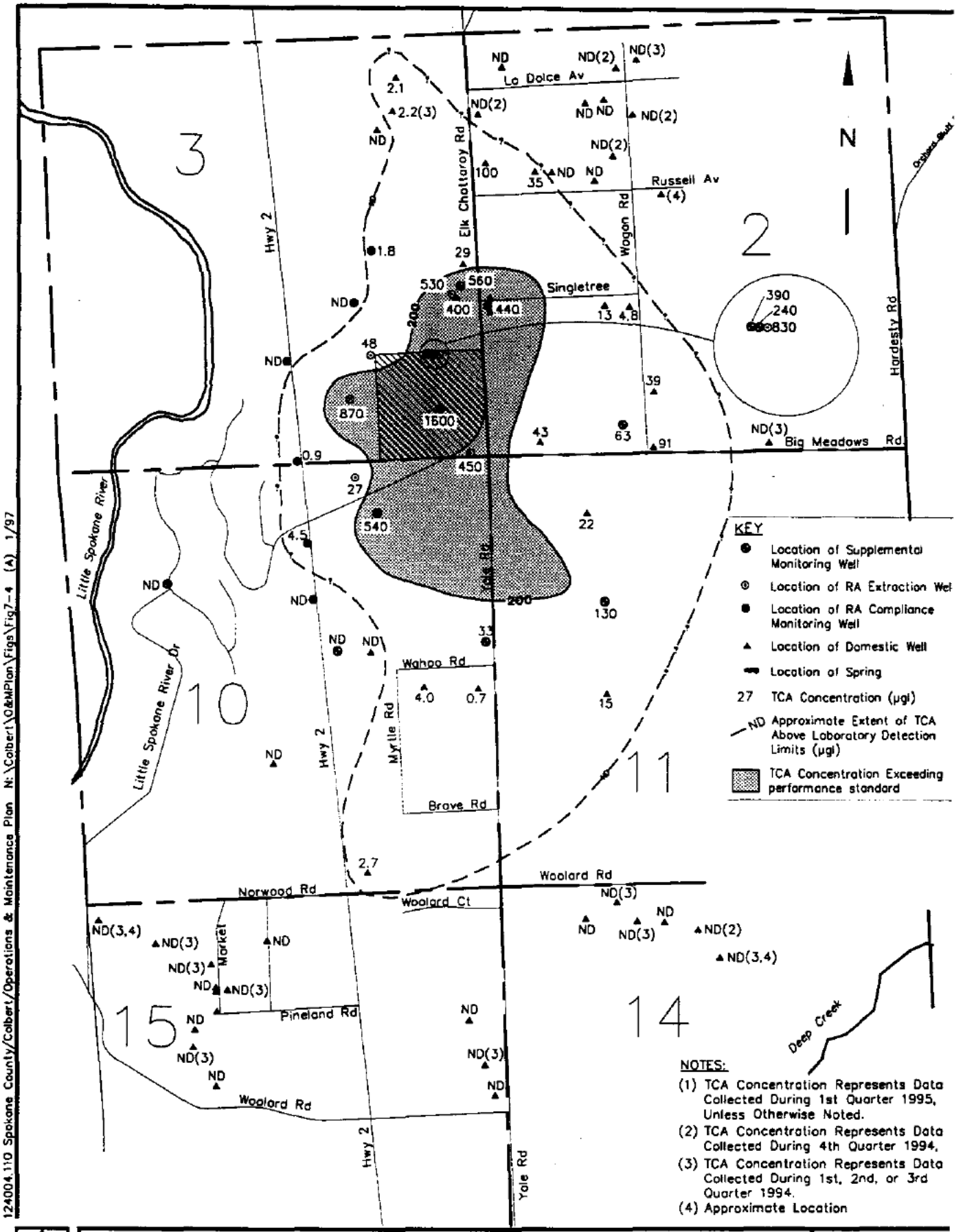
Upper Aquifers
Approximate Extent of TCA 1994/1995

Figure 7-3



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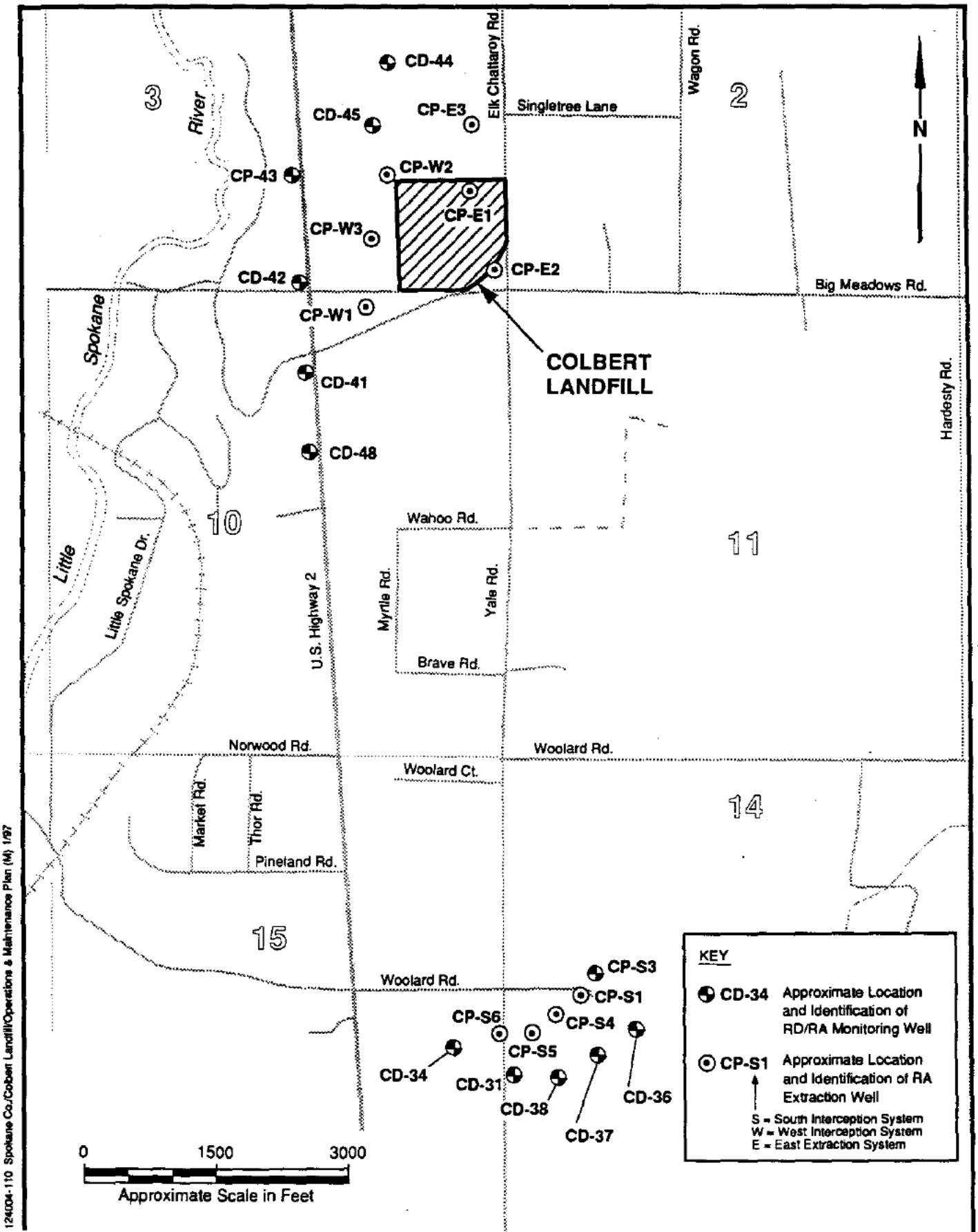
Lower Aquifers
Approximate Extent of TCA 1994/1995

Figure 7-4



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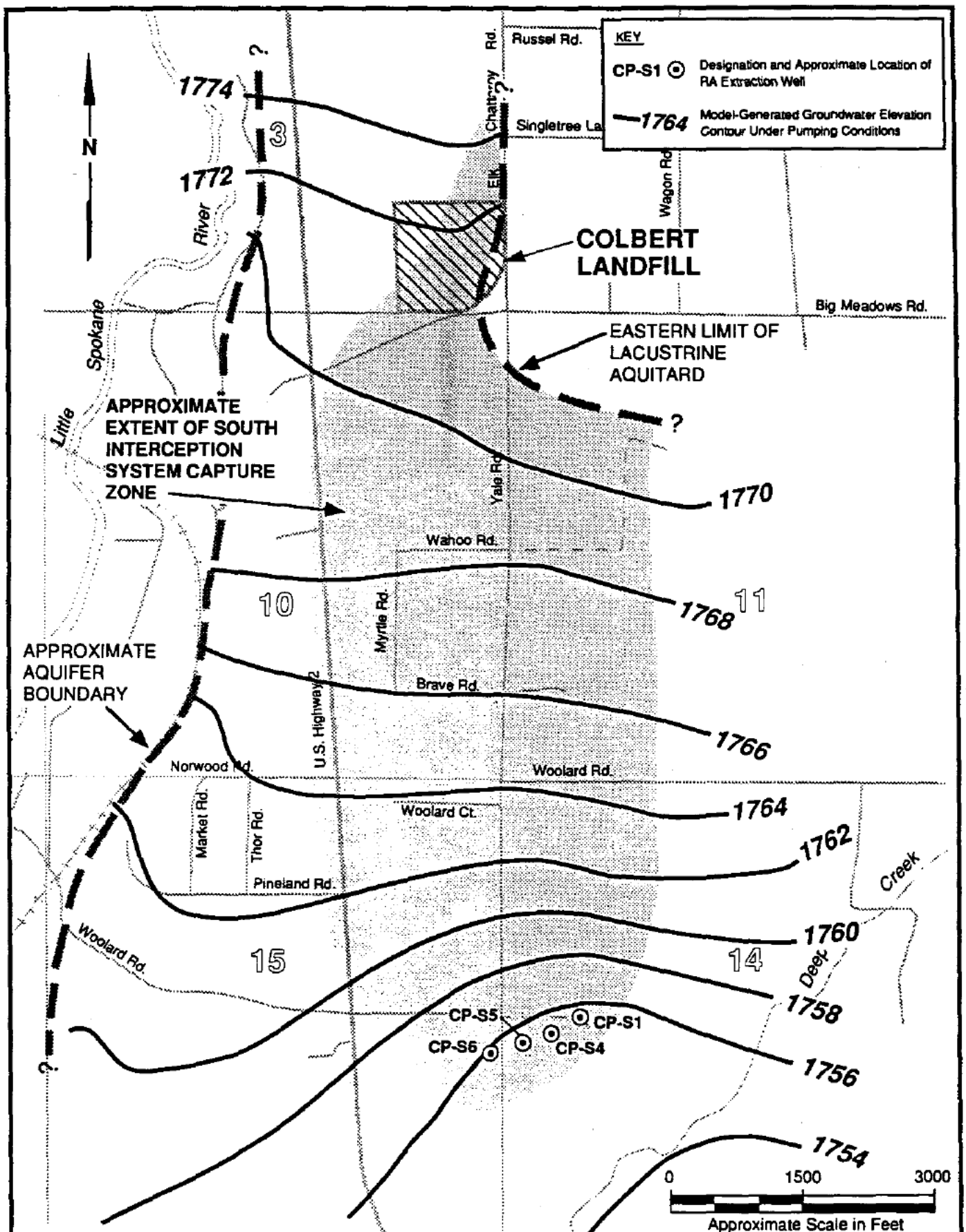
Extraction and Compliance Monitoring Well Location Map

Figure 7-5



Model-Predicted South Interception System Capture Zone

Figure 7-6

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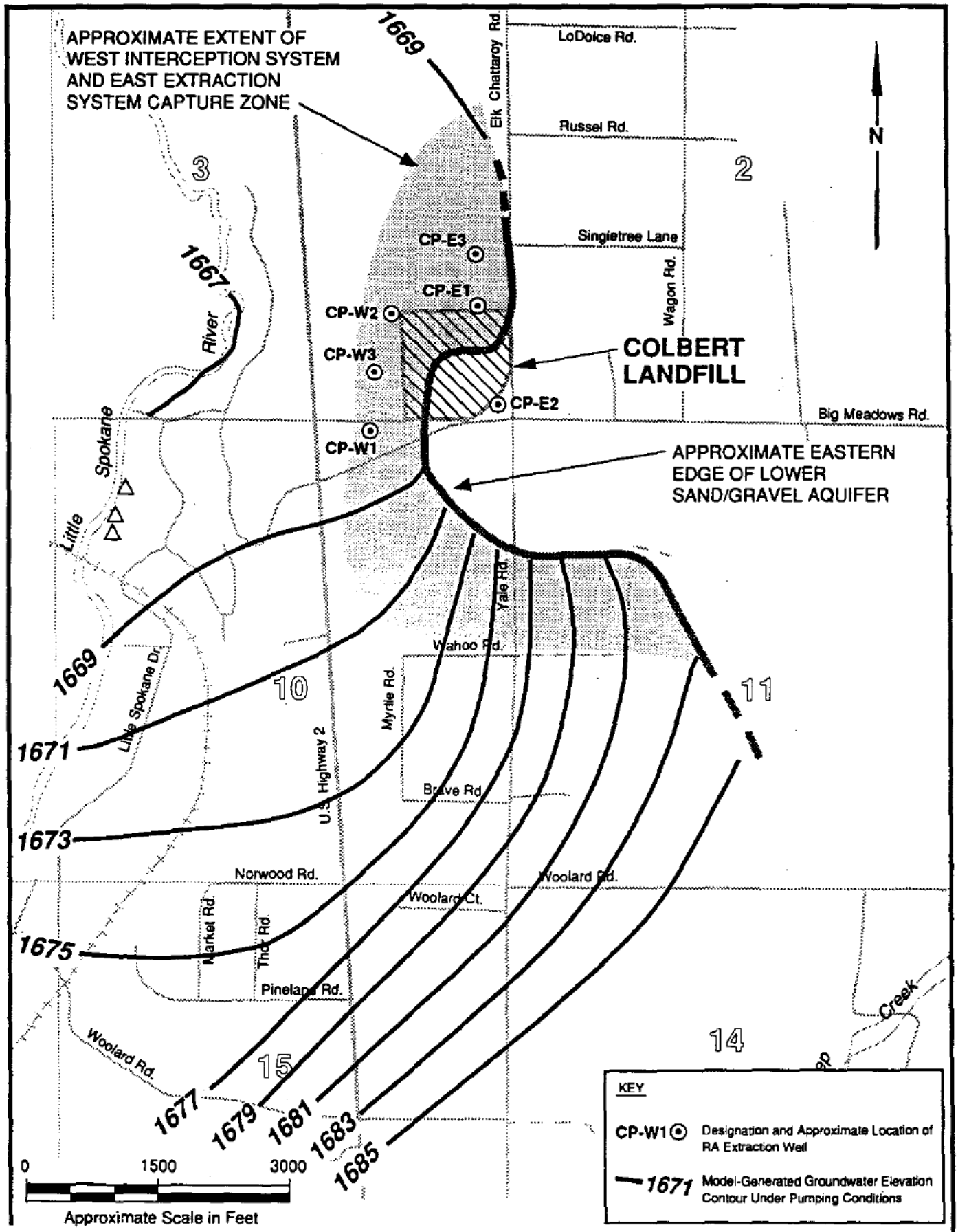

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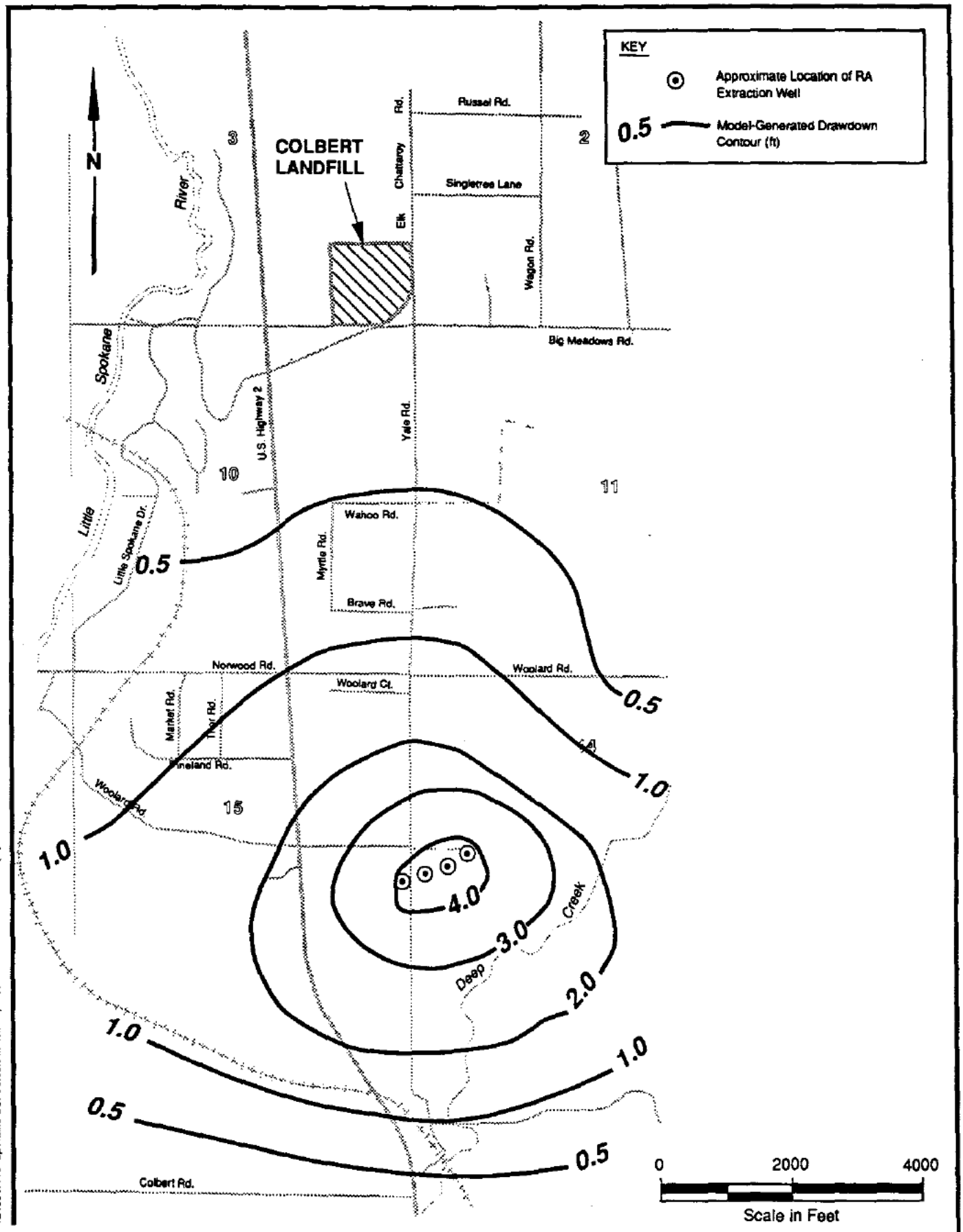
Model-Predicted West Interception and East Extraction System Capture Zone

Figure 7-7



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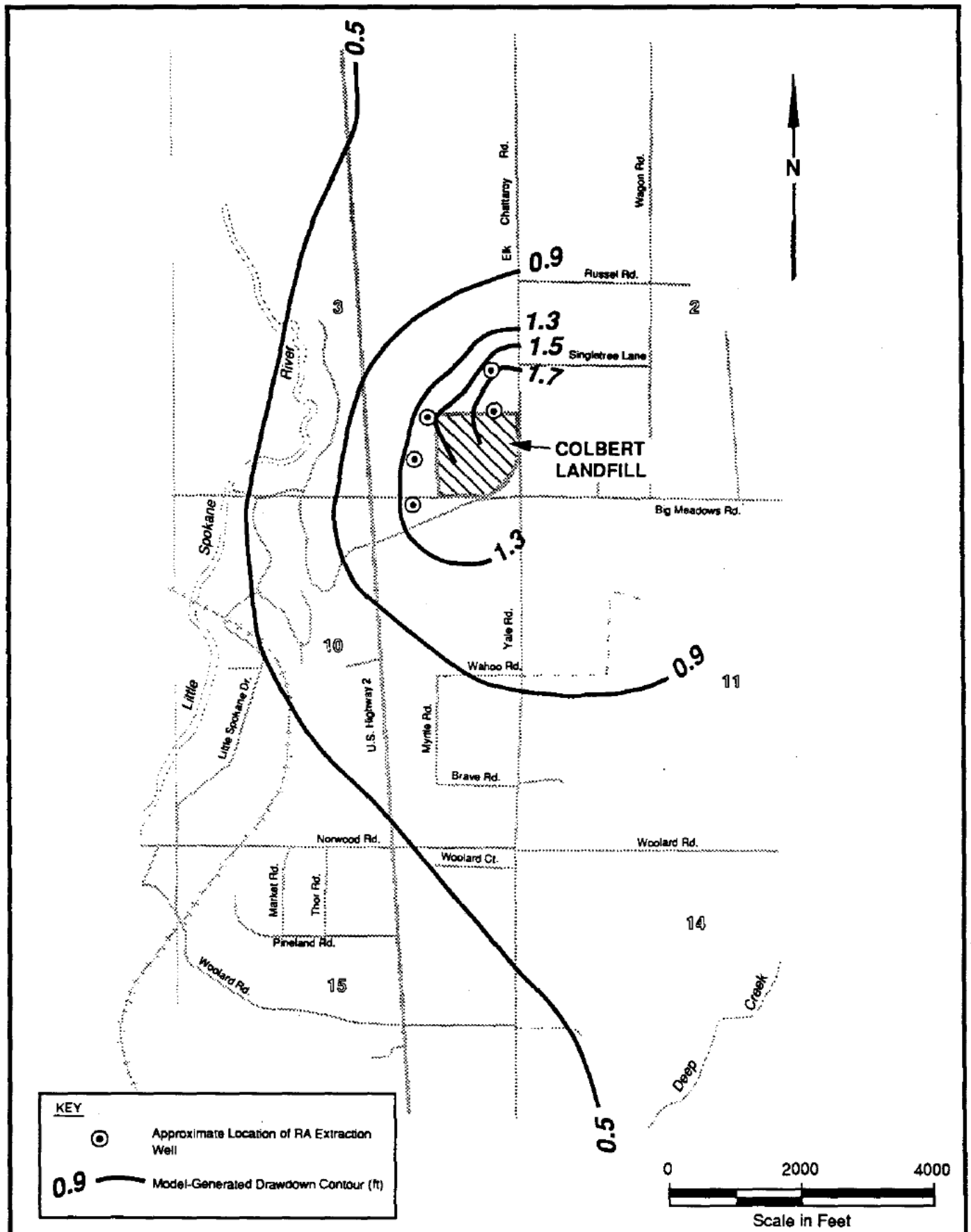
Upper Sand/Gravel Aquifer
Anticipated Regional Drawdown

Figure 7-8



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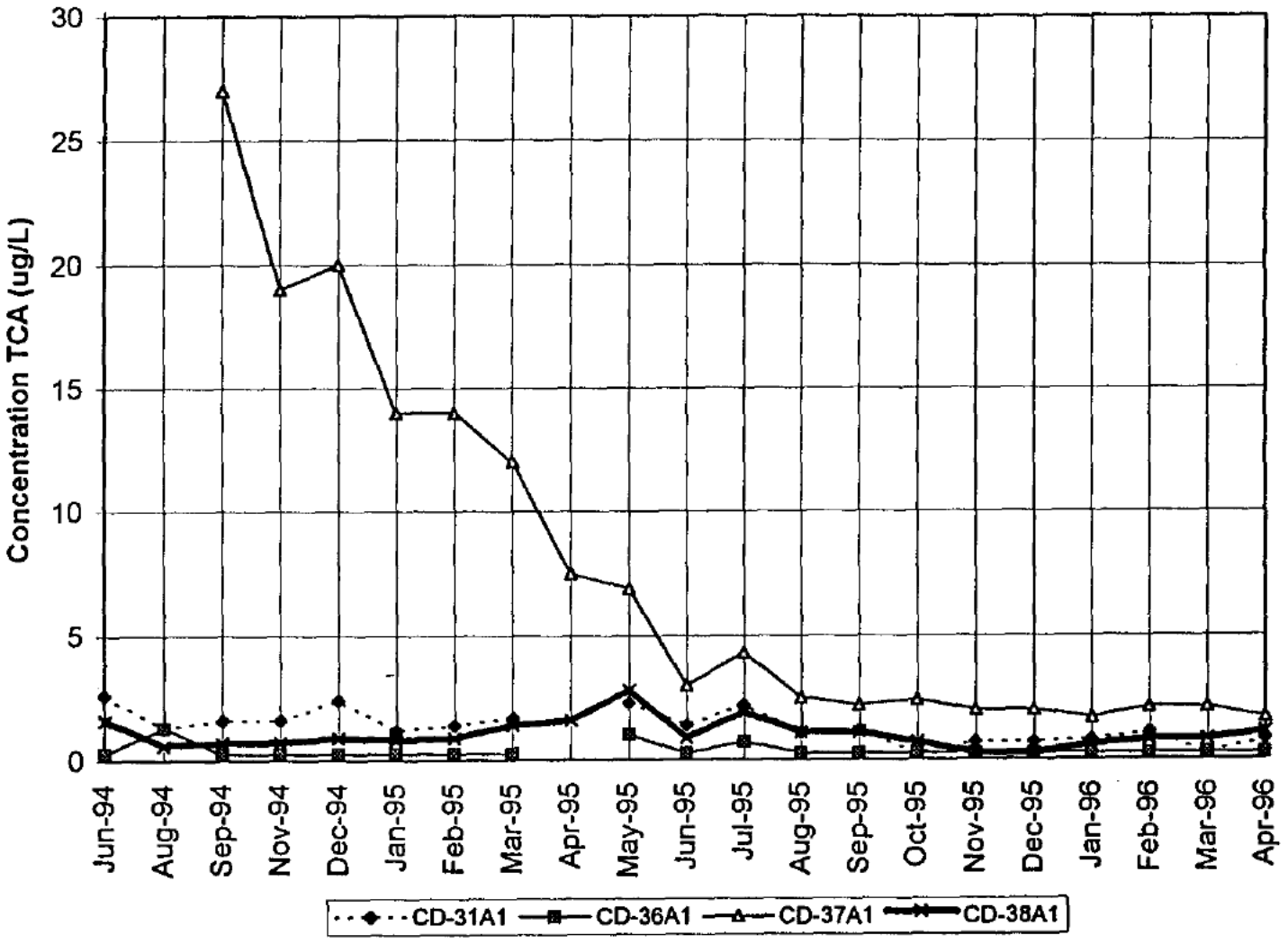
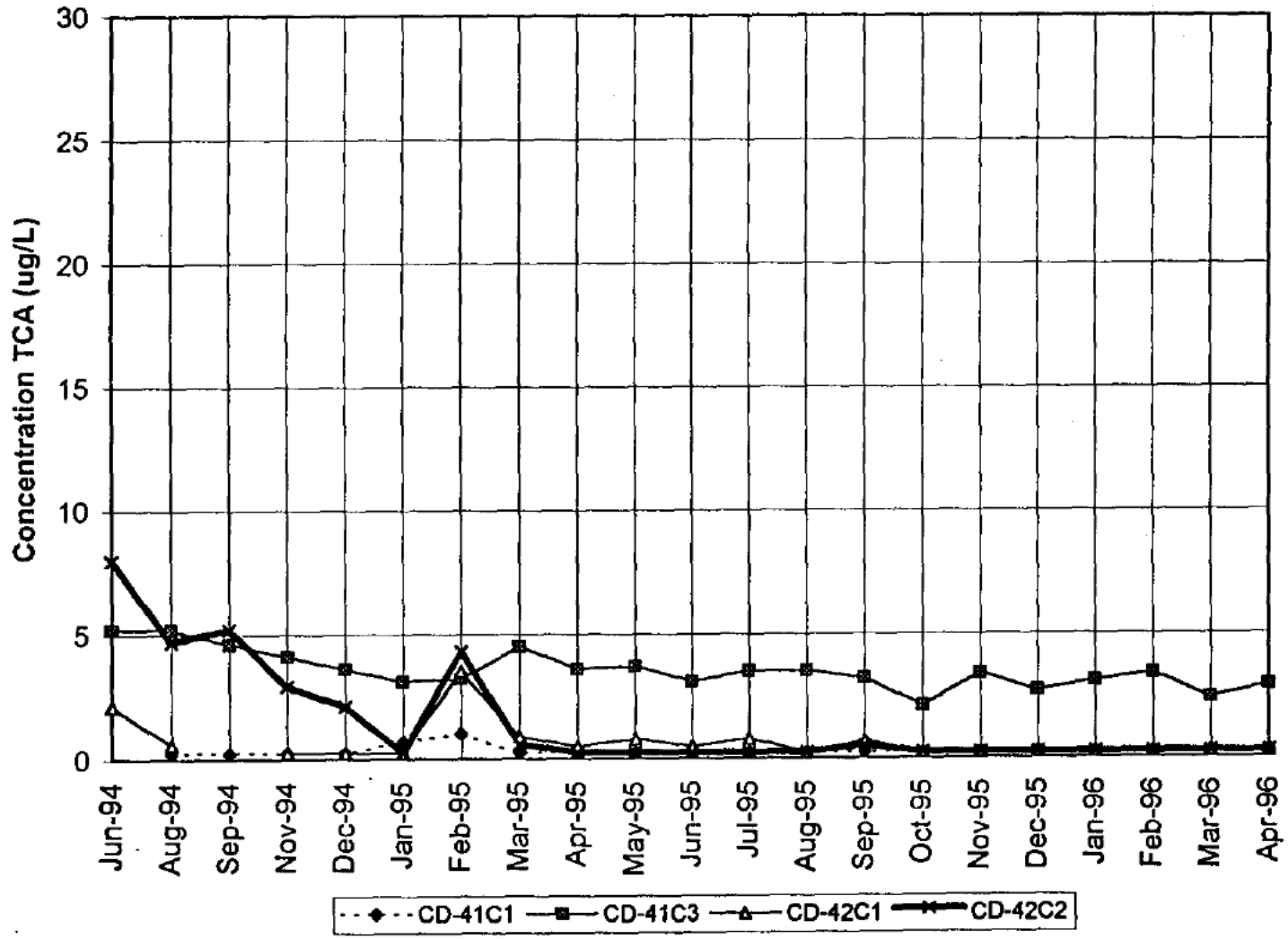
Lower Sand/Gravel Aquifer
Anticipated Regional Drawdown

Figure 7-9



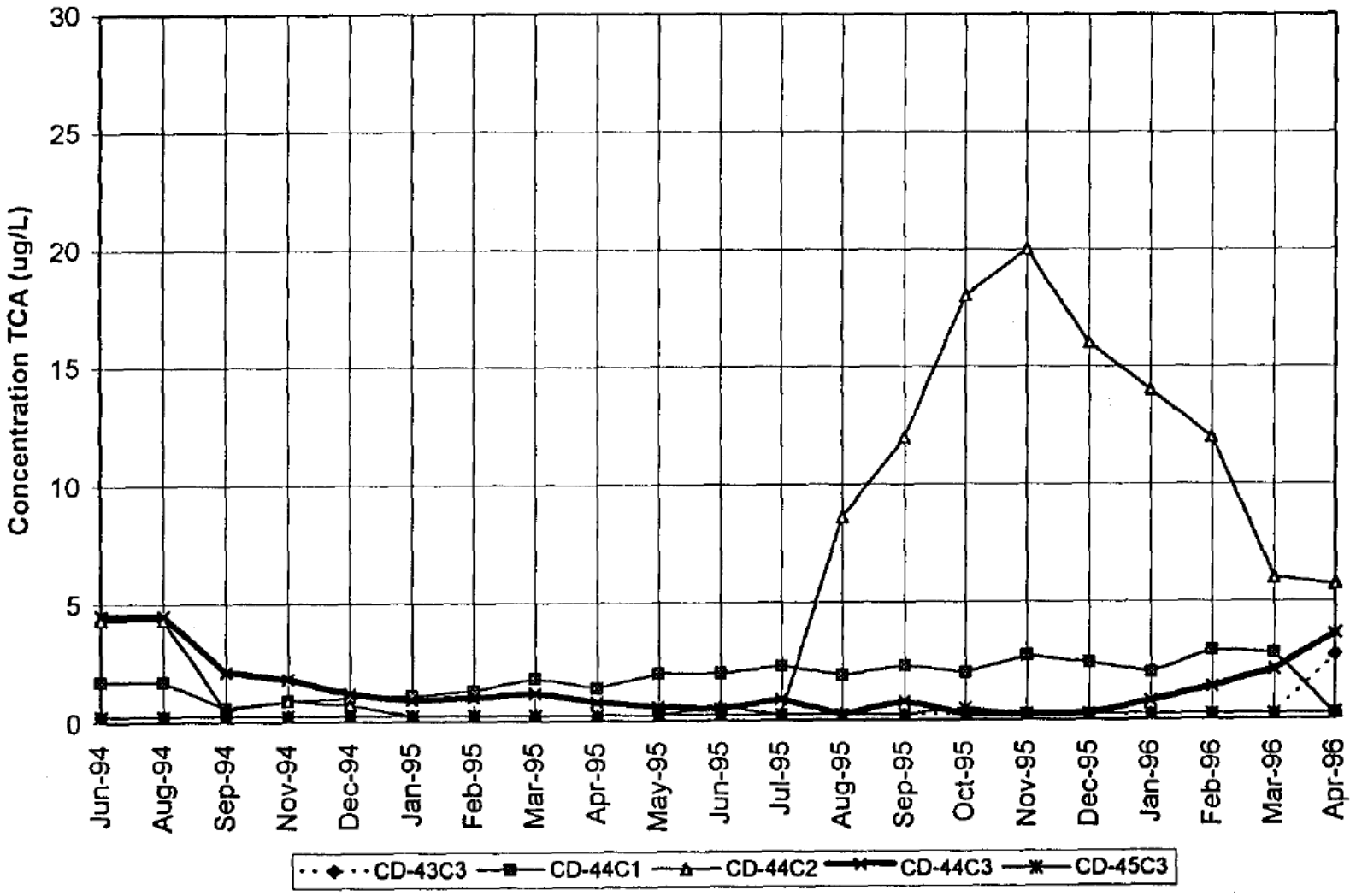
TCA Concentrations for Upper Sand/Gravel Aquifer
Downgradient Compliance Monitoring Wells

Figure 7-10



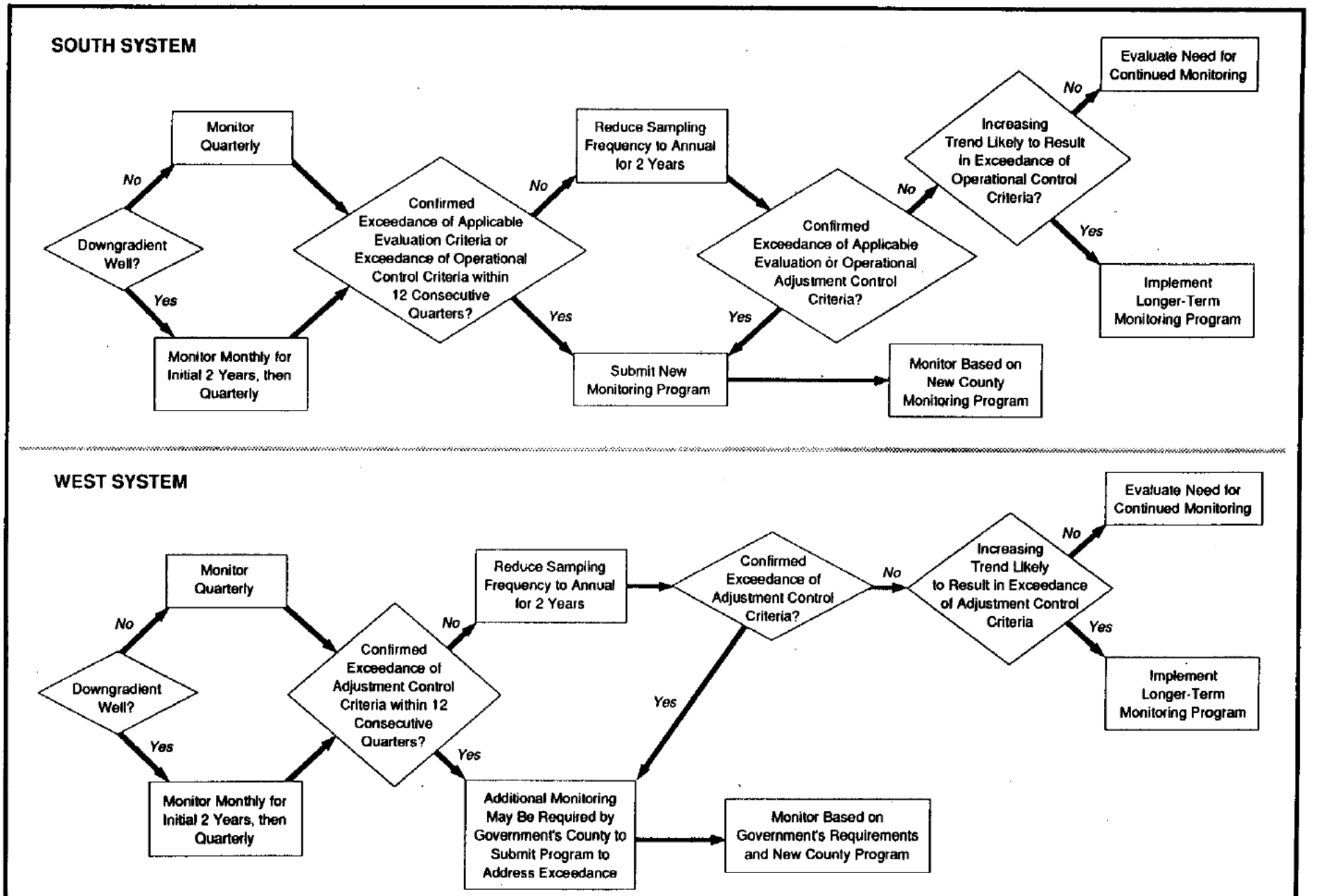
TCA Concentrations for Lower Sand/Gravel Aquifer (Set A)
Downgradient Compliance Monitoring Wells

Figure 7-11



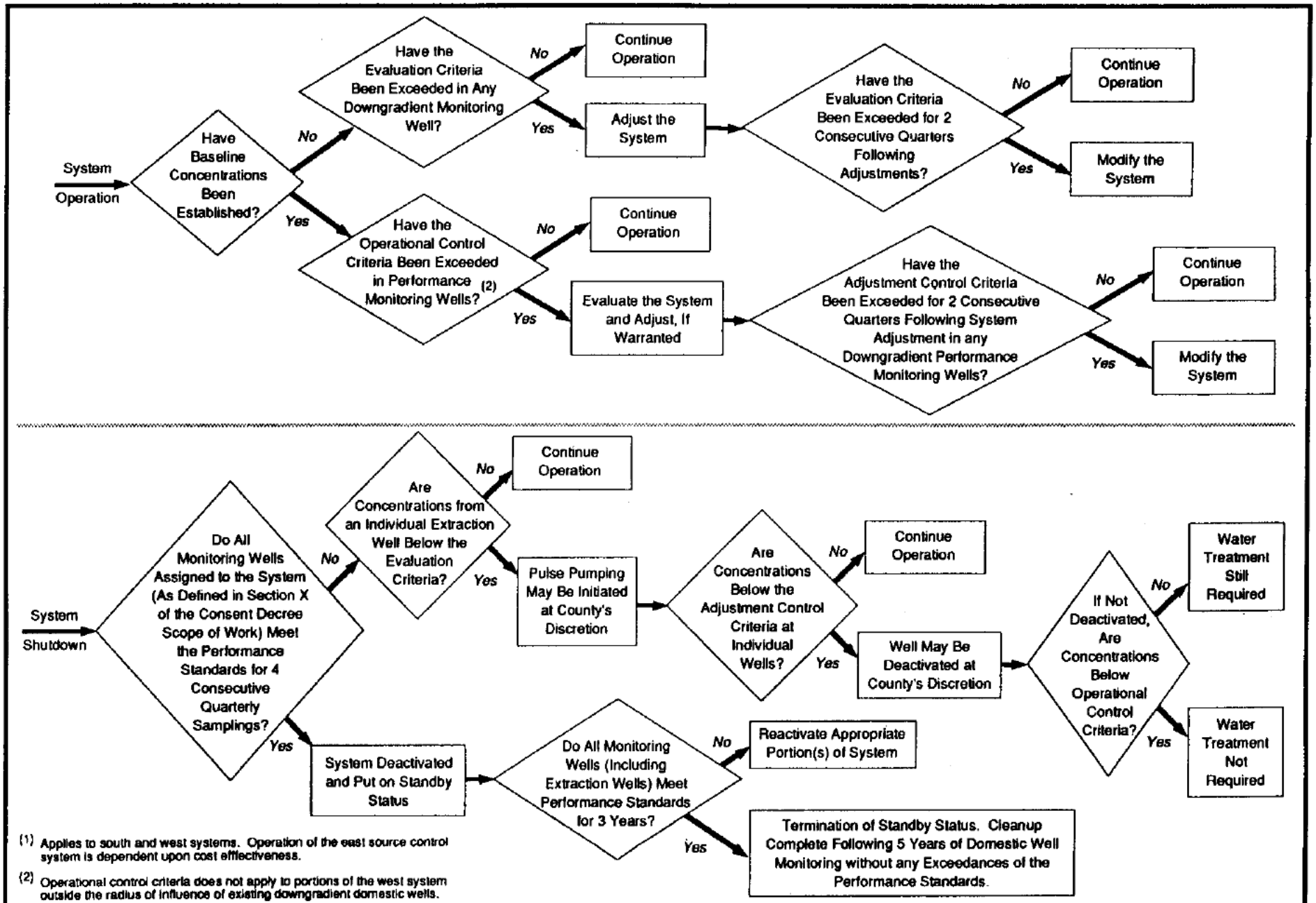
TCA Concentrations for Lower Sand/Gravel Aquifer (Set B)
Downgradient Compliance Monitoring Wells

Figure 7-12



RA Interception System Monitoring Criteria

Figure 7-13

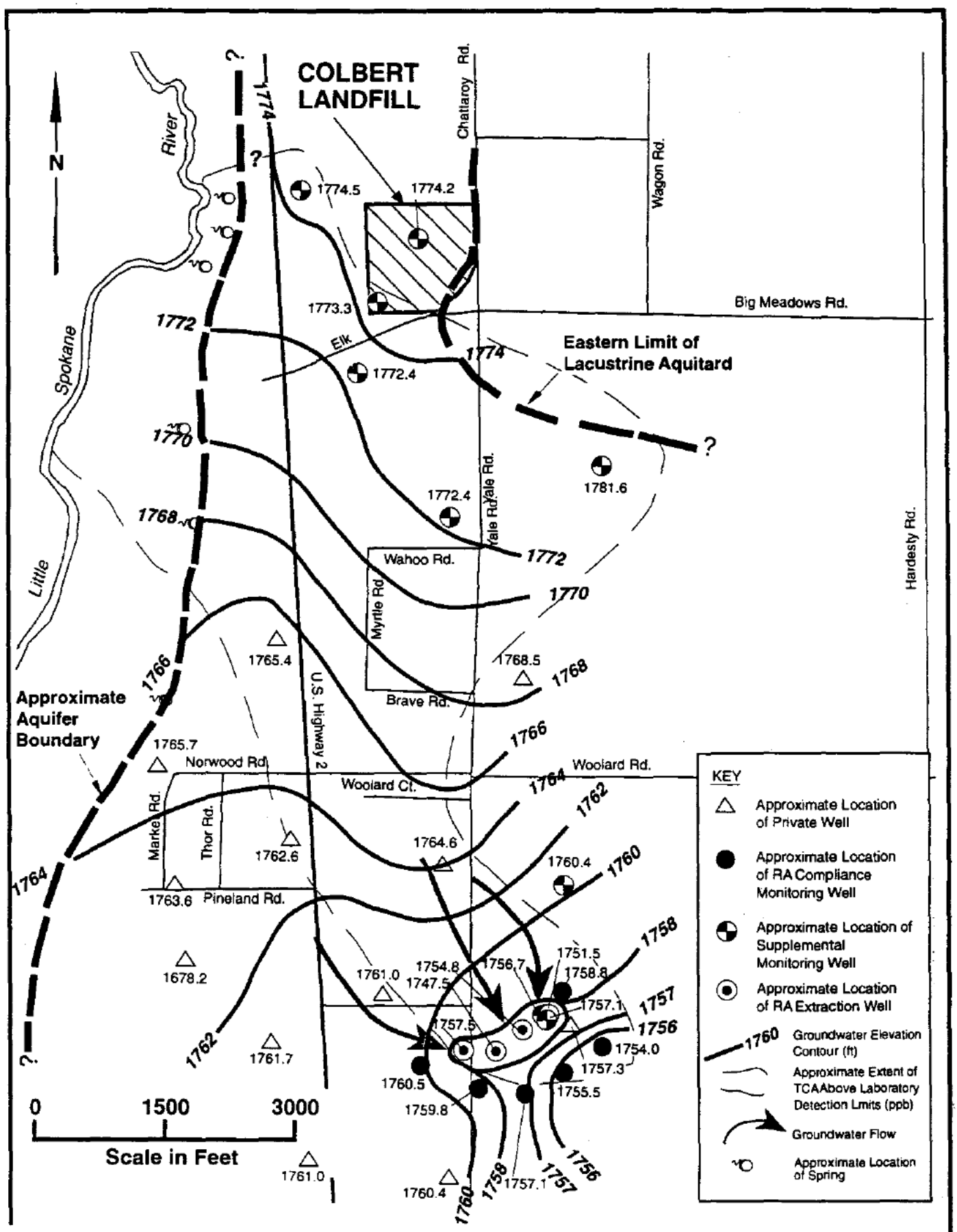


(1) Applies to south and west systems. Operation of the east source control system is dependent upon cost effectiveness.

(2) Operational control criteria does not apply to portions of the west system outside the radius of influence of existing downgradient domestic wells.

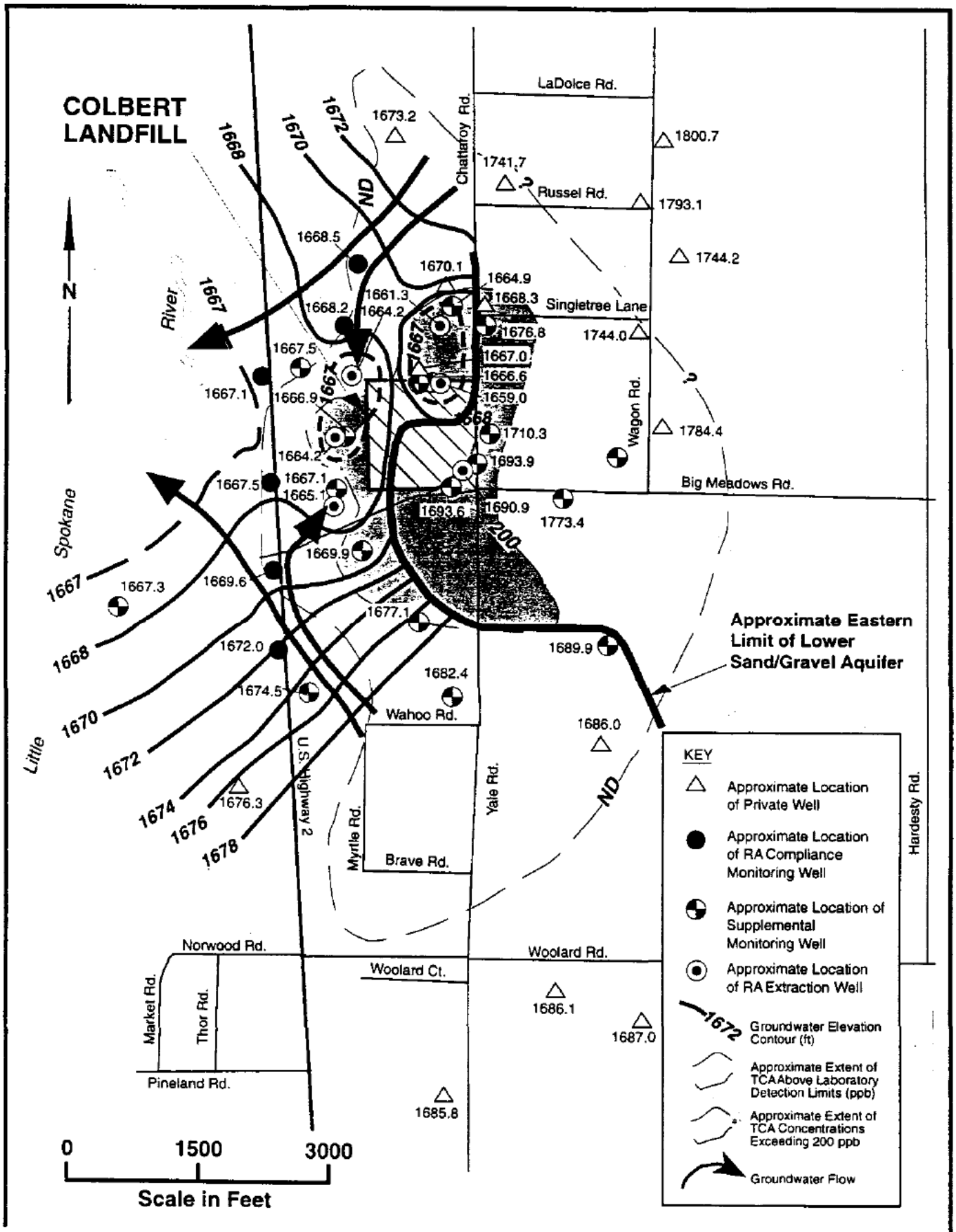
RA Interception System Operation and Shutdown Criteria[1]

Figure 7-14



Upper Aquifers
Groundwater Elevation Contours October 1996 (Pumping)

Figure 7-15



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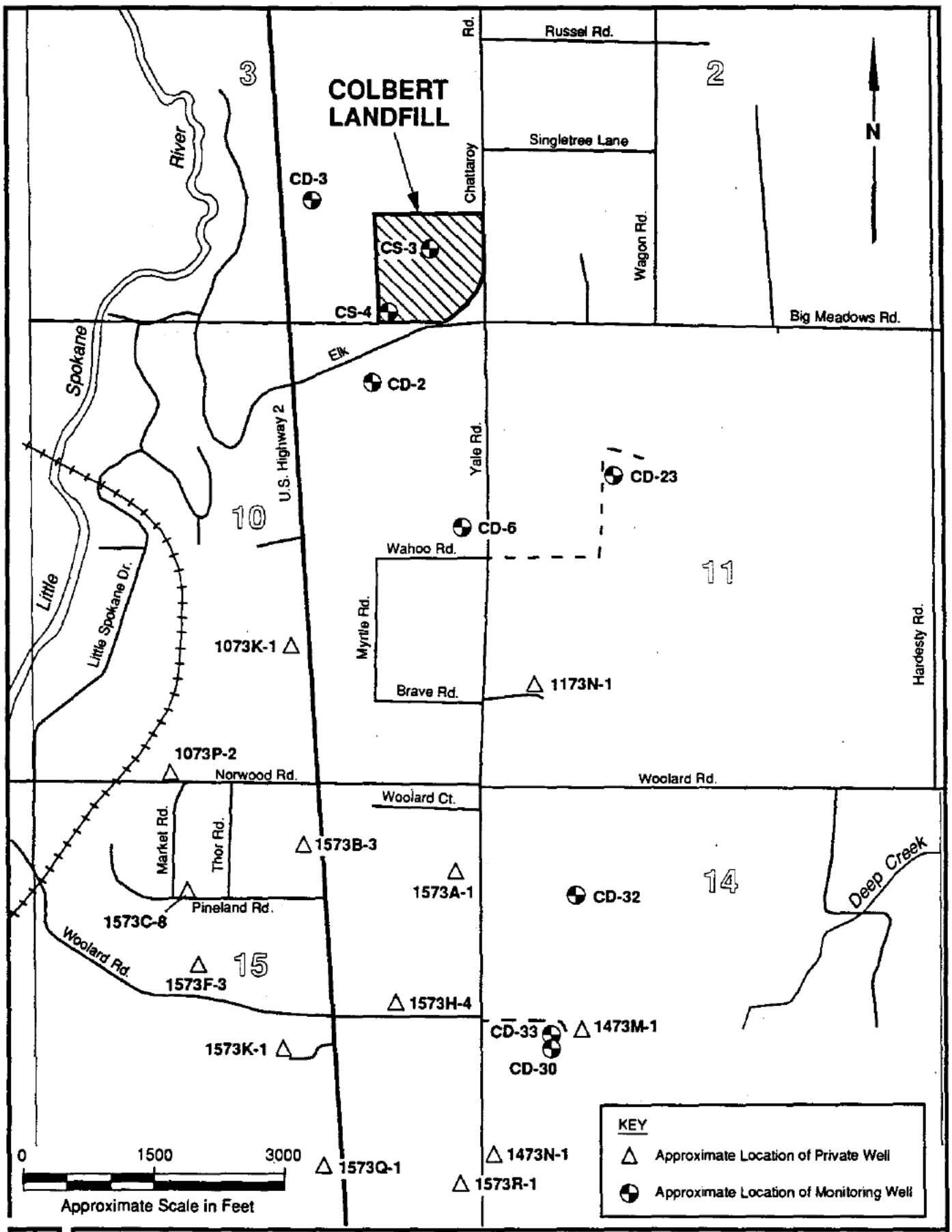
Lower Aquifers
Groundwater Elevation Contours October 1996 (Pumping)

Figure 7-16



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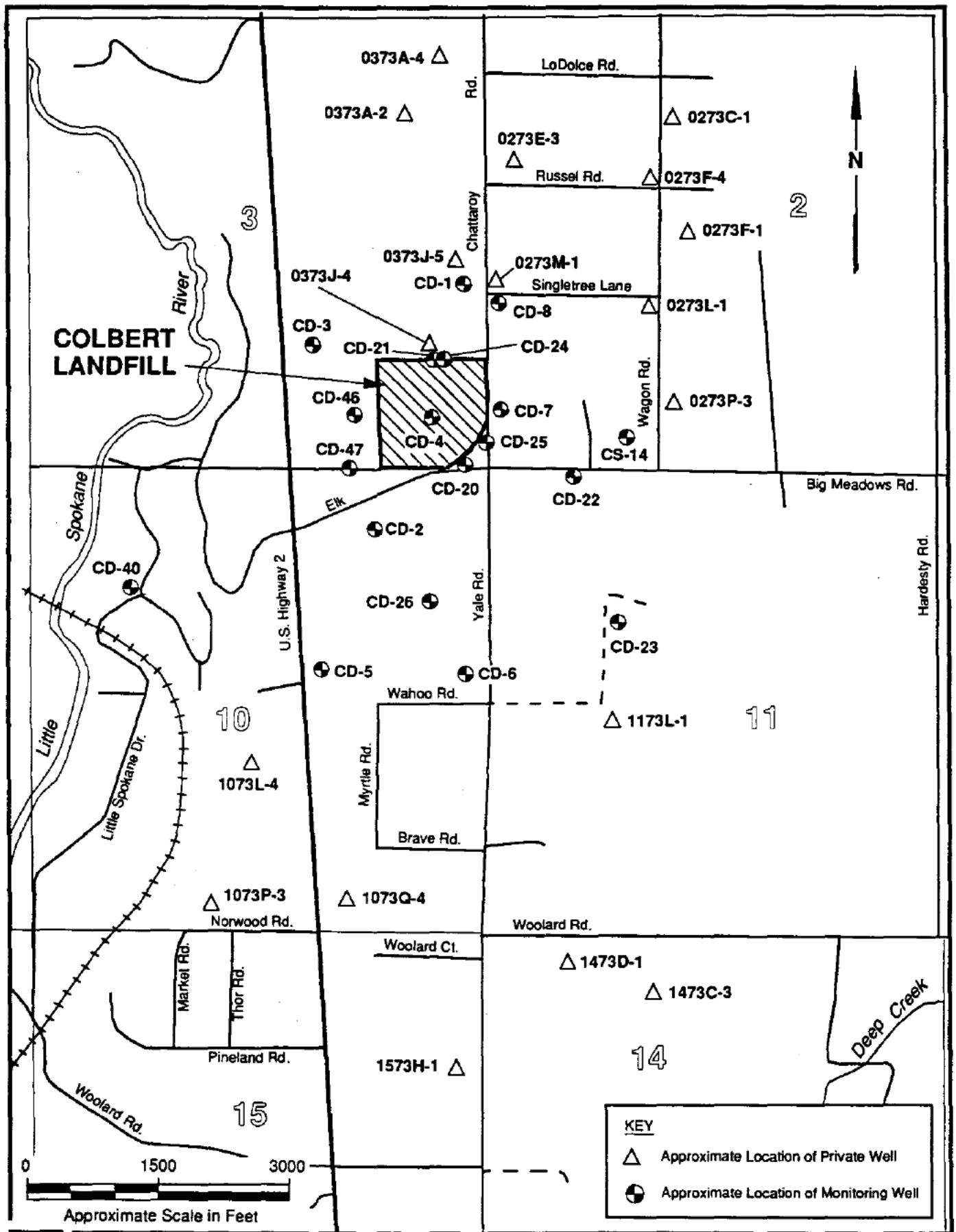
Upper Aquifers
Private Well and Monitoring Well Location Map

Figure 7-17



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Lower Aquifers
Private Well and Monitoring Well Location Map

Figure 7-18

TABLE 7-1

DESIGN FLOW RATES
RA INTERCEPTION AND EXTRACTION SYSTEMS[a]

Interception/ Extraction System	Extraction Well Designation	Model-Predicted		System Design	
		Lower Bound Flow Rate	Upper Bound Flow Rate	Minimum Flow Rate	Maximum Flow Rate
South	CP-S1	50	60	--	--
	CP-S4	50	60	--	--
	CP-S5	50	50	--	--
	CP-S6	50	60	--	--
Subtotal		200	230	200	400
West	CP-W1	80	170	--	--
	CP-W2	70	130	--	--
	CP-W3	120	230	--	--
Subtotal		270	530	250	900
East	CP-E1[b]	60	80	--	--
	CP-E2[c]	5	5	--	--
	CP-E3[b]	50	65	--	--
	CP-E4[b]	50	65	--	--
Subtotal		165	215	150	300
System Total		635	975	600	1,600

(a) Flow rates in gallons per minute (gpm).
(b) Flow rates predicted to assist West Interception System capture. Higher flow rates may be utilized for source control.
(c) Well not in model domain. Pumping rate based on Phase I pumping test results.

TABLE 7-2

WATER ELEVATION AND DRAWDOWN INFORMATION FOR RA EXTRACTION WELLS

Location	Approximate Prepumping Water Elevation[a] (ft)	Minimum Water Elevation[b] (ft)	Model-Predicted Drawdown	Maximum Available Drawdown[c] (ft)
West System				
CP-W1	1668.8	1582	4.2	87
CP-W2	1668.8	1611	2.4	58
CP-W3	1668.7	1624	3.0	45
South System				
CP-S1	1758.3	1744	6.4	14
CP-S4	1758.9	1750	6.4	9
CP-S5	1757.5	1749	6.1	8
CP-S6	1757.8	1749	6.2	9
East System				
CP-E1	1669.0	1635	3.6	34
CP-E2	1716.2	1686	NA[d]	30
CP-E3	1669.1	1645	3.6	24

(a) Water elevations from June 1993.

(b) Minimum water elevation based on depth to top of pump.

(c) Maximum allowable drawdown = approximate prepumping water elevation - minimum water elevation.

(d) Well is not located within model domain. Well should be pumped at the rate necessary to achieve maximum available drawdown.

TABLE 7-3

PROJECT CONCENTRATION-BASED CRITERIA[a]

Constituent of Concern	Performance Standards	Evaluation Criteria
1,1,1-Trichloroethane (TCA)	200	200
1,1-Dichloroethylene (DCE)	7	7
1,1-Dichloroethane (DCA)	4,050	4,050
Trichloroethylene (TCE)	5	5
Tetrachloroethylene (PCE)	0.7	7
Methylene chloride (MC)	2.5	25

(a) All concentrations in parts per billion (ug/L).

TABLE 7-4

TCA CONCENTRATIONS FOR POST RA STARTUP
TWO YEAR MONTHLY MONITORING PERIOD [a]

Monitoring Well	Aquifer [b]	Jun-94	Aug-94	Sep-94	Nov-94	Dec-94	Jan-95	Feb-95	Mar-95	Apr-95	May-95	Jun-95	Jul-95	Aug-95	Sep-95	Oct-95	Nov-95	Dec-95	Jan-96	Feb-96	Mar-96	Apr-96
CD-31A1	upper	2.6	1.3	1.6	1.6	2.4	1.2	1.4	1.7		2.3	1.4	2.2	1.1	1.2	0.5 U	0.7	0.7	0.8	1.1	0.5 U	0.8
CD-36A1	upper	0.5 U	1.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		1	0.5 U	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-37A1	upper	33		27	19	20	14	14	12	7.5	6.9	3	4.3	2.5	2.2	2.4	2	2	1.7	2.1	2.1	1.7
CD-38A1	upper	1.6	0.6	0.7	0.7	0.9	0.8	0.9	1.4	1.6	2.8	0.9	1.9	1.1	1.1	0.7	0.5 U	0.5 U	0.6	0.8	0.8	1.1
CD-41C1	lower A		0.5 U	0.5 U	0.5 U	0.5 U	0.7	1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C3	lower A	5.2	5.2	4.6	4.1	3.6	3.1	3.2	4.5	3.6	3.7	3.1	3.5	3.5	3.2	2.1	3.4	2.7	3.1	3.4	2.4	2.9
CD-42C1	lower A	2.1	0.6		0.5 U	0.5 U	0.5 U	3.5	0.9	0.5	0.8	0.5	0.8	0.5 U	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C2	lower A	8	4.7	5.2	2.9	2.1	0.5 U	4.3	0.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C1	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.7
CD-44C1	lower B	1.7	1.7	0.6	0.9	1	1.1	1.3	1.8	1.4	2	2	2.3	1.9	2.3	2	2.7	2.4	2	2.9	2.8	0.5 U
CD-44C2	lower B	4.3	4.3	0.5	0.9	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.6	0.5 U	8.6	12	18	20	16	14	12	6	5.7
CD-44C3	lower B	4.5	4.5	2.1	1.8	1.2	0.9	1	1.2	0.8	0.6	0.5	0.9	0.5 U	0.8	0.5 U	0.5 U	0.5 U	0.8	1.4	2.1	3.6
CD-45C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

(a) All concentrations in ug/L.

(b) upper = Upper Sand/Gravel Aquifer
lower A = Set A, Lower Sand/Gravel Aquifer
lower B = Set B, Lower Sand/Gravel Aquifer

TABLE 7-5

DCA CONCENTRATIONS FOR POST RA STARTUP TWO YEAR MONTHLY MONITORING PERIOD [a]

Monitoring Well	Aquifer [b]	Jun-94	Aug-94	Sep-94	Nov-94	Dec-94	Jan-95	Feb-95	Mar-95	Apr-95	May-95	Jun-95	Jul-95	Aug-95	Sep-95	Oct-95	Nov-95	Dec-95	Jan-96	Feb-96	Mar-96	Apr-96
CD-31A1	upper	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-36A1	upper	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-37A1	upper	1.3		1.1	0.5 U	0.9	0.7	0.8	0.8	0.8	0.8	0.6	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-38A1	upper	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C1	lower A		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C1	lower A	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C1	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-44C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-44C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-44C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

(a) All concentrations in ug/L.
(b) upper = Upper Sand/Gravel Aquifer
lower A = Set A, Lower Sand/Gravel Aquifer
lower B = Set B, Lower Sand/Gravel Aquifer

TABLE 7-6

DCE CONCENTRATIONS FOR POST RA STARTUP TWO YEAR MONTHLY MONITORING PERIOD [a]

Monitoring Well	Aquifer [b]	Jun-94	Aug-94	Sep-94	Nov-94	Dec-94	Jan-95	Feb-95	Mar-95	Apr-95	May-95	Jun-95	Jul-95	Aug-95	Sep-95	Oct-95	Nov-95	Dec-95	Jan-96	Feb-96	Mar-96	Apr-96
CD-31A1	upper	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-36A1	upper	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-37A1	upper	1.7		2.5	1	1.4	0.8	0.8	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-38A1	upper	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C1	lower A		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C1	lower A	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C1	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-44C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-44C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-44C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

(a) All concentrations in ug/L.

(b) upper = Upper Sand/Gravel Aquifer
lower A = Set A, Lower Sand/Gravel Aquifer
lower B = Set B, Lower Sand/Gravel Aquifer

TABLE 7-7

TCE CONCENTRATIONS FOR POST RA STARTUP
TWO YEAR MONTHLY MONITORING PERIOD [a]

Monitoring Well	Aquifer [b]	Jun-94	Aug-94	Sep-94	Nov-94	Dec-94	Jan-95	Feb-95	Mar-95	Apr-95	May-95	Jun-95	Jul-95	Aug-95	Sep-95	Oct-95	Nov-95	Dec-95	Jan-96	Feb-96	Mar-96	Apr-96
CD-31A1	upper	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-36A1	upper	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-37A1	upper	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	1.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-38A1	upper	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C1	lower A		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-41C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C1	lower A	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-42C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C1	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C2	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-48C3	lower A	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-43C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-44C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-44C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-44C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C1	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C2	lower B	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CD-45C3	lower B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

(a) All concentrations in ug/L.

(b) upper = Upper Sand/Gravel Aquifer

lower A = Set A, Lower Sand/Gravel Aquifer

lower B = Set B, Lower Sand/Gravel Aquifer

TABLE 7-8

BASELINE CONCENTRATIONS, OPERATIONAL CONTROL CRITERIA AND ADJUSTMENT CONTROL CRITERIA FOR THE UPPER SAND/GRAVEL AQUIFER [a]

Indicator Compound	Baseline Concentration	PQL	Operational Control Criteria	Adjustment Control Criteria
TCA	2.6	0.3	33[b]	103[c]
DCA	0.31	0.7	610[b]	2026[c]
DCE	0.33	1.0	N/A	4.5[c]
TCE	0.26	1.0	N/A	3.3[d]

(a) All concentrations in ug/L

(b) Operational control criteria is based on 15 percent of the evaluation criteria, plus the baseline concentration or PQL (whichever is greater)

(c) Adjustment control criteria is based on 50 percent of the evaluation criteria, plus the baseline concentration or PQL (whichever is greater)

(d) Adjustment control criteria is based on 65 percent of the evaluation criteria

TABLE 7-9

BASELINE CONCENTRATIONS, OPERATIONAL CONTROL CRITERIA AND ADJUSTMENT CONTROL CRITERIA FOR THE LOWER SAND/GRAVEL AQUIFER [a]

Indicator Compound	Baseline Concentration	PQL	Operational Control Criteria	Adjustment Control Criteria
Set A Monitoring Wells				
TCA	0.75	0.3	31[b]	101[c]
DCA	0.25	0.7	610[b]	2026[c]
DCE	0.25	1.0	N/A	4.5[c]
TCE	0.25	1.0	N/A	3.3[d]
Set B Monitoring Wells				
TCA	1.2	0.3	NA	101[c]
DCA	0.25	0.7	N/A	2026[c]
DCE	0.25	1.0	N/A	4.5[c]
TCE	0.25	1.0	N/A	3.3[d]

(a) All concentrations in ug/L
(b) Operational control criteria is based on 15 percent of the evaluation criteria, plus the baseline concentration or PQL (whichever is greater)
(c) Adjustment control criteria is based on 50 percent of the evaluation criteria, plus the baseline concentration or PQL (whichever is greater)
(d) Adjustment control criteria is based on 65 percent of the evaluation criteria

TABLE 7-10

APPROXIMATE PREPUMPING GROUNDWATER ELEVATIONS AND PREDICTED DRAWDOWN FOR SELECTED MONITORING WELLS

Location	Approximate Prepumping Water Elevation (ft)[a]	Predicted Steady State Drawdown (ft)
Upper Sand/Gravel Aquifer		
CP-S3A	1758.7	3.2
CD-31A	1759.8	3.2
CD-34A	1760.3	2.9
CD-35A	1760.5	2.2
CD-36A	1754.1	2.8
CD-37A	1755.7	3.0
CD-38A	1757.2	3.1
Lower Sand/Gravel Aquifer		
CD-41C1	1669.6	0.8
CD-41C2	1669.6	0.8
CD-41C3	1669.7	0.8
CD-42C1	1668.4	1.1
CD-42C2	1668.2	1.1
CD-42C2	1668.4	1.1
CD-43C1	1667.6	1.0
CD-43C2	1667.9	1.0
CD-43C3	1668.8	1.0
CD-44C1	1669.7	1.0
CD-44C2	1669.7	1.0
CD-44C3	1669.6	1.0
CD-45C1	1669.1	1.3
CD-45C2	1669.1	1.3
CD-45C3	1669.1	1.3
CD-48C1	1671.4	0.6
CD-48C2	1671.3	0.6
CD-48C3	1671.2	0.6
CD-02C1	1669.1	1.2
CD-05C2	1673.7	0.5

(a) Based on April 1994 measurements.

TABLE 7-11

RA COMPLIANCE MONITORING WELLS

Monitoring System/Function	Monitoring Well Designation
West Monitoring System	
Downgradient - Set A	CD-41C1
	CD-41C2
	CD-41C3
	CD-42C1
	CD-42C2
	CD-42C3
	CD-48C1
	CD-48C2
	CD-48C3
Downgradient - Set B	CD-43C1
	CD-43C2
	CD-43C3
	CD-44C1
	CD-44C2
	CD-44C3
	CD-45C1
	CD-45C2
	CD-45C3
Outboard	CD-45C1
	CD-45C2
	CD-45C3
	CD-48C1
	CD-48C2
	CD-48C3
South Monitoring System	
Downgradient	CD-31A
	CD-36A
	CD-37A
	CD-38A
Outboard	CD-34A
	CP-S3

TABLE 7-12

SUPPLEMENTAL UPPER AQUIFER GROUNDWATER MONITORING AND PRIVATE WELLS FOR WATER LEVEL MEASUREMENTS

Well	Aquifer[a]	Reference Elevation[b] (MSL)	Groundwater Elevation[c] (MSL)
Monitoring Wells			
CD-2 S	A1	1853.87	1771.3[d]
CD-3 M	A1	1845.01	1773.3
CD-6 U	A1	1856.94	1772.4
CD-23	B1	1860.51	1781.6
CD-30	A1	1845.95	1758.1
CD-32	B1	1853.44	1759.8
CD-33	A1	1846.57	1758.1
CS-3	A1	1864.13	1774.6
CS-4	A1	1858.38	1771.8
CS-10	A1	1849.77	NA[e]
Private Wells			
1573R-1 (b) (6)	NA	1851.75	1759.9
1473N-1	NA	1844.62	NA
1473M-1	NA	1839.15	1757.4
1573H-4	NA	1856.95	NA
1573F-3	NA	1840.58	NA
1073P-2	NA	1838.67	1764.6
1573Q-1	NA	1839.13	1760.0
1173N-1	NA	1858.61	NA
1573K-1	NA	1850.33[f]	1760.4
1573B-3	NA	1844.66	1761.4
1573A-1	NA	1854.60	NA
1073K (b) (6)	A1	1843.74	1764.1
1573C-8 (b) (6)	NA	1841.13	1762.4

(a) A = Upper Sand/Gravel Aquifer; B = Lacustrine Aquitard; number represents relative position in the aquifer, with "1" near top, "2" in middle unit, and "3" near base.
(b) Reference elevation is top of PVC casing for monitoring wells and access port for private wells, unless otherwise indicated.
(c) Monitoring well data is from one measurement taken June 1993, unless otherwise noted.
(d) Data is from average of two measurements taken June 1993 and April 1994.
(e) NA = information not available.
(f) Surveyed at angled port access; 0.35 ft must be subtracted from the depth to water reading due to angled access.

TABLE 7-13

SUPPLEMENTAL LOWER AQUIFER GROUNDWATER MONITORING AND PRIVATE WELLS FOR WATER LEVEL MEASUREMENTS

Well	Aquifer[a]	Reference Elevation[b] (MSL)	Groundwater Elevation[c] (MSL)
Monitoring Wells			
CD-1	C2	1853.4[d]	1669.3
CD-2 D	C2	1853.93	1669.2[e]
CD-3 L	C1	1845.00	1668.3
CD-4 L	E1	1867.61	1669.2
CD-5	C2	1854.33	1673.7[e]
CD-6 L	C2	1861.60	1680.7
CD-7 L	E1	1866.94	1711.2
CD-8	E1	1866.76	1678.5
CD-8 L	E2	1866.74	1676.3
CD-20	E1	1864.58	1716.2
CD-20	E2	1865.00	1716.2
CD-21	C1	1855.88	1669.2[e]
CD-21	C3	1857.38	1669.4[e]
CD-22	D1	1865.35	1773.1
CD-23	C2	1861.08	1689.8
CD-24	C2	1859.85	1669.2[e]
CD-25	E2	1865.00	1714.8
CD-26	C2	1860.79	1675.9
CD-40	C1	1671.67	1661.4
CD-40	C2	1671.84	1667.2
CD-40	C3	1672.29	1663.4
CD-46	C2	1852.61	1668.4
CD-47	C2	1850.88	1668.8
CS-14U	C1	1868.25	1784.7
CS-14 L	D1	1868.19	1784.7

TABLE 7-13

SUPPLEMENTAL LOWER AQUIFER GROUNDWATER MONITORING AND PRIVATE WELLS FOR WATER LEVEL MEASUREMENTS

Well	Aquifer[a]	Reference Elevation[b] (MSL)	Groundwater Elevation[c] (MSL)
Private Wells			
0273L-1 (b) (6)	NA	1888.08	1732.9
1173L-1	NA	1855.33	1683.4
0273M-1	C/E/F	1867.69	1670.8
0273P-3	E1	1863.53	1785.2
1573H-1	NA	1851.55	1683.7
1073P-3	C1	1838.79	1679.0
0273F-4	NA	1884.75	NA
0273F-1	NA	1890.60	1743.5
0373A-2	NA	1837.21	1672.8
1473D-1	NA	1855.97	1683.8
0273E-3	C1	1889.09	1747.0
0373A-4	C1	1870.64	1674.7
1473C-3	C1	1848.50	1684.6
0373J-5	F1	1860.41	1670.8
0273C-1	F1	1887.69	1801.9
1073L-4	NA	1841.52	1675.4
0373J-4	NA	1890.17	1763.4

(a) C = Lower Sand/Gravel Aquifer; D = Latah Aquitard; E = Basalt Aquifer; F = Granite Aquitard; number represents relative position in the aquifer, with "1" near top, "2" in middle, and "3" near base.

(b) Reference elevation is top of PVC for monitoring wells and access port for private wells.

(c) Monitoring well data is from one measurement taken June 1993, unless otherwise noted.

(d) Reference point is top of steel casing.

(e) Data is from average of two measurements taken June 1993 and April 1994.

8.0 QUALITY ASSURANCE PROJECT PLAN

This quality assurance project plan (QAPP) establishes the quality assurance (QA) objectives during the operation of the Colbert Landfill (landfill) remedial action (RA); the QA organization and procedures developed to meet QA and project objectives; the QA and quality control (QC) protocols and procedures associated with sampling and analysis of groundwater and treatment system influent/effluent; and data quality objectives (DQOs). The DQOs established for the project reflect the intended use of project data and, as such, prescribe the level of quality, accuracy, precision, completeness, comparability, and representativeness of data to be collected and analyzed. To assure quality data, this QAPP establishes specific procedures for sample collection and handling; sample custody; equipment calibration procedures and frequency; laboratory analytical procedures; data reduction, validation, and reporting; internal QC; performance and system audits; preventative maintenance; and data assessment procedures, corrective actions, and QA reports.

This QAPP addresses QA/QC requirements for the National Pollutant Discharge Elimination System (NPDES) discharge monitoring, which are interim requirements at this time. Revisions to this QAPP may be required at the end of the interim period, if the final NPDES discharge monitoring requirements vary from the interim requirements.

Guidance used for preparation of this QAPP is contained in various U.S. Environmental Protection Agency (EPA) documents, including *The Quality Assurance Manual for Waste Management Branch Investigations, Region X* (EPA 1986a); *A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001)* (EPA 1987a); and other EPA (1979, 1981, 1982, 1983, and 1984a) and National Institute of Occupational Safety and Health (NIOSH 1988) guidance manuals and handbooks.

8.1 PROJECT OBJECTIVES

The primary objectives of remedial action activities are to operate a groundwater extraction, treatment, and discharge system that meets the performance requirements established in the Consent Decree.

Groundwater samples will be collected from compliance monitoring wells, extraction wells, and the RA treatment facility and analyzed for the Constituents of Concern and index parameters to evaluate compliance with the Consent Decree requirements, and for operational purposes.

The Consent Decree water quality criteria, and NPDES effluent limits, that are applicable during interim operation are shown in Table 8-1 and 8-2, respectively.

Groundwater and treatment system influent/effluent samples will also be collected during long-term Phase II operation.

8.2 PROJECT DATA QUALITY OBJECTIVES

The primary DQOs for activities are to obtain data of sufficient quality to provide a high degree of confidence in the data's precision, accuracy, representativeness, completeness, and comparability. The data will be used by EPA, Ecology, and the County to verify the effectiveness of the groundwater extraction, treatment, and discharge systems in meeting the requirements specified by the project Consent Decree, and the NPDES interim discharge requirements.

The project objectives can be achieved using data of analytical level III; that is, data from analyte-specific, non-Contract Laboratory Program (CLP) procedures, as described by EPA (1987c). Level III is consistent with the Consent Decree SOW requirements. Rigorous attention will be paid to QA/QC to assure (to the degree practicable) that analytical data will be of high quality.

The QA procedures presented in this document are developed to assure that the DQOs described above is met, as well as to assure that data generated are representative of treatment plant discharge water and groundwater conditions at the site. The overall goal of the project QA program is to assure a reasonable degree of confidence in data collected in support of groundwater extraction, treatment, and discharge systems operation; and in results of associated assessments through the establishment of a rigorous system of quality and performance checks on data collection, analysis, and reporting activities, as well as appropriate and timely corrective action to ensure compliance with established performance and quality criteria. To accomplish this goal, the following QA project objectives have been established:

- To establish, with the complete support of project management, a project QA function that is sufficiently independent of project technical activities, in order to assure appropriate levels of review and surveillance of project activities and data

- To establish and define the duties and responsibilities of personnel involved in QA activities

- To establish effective systems for project documentation to assure proper development, use, and review of the data

- To establish QA procedures that provide for sufficient objective evidence to verify that laboratory, field sampling, and other technical activities are performed in accordance with established technical procedures and requirements.

As previously discussed, this QAPP presents the procedures and methods for sampling and sample handling, sample chain-of-custody, instrument/equipment calibration, chemical analysis, internal quality control, auditing, and data assessment developed to meet project and QA objectives.

8.3 PROJECT QUALITY ASSURANCE ORGANIZATION AND RESPONSIBILITIES

Spokane County, through its Project Manager (Spokane County Project Manager), is responsible for assuring compliance with the provisions of this QAPP. The County may elect to contract with an appropriate firm or individuals to provide the QA organization and personnel required to assist the County in meeting the project QA responsibilities prescribed in this QAPP. While specific individuals with project QA responsibilities have not yet been identified, the QA organization will include, in addition to the Spokane County Project Manager, a Field Services Project Manager responsible for field and QA activities. If the County elects to conduct all QA activities internally, the Spokane County Project Manager and Field Services Project Manager positions could be combined. In addition, a separate QA Coordinator (QAC) and Laboratory QA Officer would need to be identified or contracted by the County.

The project QA organization, showing individuals with QA responsibility and lines of QA authority, is shown on Figure 8-1. Specific project QA responsibilities for the Field Services Project Manager, QAC, and Laboratory QA Officer are listed by responsible individuals in Table 8-3.

8.4 DATA QUALITY OBJECTIVES FOR PARCC PARAMETERS

The purpose of this section is to describe DQOs for precision, accuracy, representativeness, completeness, and comparability (PARCC) of project data. Specific procedures to be used for sampling, chain of custody, calibration, laboratory analysis, reporting, internal QC, audits, preventative maintenance, and corrective action are described in other sections of this QAPP. Detection limits are discussed in Section 8.8.

Samples will be analyzed in accordance with accepted analytical procedures selected from published methods contained in following documents: SW-846 *Test Methods for Evaluating Solid Waste*, Third Edition (EPA 1986b) and *Standard Methods for the Examination of Water and Wastewater*, Sixteenth Edition (APHA-AWWA-WPCF 1985).

Influent/effluent samples will be analyzed for selected chemical and physical parameters to assess system treatment effectiveness and compliance with project discharge requirements.

8.4.1 PRECISION AND ACCURACY

Precision is a measure of mutual agreement among individual measurements of the same property under prescribed conditions. It is expressed as a standard deviation or relative percent difference on laboratory and blind field duplicates. Accuracy is the degree of agreement of a measurement (or an average of measurements of the same property), X, with an accepted reference or true value, T. Accuracy can be expressed as the difference between the two values (X-T), the difference as a percentage of the reference or true value (100 (X-T)/T), or as a ratio (X/T). Accuracy is a measure of the bias in a system and will be expressed as the percent recovery of spiked samples and surrogates.

Accuracy and precision are determined through QC parameters such as surrogate recoveries, matrix spikes, matrix spike duplicates, laboratory duplicates, QC check samples, and blind field duplicates. The project DQOs for the evaluation of these parameters are based on those given in the method or on functional guidelines outlined by the EPA for evaluating inorganic and organic analyses (EPA 1988a,b; 1991). Project QC objectives for surrogate recovery control limits (expressed as a percent of recovery), and for matrix spikes and matrix spike duplicate control limits [expressed as a percent of recovery and relative percent difference (RPD)] are listed in Tables 8-4 and 8-5, respectively. Control limits listed in these tables are consistent with EPA guidelines contained in the specific methods. These control limits will be used as criteria for data acceptance. Specific control limits may be modified after selection of an analytical laboratory. If the required QC limit for replication or recovery is not met, corrective action will be performed by the laboratory following the guidelines presented in Section 8.14. If the corrective action is performed and QC objectives still are not met, the QAC will be notified by the laboratory prior to data submittal, so that additional corrective action can be taken, if appropriate. Such action may include reanalysis of the sample or other determination to be made by the QAC and the Field Services Project Manager.

In addition to matrix spikes and matrix spike duplicates, QC samples for verification of precision and accuracy include laboratory duplicates, QC check samples, and blind field duplicates (Section 8.10.1). Acceptance criteria are given in the referenced method and in Tables 8-4 and 8-5.

If results for the QC check samples, laboratory duplicates, or blind field duplicates are outside the control limits, corrective action and/or data qualification requirements will be determined on a case-by-case basis by the QAC. The matrix of the QC check samples may not match the field sample matrix, and blind field duplication can be poor due to sample

inhomogeneity. Therefore, corrective action will be determined by the QAC and discussed in the data QA report.

8.4.2 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represent an actual condition or characteristic of a population. Sample locations and field sampling procedures have been chosen to maximize representativeness. The degree of representativeness will be measured by repetitive measurements of the same parameter at the same sampling location over several distinct sampling events. The potential effect of seasonal variations and sampling on accuracy will also be considered with respect to representativeness.

8.4.3 COMPLETENESS

Completeness is a measure of the proportion of data specified in the sampling plan that is determined to be valid. The QA objective for completeness during this project will be 90 percent.

8.4.4 COMPARABILITY

Comparability is an expression of the confidence with which one data set can be compared to another. All measurements will be made so that results are consistent and representative of the media and conditions measured. All data will be calculated, qualified, and reported in units consistent with EPA guidelines. Method detection limits and units to be reported are described in Section 8.8 of this document.

8.5 SAMPLING PROCEDURES AND HANDLING

8.5.1 SAMPLING SITE SELECTION AND OBJECTIVES

As previously discussed, groundwater and influent/effluent samples will be collected during the interim discharge activities. Groundwater samples will be collected from compliance monitoring wells and extraction wells located proximate to contaminant plumes. Monitoring well and extraction well locations are shown on Figure 8-2. Influent and effluent samples will be collected from the intake and discharge (respectively) of the treatment system.

Groundwater samples collected from compliance monitoring wells and extraction wells will be analyzed for a limited number of volatile organics to evaluate interception system performance and operational settings, and evaluate compliance with the minimum functional standards (MFS)

specified in WAC 173-304-490. Samples from groundwater compliance monitoring wells will be analyzed for the six volatile organic compounds identified as the Constituents of Concern (1,1,1-TCA; 1,1-DCA; 1,1-DCE; TCE; PCE; and methylene chloride) once a year, and will be analyzed for a reduced list of parameters identified as the indicator compounds (1,1,1-TCA; 1,1-DCA; 1,1-DCE; and TCE) quarterly. Samples collected from extraction wells will be analyzed for the Constituents of Concern for each sample event at Spokane County's discretion. Six additional samples (four from the upper aquifer and two from the lower aquifer) will be analyzed for constituents listed in WAC 173-304-390(2)(d)(i) to satisfy MFS requirements.

Treatment system influent and effluent will be analyzed for volatile organics (full list of EPA Method 8010A compounds) to evaluate treatment system performance, and may be analyzed (at the County's discretion) for hardness and alkalinity to evaluate the effectiveness of scale control measures. Treatment system effluent samples will also be analyzed for NPDES parameters, including:

- Total phosphorous (as P)
- Nitrate and nitrite
- Chloride, iron, and manganese
- Chronic and acute fish bioassays
- pH, turbidity, conductivity, and temperature
- Algal growth potential (if necessary).

All groundwater and treatment system influent/effluent samples will also be analyzed (in the field) for pH, specific conductivity, turbidity, and temperature.

8.5.2 Sampling Procedures

Sampling procedures are presented in the field sampling plan (Appendix F to this O&M plan). Table 8-6 presents information on chemical analyses to be conducted, sample containers and sample preservation methods to be used, and maximum sample holding times.

8.5.3 Sample Documentation

Sample documentation will comply with procedures contained in Section 4.6 of *A Compendium of Superfund Field Operations Methods* (EPA 1987a). Project sampling and sample

handling will be documented through the use of the records summarized in Table 8-7. Examples of forms to be used for sampling activities are presented in the field sampling plan.

8.5.4 LABORATORY COORDINATION AND REPORTING

The analytical laboratory will perform chemical analysis of groundwater samples. The Project Field Representative will coordinate sampling activity with the laboratory to assure that all samples can be processed within the required holding times. (Actual holding times will be verified by review during data validation as described in Section 8.9).

8.6 SAMPLE CUSTODY

Strict chain-of-custody procedures will be followed on the project to maximize sample integrity and accountability. Sample control and chain-of-custody in the field and during transport to the laboratory will be conducted in accordance with procedures described in Section 4.0 of *A Compendium of Superfund Field Operations Methods* (EPA 1987a) and Section 4.1.10 of Appendix A. For sample shipments, a chain-of-custody form similar to that presented in the field sampling plan will be used. Sample control and custody at the laboratory through sample disposal will be conducted in accordance with procedures contained in the laboratory standard operation procedures (SOP) for organics and inorganics analysis.

When samples are transferred, the person relinquishing the samples will sign the Chain-of-Custody Form and record the date and time of transfer. The sample collector will sign the form in the first signature space.

Project documentation of sample custody will be verified by the QAC during regular review of the data validation package. Data validation is discussed further in Section 8.9.

8.7 CALIBRATION PROCEDURES AND FREQUENCY

8.7.1 LABORATORY INSTRUMENTS

Laboratory instruments will be calibrated and their performance evaluated in accordance with the methods cited in Section 8.12. Instrument performance for all other analyses will be evaluated against appropriate check standards and calibration blanks for each parameter prior to commencing actual analysis on each day the analysis is performed. Divergence from benchmark criteria (as defined in the above-cited methods) will be corrected prior to analysis.

For volatile organics analysis in water, the GC will be calibrated initially for each analyte with a five-point calibration using concentrations established according to guidelines in the method. Linearity must be established by a variation of less than 20 percent RSD in the calibration factor throughout the working range. The calibration will be verified each day using one or more calibration standards, and must vary less than 15 percent from the initial calibration. Continuing calibration will be performed throughout the day using a mid-level standard and will vary less than 15 percent from the initial calibration factors. Retention time windows will be established for each analyte according to Method 8010A. These retention time windows will be updated daily according to the method and all continuing standards must fall within the windows.

Guidance for instrument calibration is described for individual methods for organic and metal analytes in EPA (1986b) and for other inorganic analyses in EPA (1983).

After calibration and standardization of instrumentation are within acceptable limits, precision and accuracy will be evaluated by analyzing a QC check sample for each analysis performed that day. QC check samples containing all analytes of interest will be either purchased commercially or prepared from pure standard materials independently from calibration standards. The QC check sample will be analyzed and evaluated according to criteria in the method. Instrument performance check standards and calibration blank results will be recorded in a laboratory log book, which will also contain evaluation parameters, benchmark criteria, and maintenance information (see Section 11.0). Table 8-8 presents suggested QC check materials for laboratory analysis and for field equipment measurement parameters not addressed in the methods cited above.

8.7.2 FIELD INSTRUMENTS

Four field instruments (pH meter, conductivity meter, thermometer, and turbidimeter) will be used during the interim discharge period. The field meters will be calibrated (if applicable) in accordance with manufacturer's instructions, which are presented in the field sampling plan. QC limits for accuracy and precision of the field analyses are listed in Table 8-9.

Calibration results will be recorded in an instrument log book dedicated to each field instrument. This log book also will contain instrument preventive maintenance information, as appropriate.

8.8 ANALYTICAL PROCEDURES

The EPA methods have established detection limits (and, in some cases, quantification limits) covering each analyzed constituent for use nationwide as a contractual requirement for analytical laboratories. Quantification limits were established after considering typical ranges of interferences affecting quantification of constituents in representative environmental samples. Quantification of constituents at levels below the established quantification limits may be achieved if interferences are not significant. For highly contaminated samples, matrix effects may require higher quantification limits.

General methods and method quantification limits for analyses to be performed are summarized in Table 8-10. Methods for analysis will include analytical procedures, specified in Table 8-10, commonly employed by the project laboratory and verified as to accuracy and precision. QC checks and decision criteria for determining if an analysis is within laboratory and method QC requirements will follow the guidelines given in the laboratory SOP and/or QA plan or in the method, if available.

Where appropriate and consistent with anticipated data uses (and in recognition of the validation requirements), these procedures may be modified, with the concurrence of the QAC, to incorporate techniques familiar to the project laboratory. Deviations from EPA methods must be substantiated by full data verification and validation procedures according to requirements presented in the *EPA 530/SW-87/008 Test Method Equivalency Petitions Manual* (EPA 1987d). Any such procedure deviations deemed significant by the QAC will be submitted to the EPA and Ecology for review and concurrence prior to implementation.

Three types of bioassays may be performed on discharge or receiving waters, chronic bioassay, acute bioassay, and algal growth potential tests. The bioassays will be performed according to protocols in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, EPA-600-4-91-002, and *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*, EPA/600/4-90/027F. The testing will be conducted on the following organisms, as specified in the substantive discharge requirements:

- Freshwater chronic toxicity test species fathead minnow: *Pimephales promelas*
- Chronic toxicity: rapid screening tests using *Ceriodaphnia dubia*, *Daphnia pulex*, and *Daphnia magna* (24-hour static test) method EPA/600-4-91-002

- Acute toxicity: Acute rapid screening tests using Duphnid (*Ceriodaphnia dubia*), *Duphia pulex, or Daphnia magna* (24-hour static test) method EPA/600/4-90/027F.

8.9 DATA REDUCTION, VALIDATION, AND REPORTING

All analyses performed for the project must be accompanied by sufficient QC results to enable reviewers to conclusively determine the quality of the data. The QAC or designee is responsible to the Field Services Project Manager for conducting checks for internal consistency, transmittal errors, laboratory protocols, and for complete adherence to the QC elements specified in this QAPP.

Field measurements (pH, conductivity, turbidity, and temperature) will be verified and checked through review of measurement and recording procedures during surveillance of field and instrumentation calibration procedures. Transfer of field data from field notebooks to raw data lists will be verified by the QAC.

Analytical data will be reported in the units specified in Table 8-10. These units have been selected to assure ease of comparison with previously generated relevant site data and human health criteria.

The laboratory will provide documentation including the sample results with appropriate annotations, and all QA/QC results associated with that sample set (method detection limits, blanks, laboratory duplicates, matrix spikes, matrix spike duplicates, laboratory control samples, and surrogate recoveries). Raw data will not be required for all samples; however, the laboratory will maintain this information in their files. Data validation procedures for all samples will include checking the following:

- Holding times
- Field trip blanks
- Field rinsate blanks
- Field transfer blanks
- Blind field duplicates
- Laboratory duplicates
- Laboratory matrix spikes
- Laboratory matrix spike duplicates

- Method blanks
- Surrogate recoveries
- Detection limits
- Assessment of precision
- Assessment of accuracy
- Assessment of completeness.

Section 8.13 presents statistical tests used to determine data precision, accuracy, and completeness. If precision or accuracy fall outside of established acceptance limits, reanalysis or corrective action will be implemented, as appropriate. All corrective action will be substantial and defensible, or the corrected data will not be used. Corrective action procedures are presented in Section 8.14.

8.10 INTERNAL QUALITY CONTROL

QC checks will consist of measurements performed in the field and laboratory. Analytical procedures referenced in Section 8.8 specify routine methods required to evaluate whether data are within proper QC limits. Additional QC checks include analysis of a number of field and laboratory QC samples, which are described in the following subsections.

8.10.1 FIELD/INTRALABORATORY METHODS

The following QC samples will be evaluated to verify accuracy and precision of analytical results for the project. The frequency of laboratory and field QC analyses is described herein.

8.10.1.1 Field Trip/Transfer Blank

The field trip/transfer blanks for water sampling will consist of deionized (DI) or distilled water in a volatile organic compound sample container (supplied by the analytical laboratory), which will be transported to the field, transferred to a new sample container in the field and returned to the laboratory for volatile organics analysis. One field trip/transfer blank will be included in each cooler containing water samples for volatile analysis.

8.10.1.2 Field Rinsate Blank

A minimum of 5 percent of the total number of non-QC groundwater samples collected using nondedicated sampling equipment will be collected and analyzed as field rinsate blanks. Field rinsate blanks will consist of DI or distilled water (supplied by the analytical laboratory) passed over and/or through decontaminated sampling equipment used to collect water samples. Surfaces and materials exposed during actual sampling will be rinsed to evaluate the effectiveness of sampling equipment decontamination procedures and potential for equipment or field cross contamination.

8.10.1.3 Blind Field Duplicate

The field duplicate for groundwater sampling will consist of two water samples collected sequentially. Samples will be coded such that the laboratory cannot discern from the sample label which samples are duplicates. A minimum of 5 percent of the total number of non-QC water samples collected will be analyzed for all analyses as blind field duplicates to provide information on the precision of chemical analysis.

8.10.1.4 Laboratory Matrix Spike

Laboratory matrix spikes will be conducted to provide information on accuracy and assure that extraction and concentration levels are acceptable. These analyses will be conducted on a minimum of 5 percent of non-QC groundwater samples (or one per sampling event, if fewer than 20 samples are obtained). The laboratory matrix spike will follow matrix spike guidelines specified in the laboratory SOP. Laboratory matrix spikes will be performed for all required analyses.

8.10.1.5 Laboratory Matrix Spike Duplicate

Laboratory matrix spike duplicates will be analyzed for a minimum of 5 percent of non-QC water samples (or one per sampling event if fewer than 20 samples are obtained). These analyses will be performed to provide information on the precision of chemical analysis. The laboratory matrix spike duplicate will follow matrix spike duplicate guidelines specified in the laboratory SOP. Laboratory matrix spike duplicates will be performed for all required organic analyses.

8.10.1.6 Laboratory Duplicates

Laboratory duplicates will be conducted on a minimum of 5 percent of all non-QC water samples to provide information on the precision of chemical analysis. Laboratory duplicates will be analyzed for all inorganic analyses.

8.10.1.7 Laboratory Method Blank

Laboratory method blanks will be analyzed for all analyses for a minimum of 5 percent of all non-QC water samples (or one per batch of samples analyzed, if fewer than 20 samples are analyzed) to assess possible laboratory contamination. Dilution water will be used whenever possible. Laboratory method blanks will contain all reagents used for analysis.

8.10.1.8 QC Check Sample

QC check samples containing each analyte of interest will be analyzed for a minimum of 5 percent of non-QC water samples or one per sampling event (if fewer than 20 samples are obtained) to verify the accuracy of laboratory equipment. Analysis will follow guidelines established in the EPA methods. Procedure calibrations will substitute for QC check samples where QC check samples are not required by the method.

8.10.2 INTERLABORATORY COMPARISONS

Interlaboratory comparisons are not planned at this time. A limited number of samples may be split with the EPA and/or Ecology, if requested.

8.11 PERFORMANCE AND SYSTEM AUDITS

This section presents the internal performance and systems audits required to monitor performance of the laboratory and field measurement systems. Performance and system audits of sampling activities and laboratory operations will consist of direct observations of work being performed, and inspection of laboratory and field equipment use, calibration, and maintenance to verify adherence to QA/QC requirements.

Internal audits of both field and laboratory activities will be conducted by the QAC or designee once within the first 6 months of operation, and once every 2 years thereafter. Field audits will be unannounced to assure representative performance of technical and QA procedures.

Laboratory audits will be scheduled to assure that project samples are being analyzed during the audit.

Checklists for both field and laboratory audits will be based on EPA's National Enforcement Investigation Center audit checklists (EPA 1984b) as presented in Forms 8-1 through 8-5 to this section. The audit will be conducted only by individuals that have no direct responsibilities for the activities being audited.

Prior to internal audits, the auditor(s) will meet with the audited party to define the scope of the audit. The physical audit will consist of reviewing audited activities, completing the checklist, and noting any nonconformances, deficiencies, and relevant observations. An exit review will be conducted with the audited party to notify them of preliminary audit findings.

The auditor or designee will prepare an audit report that includes findings, nonconformances, observations, recommended corrective action, and a schedule for completion of such action. An audit report format similar to that presented in Table 8-11 will be used.

For each identified nonconformance, a Corrective Action Report (Form 8-6) will be issued as part of the audit report by the auditor to notify the responsible party (the individual responsible for implementing corrective action) of the recommended corrective action and its schedule for completion (see Section 8.14). If a field corrective action is required, the Field Coordinator will be notified. If a laboratory corrective action is required, the Laboratory QA Officer will be notified. The audit report will be distributed to the Spokane County Project Manager and Field Services Project Manager.

The audit will remain open until all corrective action is completed by the responsible party and approved by the QAC. Once all findings are corrected and documented on Corrective Action Reports, the audit will be closed by the QAC. Closure may be effected by either a memo to be filed with the audit report or by another appropriate method. The audit reports and associated Corrective Action Reports will be submitted to Ecology and EPA once the audit is closed.

8.12 PREVENTIVE MAINTENANCE

8.12.1 FIELD INSTRUMENTS

The field representative is responsible for field instrumentation preventive maintenance for instrumentation utilized by that individual. Preventive maintenance on field instruments will be performed by qualified field technicians in accordance with manufacturer's instructions and

maintenance schedules. Maintenance will be documented in instrument log books and will include the date and initials of individual performing the maintenance.

The field representative will routinely compare instrument calibration results against preventive maintenance records to verify the effectiveness of the preventive maintenance program. The field representative is responsible for scheduling preventive maintenance required by the manufacturer.

8.12.2 LABORATORY INSTRUMENTS

The analytical laboratory manager has ultimate responsibility for maintaining laboratory instruments in good working order, including responsibilities for routine maintenance and the training of personnel in maintenance procedures. All maintenance activities and other appropriate details will be documented daily in maintenance log books by the laboratory personnel performing the maintenance. Each entry will be signed and dated. At a minimum, the preventative maintenance schedules contained in the equipment manufacturer's instructions will be followed.

8.13 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA

Analytical data will be reviewed to assure that the QA/QC objectives for precision, accuracy, and completeness are met. These reviews are intended to identify the occurrence of deficiencies in time to take corrective action. This section describes routine procedures for assessing project data.

8.13.1 ASSESSMENT OF PRECISION

Precision measures the mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. QA/QC sample types that test precision include field duplicates, laboratory duplicates, and laboratory matrix spike duplicates. The estimate of precision of duplicate measurements is expressed as a relative percent difference (RPD), and is calculated as follows:

$$RPD = \frac{D_1 - D_2}{(D_1 + D_2)/2} \times 100$$

Where D_1 = First sample value

D_2 = Second sample value (duplicate)

The RPDs will be routinely calculated and compared with DQOs.

To set control limits, the standard deviation, s, of a series of replicate measurement limits is calculated:

$$s = \sum_{i=1}^{n} \left[\frac{(Xi - \overline{X})^2}{n-1} \right]^{1/2}$$

Where: s = the sample standard deviation

n = the number of replicates

Xi = the ith replicate

X = the mean of the replicates

8.13.2 ASSESSMENT OF ACCURACY

Accuracy is assessed using results of QC check samples and laboratory matrix spike analyses, and is routinely expressed as a percent recovery, which is calculated:

$$Percent\ Recovery = \frac{(Total\ Analyte\ Found - Analyte\ Originally\ Present)\ x\ 100}{Analyte\ Added}$$

The percent recovery will be routinely calculated and checked against DQOs.

8.13.3 ASSESSMENT OF COMPLETENESS

The amount of valid data produced will be compared with the total analyses performed to assess the percent of completeness. Completeness will be routinely calculated and compared with DQOs.

8.14 CORRECTIVE ACTIONS

Corrective actions may be needed for three categories of non-conformance:

- Deviations from the methods or QA requirements established in the QAPP
- Measuring or analytical equipment malfunctions
- Analytical error.

Corrective action procedures that might be implemented based on audit results; detection of unacceptable data are developed on a case-by-case basis. Such actions may include one or more of the following:

- Altering procedures in the field
- Using a different batch of containers
- Performing an additional audit of field or laboratory procedures
- Reanalyzing samples if holding times allow
- Resampling and analyzing
- Evaluating sampling and analytical procedures to determine possible causes of the discrepancies
- Accepting the data with no action, acknowledging the level of uncertainty
- Rejecting the data as unusable.

During field operations and sampling procedures, the field representative will be responsible for taking and reporting required corrective action related to field activities. A description of any such action taken will be entered in the field log book. If field conditions are such that conformance with the QAPP is not possible, the QAC will be consulted immediately. Any corrective action or field condition resulting in a major revision of the QAPP or field sampling plan will be communicated to the County Project Manager, as well as the EPA and Ecology, for review and concurrence. This communication will be made prior to changes in the field activities whenever possible.

During laboratory analysis, the Laboratory QA Officer will be responsible for taking required corrective actions in response to equipment malfunctions. If an analysis does not meet DQOs outlined in this QAPP, corrective action will follow the guidelines in the EPA methods and the EPA guidelines for data validation for organics and inorganics (EPA 1988a,b; 1991). At a minimum, the Laboratory QA Officer will be responsible for monitoring the following:

- Calibration check compounds must be within performance criteria specified in the EPA method or corrective action must be taken prior to initiation of sample analysis. For volatile organics analysis in water (Method 8010), a minimum of five calibration standards will be prepared for each analyte of interest. One of the standards should be at a concentration near, but above, the method quantification limit. The other concentrations should correspond to the expected range of concentrations found in real

samples or should define the working range of the detector. The percent relative standard deviation cannot exceed 20 percent when comparing calibration factors to determine if the five-point calibration curve is linear. The working calibration curve or calibration factor must be verified on each working day by the injection of one or more calibration standards. If the response for any analyte varies from the predicted response by more than ±15 percent, a new calibration curve must be prepared for that analyte. No analyses may be performed until these criteria are met.

- Before processing any samples, the analyst should demonstrate, through analysis of a reagent blank, that interferences from the analytical system, glassware, and reagents are within acceptable limits. Each time a set of samples is extracted or there is a change in reagents, a reagent water blank should be processed as a safeguard against chronic laboratory contamination. The blank samples should be carried through all stages of the sample preparation and measurement steps.

  For volatile organics analysis in water, blanks must contain less than 1.0 µg/L methylene chloride. The laboratory should report the methylene chloride concentration as estimated, "J," if below the 1.0 µg/L limit. For other parameters, method blanks must be below criteria guidelines specified in the method. If contaminants are present above these levels, the source of contamination must be investigated, corrective action taken and documented, and all samples associated with a contaminated blank reanalyzed. If, upon reanalysis, blanks do not meet these requirements, the QAC will be notified immediately to discuss whether analyses may proceed.

- Retention time windows will be defined by plus or minus three times the standard deviation of the absolute retention times for each standard. The laboratory must calculate retention time windows for each standard on each GC column and whenever a new GC column is installed. The data must be retained by the laboratory. All succeeding standards in an analysis sequence must fall within the daily retention time window established by the first standard of the sequence. No analyses may proceed until this criterion is met.

- Matrix spike analysis for volatile organics must be within the specified range for recovery limits or corrective action must be taken and documented. Corrective action includes: 1) reviewing calculations, 2) checking surrogate solutions, 3) checking internal standards, and 4) checking instrument performance. Subsequent action could include recalculating the data and/or reanalyzing the sample if any of the above checks reveal a problem. If the problem cannot be corrected through reanalysis, the QAC will be notified by the laboratory prior to data submittal, so that additional corrective action can be taken, if appropriate.

  If the recovery of a surrogate compound in the method blank is outside the recovery limits, the blank will be reanalyzed along with all samples associated with that blank. If the surrogate recovery is still outside the limits, the QAC will be notified immediately to discuss whether analyses may proceed.

- If holding times are exceeded, all positive and nondetected results will be qualified as estimated concentrations. If holding times are grossly exceeded, the QAC may determine the data to be unusable.

- If laboratory instrumentation deviates from required calibration specifications, the QAC will either flag data as estimated or determine it to be unusable, according to guidelines established by EPA (EPA 1988a,b; 1991).

If analytical conditions are such that nonconformance with this QAPP is indicated, the QAC will be notified as soon as possible, so that any additional corrective actions can be taken.

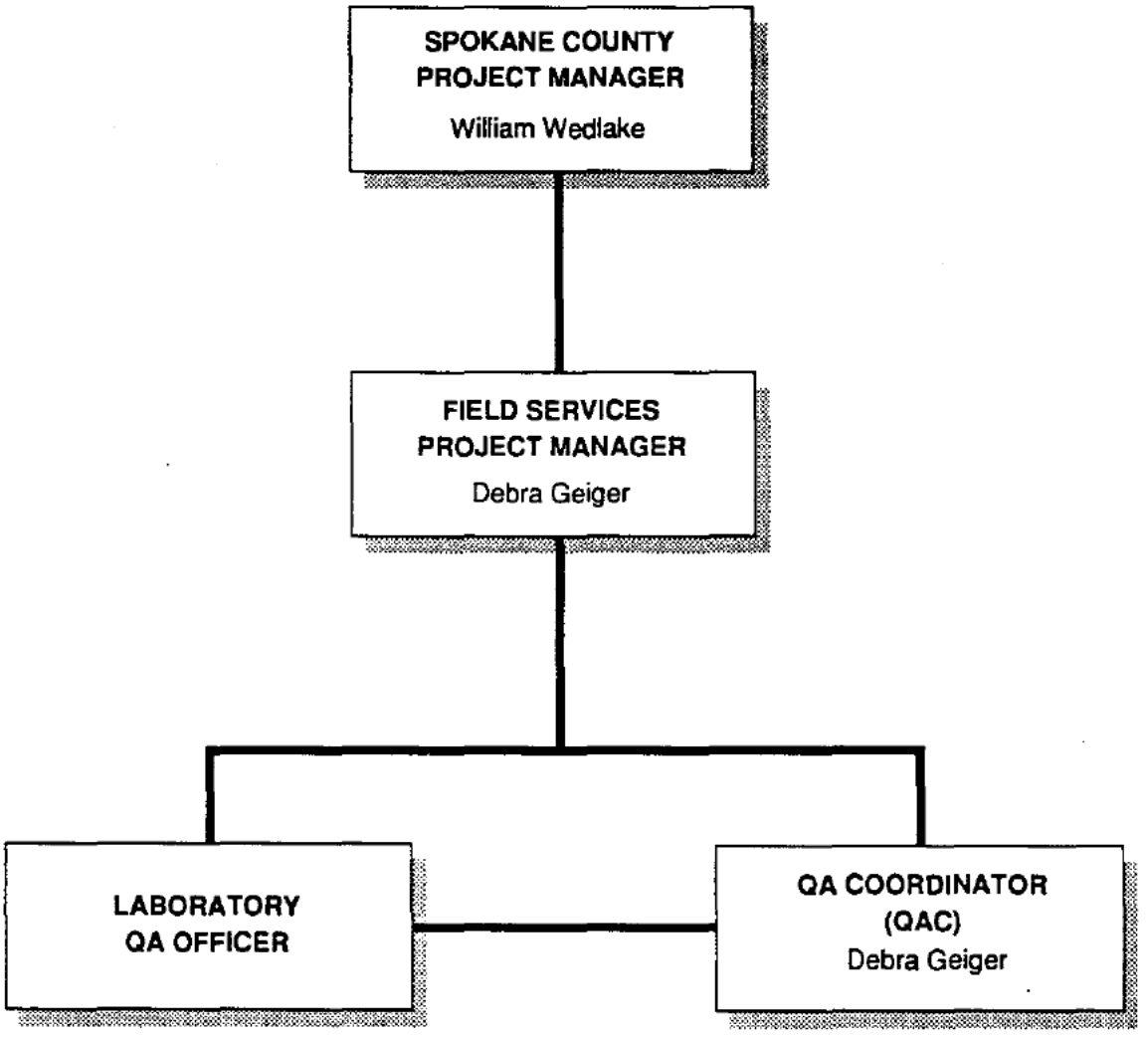
Corrective Action Reports (Form 8-6) will be used to document response to reported nonconformances. These reports may be generated from internal or external audits or from informal reviews of project activities (Section 8.11).

Corrective Action Reports initially will be reviewed for appropriateness of recommendations and actions by the QAC (for QA matters) and by the Project Manager (for technical approach). The reports will then be forwarded to the County Project Manager for review.

8.15 QUALITY ASSURANCE REPORTS TO MANAGEMENT

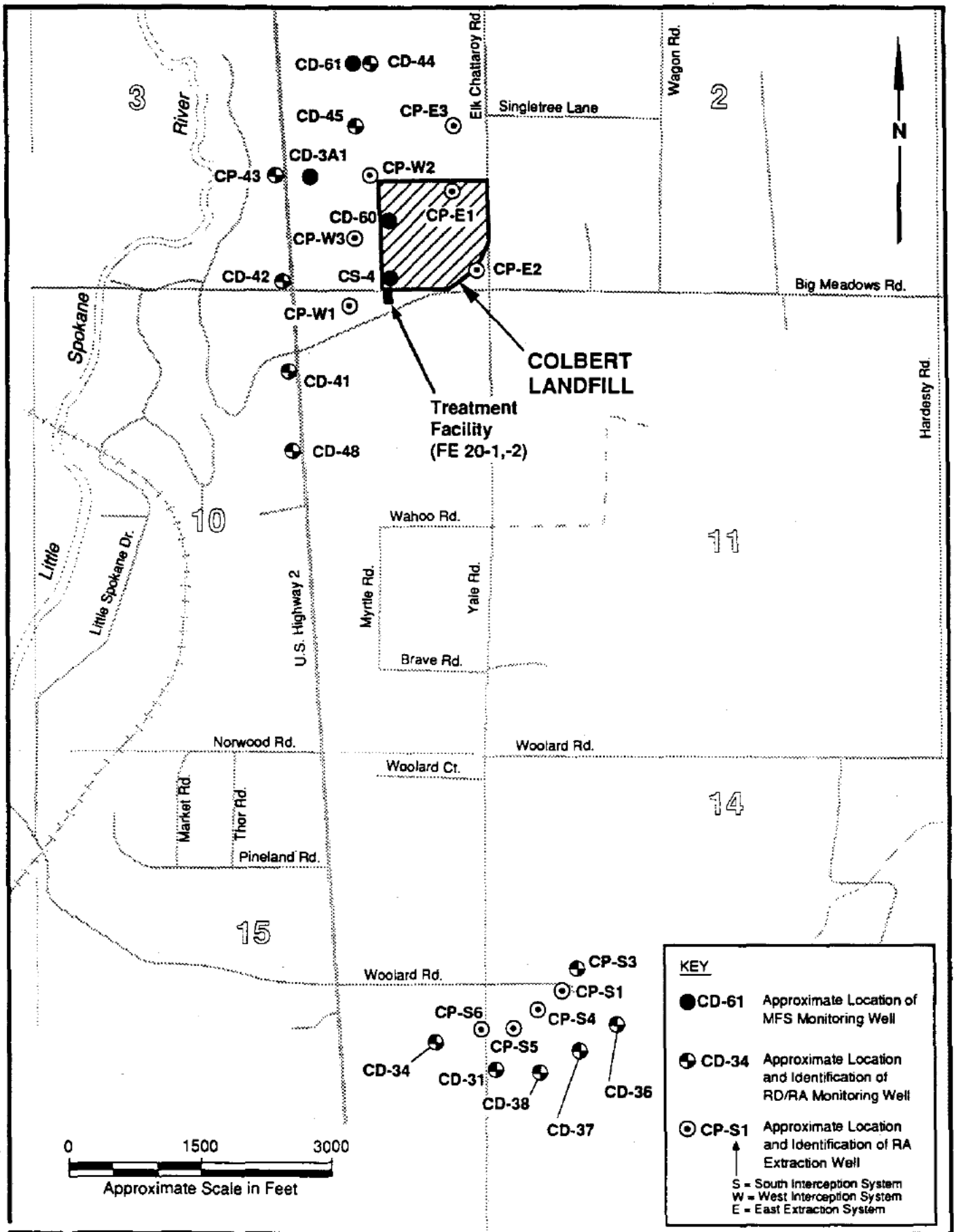
All data packages submitted to the EPA and Ecology will include a QA report containing results of the QA workups and conclusions. This QA report will summarize all relevant data quality information. The QAC will be responsible for data quality assessments and associated QA reports.

QA audit reports will be prepared and submitted to the Project Manager, the County Project Manager, and EPA. Final task or investigative reports will contain a separate QA section summarizing data quality information.



Project Quality Assurance Organization

Figure 8-1



124004.110 Spokane Co./Colbert Landfill/Operations & Maintenance Plan (M) 1/97

Extraction, Compliance, and MFS Monitoring Location Map

Figure 8-2

FIELD CHECKLIST

Field Observations

Yes__ No__ N/A__ 1. Was permission granted to enter and inspect the facility? (Required if RCRA inspection.)

_____
_____
_____

Yes__ No__ N/A__ 2. Is permission to enter the facility documented? If yes, where is it documented?

_____
_____
_____

Yes__ No__ N/A__ 3. Were split samples offered to the facility? If yes, was the offer accepted or declined?

_____
_____
_____

Yes__ No__ N/A__ 4. Is the offering of split samples recorded? If yes, where is it recorded?

_____
_____
_____

Yes__ No__ N/A__ 5. If the offer to split samples was accepted, were the split samples collected? If yes, how were they identified?

_____
_____
_____

Yes__ No__ N/A__ 6. Are the number, frequency, and types of field measurements and observations taken as specified in the project plan or as directed by the project coordinator? If yes, where are they recorded?

_____
_____
_____

Yes__ No__ N/A__ 7. Are samples collected in the types of containers specified for each type of analysis? If no, what kind of sample containers were used?

_____

_____

_____

Yes__ No__ N/A__ 8. Are samples preserved as required? If no or N/A, explain.

_____

_____

_____

Yes__ No__ N/A__ 9. Are the number, frequency, and types of samples collected as specified in the project plan or as directed by the project coordinator? If no, explain why not.

_____

_____

_____

Yes__ No__ N/A__ 10. Are samples packed for preservation when required (i.e., packed in ice, etc.)? If no or N/A, explain why.

_____

_____

_____

Yes__ No__ N/A__ 11. Is sample custody maintained at all times? How?

_____

_____

_____

FIELD CHECKLIST

Document Control

Yes__ No__ N/A__ 1. Have all unused and voided accountable documents been returned to the coordinator by the team members?

_____
_____
_____

Yes__ No__ N/A__ 2. Were any accountable documents lost or destroyed? If yes, have document numbers of all lost or destroyed accountable documents been recorded, and where are they recorded?

_____
_____
_____

Yes__ No__ N/A__ 3. Are all samples identified with sample tags? If no, how are samples identified?

_____
_____
_____

Yes__ No__ N/A__ 4. Are all sample tags completed (e.g., station no., location, date, time, analyses, signatures of samplers, type, preservatives, etc.)? If yes, describe types of information recorded.

_____
_____
_____

Yes__ No__ N/A__ 5. Are all samples collected listed on a chain-of-custody record? If yes, describe the type of chain-of-custody record used and what information is recorded.

_____
_____
_____

Yes__ No__ N/A__ 6. If used, are the sample tag numbers recorded on the chain-of-custody documents?

_____
_____
_____

Yes__ No__ N/A__ 7. Does information on sample tags and chain-of-custody records match?

_____
_____
_____

Yes__ No__ N/A__ 8. Does the chain-of-custody record indicate the method of sample shipment?

_____
_____
_____

Yes__ No__ N/A__ 9. Is the chain-of-custody record included with the samples in the shipping container?

_____
_____
_____

Yes__ No__ N/A__ 10. If used, do the sample traffic reports agree with the sample tags?

_____
_____
_____

Yes__ No__ N/A__ 11. If required, has a receipt for the samples been provided to the facility (required by RCRA)? Describe where offer of a receipt is documented.

_____
_____
_____

Yes__ No__ N/A__ 12. If used, are blank samples identified?

_____
_____
_____

Yes__ No__ N/A__ 13. If collected, are duplicate samples identified on sample tags and chain-of-custody records?

_____
_____
_____

Yes_ No_ N/A_ 14. If used, are spiked samples identified?

Yes_ No_ N/A_ 15. Are logbooks signed by the individual who checked out the logbook from the project coordinator?

Yes_ No_ N/A_ 16. Are logbooks dated upon receipt from the project coordinator?

Yes_ No_ N/A_ 17. Are logbooks project-specific (by logbook or by page)?

Yes_ No_ N/A_ 18. Are logbook entries dated and identified by author?

Yes_ No_ N/A_ 19. Is the facility's approval or disapproval to take photographs noted in a logbook?

Yes_ No_ N/A_ 20. Are photographs documented in logbooks (e.g., time, date, description of subject, photographer, etc.)?

Yes_ No_ N/A_ 21. If film from a self-developing camera is used, are photos matched with logbook documentation?

Yes__ No__ N/A__ 22. Are sample tag numbers recorded? If yes, describe where they are recorded.

_____

_____

_____

Yes__ No__ N/A__ 23. Are calibration of pH meters, conductivity meters, etc., documented? If yes, describe where this is documented.

_____

_____

_____

Yes__ No__ N/A__ 24. Are amendments to the project plan documented? If yes, describe where the amendments are documented.

_____

_____

_____

FIELD CHECKLIST

Debriefing with Project Coordinator

Yes_ No_ N/A_ 1. Was a debriefing held with project coordinator and/or other participants?

_____

_____

_____

Yes_ No_ N/A_ 2. Were any recommendations made to the project participants during the debriefing? If yes, list recommendations.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

LABORATORY CHECKLIST

SIGNATURE OF AUDITOR _____ DATE OF AUDIT _____
LABORATORY _____ CEAT PROJECT NO. _____
LABORATORY LOCATION _____
CONTRACTS IN EFFECT _____

(List Contract Numbers)

1. Name of Sample Custodian and other personnel responsible for sample receipt and document control.

_____

_____

2. Where are the Sample Custodian's procedures and responsibilities documented?

_____

_____

3. Where are written Standard Operating Procedures (SOPs) pertaining to receipt of samples documented (laboratory manual, written instructions, etc.)?

_____

_____

4. Where is the receipt of chain-of-custody record(s) with samples being documented?

_____

_____

5. Review sample receipt documentation to assure that the nonreceipt of chain-of-custody record(s) with samples is being documented.

_____

_____

6. Where is the integrity of the shipping container(s) being documented [custody seal(s) intact, container locked or sealed properly, etc.]?

_____

_____

7. Review the sample documentation to assure that the lack of integrity of the shipping container(s) is being documented (i.e., evidence of tampering, custody seals broken or damaged, locks unlocked or missing, etc.).

_____

_____

8. Determine, by asking the Sample Custodian or reviewing the laboratory SOP manual, if agreement among Sample Management Office forms, chain-of-custody records, and sample tags is being verified? State source of information.

_____

_____

9. Where is the agreement or nonagreement verification being documented?

_____

_____

10. Review sample receipt documentation to assure that sample tag numbers are recorded by the Sample Custodian.

_____

_____

11. Where are written Standard Operating Procedures (SOPs) pertaining to the sample storage documented (laboratory manual, written instructions, etc.)?

_____

_____

12a. Do written SOPs and actual laboratory practices demonstrate laboratory security?

_____

_____

12b. Describe sample storage area (upright refrigerator in GC lab, walk-in cooler in sample receiving area, etc.).

_____

_____

13. How is sample identification maintained?

_____

_____

14. How is sample extract (or inorganics concentrate) identification maintained?

_____

_____

15. How are samples that require preservation stored to maintain their preservation?

_____

_____

16. How are written Standard Operating Procedures (SOPs) pertaining to sample handling and tracking documented?

_____

_____

17. What laboratory records are used to record personnel receiving and transferring samples in the laboratory?

_____

_____

18. Affirm that each instrument used for sample analysis (GC, GC/MS, AA, etc.) has an instrument log. List those instruments which do not.

_____

_____

19. Determine where analytical methods are documented and ask if methods are available to the analysts.

_____

_____

20. Determine where quality assurance procedures are documented and ask if procedures are available to the analysts.

_____

_____

21. How are written Standard Operating Procedures (SOPs) for compiling and maintaining sample document files documented?

_____

_____

22. How are sample documents filed (by case number, internal laboratory number, batch number, sample number, etc.)?

_____

_____

23. Review sample document files to determine if a document file inventory is prepared for each case file.

_____

_____

24. Review sample document files to determine if all documents in the case files are consecutively numbered according to the file inventories.

_____

_____

25. Observe the document file storage area to determine if the laboratory document files are stored in a secure area.

_____

_____

26. Has the laboratory received any confidential documents?

_____

_____

Complete questions 27, 28, and 29 ONLY if the response to question 26 was yes.

27. Review the case files to assure that confidential documents are segregated from other laboratory documents.

_____

_____

28. Review the case files to assure that confidential documents are stored in a secure manner.

_____

_____

29. Review recommendations from the previous audit to determine if the recommendations have been implemented. If not, the recommendations should be repeated and the laboratory director and the Project Officer should be notified.

_____

_____

LABORATORY CHECKLIST

Debriefing with Laboratory Personnel

1. List observations made by the auditor.

_____
_____
_____
_____
_____

2. Make recommendations with respect to each observation.

_____
_____
_____
_____
_____

3. Discuss observations and recommendations made by the auditor.

_____
_____
_____
_____
_____

LANDAU ASSOCIATES, INC.

CORRECTIVE ACTION REPORT

Sample Program Identification: _____

Sampling Dates: _____

Material to be Sampled: _____

Measurement Parameter: _____

Acceptable Data Range: _____

_____

Corrective Actions Initiated By: _____

Title: _____ Date: _____

Problem Areas Requiring Corrective Action: _____

_____

_____

_____

_____

_____

Measures to Correct Problems: _____

_____

_____

_____

_____

Means of Detecting Problems (field observations, systems audit, etc.) _____

_____

_____

Approval for Corrective Actions: _____

Title: _____ Date: _____

Signature _____

TABLE 8-1

CONSENT DECREE WATER QUALITY CRITERIA[a]

Constituent of Concern	Performance Standard	Evaluation Criteria
1,1,1-Trichloroethane	200	200
Trichloroethylene	5	56
1,1-Dichloroethane	4,050	4,050
1,1-Dichloroethylene	7	7
Methylene chloride	2.5	25
Tetrachloroethylene	0.7	7

(a) Concentration in parts per billion (µg/L).

TABLE 8-2

NPDES EFFLUENT LIMITATIONS

Parameter	Average Monthly[a]	Maximum Daily[b]
Chloride	230 mg/L	
1,1-Dichloroethane		4,050 µg/L
1,1-Dichloroethylene		7 µg/L
Iron	300 µg/L	
Manganese	50 µg/L	
Methylene chloride		2.5 - 25 µg/L
Nitrates	10 mg/L	
pH		8.5
Total phosphorus		930 µg/L
Tetrachloroethylene		0.7[c] - 7[d] µg/L
1,1,1-Trichloroethane		200 µg/L
Trichloroethylene		5 µg/L

(a) The average monthly effluent limitation is defined as the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.
(b) The maximum daily effluent limitation is defined as the highest allowable daily discharge.
(c) Performance standard established in the ROD and Consent Decree.
(d) Evaluation criteria established in the Consent Decree.

TABLE 8-3

QUALITY ASSURANCE RESPONSIBILITIES

Personnel	Responsibilities
Field Services Project Manager	Coordinate technical project direction and product technical review; coordinate project/agency interaction; review project QA needs and approve appropriate QA corrective actions as needed; oversee technical project team performance to ensure successful accomplishment of technical and QA project objectives.
Project QA Coordinator (QAC)	Provide technical QA assistance; direct implementation of QAPP; arrange contract and other external procurement packages for QA needs; prepare corrective action response; prepare and submit QA reports to project management; conduct or supervise laboratory and field audits.
Laboratory QA Officer	Ensure that all laboratory QA objectives are met and laboratory QA/QC information is properly documented and reported.

TABLE 8-4

SURROGATE RECOVERY CONTROL LIMITS IN WATER SAMPLES

Surrogate Name	Control Limits (percent)[a]
Volatile Organics (8010A)	
Bromofluorobenzene	67 - 130
Bromochloromethane	62 - 138

(a) Surrogate selection and control limits may be revised after selection of analytical laboratory.

TABLE 8-5

LABORATORY MATRIX SPIKE/MATRIX SPIKE DUPLICATE CONTROLS IN WATER SAMPLES

Parameter	Recovery (percent)	RPD[a] (percent)
Volatile Organics Analysis (8010A)		
1,1-Dichloroethylene	61 - 145	20
Trichloroethylene	71 - 120	20
1,1,1-Trichloroethane	20 - 160	50
1,1-Dichloroethane	20 - 160	50
Methylene chloride	20 - 160	50
Tetrachloroethylene	20 - 160	50
Metals (6010/7000)	70 - 125	20
Other Inorganics		
Chloride, nitrate, nitrite, ammonia, total phosphorus, sulfate	75 - 125	20

(a) RPD = relative percent difference.

TABLE 8-6

SAMPLE CONTAINERS, PRESERVATIONS, AND HOLDING TIMES

Analysis	Sample Container[a]	Preservation	Holding[b] Time
Volatile organic compounds	40 mL glass vials (leave no headspace, Teflon-lined septum cap	Maintain on ice	14 days
Total organic carbon	polyethylene or glass	cool to 4°C, H_2SO_4 to pH<2	28 days
Chemical oxygen demand	polyethylene or glass	cool to 4°C, H_2SO_4 to pH<2	28 days
Total coliform	polyethylene	cool to 4°C, chloride stabilizers	24 hours
Metals (dissolved)			
Zinc, iron, manganese	polyethylene	HNO_3 to pH<2	6 months
Metals (total			
Iron, manganese	polyethylene	HNO_3 to pH<2	6 months
Other Inorganics			
Nitrate + Nitrite, and Ammonia as N	polyethylene	cool to 4°C, H_2SO_4 to pH<2	28 days
Nitrite, Nitrate	polyethylene	None	48 hours
Chloride	polyethylene	Cool to 4°C	28 days
Sulfate	polyethylene	cool to 4°C, H_2SO_4 to pH<2	28 days
Total phosphorus	polyethylene	cool to 4°C, H_2SO_4 to pH<2	28 days
Toxicity (acute and chronic)	2½-gallon plastic cubileter containers	Cool to 4°	36 hours
Algal growth potential	glass, Teflon-lined cap	Cool to 4°C	36 hours

(a) Sample container specifications may be modified after consultation with the analytical laboratory.

(b) Holding times are from date of collection. All samples will be shipped to the laboratory within 24 hours (except as noted for samples collected on Friday). Arrangements will be made with the laboratory for timely receipt of samples with short holding times.

TABLE 8-7

SAMPLING AND SAMPLE HANDLING RECORDS

Record	Use	Responsibility/Requirements
Field Log Book	Record significant events, observations, and measurements	Maintained by sample collector; must be bound; all entries factual, detailed, and objective; entries must be signed and dated.
Sample Collection Form	Provide a record of each sample collected (Appendix B)	Completed, dated, and initialed by sample collector; maintained in project file
Sample Label	Accompanies sample; contains specific sample identification information	Attached to sample container by analytical laboratory and completed by sampler
Chain-of-Custody Seal	Seals sample shipment container to prevent tampering or sample transference (Appendix B)	Completed, signed, and applied by sample collector at time samples are transported
Chain-of-Custody Record	Accompanies samples, provides record of samples for custody from field to disposal of sample	Completed and signed by sample collector before relinquishing custody; must be signed by person accepting custody; must accompany samples at all times
Sample Analysis Request Packing List	Provides a record of each sample number, date of collection/transport, sample matrix, analytical parameters for which samples are to be analyzed, and condition of samples on receipt at laboratory (Appendix B)	Completed by sample collector at time of sampling transport; carbonless copies distributed to laboratory (copy 2) and project file (copy 1)

TABLE 8-8

INSTRUMENT PERFORMANCE CHECK MATERIALS AND FREQUENCY

Parameter	Check Material[a]	Frequency
Laboratory Analysis		
Chloride	Commercially prepared[b] standard solution	Daily or every 20 samples[c]
Nitrate	Commercially prepared standard solution	Daily or every 20 samples
Nitrite	Commercially prepared standard solution	Daily or every 20 samples
Ammonia	Commercially prepared standard solution	Daily or every 20 samples
Hardness	Commercially prepared standard solution	Daily or every 20 samples
Alkalinity	NA	NA
Total phosphorus	Standardized curvettes	Once per year
Sulfate	NA	NA
Field Measurement		
pH (meter)	pH 4, 7, 10 standard buffer solution	Minimum of every 4 hours of field use
Conductivity	KCl standard solution	Minimum of every 4 hours of field use
Temperature	National Bureau of Standards thermometer	Minimum of every 6 months
Turbidity		Minimum of every 4 hours of field use

NA = Not Applicable

(a) Check materials are subject to change based on actual preliminary instrument qualifying results.

(b) Standard solution may also be prepared by the laboratory independently from calibration solutions.

(c) Whichever is greater; daily is defined as every day the analysis is performed.

TABLE 8-9

FIELD ANALYSIS QUALITY CONTROL LIMITS

Parameter	Units	Accuracy	Precision
pH unit	Standard pH units	±0.1 pH unit	±0.1 pH unit
Specific conductivity	µmhos/cm	±5%	±5%
Temperature	°C	±0.1°C	±0.1°C
Turbidity	NTU	±5%	5%

TABLE 8-10

METHODS AND QUANTIFICATION LIMITS FOR ANALYSIS OF GROUNDWATER

Analyte	Analysis Method	Quantification Limit
Volatile Organics	EPA 8010A[a]	(µg/L)
Dichlorodifluoromethane		--
Chloromethane		0.8
Vinyl chloride		1.8
Bromomethane		3.0
Chloroethane		5.2
Trichlorofluoromethane		--
1,1-Dichloroethylene[b]		1.3
Methylene chloride[b]		2.5
trans-1,2-Dichloroethylene		1.0
1,1-Dichloroethane[b]		0.7
Chloroform		0.5
1,1,1-Trichloroethane[b]		0.3
Carbon tetrachloride		1.2
1,2-Dichloroethane		0.3
Trichloroethylene[b]		1.2
1,2-Dichloropropane		0.4
Bromodichloromethane		1.0
trans-1,3-Dichloropropylene		3.4
1,1,2-Trichloroethane		0.2
Tetrachloroethylene[b]		0.3
Chlorodibromomethane		0.9
Chlorobenzene		2.5
Bromoform		2.0
1,1,2,2-Tetrachloroethane		0.3
1,3-Dichlorobenzene		3.2
1,4-Dichlorobenzene		2.4
1,2-Dichlorobenzene		1.5
Benzyl chloride		--
Bromobenzene		--
2-Chloroethyl vinyl ether		1.3
Dibromomethane		--
1,1,1,2-Tetrachloroethane		--
Trichloropropane		--
Metals (total)		(µg/L)
Iron	EPA 6010	100
Manganese	EPA 6010	15
Metals (dissolved)		(µg/L)
Iron	EPA 6010	100
Manganese	EPA 6010	15
Zinc	EPA 6010	20

TABLE 8-11

AUDIT REPORT FORMAT

1. Purpose of audit
2. Audit basis
3. Time and place of audit
4. Personnel contacted
5. Audit team members
6. Summary of events
7. Findings and recommendations
   a. Positive findings
   b. Negative findings
8. Required follow up (responsible parties, summary of required corrective action, date of re-audit, if required)
9. Distribution of audit report and corrective action reports

9.0 DOCUMENTATION, RECORDKEEPING, AND REPORT REQUIREMENTS

The keeping and maintenance of records is critical to providing the information necessary for managing and documenting facility operations and for reporting the progress of the remedial action to the public and regulatory agencies. Effective documentation and document management will improve operating personnel efficiency, reduce costs, lower risks, enhance strategic planning, and allow for the preparation of clear and concise reports. Clear, concise reports to the public and regulatory agencies will improve communications, prevent and/or reduce problems, and provide for the development of an honest and trusting relationship among all parties that may lead to reduced remedial action costs and duration.

This section provides an overview of recordkeeping and reporting requirements for the facility and references appropriate other sections of this plan and other reports that contain more detailed requirements. Documentation and recordkeeping must be accomplished for the following activities:

- Facility daily operations
- Facility operating parameters
- Aquifer management
- Sampling and analysis (see Section 8.0, quality assurance project plan; Appendix F, field sampling plan)
- Facility maintenance and repair (see Section 10.0)
- Safety (see Section 11.0)
- Spill response (see Section 11.0)
- Environmental regulatory compliance (see Appendix A)
  - Dangerous waste management
  - Solid waste management
  - Chemical inventory management
  - Hazard communication
- Remedial action operation and maintenance cost projection.

9.1 RECORDS HANDLING

Records for these activities should be neatly labeled and organized, promptly filed, and kept at the facility. As appropriate, important records should be copied and stored offsite to prevent their loss in the event of a disaster at the facility. Originals should be retained at the facility.

9.2 RECORDS RETENTION

Records must be retained for varying periods of time based on the requirements of the applicable governing regulations. In general, facility operating records must be retained for a minimum of 2 to 5 years, and records related to personnel training, chemical exposures, and medical monitoring must be retained for a minimum of 2 to 5 years following termination of employment for a worker. The regulatory requirements establish minimum record retention periods; however, it is recommended that all nontrivial records be retained for the duration of the remedial action. Records retained beyond the minimum required retention period may be stored offsite in a safe location.

Reporting requirements to regulatory agencies vary with the requirements of the governing regulations. Required reports are summarized in Table 9-1.

9.3 DOCUMENTATION AUDITS

Management may and should conduct periodic operations audits of facility operations that include reviews of documentation and recordkeeping practices. These audits should conclude with a written audit report detailing items/areas of deficiency and should identify corrective actions to be implemented by facility personnel. Facility records are also subject to inspection by regulatory agency personnel and, therefore, should not be removed from the facility except for brief periods as necessary for copying.

9.4 FACILITY DAILY OPERATIONS

The facility operator is responsible for keeping a logbook of activities at the facility. An entry in the logbook should be made each time the facility operator visits the site. Information to be recorded includes:

- Facility operating status
- Times and reasons for changes to facility operating status

- Values of key operating parameters
- Major maintenance/report activities
- Problems encountered/solved
- Work by outside vendors/maintenance staff
- Checks of facility components/status
- Health and safety related information
- Chemical/waste shipments and/or deliveries
- Interactions with public, regulatory agencies, visitors, or other parties
- Unusual/suspect information, conditions, or operation of facility equipment or instruments.

A sample daily operations log entry is shown on Figure 9-1.

The facility operator is also responsible for maintaining a sign-in log for visitors. A sample visitor's sign-in log is shown in Table 9-2.

Date 5/6/94, Friday/0815-0500

Operator S.G. Anderson

Weather Cloudy, ~50°F, light rain

- Plant flow @ 980 gpm, all 10 wells operating
- Joe Boyd from SC Utilities Department Maintenance arrived to work on electrical problem with pump P25-2
- Inspected scale control coupon for scale, very light film present
- High water level alarm in well vault CP-E3; check vault, no water present, cleaned sump and sensor, alarm condition cleared
- Joe Boyd said pump problems due to loose connection at pump disconnect switch, which he fixed. Tested pump, works fine.
- Completed general housekeeping
- Verified scale control level in tank T-1 with dip stick
- Received analytical results from CAS for 4/25/94 sampling event. All effluent NPDES limits achieved.
- Scheduled next delivery of scale control chemical with ABC Chemical Co. for 5/25/94 (1,000 gallons)
- Reviewed plant status @ ICM computer, no problems apparent
- Left site @ 0500.

Sample Operations Log | Figure 9-1

TABLE 9-1

REQUIRED REPORTS

Report	Person Responsible for Preparation	Date Due	Recipient[a]
Remedial action progress report	Project manager	Quarterly	Ecology, EPA
Effluent compliance report	Facility operator[b]	Quarterly	Ecology, EPA
Form 4, generator annual[c] dangerous waste report	Facility operator[b]	March 1	Ecology
Tier 1 emergency and hazardous[d] chemical inventory report	Facility operator[b]	July 1	Ecology
Facility operation and maintenance status and cost report	Facility operator/ project manager		Manager, Spokane County Utilities Department

(a) Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency.

(b) All reports must be approved by project manager.

(c) Form 4 report will be required only if Dangerous Waste as defined in WAC 173-303 is disposed from the facility in the previous year (see Appendix A)

(d) Tier 1 report will be required only if at any one time in the previous year 10,000 or more pounds of a hazardous chemical was stored on site (see Appendix A).

TABLE 9-2

VISITOR SIGN-IN LOG
COLBERT LANDFILL REMEDIAL ACTION PROJECT,
AIR STRIPPING TREATMENT FACILITY
SPOKANE COUNTY UTILITIES DEPARTMENT

Date	Time In	Time Out	Name	Company	Purpose of Visit

10.0 MAINTENANCE

10.1 GENERAL

The facility should be considered as a specialized and complex manufacturing facility whose basic product is treated groundwater. The goal of the plant operator is to ensure a high quality water at the lowest possible cost. To ensure reliable achievement of this goal, the frequency and severity of equipment breakdowns and process upsets must be minimized, equipment life must be extended, and an optimum use of assigned manpower must be made. Adherence to good preventive maintenance will ensure reliable operation of the facility.

Regular and conscientious inspection and evaluation of equipment will prevent many problems from occurring. The impact of problems that do occur will be significantly reduced, since they will be promptly identified, recorded, and corrected. The timely implementation of appropriate corrective action is one of the most important responsibilities of the treatment plant operator. With a good preventive maintenance program, typically only 10 to 15 percent of the total labor effort will be devoted to equipment breakdown. On the other hand, a plant without a good preventive maintenance program might require many times more labor effort for major equipment repair.

Most maintenance activities at a facility can be grouped into three categories: major repairs, corrective maintenance, and preventive maintenance. Major repairs or alterations generally require the specific piece of equipment to be out of service and often consists of removal and replacement of the equipment. Consequently, the cost of a major repair is high, not only in financial terms, but in terms of reduction in plant performance and the associated political or regulatory ramifications. Corrective maintenance, in contrast, involves minor repairs and associated functions of a non-routine nature, but is usually accomplished with a minimum of equipment downtime or process interruption. The replacement of worn belts, bearings, and seals are typical examples of corrective maintenance.

Preventive maintenance is performed to prevent equipment breakdown, to reduce wear, and to improve efficiency in an effort to extend the life of the equipment. Preventive maintenance is normally accomplished as part of the routine plant operation and is characterized by routine inspection, lubrications, mechanical adjustments, calibration, cleaning of filters or strainers, and renewal of consumable parts.

The purpose of this section is to convey the importance of a well documented and functional maintenance program. Schedules and record documentation schemes for general plant maintenance and housekeeping are presented for illustrative purposes and should be modified as necessary based on the operator's abilities and preferences. It is the facility operator's responsibility to schedule and update equipment maintenance activities and to keep the operations and maintenance documentation current.

The primary guide for each piece of machinery should be the manufacturer's operation and maintenance manual. In the event of a disagreement between instructions presented herein and those provided by the equipment manufacturer, the manufacturer's instructions should be followed. All information from equipment manufacturers should be sorted in bound format along with this plan and clearly indexed by the plant equipment tag numbering system.

Many of the bolting systems used at the facility are constructed of stainless-steel (Type 304 or 316). Stainless-steel surfaces in contract under pressure (e.g., a nut and bolt) can rapidly cold weld themselves together. Therefore, it is important to use a Teflon-based antiseize compound (not WD-40 or similar) when assembling stainless-steel components.

10.2 MAJOR EQUIPMENT INFORMATION

10.2.1 WARRANTY PROVISIONS

Warranties for all warranted equipment are summarized in Table 10-1. Refer to the facility construction contract documents and the equipment operation and maintenance notebooks for a more complete description of the warranties for specific equipment items. The start date for all warranties is April 1994. For warranty work or repair, consult the manufacturer or supplier of the equipment as listed in the operations and maintenance notebooks.

10.2.2 CONTRACT MAINTENANCE

Contract maintenance and repairs for defects in materials and workmanship associated with the facility construction is available from the construction contractor for a period of 1 year following substantial completion of the construction work (April 1994). Contact Gordon Bawden of Humphrey Construction at (206) 448-2400 to arrange for service.

After the 1-year period following construction, and even during this time period for routine maintenance items, the operator should evaluate the need for contracting with a private firm for assistance with completing routine maintenance and providing emergency assistance for repairs.

10.3 ROUTINE PREVENTIVE MAINTENANCE

Routine periodic maintenance activities necessary for satisfactory operation of the facility are presented in Table 10-2. The information should be used as a guide in setting up the equipment record system (See Section 10.8).

10.4 GENERAL MAINTENANCE OF PLANT AND RELATED EQUIPMENT

The term maintenance is used to mean the process of keeping facility equipment and structures in a suitable condition to perform the services for which they are intended. Maintenance should be carried out in a manner which prevents emergencies or unscheduled shutdowns. For a specific piece of equipment there are three factors which must be considered: design, construction, and operation. The basic design was established in such a manner that good preventive maintenance could be performed, and construction of the facilities was inspected in such a manner that no known faulty materials or equipment were incorporated in the system. Therefore, the facility should operate with a minimum of maintenance. Plans, specifications shop drawings, and as-built drawings show dimensions of each unit and all pipes, valves, gates etc., and these should be kept up to date and filed in the control room for ready reference.

All maintenance and preventive maintenance requires considerable skill which can only be acquired by experience, study, and practice. Good housekeeping is fundamental to an effective maintenance program and should observe the following basic rules:

- Keep a clean, neat and orderly treatment facility
- Establish a systematic plan for execution of daily operations
- Establish a routine schedule for inspections and preventive maintenance
- Keep data and records of each piece of equipment with emphasis on unusual incidents and faulty operating conditions

Observe safety measures when performing any type of maintenance (see Section 11.5).

Too much emphasis cannot be placed on recordkeeping. The operator and maintenance personnel can determine the weaknesses of various pieces of equipment from a review of such records. Maintenance records are invaluable for determining those repair parts that should be kept in stock and for scheduling equipment repairs to minimize process emergencies and interruption.

The basic records should be maintained in organized files. Maintenance information cards should indicate any regular, periodic inspections, cleaning and replacement of worn parts, and other data that are generally felt to be important to that specific piece of equipment. The date when the next regular servicing of equipment is scheduled should appear on the card. Equipment that requires specific or constant attention can be readily identified by tagging it with flags.

For any program to be successful, it must be readily accepted and understood by plant operating personnel. Acceptance or rejection of such a program will make or break the entire concept. Being aware of this fact, individuals must be informed of any changes regarding procedures through group or individual sessions.

Any maintenance program for a particular piece of equipment should be in accordance with the manufacturer's recommendations. The effectiveness of the maintenance program depends on four basic elements:

- A planned maintenance program
- Thorough knowledge of equipment
- Adequate replacement parts
- Use of proper tools.

10.5 TESTING AND CALIBRATION

Periodic testing should be conducted on various structures and equipment to detect weaknesses before failures occur. These include:

- Flow rate checks of pumps should be conducted on a periodic basis.
- Every valve in the plant should be operated periodically to ensure that valves seldom used are in operating condition.
- All measuring devices should be cleaned, calibrated, and inspected on a regular basis.
- Alarms and trip devices should be tested on a regular basis.
- Tanks and vessels should be emptied on a routine basis for inspection. Equipment that is normally submerged must be inspected at least once each year (except groundwater extraction pumps).
- Amp checks of electric motors should be conducted on a periodic basis.

10.6 LUBRICATION

Only lubricants recommended by the equipment's manufacturer should be used for lubrication. Lubrication of a given piece of equipment should consistently use the same lubricant. Overlubrication can create problems too, so it is important that the lubrication is at the necessary intervals and in the correct manner and amount. Overlubrication can cause problems such as shorting of electric motors, blow out of seals, messy and unsafe working conditions, process contamination, etc. It is important the used or contaminated lubricants are disposed of in an environmentally acceptable manner. Many waste lubricants are classified as hazardous wastes.

A bearing that is operating extremely hot is evidence that something is wrong. While the high temperature will not always cause immediate bearing failure, the conditions responsible for the high temperature should be investigated and corrected immediately. Many bearings failures are lubricant related and are caused by the use of the wrong lubricant, mixing of different grades of lubricants, over-lubrication, or dirty oil. Bearing failure due to misalignment, excessive belt tension, or other driving conditions are also important factors, but are not directly related to lubrications. As an example, sleeve-type bearings can overheat because of worn rings that do not rotate properly to keep the journal oiled. Malfunctioning oil supply to bearings is a cause of overheating as is obstruction of some portion of the motor ventilation system. Leaks or other failure in piping or pumping, or excessive ambient temperature, are other causes of bearing overheating.

10.7 ELECTRICAL MAINTENANCE

Operating personnel should be thoroughly indoctrinated in the proper procedure for normal starting, stopping, and control sequencing of all electrical equipment. They should also be instructed as to methods of cleaning external surfaces of motors and enclosed electrical equipment and surrounding areas, as well as to which motors and enclosed control devices are waterproof and will withstand hosing, and which pieces of equipment must be kept dry. A careful indoctrination of all operating personnel in the rules of electrical safety is also important.

No mechanical work or remodeling should ever be undertaken without first requesting the electrical maintenance staff to protect the electrical equipment in the area from dirt and accidental contact.

10.7.1 ELECTRICAL SWITCH GEAR

In most cases, it is not advisable for plant operators to attempt repairs on electrical switch gear other than to replace fuses or reset circuit breakers. However, they should NEVER attempt to test or change fuses, or do any cleaning or maintenance, on systems carrying more than 240 volts. There is a significant element of danger present when working on electrical equipment and persons not qualified to do this kind of work are well advised to seek the help of specialists. Electrical equipment should be kept free of dust and moisture and routinely inspected. Always trip, lock and tag circuit breakers, and test for voltage afterward, before doing any work.

10.7.2 MOTORS

Operators should follow manufacturers' instructions in regard to maintenance and lubrication of motors, and should frequently check for indications of possible trouble such as high bearing temperatures, vibrations, and unusual noises. If overload protectors trip frequently, larger protectors should not be installed unless advised by a qualified electrician. Overload devices protecting motors that have a service factor should be rated at not more than 1.25 times the full load current as indicated on the nameplate. Overload devices protecting motors that do not have service factors, should be rated at not more than 1.5 times the full load current of the motor.

Contact points on electrical controls should be checked at least every 6 months to be sure they are not pitted or corroded. Points should be replaced if necessary. All connections should be checked for tightness.

10.8 EQUIPMENT RECORD SYSTEM

Mechanical equipment is assigned tag numbers to improve the efficiency of equipment identification and recordkeeping. The tag numbering system is based on type of equipment, the specific system within the plant, and the relative quantity of similar pieces of equipment in that process. The fundamentals of the tag numbering system are presented in Section 6.1, and the system code numbers are listed in Table 6-1. The numbering system has been purposely made consistent to between operations and maintenance activities since separation or inconsistency would lead to confusion and possible plant problems.

The plant record system provides a basic description of each piece of equipment and its function within the plant. The records serve as the basis for preventive and corrective maintenance tasks to be performed and their frequency of performance. Logging of maintenance activities is

useful in identifying chronic maintenance problems, and in developing realistic time budgets for future maintenance.

10.8.1 RECORDS

Records of service, maintenance, and repairs, indicating, among other information, the time and cost required to perform the work, should be kept in order to develop historical data vital for planning purposes. Standardization of records and procedures in recording will reduce confusion in the use of these records. Also, these records will permit the determination of major or recurring trouble areas where improved maintenance or other appropriate action may be required. This is done by a flag system. Each time maintenance is performed on a specific piece of equipment, the unused left hand flag is lowered. Periodically, supervisory staff should review the card file system and identify those pieces of equipment that have required heavy maintenance, which is indicated by the number of flags indicated on each equipment card. Accordingly, when recurring maintenance problems are identified, they can be evaluated and often corrected so as to eliminate recurrent excessive maintenance.

An effective maintenance program requires keeping of maintenance information cards. The plant supervisor has the responsibility of overseeing and ensuring that the record system is kept functional, accurate and up to date. Each card should contain the following information:

- Equipment tag number
- Name and location of equipment
- Manufacturer, supplier, building, etc.
- Type, model, style, capacity, size, serial and code number, rating, etc.
- Installation date
- Nature and frequency of preventive maintenance
- Proper lubricants
- Nature and date of corrective maintenance.

10.8.2 EQUIPMENT DATA CARDS

Data cards are prepared for each item of equipment in the plant. Format examples are presented as Forms 10-1, 10-2, 10-3, and 10-4 for use on 4- by 6-inch file cards. The index system should be based on the facility systems and assigned equipment tag numbers. These cards will save many hours in the future and preserve data on equipment on which the nameplates are subject to obliteration due to abrasion and/or painting. Equipment tags should be kept legible and on all equipment.

10.8.3 SERVICE RECORDS

Forms should be completed for each service or maintenance activity. A possible format for this is shown in Form 10-5. The index number should correspond to the equipment tag number.

Data for entry on the top half of the form must be obtained from the manufacturer's recommended service and lubricating instruction. The bottom half should be completed as the indicated service is performed.

Upon completion of the top half of the form, it is recommended that forms be maintained in a separate section of a notebook according to plant equipment and system numbering designations.

10.8.4 HISTORY OF REPAIRS

A record of repairs performed in the service of equipment is to be maintained by entries on the repair record card in accordance with example Form 10-6. These forms are filed with the equipment records.

10.8.5 MOTOR SERVICE RECORDS

The motor service record card (Form 10-7) is completed for every electrical motor in the plant and used to record data obtained during motor tests. In addition to motor data, other appurtenances such as control equipment are indicated on this record.

10.8.6 REMINDER FILE

Based on information contained on Form 10-5, a reminder card or tickler card should be prepared for each item requiring scheduled service. An example is presented as Form 10-8. Normally these cards should not be prepared for items requiring daily or weekly service, but

should be restricted to longer intervals of time that can be easily forgotten or overlooked. When these cards are completed, they should be placed in a file separated by week of the year under the week in which the service is to be performed.

The service reminder card should be checked each week to determine what equipment is due for service. Upon performing the prescribed service, the date is recorded on the card and it is returned to the reminder file under the week when the service will again be required.

10.8.7 SPARE PARTS RECORDS

Spare parts should always be kept in stock to eliminate or reduce the possibility of equipment being out of service for an extended period of time. Form 10-9 provides a means of maintaining a record of spare parts ordered, received, and used. These forms are used to list spare parts as they are placed on order, to record their receipt and issue, and to inventory the parts in stock.

10.8.8 TROUBLE REPORTS

Form 10-10 is an example of a trouble report which the operator should use to report equipment taken out of service because of malfunction that he believes to be in need of inspection by others.

10.9 GROUNDWATER EXTRACTION PUMPS AND WELL CASINGS

Groundwater extraction pumps are an important piece of equipment in a facility of this type and warrant specific discussion. A breakdown of pumping equipment means delay in the environmental cleanup process. A complete understanding of pump construction and operation is essential to proper maintenance.

Performance curves are available for each pump. Periodic checks of pump performance, efficiency, and amperage draw should be performed in order to indicate any impending maintenance problem.

The only moving part of the pump is the impeller rotating in the case. The impeller is carried on a shaft supported by bearings. These bearings are built of nylon sleeve-type guides. Lubrication of these bearings is not necessary, as they are water cooled. However, a sufficient flow of cooling water past the bearings is necessary. Therefore, do not operate the pumps at speeds less

than approximately 50 percent of capacity for extended periods of time. Bearings should be changed at intervals recommended by the manufacturer.

The submerged section of the well casings, as well as the pump/motor housings, shrouds, and riser pipes, may eventually become fouled by: 1) deposited scale material (calcium carbonate) or 2) biological growth. Periodic rehabilitation of the well and cleaning of pump components to remove fouling may be necessary to maintain desired groundwater extraction flow rates and pump efficiencies.

10.9.1 WELL PERFORMANCE ASSESSMENT

Well performance can be assessed by evaluating changes in specific capacity over time. Specific capacity is defined as the well discharge rate divided by the well drawdown. Specific capacity can be plotted versus time to obtain a graphical indication of changes in well performance. If the extraction wells suffer no deterioration of performance, then the specific capacity will remain fairly constant. However, if an extraction well becomes clogged or otherwise loses efficiency, its specific capacity will decrease. The specific capacity can be determined at any point in time using data collected and automatically stored in the control system data loggers. A decrease in specific capacity of 30 to 50 percent may indicate a need for well rehabilitation.

10.9.2 EXTRACTION WELL

A number of physical and chemical processes are available for well rehabilitation. The most appropriate method(s) of treatment will depend on the nature and degree of the problem that caused the decrease in well efficiency, and the expertise and availability of local contractors qualified to perform the work. This section describes typical well rehabilitation procedures. The specific procedures to be applied to a given well performance problem should be determined at the time the problem is identified, in consultation with a hydrogeologist knowledgeable in well rehabilitation.

A series of treatments with chlorine and/or acids combined with surging are the most common methods for rehabilitating wells in which the screen is clogged with growths of bacteria or scale. A well drilling contractor typically performs this work since the drilling rig produces the best surging action. The well will first be shock-chlorinated by creating a 500 ppm chlorine solution in the well. The well will then be solid surged for several hours, and then the chlorine solution will be removed by bailing. The spent solution shall be allowed to reinfiltrate the aquifer in the area of

PUMP DATA CARD

Pump: _____ Index No.: _____

Location: _____

Manufacturer: _____

Model: _____ Size: _____

Capacity or rating: _____

Type: _____

Figure: _____ Base: _____

Serial No.: _____ Special Materials: _____

Installed: _____ Cost: _____

Local Representative: _____

FAN DATA CARD

Motor: _____ Index No.: _____

Manufacturer: _____

Horsepower: _____ Speed: _____

Voltage: _____ Amps: _____

Phase: _____ Cycles: _____

Service Factor: _____ Ambient Temperature: _____

Insulation: _____ Temperature Rise: _____

Frame: _____ Enclosure: _____

Serial No. _____

Installed: _____ Cost: _____

EQUIPMENT DATA CARD

Item: _____ Index No.: _____

Location: _____

Manufacturer: _____

Model: _____ Type: _____

Serial No.: _____ Size: _____

_____

_____

_____

Installed: _____ Cost: _____

Local Representative: _____

MOTOR DATA CARD

Unit: _____ Index No.: _____

Location: _____

Manufacturer: _____

Model: _____

Serial No.: _____ Size: _____

Rating HP: _____ Capacity: _____

Input RPM: _____ Output RPM: _____

Service Factor: _____ Ratio: _____

Data Installed: _____ Cost: _____

Local Representative: _____

SERVICE RECORD

Index No. _____

Equipment: _____

Service Manual: _____

Item No.	Equipment Part Requiring Service	No. of Fittings	Service or Lubricant No.	Frequency of Service

Item	Date	Initial	Item	Date	Initial	Item	Date	Initial	Item	Date	Initial

RECORD OF REPAIRS

Index No. _____

Equipment: _____

Service Manual: _____

Date	Maintenance Work Required and Parts Replaced	Replacement Part		Time Hours
		Number	Cost	

MOTOR SERVICE RECORD CARD

Index No. _____

Primary Equipment: _____ Overload Relay _____ Size _____

Manufacturer: _____ Heater No. _____ Setting _____ C.T.Amps _____

HP _____ Volts _____ Amps _____ Starter _____ Type _____ HP _____

Phase _____ Cycles _____ Voltage _____ Cycle _____ Coil No. _____

TEST DATA

Date of Test	MOTOR						Wiring Megger Reading	Starter	Overload Relay	Lubrication	Remarks
	Voltage		Amperes			Megger Reading					
	Run	Off	1	2	3						

SERVICE REMINDER CARD

Service Frequency _____ Index No. _____

Equipment Item No. _____

Date stamp when service has been complete.

SPARE PARTS RECORD CARD

Order		Item			Received		Issued			No. In Stock	Inventory Date & Initial
No.	Date	Qty	Description	Cat. No.	Date	Cost	Date	Qty	Index No.		

TROUBLE REPORT

Equipment: _____

Location: _____

Comments: _____

_____

_____

Operator: _____ Date: _____ Time: _____

Equipment: _____

Location: _____

Comments: _____

_____

_____

Operator: _____ Date: _____ Time: _____

Equipment: _____

Location: _____

Comments: _____

_____

_____

Operator: _____ Date: _____ Time: _____

contaminated soil and groundwater, but should be containerized for treatment and/or disposal onsite or offsite when working in clean areas. If well treatment is required because of calcium carbonate accumulation, the well will then be treated with hydrochloric acid in accordance with accepted well rehabilitation practices, using inhibitors to reduce damage to metal surfaces and chelating agents, if necessary, to keep iron in solution. Solid surging will again be followed by bailing for chemical removal. After treatment, the specific capacity should be determined. All well treatment wastes must be treated and disposed of in conformance with applicable regulations. Normally, rehabilitation can return specific capacity to 90 percent of its original value.

If rehabilitation is not effective in restoring the specific capacity to near 90 percent of its original value, then the well rehabilitation contractor should remove the chemicals and any loosened materials from the well, use a fabricated wire brush to remove a sample of the clogging material from the screen, and recover the sample by pumping or bailing it from the well bottom. The sample will then be sent to an analytical laboratory for determination of its composition and recommendations for removing it. The result will be either a determination of a reasonable means of rehabilitating the existing well, or a decision to abandon the well and construct a new well nearby. The existing well will be pumped (to the extent possible) as part of the extraction system while a new well is being constructed.

TABLE 10-1

LIST OF EQUIPMENT AND FACILITY MATERIALS WARRANTIES

Construction Specification Section No.	Warranty Term[a]	Description[b]
03346	5 years	concrete floor finish
07200	6 months	thermal insulation
07900	3 years	joint sealer
08110	1 year	doors, door frames, window frames
08330	1 year	roll up and sectional doors
08700	1 year	door hardware
08800	1 year; 10 years	glass and glazing
09260	6 months	gypsum wallboard systems
09530	6 months	acoustical insulation
09545	6 months	suspended ceiling
09660	5 years	tile flooring
09800	5 years	chemical resistant coating
09900	6 months	paint
10160	6 months	toilet compartment
10400	12 months	signs
10522	6 months	fire extinguishers and cabinets
10800	1 year	toilet and bath accessories
11200	5 years	plastic tanks T-1 and T-3
11210	5 years	FRP tank T-3
11230	1 year	process pumps
11240	1 year	chemical feed pumps
11452	1 year	appliances
11500	1 year	air compressor
11600	1 year	laboratory hood
12345	1 year	laboratory cabinets

TABLE 10-1

LIST OF EQUIPMENT AND FACILITY MATERIALS WARRANTIES

Construction Specification Section No.	Warranty Term[a]	Description[b]
12510	6 months	blinds
12600	6 months	furniture
13120	20 years	building and shed
15060	1 year	pipes and fittings
15100	1 year	valves
15140	1 year	pipe supports
15260	1 year	piping insulation
15400	1 year	plumbing accessories
15782	5 years	packaged air conditioning units
15784	1 year	unitary air conditioning unit
16010	1 year	basic electrical components
17000 - 17700	not specified	ICM system
11580	3 years	air stripping tower
11580	5 years	air stripping tower fan

(a) Start date for all warranties is April 1994.
(b) See referenced construction specification for full description of defects covered by warranty.

TABLE 10-2

ROUTINE MAINTENANCE SCHEDULE

Item	Each Visit	Weekly	Monthly	Quarterly	As Required
General					
Exercise all inactive valves				X	
Paint exposed metal surfaces					X
Operate pump drives through full range of operation				X	
Record water, gas, electrical consumption			X		
Inspect gratings and chemical resistant coating for defects or corrosion			X		
Check fire extinguishers, service					yearly
Influent System (System 20)					
Inspect piping	X				
Clean flow meters					yearly
Service motor-operated value FCV 20-1					yearly
Bypass System (System 21)					
Inspect piping	X				
Service motor-operated valve LCV 21-1					yearly
Scale Control Chemical Injection System (System 22)					
Inspect pumps	X				
Check feed rate			X		
Check tank T-1 level		X			
Alternate pump duty			X		
Check discharge pressure	X				
Flush pump and clean pump				X	
Service/lubricate pump					X
Influent and Bypass Drain System (System 23)					
Inspect piping			X		
Test battery				X	
Service motor-operated valves VF 23-1, VF 23-2					yearly
Fan System (System 24)					
Inspect louvers	X				
Inspect inlet filters				X	
Clean or replace air filters					6 months
Check belt (wear and tension)			X		
Check motor temperature		X			
Check vibration		X (by feel)			X (vibration analyzer)
Batch Cleaning Recirculation System (System 25)					
Check entire system					before each use
Clean pump P 25-1 inlet strainer					before each use
Inspect pump P 25-1				X	
Service pump P 25-1					X
Inspect piping	X (when in use)		X		
Inspect tank T-3	X (when in use)				before each use
Inspect pump P 25-2	X (when in use)				
Check pump P 25-2 feed rate				X	
Flush and clean system					after each use
Service pump P 25-2					X
Clean flow meter					yearly

TABLE 10-2

ROUTINE MAINTENANCE SCHEDULE

Item	Each Visit	Weekly	Monthly	Quarterly	As Required
Chemical Feed System (System 26)					
Check piping					before each use
Check/test drum pump					before each use
Flush and clean system					after each use
Defoamer Feed System (System 27)					
Check piping					before each use
Check/test pump P 27-1					before each use
Check feed rate					before each use
Flush and clean system					after each use
Sump System (System 28)					
Inspect sumps		X			
Observe pumping operation			X		
Hose down sump			X		
Check building sump for leaks			X		
Check sump heaters		X (in season)			
Lubricate pumps					X
Inspect pump and impeller					yearly
Potable Water System (System 29)					
Inspect meter			X		
Check backflow preventor			X		
Check eye wash/shower alarms				X	
Well Vaults (System 101-111)					
Visual inspection of vault and piping		X			
Wet well level		X			
Inspect VFD		X			
Inspect pumps and shafts					every 2 years
Inspect pump impeller					every 2 years
Clean well casings					X
Check sump high-level alarm					yearly
Inspect air supply vents			X		
Check pressure indicator				X	
Check air/vac release				X	
Check security alarms					
Groundwater Conveyance System					
Inspect manholes			X		
Pressure test pipeline					every 5 years
Service air/vac release valves					every 2 years
Inspect outfall				X	
Inspect outfall tanks and wier					yearly
Air Stripping Tower					
Inspect scale coupon			X		
Inspect ladders/platforms			X		
Inspect antenna			X		
Inspect lightning rods/cables			X		
Inspect clearwell					yearly
Inspect liquid distribution for level					yearly
Inspect mist eliminator				X	
Inspect anchor dogs				X	
Inspect ducting, supports			X		
Inspect/clean instrumentation					yearly

TABLE 10-2

ROUTINE MAINTENANCE SCHEDULE

Item	Each Visit	Weekly	Monthly	Quarterly	As Required
Building and Site Maintenance					
Inspect metal Buildings (including roof, doors, door frames, windows and louvers)	X (general)			X (detailed)	
Clean gutters					yearly
Inspect site grounds, walks, parking lot, lawn, etc.			X		
Service septic tank					every 3 years
Inspect/clean storm water facilities (ditches, dry wells)					yearly
Inspect fences and gates				X	
Service electric transformers					yearly (by WWP)
HVAC System					
Service air conditioners (2)					every 2 years
Service exhaust fans (4)					every 2 years
Service unit heaters (4)					X
Control Room					
Check fans and heaters			X		
Service computers					yearly
Air Compressor					
Inspect compressor			X		
Check discharge air temperature					yearly
Check oil level and temperature			X		
Check air pressure gauges				X	
Clean or replace air filters					X
Lubricate					X
Check alignment and couplings					yearly
Check motor amp draw and voltage					yearly

11.0 HEALTH AND SAFETY PROGRAM

The purpose of this chapter is to establish a framework for an effective safety program. A well organized safety program is vital to the well being of the facility, its employees and visitors, the public, and the successful implementation of the remedial action. This chapter describes the safety program framework, specific safety hazards, and general facility safety procedures. Manufacturers' operations and maintenance manuals provide details for safe operation of specific equipment, and will be kept at the facility. Applicable regulations, including WAC 296-62 (General Occupational Health Standards), should also be obtained and kept at the facility. This regulation includes the following parts:

- Part A: Occupational health and environmental control
- Part B: Access to records
- Part C: Hazard communication
- Part D: Controls and definitions
- Part E: Respiratory protection
- Parts F/G: Carcinogens
- Parts H/I: Air contaminants.

Safety standards are always improving and new facility specific safety concerns will arise over time; hence, this chapter must be periodically updated. For this section, the term facility includes the main treatment facility building and site, as well as all ancillary areas such as the groundwater conveyance pipeline and the well heads.

11.1 SAFETY PROGRAM

This section presents a general framework from which a safety program can be developed. The final responsibility for developing and implementing the safety program and for the use of safe work practices rests with Spokane County, its management, and workers.

11.1.1 RESPONSIBLE INDIVIDUALS

The project manager and facility operator will have primary responsibility for safety. See Section 2.0 for identification of the persons currently holding these positions.

11.1.1.1 Project Manager

The project manager has the responsibility for overall project safety policies, planning, and execution. The project manager is responsible for making project-level decisions regarding safety rules and operations in consultation with the facility operator. The project manager will conduct the initial orientation training and will be the main point of contact about facility safety issues. He/she will periodically visit the facility and will periodically audit safety practices. The project manager shall:

- Ensure that personnel are aware of the provisions of this plan, are instructed in safe work practices, and understand the planned procedures for dealing with onsite emergencies
- Inform personnel of the new potential hazards associated with changes to facility operations
- Correct any work practices or conditions that may result in injury to personnel or exposure to hazardous substances
- Investigate and direct corrective action for all significant accidents/incidents and nonroutine chemical exposures
- Verify that appropriate personal protective equipment is available for use by all employees
- Update/modify the safety program and safety program manual as needed.

11.1.1.2 Facility Operator

The facility operator is responsible for all day-to-day activities, including implementation of the safety program. The facility operator will implement the program as written, or consult with the project manager where alternatives or assistance may be desirable or necessary. The facility operator will notify the project manager of any unanticipated conditions that arise so that any necessary modifications can be made to the safety program. Facility support staff will report suspect or unfamiliar conditions to the facility operator. The facility operator shall:

- Enforce safety procedures among facility workers

- Hold regular safety meetings
- Determine personal protective equipment levels
- Coordinate air monitoring activities
- Evaluate weather and hazard information and make any necessary modifications to work plans and personal protection levels to maintain personnel safety
- Ensure that contractors, subcontractors, regulatory agency representatives, and site visitors planning to enter the facility comply with the minimum requirements of the safety program.

11.1.2 TRAINING

All facility operating and/or monitoring personnel shall have completed formal training that complies with 29 CFR 1910.120 and WAC 296-62-3040 (certificates of successful completion of training will be maintained in onsite files), and shall have on-the-job training for those tasks they are assigned to perform. All operations will be reviewed and all unfamiliar operations will be rehearsed prior to performing the actual procedure. Training will be conducted by a qualified safety professional.

Orientation training for each worker will be held prior to their beginning work at the facility. A part of the orientation training should consist of the review of this operation and maintenance plan. The initial training will be supplemented, as necessary, by subsequent safety meetings. Orientation training will include:

- Health effects and hazards of the chemicals identified or suspected to be present.
- Personal protective equipment.
- Air monitoring methods and action levels.
- Use, care, maintenance, and fitting of personal protective equipment, including air purifying respirators. Training in respiratory equipment use will conform to ANSI Z88.2(1980) and 29 CFR 1910.134, which establishes the necessity, effectiveness, and limitations of respiratory equipment.
- Decontamination procedures.
- Accepted practices for activities within specified areas, including prohibition of food consumption and smoking within the facility or prior to decontamination.
- Confined space entry procedures.

- Emergency response procedures as specified in Section 11.2.
- Spill response procedures as specified in Section 12.0.
- Review and familiarization with monitoring and process equipment.
- Review of job descriptions and assignments.
- Medical monitoring requirements.

Written documentation (Form 11-1) of training will be required from all facility personnel and will be maintained by the facility operator of the site.

11.1.3 SAFETY MEETINGS AND LOGBOOK

The facility operator will schedule and hold regular safety meetings at a frequency of at least once per week. Additional safety meetings will be held prior to any major maintenance activities or batch cleaning of the air stripping tower. A safety logbook will be maintained for recording events relating to worker safety. Issues discussed during safety meetings and any other pertinent activities or conversations are to be recorded in the log book.

11.1.4 MEDICAL MONITORING

A baseline medical evaluation and annual update exams are required for all facility operators working outside the control room who may come into contact with untreated groundwater or hazardous chemicals. Nonroutine, follow-up examinations are appropriate if significant exposures to toxic chemicals are known or suspected to have occurred. Documentation of medical evaluations (including medical clearance for respirator use) will be maintained by the project manager.

11.1.5 ACCIDENT/INCIDENT REPORTING AND CORRECTION

For each significant accident or nonroutine exposure, the facility operator (or project manager if the facility operator is affected) should: 1) complete a written accident/incident report using Form 11-2, within 24 hours, sending copies to the project manager and other County personnel as required; 2) conduct an investigation to determine the cause of or factors contributing to the occurrence; 3) take the appropriate actions to communicate the existence of the cause or

factors to all workers; and 4) implement modifications to the facility equipment or safety plan as appropriate to minimize the risk of a future occurrence.

All information related to the investigation and corrective action should be documented. The information provided in the employee exposure/injury incident report is not to be released under any circumstances to parties other than these persons, bona fide emergency response team members, or appropriate regulatory agency personnel. The project manager is ultimately responsible for investigating, identifying, and correcting any unsafe conditions causing or contributing to any accidents/incidents.

11.2 EMERGENCY RESPONSE PROCEDURES

Personnel will report serious or life-threatening accidents/incidents immediately by calling the appropriate emergency services numbers (ambulance, fire, etc.) indicated in Table 11-1 and providing the indicated information. A route from the site to the hospital is provided on Figure 11-1. Do not move the victim unless necessary. Check victim's breathing immediately, especially if wearing a respirator. Remove the respirator immediately if necessary to restore breathing. Otherwise, wait until the victim is moved to an area with a safe atmosphere before removing the respirator. Refer to Section 11.5.3.3 for emergency decontamination procedures and Section 11.9 for first aid procedures.

11.2.1 NON-LIFE THREATENING INJURIES

In emergency situations that are not life-threatening, the victim should be moved to a safe area and protective clothing removed, if doing so does not cause delays or aggravate the injury. Respirators should be removed after the victim has been removed from a breathing hazard area. Normal decontamination procedures should be followed when possible. Administer first aid to the victim by an individual who holds current first-aid and/or CPR certifications utilizing the emergency equipment onsite (facility or field vehicles). Notify the local first-aid squad/rescue unit, a local hospital, the facility operator, and project manager, as appropriate, depending on the nature of the emergency.

11.2.2 EVACUATION

The facility operator will be responsible for determining if circumstances exist that require reevaluation and/or evacuation, and should always assume worst-case conditions until proven otherwise. Specific evacuation procedures and warning signs and signals will be covered in the safety training session prior to beginning work. Two levels of evacuation are available: 1) withdrawal from the immediate work area onsite, and 2) evacuation of the surrounding area.

11.2.2.1 Withdrawal from Work Area

Withdrawal to a safe (upwind of work area, if applicable) location is appropriate in response to the following situations:

- Detection of volatile organics and/or toxic gases at concentrations above action levels for the level of protection being worn (see Section 11.5.4)
- Occurrence of a minor accident -- activities can resume after first-aid and decontamination procedures have been administered
- Malfunction or failure of protective equipment, clothing, or respirator.

11.2.2.2 Surrounding Area

Certain situations could require evacuation of the surrounding area in the vicinity of the facility or the pipeline or well heads. The facility operator or most senior person present will be responsible for determining if circumstances exist for area-wide evacuation, and should always assume worst-case conditions until proven otherwise. Fire and police departments must be contacted immediately. If evacuation is necessary, it will be implemented with the assistance of these emergency response personnel. Situations potentially requiring excavation of the surrounding area include:

- A major release of hydrochloric acid from the air stripping tower or batch cleaning solution tank
- A major release of contaminated groundwater to private property.

11.3 SAFETY DEVICES AND FEATURES

The facility incorporates numerous safety devices and features in its design. These include:

- Numerous fail-safe checks and mechanisms implemented automatically by the instrumentation and controls system (see Section 6.4)
- Automatic telephone dial out system to notify authorities in the event of certain facility incidents (fire, use of safety showers, etc.)
- Perimeter fence and locking gate to protect plant equipment and keep out unauthorized persons who are unaware of the potential dangers at the plant
- Hand railings on all elevated walkways and platforms, and safety cages on all ladders
- Numerous system isolation valves and pipe unions to facilitate maintenance and repair while minimizing exposure to chemicals
- Gratings over all sumps
- Protective housing and guards on certain mechanical equipment
- Fire extinguishers
- Eye washes and showers
- Industrial first-aid kit.

11.3.1 EMERGENCY COMMUNICATIONS

A telephone is located in the facility control room. Numbers of emergency facilities and personnel should be located adjacent to the telephone. Portable two-way radios or cellular telephones should be used when necessary to coordinate work occurring simultaneously at both the control room and well vaults or pipeline, or when potentially hazardous work is being performed away from the treatment facility building.

Hand signals should be established and standardized among all workers so that each worker can immediately inform co-workers of dangerous situations. The following hand signals should be used:

Signal	Meaning
Thumbs up	Okay
Thumbs down	Not okay
Hands on waist	Exit exclusion zone
Hands on throat	Cannot breath

Rotating hands above head	Need help
Rotating hands to the side	Situation under control

11.3.2 MOBILE EMERGENCY EQUIPMENT

An industrial first-aid kit, including a description of CPR and other emergency first aid, a portable air horn, an eyewash kit, and a decontamination water sprayer should be present in at least one vehicle when working away from the treatment facility building. A personnel decontamination station should also be used, if necessary (see Section 11.5.3.1).

11.4 SAFETY HAZARDS AND ACCIDENT PREVENTION PROCEDURES

This section presents specific facility hazards and general and specific accident prevention rules and procedures.

11.4.1 GENERAL ACCIDENT PREVENTION PROCEDURES

The following are some general safety procedures to be followed at all times during work at the facility:

- All personnel must comply with the established safety program. Any employee who does not comply with any provision of the safety program may be dismissed.

- No worker shall knowingly be permitted or required to work while the worker's abilities or alertness is impaired by fatigue, illness, or other causes. Working under the influence of intoxicants, narcotics, or controlled substances is prohibited.

- Workers entering manholes, sumps, tanks, vaults, or other similar places that receive little ventilation shall comply with the confined space entry procedures in Section 11.7.5.

- Personnel taking prescription medicine should inform the facility operator if the medication is suspected to impair the worker's abilities, and if the medication must be taken at specific times during the day. Personnel may not take medicine prior to proper decontamination.

- Workers shall not handle, operate, or tamper with any electrical equipment, machinery, or pipes in a manner not within the scope of their duties, unless they have received instructions from their supervisor. Only properly trained and authorized personnel are allowed to climb the air stripping tower or batch cleaning tank, or enter confined spaces such as pipeline manholes or well vaults, unless otherwise authorized by the facility operator.

- Care will be taken when lifting heavy objects, using the large muscles of the leg instead of the smaller muscles of the back.

- Hard hats shall be worn on all assignments where danger of falling objects or other injury is present, and are recommended elsewhere for general head protection against overhead pipes, cabinets, etc.

- Steel-toed safety shoes are recommended in all areas of the facility, except the control room, and are required when performing any work that could involve the falling or dropping of heavy objects or equipment.

- Safety glasses are required at all times in all areas of the facility except the control room. Face shield and aprons are required when appropriate for protection against splashes of groundwater or chemicals.

- Loose or frayed clothing, dangling ties, etc. shall not be worn around moving machinery or other sources of potential entanglement. Long hair must be tied back.

- Ear plugs shall be used when working around loud machinery and when reduced hearing would not present a hazard.

- If any personal protective equipment fails, personnel will exit to a safe area immediately.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of contaminated material is prohibited. Meals will be eaten only in the control room after proper decontamination. Smoking is not allowed in the facility building, manholes, or well vaults.

- If any physical discomfort is experienced (abnormalities, light-headedness), personnel will immediately stop work, inform a coworker, and leave the area together.

- Do not hammer on or use pipe wrenches or pliers on plastic pipe or valves; they may break.

- Use tools properly. Do not use pipe wrenches as a substitute for other wrenches. Wrenches should not be altered by the addition of handle extensions or "cheaters." Do not use a screwdriver as a chisel or pry bar. Do not lift or lower portable electric tools by means of the power cord; use a rope.

- Do not leave the cords of portable electric tools where cars or trucks will run over them, or where they may fall into water.

- Any damage to ladders, platforms, or other supporting structures must be immediately repaired or reported promptly to the supervisor.

- To prevent falls, keep sump safety grating, manhole covers, and well vault doors in place and closed when not actively working inside.

- Gasoline shall not be used for cleaning purposes.
- Do not work under equipment or vehicles supported by jacks or chain hoists, without protective blocking that will prevent injury if jacks or joists should fail.
- Air hoses should not be disconnected until the hose line has been depressurized.
- Observe NO SMOKING signs — hazardous gases may be present. Also, flammable materials may be present in the building and storage shed.
- Industrial water from hose bibs is not potable water; therefore **Do Not Drink It**. Clean potable water for drinking and washing is provided.

11.4.2 PERSONNEL PROTECTIVE EQUIPMENT

The County provides all required personnel protective equipment. The facility operator is responsible for determining what equipment is needed, maintaining an appropriate inventory of equipment, and ordering additional equipment. Equipment to protect against chemical hazards is described in Section 11.5.2 and described on the chemical material safety data sheets (MSDSs) found in Appendix C. This equipment includes safety glasses, face shields, splash aprons, chemically resistant gloves, and boots. Equipment to protect against physical hazards includes safety glasses, safety boots, gloves, and other equipment as appropriate to the work.

11.5 CHEMICAL HAZARDS

11.5.1 GENERAL

This section describes specific hazards and associated protection procedures. Appendix C includes the MSDSs for the major chemicals anticipated for use at the facility. As described in Appendix A, federal regulations require that MSDSs for all chemicals and products (including solvents, glues, paints, etc.) be obtained and kept at the facility in a notebook which is accessible at all times to facility workers.

11.5.2 PERSONAL PROTECTIVE EQUIPMENT

Levels of protection against chemical exposure have been defined by the EPA in the *Standard Operating Safety Guides* (EPA 1984c). The levels of protection that are needed are described below. Table 11-2 lists the appropriate materials for gloves, aprons, and other protective equipment for each chemical.

11.5.2.1 Level D

Level D protective equipment may be worn when there is no potential for splashing or unexpected inhalation of chemical vapors. Level D equipment includes:

- Hard hat when working around moving equipment or areas with low or restricted head room
- Safety glasses when working around construction or moving equipment
- Long-sleeved shirt and long-pants, or coveralls
- Gloves (neoprene or PVC gloves must be used when handling potentially contaminated items such as sample bottles or equipment)
- Boots/shoes with steel or impact-resistant plastic toe and shank.

Level D equipment may be worn during the following activities:

- During general facility work
- During work in well vaults or manholes (other than work with piping that could result in contact with groundwater), provided air monitoring in excavation does not detect organic vapors above background concentrations.

11.5.2.2 Level D (Modified)

Level D (modified) equipment will be worn when a higher degree of dermal or skin protection is needed, and respiratory protection is not needed. Level D (modified) equipment includes:

- Hard hat (a splash shield will be used when a high splashing potential is present)
- Safety glasses
- One-piece disposable coveralls, hereafter referred to as Tyvek (saran or polycoated Tyvek when needed for greater splash protection, or when working outdoors in rain)
- Thin PVC inner-disposable gloves
- Outer-disposable gloves (leather outer gloves may be worn, but gloves will be treated as contaminated if used in the exclusion zone)
- Boots with steel (or impact-resistant plastic) toe and shank
- Boot to Tyvek and glove to sleeve seams sealed (taped) if appropriate given the work.

Level D (modified) equipment may be worn during the following work activities:

- During piping-related work in well vaults, manholes, or at the facility treatment building
- Taking well water level readings (eye protection required when deconning tape)
- Collecting groundwater samples
- When pressure washing
- During batch cleaning of the air stripping tower.

Periodic (approximately once per hour and more frequently when necessary) air monitoring is required during these activities.

11.5.2.3 Level C

Level C protection differs from Level D (modified) protection in that it affords a higher degree of respiratory protection. Air-purifying respirators are worn to reduce atmospheric contaminant levels before air enters the lungs. Level C protective equipment includes:

- Level D (modified) equipment and taped glove to Tyvek and boot to Tyvek seams
- Full-face respirator with high-efficiency organic vapor cartridges (OSHA/NIOSH approved), or acid gas cartridges when handling acid or caustic.

Level C protection will be required for activities where substantial volumes of untreated groundwater may be encountered, or any areas where air quality monitoring indicates concentrations in excess of action levels described in Section 11.5.4. Air monitoring during these activities is required about every ½ hour.

All personnel who will be conducting work where respirators may be required must pass a fit test with a full-face respirator prior to beginning work. Beards are prohibited when wearing respirators as they prevent the respirator from sealing to the face. Respirators will be placed in clean plastic bags after decontamination and stored in the work zone for easy access if they are needed.

11.5.3 DECONTAMINATION

Upon completion of work activities, workers will remove disposable clothing and gloves. These items will be disposed of daily and will be treated as noncontaminated trash, unless heavily contaminated.

11.5.3.1 Personnel Decontamination Procedures

A decontamination area should be set up in advance if the potential exists for significant exposure. Before commencing work, all personnel will be trained by the facility operator in decontamination procedures. Personnel decontamination will be as follows:

Step 1: Place wash basins on plastic sheeting in a convenient area near the work.

Step 2: Discard outer gloves.

Step 3: Wash and rinse boots.

Step 4: Decontaminate equipment with disposable wetted rags. Place disposables in receptacles.

Step 5: Remove Tyvek. Place disposables in receptacles.

Step 6: Remove, wash, rinse, and sanitize respirator (if used).

Step 7: Discard inner gloves.

Step 8: Wash hands and face with clean water and soap.

Step 9: Workers should shower in the treatment building toilet room or immediately upon returning home.

Decontamination water can be disposed of in the well vault sumps or treatment building sumps.

11.5.3.2 Respirator Decontamination

Certain parts of contaminated respirators, such as the harness assembly or cloth components, are difficult to decontaminate. If grossly contaminated, these parts will be discarded. Respirators will be sanitized by rinsing them in a detergent solution followed by several clear rinses, before hanging them to dry.

Each worker is responsible for decontaminating their own respirator at the end of each day of use, and will be trained in respirator maintenance as part of the safety program.

11.5.3.3 Emergency Decontamination

In case of an emergency, gross decontamination procedures will be implemented as rapidly as possible. The facility treatment building has three emergency eye washes and showers. A portable eye wash and water sprayer should be available in the first-aid kit maintained in a vehicle that is present when piping work in well vaults or manholes is performed. If a life-threatening injury occurs that results in a worker becoming highly contaminated, and the injured worker cannot undergo decontamination procedures without incurring additional injuries or risk, the worker will be transported wrapped in plastic sheeting. The medical facility must be: 1) informed that the injured individual has not been decontaminated, and 2) given information regarding the most probable contaminants.

11.5.4 AIR MONITORING

11.5.4.1 General

Inhalation is one of the potential routes of exposure to chemical toxicants, particularly for volatile organic compounds (such as those known to be present in groundwater, see Section 11.5.5). The level of respiratory protection required for workers performing activities in areas of potential hazards must be determined based on the location of these activities and the concentration of organic vapors measured in the area of the work during the activities. Respirators will not protect against explosive or oxygen deficient atmospheres and these atmospheres must be detected by monitoring and avoided.

11.5.4.2 Instrumentation

Monitoring for organic vapors is accomplished within the worker breathing zone using a photoionization detector (PID). The PID is a portable instrument that measures the concentration of ionizable compounds in air. The PID should be configured with a 10.6-electron volt ultraviolet lamp, which is sufficient to ionize most of the volatile organic chemicals previously detected in the groundwater (see Table 8-1) and which may be present in the atmosphere. Methylene chloride cannot be detected with the PID. However, since the permissible exposure level (PEL) for methylene chloride is relatively high (see Table 11-2) and during previous work at the site it has only been present in combination with other detectable compounds, the use of air monitoring equipment capable of detecting methylene chloride is not considered necessary. 1,1-Dichloroethene (DCE) has a PEL of 1.0 ppm and cannot be reliably detected at that concentration with a PID.

However, the maximum concentration of DCE detected onsite was 0.5 ppm in groundwater near the center of the landfill. Therefore, based on the results of previous sampling, DCE is not considered to present an inhalation hazard, and the use of air monitoring equipment capable of detecting DCE is not considered necessary. If significant concentrations (above 25 ppm) of volatile organic compounds are detected by the PID, other field monitoring equipment (i.e., detector tubes) should be used to ensure that methylene chloride and DCE are not present in concentrations approaching the PEL.

In addition to air monitoring using the PID, air monitoring for confined spaces requires the use of a combustible gas indicator (CGI) and an oxygen monitor. The CGI is used to detect potentially explosive methane gas or other flammable gases. The CGI provides results as a percentage of the lower explosive limit (LEL). The work area will be immediately evacuated if the CGI reads 20 percent or greater. The oxygen monitor is used to detect deficient atmospheres. Normal atmospheres have an oxygen concentration of 21 percent. The work area will be immediately evacuated if the oxygen concentration is below 19.5 percent.

The calibration of the PID, CGI, and oxygen monitors should be checked each day using commercially available calibration gases and the results recorded. Fresh batteries should be immediately available whenever air monitoring is being performed.

11.5.4.3 Action Levels

Table 11-3 lists action levels that will trigger an upgrade of respiratory protection, or indicate when area evacuation is necessary. Workers will evacuate the area if the PID reads over 25 ppm, the CGI reads over 20 percent of the LEL, or the oxygen monitor reads less than 19.5 percent. Workers will allow the gases to vent and dissipate for at least 30 minutes before returning to take further readings, or 10 minutes if forced air ventilation is available. Respiratory protection will be required if the breathing zone organic vapor reading exceeds 25 ppm for over one minute, or exceeds 50 ppm for a momentary peak. Note that respirators will not protect against explosive or oxygen-deficient atmospheres.

A full-face respirator equipped with organic vapor cartridges provides a protection factor of 100. Thus, it may be safely worn in concentrations up to 100 times those established above. Conditions that reach or exceed this 100 protection factor and, therefore, require the use of a supplied air respirator (Level B protection) are not anticipated. However, if conditions are

encountered that warrant Level B protection, the work area will be evacuated until concentrations fall below the action levels for evacuation.

11.5.5 CHEMICALS

Untreated groundwater and batch cleaning chemicals have both direct contact and vapor inhalation hazards that can result from the process operations, maintenance activities, or sampling. The untreated groundwater contains several hazardous substances, including volatile organic compounds that may volatilize from the water into the air. Batch cleaning chemicals also have both contact and inhalation exposure hazards. These chemicals are described in Table 11-2. Maximum concentrations of chemicals in groundwater observed at the time of preparation of this plan are presented in Table 11-4.

11.5.6 EMERGENCY PROPANE HEATER

The facility has an emergency propane heater to prevent freeze damage in the process area in the event of a prolonged power failure during cold weather. Combustion of propane in the heater will consume oxygen and give off carbon dioxide and carbon monoxide gases, resulting in hazardous conditions in the building that could cause unconsciousness or death. When using the heater, at least some ventilation must be provided to ensure fresh air to support combustion and to reduce exhaust gas levels. Extreme care must be used when entering the building while or after the heater has been used. Prior to entry, ventilate the building by opening exterior doors, including the roll-up door, and monitor for oxygen. The minimum safe oxygen level is 19.5 percent. When the heater is in use, the building should not be entered except to service the heater.

11.5.7 CHEMICAL DELIVERY

11.5.7.1 General

Various chemicals are used at the facility to control scaling and biological fouling, and periodic delivery of these chemicals will be required. Extreme care should be exercised at all times when working with acids, caustic, oxidizing agents, or other chemicals. If questions arise, resolve them before proceeding. In general, the following safety rules should be followed:

8. Do not bring food or drink in an area where potentially toxic substances are stored, mixed, or otherwise handled, as this will not be allowed.

9. Be extremely careful to avoid spills or splashes when handling chemicals. Spilled chemicals must be removed immediately. Remove by flushing with water or other appropriate methods (see Section 12.0, spill response plan).

10. Wear appropriate protective goggles and clothing when handling or observing the transfer or use of chemicals (see Table 11-2).

11. If you contact acids or caustic chemicals, take immediate action by flushing the affected part with water. If you should swallow a chemical, telephone for help, check the chemical warning on the container, consult MSDS located in the office, and follow instructions.

12. Store all chemicals or other injurious materials in proper, approved containers. Antidotes and first-aid treatment methods will be attached to the container and made readily available to all workers at the facility.

11.5.7.2 Delivery Procedures

The facility operator and the driver of the chemical delivery truck should be aware of the following procedures for safe delivery:

1. Upon arrival at the facility, the truck driver should inform the facility operator of the chemical delivery. The driver must provide the bill of lading **BEFORE** the driver begins to discharge the contents of the truck. The bill of lading verifies:

   a. Type of chemical solution
   b. Concentration of chemical solution
   c. Volume of chemical solution

   The facility operator must verify that the tank or receptacle, and any contents or residual contents therein, are chemically compatible with the chemical being delivered and the tank or receptacle has sufficient volume available to receive the delivery. The driver must wear steel-toe boots, hard hat, and other protective clothing, as appropriate.

2. The facility operator is responsible for directing the driver to the unloading area, showing the driver which line to hook up to, and directing the driver when and how much to unload. Note that for the delivery of some batch cleaning chemicals, the chemicals are unloaded in increments, not in a single transfer.

3. No chemical shall be unloaded from any motor vehicle unless the handbrake is securely set and all other reasonable precautions (wheel chock) are taken to prevent motion of the motor vehicle during the unloading process.

4. A motor carrier who transports chemicals by a cargo truck must ensure that the cargo tank is attended by a qualified person at all times during unloading. A person is qualified if that person has been made aware of the nature of the chemical being transported and unloaded, has been instructed on the procedures to be followed in

emergencies, and that person is authorized to move the cargo tank. During unloading of a chemical, the person must be awake, have an unobstructed view of the cargo tank and discharge connection, and be within 25 ft of the cargo tank. Note that a delivery hose, when attached to the cargo truck, is considered a part of the vehicle.

5. Drip pans must be used for all hose connections outside the facility containment areas or building process area.

11.6 BIOLOGICAL HAZARDS

11.6.1 BIOLOGICAL GROWTH

Biological growth could accumulate in the air stripping tower, particularly in the mist eliminator. Air stripping tower maintenance activities including inspection or cleaning of the mist eliminator or liquid distributor could result in contact with this material. Contact should be prevented since the biological growth may contain infectious bacteria or molds that could cause disease. The proper use of protective equipment will minimize the potential infection hazard (see Section 11.4.2). Also, postponement of these maintenance activities until after batch cleaning will reduce biological hazards. However, take care to avoid exposure to residual batch cleaning chemicals.

Septic waste may also be infectious. The septic system should be maintained only by qualified personnel.

11.6.2 WILDLIFE

Rattlesnakes are known to be present in the Spokane area, and although the potential for encountering a rattlesnake is low, workers should be cautious when walking through brush and vegetation. Rattlesnakes are usually 35 to 45 inches long, have a pit between the eye and nostril on each side of a triangular-shaped head, elliptical pupils, and two large fangs. Nonpoisonous snakes have round pupils, more rounded heads, and no fangs or pits.

First aid for a snakebite victim includes: 1) transporting the victim to the hospital as quickly as possible; 2) keeping the victim still, calm, and preferably in a lying position; and 3) immobilizing the bitten extremity and keep it at or below the heart level.

Black widow spiders have been observed at the site, and brown recluse spiders are also likely to be present. Both are typically reclusive and prefer warm dark areas for their nests. Care should be taken when disturbing such potential nesting areas. First aid for a black widow, brown reclusive, or other venomous spider bite is identical to first aid for a snakebite.

11.7 PHYSICAL HAZARDS

Physical hazards include fire/explosions, mechanical equipment, electrical equipment, elevated areas, and heat/cold. These hazards are described in detail in this section.

11.7.1 FIRE/EXPLOSION

Fire hazards at the treatment facility building are not great, since no chemicals used at the facility (other than miscellaneous paints, solvents, etc.) are flammable and the building is constructed primarily of nonflammable materials. Be aware that all exterior building windows are barred for security, which eliminates alternate emergency egress routes.

There is the potential for encountering pockets of potentially explosive methane gas in well vaults or manholes. Minor fires can be fought with available fire extinguishing equipment. In the event of a major fire or explosion, all personnel should immediately evacuate to a safe area upwind. The facility operator must evaluate the need for further evacuation and/or emergency services. Be aware that catalytic converters on the underside of vehicles are sufficiently hot to ignite dry grass, whether from driving through tall grass or from leaving a running vehicle parked in a grassy area.

Fire extinguishers are located throughout the facility and additional fire extinguishers should be maintained in vehicles when working in the pipeline manholes or well vaults. All fire extinguishers at the facility are dry A-B-C type. Fire extinguisher maintenance and use should follow the recommended guidelines of the fire extinguisher supplier and the recommendations of the manufacturers of the equipment located nearby.

11.7.2 MECHANICAL EQUIPMENT

Potentially hazardous equipment at the plant include pressurized piping, pumps, fans, valves, air compressor, motorize louvers, and heaters. Some general equipment safety guidelines include:

- Guards and other protective devices on equipment must be properly installed and maintained.

- Machinery should not be repaired or adjusted while in operation, nor should oiling of moving parts be attempted, except on equipment that is designed or fitted with safeguards to protect the person performing the work.

- Special care should be taken around fans, valves, and pumps, as protective clothing, fingers, or hair can be caught in moving parts. Also, machinery such as compressors and motors may become extremely hot during use.

- Much of the equipment at the facility operates automatically. Turn off and lock out and tag power controls before attempting to inspect, maintain, or service any equipment. See Section 10.7 for additional electrical safety guidelines.

Nearly all of the piping and valves at the facility contain pressurized potentially hazardous liquids. Drain all lines and flush with potable water, if possible, prior to opening or disassembling any piping components. Wear appropriate personal protective equipment and conduct air monitoring, as appropriate, given the chemicals in the pipe and the probable quantity released.

Positive displacement pumps, such as the chemical feed metering pumps, represent special hazard because they do not have a shut off head and, if a line becomes clogged, the pump will continue to force fluid into the discharge line until something breaks. All pumps of this type used at the facility are fitted with pressure relief valves that return ejected fluids to the pump intake. However, if these valves do not function properly, elevated pressures could cause an explosive rupture of piping or fittings.

11.7.3 ELECTRICAL SAFETY

Equipment in the facility uses electricity. The maintenance of the equipment requires exposure to electrical hazards that may result in shock or death unless safe practices are used. The following are general guidelines for electrical safety:

- Allow only qualified and authorized personnel to work on electrical equipment and wiring or to perform electrical maintenance.

- Provide and use lock-out switches and tags at all remote locations (i.e., out of direct sight) or where the starter is remotely located from the equipment.

- Do not grab a person being shocked. De-energize the circuit first.

- Do not throw water on electrical fires.

- Electrical equipment and lines always should be considered as energized unless they are positively proven to be de-energized and properly grounded.

- The use of metal ladders or metal tape measures around electrical equipment should be prohibited.
- Two persons should be present when working on energized equipment.
- Use approved rubber safety gloves on voltages above 300 V.
- An electrical control panel should never be opened unless the job requires it and then only by qualified and authorized personnel.
- Personnel should avoid grounding themselves in water or on pipes, drains, or metal objects when working on electrical equipment or wiring.
- No electrical safety device or alarm should be made inoperative or bypassed.
- When working in close quarters, all nearby energized circuits should be turned off.
- All electrical tools should have insulated handles.
- Metal-cased flashlights should never be used.
- Jewelry should not be worn when working with or near electric circuitry.
- All electric motors, switches, and control boxes should be kept clean at all times.
- Rubber mats should be used at control centers and electrical panels.
- Utility transformers and electrical meters should only be opened and serviced by utility personnel.

11.7.4 ELEVATED AREAS

Hazards associated with elevated areas include falling for workers in elevated areas and falling objects for workers beneath elevated areas. Safety guidelines for elevated areas are:

- Use care when climbing ladders. The air stripper and batch cleaning tank ladders are fitted with safety cages. Safety cages can create a false sense of security; falls from these ladders are still possible and dangerous.
- Face the ladder and use both hands while climbing. Do not carry tools or other items in the hands while climbing. Put them in a backpack or haul them up with a rope from the platform areas.
- Use care when working on platforms. Use safety chains across ladder access openings to prevent falls.

- Wear a harness when performing work in elevated areas that require reaching out from or climbing above a ladder or platform. Secure the harness eye to a sturdy attachment point using as short a rope (minimum 1/2 inch diameter) as possible.
- Use a manlift or scaffolding, if necessary, to reach inaccessible equipment.
- Do not throw material, tools, or other objects from elevated areas.
- Do not work directly underneath a person working in an elevated area.

11.7.5 CONFINED SPACES

11.7.5.1 Entry and Operational Procedures

A confined space is defined by the concurrent existence of the following conditions:

1. Existing ventilation is insufficient to remove dangerous air contamination and/or oxygen deficiency that may exist or develop.
2. Ready access or egress for the removal of a suddenly disabled employee is difficult due to location and/or size of opening(s).

The types of confined spaces at the facility include tanks, well vaults, manholes, and the air stripping tower. Well vaults and manholes may be reclassified to unconfined spaces if a continuous history of air monitoring indicates that explosive gases or toxic vapors have never been encountered. If conditions change, or if a significant quantity of groundwater is released into the space, the space shall be immediately reclassified as a confined space.

All persons required to enter a confined space shall be properly trained in the use of all applicable atmospheric testing equipment, pre-entry test procedures, respirators, and first aid/CPR, and shall follow the safety procedures relating to confined space activity as prescribed by state law and County policy.

No one shall perform, or order to be performed, any work in a confined space unless all required safety equipment is available. No one shall perform work in a confined space or act in a standby capacity at a confined space site unless properly trained. At least one employee shall remain directly outside the confined space opening to assist in case of emergency and shall be first aid/CPR certified. At least one other employee must be within visual and/or voice contact. The main standby person is responsible for double-checking the safety harness and belt adjustments, as well as attending to the hoisting device. An approved safety harness with a safety line attached to it shall be worn at all times when entering, working in, and exiting a confined space. The line

must be ½-inch in diameter and have a 2,000-lb test strength. The appropriate personal protective equipment shall be available and worn as needed (see Section 11.4.2).

Ventilation equipment, such as fixed or portable ventilation blowers, of sufficient size to adequately ventilate the confined space shall be used. When purging a confined space with blowers, always allow at least 10 minutes for an adequate purge. Always repeat the air testing procedures outlined in the pre-entry checklist after ventilating and before entering the confined space (see Form 11-3). Air monitoring shall be performed after ventilation in accordance with this Section and Section 11.5.4.

A confined space entry permit shall be completed by the facility operator and a copy of the permit maintained at the work site (see Form 11-3). The pre-entry checklist shall be completed prior to entering the confined space. ALL pre-entry checklists and entry permits shall be kept on file in the facility control room after the job is completed. Whenever the opening of a confined space is located near traffic flow, proper barricading, coning, and signing procedures must be followed and noted on the checklist.

11.7.5.2 Entry and Working in a Confined Space

Entry is permitted only after all pre-entry testing is complete, the correct number of standby personnel are present, all applicable equipment is available and properly adjusted, the pre-entry checklist (Form 11-3) is properly completed, and a confined space entry permit is issued. The confined space entry checklist includes space to record air monitoring results. Periodic air monitoring results can be recorded on Form 11-4. If necessary due to readings approaching the action levels, the atmosphere in the confined space should be monitored every 15 minutes and the results recorded on Form 11-5.

No worker shall enter a confined space without the harness-type safety belt with safety rope. If the confined space opening is of the top opening entry variety, the harness must be able to suspend a person in an upright position. Tie off the end of the safety line to a well anchored, fixed object, if available. Never leave the safety line unattended. Ensure adequate communication exists between the employee inside the confined space and the standby person.

If at any time while in the confined space the oxygen level is reduced to 19.5 percent or the combustible gas concentration exceeds 20 percent LEL — **exit the space immediately!** Do not reenter the space until it has been properly ventilated and monitoring indicates safe oxygen and combustible gas levels. Use respirators if the toxic gas levels exceed the action levels of 25 ppm.

11.7.6 HEAT-RELATED ILLNESSES

Summer temperatures in the Spokane area may at times exceed 100 degrees Fahrenheit (°F). Heat-related illness can cause physical discomfort, loss of efficiency, personal injury, and, in the extreme, can be life-threatening. During periods of extreme hot weather, the facility operator may implement modified work hours, or suspend outdoor activities, until more temperate weather returns. Workers wearing protective clothing are highly susceptible to heat-related illness. Causes of heat-related illnesses include unacclimated workers, lack of physical fitness, being overweight, recent alcohol intake, dehydration, individual susceptibility, and cardiovascular disease. The three most common types of heat-related illness are heat cramps, heat exhaustion, and heat stroke, the symptoms of which are briefly described below:

- Heat cramps are caused by profuse perspiration with inadequate fluid intake and chemical replacement (especially salts). Symptoms include muscle spasms and pain in the extremities and abdomen. First-aid treatment includes drinking half a glass of salt water (1 teaspoon of salt per glass) every 15 minutes over a period of about 1 hour.

- Heat exhaustion is caused by dehydration, or water deficiency. Symptoms include fatigue, nausea, headache, clammy and moist skin, and a pale complexion. First aid treatment includes taking the individual to a cooler environment and administering fluids.

- Heat stroke is a life-threatening condition resulting from a failure of the body's temperature regulation ability, which leads to the loss of evaporative cooling and an uncontrolled accelerating rise in body temperature. If heat stroke is suspected, immediate medical attention is necessary. Symptoms of heat stroke include red, mottled, hot, and dry skin. First-aid treatment includes immediate cooling by spraying the individual with cool water or wrapping the individual in a wet sheet and vigorous fanning of the individual to reduce body temperature.

Prevention of heat-related illness can be accomplished by medically screening workers, allowing workers to slowly acclimate to heat exposure, monitoring workers during sustained heat, and ensuring that ample drinking water is available at all times and is taken frequently during the work day. The potential for heat-related illness can be drastically reduced by following a work/rest schedule for workers wearing protective gear. The schedule will be determined by the facility operator and will be based on field conditions, level of work effort, and individual reactions.

The facility operator will evaluate the health and physical fitness of field personnel wearing protective gear prior to beginning project field activities. This may include taking baseline pulse and temperature readings. These readings will provide the basis for comparison if vital sign monitoring becomes necessary during hot weather conditions. A person's body temperature and

pulse rate will tend to rise while working in hot weather conditions. Workers who are ill (i.e., cold or flu), have sunburns, or other difficulties should inform the facility operator, as these conditions can affect vital sign readings.

If necessary, at the end of each work period, the workers will remove their protective clothing and the facility operator shall do one or more of the following for each worker:

1. Take their oral temperature and proceed as given below:

   a. Less than or equal to 99°F - no action
   b. Greater than 99°F and less than or equal to 99.7°F - cool them off with a water spray and do not allow them to return to work unless their temperature is 99°F at the end of the rest period.
   c. Greater than 99.7°F and less than or equal to 100.4°F - cool them off with a water spray, double their rest period, and do not allow them to return to work unless their temperature is less than or equal to 99°F. If heat exhaustion or heat stroke symptoms are present, seek medical attention.

2. Take their pulse. If their pulse is over 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.

3. Check carefully for symptoms of heat illness and react accordingly.

4. Have each person slowly drink cool, but not cold, water or diluted unsweetened fruit juice. It is important that fluid intake be regular (suggested intake is approximately 1 cup every 20 minutes).

Prior to each day's field activities, the team will ensure that sufficient drinking water or diluted fruit juice and ample cooling water (in a pressure sprayer) is on-hand. Be sure to keep all fluids and cooling water in the shade. Workers should remove their protective clothing as completely as possible during rest breaks to let the body cool and to help prevent heat rashes.

11.7.7 COLD-RELATED ILLNESSES

Cold temperatures can also pose health hazards to field workers. Winter temperatures in the Spokane area can drop well below freezing. Outdoor activities may need to be delayed during extreme cold weather. The serious health effects that can result from exposure to cold temperatures include hypothermia and frostbite. Hypothermia results from the lowering of the body's deep core temperature. Body core temperatures below 96.8°F cause reduced mental alertness, reduction in rational decision-making, and possibly the loss of consciousness (which is potentially fatal). A

person with hypothermia should receive medical attention immediately. Signs of frostbite include sudden whitening of the skin and numbness. Treatment includes warming with blankets, warm compresses, or lukewarm water. Hot water, ointments, or massage should not be used. Workers should inform the facility operator if their hands, feet, or face feel numb, and workers should monitor each other for patches of pale skin on the face and ears.

Wind chill, or the cooling power of moving air, is of critical importance when evaluating cold exposure to field workers. The potential for frostbite increases with colder temperatures and higher wind speeds. Table 11-5 provides information for determining wind chill.

Pain in the extremities may be the first early warning sign of the onset of cold-related illnesses; one of the last stages is severe shivering. Workers experiencing shivering should inform the facility operator and should go into a heated area until they feel that they have totally recovered from the effects of the cold weather. The facility operator should monitor the remaining workers.

Workers must wear adequate insulating clothing whenever temperatures are expected to be below 40°F. The most difficult areas to keep warm are the hands and feet. When dressed to protect against chemical exposure, light polypropylene or cotton liner gloves worn under PVC inner gloves are appropriate during the cold season. Alternatively, workers may choose to wear leather or another type of heavier outer gloves (rather than the usual neoprene gloves). However, these outer gloves will then be treated as contaminated if they have been in contact with contaminated materials or surfaces. Contaminated outer gloves must be properly disposed of and not be taken back to the worker's car or home.

The steel-toe insert in neoprene chemical resistant boots aggravate the problem of cold feet during the winter months. To help alleviate this problem, workers should wear neoprene boots with oversized steel toe and shank that will accommodate extra wool socks or a felt liner. Workers should not try to wear extra socks inside their normally sized steel toe and shank boots, as this can lead to reduced circulation, resulting in even colder feet.

Other problems can arise during the cold season (i.e., duct tape may not stick, nitrile outer gloves can freeze, respirator exhalation valves can freeze shut, and pens may not write). Some of these problems can be eliminated (i.e., using a special tape made for cold weather use, etc.); however, workers and managers should be prepared for tasks taking more time during the winter months.

11.8 SPILL RESPONSE

Spills of untreated groundwater or chemicals shall be responded to immediately. Refer to Section 12.0 for spill response procedures. All safety procedures must be followed during spill response, including the use of protective clothing and air monitoring.

11.9 FIRST AID

The knowledge and use of first aid cannot be overemphasized. Prompt reporting and attention to all injuries is important. The Red Cross offers first aid training and selected facility personnel should receive this training.

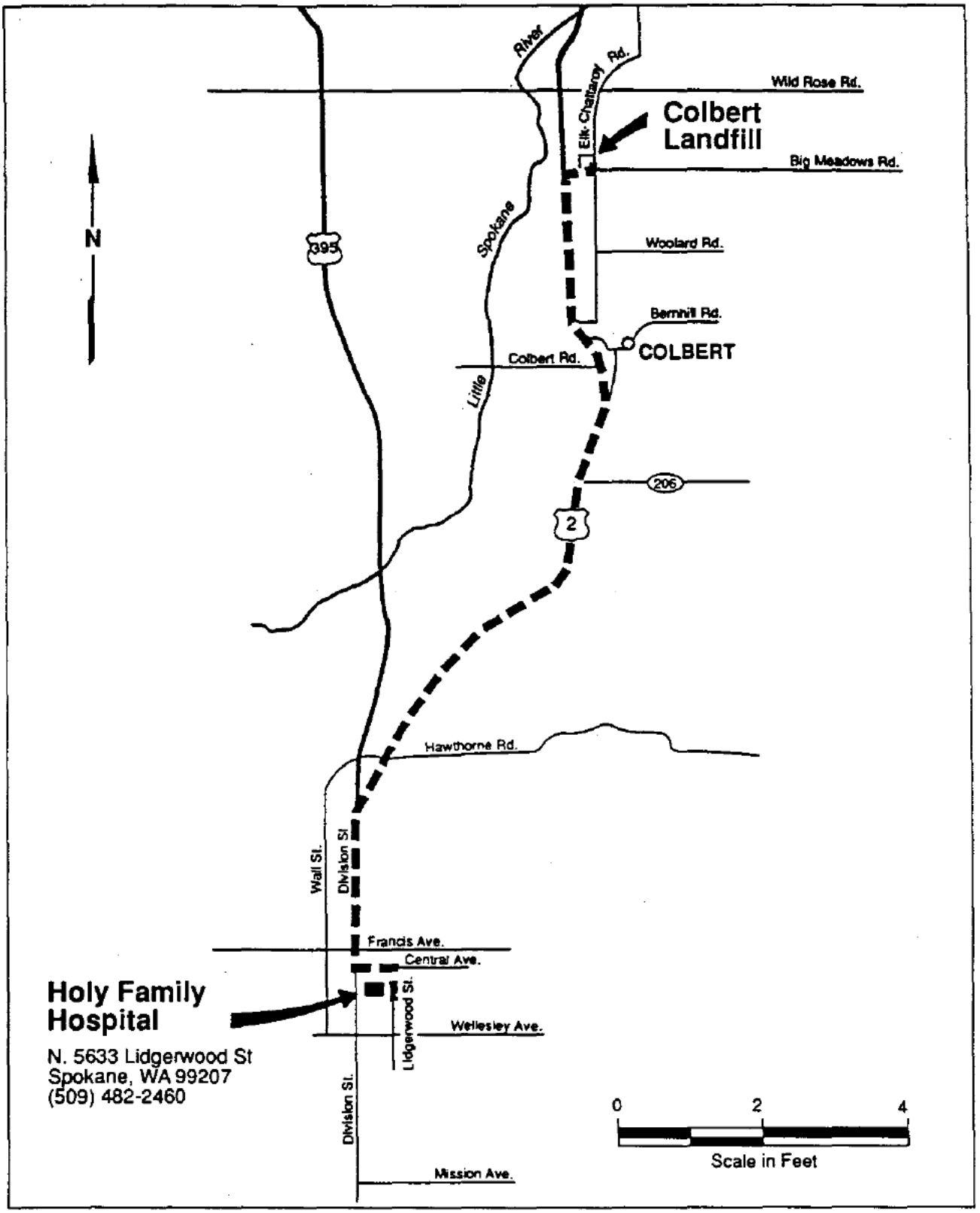
If there is any doubt about what to do or the seriousness of an injury, the proper emergency medical services should be called immediately (see Table 11-1).

11.9.1 FIRST AID AND MEDICAL PROCEDURES

Some general rules for all kinds of first aid are the following:

- Be calm and assess the situation
- Perform the simplest tasks of first aid well
- Take care of the most import conditions first—breathing must be restored, toxic fume inhalation must be reduced, and bleeding must be stopped
- Unless necessary, do not move the person
- Make sure hands, materials, instruments, and the general area are clean when treating wounds.

First aid emergencies can be divided into rescue techniques, severe injuries, treatment for shock, and minor injuries. The steps of first aid for each category are given in Table 11-6, including a list of the kind of injuries in each category.



Directions: Drive to Highway 2 (Highway 2 runs north and south between the Little Spokane River and Chattaroy Road). Drive south on Highway 2 toward Spokane and follow through town (turns to Division St.). Get in the far left lane. Turn left at Central Avenue (at Perkins Restaurant). Drive one block and take a right on Lidgerwood Street. Follow signs to the emergency entrance.

Route to Holy Family Hospital

Figure 11-1

TRAINING RECORD

Employee Name: _____

Address: _____

Phone: _____

Company: _____

Training:
(List all successfully completed health and safety training)

Date	Location	Trainer	Hours	Title/Subject Matter

I certify that I have successfully completed the training programs listed above.

Signature: _____

Date: _____

EMPLOYEE EXPOSURE/INJURY INCIDENT REPORT

(Use additional pages if necessary)

Date: _____ Time: _____

Name: _____ Employer: _____

Site Name and Location: _____

Site Weather (clear, rain, snow, etc.): _____

_____

Nature of Illness/Injury: _____

_____

Symptoms: _____

Action Taken: Rest _____ First Aid _____ Medical _____

Transported by: _____

Witnessed by: _____

Hospital's Name: _____

Treatment: _____

Comments: _____

_____

_____

What was the person doing at the time of the accident/incident? _____

_____

_____

Personal Protective Equipment Worn: _____

_____

Cause of Accident/Incident: _____

_____

_____

What immediate action was taken to prevent recurrence: _____

_____

_____

Additional Comments:

Employee's Signature: _____ Date

Supervisor's Signature _____ Date

Site Safety Officer/Field Coordinator Signature _____ Date

CONFINED SPACE ENTRY PERMIT AND PRE-ENTRY CHECKLIST

Location of Work:

Type of Work to be Performed:

Entry Employee:

Standby Employee:

Standby Employee:

Entry Date: Entry Time:

Outside Contractor(s):

Isolation Checklist

Blocking or Disconnecting

Electrical

Mechanical

Other

Hazardous Work

Painting	Welding	Brazing	Mechanical
Adhesive/solvent use		Sampling	Cleaning

Hazards Expected

Corrosives	Biological
Toxic Chemicals	Flammable materials
Spilled Liquids	Electrical
Elevated Areas	Other

Fire Safety Precautions

Personal Safety

Ventilation Requirements	Employee Qualified
Respirators	Standby Persons
Clothing	First Air/CPR Certified
Head, Hand, Foot Protection	Hoisting Device
Eye, Hearing Protection	
Life lines and Harnesses	
	(Standby Employee Signature)
Lighting	
Communications	
Training Sign-Off	
	Supervisor

Detectors

Property Charged / Fresh Batteries

Calibrated (Date)

Last Inspected (Date)

Atmospheric Gas Tests		(Air sampling to be taken in all levels of the space the worker may occupy)
Oxygen	_____%	If less than 19.5%, abort entry
Combustible Gases	_____% LEL	If greater than 20% LEL, abort entry
Toxic Vapor	_____ ppm	If greater than 25 ppm, abort entry

Time:

All records are to be maintained at the work site and returned to the supervisor when the job is completed.

CONFINED SPACE ATMOSPHERIC TEST LOG

COMBUSTIBLE GAS	OXYGEN LEVEL	TOXIC VAPORS
Normal reading: 00% Reading must be below 20% before entry.	Normal reading: 21% Reading must be above 19.5% before entry. A reading above 25% indicates excess oxygen or fire hazard.	Normal Reading: 00% Reading must be below 25 ppm before entry.

Date/Time	Location	Tested By	Combustible Gas %	Oxygen %	Toxic Vapors ppm	Remarks

Remarks:

CONTINUOUS MONITORING CHECKLIST

Time Entered: _____ Signature: _____

Location: _____

15-Minute Atmospheric Gas Test:

Oxygen	_____%	Oxygen - if less than 19.5%, GET OUT
Combustible Gas	_____% LEL	
Toxic Vapors	_____ ppm	

15-Minute Atmospheric Gas Test:

Oxygen	_____%	Combustible Gas - if greater than 20% LEL, GET OUT
Combustible Gas	_____% LEL	
Toxic Vapors	_____ ppm	

15-Minute Atmospheric Gas Test:

Oxygen	_____%	Toxic Vapors - if greater than 25 ppm, GET OUT
Combustible Gas	_____% LEL	
Toxic Vapors	_____ ppm	

15-Minute Atmospheric Gas Test:

Oxygen	_____%
Combustible Gas	_____% LEL
Toxic Vapors	_____ ppm

Time Out: _____ Signature: _____

TABLE 11-1

EMERGENCY FACILITIES AND NUMBERS

HOSPITAL: - Holy Family Hospital, N. 5633 Lidgerwood Street, Spokane, WA 99207
Emergency: (509) 482-2460
Information: (509) 482-0111

DIRECTIONS - Drive to Highway 2 (Highway 2 runs north and south between the Little Spokane River and Chattaroy Road). Drive south on Highway 2 toward Spokane and follow through town (turns into Division Street). Get in the far left lane. Turn left at Central Avenue (at Perkins Restaurant). Drive one block and take a right on Lidgerwood Street. Follow signs to the emergency entrance. See map (Figure 11-1) for emergency route.

TELEPHONE - A telephone will be located onsite in the project office trailer.

EMERGENCY TRANSPORTATION SYSTEMS (Fire, Police, Ambulance) - 911

EMERGENCY CONTACTS

Fire District #4	**911**
Ambulance Service	**911**
Sheriff's Desk	**911** or (509) 456-2240
Holy Family Hospital	(509) 482-2460
Washington State Department of Ecology	(509) 456-2926
EPA Region 10 (Environmental Emergencies)	(206) 553-1263
Poison Center	1-800-572-5842

In the event of an emergency, do the following:

1. Call 911 for help as soon as possible. Give the following information:
   - **WHERE** the emergency is - the Colbert Landfill is located at the northwestern quadrant of the intersection of Elk-Chattaroy, Yale, and Big Meadows Roads.
   - **PHONE NUMBER** you are calling from.
   - **WHAT HAPPENED** - type of injury.
   - **WHAT** is being done for the victim(s).
   - **YOU HANG UP LAST** - let the person you called hang up first.

2. If the victim can be moved, transport the individual to the hospital while one person calls the hospital to notify them. If the injury or exposure is not life threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a blanket or sheet of plastic prior to transport.

3. Notify the facility operator and the project manager.

TABLE 11-2

SUMMARY OF FACILITY CHEMICAL DATA

Chemical	Source	Explosive limits LEL (UEL)	Common Properties	Physiological Effects	Vapor Pressure (mm Hg)	pH	Minimum Personal Protective Equipment	Permissible Exposure Limit in Air (ppm)	Air Monitoring Method
Methylene chloride	groundwater	14% (22%)	colorless liquid with aromatic odor	eye, lung, and skin irritation, headache, irritability, numbness, tingling in limbs	380	5 - 8	safety glasses, gloves (PVC or neoprene)	100 (IDLH = 5000)	None (other VOCs used as surrogates)
1,1,1-Trichloro-ethane	groundwater	nonflammable	colorless, sweet odor	eye and skin irritation, dizziness, drowsiness	100	5 - 8	safety glasses, glove (PVC or neoprene)	350	None (other VOCs used as surrogates)
1,1-Dichloro-ethane	groundwater	5.6% (?)	colorless, sweet odor	skin irritation, dizziness, drowsiness	230	5 - 8	safety glasses, gloves (PVC or neoprene)	100 (IDLH = 4000)	PID (not compound specific)
1,1-Dichloro-ethene	groundwater	5.6% (12.8%)	slight acrid odor	eye irritation, dizziness, nausea, intoxication	-	5 - 8	safety glasses, gloves (PVC or neoprene)	1.0	PID (not compound specific)
Trichloro-ethylene	groundwater	nonflammable 8% (10.5%)	colorless, sweet odor	eye, nose, and throat irritation, headache, dizziness, nausea, drowsiness	100	5 - 8	safety glasses, gloves (PVC or neoprene)	50 (IDLH = 1000)	PID (not compound specific)
Tetrachloro-ethylene	groundwater	nonflammable	colorless, sweet odor	eye, nose, and skin irritation, headache, dizziness, nausea, drowsiness, increased perspiration	16	5 - 8	safety glasses, gloves (PVC or neoprene)	25 (IDLH = 500)	PID (not compound specific)
Scale control chemical (polyacrylate)	tank T-1	nonflammable	clear water-white liquid	slight eye and skin irritation	-	3.6 - 4.0	safety glasses, gloves (PVC or neoprene)	-	none
Defoaming chemical	drums	nonflammable	white, some odor	very slight skin irritation	2	6 - 8	safety glasses, gloves (PVC or neoprene)	-	none

TABLE 11-2

SUMMARY OF FACILITY CHEMICAL DATA

Chemical	Source	Explosive limits LEL (UEL)	Common Properties	Physiological Effects	Vapor Pressure (mm Hg)	pH	Minimum Personal Protective Equipment	Permissible Exposure Limit in Air (ppm)	Air Monitoring Method
Hydrochloric acid (35 percent solution)	tanker truck, tank T-3	nonflammable	clear, sharp irritating odor	extremely corrosive; will burn on contact. Vapors irritating to eyes, nose, and lungs	80	Approx. 0	safety glasses, face shield, boots, gloves, apron (nitril, neoprene, or PVC)	5	draeger tubes
Sodium hydroxide (50 percent solution)	drums	nonflammable	clear, no odor	extremely corrosive; will burn on contact. Vapors irritating to eyes, nose, and lungs	13, increases to 135 when diluted to 10 percent	Approx. 14	safety glasses, face shield, gloves, apron (nitrile or butyl rubber, PVC, or neoprene)	1.2*	draeger tubes
Hydrogen peroxide (35 percent solution)	drums	nonflammable, but can start fires on contact with combustible materials	clear	oxidizer, will burn on contact, vapors irritating to eyes, nose, and lungs	23	-	safety glasses, face shield, gloves, apron (neoprene, PVC, or butyl rubber)	1	draeger tubes

Note: See Section 12.0 for spill response procedures. See Appendix D for material safety data sheets.

*NIOSH/OSHA TWA

TABLE 11-3

ACTION LEVELS FOR RESPIRATORY PROTECTION
COLBERT LANDFILL

Monitoring Parameter	Reading[a]	Level of Protection
Combustible gas (during intrusive activities in the refuse disposal and work areas within 50 ft of the refuse disposal area	10-20% of lower exposure limit (LEL)	Continue onsite monitoring with extreme caution as higher levels are encountered
	>20% LEL	Explosion hazard; withdraw from area immediately
Organic vapors[b] (during all intrusive activities within the refuse disposal area)	0-15 ppm over background[c]	Level D (modified)
	15-100 ppm over background	Level C: Full-face air purifying respirator equipped with organic vapor and high efficiency particulate cartridges
	>100 ppm over background	Withdraw from area immediately

(a) Sustained readings over a one minute duration.
(b) Determine using a PID or other appropriate organic vapor detector.
(c) Background readings obtained 50 ft upwind of site activity.

TABLE 11-4

ESTIMATED MAXIMUM CONTAMINANT CONCENTRATIONS IN GROUNDWATER COLBERT LANDFILL[a]

	Maximum Concentration (ppb)[b]	
Constituent of Concern	**Upper Aquifer**	**Lower Aquifer**
1,1,1-Trichloroethane (TCA)	400	4,200
1,1-Dichloroethylene (DCE)	43	560
1,1-Dichloroethane (DCA)	180	120
Trichloroethylene (TCE)	14	580
Tetrachloroethylene (PCE)	ND[c]	2.9
Methylene chloride	35	4,400

(a) Landau Associates (1991).
(b) ppb = parts per billion; equivalent to micrograms per liter (μg/L).
(c) ND = not detected in any well in aquifer.

TABLE 11-5

COOLING POWER OF WIND ON EXPOSED SKIN[a]

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER in < hr with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed skin within 1 minute.			GREAT DANGER Skin may freeze within 30 seconds				

(a) Expressed as an equivalent temperature under calm conditions. Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA, as cited by the American Council of Hygienists, 1990-1991 threshold limit values.

TABLE 11-6

GENERAL FIRST AID STEPS

Kind of Emergency	
Rescue Techniques	**Action**
CPR (artificial resuscitation)	Call for medical assistance immediately 1. Open airways by tipping head, clearing mouth, supporting neck 2. Restore breathing by CPR or artificial resuscitation 3. Restore circulation with direct pressure on wounds 4. Decide on therapy for other injuries
Heart attack	Treat for shock (see below) Keep person quiet, raise head and prop him up if necessary to restore breathing Administer oxygen, if available
Choking	Use Heimlich maneuver—stand behind victim, hold your arms around his waist near diaphragm, hold your own wrists firmly and squeeze hard. If he is collapsed, place your hands on top of each other on back near diaphragm and push toward the head
Severe Injuries	Call for medical assistance immediately
Hemorrhage	Stop bleeding by using direct pressure
Electrical shock	Disconnect circuit (do not grab victim if in contact with live circuit) Treat for shock if necessary Seek medical assistance immediately
Eye injuries	Flush chemical away from eye or skin with water. Do not apply direct pressure to the eyeball. Seek medical assistance immediately
Chemical burns	Neutralize, flush with water, clean, and dress wounds if possible Seek medical assistance immediately
Thermal burns	Use cold compress and seek medical assistance immediately. Seek medical assistance immediately
Fracture	Keep joint straight and apply splint to extend above and below break. Seek medical assistance immediately

TABLE 11-6

GENERAL FIRST AID STEPS

Kind of Emergency	
Treatment for Shock	Give artificial resuscitation if necessary. Keep person lying down, head level with body. Elevate feet if not painful. Raise head and chest if there is difficulty breathing. Keep person warm with light blanket. Give sips of water, if conscious and there is no abdominal pain. Seek medical assistance immediately
Minor Injuries	
Abrasions, cuts, scratches Minor burns	Wash and rinse wounds.
Head injuries Chest injuries	Remove foreign material, if possible.
Nosebleeds Mouth injuries	Apply antiseptic and dressing.
	Treat for shock, if necessary.
	Apply cold compresses for nosebleeds, sprains, mild injuries.
	If teeth are dislodged, wrap in moist gauze and take to dentist.
Puncture wounds	Refer to physician if puncture wound is deep or injury seems complicated.

12.0 SPILL PREVENTION AND RESPONSE PLAN

12.1 PURPOSE

The spill prevention and response plan defines the responsibilities, procedures, and facilities used at the facility to implement environmental best management practices (BMPs) for spill prevention and response. The BMPs are as follows:

- Prevention - Operational BMPs include operating procedures, maintenance, training, inspection, recordkeeping, housekeeping, chemical material handling, and waste management.

- Control - Source control facilities and structures constructed to control the release of spills to the environment.

- Response - Emergency spill response procedures, including spill reporting, response, and cleanup procedures to be implemented by the facility's spill response personnel.

12.2 SCOPE

This plan is intended to identify the spill risks present at the facility, and define the facilities and procedures used to prevent, control, and respond to spills. Specifically, the plan is intended to:

- Identify chemical spill risks at the facility, including the locations, types, and quantities of chemicals

- Identify plans and procedures to prevent spills, including management, operations, and personnel responsibilities

- Identify facilities, structures, equipment, and material storage facilities at the facility to control spills to prevent release to the environment

- Define plans, procedures, and equipment to be used by facility personnel to implement spill detection, reporting, response, countermeasures, and cleanup, including emergency notification contacts.

Specific spill control facilities and operating procedures for specific system at the facility are further described in other sections of this document. Appendix A includes information regarding management of dangerous waste generated from spill response actions.

12.3 APPLICABLE REGULATION AND PERMIT REFERENCES

- Chapter 173-220 Washington Administrative Code, *National Pollutant Discharge Elimination System Permit Program.*
- Chapter 173-303 Washington Administrative Code, *Dangerous Waste Regulations.*

12.4 PERSONNEL RESPONSIBILITIES

12.4.1 PROJECT MANAGER

The project manager is responsible for:

- Assigning personnel and providing for adequate training for implementation of this plan
- Providing the primary contact point with regulatory agencies and other entities that are contacted regarding spills
- Approving all transmittals of records and reports to the regulatory agencies
- Identifying updates and modifications to the referenced regulation and permit; updating this plan, as appropriate, to comply with new regulatory requirements.

12.4.2 FACILITY OPERATOR

The facility operator is responsible for:

- Preparing spill report forms for each spill incident and submitting the report to the project manager
- Coordinating orientation of new employees and training of personnel assigned spill management responsibility
- Conducting routine inspections of spill control equipment and facilities to ensure implementation of effective spill response
- Maintaining records and reports associated with this plan.

12.4.3 SPILL COORDINATOR

A Spill Coordinator will be assigned for each spill and will serve as on-scene coordinator for overall response activities. The Spill Coordinator will be one of the following persons, listed in order of preference and availability:

1. Project Manager

2. Facility Operator
3. Spill Response Team Members
4. Outside emergency responders.

Section 2.0 identifies the individuals holding the project manager and facility operator positions and their contact telephone numbers.

12.4.4 SPILL RESPONSE TEAM

Selected County employees will be assigned to the facility Spill Response Team. Members of the Spill Response Team are responsible for:

- Maintaining spill response preparedness and training
- Maintaining spill control equipment and facilities
- Reporting spills, as required
- Implementation of spill response procedures
- Preparing and managing documentation.

12.5 FACILITY LOCATIONS, CHEMICAL USE, AND POTENTIAL SPILL AREAS

Untreated groundwater and chemical products are used or handled at the facility by both County personnel and private contractors. This section describes the primary operational areas where chemicals are used, the types of chemicals used, and the potential spill areas. The site plans of the facility are presented with the as-built construction drawings that include the facilities described here. The primary operation areas of the facility where chemicals are used or handled, and, therefore, the primary potential spill areas, are as follows:

- Well vaults and groundwater conveyance pipelines (and adjacent private property), treatment building, and air stripping tower: Untreated groundwater.
- Well vaults and treatment building: Untreated groundwater, paints, solvents, oils, landscaping chemicals (pesticides, herbicides, fertilizers, etc.).
- Batch cleaning tank T-3: Hydrochloric acid and spent hydrochloric acid cleaning solution (brine).

- Process area: Untreated groundwater, scale control chemicals, defoamer, hydrochloric acid and spent hydrochloric acid cleaning solution, hydrogen peroxide, sodium hydroxide, and other chemicals (see above for treatment building).

In addition, vehicles and equipment located at the facility contain diesel fuel, gasoline, hydraulic fluid, antifreeze, and various other chemicals. Spills could occur throughout the facility (including well vaults and pipelines) as a result of either facility-controlled activities or by vandalism. Spills may be detected by either County personnel or private individuals. All spills will be responded to as described in the following section.

Spills in any area of the treatment building (including air stripping tower and batch cleaning tank containment areas) could enter the sumps in these areas and be pumped into the air stripping tower and flow to the outfall. Therefore, it is important that spills be prevented.

12.6 SPILL PREVENTION OPERATIONAL BEST MANAGEMENT PRACTICES

Spill prevention operational BMPs include operating procedures, maintenance, training, inspection, recordkeeping, housekeeping, chemical material handling, and waste management. A summary of these procedures is presented below:

- Ensuring required BMPs are implemented throughout the facility
- Housekeeping and maintenance of the facility
- Ensuring personnel use appropriate operating and maintenance procedures for the facility, as defined in this plan, for facility use, chemical handling, and waste management
- Conducting routine inspections of facility equipment and procedures
- Conducting required training of facility personnel
- Maintaining necessary records of procedures, inspections, and other appropriate information
- Ensuring use of required environmental BMPs by contractors.
- Ensuring use by facility personnel of required operating procedures during chemical deliveries

- Maintaining equipment and facilities, including chemical handling and transfer equipment, pumps, hoses, pipelines, emergency shutoff systems, and related components

- Testing of equipment, including the groundwater conveyance pipeline equipment, to ensure operational integrity.

12.7 SOURCE CONTROL FACILITIES AND STRUCTURES

Source control facilities and structures are used at the primary operating facilities to control the release of spills to the environment. Source control BMPs include:

- Drainage control structures for runon/runoff control and stormwater conveyance control

- The air stripping tower and batch cleaning tank are located in containment areas with concrete floor slabs and wall

- The treatment building and well vaults have concrete slab floors, allowing collection of small spills from the floor surface

- Drip pans are used during bulk chemical delivery.

12.8 SPILL RESPONSE PROCEDURES

This section presents the spill response procedures used by facility personnel, defining the spill detection and reporting procedures, spill response and cleanup procedures, and spill recordkeeping procedures.

12.8.1 SPILL DETECTION AND REPORTING PROCEDURES

Spills may be detected by either facility personnel or the public. All facility personnel will be informed of basic spill detection and reporting procedures. The spill detection and initial response procedures for facility personnel are presented in Table 12-1. Information signs describing reporting and initial response procedures are posted in the facility office and a copy should be readily available when working away from the treatment building.

In the event of a spill detected by the public, they will contact the local police or fire department, who will then contact the facility response contact person.

12.8.2 SPILL RESPONSE AND CLEANUP PROCEDURES

Once a spill has been detected and reported to the Spill Coordinator, the coordinator and spill response team will take over all activities for spill response. The responsibilities of the Spill Coordinator are presented in Table 12-2, and the responsibilities of the spill response team are presented in Table 12-3.

Spill response at the facility is designed to provide timely detection, control, notification, and cleanup of spills. Spill control priorities are:

- Assess the situation and determine the response requirements appropriate to the magnitude of the incident and in accordance with this plan.
- Control the spill to prevent entry of spilled materials into storm drains, dry wells, building floor drains and sumps, or control the areal extent of the spill, if it has entered these areas.
- Spills in the treatment building should be prevented from entering the floor drain/sump system, as it will be automatically pumped to the air stripping tower and flow into the outfall pipeline.
- Spills of untreated groundwater can be allowed to drain into well vault sumps, but take care to prevent flooding of the well vault. The untreated groundwater should not be discharged without being first treated in the air stripping treatment system.
- Notify appropriate agencies/outside emergency response organizations capable of providing the required assistance.
- Clean up the spill, focusing first on continued control, then on lessening the impact on sensitive environmental areas.
- Prepare and submit follow-up reports as required by appropriate agencies and community emergency authorities.

Spills will be initially reported to the Spill Coordinator or by person-to-person communication, two-way radio, or telephone. The Spill Coordinator and the Spill Response Team will implement activities for spill response. The person or employee discovering the spill will have no further involvement, unless they are a member of the Spill Response Team. The Spill Coordinator is ultimately responsible for evaluating the information received and implementing the appropriate response. If necessary, the Spill Coordinator shall notify the appropriate authorities, as listed in Table 12-4.

A key element of spill response is the safety of the personnel responding to the spill. The Spill Response Team will be trained to respond to only those spills involving limited risk of

exposure to hazardous materials and dangerous emergency situations. In the event of a highly hazardous spill incident (i.e., large spill of hydrochloric acid or other batch cleaning chemical), the personnel will conduct only those activities which do not involve dangerous situations.

Materials contaminated by the spill will be disposed of as required, depending on the characteristics of the waste material generated. Spill cleanup materials determined to be dangerous waste will be managed and disposed of as required in the dangerous waste regulations. Spill documentation will be prepared as described in this section. Spill response equipment will be replenished promptly.

12.8.3 Spill Recordkeeping Procedures

Each spill should be logged in on the List of Spill Incidents form (Table 12-5). A Spill Report form (Form 12-1) is to be filled out for each spill event and kept on file at the facility. All report forms are to be maintained on file for the duration of operation of the facility, or as regulations permit.

12.9 SPILL RESPONSE EQUIPMENT

The facility has the following spill response equipment and facilities:

- Facility equipment shed to serve as spill response headquarters
- Vehicles, including automobiles, to transport personnel and supplies
- Absorbent pads and granules to absorb spilled acid or other materials
- Protective clothing for the Spill Release Team (e.g., suits, boots, gloves, respirators, face shields)
- Fire extinguishers and other routine fire fighting equipment located throughout the facility
- Two-way radios or cellular phones, with the first of each pair permanently located in the facility control room and the second of the pair where needed
- First aid equipment
- Shovels
- Waste collection drums

- Baking soda to neutralize the residual from acid spills and dilute hydrochloric acid to neutralize the residual from base spills.

Recommended spill response equipment is listed in Table 12-6. Spill response personnel gear and equipment shall be stored at the treatment facility equipment shed. Table 12-6 should be reviewed on a yearly basis and updated whenever any information changes. Routine inspections of spill control equipment and facilities will be conducted by the facility operator or designee. Inspection results will be documented on a Spill Control Response Equipment and Facilities Inspection and Maintenance form (Table 12-7).

12.10 TRAINING

The facility operator will train all appropriate employees in basic spill detection and response procedures to provide the most rapid response to spill situations. Basic spill response training will include familiarization of all employees with the location of spill control equipment, posted instructions, and emergency phone numbers. Special training will be given to selected employees who will be involved in spill response, such as members of the Spill Response Team. This training will consist of spill control and containment techniques to minimize the area and vertical extent of spills, location and proper use of personnel and equipment, and specific spill notification requirements. Refresher training shall be scheduled and conducted by the facility operator each year.

This plan should be used as the principal training document for initial and ongoing training for all employees directly or potentially involved with spill control. The training should be conducted following the plan outline, and all contents of the plan should be covered.

Spill control training shall be documented in each employee's personnel file by the facility operator.

12.11 REQUIRED PLAN UPDATES

This spill and response plan will be reviewed annually and updated whenever a significant change occurs, including:

- The facility changes in its design, construction, operations, maintenance, or other circumstances in a way that materially increases the potential for spills, or changes the response necessary in an emergency situation

- Failure of the plan in an emergency

- A change in regulations governing spill prevention
- The list of emergency equipment changes
- Any other factor or combination of factors that render the plan inadequate or nonresponsive.

The facility operator will be responsible for updating the plan. The plan will be reviewed and approved by the project manager.

SPILL REPORT FORM

FORM PREPARED BY: _____

REPORT DATE: _____ DATE/TIME OF SPILL: _____

PERSON DETECTING SPILL: _____

MATERIAL SPILLED: _____

QUANTITY OF MATERIAL SPILLED: _____
(If unknown estimate)

LOCATION OF SPILL: _____
_____
_____

AGENCIES/PERSONS AND ORGANIZATIONS NOTIFIED: DATE/TIME

1. _____ _____
2. _____ _____
3. _____ _____
4. _____ _____

HEALTH CONDITIONS (MONITOR AT HALF HOUR INCREMENTS):
_____
_____
_____

RESPONSE TIME:

SPILL OCCURRED AT _____ AM/PM (CIRCLE ONE)
SPILL CONTAINED AT ____ AM/PM (CIRCLE ONE)
SPILL CLEANED UP AT ____ AM/PM (CIRCLE ONE)

DID SPILL REACH STORM DRAIN, DRY WELL, DITCH, UTILITY TRENCH, FACILITY OUTFALL, OR OTHER CONDUIT? ☐ YES ☐ NO

IF YES, LOCATION/TYPE OF CONDUIT AND LIKELY DISCHARGE POINT: _____
_____
_____

POTENTIAL WATERCOURSE AFFECTED: _____

CAUSE OF SPILL: _____
_____

REPORT DATE: _____ DATE/TIME OF SPILL: _____

ACTION TAKEN TO CONTAIN/CLEANUP SPILL: _____

SAMPLES COLLECTED? ☐ YES ☐ NO

IF YES, ANALYSES PERFORMED: _____

LONG-TERM CLEANUP ACTIONS: _____

ACTIONS TAKEN TO PREVENT RECURRENCE: _____

FINAL DISPOSITION OF SPILLED MATERIAL AND CLEANUP DEBRIS:

COMMENTS: _____

TABLE 12-1

SPILL DETECTION AND INITIAL RESPONSE PROCEDURES FOR FACILITY PERSONNEL

In the event a spill of chemical is detected, the following steps must be taken by facility personnel:

1. Evacuate area and ensure personal safety.

2. If injured, obtain medical attention for yourself. Obtain medical attention for other injured persons.

3. If no personal danger exists, attempt to shut off source of spill and prevent release of spill to stormwater.

4. Notify spill coordinator, and provide the following information:
   a. Injuries
   b. Nature of spill
   c. Location of spill
   d. Material spilled or released (if known)
   e. Estimated volume of spill or release
   f. Your name and organization
   g. Any other relevant information
   h. Stay on line until directed to hang up.

5. Remain at site until spill response team arrives, and identify yourself as the person who reported the spill.

TABLE 12-2

SPILL COORDINATOR PROCEDURES FOR SPILL RESPONSE

To respond to a spill or leak of hazardous material, the following steps should be taken by the environmental or spill coordinator:

Immediately:

1. Notify persons potentially affected by spill, and evacuate area if required.

2. Obtain medical attention for injured persons.

3. Coordinate shutoff of spill source.

4. Notify spill response team.

5. Assess possible hazards to human health or the environment. If evacuation of the local area is advisable, government authorities must be notified immediately.

6. Federal and state law require immediate reporting of any spill into surface waters or public storm or sanitary sewers. See Table 12-4 for contacts and telephone numbers.

   Provide the following information:

   a. Nature of emergency
   b. Location of emergency condition or spill
   c. Material spilled or released (if known)
   d. Estimated volume of spill or release
   e. Assistance needed stay on the line until directed to hang up or until called party hangs up.
   f. Your name and organization
   f. Any other relevant information.

7. Coordinate containment and cleanup of released materials.

Later:

1. Complete spill report form to document incident.

2. Submit spill report form to Washington Department of Ecology within 15 days of incident.

3. Arrange for disposal of contaminated material.

4. Review spill response plan for deficiencies.

TABLE 12-3

SPILL RESPONSE TEAM PROCEDURES FOR SPILL RESPONSE

To respond to a spill or leak of hazardous material, the following steps should be taken by the emergency response team:

1. Make sure all unnecessary personnel are evacuated from the spill area.
2. Shut off source of spill.
3. Mobilize emergency and spill response equipment to the spill area.
4. Put on protective clothing and equipment as required.
5. Contain spill by building berms using sand, absorbents, or pads.
6. For large acid or base spills, have vacuum truck brought to site to remove as much liquid as possible.
7. Neutralize residual from acid or base spill using appropriate chemicals.
8. Clean up spill by pumping, shoveling, or absorbing the spill and all cleanup material into tanks, drums, or tanker trucks as appropriate.
9. Correctly characterize, label, store, and dispose of collected materials
10. Clean, maintain, and replenish emergency equipment as required.

TABLE 12-4

AGENCIES WITH EMERGENCY AND SPILL COORDINATION AGREEMENTS OR NOTIFICATION REQUIREMENTS FOR THE FACILITY

Fire District #4
911

Ambulance Service
911

Sheriff
911 OR (509) 456-2926

Washington Department of Ecology
Northeast Regional Office
Spokane, WA
(509) 456-2926
24-Hour Emergency Spill Response (206)-649-7000

Holy Family Hospital
N. 5633 Lidgerwood Street
Spokane, WA 99207
(509) 482-2460

Spokane County Health Department
(509) 324-1560

National Response Center
(800)-424-8802

EPA Region 10
Seattle, WA
(206) 553-1263

Poison Center
(800) 572-5842

TABLE 12-5

LIST OF SPILL INCIDENTS

Date	Material	Quantity	Location

TABLE 12-6

RECOMMENDED SPILL RESPONSE EQUIPMENT

Item	Quantity	Capabilities
Fire Extinguisher, Class A-B-C	4 + 1 in vehicle	Suitable for fighting all types of fires
First Aid Equipment	1 Kit in control room +1 kit in vehicle	Suitable for treating minor cuts, abrasion, illnesses, and burns
Emergency Eyewash/ Showers	3	Suitable for washing injurious material from eyes and body
Emergency Portable Eyewash	1	Suitable for washing injurious material from eyes
Rubber Rain Suit	4	Suitable for protection against liquids, such as acid or scale control chemical spills
Tyvek Suits	10	Suitable for protection against contaminated dirt and other dry materials
Disposable Rubber Gloves	20 Pairs	Suitable for protection against liquids, such as chemical spills
Rubber Boots	1 Pair per team member	Steel toe, suitable for protection against liquids, such as chemical spills
Face Shields	2	Plastic with securing straps, suitable for protection against splashes of liquids
Respirator with organic vapor cartridge or acid vapor cartridges	2 of each type, with 2 pair cartridges per mask	Rubber mask, suitable for protection against organic vapors in atmosphere with normal oxygen levels. NOT SUITABLE FOR OXYGEN DEFICIENT ATMOSPHERES!
Absorbent Pads	50 minimum	Suitable for absorbing oil and other chemicals
Absorbent Granules	2 bags (100 lb)	Suitable for absorbing oil and other chemicals
Shovel	2	Steel with wood handles
Flashlights	2	Large, with fresh batteries (replace every year)
55-Gallon Drum	2	Steel drum, good condition, suitable for holding liquids, solids, etc.
55-Gallon Drum	2	Plastic drum, good condition, suitable for holding corrosive liquids, solids, etc.
Baking Soda	100 lb	Suitable for neutralizing residual from acid spills
Dilute Hydrochloric Acid	10 gal	Suitable for neutralizing residual from base spills

TABLE 12-7

SPILL CONTROL/RESPONSE EQUIPMENT AND FACILITIES INSPECTION AND MAINTENANCE

The facility must perform the following activities on the schedule indicated. Use Table 12-7 as equipment checklist.

Item	Inspection Schedule	Activity Schedule	Person Responsible	Effective Date
Spill Control/Response Equipment	Routine, complete Inspection Form	Correct deficient items as necessary		
Spill Control/Response Facilities	Routine, complete Inspection Form	Correct deficient items as necessary		

13.0 STAFFING

This section summarizes the staffing requirements for management, operation, and maintenance of the facility. Staffing requirements for the facility were estimated and are presented in Table 13-1. These estimates are based on continuous operation of the facility and adjusted for facility-specific factors. Intermittent operation of the facility will reduce staffing requirements, but not at a rate directly proportional to operating time. County-specific factors (productivity of labor, training, management ability, etc.) have not been incorporated in the estimate and, therefore, actual staffing requirements may vary from the estimated values.

As shown in Table 13-1, inclusion of facility-specific factors in the staffing evaluation tended to decrease the estimated staffing requirements as compared to an "average" facility. The facility is considered average for the following items: level of treatment, constant operation, productivity of labor, training, and relatively new equipment, and present flow near design flow. The facility will require greater than average staffing because of the following items: plant layout (extended over large area due to 10 well heads); type of waste removal requirement (effluent standard rather than removal efficiency requirement); climate (slightly extreme winters); automatic monitoring (none for contaminants of concern); and automatic sampling (none for contaminants of concern). The facility will require less than average staffing because of the following items: unit processes (essentially only one process), laboratory work (off-site for most analyses) and off-plant maintenance (contract maintenance for corrective action only).

TABLE 13-1

STAFFING ASSESSMENT FOR FACILITY

Local Condition	Management	Operations	Maintenance	Laboratory	Clerical
Average Staffing[a]	1.0	4.0	1.0	1.0	1.0
Plant Layout	-	+10%	+10%	-	-
Unit Processes	-40%	-40%	-40%	-40%	-40%
Level of Treatment	-	-	-	-	-
Type of Removal Requirement	-	+5%	-	+10%	-
Productivity of Labor	-	-	-	-	-
Climate	-	-	+5%	-	-
Training	-	-	-	-	-
Automatic Monitoring	-	-5%	+5%	-	-
Automatic Sampling	-	+5%	-	+5%	-
Off-Plant Laboratory Work	-	-	-	-60%	-
Off-Plant Maintenance Work	-	-	-25%	-	-
Age and Condition of Equipment	-	-	-	-	-
Pattern of Staffing	-	-50%	-	-	-
Total % Change	-40%	-75%	-45%	-85%	-40%
Staffing Required	0.4	1.0	0.5	0.1	0.4

(a) Based on a survey of 14 wastewater treatment plants, total staffing is related to facility capacity by:

Staffing = 1.66 x Plant Design Flow (MGD) + 5.6

Plant Design Flow = 1,000 gpm X 60 min/hr x 24 hr/day x 10^{-6} = 1.44 MGD

Therefore, staffing = 1.66 x 1.44 + 5.6 = 8.

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APPENDIX A
ENVIRONMENTAL REGULATORY COMPLIANCE

INTRODUCTION

The operation of the groundwater treatment facility at the Colbert Landfill is potentially subject to the requirements of a number of different environmental regulations. In some cases, certain requirements clearly apply, as those covering the discharge of the treated groundwater from the air stripping tower. However, in other cases, the applicability of regulatory requirements will depend on circumstances at the facility. It is important to understand what actions may trigger the applicability of a regulation so that compliance problems can be prevented from occurring; either by avoiding the action or by insuring all the regulatory requirements are met. Following is a summary of some key environmental regulations and requirements that either are or could be applicable to the operations.

WASTEWATER DISCHARGE REQUIREMENTS

The treated groundwater from the air stripping tower is discharged to the Little Spokane River. Because the facility is located in a Superfund site and is part of the cleanup activities on the site, an NPDES permit is not required. However, in place of the NPDES permit, the Washington State Department of Ecology (Ecology) has substantive discharge requirements that apply to the discharge. A copy of those requirements are in Appendix B of this document. The facility is required to sample and test the effluent, record the results, and report the results of the testing. It also specifies limitations on certain parameters that must be met in the discharge.

DANGEROUS WASTE MANAGEMENT REQUIREMENTS

Facilities that generate, manage, or dispose of dangerous waste in Washington are subject to the Washington dangerous waste regulations in chapter 173-303 WAC. To determine whether these regulations apply to the facility, it must first be determined whether any dangerous waste is generated, how much is generated each month, and whether the generated dangerous waste is accumulated onsite.

DESIGNATING DANGEROUS WASTE

The Washington State dangerous waste regulations (chapter 173-303 WAC) require everyone who generates solid waste (this includes solids, liquids, and gasses) to determine if any of their wastes are classified as a dangerous waste. This designation is done by comparing each waste with the lists of products that are a dangerous waste when discarded unused (applies only to unused materials); the list of dangerous waste sources, the dangerous waste characteristics (ignitability, corrosivity, reactivity, toxicity); and the dangerous waste criteria (toxic and persistent). The sections of the dangerous waste regulations covering these lists, characteristics, and criteria are WAC 173-303-080 to 100. The lists are in WAC 173-303-9903. Wastes may be designated by testing them or by generator knowledge of the waste.

Dangerous waste could potentially be generated from a variety of facility activities, including:

- Maintenance, including cleaning, degreasing, painting, etc.
- Cleaning of the facility dry wells and sumps
- Batch cleaning of the air stripping tower.

Whether these activities generate dangerous waste depends upon the materials used and their characteristics after they are used. Chemicals that may be used during batch cleaning of the air stripping tower include hydrochloric acid, sodium hydroxide, and hydrogen peroxide. Hydrochloric acid could be used to dissolve calcium carbonate scale if it should form on the tower packing. Sodium hydroxide would then be used as necessary to neutralize the acid to a pH between 6 to 8. This procedure is detailed in the main body of this plan (Table 6-35). The final spent batch cleaning solution would then not be considered a dangerous waste in terms of its pH. To be considered a dangerous waste with respect to pH, the spent batch cleaning solution would have to have a pH less than or equal to 2, or greater than or equal to 12.5.

Hydrogen peroxide could be used for batch cleaning if biological fouling is present in the air stripping tower. As the hydrogen peroxide oxidizes the biological growth, the hydrogen peroxide and biological growth are broken down into non-hazardous oxidized bacteria and water. As long as hydrogen peroxide is not used in significant excess of the required quantity, the residual spent batch cleaning solution is not expected to possess the dangerous waste definition of an "oxidizer" as defined in WAC 173-303-090. If hydrogen peroxide is used in excess quantity, such

that there remains a substantial concentration of hydrogen peroxide in the spent cleaning solution, then the solution could be considered a dangerous waste by virtue of the definition of an oxidizer.

Properly neutralized batch cleaning solution is not expected to have the characteristics of or meet the criteria as dangerous waste, since they also are not listed as dangerous wastes. They are not expected to be designated as dangerous waste.

However, if surplus unused hydrochloric acid, unused sodium hydroxide, or unused hydrogen peroxide are to be disposed, they will likely possess the characteristics of a dangerous waste. These unused compounds would then be designated as dangerous waste.

Paint, solvents, and rags used to apply or clean up these materials may also be designated dangerous wastes, depending upon the nature of the paint and solvents that are used.

DANGEROUS WASTE QUANTITY LIMITS

If a facility generates less than 220 pounds per month of dangerous waste and accumulates less than 2,200 pounds of dangerous waste at any one time, they are a small quantity generator. Small quantity generators are not subject to the requirements of the dangerous waste regulations provided they:

- Properly designate their waste
- Manage their waste in a way that does not pose a potential threat to human health or the environment
- Either treat or dispose of their dangerous waste in an onsite facility, or ensure delivery to an offsite facility that is permitted to manage dangerous waste, beneficially reuse or recycle the waste, or is permitted to manage municipal or industrial solid waste.

It should be noted that there are certain wastes that have a 2.2 pound limitation for determining whether a generator is fully regulated. These wastes are not expected to be present at the facility; however, the operator should be aware of their significance in case they may be present. These wastes are discarded products that are listed under the "P" list of discarded chemicals (WAC 173-303-9903), and all have a quantity limitation of 2.2 pounds. This means that to remain a small quantity generator, you must generate less than 2.2 pounds per month of that waste and accumulate less than a total of 2.2 pounds at any one time in order to remain a small quantity generator. The "P" list is included as an attachment a to this appendix. This document will continue to refer only to the 220 pound limitation that exists for most waste. But it is important to keep in mind this exception.

If a facility generates more than 220 pounds of dangerous waste per month or accumulates more than 2,200 pounds at any one time, it is subject to the dangerous waste management requirements in the dangerous waste regulations. Therefore, it is important to closely track the amount of waste generated.

DANGEROUS WASTE MANAGEMENT REQUIREMENTS

This summary does not provide detailed instructions for managing dangerous waste since it is likely that the facility will remain a small quantity generator. To avoid being subject to full regulation of the waste, small quantity generators must comply with certain limited requirements.

Should the facility generate over 220 pounds per month of dangerous waste or accumulate more than 2,200 pounds of dangerous waste at any one time, the facility will be considered fully regulated. If fully regulated, there are a number of dangerous waste management requirements that will apply in the following areas as well as others:

- Waste designation
- Generator notification to Ecology
- Container type
- Storage and accumulation
- Waste container and tank labeling
- Facility inspections
- Recordkeeping and reporting
- Manifesting
- Transportation
- Disposal.

If it is determined that the facility could generate or accumulate enough waste to be fully regulated, the facility operator should carefully review the requirements of the dangerous waste regulations to insure that all requirements will be met by the facility. Information regarding the applicable requirements can be obtained from Ecology or Landau Associates.

CHEMICAL INVENTORY REPORTING

The Emergency Planning and Community Right to Know Act (EPCRTKA, Sections 311 and 312) created requirements for providing information to the community on hazardous chemical that are present at a facility at any one time in quantities equal to or exceeding 10,000 pounds (the specific requirements are in 40 CFR 370). In addition, the same reporting requirements apply for any extremely hazardous chemicals present onsite at any one time in quantities equal to or exceeding 500 pounds. Chemical manufacturers and suppliers are required to provide a MSDS with each hazardous chemical they provide. Therefore, if a chemical has a MSDS, it should be assumed that it is a hazardous chemical subject to the chemical inventory requirements of EPCRTKA unless the material is determined to qualify as nonhazardous. Extremely hazardous chemicals are listed in Appendix A of 40 CFR 355.

CHEMICALS AFFECTED

Based on the projected operations of the Colbert Landfill groundwater treatment facility, there are three chemicals that could potentially be onsite in sufficient quantities to require reporting under the chemical inventory reporting requirements located in 40 CFR 370. These are hydrochloric acid, hydrogen peroxide, and sodium hydroxide. If the following amounts of these chemicals are onsite at any one time, then the chemical inventory reporting requirements are applicable:

- Hydrochloric acid — 10,000 pounds
- Hydrogen peroxide (52 percent concentration or less) — 10,000 pounds
- Hydrogen peroxide (greater than 52 percent concentration) — 500 pounds
- Sodium hydroxide — 10,000 pounds

REPORTING

If the above chemicals are onsite in amounts equal to or in excess of the specified quantity limits, the facility is subject to the regulations in 40 CFR 370, which require submittal of MSDSs to the local fire department, the local emergency planning committee, and the state emergency response committee within three months of the date that the quantity of each chemical onsite

reaches the limit. In addition, an annual inventory form (located in 40 CFR 370) for the affected chemicals must be filled out and reported to the same organizations each year by March 1 of the following year.

By carefully monitoring the amounts (and in the case of hydrogen peroxide, the concentration) of the chemicals brought onsite, it should be possible to avoid triggering the chemical inventory requirements. However, if one or more of these chemicals must be present in excess of the limits, the facility operator should insure that the MSDSs and the inventory forms are submitted as required in 40 CFR 370. For assistance in preparing the required inventory report, contact the Ecology or Landau Associates.

HAZARD COMMUNICATION STANDARD

The hazard communication regulations require employers to inform their workers of the hazards associated with the chemicals they will encounter in the work place. It is often called "worker right to know" after the federal Worker Right to Know Act that mandated the requirements. In Washington state, the requirements are located in Part C of chapter 296-62 WAC. The program is administered by the Washington State Department of Labor and Industries, Division of Industrial Safety and Health (WISHA), and is required for all facilities that handle hazardous chemicals.

HAZARDOUS CHEMICALS

Hazardous chemical is defined in the Washington Administrative Code as any chemical that poses a physical hazard or health hazard. This is obviously very broad. Since MSDSs are required for all hazardous chemicals, the facility should treat any chemical onsite that has an MSDS as being hazardous and, therefore, subject to the hazard communication standard unless a specific determination is made that it is nonhazardous. The chemical manufacturer and supplier are required to provide a MSDS for all hazardous chemicals they manufacture or distribute.

Hydrochloric acid, hydrogen peroxide, and sodium hydroxide are hazardous chemicals and will cause the facility to be subject to the hazard communication requirements if they are brought onsite. It is important to also carefully evaluate all other chemicals onsite (such as paint, solvents, laboratory reagents, etc.) to determine if any are hazardous.

SUMMARY OF REQUIREMENTS

Employers who have hazardous chemicals in the work place are required to take measures to implement the requirements of the hazard communication standard. The measures include the following items:

- Identification of hazardous chemicals in the work place
- Preparation of a written program
- Applying labels and other forms of warning
- Making MSDSs available
- Informing and training employees.

WISHA has developed guidelines for complying with the hazard communication requirements in WAC 296-62-05429, Appendix E (included as an attachment to this appendix). The facility operator should review these requirements to determine if the facility is subject to the requirements and take the required actions if the are applicable to insure compliance.

ATTACHMENT

"P" Chemical Products

WAC 173-303-9903 Discarded chemical products list.

Discarded Chemical Products List

"P" Chemical Products

Comment: For the convenience of the regulated community, the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), and R (Reactivity). Absence of a letter indicates that the compound is only listed for acute toxicity.

The "P" wastes and their corresponding Dangerous Waste Numbers are:

Dangerous Waste No.	Chemical Abstracts No.	Substance
P023	107-20-0	Acetaldehyde, chloro-
P002	591-08-2	Acetamide, N-(aminothioxomethyl)-
P057	640-19-7	Acetamide, 2-fluoro-
P058	62-74-8	Acetic acid, fluoro-, sodium salt
P002	591-08-2	1-Acetyl-2-thiourea
P003	107-02-8	Acrolein
P070	116-06-3	Aldicarb
P004	309-00-2	Aldrin
P005	107-18-6	Allyl alcohol
P006	20859-73-8	Aluminum phosphide (R,T)
P007	2763-96-4	5-(Aminomethyl)-3-isoxazolol
P008	504-24-5	4-Aminopyridine
P009	131-74-8	Ammonium picrate (R)
P119	7803-55-6	Ammonium vanadate
P099	506-61-6	Argentate(1-), bis(cyano-C)-, potassium
P010	7778-39-4	Arsenic acid H_3AsO_4
P012	1327-53-3	Arsenic oxide As_2O_3
P011	1303-28-2	Arsenic oxide As_2O_5
P011	1303-28-2	Arsenic pentoxide
P012	1327-53-3	Arsenic trioxide
P038	692-42-2	Arsine, diethyl-
P036	696-28-6	Arsonous dichloride, phenyl-
P054	151-56-4	Aziridine
P067	75-55-8	Aziridine, 2-methyl-
P013	542-62-1	Barium cyanide
P024	106-47-8	Benzenamine, 4-chloro-
P077	100-01-6	Benzenamine, 4-nitro-
P028	100-44-7	Benzene, (chloromethyl)-
P042	51-43-4	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-, (R)-
P046	122-09-8	Benzeneethanamine, alpha,alpha-dimethyl-
P014	108-98-5	Benzenethiol
P001	[1]81-81-2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts, when present at concentrations greater than 0.3%
P028	100-44-7	Benzyl chloride
P015	7440-41-7	Beryllium
P017	598-31-2	Bromoacetone
P018	357-57-3	Brucine
P045	39196-18-4	2-Butanone, 3,3-dimethyl-1-(methylthio)-, O-[(methylamino)carbonyl] oxime
P021	592-01-8	Calcium cyanide
P021	592-01-8	Calcium cyanide $Ca(CN)_2$
P022	75-15-0	Carbon disulfide
P095	75-44-5	Carbonic dichloride
P023	107-20-0	Chloroacetaldehyde
P024	106-47-8	p-Chloroaniline
P026	5344-82-1	1-(o-Chlorophenyl)thiourea
P027	542-76-7	3-Chloropropionitrile
P029	544-92-3	Copper cyanide
P029	544-92-3	Copper cyanide Cu(CN)
P030		Cyanides (soluble cyanide salts), not otherwise specified
P031	460-19-5	Cyanogen
P033	506-77-4	Cyanogen chloride
P033	506-77-4	Cyanogen chloride (CN)Cl
P034	131-89-5	2-Cyclohexyl-4,6-dinitrophenol
P016	542-88-1	Dichloromethyl ether
P036	696-28-6	Dichlorophenylarsine
P037	60-57-1	Dieldrin
P038	692-42-2	Diethylarsine
P041	311-45-5	Diethyl-p-nitrophenyl phosphate
P040	297-97-2	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	55-91-4	Diisopropylfluorophosphate (DFP)
P004	309-00-2	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a,-hexahydro-, (1alpha,4alpha,4abeta,5alpha, 8alpha,8abeta)-
P060	465-73-6	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha,4abeta,5beta, 8beta,8abeta)-
P037	60-57-1	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2aalpha,3beta, 6beta,6aalpha,7beta, 7aalpha)-
P051	[1]72-20-8	2,7:3,6-Dimethanonaphth [2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2abeta,3alpha, 6alpha,6abeta,7beta, 7aalpha)-, & metabolites
P044	60-51-5	Dimethoate
P046	122-09-8	alpha,alpha-Dimethylphenethylamine
P047	[1]534-52-1	4,6-Dinitro-o-cresol, & salts
P048	51-28-5	2,4-Dinitrophenol
P020	88-85-7	Dinoseb
P085	152-16-9	Diphosphoramide, octamethyl-
P111	107-49-3	Diphosphoric acid, tetraethyl ester
P039	298-04-4	Disulfoton
P049	541-53-7	Dithiobiuret
P050	115-29-7	Endosulfan
P088	145-73-3	Endothall
P051	72-20-8	Endrin
P051	72-20-8	Endrin, & metabolites
P042	51-43-4	Epinephrine
P031	460-19-5	Ethanedinitrile
P066	16752-77-5	Ethanimidothioic acid, N-[[(methylamino)carbonyl]oxy]-, methyl ester

P101	107-12-0	Ethyl cyanide
P054	151-56-4	Ethyleneimine
P097	52-85-7	Famphur
P056	7782-41-4	Fluorine
P057	640-19-7	Fluoroacetamide
P058	62-74-8	Fluoroacetic acid, sodium salt
P065	628-86-4	Fulmuric acid, mercury(2+) salt (R,T)
P059	76-44-8	Heptachlor
P062	757-58-4	Hexaethyl tetraphosphate
P116	79-19-6	Hydrazinecarbothioamide
P068	60-34-4	Hydrazine, methyl-
P063	74-90-8	Hydrocyanic acid
P063	74-90-8	Hydrogen cyanide
P096	7803-51-2	Hydrogen phosphide
P060	465-73-6	Isodrin
P007	2763-96-4	3(2H)-Isoxazolone, 5-(aminomethyl)-
P092	62-38-4	Mercury, (acetato-O)phenyl-
P065	628-86-4	Mercury fulminate (R,T)
P082	62-75-9	Methanamine, N-methyl-N-nitroso-
P064	624-83-9	Methane, isocyanato-
P016	542-88-1	Methane, oxybis[chloro-
P112	509-14-8	Methane, tetranitro- (R)
P118	75-70-7	Methanethiol, trichloro-
P050	115-29-7	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide
P059	76-44-8	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-
P066	16752-77-5	Methomyl
P068	60-34-4	Methyl hydrazine
P064	624-83-9	Methyl isocyanate
P069	75-86-5	2-Methyllactonitrile
P071	298-00-0	Methyl parathion
P072	86-88-4	alpha-Naphthylthiourea
P073	13463-39-3	Nickel carbonyl
P073	13463-39-3	Nickel carbonyl $Ni(CO)_4$, (T-4)-
P074	557-19-7	Nickel cyanide
P074	557-19-7	Nickel cyanide $Ni(CN)_2$
P075	[1]54-11-5	Nicotine, & salts
P076	10102-43-9	Nitric oxide
P077	100-01-6	p-Nitroaniline
P078	10102-44-0	Nitrogen dioxide
P076	10102-43-9	Nitrogen oxide NO
P078	10102-44-0	Nitrogen oxide NO_2
P081	55-63-0	Nitroglycerine (R)
P082	62-75-9	N-Nitrosodimethylamine
P084	4549-40-0	N-Nitrosomethylvinylamine
P085	152-16-9	Octamethylpyrophosphoramide
P087	20816-12-0	Osmium oxide OsO_4, (T-4)-
P087	20816-12-0	Osmium tetroxide
P088	145-73-3	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P089	56-38-2	Parathion
P034	131-89-5	Phenol, 2-cyclohexyl-4,6-dinitro-
P048	51-28-5	Phenol, 2,4-dinitro-
P047	[1]534-52-1	Phenol, 2-methyl-4,6-dinitro-, & salts
P020	88-85-7	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
P009	131-74-8	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P092	62-38-4	Phenylmercury acetate
P093	103-85-5	Phenylthiourea
P094	298-02-2	Phorate
P095	75-44-5	Phosgene
P096	7803-51-2	Phosphine
P041	311-45-5	Phosphoric acid, diethyl 4-nitrophenyl ester
P039	298-04-4	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
P094	298-02-2	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
P044	60-51-5	Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester
P043	55-91-4	Phosphorofluoridic acid, bis(1-methylethyl) ester
P089	56-38-2	Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester
P040	297-97-2	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
P097	52-85-7	Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester
P071	298-00-0	Phosphorothioic acid, O,O,-dimethyl O-(4-nitrophenyl) ester
P110	78-00-2	Plumbane, tetraethyl-
P098	151-50-8	Potassium cyanide
P098	151-50-8	Potassium cyanide K(CN)
P099	506-61-6	Potassium silver cyanide
P070	116-06-3	Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime
P101	107-12-0	Propanenitrile
P027	542-76-7	Propanenitrile, 3-chloro-
P069	75-86-5	Propanenitrile, 2-hydroxy-2-methyl-
P081	55-63-0	1,2,3-Propanetriol, trinitrate (R)
P017	598-31-2	2-Propanone, 1-bromo-
P102	107-19-7	Propargyl alcohol
P003	107-02-8	2-Propenal
P005	107-18-6	2-Propen-1-ol
P067	75-55-8	1,2-Propylenimine
P102	107-19-7	2-Propyn-1-ol
P008	504-24-5	4-Pyridinamine
P075	[1]54-11-5	Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, & salts
P114	12039-52-0	Selenious acid, dithallium(1+) salt
P103	630-10-4	Selenourea
P104	506-64-9	Silver cyanide
P104	506-64-9	Silver cyanide Ag(CN)
P105	26628-22-8	Sodium azide
P106	143-33-9	Sodium cyanide
P106	143-33-9	Sodium cyanide Na(CN)
P108	[1]57-24-9	Strychnidin-10-one, & salts
P018	357-57-3	Strychnidin-10-one, 2,3-dimethoxy-
P108	[1]57-24-9	Strychnine, & salts
P115	7446-18-6	Sulfuric acid, dithallium(1+) salt
P109	3689-24-5	Tetraethyldithiopyrophosphate
P110	78-00-2	Tetraethyl lead
P111	107-49-3	Tetraethyl pyrophosphate
P112	509-14-8	Tetranitromethane (R)
P062	757-58-4	Tetraphosphoric acid, hexaethyl ester
P113	1314-32-5	Thallic oxide
P113	1314-32-5	Thallium oxide Tl_2O_3
P114	12039-52-0	Thallium(I) selenite
P115	7446-18-6	Thallium(I) sulfate
P109	3689-24-5	Thiodiphosphoric acid, tetraethyl ester
P045	39196-18-4	Thiofanox
P049	541-53-7	Thioimidodicarbonic diamide $[(H_2N)C(S)]_2NH$

P014	108-98-5	Thiophenol
P116	79-19-6	Thiosemicarbazide
P026	5344-82-1	Thiourea, (2-chlorophenyl)-
P072	86-88-4	Thiourea, 1-naphthalenyl-
P093	103-85-5	Thiourea, phenyl-
P123	8001-35-2	Toxaphene
P118	75-70-7	Trichloromethanethiol
P119	7803-55-6	Vanadic acid, ammonium salt
P120	1314-62-1	Vanadium oxide V_2O_5
P120	1314-62-1	Vanadium pentoxide
P084	4549-40-0	Vinylamine, N-methyl-N-nitroso-
P001	[1]81-81-2	Warfarin, & salts, when present at concentrations greater than 0.3%
P121	557-21-1	Zinc cyanide
P121	557-21-1	Zinc cyanide $Zn(CN)_2$
P122	1314-84-7	Zinc phosphide Zn_3P_2, when present at concentrations greater than 10% (R,T)

FOOTNOTE: [1]CAS Number given for parent compound only.

ATTACHMENT

WAC 296-2-05429, Appendix E
Guidelines for Employer Compliance

WAC 296-62-05429, Appendix E--Guidelines for employer compliance (advisory).

The hazard communication standard (HCS) is based on a simple concept--that employees have both a need and a right to know the hazards and identities of the chemicals they are exposed to when working. They also need to know what protective measures are available to prevent adverse effects from occurring. The HCS is designed to provide employees with the information they need.

Knowledge acquired under the HCS will help employers provide safer workplaces for their employees. When employers have information about the chemicals being used, they can take steps to reduce exposures, substitute less hazardous materials, and establish proper work practices. These efforts will help prevent the occurrence of work-related illnesses and injuries caused by chemicals.

The HCS addresses the issues of evaluating and communicating hazards to workers. Evaluation of chemical hazards involves a number of technical concepts, and is a process that requires the professional judgment of experienced experts. That is why the HCS is designed so that employers who simply use chemicals, rather than produce or import them, are not required to evaluate the hazards of those chemicals. Hazard determination is the responsibility of the producers and importers of the materials. Producers and importers of chemicals are then required to provide the hazard information to employers that purchase their products.

Employers that do not produce or import chemicals need only focus on those parts of the rule that deal with establishing a workplace program and communicating information to their workers. This appendix is a general guide for such employers to help them determine what is required under the rule. It does not supplant or substitute for the regulatory provisions, but rather provides a simplified outline of the steps an average employer would follow to meet those requirements.

1. Becoming Familiar With The Rule.

WISHA has provided a simple summary of the HCS in a pamphlet entitled "Hazardous Chemicals - Right to Know - Washington Hazard Communication Standard" WISHA Publication Number P413-014-000. Some employers prefer to begin to become familiar with the rule's requirements by reading this pamphlet. A copy may be obtained from your local WISHA office.

The standard is long, and some parts of it are technical, but the basic concepts are simple. In fact, the requirements reflect what many employers have been doing for years. You may find that you are already largely in compliance with many of the provisions, and will simply have to modify your existing programs somewhat. WISHA is an OSHA-approved state plan state, and you must comply with the state's requirements, which may be different than those of the federal rule.

The HCS requires information to be prepared and transmitted regarding all hazardous chemicals. The HCS covers both physical hazards (such as flammability), and health hazards (such as irritation, lung damage, and cancer). Most chemicals used in the workplace have some hazard potential, and thus will be covered by the rule.

One difference between this rule and many others adopted by WISHA is that this one is performance-oriented. That means that you have the flexibility to adapt the rule to the needs of your workplace, rather than having to follow specific, rigid requirements. It also means that you have to exercise more judgment to implement an appropriate and effective program.

The standard's design is simple. Chemical manufacturers and importers must evaluate the hazards of the chemicals they produce or import. Using that information, they must then prepare labels for containers, and more detailed technical bulletins called material safety data sheets (MSDS).

Chemical manufacturers, importers, and distributors of hazardous chemicals are all required to provide the appropriate labels and material safety data sheets to the employers to which they ship the chemicals. The information is to be provided automatically. Every container of hazardous chemicals you receive must be labeled, tagged, or marked with the required information. Your suppliers must also send you a properly completed material safety data sheet (MSDS) at the time of the first shipment of the chemical, and with the next shipment after the MSDS is updated with new and significant information about the hazards.

WAC 296-62-05429 (Cont.)

You can rely on the information received from your suppliers. You have no independent duty to analyze the chemical or evaluate the hazards of it.

Employers that "use" hazardous chemicals must have a program to ensure the information is provided to exposed employees. "Use" means to package, handle, react, or transfer. This is an intentionally broad scope, and includes any situation where a chemical is present in such a way that employees may be exposed under normal conditions of use or in a foreseeable emergency.

The requirements of the rule that deal specifically with the hazard communication program are found in WAC 296-62-05409, Written hazard communication program; WAC 296-62-05411, Labels and other forms of warning; WAC 296-62-05413, Material safety data sheets; and WAC 296-62-05415, Employee information and training. The requirements of these paragraphs should be the focus of your attention. Concentrate on becoming familiar with them, using WAC 296-62-05403, Scope and application, and WAC 296-62-05405, Definitions applicable to this part, as references when needed to help explain the provisions.

There are two types of work operations where the coverage of the rule is limited. These are laboratories and operations where chemicals are only handled in sealed containers (e.g., a warehouse). The limited provisions for these workplaces can be found in WAC 296-62-05403, Scope and application. Basically, employers having these types of work operations need only keep labels on containers as they are received; maintain material safety data sheets that are received, and give employees access to them; and provide information and training for employees. Employers do not have to have written hazard communication programs and lists of chemicals for these types of operations. Some of these employers may have to comply with other similar standards which have requirements for a written program. For example, laboratories may be required to have a written chemical hygiene plan under WAC 296-62-400, Hazardous Chemicals in Laboratories.

The limited coverage of laboratories and sealed container operations addresses the obligation of an employer to the workers in the operations involved, and does not affect the employer's duties as a distributor of chemicals. For example, a distributor may have warehouse operations where employees would be protected under the limited sealed container provisions. In this situation, requirements for obtaining and maintaining MSDSs are limited to providing access to those received with containers while the substance is in the workplace, and requesting MSDSs when employees request access for those not received with the containers. However, as a distributor of hazardous chemicals, that employer will still have responsibilities for providing MSDSs to downstream customers at the time of the first shipment and when the MSDS is updated. Therefore, although they may not be required for the employees in the work operation, the distributor may, nevertheless, have to have MSDSs to satisfy other requirements of the rule.

2. Identify Responsible Staff.

Hazard communication is going to be a continuing program in your facility. Compliance with the HCS is not a "one shot deal." In order to have a successful program, it will be necessary to assign responsibility for both the initial and ongoing activities that have to be undertaken to comply with the rule. In some cases, these activities may already be part of current job assignments. For example, site supervisors are frequently responsible for on-the-job training sessions. Early identification of the responsible employees, and involvement of them in the development of your plan of action, will result in a more effective program design. Evaluation of the effectiveness of your program will also be enhanced by involvement of affected employees.

For any safety and health program, success depends on commitment at every level of the organization. This is particularly true for hazard communication, where success requires a change in behavior. This will only occur if employers understand the program, and are committed to its success, and if employees are motivated by the people presenting the information to them.

WAC 296-62-05429 (Cont.)

3. Identify Hazardous Chemicals in the Workplace.

The standard requires a list of hazardous chemicals in the workplace as part of the written hazard communication program. The list will eventually serve as an inventory of everything for which an MSDS must be maintained. At this point, however, preparing the list will help you complete the rest of the program since it will give you some idea of the scope of the program required for compliance in your facility.

The best way to prepare a comprehensive list is to survey the workplace. Purchasing records may also help, and certainly employers should establish procedures to ensure that in the future purchasing procedures result in MSDSs being received before a material is used in the workplace.

The broadest possible perspective should be taken when doing the survey. Sometimes people think of "chemicals" as being only liquids in containers. The HCS covers chemicals in all physical forms--liquids, solids, gases, vapors, fumes, and mists--whether they are "contained" or not. The hazardous nature of the chemical and the potential for exposure are the factors which determine whether a chemical is covered. If it is not hazardous, it is not covered. If there is no potential for exposure (e.g., the chemical is inextricably bound and cannot be released), the rule does not cover the chemical.

Look around. Identify chemicals in containers, including pipes, but also think about chemicals generated in the work operations. For example, welding fumes, dusts, and exhaust fumes are all sources of chemical exposures. Read labels provided by suppliers for hazard information. Make a list of all chemicals in the workplace that are potentially hazardous. For your own information and planning, you may also want to note on the list the location(s) of the products within the workplace, and an indication of the hazards as found on the label. This will help you as you prepare the rest of your program.

WAC 296-62-05403, Scope and application, includes exemptions for various chemicals or workplace situations. After compiling the complete list of chemicals, you should review paragraph (b) of this section to determine if any of the items can be eliminated from the list because they are exempted materials. For example, food, drugs, and cosmetics brought into the workplace for employee consumption are exempt. So rubbing alcohol in the first aid kit would not be covered.

Once you have compiled as complete a list as possible of the potentially hazardous chemicals in the workplace, the next step is to determine if you have received material safety data sheets for all of them. Check your files against the inventory you have just compiled. If any are missing, contact your supplier and request one. It is a good idea to document these requests, either by copy of a letter or a note regarding telephone conversations. If you have MSDSs for chemicals that are not on your list, figure out why. Maybe you do not use the chemical anymore, or maybe you missed it in your survey. Some suppliers do provide MSDSs for products that are not hazardous. These do not have to be maintained by you.

You should not allow employees to use any chemicals for which you have not received an MSDS. The MSDS provides information you need to ensure proper protective measures are implemented prior to exposure.

4. Preparing and Implementing a Hazard Communication Program.

All workplaces where employees are exposed to hazardous chemicals must have a written plan which describes how the standard will be implemented in that facility. Preparation of a plan is not just a paper exercise--all of the elements must be implemented in the workplace in order to be in compliance with the rule. See WAC 296-62-05409 for the specific requirements regarding written hazard communication programs. The only work operations which do not have to comply with the written plan requirements are laboratories and work operations where employees only handle chemicals in sealed containers. See WAC 296-62-05403, Scope and application, for the specific requirements for these two types of workplaces.

The plan does not have to be lengthy or complicated. It is intended to be a blueprint for implementation of your program--an assurance that all aspects of the requirements have been addressed.

WAC 296-62-05429 (Cont.)

Many trade associations and other professional groups have provided sample programs and other assistance materials to affected employers. These have been very helpful to many employers since they tend to be tailored to the particular industry involved. You may wish to investigate whether your industry trade groups have developed such materials.

Although such general guidance may be helpful, you must remember that the written program has to reflect what you are doing in your workplace. Therefore, if you use a generic program it must be adapted to address the facility it covers. For example, the written plan must list the chemicals present at the site, indicate who is to be responsible for the various aspects of the program in your facility, and indicate where written materials will be made available to employees.

If WISHA inspects your workplace for compliance with the HCS, the WISHA compliance officer will ask to see your written plan at the outset of the inspection. In general, the following items will be considered in evaluating your program.

The written program must describe how the requirements for labels and other forms of warning, material safety data sheets, and employee information and training, are going to be met in your facility. The following discussion provides the type of information compliance officers will be looking for to decide whether these elements of the hazard communication program have been properly addressed:

A. Labels and Other Forms of Warning.

In-plant containers of hazardous chemicals must be labeled, tagged, or marked with the identity of the material and appropriate hazard warnings. Chemical manufacturers, importers, and distributors are required to ensure that every container of hazardous chemicals they ship is appropriately labeled with such information and with the name and address of the producer or other responsible party. Employers purchasing chemicals can rely on the labels provided by their suppliers. If the material is subsequently transferred by the employer from a labeled container to another container, the employer will have to label that container unless it is subject to the portable container exemption. See WAC 296-62-05411 for specific labeling requirements.

The primary information to be obtained from a WISHA-required label is an identity for the material, and appropriate hazard warnings. The identity is any term which appears on the label, the MSDS, and the list of chemicals, and thus links these three sources of information. The identity used by the supplier may be a common or trade name ("Black Magic Formula"), or a chemical name (1,1,1,-trichloroethane). The hazard warning is a brief statement of the hazardous effects of the chemical ("flammable," "causes lung damage"). Labels frequently contain other information, such as precautionary measures ("do not use near open flame"), but this information is provided voluntarily and is not required by the rule. Labels must be legible, and prominently displayed. There are no specific requirements for size or color, or any specified text.

With these requirements in mind, the compliance officer will be looking for the following types of information to ensure that labeling will be properly implemented in your facility:

1. Designation of person(s) responsible for ensuring labeling of in-plant containers;

2. Designation of person(s) responsible for ensuring labeling of any shipped containers;

3. Description of labeling system(s) used;

4. Description of written alternatives to labeling of in-plant containers (if used); and

5. Procedures to review and update label information when necessary.

WAC 296-62-05429 (Cont.)

Employers that are purchasing and using hazardous chemicals--rather than producing or distributing them--will primarily be concerned with ensuring that every purchased container is labeled. If materials are transferred into other containers, the employer must ensure that these are labeled as well, unless they fall under the portable container exemption (WAC 296-62-05411(7)). In terms of labeling systems, you can simply choose to use the labels provided by your suppliers on the containers. These will generally be verbal text labels, and do not usually include numerical rating systems or symbols that require special training. The most important thing to remember is that this is a continuing duty--all in-plant containers of hazardous chemicals must always be labeled. Therefore, it is important to designate someone to be responsible for ensuring that the labels are maintained as required on the containers in your facility, and that newly purchased materials are checked for labels prior to use.

B. Material Safety Data Sheets.

Chemical manufacturers and importers are required to obtain or develop a material safety data sheet for each hazardous chemical they produce or import. Distributors are responsible for ensuring that their customers are provided a copy of these MSDSs. Employers must have an MSDS for each hazardous chemical which they use. Employers may rely on the information received from their suppliers. The specific requirements for material safety data sheets are in WAC 296-62-05413.

There is no specified format for the MSDS under the rule, although there are specific information requirements. OSHA has developed a nonmandatory format, OSHA Form 174, which may be used by chemical manufacturers and importers to comply with the rule. The MSDS must be in English (although the employer may maintain copies in other languages as well). You are entitled to receive from your supplier a data sheet which includes all of the information required under the rule. If you do not receive one automatically, you should request one. If you receive one that is obviously inadequate, with, for example, blank spaces that are not completed, you should request an appropriately completed one. If your request for a data sheet or for a corrected data sheet does not produce the information needed, you should contact your local labor and industries field office for assistance in obtaining the MSDS as stated in WAC 296-62-05413(12).

The role of MSDSs under the rule is to provide detailed information on each hazardous chemical, including its potential hazardous effects, its physical and chemical characteristics, and recommendations for appropriate protective measures. This information should be useful to you as the employer responsible for designing protective programs, as well as to the workers. If you are not familiar with material safety data sheets and with chemical terminology, you may need to learn to use them yourself. A glossary of MSDS terms may be helpful in this regard. Generally speaking, most employers using hazardous chemicals will primarily be concerned with MSDS information regarding hazardous effects and recommended protective measures. Focus on the sections of the MSDS that are applicable to your situation.

Because many MSDSs are produced in states other than Washington, there may be a difference between the permissible exposure limit (PEL) listed on the MSDS and the WISHA required PEL. For this reason WISHA will accept the OSHA PEL on the MSDS, but for training and evaluation of employee exposure, within Washington state, the WISHA PEL must be used. Most of the OSHA and WISHA PELs will be identical, but at times some will be different. For example, in April 1994, the OSHA PEL for carbon monoxide was 50 ppm for an 8 hour time-weighted average (TWA) with no short-term exposure limit (STEL) or ceiling value, but the WISHA PEL for carbon monoxide was 35 ppm for an 8 hour TWA, with a ceiling value of 200 ppm and no STEL. The current WISHA PELs are listed in WAC 296-62-075, Air contaminants.

MSDSs must be readily accessible to employees when they are in their work fields during their workshifts. This may be accomplished in many different ways. You must decide what is appropriate for your particular workplace. Some employers keep the MSDSs in a binder in a central location (e.g., in the pickup truck on a construction site). Others, particularly in workplaces with large numbers of chemicals, computerize the information and provide access through terminals. As long as employees can get the information when they need it, any approach may be used. The employees must have access to the MSDSs themselves--simply having a system where the information can be read to them over the phone is only permitted under the mobile worksite provision, WAC 296-62-05413(9) when employees must travel between workplaces during the shift. In this situation, they have access to the MSDSs prior to leaving the primary worksite, and when they return, so the telephone system is simply an emergency arrangement

WAC 296-62-05429 (Cont.)

In order to ensure that you have a current MSDS for each chemical in the plant as required, and that employee access is provided, the compliance officers will be looking for the following types of information in your written program:

1. Designation of person(s) responsible for obtaining and maintaining the MSDSs;

2. How such sheets are to be maintained in the workplace (e.g., in notebooks in the work area(s) or in a computer with terminal access), and how employees can obtain access to them when they are in their work area during the work shift;

3. Procedures to follow when the MSDS is not received at the time of the first shipment;

4. For producers, procedures to update the MSDS when new and significant health information is found; and

5. Description of alternatives to actual data sheets in the workplace, if used.

For employers using hazardous chemicals, the most important aspect of the written program in terms of MSDSs is to ensure that someone is responsible for obtaining and maintaining the MSDSs for every hazardous chemical in the workplace. The list of hazardous chemicals required to be maintained as part of the written program will serve as an inventory. As new chemicals are purchased, the list should be updated. Many companies have found it convenient to include on their purchase orders the name and address of the person designated in their company to receive MSDSs.

C. Employee Information and Training.

Each employee who may be "exposed" to hazardous chemicals when working must be provided information and trained prior to initial assignment to work with a hazardous chemical, and whenever the hazard changes. "Exposure" or "exposed" under the rule means that "an employee is subjected to a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.) and includes potential (e.g., accidental or possible) exposure." See WAC 296-62-05415 for specific requirements. Information and training may be done either by individual chemical, or by categories of hazards (such as flammability or carcinogenicity). If there are only a few chemicals in the workplace, then you may want to discuss each one individually. Where there are large numbers of chemicals, or the chemicals change frequently, you will probably want to train generally based on the hazard categories (e.g., flammable liquids, corrosive materials, carcinogens). Employees will have access to the substance-specific information on the labels and MSDSs.

Information and training is a critical part of the hazard communication program. Information regarding hazards and protective measures are provided to workers through written labels and material safety data sheets. However, through effective information and training, workers will learn to read and understand such information, determine how it can be obtained and used in their own workplaces, and understand the risks of exposure to the chemicals in their workplaces as well as the ways to protect themselves. A properly conducted training program will ensure comprehension and understanding. It is not sufficient to either just read material to the workers, or simply hand them material to read. You want to create a climate where workers feel free to ask questions. This will help you to ensure that the information is understood. You must always remember that the underlying purpose of the HCS is to reduce the incidence of chemical source illnesses and injuries. This will be accomplished by modifying behavior through the provision of hazard information and information about protective measures. If your program works, you and your workers will better understand the chemical hazards within the workplace. The procedures you establish regarding, for example, purchasing, storage, and handling of these chemicals will improve, and thereby reduce the risks posed to employees exposed to the chemical hazards involved. Furthermore, your workers' comprehension will also be increased, and proper work practices will be followed in your workplace.

WAC 296-62-05429 (Cont.)

If you are going to do the training yourself, you will have to understand the material and be prepared to motivate the workers to learn. This is not always an easy task, but the benefits are worth the effort. More information regarding appropriate training can be found in a booklet entitled "Understanding Right to Know," Publication Number P413-012-000. A copy may be obtained from your local labor and industries office.

In reviewing your written program with regard to information and training, the following items need to be considered:

1. Designation of person(s) responsible for conducting training;

2. Format of the program to be used (audiovisuals, classroom instruction, etc.);

3. Elements of the training program (should be consistent with the elements in WAC 296-62-05415; and

4. Procedure to train new employees at the time of their initial assignment to work with a hazardous chemical, and to train employees when a new hazard is introduced into the workplace.

The written program should provide enough details about the employer's plans in this area to assess whether or not a good faith effort is being made to train employees. WISHA does not expect that every worker will be able to recite all of the information about each chemical in the workplace. In general, the most important aspects of training under the HCS are to ensure that employees are aware that they are exposed to hazardous chemicals, that they know how to read and use labels and material safety data sheets, and that, as a consequence of learning this information, they are following the appropriate protective measures established by the employer. WISHA compliance officers will be talking to employees to determine if they have received training, if they know they are exposed to hazardous chemicals, and if they know where to obtain substance-specific information on labels and MSDSs.

The HCS does not require employers to maintain records of employee training, but many employers choose to do so. This may help you monitor your own program to ensure that all employees are appropriately trained. If you already have a training program, you may simply have to supplement it with whatever additional information is required under the HCS.

An employer can provide employees information and training through whatever means are found appropriate and protective. Although there would always have to be some training on-site (such as informing employees of the location and availability of the written program and MSDSs), employee training may be satisfied in part by general training about the requirements of the HCS and about chemical hazards on the job which is provided by, for example, trade associations, unions, colleges, and professional schools. In addition, previous training, education and experience of a worker may relieve the employer of some of the burdens of informing and training that worker. Regardless of the method relied upon, however, the employer is always ultimately responsible for ensuring that employees are adequately trained. If the compliance officer finds that the training is deficient, the employer will be cited for the deficiency regardless of who actually provided the training on behalf of the employer.

D. Other Requirements.

In addition to these specific items, compliance officers will also be asking the following questions in assessing the adequacy of the program:

Does a list of the hazardous chemicals exist in each work area or at a central location?

Are methods the employer will use to inform employees of the hazards of nonroutine tasks outlined?

WAC 296-62-05429 (Cont.)

Are employees informed of the hazards associated with chemicals contained in unlabeled pipes in their work areas?

On multi-employer worksites, has the employer provided other employers with information about labeling systems and precautionary measures where the other employers have employees exposed to the initial employer's chemicals?

Is the written program made available to employees and their designated representatives?

If your program adequately addresses the means of communicating information to employees in your workplace, and provides answers to the basic questions outlined above, it will be found to be in compliance with the rule.

5. Checklist for Compliance.

The following checklist will help to ensure you are in compliance with the rule:

Obtained a copy of the rule.
Read and understood the requirements.
Assigned responsibility for tasks.
Prepared an inventory of chemicals.
Ensured containers are labeled.
Obtained MSDS for each chemical.
Prepared written program.
Made MSDSs available to workers.
Conducted training of workers.
Established procedures to maintain current program.
Established procedures to evaluate effectiveness.

6. Further Assistance.

If you have a question regarding compliance with the HCS, you should contact your local labor and industries field office for assistance. All field offices have industrial hygienists who can answer your questions. Free consultation services are also available to assist employers, and information regarding these services can be obtained through the field offices as well.

The telephone number for the labor and industries office closest to you should be listed in your local telephone directory. If you are not able to obtain this information, you may contact labor and industries, office of information and assistance, 1-800-4BE-SAFE for further assistance in identifying the appropriate contacts.
[Statutory Authority: Chapter 49.17 RCW. 94-16-145 (Order 94-08), 296-62-05421, filed 8/3/94, effective 9/12/94.]

SUBSTANTIVE DISCHARGE REQUIREMENTS

State of Washington
DEPARTMENT OF ECOLOGY
Toxics Cleanup Program
Site Cleanup Section
P.O. Box 47600
Olympia, Washington 98504-4600

Site Location:	Spokane County Colbert Landfill
Discharge Type:	Remediation of Contaminated Groundwater
Discharge Location:	Township - 27 North Range - 43 East, W.M. Section - 3 Northwestern Quadrant
Receiving Water:	Little Spokane River
Waterway Segment Number:	245501

STATEMENT OF PURPOSE

In September 1987, a Record of Decision (ROD) for interim and final remedial action at the Spokane County Colbert Landfill Superfund Site was signed by the Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology). The Colbert Landfill ROD was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). On March 9, 1989, Spokane County agreed to the requested remedial action by signing a Consent Decree.

The remedial action includes the management of the migration of contaminants present in the groundwater due to the Colbert Landfill. Contaminated groundwater is to be extracted and treated for volatile organic compounds by air stripping. Treated groundwater is to be discharged to the Little Spokane River. Pursuant to Section 121(e) of CERCLA, a National Pollutant Discharge Elimination System (NPDES) permit is not required for remedial activities conducted entirely on-site. However, all substantive requirements for an NPDES permit must be met.

In compliance with the provisions of the Federal Water Pollution Control Act and the State of Washington Water Pollution Control Law, Chapter 90.48 RCW, the National Pollutant Discharge Elimination System Permit Program, Chapter 173-220 WAC, and the Water Quality Standards for the Surface Waters of the State of Washington, Chapter 173-201A WAC, this document establishes discharge requirements for the treated groundwater to the Little Spokane River.

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FACT SHEET

This fact sheet explains the Substantive Requirements of the NPDES regulations to be met at the Colbert Landfill Superfund site. This fact sheet also explains the nature of the proposed discharge, the limits placed on the contaminants in treated groundwater, and the regulatory and technical basis for those limits. The final limits of discharge will be based on the efficiency of the treatment system, within the performance and evaluation criteria of the Consent Decree. These requirements will be evaluated after five years from the date of issuance of this document, or sooner as appropriate.

BACKGROUND INFORMATION

SITE HISTORY AND BACKGROUND

The Colbert Landfill is a Spokane County owned sanitary landfill that was operated from 1968 through 1986. The landfill is located in Spokane County, approximately 15 miles north-northeast of Spokane, Washington, and covers 40 acres. During the five years from 1975 to 1980, a local electronics manufacturing company, KeyTronic Corporation, used the Colbert Landfill to dispose of spent organic solvents, mainly methylene chloride (MC) and 1,1,1-trichloroethane (TCA). During the same period, a nearby military facility, Fairchild Air Force Base, also disposed of various solvent wastes at the site. A variety of other chemicals, such as pesticides and refinery tar residues, from other sources were also disposed at the site, but have not been detected to date.

In 1980 nearby residents complained to Ecology about these disposal practices. State and county officials, under the lead of the Spokane County Utilities Department, initiated an investigation into complaints of groundwater contamination in the area by sampling nearby private wells of which some were found to be contaminated with TCA. In August of 1983, EPA, pursuant to Section 105 of CERCLA, placed the Colbert Landfill Site on the National Priorities List. A Remedial Investigation/Feasibility Study (RI/FS) was completed in 1987. The site boundary is shown on Figure 1-1.

WASTEWATER CHARACTERIZATION

Groundwater at the Colbert Landfill Site is contaminated by volatile organic compounds (VOCs). These contaminants are present in the upper sand/gravel aquifer and the lower sand/gravel aquifer. The six VOCs detected at the highest concentrations are listed in Table 1. The ROD selected these VOCs as the main contaminants of concern; treatment for these contaminants should address all other VOCs present in the groundwater. These six VOCs are the indicator parameters of concern requiring effluent limits.

Table 1. Contaminants of Concern in Groundwater

Contaminants	Maximum Concentration Detected (ug/L)[1]	
	Upper Aquifer	Lower Aquifer
1,1,1-Trichloroethane (TCA)	1300	5600
1,1-Dichloroethylene (DCE)	47	190
1,1-Dichloroethane (DCA)	600	420
Trichloroethylene (TCE)	72	230
Tetrachloroethylene (PCE)	23	1
Methylene Chloride (MC)	ND[2]	2500

In addition, data collected during and following the RI/FS included analysis of groundwater samples for other potential pollutants such as semi-volatile organic compounds, pesticides, polychlorinated biphenyls (PCBs), and priority pollutant metals. These pollutant types were not detected in the groundwater above levels of concern for public health and the environment.

Barium, iron, and manganese were the only metals with published water quality criteria detected in groundwater. Barium and iron concentrations were below the water quality criteria. At least one detection of manganese exceeded the water quality criteria. Manganese has been retained as a parameter of concern requiring effluent limits. Iron has also been retained. While iron is commonly found in landfill leachate, its presence at the Colbert Landfill site has been sporadic and may be an anomaly of the materials used for well construction (e.g. steel casings).

Samples of groundwater and surface water (receiving water) were analyzed for inorganic/conventional parameters. Chloride was detected in the receiving water at concentrations greater than published water quality criteria. Chloride has been retained as a parameter of concern requiring effluent limits. Nitrates and total phosphorous were detected in groundwater. These conventional parameters are of concern as they can stimulate excessive or nuisance growths of algae and other aquatic plants. The discharge for the Colbert Landfill project is to the Little Spokane River about 20 river miles upstream of the Spokane River, which eventually flows into Long Lake. A memorandum of agreement is in place for the Spokane River Phosphorous Management Plan to control phosphorous discharges to the Spokane River from all point source dischargers. Both nitrates and total phosphorous are retained as parameters of concern requiring effluent limits.

[1] ROD, September 1987
[2] ND = not detected

DESCRIPTION OF TREATMENT PROCESS

The Consent Decree required the design and implementation of a groundwater extraction and treatment system for the contaminated groundwater. The treatment system became operational in the Spring of 1994.

The groundwater extraction system consists of ten extraction wells, four in the upper aquifer and six in the confined lower aquifer. The groundwater extraction system includes three components: the South Interception System, the West Interception System, and the East Extraction System. The South System intercepts groundwater to prevent further migration of the constituents of concern in the Upper Sand/Gravel Aquifer, and consists of groundwater extraction wells CP-S1, CP-S4, CP-S5 and CP-S6. The West System intercepts groundwater to prevent further spread of the constituents of concern in the Lower Sand/Gravel Aquifer, and consists of groundwater extraction wells CP-W1, CP-W2 and CP-W3. The East System provides source control, extracts groundwater from the Lower Sand/Gravel Aquifer and Basalt Aquifers, and consists of groundwater extraction wells CP-E1 and CP-E3 (Lower Sand/Gravel Aquifer) and CP-E2 (Basalt Aquifer). (See Figure 1-2).

The treatment facility receives groundwater pumped from the extraction wells through a series of interconnecting pipelines (Figure 1-2). All extracted groundwater is combined into a single pipeline after flow metering at the treatment facility. A nontoxic polyacrylate-based scale control chemical is metered into the combined groundwater pipeline on a flow proportional basis prior to discharge of the water to the air stripping tower to prevent the precipitation of mineral scale on the air stripping tower media. Extracted groundwater is conveyed to the top of the air stripping tower, distributed evenly over the horizontal cross-sectional area and then allowed to trickle down over the internal media. Air is blown through the stripping tower by an electrically driven fan, which maintains a minimum air-to-water ratio of approximately 100 (volume-to-volume basis). The volatile gases dissolved in the groundwater diffuse into the air stream as the water trickles down the tower. The air containing the constituents of concern is discharged to the atmosphere from the top of the air stripping tower, which is approximately 70 feet above the ground surface. The treated groundwater collects in the air stripping tower sump and flows out of the sump by gravity through a pipeline that conveys the treated water to the Little Spokane River. The water passes through an energy dissipation box approximately 50 feet upgradient of the outfall. The outfall is an 18 inch PVC pipe which is submerged under normal stream flow conditions. To prevent erosion and scour, quarry spalls have been placed on the downgradient bank slope.

SUMMARY OF COMPLIANCE WITH PREVIOUS SUBSTANTIVE REQUIREMENTS

A set of substantive requirements was provided to Spokane County on November 1, 1994. Based on Remedial Action Status Reports, submitted quarterly, Spokane County has remained in compliance with the previous substantive requirements

PROPOSED LIMITATIONS AND CONDITIONS

Federal and State regulations require that effluent limitations set forth in a NPDES permit must be either technology- or water quality-based. Technology-based limitations are based upon the treatment methods available to treat specific wastewater. Technology-based limitations are set by regulation or developed on a case-by-case basis (40 CFR 125.3, and chapter 173-220 WAC). Water quality-based limitations are based upon compliance with the Surface Water Quality Standards (chapter 173-201A WAC), Ground Water Standards (chapter 173-200 WAC) or Sediment Quality Standards (chapter 173-204 WAC). The more stringent of these two limits must be chosen for each of the parameters of concern. Each of these types of limits is described in more detail below.

TECHNOLOGY-BASED EFFLUENT LIMITATIONS

Technology-based limits for VOCs removed by air stripping have not been published. Air stripping is a proven technology for removing volatile organic compounds present in water. The treatment plant should reduce contaminant levels below water quality-based limits. Percent removal efficiencies will be calculated and maintained as appropriate.

SURFACE WATER QUALITY-BASED EFFLUENT LIMITATIONS

In order to protect existing water quality and preserve the designated beneficial uses of Washington's surface waters, WAC 173-201A-060 states that waste discharge permits shall be conditioned such that the discharge will meet established Surface Water Quality Standards. The Washington State Surface Water Quality Standards (chapter 173-201A WAC) is a state regulation designed to protect the beneficial uses of the surface waters of the state.

Numerical Criteria for the Protection of Aquatic Life

"Numerical" water quality criteria are numerical values set forth in the State of Washington's Water Quality Standards for Surface Waters (chapter 173-201A WAC). They specify the levels of pollutants allowed in a receiving water while remaining protective of aquatic life. Numerical criteria set forth in the Water Quality Standards are used along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit. When surface water quality-based limits

are more stringent or potentially more stringent than technology-based limitations, they must be used in a permit.

Numerical Criteria for the Protection of Human Health

The U.S. EPA has promulgated 91 numeric water quality criteria for the protection of human health that are applicable to Washington State. These are published in the National Toxics Rule, Federal Register, V. 57, No. 246, Tuesday, December 22, 1992. These criteria are designed to protect humans from cancer and other disease and are primarily applicable to fish and shellfish consumption and drinking water from surface waters.

Narrative Criteria

In addition to numerical criteria, "narrative" water quality criteria (WAC 173-201A-030) limit toxic, radioactive, or deleterious material concentrations below those which have the potential to adversely affect characteristic water uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health. Narrative criteria protect the specific beneficial uses of all fresh (WAC 173-201A-130) and marine (WAC 173-201A-140) waters in the State of Washington.

Antidegradation

The State of Washington's Antidegradation Policy requires that discharges into a receiving water shall not further degrade the existing water quality of the water body. In cases where the natural conditions of a receiving water are of lower quality than the criteria assigned, the natural conditions shall constitute the water quality criteria. Similarly, when the natural conditions of a receiving water are of higher quality than the criteria assigned, the natural conditions shall constitute the water quality criteria. More information on the State Antidegradation Policy can be obtained by referring to WAC 173-201A-070.

Ecology has reviewed existing records and is unable to determine if ambient water quality is either higher or lower than the designated classification criteria given in chapter 173-201A WAC; therefore, Ecology will use the designated classification criteria for this water body in establishing substantive requirements. The discharge should not cause a degradation of existing water quality or beneficial uses.

Critical Conditions

Surface water quality-based limits are derived for the waterbody's critical condition, which represents the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota, human health, and existing or characteristic water body uses.

Mixing Zones

The Water Quality Standards allow the Department of Ecology to authorize mixing zones around a point of discharge in establishing surface water quality-based effluent limits. Both "acute" and "chronic" mixing zones may be authorized for pollutants that can have a toxic effect on the aquatic environment near the point of discharge. The concentration of pollutants at the boundary of these mixing zones may not exceed the numerical criteria for that type of zone. Mixing zones can only be authorized for discharges that are receiving all known, available, and reasonable methods of prevention and control (AKART) and in accordance with other mixing zone requirements of WAC 173-201A-100.

The National Toxics Rule allows the chronic mixing zone to be used to meet human health criteria.

Description of the Receiving Water

The facility discharges to the Little Spokane River which is designated as a Class A receiving water in the vicinity of the outfall. Characteristic uses include the following:

> water supply (domestic, industrial, agricultural); stock watering; fish migration; fish rearing, spawning and harvesting; wildlife habitat; primary contact recreation; sport fishing; boating and aesthetic enjoyment; commerce and navigation.

Water quality of this class shall meet or exceed the requirements for all or substantially all uses.

Surface Water Quality Criteria

Applicable criteria are defined in chapter 173-201A WAC for aquatic biota. Criteria for this discharge are summarized below:

Fecal Coliforms	100 colonies/100 mL maximum geometric mean
Dissolved Oxygen	8 mg/L minimum
Temperature	18 degrees Celsius maximum
pH	6.5 to 8.5 standard units
Turbidity	less than 5 NTU above background
Toxics	No toxics in toxic amounts (see Table 2 for numeric criteria for toxics of concern for this discharge)

Consideration of Surface Water Quality-Based Limits for Numeric Criteria

The following table presents the effluent limitations for toxics which may be present in the discharge. The basis for selection of the limits follows.

Table 2. Effluent Limitations

Parameter	Average Monthly[3]	Maximum Daily[4]
Chloride	230 mg/L	
DCA		4050 ug/L
DCE		7 ug/L
Iron	300 ug/L	
Manganese	50 ug/L	
MC		2.5 ug/L
Nitrates	10 mg/L	
Total Phosphorus		930 ug/L
PCE		0.7 ug/L
TCA		200 ug/L
TCE		5 ug/L

The effluent limits for the six indicator VOCs are based on the remediation goals established in the Record of Decision (1987) and the performance standards established in the Consent Decree (1989). The effluent limits for all six VOCs are based upon levels protective of human health only, i.e., Safe Drinking Water Act Maximum Contaminant Levels (MCLs), or human health risk-based levels. They do not consider water quality criteria. Modification of the performance standards in the Consent Decree in order to address water quality criteria would require an amendment of the Consent Decree (as defined in Section XXV Amendment of Consent Decree). The performance standards established in the Consent Decree are not subject to dispute resolution (Section XXXVII Dispute Resolution, paragraph C).

Due to difficulties anticipated in accurately quantifying MC and PCE at their performance standards (effluent limitations), alternative evaluation criteria were established in the Consent Decree. The evaluation criteria are 25 ug/L and 7 ug/L for MC and PCE, respectively. If the levels to which these compounds can be accurately quantified (using

[3] The average monthly effluent limitation is defined as the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

[4] The maximum daily effluent limitation is defined as the highest allowable daily discharge.

EPA Method 8010) change during the course of the remedial action, the evaluation criteria will be adjusted accordingly.

The effluent limit for chloride (230 mg/L) is based on the freshwater chronic value set forth in the State of Washington's Water Quality Standards for Surface Waters (chapter 173-201A WAC) and Federal Water Quality Criteria.

The effluent limits for iron and manganese (300 ug/L and 50 ug/L, respectively) are based on the Secondary MCLs set forth in the State of Washington's Drinking Water Regulations (chapter 246-290 WAC).

The effluent limit for nitrates (10 mg/L) is based on the MCL set forth in the State of Washington's Drinking Water Regulations (chapter 246-290 WAC) and the federal Safe Drinking Water Act.

The effluent limit for phosphorous (930 ug/L) is based on attaining the water quality criterion of 100 ug/L, recommended in EPA's Quality Criteria for Water 1986 (the Gold Book), at the edge of the mixing zone, as demonstrated in the following mass balance:

$$C_{mz}(Q_{mz} + Q_e) = C_u Q_{mz} + C_e Q_e \text{, yields}$$

$$C_e = (C_{mz}(Q_{mz} + Q_e) - C_u Q_{mz})/Q_e$$
$$= 930 \text{ ug/L, where}$$

C_{mz} = Maximum edge of mixing zone phosphorous concentration from the Gold book
= 100 ug/L

C_u = Upstream phosphorous concentration ("Water Quality Assessment for the Little Spokane River System")
= 20 ug/L

C_e = Effluent phosphorous concentration

Q_{mz} = Mixing zone flow
= (1/4) Q_u

Q_u = Dartford 7Q10 upstream flow (Dartford gauging station)
= 91.9 cfs

Q_e = Effluent flow
= 2.2 cfs

Whole Effluent Toxicity

The Water Quality Standards for Surface Waters require that the effluent not cause toxic effects in the receiving waters. Many toxic pollutants cannot be detected by commonly available detection methods. However, toxicity can be measured directly by exposing living

organisms to the wastewater in laboratory tests and measuring the response of the organisms. Toxicity tests measure the aggregate toxicity of the whole effluent, and therefore this approach is called whole effluent toxicity (WET) testing. Some WET tests measure acute toxicity and other WET tests measure chronic toxicity.

Acute toxicity tests measure mortality as the significant response to the toxicity of the effluent. Dischargers who monitor their wastewater with acute toxicity tests are providing an indication of the potential lethal effect of the effluent to organisms in the receiving environment.

Chronic toxicity tests measure various sublethal toxic responses such as retarded growth or reduced reproduction. Chronic toxicity tests often involve either a complete life cycle test of an organism with an extremely short life cycle or a partial life cycle test on a critical stage of one of a test organism's life cycles. Organism survival is also measured in some chronic toxicity tests.

The WET tests evaluated during the previous substantive requirements indicate that no reasonable potential exists to cause receiving water acute toxicity. The substantive requirements will not include an acute WET limit but will require use of rapid screening tests to assure acute toxicity does not appear. If a rapid screening test indicates that acute toxicity has appeared, Spokane County will investigate immediately and take appropriate action. Toxicity is assumed to have increased if WET testing conducted in response to rapid screening tests fails to meet the performance standards in WAC 173-205-020 "whole effluent toxicity performance standard."

The WET tests evaluated during the previous substantive indicate that no reasonable potential exists to cause receiving water chronic toxicity. The substantive requirements will not include a chronic WET limit but will require use of chronic rapid screening tests to assure chronic toxicity does not appear. If a rapid screening test indicates that chronic toxicity has appeared, Spokane County will investigate immediately and take appropriate action. Toxicity is assumed to have increased if WET testing conducted in response to rapid screening tests fails to meet the performance standards in WAC 173-205-020 "whole effluent toxicity performance standard."

Sediment Quality

Ecology has promulgated aquatic sediment standards (chapter 173-204 WAC) to protect aquatic biota and human health. These standards state that Ecology may require Permittees to evaluate the potential for the discharge to cause a violation of applicable standards (WAC 173-204-400).

Ecology has been unable to determine at this time the potential for this discharge to cause a violation of sediment quality standards. If Ecology determines in the future that there is a potential for violation of the Sediment Quality Standards, Ecology will discuss with Spokane

County the need to demonstrate that either the point of discharge is not an area of deposition or, if the point of discharge is a depositional area, that there is not an accumulation of toxics in the sediments.

GROUND WATER QUALITY LIMITATIONS

Ecology has promulgated Ground Water Quality Standards (chapter 173-200 WAC) to protect beneficial uses of ground water. Permits issued by Ecology shall be conditioned in such a manner so as not to allow violations of those standards (WAC 173-200-100).

There is no discharge to ground and therefore no limitations are required based on potential effects to ground water.

COMPARISON OF EFFLUENT LIMITS WITH THE EXISTING SUBSTANTIVE REQUIREMENTS

The effluent limits have not been modified.

MONITORING AND REPORTING

Effluent monitoring, recording, and reporting are required (WAC 173-220-210 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and the effluent limitations are being achieved.

The monitoring and testing schedule is detailed in the proposed substantive requirements under Condition S.2. Specified monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring.

SUBSTANTIVE REQUIREMENTS

S1. EFFLUENT LIMITATIONS

The discharge of treated groundwater at the designated outfall to the Little Spokane River is subject to meeting the following limitations:

OUTFALL No. 1 EFFLUENT LIMITATIONS

Parameter	Average Monthly[5]	Maximum Daily[6]
Chloride	230 mg/L	
DCA		4050 ug/L
DCE		7 ug/L
Iron	300 ug/L	
Manganese	50 ug/L	
MC		2.5[7] - 25[8] ug/L
Nitrates	10 mg/L	
Total Phosphorus		930 ug/L
PCE		0.7[7] - 7[8] ug/L
TCA		200 ug/L
TCE		5 ug/L

[5] The average monthly effluent limitation is defined as the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.
[6] The maximum daily effluent limitation is defined as the highest allowable daily discharge.
[7] Performance standard established in the ROD and Consent Decree.
[8] Evaluation criteria established in the Consent Decree.

S2. TESTING SCHEDULE

Spokane County shall monitor the system and the treated groundwater according to the following schedule:

Tests	Sample Location	Sampling Frequency	Sample Type
Volatile Organic Compounds (Method 8010)	Combined influent pipeline and discharge pipeline at treatment facility designated location	Six Constituents of Concern - monthly; Full Method 8010 compounds - quarterly	Grab
Toxicity Testing - Rapid Screening Tests	Discharge pipeline at treatment facility designated location	Semi-annually	Grab[9]
Nitrate+Nitrite	Discharge pipeline at treatment facility designated location	Once in June; Once in August; Once during winter	Grab
Total Phosphorous	Discharge pipeline at treatment facility designated location	Once in June; Once in July; Once in August; Once during winter	Grab
Chloride, Iron, Manganese	Discharge pipeline at treatment facility designated location	Quarterly	Grab
pH, Flow	Discharge pipeline at treatment facility designated location	Daily	Continuous - metered
Turbidity, Electrical Conductivity, Temperature	Discharge pipeline at treatment facility designated location	Weekly	Grab

Samples collected for the Rapid Screening tests should be collected concurrently with the samples collected for the VOC test.

S3. MONITORING AND REPORTING

Spokane County shall monitor and report in accordance with the following conditions.

A. Reporting

Monitoring results obtained during the previous three (3) months shall be summarized and reported in the Remedial Action Status Report and submitted no later than 3 months following the completed reporting period. The report shall be sent to the Department of Ecology, Toxics Cleanup Program, Site Cleanup Section, P.O. Box 47600, Olympia, Washington 98504-7600.

[9] Sufficient quantity of effluent will be collected for archiving samples which may require chemical analysis, see Special Conditions S4. & S5.

B. Records Retention

Spokane County shall retain records of all monitoring information, including all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports, and records of all data, for a period of at least 3 years.

C. Recording of Results

For each measurement or sample taken, Spokane County shall record the following information: (1) the date, exact place and time of sampling; (2) the individual who performed the sampling or measurement; (3) the dates the analyses were performed; (4) who performed the analyses; (5) the analytical techniques or methods used; and (6) the results of all analyses.

D. Representative Sampling

Samples and measurements taken to meet these requirements shall be representative of the volume and nature of the monitored discharge, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets and maintenance-related conditions affecting effluent quality.

E. Test Procedures

All sampling and analytical methods used to meet the monitoring requirements specified in these substantive requirements shall conform to the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136, unless otherwise specified or approved in writing by Ecology.

F. Flow Measurement

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated, and maintained to ensure that the accuracy of the measurements is consistent with the accepted industry standard for that type of device. Frequency of calibration shall be in conformance with manufacturer's recommendations or at a minimum frequency of at least one calibration per year. Calibration records should be maintained for a minimum of three years.

G. Laboratory Accreditation

All monitoring data, except for flow, temperature, settleable solids, conductivity, pH, and internal process control parameters, shall be prepared by a laboratory registered or accredited under the provisions of, Accreditation of Environmental Laboratories, Chapter 173-50 WAC. Conductivity and pH shall be accredited if the laboratory must otherwise be registered or accredited.

H. Additional Monitoring by Spokane County

If Spokane County monitors any pollutant more frequently than required by these substantive requirements (S2.) using test procedures specified by Condition S3.E., then the results of this monitoring shall be included in the calculation and reporting of the data submitted in the Quarterly Remedial Action Status Report.

S4. ACUTE TOXICITY

A. Testing Requirements

In consideration of the potential to have toxicity occur and cause receiving water impacts the following monitoring is required. Spokane County shall conduct 24 hour acute rapid screening tests using:

Daphnid (*Ceriodaphnia dubia*, *Daphnia pulex*, or *Daphnia magna*) (24-hour static test, method: EPA/600/4-90/027F).

A minimum of 40 organisms shall be used in both the control and 100% effluent. Tests shall be conducted once in the summer and once in the winter and have a maximum acceptable mortality rate of 0.20 in 100% effluent. The mortality rate is determined by WAC 173-205-120(2)(b). If the mortality rate is greater than 0.20, then the archived effluent samples will be analyzed for semi-volatile organics (8270), pesticides and PCBs (8080 and 8140), priority pollutant metals, and ammonia to determine the source of toxicity. The effluent may be retested with all species and durations used in the last substantive requirements with acute whole effluent toxicity testing - to be determined between Ecology and Spokane County.

B. Sampling and Reporting Requirements

1. All reports for whole effluent toxicity tests shall be submitted in accordance with the most recent Ecology specifications regarding format and content. Reports shall contain bench sheets and reference toxicant results for test methods.

2. Testing shall be conducted on grab samples. Samples taken for toxicity testing shall be cooled to 4 degrees Celsius while being collected and shall be sent to the lab immediately upon completion. The lab shall begin the toxicity testing as soon as possible but no later than 36 hours after sampling was ended.

3. All samples taken for toxicity testing shall have pH, total alkalinity, total hardness, dissolved oxygen, and conductivity or salinity measured prior to test initiation.

4. If test results are determined to be invalid or anomalous by Ecology, testing shall be repeated with freshly collected effluent. If control performance does not meet protocol standards for acceptability, the test shall be repeated with freshly collected effluent.

5. Dilution water for toxicity testing shall be laboratory water or pristine natural water of sufficient quality for good control performance.

6. The whole effluent toxicity tests shall be run on an unmodified sample of final effluent.

7. Spokane County may choose to conduct a full dilution series test in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control.

8. All whole effluent toxicity tests that involve hypothesis testing and do not comply with the acute statistical power standard of 29% as defined in WAC 173-205-020 must be repeated on a fresh sample with an increased number of replicates to increase the power.

9. Acids and bases shall not be added to samples or test solutions unless pH is outside the range 6.0 to 9.0. Control of unionized ammonia toxicity due to pH rise shall only be accomplished by holding test chambers in a CO_2 atmosphere.

S5. CHRONIC TOXICITY

A. Testing Requirements

Spokane County shall conduct chronic rapid screening tests using:

Daphnid (*Ceriodaphnia dubia*, *Daphnia pulex*, or *Daphnia magna*) (24-hour static test, method: EPA/600/4-89/001).

Tests shall be conducted once in the summer and once in the winter and shall be expected to have no statistically significant difference in response between the acute critical effluent concentration (ACEC) and the control using the method in Appendix H of EPA/600/4-89/001 or an equivalent method approved by Ecology. Whenever a rapid screening test result has a statistically significant difference in response between the ACEC and the control, then the archived effluent samples will be analyzed for semi-volatile organics (8270), pesticides and PCBs (8080 and 8140), priority pollutant metals, and ammonia to determine the source of toxicity. The effluent may be retested with all species and durations used in the last substantive requirements with acute

whole effluent toxicity testing - to be determined between Ecology and Spokane County.

B. Sampling and Reporting Requirements

1. All reports for whole effluent toxicity tests shall be submitted in accordance with the most recent Ecology specifications regarding format and content. Reports shall contain bench sheets and reference toxicant results for test methods.

2. Testing shall be conducted on grab samples. Samples taken for toxicity testing shall be cooled to 4 degrees Celsius while being collected and shall be sent to the lab immediately upon completion. The lab shall begin the toxicity testing as soon as possible but no later than 36 hours after sampling was ended.

3. All samples taken for toxicity testing shall have pH, total alkalinity, total hardness, dissolved oxygen, and conductivity or salinity measured prior to test initiation.

4. If test results are determined to be invalid or anomalous by Ecology, testing shall be repeated with freshly collected effluent. If control performance does not meet protocol standards for acceptability, the test shall be repeated with freshly collected effluent.

5. Dilution water for toxicity testing shall be laboratory water or pristine natural water of sufficient quality for good control performance.

6. The whole effluent toxicity tests shall be run on an unmodified sample of final effluent.

7. Spokane County may choose to conduct a full dilution series test in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control.

8. All whole effluent toxicity tests that involve hypothesis testing and do not comply with the acute statistical power standard of 29% as defined in WAC 173-205-020 must be repeated on a fresh sample with an increased number of replicates to increase the power.

9. Acids and bases shall not be added to samples or test solutions unless pH is outside the range 6.0 to 9.0. Control of unionized ammonia toxicity due to pH rise shall only be accomplished by holding test chambers in a CO_2 atmosphere.

S6. ALGAL GROWTH POTENTIAL STUDY

Algal Growth Potential Studies conducted under the previous substantive requirements shall resume between May and October if there is a significant increase in the nitrogen or phosphorus concentrations in the treated groundwater. A significant increase for nitrogen and phosphorous is defined as: a nitrogen concentration exceeding 7 mg/L for two consecutive sampling events; a phosphorous concentration exceeding 0.1 mg/L for two consecutive sampling events. Spokane County may cease algal growth studies between October and May; and/or when the nitrogen and phosphorous concentrations in the treated groundwater are less than 5 mg/L and 0.05 mg/L, respectively, and the algal growth studies indicate no significant difference between upstream and downstream algal growth potential.

When an algal growth potential study is triggered, Spokane County shall collect water samples from the Little Spokane River on a monthly basis from May to October and perform an algal growth potential study using the algae Selenastrum capricornutum. Water for the algal growth potential studies shall be collected upstream of the outfall of the treated groundwater and at a downstream location equivalent to the edge of the mixing zone. If no significant stimulation of algal growth potential is observed, then the algal growth potential studies shall be suspended

CRITICAL AND HAZARDOUS MATERIALS LIST

Please fill out the following list as per instructions on the reverse, return to the Department of Buildings, and retain a copy at your place of business. Feel free to make copies, attach additional pages, and/or add explanatory notes, if appropriate.

Company Name: Spokane County Property Address: 22515 N. Elk-Chattaroy Road
Colbert, WA

PRODUCT 1

Product and/or Chemical Name:	Scale Control Polymer
Maximum Quantity (Gals, Lbs, Cu.Ft.):	Up to 1,325 gal
Material Classification (UBC Table 9-A, 9-B):	No hazard rating
MSDS Sheet etc.:	Data Sheet No. 1, attached and No. 1a
Area Stored and/or Used:	Stored indoors, used indoors, continuous use
Proposed Method of Storage:	Polyethylene tank (aboveground)

PRODUCT 2

Product and/or Chemical Name:	Defoamer
Maximum Quantity (Gals, Lbs, Cu.Ft.):	Up to 55 gal
Material Classification (UBC Table 9-A, 9-B):	Sensitizer
MSDS Sheet etc.:	Data Sheet No. 2, attached
Area Stored and/or Used:	Used indoors, no ongoing use or storage
Proposed Method of Storage:	Maximum of two 55 gal drums

PRODUCT 3

Product and/or Chemical Name:	Hydrochloric Acid
Maximum Quantity (Gas, Lbs, Cu. Ft.):	Up to 1,800 gal of 35%, up to 7,000 gal of 10%
Material Classification (UBC Table 9-A, 9-B):	Corrosive, toxic, Class 1 Unstable
MSDS Sheet etc.:	Data Sheet No. 3, attached
Area Stored and/or Used:	Stored outdoors, used outdoors, except circulates in indoor process piping, no ongoing use or storage
Proposed Method of Storage:	FRP tank (aboveground), or eight 55-gal drums, or tanker truck.

PRODUCT 4

Product and/or Chemical Name:	Sodium Hydroxide
Maximum Quantity (Gals, Lbs, Cu.Ft.):	Up to 220 gal of 50%
Material Classification (UBC Table 9-A, 9-B):	Corrosive, toxic, Class 1 Unstable
MSDS Sheet etc.:	Data Sheet No. 4, attached
Area Stored and/or Used:	Used indoors, no ongoing use or storage
Proposed Method of Storage:	Maximum of four 55-gal drums.

PRODUCT 5

Product and/or Chemical Name:	Hydrogen peroxide
Maximum Quantity (Gals, Lbs, Cu.Ft.):	Up to 220 gal of 35%
Material Classification (UBC Table 9-A, 9-B):	Irritant, corrosive, Class 2 Oxidizer
MSDS Sheet etc.:	Data Sheet No. 5, attached
Area Stored and/or Used:	Used indoors, no ongoing use or storage
Proposed Method of Storage:	Maximum of four 55-gal drums.

The above is a true and correct accounting of the chemicals intended to be used and/or stored at the referenced facilities.

Signed by: Michael A. Stanaszak Date: 9/9/93
Owner or Authorized Representative
Michael A. Stanaszak
Landau Associates, Inc.

09/09/93 J:\COLBERT\069-BAR.LIT

DATA SHEET NO. 1

NALCO

MATERIAL SAFETY DATA SHEET

PRODUCT NALCO 8357 SCALE INHIBITOR

Emergency Telephone Number
Medical (708) 920-1510 (24 hours)

SECTION 1 PRODUCT IDENTIFICATION

TRADE NAME: NALCO 8357 SCALE INHIBITOR
DESCRIPTION: An aqueous solution of a polyacrylate

NFPA 704M/HMIS RATING: 1/1 HEALTH 1/1 FLAMMABILITY 0/0 REACTIVITY 0 OTHER
0=Insignificant 1=Slight 2=Moderate 3=High 4=Extreme

SECTION 2 HAZARDOUS INGREDIENTS

Our hazard evaluation of the ingredient(s) under OSHA's Hazard Communication Rule, 29 CFR 1910.1200 has found none of the ingredient(s) hazardous.

SECTION 3 PRECAUTIONARY LABEL INFORMATION

CAUTION: May cause irritation to skin and eyes. Avoid contact with skin, eyes and clothing. Do not take internally.

Empty containers may contain residual product. Do not reuse container unless properly reconditioned.

SECTION 4 FIRST AID INFORMATION

EYES: Flush with water for 15 minutes. Call a physician.
SKIN: Flush with water for 15 minutes.
INGESTION: Do not induce vomiting. Give water. Call a physician.
INHALATION: Remove to fresh air. Treat symptoms. Call a physician.

NOTE TO PHYSICIAN: No specific antidote is known. Based on the individual reactions of the patient, the physician's judgment should be used to control symptoms and clinical condition.

CAUTION: If unconscious, having trouble breathing or in convulsions, do not induce vomiting or give water.

SECTION 5 HEALTH EFFECTS INFORMATION

PRIMARY ROUTE(S) OF EXPOSURE: Eye, Skin

EYE CONTACT: May cause irritation with prolonged contact.
SKIN CONTACT: May cause irritation with prolonged contact.

SYMPTOMS OF EXPOSURE: A review of available data does not identify any symptoms from exposure not previously mentioned.

AGGRAVATION OF EXISTING CONDITIONS: A review of available data does

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SECTION 5 HEALTH EFFECTS INFORMATION (CONTINUED)

not identify any worsening of existing conditions.

SECTION 6 TOXICOLOGY INFORMATION

ACUTE TOXICITY STUDIES: Acute toxicity studies have been conducted on this product. The results are shown below.

ACUTE ORAL TOXICITY (ALBINO RATS): LD50 = Greater than 5,000 mg/kg

ACUTE DERMAL TOXICITY (ALBINO RABBITS): LD50 = Greater than 2,000 mg/kg

PRIMARY SKIN IRRITATION TEST (ALBINO RABBITS):
SKIN IRRITATION INDEX DRAIZE RATING: 0.0/8.0 Non-irritating

PRIMARY EYE IRRITATION TEST (ALBINO RABBITS):
EYE IRRITATION INDEX DRAIZE RATING: 2.7/110.0 Minimally irritating

SECTION 7 PHYSICAL AND CHEMICAL PROPERTIES

COLOR: Clear water-white FORM: Liquid ODOR: Organic

DENSITY:	10.2 lbs/gal.	
SOLUBILITY IN WATER:	Completely	
SPECIFIC GRAVITY:	1.21 - 1.23 @ 60 Degrees F	ASTM D-1298
pH (NEAT) =	3.6 - 4.0	ASTM E-70
VISCOSITY:	51 cps @ 60 Degrees F	ASTM D-2983
FREEZE POINT:	20 Degrees F	ASTM D-1177
FLASH POINT:	None (PMCC)	ASTM D-93

NOTE: These physical properties are typical values for this product.

SECTION 8 FIRE AND EXPLOSION INFORMATION

FLASH POINT: None (PMCC) ASTM D-93

EXTINGUISHING MEDIA: This product would not be expected to burn unless all the water is boiled away. The remaining organics may be ignitable. Use water to cool containers exposed to fire.

UNUSUAL FIRE AND EXPLOSION HAZARD: May evolve NOx under fire conditions. Containers exposed in a fire should be cooled with water to prevent vapor pressure buildup leading to a rupture.

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SECTION 9 REACTIVITY INFORMATION

INCOMPATIBILITY: Avoid contact with strong oxidizers (eg. chlorine, peroxides, chromates, nitric acid, perchlorates, concentrated oxygen, permanganates) which can generate heat, fires, explosions and the release of toxic fumes.
THERMAL DECOMPOSITION PRODUCTS: In the event of combustion CO, CO2, NOx may be formed. Do not breathe smoke or fumes. Wear suitable protective equipment.

SECTION 10 PERSONAL PROTECTION EQUIPMENT

RESPIRATORY PROTECTION: Respiratory protection is not normally needed since the volatility and toxicity are low. If significant vapors, mists or aerosols are generated, wear a NIOSH approved or equivalent respirator.

For large spills, entry into large tanks, vessels or enclosed small spaces with inadequate ventilation, a pressure-demand, self-contained breathing apparatus is recommended.

VENTILATION: General ventilation is recommended.

PROTECTIVE EQUIPMENT: Use impermeable gloves and chemical splash goggles when attaching feeding equipment or doing maintenance.

The availability of an eye wash fountain and safety shower is recommended.

If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

SECTION 11 SPILL AND DISPOSAL INFORMATION

IN CASE OF TRANSPORTATION ACCIDENTS, CALL THE FOLLOWING 24-HOUR TELEPHONE NUMBER (708-920-1510)

SPILL CONTROL AND RECOVERY:

Small liquid spills: Contain with absorbent material, such as clay, soil or any commercially available absorbent. Shovel reclaimed liquid and absorbent into recovery or salvage drums for disposal. Refer to CERCLA in Section 14.

Large liquid spills: Dike to prevent further movement and reclaim into recovery or salvage drums or tank truck for disposal. Refer to CERCLA in Section 14.

DISPOSAL: If this product becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C,

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SECTION 11 SPILL AND DISPOSAL INFORMATION (CONTINUED)

nor is it listed under Subpart D.

As a non-hazardous liquid waste, it should be solidified with stabilizing agents (such as sand, fly ash, or cement) so that no free liquid remains before disposal to an industrial waste landfill. A non-hazardous liquid waste can also be incinerated in accordance with local, state and federal regulations.

SECTION 12 ENVIRONMENTAL INFORMATION

AQUATIC DATA:

96 hour static acute LC50 to Bluegill Sunfish = Greater than 1,000 ppm

96 hour no observed effect concentration is 1,000 ppm based on no mortality or abnormal effects.

96 hour static acute LC50 to Rainbow Trout = Greater than 1,000 ppm

96 hour no observed effect concentration is 1,000 ppm based on no mortality or abnormal effects.

48 hour static acute LC50 to Daphnia Magna = Greater than 1,000 ppm

48 hour no observed effect concentration is 560 ppm based on no mortality or abnormal effects.

TOXICITY RATING: Essentially non-toxic

96 hour static acute LC50 to Mysid Shrimp = 464 mg/L

TOXICITY RATING: Slightly toxic

96 hour static acute LC50 to Silversides (Menidia beryllina) = Greater than 1,000 mg/L

TOXICITY RATING: Essentially non-toxic

If released into the environment, see CERCLA in Section 14.

NALCO CHEMICAL COMPANY ONE NALCO CENTER • NAPERVILLE, ILLINOIS 60563-1198
AREA 708-305-1000

SECTION 13 TRANSPORTATION INFORMATION

DOT PROPER SHIPPING NAME/HAZARD CODE - PRODUCT IS NOT REGULATED DURING TRANSPORTATION

SECTION 14 REGULATORY INFORMATION

The following regulations apply to this product.

FEDERAL REGULATIONS:

OSHA'S HAZARD COMMUNICATION RULE, 29 CFR 1910.1200:
Based on our hazard evaluation, none of the ingredients in this product are hazardous.

CERCLA, 40 CFR 117, 302:
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312 AND 313:

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355):
This product does not contain ingredients listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 and 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370):
Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372):
This product does not contain ingredients on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA):
The chemical ingredients in this product are on the 8(b) Inventory List (40 CFR 710).

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), 40 CFR 261 SUBPART C & D:
Consult Section 11 for RCRA classification.

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 (formerly Sec. 307), 40 CFR 116 (formerly Sec. 311):
None of the ingredients are specifically listed.

CLEAN AIR ACT, 40 CFR 60, SECTION 111, 40 CFR 61, SECTION 112:
This product does not contain ingredients covered by the Clean Air Act.

NALCO CHEMICAL COMPANY ONE NALCO CENTER • NAPERVILLE, ILLINOIS 60563-1198
AREA 708-305-1000

SECTION 14 REGULATORY INFORMATION (CONTINUED)

STATE REGULATIONS:

CALIFORNIA PROPOSITION 65:
This product does not contain any chemicals which require warning under California Proposition 65.

MICHIGAN CRITICAL MATERIALS:
This product does not contain ingredients listed on the Michigan Critical Materials Register.

STATE RIGHT TO KNOW LAWS:
The following ingredient(s) are disclosed for compliance with State Right To Know Laws:

Acrylate polymer	Trade secret
Inorganic salts	Trade secrets
Water	7732-18-5

INTERNATIONAL REGULATIONS:

This is not a WHMIS controlled product under The House of Commons of Canada Bill C-70.

SECTION 15 ADDITIONAL INFORMATION

None

SECTION 16 USER'S RESPONSIBILITY

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to ensure safe workplace operations. Please consult your local sales representative for any further information.

SECTION 17 BIBLIOGRAPHY

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Klaassen, C. D., and Admur, M. O., eds., Macmillian Publishing Company, Inc., N. Y., 2nd edition, 1980.

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DANGEROUS PROPERTIES OF INDUSTRIAL MATERIALS, Sax, N. Irving, ed., Van Nostrand Reinhold Company, N.Y., 6th edition, 1984.

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Title 29 Code of Federal Regulations Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA).

THRESHOLD LIMIT VALUES FOR CHEMICAL SUBSTANCES AND PHYSICAL AGENTS IN THE WORKROOM ENVIRONMENT WITH INTENDED CHANGES, American Conference of Governmental Industrial Hygienists, OH.

PREPARED BY: Ricky A. Stackhouse PhD., Toxicologist
DATE CHANGED: 09/26/91 DATE PRINTED: 10/04/91

NALCO CHEMICAL COMPANY ONE NALCO CENTER • NAPERVILLE, ILLINOIS 60563-1198
AREA 708-305-1000

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LANDAU ASSOCIATES, INC.

ALLIED COLLOIDS INC

2301 WILROY ROAD, P.O. BOX 820
SUFFOLK, VA 23439-0820
(804) 538-3700

JAK

24-HOUR EMERGENCY CONTACT
CHEMTREC: 800/424-9300

Data Sheet No. 1a

Material Safety Data Sheet

SECTION I - IDENTIFICATION

PRODUCT: **DP6-2696**

ISSUE/REV DATE: 9-Nov-92

CHEMICAL FAMILY: Acrylic polymer in an aqueous solution.

DESCRIPTION: Clear to pale yellow liquid. Odorless, or with a slight mild odor.

HMIS RATING (NPCA)

H	0	HEALTH
F	0	FLAMMABILITY
R	0	REACTIVITY
P	*	PERSONAL

* PERSONAL PROTECTION RA BY OSHA, DEPARTMENT OF

DEGREE OF HAZAR
4 = SEVERE
3 = SERIOUS
2 = MODERATE
1 = SLIGHT
0 = MINIMAL

SECTION II - HAZARDOUS INGREDIENTS

INGREDIENT	CAS No.	LIMIT(S) IN AIR PPM	LIMIT(S) IN AIR mg/m³	REMARKS
This product is not hazardous as defined in 29CFR1910.1200				

SECTION III - PHYSICAL PROPERTIES

BOILING POINT: 90-100 C

SPECIFIC GRAVITY: 1.0-1.4

VAPOR DENSITY (air=1): ND

pH: 6-8

VOLATILES (% by volume): ND

VAPOR PRESSURE (mmHg): AS WATER

EVAPORATION RATE (ether=1): < 1

SOLUBILITY IN WATER: Soluble.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

EXTINGUISHING MEDIA

NA (will not burn). Use media appropriate for type of fire and combustibles in area.

FLASH POINT: NONE

LEL: NA

UEL: NA

SPECIAL FIRE FIGHTING PROCEDURES

Firefighters should wear normal protective equipment. SCBA is recommended for confined areas. Cool exposed drums or tanks with water.

UNUSUAL FIRE AND EXPLOSION HAZARDS

NA (No known unusual fire and explosion hazards.)

SECTION V - REACTIVITY DATA

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR.

INCOMPATIBILITY: Strong oxidants.

SECTION VI - HEALTH HAZARD DATA

NATURE OF PRINCIPAL HAZARD(S): NA (not a health hazard as defined by OSHA)

TARGET ORGAN(S): NA

SIGNS, SYMPTOMS, AND EFFECTS OF EXPOSURE:
Eye contact may produce slight irritation and/or redness.

CARCINOGENICITY:
Not listed as a carcinogen by IARC, NTP, OSHA or ACGIH

EXPOSURE LIMITS: None established

SAFETY PRECAUTIONS:
Do not get in eyes, on skin, on clothing.
Wash thoroughly after handling.
Avoid prolonged or repeated skin contact.

FIRST AID:

EYE CONTACT:	Immediately flush eyes with plenty of water for at least 15 minutes. Call a physician if irritation continues.
INGESTION:	Give large quantities of water and call a physician. Never give anything by mouth to an unconscious person.
SKIN CONTACT:	Remove contaminated clothing and launder before reuse. Wash effected area with soap and water.
INHALATION:	Remove to fresh air.

SECTION VII - ENVIRONMENTAL DATA

SPILL OR LEAK PROCEDURES
Remove all ignition sources. Dike area to control runoff, and collect spill in appropriate container(s). Use an inert absorbant such as vermiculite to collect residual liquid. Then water wash area to waste treatment to eliminate slip hazard.

WASTE DISPOSAL METHOD
Disposal must be arranged in accordance with local, state and federal regulations. This material, when unadulterated, is not a RCRA regulated hazardous waste. However, local disposal regulations will often apply. Care must be taken to prevent environmental contamination from the disposal of material, residues and containers.

SECTION VIII -PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY PROTECTION:	Use NIOSH approved respirator for organic vapor and/or mist, as required to control exposure.		
PROTECTIVE GLOVES:	Chemical resistant gloves.	EYE PROTECTION:	Full sideshield safety glasses or goggles (ANSI Z87.1 standard).
VENTILATION:	Recommended general ventilation rate of, as a minimum, 10 air changes per hour.		
OTHER EQUIPMENT:	Provide eyewash station(s). Select additional protective equipment (eg apron, face shield, etc.), depending on conditions of use.		

Allied Colloids Inc
Material Safety Data Sheet

SECTION IX - REGULATORY INFORMATION

SHIPPING INFORMATION

PROPER SHIPPING NAME: NOT A DOT/IMO HAZARDOUS MATERIAL

ID NUMBER: NA RQ: NA DOT EMERGENCY GUIDE (ERG) #: 31

HAZARD CLASS or DIVISION: NA PACKING GROUP: –

TSCA COMPONENTS APPEAR ON THE TSCA INVENTORY

SARA PRODUCT HAZARD CATEGORIES (Sec 311): PRODUCT NOT SUBJECT TO REPORTING

The following components are defined as toxic chemicals subject to reporting requirements of SARA Section 313 and of 40 CFR 372:

No components are 313 Toxic Chemicals

STATE LABELLING INFORMATION

NJ RTK LABEL - COMPONENTS INCLUDE:	CAS or ID #:
WATER	7732-18-5
SODIUM POLYACRYLATE	113184-25-1

CA PROP 65: NOT KNOWN TO CONTAIN A REGULATED ITEM

SECTION X - ADDITIONAL INFORMATION

NA=Not Applicable; ND=Not Determined or No Data

Avoid high temperatures and open systems to minimize vapor release and exposures.

Keep containers closed and properly labelled.
Do not reuse containers before contents are completely removed, and the container is properly cleaned and reconditioned. (Refer also to Section VII)

Good personal hygiene practices can reduce potential exposure. Wash with soap and water following any contact with this product, as well as before breaks and meals. Shower and change clothing at end of work shift. If clothing becomes contaminated, remove and launder or dry-clean before reuse.

The information and recommendations contained herein are, to the best of Allied Colloids Inc's knowledge and belief, accurate and reliable as of the last revision date. This document is offered in good faith. The information relates to the specific material designated, and may not be valid for such material used in combination with any other materials, in any process, or if used in a manner other than for which it is intended.

Allied Colloids Inc does not warrant or guarantee accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use. We do not accept liability for any loss or damage that may occur from the use of this information, nor do we offer warranty against patent infringement.

DATA SHEET NO. 2

KJR

LANDAU ASSOCIATES
23107 100TH AVE. W.
EDMONDS, WA 98020
KEN REIMER

DOW CORNING CORPORATION
MATERIAL SAFETY DATA SHEET

MATL NAME: DOW CORNING(R) ANTIFOAM 1520-US
EMERGENCY TELEPHONE NO. (517) 496-5900

SECTION I - GENERAL INFORMATION

MANUFACTURER'S NAME: DOW CORNING CORP. PRODUCT INFORMATION NO. (517) 496-6000
ADDRESS: SOUTH SAGINAW ROAD, MIDLAND MI 48686

PROPER SHIPPING NAME(49CFR 172.101): NONE
D.O.T. HAZARD NAME(49CFR 172.101): NONE
D.O.T. ID NO(49CFR 172.101): NONE
D.O.T. HAZARD CLASS(49CFR 172.101): NONE
RCRA HAZARD CLASS(40CFR 261)(IF DISCARDED): NONE
E.P.A. PRIORITY POLLUTANTS(40CFR 122.53): NONE
NFPA - NATIONAL FIRE PROTECTION ASSOCIATION - 704
HEALTH (NFPA): 1 FLAMMABILITY (NFPA): 1 REACTIVITY (NFPA): 0
CAS NO: MIXTURE DOW CORNING WARNING CODE: NOT USED
GENERIC DESCRIPTION: SILICONE EMULSION

SECTION II - HAZARDOUS INGREDIENTS AS DEFINED IN 29 CFR 1910.1200 (CARCINOGENS IDENTIFIED WITH AN ASTERISK *)

CAS NO.	INGREDIENT	WT.%	EXPOSURE LIMITS
007631869	SILICA, AMORPHOUS	1	OSHA PEL: TWA 6 MG/M3, ACGIH TLV: TWA 10 MG/M3 TOTAL DUST
031566311	GLYCERYL MONOSTEARATE	1	ACGIH TLV, STEARATES: TWA 10 MG/M3 TOTAL DUST.
009004675	METHYL CELLULOSE	2	SUPPLIER GUIDE: TWA 10 MG/M3.
009005714	SORBITAN (EO GYLCOL),-TRISTEARATE	2	ACGIH TLV, STEARATES: TWA 10 MG/M3 TOTAL DUST.

SECTION III - EFFECTS OF OVEREXPOSURE

EYE: DIRECT CONTACT MAY CAUSE TEMPORARY DISCOMFORT WITH MILD REDNESS AND DRYNESS SIMILAR TO WINDBURN.

SKIN: A SINGLE PROLONGED EXPOSURE (24 TO 48 HOURS) CAUSES NO KNOWN ADVERSE EFFECT.

INHALATION: NO IRRITATION TO EYES AND RESPIRATORY PASSAGES. NO INJURY IS LIKELY

DOW CORNING CORPORATION
MATERIAL SAFETY DATA SHEET

MATL NAME: DOW CORNING(R) ANTIFOAM 1520-US

SECTION III - EFFECTS OF EXPOSURE (CONTINUED)

FROM RELATIVELY SHORT EXPOSURE OF LESS THAN 8 HOURS.

ORAL: SMALL AMOUNTS TRANSFERRED TO THE MOUTH BY FINGERS DURING USE, ETC., SHOULD NOT INJURE. SWALLOWING LARGE AMOUNTS MAY CAUSE DIGESTIVE DISCOMFORT.

COMMENTS: NO KNOWN ADVERSE CHRONIC HEALTH EFFECTS, BUT UNNECESSARY EXPOSURE TO ANY CHEMICAL SHOULD BE AVOIDED.
THIS PRODUCT, AS WITH ANY CHEMICAL, MAY ENHANCE ALLERGIC CONDITIONS ON CERTAIN PEOPLE. WE DO NOT KNOW OF ANY MEDICAL CONDITIONS THAT MIGHT BE AGGRAVATED BY EXPOSURE TO THIS PRODUCT.
NO INJURY FROM DUSTS SHOULD OCCUR DURING REASONABLE USE. IF USE CREATES RESPIRABLE PARTICLES SOME RESPIRATORY SYSTEM INJURY MAY OCCUR.

SECTION IV - EMERGENCY AND FIRST AID PROCEDURES

EYES: FLUSH IMMEDIATELY WITH WATER.

SKIN: WIPE OFF AND FLUSH WITH WATER.

INHALATION: NO FIRST AID SHOULD BE NEEDED.

ORAL: NO FIRST AID SHOULD BE NEEDED.

COMMENT: NONE.

SECTION V - FIRE AND EXPLOSION DATA

FLASH POINT (METHOD USED): NONE.
AUTOIGNITION: NOT DETERMINED
FLAMMABILITY LIMITS IN AIR : LOWER:N.A. UPPER: N.A.

EXTINGUISHING MEDIA: WATER WATER FOG X CO2 X DRY CHEMICAL X FOAM X OTHER

SPECIAL FIRE FIGHTING PROCEDURES: SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING SHOULD BE WORN IN FIGHTING FIRES INVOLVING CHEMICALS

UNUSUAL FIRE AND EXPLOSION HAZARDS: NONE KNOWN TO DOW CORNING.

COMMENTS: N.A. - NOT APPLICABLE.

SECTION VI - PHYSICAL DATA

BOILING POINT(@ 760 MM HG): APPROX. 212F/100C
SPECIFIC GRAVITY (AT 77 DEG F/25 DEG C): 1.0
MELTING POINT: BELOW 32F/0C (FREEZING POINT)
VAPOR PRESSURE (AT 77 DEG F/25 DEG C): 24 MM (WATER)
VAPOR DENSITY (AIR = 1 AT 77 DEG F/25 DEG C): THAT OF MOIST AIR
PERCENT VOLATILE BY WEIGHT (%): APPROX. 74 (WATER)
EVAPORATION RATE (ETHER = 1): NOT APPLICABLE
SOLUBILITY IN WATER(%): MISCIBLE IN MOST PROPORTIONS
ODOR, APPEARANCE, COLOR: SOME ODOR, LIQUID, WHITE

NOTE: THE ABOVE INFORMATION IS NOT INTENDED FOR USE IN PREPARING PRODUCT SPECIFICATIONS. CONTACT DOW CORNING BEFORE WRITING SPECIFICATIONS

DOW CORNING CORPORATION
MATERIAL SAFETY DATA SHEET

MATL NAME: DOW CORNING(R) ANTIFOAM 1520-US

SECTION VII - REACTIVITY DATA

STABILITY: STABLE

INCOMPATABILITY(MATERIAL TO AVOID): OXIDIZING MATERIAL CAN CAUSE A REACTION.

CONDITIONS TO AVOID: NOT APPLICABLE

HAZARDOUS DECOMPOSITION PRODUCTS: SILICON DIOXIDE, CARBON DIOXIDE, AND TRACES OF INCOMPLETELY BURNED CARBON PRODUCTS.

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: NOT APPLICABLE

COMMENTS: NONE

SECTION VIII - SPILL, LEAK, MAINTENANCE/REPAIR AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: USE ABSORBENT MATERIAL TO COLLECT AND CONTAIN.

PROTECTIVE EQUIPMENT:
EYES: USE PROPER PROTECTION -- SAFETY GLASSES, AS A MINIMUM.

SKIN: WASHING AT MEALTIME AND END OF SHIFT IS ADEQUATE.

INHALATION: NO RESPIRATORY PROTECTION SHOULD BE NEEDED.

WASTE DISPOSAL METHOD: DOW CORNING SUGGESTS THAT ALL LOCAL,STATE AND FEDERAL REGULATIONS CONCERNING HEALTH AND POLLUTION BE REVIEWED TO DETERMINE APPROVED DISPOSAL PROCEDURES. CONTACT DOW CORNING IF THERE ARE ANY DISPOSAL QUESTIONS.

D.O.T. (49CFR 171.8)/E.P.A. (40CFR 117) SPILL REPORTING INFORMATION
HAZARDOUS SUBSTANCE: NONE REPORTABLE QUANTITY: NOT APPLICABLE
CONCENTRATION OF HAZARDOUS SUBSTANCE: NOT APPLICABLE
REPORTABLE QUANTITY OF PRODUCT: NOT APPLICABLE

COMMENTS: PRODUCT CONTAINS NO INGREDIENT SUBJECT TO D.O.T OR E.P.A. CERCLA/SARA ENVIRONMENTAL RELEASE REPORTING REGULATIONS. SEE SEC. XI FOR ADDITIONAL SARA COMPLIANCE INFORMATION.

SECTION IX - ROUTINE HANDLING PRECAUTIONS

PROTECTIVE EQUIPMENT:
EYES: USE PROPER PROTECTION -- SAFETY GLASSES, AS A MINIMUM.

SKIN *: WASHING AT MEALTIME AND END OF SHIFT IS ADEQUATE.

INHALATION: NO RESPIRATORY PROTECTION SHOULD BE NEEDED.

VENTILATION:
LOCAL EXHAUST: NONE SHOULD BE NEEDED
MECHANICAL (GENERAL): RECOMMENDED

SUITABLE RESPIRATOR: NONE SHOULD BE NEEDED.

THESE PRECAUTIONS ARE FOR ROOM TEMPERATURE HANDLING, USE AT ELEVATED TEMPERATURES, OR AEROSOL/SPRAY APPLICATIONS, MAY REQUIRE ADDED PRECAUTIONS.
* GOOD PRACTICE REQUIRES THAT GROSS AMOUNT OF ANY CHEMICAL BE REMOVED FROM THE SKIN AS SOON AS PRACTICAL, ESPECIALLY BEFORE EATING OR SMOKING.
COMMENTS: NONE

SECTION X - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: KEEP FROM FREEZING. USE REASONABLE CARE AND CAUTION.

OTHER PRECAUTIONS: NONE KNOWN TO DOW CORNING.
COMMENTS: NONE

DOW CORNING CORPORATION
MATERIAL SAFETY DATA SHEET

MATL NAME: DOW CORNING(R) ANTIFOAM 1520-US

SECTION XI - COMMENTS

ADDITIONAL SARA REGULATORY COMPLIANCE INFORMATION
SEC. 312 HAZARD CLASS: NONE.
SEC. 313 NOTIFICATION: NOT APPLICABLE - EITHER NONE PRESENT OR NONE PRESENT IN REGULATED QUANTITIES.

SECTION XII - COMMENTS

SUPPLEMENTAL STATE COMPLIANCE INFORMATION

PENNSYLVANIA:	1%	7631869	SILICA, AMORPHOUS
		7732185	WATER
		63148629	POLYDIMETHYLSILOXANE
MASSACHUSETTS:	1%	7631869	SILICA, AMORPHOUS
NEW JERSEY:	1%	7631869	SILICA, AMORPHOUS, FUMED; #1655
PREVAILING COMPONENTS SAME AS PENNSYLVANIA ABOVE PLUS:			
		9004675	METHYL CELLULOSE
		9005714	SORBITAN (EO GLYCOL),-TRISTEARATE
		31566311	GLYCERYL MONOSTEARATE

THESE DATA ARE OFFERED IN GOOD FAITH AS TYPICAL VALUES AND NOT AS A PRODUCT SPECIFICATION. NO WARRANTY, EITHER EXPRESSED OR IMPLIED, IS HEREBY MADE. THE RECOMMENDED INDUSTRIAL HYGIENE AND SAFE HANDLING PROCEDURES ARE BELIEVED TO BE GENERALLY APPLICABLE. HOWEVER, EACH USER SHOULD REVIEW THESE RECOMMENDATIONS IN THE SPECIFIC CONTEXT OF THE INTENDED USE AND DETERMINE WHETHER THEY ARE APPROPRIATE.

PREPARED BY: JACK L. SHENEBERGER
LAST REVISION DATE: MARCH 16, 1990
PREVIOUS REVISION DATE: APRIL 8, 1987
DATE: MARCH 02, 1992
(R) INDICATES REGISTERED OR TRADEMARK OF THE DOW CORNING CORPORATION.

OxyChem®

DATA SHEET NO. 3

MATERIAL SAFETY DATA SHEET

MSDS NUMBER : M7695

MSDS DATE : 02-01-93

PRODUCT NAME : MURIATIC ACID 20 COMMERCIAL

24 HOUR EMERGENCY PHONE: 1-800-733-3665 OR 716-278-7021

I. PRODUCT IDENTIFICATION

HMIS HAZARD RATINGS

HEALTH HAZARD 3 FIRE HAZARD 0 REACTIVITY 2

Based on the National Paint & Coatings Association HMIS rating system.

SARA/TITLE III HAZARD CATEGORIES (See Section X)

Immediate (ACUTE) Health: YES
Delayed (Chronic) Health: NO
Fire Hazard: NO
Reactive Hazard: YES
Sudden Release of Pressure: NO

MANUFACTURER'S NAME AND ADDRESS: Occidental Chemical Corporation
Customer Service, Occidental Tower,
P O Box 809050, Dallas, Texas 75380
Telephone (1-800-752-5151)

CHEMICAL NAME: Hydrochloric Acid CAS NUMBER: 7647-01-0

SYNONYMS/COMMON NAMES: HCl; Aqueous Hydrogen Chloride, Muriatic Acid

CHEMICAL FORMULA: HCl

DOT PROPER SHIPPING NAME: Hydrochloric Acid

DOT HAZARD CLASS: Corrosive Material

DOT I.D. NUMBER: UN1789

DOT HAZARDOUS SUBSTANCE: RQ5000#

II. HEALTH HAZARD INFORMATION

EMERGENCY AND FIRST AID PROCEDURES

EYES:

OBJECT IS TO FLUSH MATERIAL OUT IMMEDIATELY THEN SEEK MEDICAL ATTENTION. IMMEDIATELY flush eyes with large amounts of water for at least 15 minutes holding lids apart to ensure flushing of the entire eye surface. Washing eyes within seconds is essential to achieve maximum effectiveness. SEEK MEDICAL ATTENTION IMMEDIATELY.

SKIN:

IMMEDIATELY wash contaminated areas with plenty of soap and water for at least 15 minutes. A soothing ointment may be applied to irritated skin after thorough cleansing. Remove contaminated clothing and footwear and wash clothing before reuse. Discard footwear which cannot be decontaminated. SEEK MEDICAL ATTENTION IMMEDIATELY.

CAS - Chemical Abstract Service Number
PEL - Other Permissible Exposure Limit
TLV - ACGIH Threshold Limit Value, Current
NE - No relevant information found or not available
CERP - Corporate Exposure Limit
* - See Chronic Effects Information
NA - Not applicable

IMPORTANT: The information presented herein, while not guaranteed, was prepared by competent technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY, OR GUARANTY, EXPRESS OR IMPLIED IS MADE REGARDING PERFORMANCE, STABILITY, OR SYNEGRICS. This information is not intended to be all-inclusive as to the manner and conditions of use, handling and storage. [illegible] handling and use [illegible]

II. HEALTH HAZARD INFORMATION (Continued)

INHALATION:
Remove to fresh air: if breathing is difficult, have trained person administer oxygen. If respiration stops, give mouth-to-mouth resuscitation. GET MEDICAL ATTENTION.

INGESTION:
NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. If available, give several glasses of milk. Keep airway clear. SEEK MEDICAL ATTENTION IMMEDIATELY.

ROUTES OF EXPOSURE

INHALATION:
Inhalation of gas, mist, fog, or spray will cause severe irritation of the upper respiratory tract, resulting in coughing, burning of the throat, and a choking sensation. If inhaled deeply, edema of the lungs may occur.

SKIN:
Irritating and corrosive to skin and can cause severe burns if not promptly washed off. Repeated contact of the skin may lead to the development of dermatitis.

EYE CONTACT:
This product rapidly causes severe irritation of the eyes and eyelids. If the acid is not quickly removed by thorough irrigation with water, there may be prolonged or permanent visual impairment or total loss of sight. Hydrogen chloride gas escaping from the aqueous solution is immediately irritating to the eyes.

INGESTION:
This product causes severe burns of mucous membranes of the mouth, esophagus, and stomach if swallowed.

EFFECTS OF OVEREXPOSURE

ACUTE:
Strongly irritating and corrosive to the eyes, skin, mouth, and digestive system. Vapors are irritating to the respiratory tract; excessive exposure may cause more severe symptoms including pulmonary edema.

The local dermal effect may consist of multiple areas of superficial destruction of the skin or of primary irritant dermatitis. Similarly, inhalation of spray, mist, or vapor may result in varying degrees of irritation or damage to the respiratory tract tissues and an increased susceptibility to respiratory illness. Prolonged or repeated exposure to concentrations in excess of the TLV may cause discoloration and/or erosion of the teeth.

CHRONIC:
No known chronic health effects.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:
Any acute or chronic respiratory condition.

TOXICOLOGY DATA:

Hydrochloric Acid		
Acute Oral LD50	(rabbit)	900 mg/kg
Acute Inhalation LC50	(rat, 1hr)	3124 ppm
Corrosivity	(rabbit)	0.01%-15% Concentration Non- Corrosive
Corrosivity	(rabbit)	>15% Concentration Corrosive

III. IMPORTANT COMPONENTS

CAS NUMBER / NAME
7732185 Water

EXPOSURE LIMITS
PEL=Not Established
TLV=Not Established

PERCENTAGE
VOL 78.30-82
WT 64-69

COMMON NAMES:

Listed On(List Legend Below):
19 23

7647010 Hydrochloric acid

EXPOSURE LIMITS
PEL=5 ppm; 7 mg/m3, Ceiling (15 min)
TLV=5 ppm; 7.5 mg/m3, Ceiling (15 min)

PERCENTAGE
VOL 18-21.70
WT 31-36

COMMON NAMES:
HYDROGEN CHLORIDE

Listed On(List Legend Below):
01 02 13 18 21

All components of this product that are required to be on the TSCA Inventory are listed on the inventory.

Not listed as carcinogen - IARC, NTP, OSHA

LIST LEGEND

1 SARA EXTR HAZ SUB, SECTION 302	2 SARA TOXIC CHEM, SECTION 313
13 PA ENVIROMENTAL HAZ SUBSTANCE	18 NY HAZARDOUS SUBSTANCES
19 PA REQUIREMENT- 3% OR GREATER	21 NJ SPECIAL HEALTH HAZ SUB
23 NJ REQUIREMENT- 1% OR GREATER	

IV. FIRE AND EXPLOSION DATA

FLASH POINT: NA AUTOIGNITION TEMPERATURE: NA

FLAMMABLE LIMITS IN AIR, % BY VOLUME- UPPER: Nonflammable
LOWER: Nonflammable

EXTINGUISHING MEDIA:
Hydrogen chloride is non-combustible. Carbon dioxide, dry chemical and foam may all be used in areas where hydrogen chloride is stored.

SPECIAL FIRE FIGHTING PROCEDURES:
Positive pressure, self-contained respiratory protection should be provided for fire fighters in buildings or confined areas where this product is stored.

UNUSUAL FIRE AND EXPLOSION HAZARD:
This product is nonflammable and nonexplosive under normal conditions of use. At high temperatures, this product can generate toxic and irritating gases. If storage containers are exposed to excessive heat, over-pressurization and rupture of the containers can result. The use of water on this product should be discouraged. Addition of water may cause violent reaction.

This product attacks most metals with evolution of explosive hydrogen gas.

V. SPECIAL PROTECTION

VENTILATION REQUIREMENTS:

Work in well ventilated areas. Use good engineering controls. Use local exhaust ventilation where mist, spray, gas, vapors, or fumes may be generated.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY:

Use a NIOSH/MSHA approved respirator following manufacturer's recommendation where gas, vapor, fumes, spray, or mist may be generated.

EYE:

Wear chemical safety goggles plus full face shield to protect against splashing when appropriate (ANSI Z87.1).

GLOVES:

Wear chemical resistant gloves such as natural rubber, neoprene, nitrile or PVC.

OTHER CLOTHING AND EQUIPMENT:

Impervious and chemical resistant clothing and rubber shoes or boots should be used where any possibility of skin contact exists. Emergency shower and eyewash facility should be in close proximity (ANSI Z358.1).

VI. PHYSICAL DATA

	20 °Be'	22°Be'
BOILING POINT @ 760 mm Hg:	176°F 80°C	140°F 60°C
FREEZING POINT:	-49.3°F -45°C	-29.2°F -34°C
SPECIFIC GRAVITY (H_2O=1):	1.16	1.18
DENSITY:	1.16 gm/cc, 9.67 lb/gal	1.18 gm/cc 9.83 lb/gal
VAPOR PRESSURE @ 20°C:		80mm

SOLUBILITY IN H_2O % BY WT: Infinite

VAPOR DENSITY (Air=1): 1.3 @20C

APPEARANCE AND ODOR: Clear to slightly yellow liquid with a sharp irritating odor.

pH: 0.2% solution has a pH of ~2.

All data varies with concentration.

VII. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY:

Under normal conditions of use, this product is stable. Releases hydrogen chloride gas when heated.

INCOMPATIBILITY:

Avoid contacting this product with alkalies, alkali metals or other active metals and certain of their compounds. Do not add water directly to the product. The product may be added to water with mixing and dilution. Mixing with strong oxidizers can yield chlorine gas.

HAZARDOUS DECOMPOSITION PRODUCTS:

At high temperatures, this product generates toxic and irritating gases. Reacts with metals with the evolution of hydrogen which when mixed in air may result in fire or explosion if ignited. Chlorine gas may be released by mixing with strong oxidizers.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION:

Material is not known to polymerize.

VIII. HANDLING AND STORAGE

HANDLING AND STORAGE PRECAUTIONS:

When handling, wear chemical safety goggles and face shield, gloves and protective clothing.
Avoid breathing vapor, use with adequate ventilation - if exposure is likely, wear appropriate respiratory protection.
Wash thoroughly after handling.
Keep heat, sparks, open flames, pilot lights, and lighted cigarettes away from area of use as toxic, corrosive, and explosive gases may be formed.
Keep container tightly closed when not in use.
Store in cool, ventilated area away from flammable substances and oxidizing materials, particularly nitric acid or chlorates.
Open container carefully to avoid spurting.
DO NOT ADD WATER DIRECTLY TO PRODUCT, and do not mix with alkalies such as sodium hydroxide (caustic soda) or alkali metals, to avoid possible violent reaction. The product may be added to water with mixing and dilution.
Do not store in unlined containers. Leaking containers should be removed to outdoors or to an isolated and well ventilated area and contents transferred to a suitable container or disposed in a safe manner.
Dike and vent storage tanks.

IX. ENVIRONMENTAL PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

Proceed with caution and restrict access to area. Keep unprotected personnel up wind of spill area. Get protective clothing and equipment. Dike and contain spill and prevent from entering sewers and waterways. Contain spill and pump into marked containers for reclamation or disposal. For small spills or residue after pumping, neutralize with soda ash or dilute caustic soda solution or absorb with compatible substances much as sand or earth. Clean up material should be removed and placed in approved containers. Spills or releases should be reported, if required, to the appropriate local, state, and federal agencies.

WASTE DISPOSAL METHOD:

The materials resulting from clean-up operations may be hazardous wastes and, therefore, subject to specific regulations. Package, store, transport, and dispose of all clean-up materials and any contaminated equipment in accordance with all applicable federal, state, and local health and environmental regulations. Shipments of waste materials may be subject to manifesting requirements per applicable regulations. Appropriate disposal will depend on the nature of each waste material and should be performed by competent and properly permitted contractors. Ensure that all responsible federal, state, and local agencies receive proper notification of spill and disposal methods.

X. ADDITIONAL INFORMATION

Sec 311 of the Clean Water Act lists Muriatic Acid as a hazardous substance which, if discharged into or upon water, may required immediate response to mitigate danger to public health. Spills of Muriatic Acid of 5000 or more pounds must be reported to the National Response Center, 1-800-424-8802.

Contained on a composite list as required under Sec 101(14) of the Comprehensive Environmental Response, Compensation and Liability Act (Superfund) which includes substances designated pursuant to Sec. 3001 of the Solid Waste Disposal Act (RCRA), Sec. 307 of the Clean Water Act, Sec 112 of the Clean Air Act, Sec 7 of TSCA and Sec 102 of CERCLA.

[illegible] 29CFR 1910.1200 requires that information be [illegible]

the Comprehensive Environmental Response, Comp
Liability Act (Superfund) which includes substances designated pursuant to Sec. 3001 of the Solid Waste Disposal Act (RCRA), Sec. 307 of the Clean Water Act, Sec 112 of the Clean Air Act, Sec 7 of TSCA and Sec 102 of CERCLA.

OSHA Standard 29CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, material safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Material Safety Data Sheet available to your employees.

To aid our customers in complying with regulatory requirements, SARA Title III hazard categories for this product are indicated in Section I. If the word "YES" appears next to any category, this product may be reportable by you under the requirements of 40 CFR Part 370. Please consult those regulations for details.

This product contains a toxic chemical or chemicals subject to the reporting requirements of SECTION 313 of TITLE III of the SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 and ,40 CFR PART 372. (See Section III,List Legend 02)

XI. PREPARATION INFORMATION

For additional Non-Emergency health, safety, or environmental information telephone (716) 286-3081, or write to:

Occidental Chemical Corporation
Product Stewardship Department
Suite 400
360 Rainbow Boulevard South
Niagara Falls, NY 14302

For Emergencies: 24 HOUR EMERGENCY PHONE: 1-800-733-3665

This MSDS replaces MSDS Number M7695 dated 06/21/89.

WARNING LABEL INFORMATION

SIGNAL WORD: DANGER

STATEMENT OF HAZARDS:

CORROSIVE
CAUSES SEVERE BURNS TO EYES, SKIN, AND DIGESTIVE TRACT
SEVERELY IRRITATING TO RESPIRATORY TRACT - EXCESSIVE EXPOSURE MAY CAUSE LUNG DAMAGE.
MAY CAUSE DISCOLORATION AND EROSION OF TEETH

PRECAUTIONARY STATEMENTS:

Keep container closed except when transferring material.
Do not breathe vapor.
Insure adequate ventilation or use an approved respirator.
Do not get in eyes, on skin, on clothing.
Use goggles, face shield, and rubber shoes. Wear protective clothing and gloves made of vinyl, neoprene, or rubber.
Wash thoroughly after handling.
Material in contact with metals may liberate toxic and flammable gases.
In presence of moisture, material in contact with metals may release flammable hydrogen gas.
Do not allow entry to sewers or waterways.

FIRST AID:

FOR EYES:

OBJECT IS TO FLUSH MATERIAL OUT IMMEDIATELY THEN SEEK MEDICAL ATTENTION. IMMEDIATELY flush eyes with large amounts of water for at least 15 minutes holding lids apart to ensure flushing of the entire eye surface. Washing eyes within seconds is essential to achieve maximum effectiveness. SEEK MEDICAL ATTENTION IMMEDIATELY.

FOR SKIN:

IMMEDIATELY wash contaminated areas with plenty of soap and water for at least 15 minutes. A soothing ointment may be applied to irritated skin after thorough cleansing. Remove contaminated clothing and footwear and wash clothing before reuse. Discard footwear which cannot be decontaminated. SEEK MEDICAL ATTENTION IMMEDIATELY.

IF INHALED:

Remove to fresh air. If breathing is difficult, trained person administer oxygen. If respiration stops, give mouth-to-mouth resuscitation. GET MEDICAL ATTENTION.

IF SWALLOWED:

NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. If available, give several glasses of milk. Keep airway clear. SEEK MEDICAL ATTENTION IMMEDIATELY.

WARNING LABEL INFORMATION (Continued)

SPILL OR LEAK:

Get protective equipment. Contain spill and pump into marked container for reclamation or disposal. Avoid discharges to sewers and streams. Spills of 5000 pounds or more must be reported to the National Response Center. 1-800-424-8802.

FIRE:

Material will not burn. Use extinguishing medium as appropriate for surrounding fire. Use self-contained breathing apparatus and full protective equipment fire will liberate toxic gases. ADDITION OF WATER MAY CAUSE VIOLENT REACTION.

HANDLING AND STORAGE:

Store in a cool, dry, well-ventilated area away from metals and strong alkalies, flammable substances and oxidizing materials.
Dike and vent storage tanks.
Do not add water directly to product, do not mix with alkalies or alkali metals.
Do not store in unlined containers.

DISPOSAL:

Submit to an approved chemical disposal service for disposal in accordance with government regulations.

INFORMATION REQUIRED BY FEDERAL, STATE OR LOCAL REGULATIONS:

This product contains:

CAS#	NAME
7732185	Water
7647010	Hydrochloric acid

HMIS RATING SYSTEM: HEALTH 3 FLAMMABILITY 0 REACTIVITY 2

FOR INDUSTRIAL USE ONLY **LABEL 023M7695**

For additional information see Material Safety Data Sheet (MSDS) for this product.

OxyChem®

Responsible Care® A Public Commitment

MATERIAL SAFETY DATA SHEET

DATA SHEET NO. 4

MSDS NUMBER : M4806

MSDS DATE : 04-12-93

PRODUCT NAME : 50% CAUSTIC SODA-DIAPHRAGM

24 HOUR EMERGENCY PHONE: 1-800-733-3665 OR 716-278-7021

I. PRODUCT IDENTIFICATION

HMIS HAZARD RATINGS

HEALTH HAZARD 3 FIRE HAZARD 0 REACTIVITY 2

Based on the National Paint & Coatings Association HMIS rating system

SARA/TITLE III HAZARD CATEGORIES (See Section X)

Immediate (ACUTE) Health: YES
Delayed (Chronic) Health: NO
Fire Hazard: NO
Reactive Hazard: YES
Sudden Release of Pressure: NO

MANUFACTURER'S NAME AND ADDRESS: Occidental Chemical Corporation
Customer Service, Occidental Tower,
P O Box 809050, Dallas, Texas 75380
Telephone (1-800-752-5151)

CHEMICAL NAME: Sodium Hydroxide CAS NUMBER: 1310-73-2

SYNONYMS/COMMON NAMES: Sodium Hydroxide; NaOH

CHEMICAL FORMULA: NaOH

DOT PROPER SHIPPING NAME: Sodium Hydroxide, Liquid

DOT HAZARD CLASS: Corrosive Material

DOT I.D. NUMBER: UN1824

DOT HAZARDOUS SUBSTANCE: RQ 1000 lbs.

II. HEALTH HAZARD INFORMATION

EMERGENCY AND FIRST AID PROCEDURES

EYES:

OBJECT IS TO FLUSH MATERIAL OUT IMMEDIATELY THEN SEEK MEDICAL ATTENTION. IMMEDIATELY flush eyes with large amounts of water for at least 15 minutes, holding lids apart to ensure flushing of entire surface. Washing eyes within several seconds is essential to achieve maximum effectiveness. SEEK MEDICAL ATTENTION IMMEDIATELY.

CAS = Chemical Abstract Service Number
PEL = OSHA Permissible Exposure Limit
TLV = ACGIH Threshold Limit Value, Current
NA = No relevant information found or not available
CORP = Corporate Exposure Limit
* = See Chronic Effects Information
NE = Not available

IMPORTANT: The information presented herein, while not guaranteed, was prepared by competent technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY, OR GUARANTY, EXPRESS OR IMPLIED IS MADE REGARDING PERFORMANCE, STABILITY, OR OTHERWISE. This information is not intended to be all-inclusive as to the manner and conditions of use, handling and storage. Other factors may involve other or additional safety or performance considerations. While our technical personnel will be happy to respond to questions regarding safe handling and use procedures, safe handling and use remains the responsibility of the customer. No recommendations for use are intended or, and nothing herein shall

II. HEALTH HAZARD INFORMATION (Continued)

SKIN:

IMMEDIATELY wash with plenty of water for at least 15 minutes. Remove contaminated clothing and footwear. Wash clothing before reuse and discard footwear which cannot be decontaminated. SEEK MEDICAL ATTENTION IMMEDIATELY.

INHALATION:

Remove to fresh air; if breathing is difficult have trained person administer oxygen. If respiration stops, give mouth-to-mouth resuscitation. GET MEDICAL ATTENTION.

INGESTION:

NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. If available, give several glasses of milk. If vomiting occurs spontaneously, keep airway clear. SEEK MEDICAL ATTENTION IMMEDIATELY.

ROUTES OF EXPOSURE

INHALATION:

Breathing dust, mist or spray may cause damage to the upper respiratory tract and lung tissue proper which could produce chemical pneumonia, depending upon severity of exposure.

SKIN:

Contact produces severe burns and destroys tissues. Irritation may be delayed.

EYE CONTACT:

Causes severe burns that result in damage to the eyes and possibly blindness.

INGESTION:

Causes severe burns to mucous membranes of the mouth, throat, esophagus, and stomach.

EFFECTS OF OVEREXPOSURE

ACUTE:

Corrosive to all body tissues by all routes of exposure. The effect of local dermal exposure may consist of multiple areas of superficial destruction of the skin or of primary irritant dermatitis. Similarly, inhalation of dust, spray, or mist may result in varying degrees of irritation or damage to the respiratory tract tissues and an increased susceptibility to respiratory illness.

CHRONIC:

No known chronic effects.

TOXICOLOGY DATA:

Caustic soda is a corrosive material.
Acute Dermal LD50 (rabbit) 1350 mg/kg

Human Dermal Exposure

Regardless of concentrations, the severity of damage and extent of its irreversibility increases with length of contact time. Prolonged contact with sodium hydroxide solutions of =>1% can cause a high degree of tissue destruction. The latent period following skin contact during which no sensation of irritation occurs, varies from several hours for 0.4 - 4% solution to 3 minutes with concentrations of 25% or greater.

III. IMPORTANT COMPONENTS

CAS NUMBER / NAME
7732185 Water

EXPOSURE LIMITS	PERCENTAGE	
PEL=Not Established	VOL	ND
TLV=Not Established	WT	48.50-91

COMMON NAMES:

Listed On(List Legend Below):
19 23

1310732 Sodium hydroxide (Na(OH))

EXPOSURE LIMITS	PERCENTAGE	
PEL=2 mg/m3, Ceiling	VOL	ND
TLV=2 mg/m3, Ceiling	WT	9-51.50

COMMON NAMES:
CAUSTIC SODA

Listed On(List Legend Below):
13 18 21

7647145 Sodium chloride (NaCl)

EXPOSURE LIMITS	PERCENTAGE	
PEL=None established	VOL	ND
TLV=None established	WT	0-1.30

COMMON NAMES:
SALT

Listed On(List Legend Below):
23

7775099 Chloric acid, sodium salt

EXPOSURE LIMITS	PERCENTAGE	
PEL=Not Established	VOL	ND
TLV=Not Established	WT	0-0.30

COMMON NAMES:
SODIUM CHLORATE

Listed On(List Legend Below):
12 21

All components of this product that are required to be on the TSCA inventory are listed on the inventory.

Not listed as carcinogen - IARC, NTP, OSHA

LIST LEGEND

12 PA HAZARDOUS SUBSTANCE	13 PA ENVIROMENTAL HAZ SUBSTANCE
18 NY HAZARDOUS SUBSTANCES	19 PA REQUIREMENT- 3% OR GREATER
21 NJ SPECIAL HEALTH HAZ SUB	23 NJ REQUIREMENT- 1% OR GREATER

IV. FIRE AND EXPLOSION DATA

FLASH POINT: NA AUTOIGNITION TEMPERATURE: Nonflammable

FLAMMABLE LIMITS IN AIR, % BY VOLUME- UPPER: NA
LOWER: NA

EXTINGUISHING MEDIA:

This product is not combustible. Foam, carbon dioxide or dry chemical may be used where this product is stored.

SPECIAL FIRE FIGHTING PROCEDURES:

Wear full protective clothing. Avoid direct contact of this product with water as this can cause a violent exothermic reaction.

UNUSUAL FIRE AND EXPLOSION HAZARD:

Direct contact with water can cause violent exothermic reaction.

V. SPECIAL PROTECTION

VENTILATION REQUIREMENTS:

Special ventilation is not required under normal use. Use local exhaust ventilation where dust, mist, or spray may be generated. NOTE: Where carbon monoxide or other reaction products may be generated, special ventilation may be required.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY:

Respiratory protection is not required under normal use. Use NIOSH/MSHA approved respirators where dust, mist, or spray may be generated.

EYE:

Wear chemical safety goggles plus full face shield to protect against splashing (ANSI Z87.1).

GLOVES:

Wear chemical resistant gloves such as natural and butyl rubber. Gloves may be decontaminated by washing with mild soap and water.

OTHER CLOTHING AND EQUIPMENT:

Impervious protective clothing and chemically resistant safety shoes should be worn to minimize contact. Wash contaminated clothing with soap and water and dry before reuse. Emergency shower and eyewash facility should be in close proximity. (ANSI Z358.1).

VI. PHYSICAL DATA

PHYSICAL STATE: LIQUID	Concentration, Weight % 10	20	30	40	50
BOILING POINT @ 760 mm Hg, °C:	110	113	119	129	144
FREEZING POINT, °C:	-10	-32	0	15	12
VAPOR PRESSURE, mm Hg @ 60°C:	135	110	76	46	13
SPECIFIC GRAVITY @15.6°C/15.6°C:	1.11	1.22	1.33	1.43	1.53
DENSITY, lbs/gallon @ 15.6°C/15.6°C:	9.27	10.20	11.11	11.97	12.76

SOLUBILITY IN H2O, % by Wt: ...completely soluble

VAPOR DENSITY (Air = 1): Not Applicable

APPEARANCE AND ODOR: Clear liquid with no distinct odor

ODOR THRESHOLD (PPM): Not Available

EVAPORATION RATE: Not Known

COEFFICIENT WATER/OIL DISTRIBUTION: Not Available

pH: 7.5% solution has pH 14.0

VII. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY:
Under normal conditions, this product is stable.

INCOMPATIBILITY:
See Section VIII. Avoid contact with water. This product may be added slowly to water or acids with dilution and constant stirring to avoid a violent exothermic reaction. When handling this product, avoid contact with aluminum, tin, zinc, and alloys containing these metals. Do not mix with strong acids without dilution and agitation to prevent violent or explosive reaction. Avoid contact with leather, wool, acids, organic halogen compounds and organic nitro compounds.

HAZARDOUS DECOMPOSITION PRODUCTS:
None known.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION:
Material is not known to polymerize.

VIII. HANDLING AND STORAGE

HANDLING AND STORAGE PRECAUTIONS:

Do not get into eyes, on skin, on clothing.
Avoid breathing dust, mists, or spray.
Do not take internally.
Use with adequate ventilation and wear respiratory protection when exposure to dust, mist or spray is possible.
When handling, wear chemical splash goggles, face shield, rubber gloves and protective clothing.
Wash thoroughly after handling or contact - exposure can cause burns which are not immediately painful or visible.
Keep container closed.
Product can react violently with water, acids, and other substances - read Special Mixing and Handling Instructions below carefully before using.
Product is corrosive to tin, aluminum, zinc and alloys containing these metals, and will react violently with these metals in powder form.
Hazardous carbon monoxide gas can form upon contact with food and beverage products in enclosed spaces and can cause death. Follow appropriate tank entry procedures (ANSI Z117.1).

SPECIAL MIXING AND HANDLING INSTRUCTIONS

Product can react violently with water. Considerable heat is generated when product is mixed with water. Therefore, when making solutions always carefully follow these steps:

ALWAYS wear ALL protective clothing described above. NEVER add water to product. ALWAYS add product - with constant stirring - slowly to surface of lukewarm (80-100°F) water, to assure product is being completely dissolved as it is added.

If product is added too rapidly, or without stirring, and becomes concentrated at bottom of mixing vessel, excessive heat may be generated, resulting in DANGEROUS boiling and spattering and a possible IMMEDIATE AND VIOLENT ERUPTION of highly caustic solution.

NOTE: Never add more product than can be absorbed by solution while maintaining temperature below 200°F (@ sea level) to prevent boiling and spattering.

Product can react EXPLOSIVELY with acids, aldehydes, and many other organic chemicals - when mixing product with solutions containing such chemicals, follow all of above mixing instructions, and add product very gradually, while stirring constantly.

ALWAYS empty and clean containers of all residues before adding product, to avoid possible EXPLOSIVE reaction between product and unknown residue.

Returnable containers should be shipped in accordance with supplier's recommendations. Return shipments should comply with all federal, state, and DOT regulations. All residual caustic soda should be removed from containers prior to disposal.

IX. ENVIRONMENTAL PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

Leaks should be stopped. Spills should be contained and cleaned up immediately. Spills should be removed by using a vacuum truck. Neutralize remaining traces of material with any dilute inorganic acid such as hydrochloric, sulfuric, nitric phosphoric, and acetic acid. The spill area should then be flushed with water followed by liberal covering of sodium bicarbonate. All clean-up material should be removed and placed in approved containers, labeled and stored in a safe place to await proper treatment or disposal. Spills on areas other than pavement, e.g., dirt or sand, may be handled by removing the affected soils and placing in approved containers. Persons performing clean-up work should wear adequate personal protective equipment and clothing. Spills or releases should be reported, if required, to the appropriate local, state and federal regulatory agencies.

CAUTION: Caustic soda may react violently with acids and water.

WASTE DISPOSAL METHOD:

The materials resulting from clean-up operations may be hazardous wastes and, therefore, subject to specific regulations. Package, store, transport, and dispose of all clean-up materials and any contaminated equipment in accordance with all applicable federal, state, and local health and environmental regulations. Shipments of waste materials may be subject to manifesting requirements per applicable regulations. Appropriate disposal will depend on the nature of each waste material and should be performed by competent and properly permitted contractors. Ensure that all responsible federal, state, and local agencies receive proper notification of spill and disposal methods.

X. ADDITIONAL INFORMATION

OSHA Standard 29CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, material safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Material Safety Data Sheet available to your employees.

To aid our customers in complying with regulatory requirements, SARA Title III hazard categories for this product are indicated in Section I. If the word "YES" appears next to any category, this product may be reportable by you under the requirements of 40 CFR Part 370. Please consult those regulations for details.

XI. PREPARATION INFORMATION

For additional Non-Emergency health, safety, or environmental information telephone (716) 286-3081, or write to:

Occidental Chemical Corporation
Product Stewardship Department
Suite 400
360 Rainbow Boulevard South
Niagara Falls, NY 14302

For Emergencies: 24 HOUR EMERGENCY PHONE: 1-800-733-3665

This MSDS replaces MSDS Number M4806 dated 01/18/93

WARNING LABEL INFORMATION

SIGNAL WORD: DANGER

STATEMENT OF HAZARDS:

CAUSES SEVERE BURNS TO SKIN, EYES AND MUCOUS MEMBRANES.
CONTACT WITH EYES CAN CAUSE PERMANENT EYE DAMAGE.
INHALATION OF DUST, MIST, OR SPRAY CAN CAUSE SEVERE LUNG DAMAGE.
CAN REACT VIOLENTLY WITH WATER, ACIDS, AND OTHER SUBSTANCES.

PRECAUTIONARY STATEMENTS:

Do not get into eyes, on skin, on clothing.
Avoid breathing dust, mist, or spray.
Do not take internally.
Use with adequate ventilation and employ respiratory protection when exposure to dust, mist, or spray is possible.
When handling, wear chemical splash goggles, face shield, rubber gloves and protective clothing.
Wash thoroughly after handling or contact - exposure can cause burns which are not immediately painful or visible.
Keep container closed.
Product can react violently with water, acids, and other substances - read Handling and Storage instructions carefully before using.
Product is corrosive to tin, aluminum, zinc, and alloys containing these metals, and will react violently with these metals in powder form.
Hazardous carbon monoxide gas can form upon contact with food and beverage products in enclosed spaces and can cause death. Follow appropriate tank entry procedures.

FIRST AID:

FOR EYES:

OBJECT IS TO FLUSH MATERIAL OUT IMMEDIATELY THEN SEEK MEDICAL ATTENTION. IMMEDIATELY flush eyes with large amounts of water for at least 15 minutes forcibly holding lids apart to ensure flushing of entire surface. Washing eyes within several seconds is essential to achieve maximum effectiveness. SEEK MEDICAL ATTENTION IMMEDIATELY.

FOR SKIN:

IMMEDIATELY wash with plenty of water for at least 15 minutes. Remove contaminated clothing and footwear. Wash clothing before reuse and discard footwear which cannot be decontaminated. SEEK MEDICAL ATTENTION IMMEDIATELY.

IF INHALED:

Remove to fresh air. If breathing is difficult, have trained person administer oxygen. If respiration stops, give mouth-to-mouth resuscitation. GET MEDICAL ATTENTION.

IF SWALLOWED:

NEVER GIVE ANYTHING NY MOUTH TO AN UNCONSCIOUS PERSON. If swallowed, DO NOT INDUCE VOMITING . Give large quantities of water. If available, give several glasses of milk. If vomiting occurs spontaneously, keep airway clear. SEEK MEDICAL ATTENTION IMMEDIATELY.

IN CASE OF:

SPILL OR LEAK:

Leaks should be stopped. Spills, after containment, should be shoveled up or removed by vacuum truck (if liquid) to chemical waste area. Neutralize residue with dilute acid, flush spill area with water followed by liberal covering of sodium bicarbonate. Dispose of wash water and spill by-products according to federal, state, and local regulations.

WARNING LABEL INFORMATION (Continued)

HANDLING AND STORAGE:

Considerable heat is generated when product is mixed with water. Therefore, when making solutions always carefully follow these steps:

ALWAYS wear ALL prescribed protective clothing. NEVER add water to product. ALWAYS add product - with constant stirring - slowly to surface of lukewarm (80-100°F) water, to assure product is being completely dissolved as it is added.

If product is added too rapidly, or without stirring, and becomes concentrated at bottom of mixing vessel, excessive heat may be generated, resulting in DANGEROUS boiling and spattering and a possible IMMEDIATE AND VIOLENT ERUPTION of highly caustic solution.

NOTE: Never add more product than can be absorbed by solution while maintaining temperature below 200°F (@ sea level) to prevent boiling and spattering.

Product can react EXPLOSIVELY with acids, aldehydes, and many other organic chemicals - when mixing product with solutions containing such chemicals, follow all of above mixing instructions, and add product very gradually, while stirring constantly.

ALWAYS empty and clean containers of all residues before adding product, to avoid possible EXPLOSIVE reaction between product and unknown residue.

Returnable containers should be shipped in accordance with supplier's recommendations. Return shipments should comply with all federal, state, and DOT regulations. All residual caustic soda should be removed from containers prior to disposal.

DISPOSAL:

The materials resulting from clean-up operations may be hazardous wastes and, therefore, subject to specific regulations. Package, store, transport, and dispose of all clean-up materials and any contaminated equipment in accordance with all applicable federal, state, and local health environmental regulations. Shipments of waste materials may be subject to manifesting requirements per applicable regulations. Appropriate disposal will depend on the nature of each waste material and should be performed by competent and properly permitted contractors. Ensure that all responsible federal, state, and local agencies receive proper notification of disposal.

INFORMATION REQUIRED BY FEDERAL, STATE OR LOCAL REGULATIONS:

This product contains:

CAS#	NAME
7732185	Water
1310732	Sodium hydroxide (Na(OH))
7647145	Sodium chloride (NaCl)
7775099	Chloric acid, sodium salt

HMIS RATING SYSTEM: HEALTH 3 FLAMMABILITY 0 REACTIVITY 2

FOR INDUSTRIAL USE ONLY **LABEL 043M4806**

DATA SHEET NO. 5

MATERIAL SAFETY DATA SHEET

Ashland

ASHLAND CHEMICAL, INC.
Subsidiary Of Ashland Oil, Inc
P.O. BOX 2219
COLUMBUS, OHIO 43216
(614) 889-3333

24-HOUR Emergency Telephone
1(800) 274-5263
1(800) ASHLAND

002624

HYDROGEN PEROXIDE 35% TECH

Page:

THIS MSDS COMPLIES WITH 29 CFR 1910.1200 (THE HAZARD COMMUNICATION STANDARD)

****

Product Name: HYDROGEN PEROXIDE 35% TECH
CAS NUMBER: 7722-84-1

Data Sheet No: 0004061-005.000
Prepared: 09/25/90
Supersedes: 03/04/86

CASCADE COLUMBIA DISTRIBUTION
P O BOX 9247 QUEEN ANNE STN
SEATTLE WA 98109

ATTN: PLANT MGR./SAFETY DIR.

05 50 108 1581040-

PRODUCT: 3473010
INVOICE: 411100
INVOICE DATE: 03/15/93
TO: CASCADE COLUMBIA DISTRIBUTION
3231 17TH AVENUE WEST
SEATTLE WA 98119

SECTION I - PRODUCT IDENTIFICATION

General or Generic ID: PEROXIDE

DOT Hazard Classification: OXIDIZER (173.151)

SECTION II - COMPONENTS

IF PRESENT, IARC, NTP AND OSHA CARCINOGENS AND CHEMICALS SUBJECT TO THE REPORTING REQUIREMENTS OF SARA TITLE III SECTION 313 ARE IDENTIFIED IN THIS SECTION.
SEE DEFINITION PAGE FOR CLARIFICATION

INGREDIENT	% (by WT)	PEL	TLV	Note
HYDROGEN PEROXIDE CAS #: 7722-84-1	35	1 PPM	1 PPM	
WATER CAS #: 7732-18-5	65			

SECTION III - PHYSICAL DATA

Boiling Point	for PRODUCT	226.00 Deg F (107.77 Deg C) @ 760.00 mm Hg
Vapor Pressure	for PRODUCT	23.00 mm Hg @ 86.00 Deg F (30.00 Deg C)
Specific Vapor Density	AIR = 1	.9
Specific Gravity		1.133 @ 68.00 Deg F (20.00 Deg C)
Percent Volatiles		100.00%
Evaporation Rate	(N-BUTYL ACETATE = 1)	< 1.00

SECTION IV - FIRE AND EXPLOSION INFORMATION

FLASH POINT NOT APPLICABLE

EXPLOSIVE LIMIT NOT APPLICABLE

EXTINGUISHING MEDIA: WATER FOG

HAZARDOUS DECOMPOSITION PRODUCTS: NOT APPLICABLE

FIREFIGHTING PROCEDURES: WEAR SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN THE POSITIVE PRESSURE DEMAND MODE AND FULL BODY PROTECTION WHEN FIGHTING FIRES.

SPECIAL FIRE & EXPLOSION HAZARDS: DECOMPOSITION CAN RELEASE OXYGEN WHICH SUPPORTS COMBUSTION AND REDUCES THE EFFECTIVENESS OF SUFFOCATION TYPE FIRE EXTINGUISHERS.

THIS MATERIAL IS A POWERFUL OXIDIZER. CONTACT WITH COMBUSTIBLE MATERIALS CAN RESULT IN FIRE OR EXPLOSION.

NFPA CODES: HEALTH- 2 FLAMMABILITY- 0 REACTIVITY- 1

OXIDIZING MATERIAL

SECTION V - HEALTH HAZARD DATA

THIS MATERIAL IS A POWERFUL OXIDIZER. CONTACT WITH COMBUSTIBLE MATERIALS CAN RESULT IN FIRE OR EXPLOSION.

NFPA CODES: HEALTH- 2 FLAMMABILITY- 0 REACTIVITY- 1

OXIDIZING MATERIAL

SECTION V-HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE LEVEL 1 PPM

THRESHOLD LIMIT VALUE 1 PPM

EFFECTS OF ACUTE OVEREXPOSURE:

EYES - CAN CAUSE SEVERE DAMAGE, EVEN BLINDNESS; EFFECTS MAY NOT BE IMMEDIATE, MAY BE DELAYED AS MUCH AS A WEEK.
SKIN - CAN CAUSE TEMPORARY BLEACHING, REDNESS, AND BLISTERING.
BREATHING - EXCESSIVE INHALATION OF VAPORS CAN CAUSE NASAL AND RESPIRATORY IRRITATION.
SWALLOWING - RESULTS IN EVOLUTION OF OXYGEN AND MAY CAUSE BLEEDING AND INJURY TO THE STOMACH AND ESOPHAGUS AS A RESULT OF SUDDEN DISTENTION.

FIRST AID:

IF ON SKIN: IMMEDIATELY FLUSH EXPOSED AREA WITH WATER FOR AT LEAST 15 MINUTES, GET MEDICAL ATTENTION. REMOVE

CONTINUED ON PAGE: 2

SECTION V-HEALTH HAZARD DATA (Continued)

CONTAMINATED CLOTHING. LAUNDER CONTAMINATED CLOTHING BEFORE RE-USE.

IN EYES: IMMEDIATELY FLUSH WITH LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES, LIFTING UPPER AND LOWER LIDS OCCASIONALLY. GET IMMEDIATE MEDICAL ATTENTION.

IF PHYSICIAN IS NOT IMMEDIATELY AVAILABLE, CONTINUE FLUSHING WITH WATER.

DO NOT USE CHEMICAL ANTIDOTE.

IF SWALLOWED: DO NOT INDUCE VOMITING. IMMEDIATELY DRINK TWO GLASSES OF WATER. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. CALL PHYSICIAN OR TRANSPORT TO AN EMERGENCY FACILITY.

IF BREATHED: IF AFFECTED, REMOVE INDIVIDUAL TO FRESH AIR. IF TIGHTNESS OR CONGESTION IN CHEST DEVELOPS, GET MEDICAL ATTENTION.

PRIMARY ROUTE(S) OF ENTRY:

INHALATION, SKIN CONTACT

SECTION VI-REACTIVITY DATA

HAZARDOUS POLYMERIZATION: CANNOT OCCUR

STABILITY: STABLE — AVOID HEAT, OPEN FLAME, AND PROLONGED STORAGE AT ELEVATED TEMPERATURES.

INCOMPATIBILITY: AVOID CONTACT WITH:, FERROUS METALS, COPPER, ORGANIC MATERIALS, COMBUSTIBLE MATERIALS, REDUCING AGENTS, CYANIDES

SECTION VII-SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

SMALL SPILL: IMMEDIATELY SOAK UP SPILL WITH PERLITE OR VERMICULITE. SWEEP UP WITH NON-SPARKING EQUIPMENT.

LARGE SPILL: PERSONS NOT WEARING PROTECTIVE EQUIPMENT SHOULD BE EXCLUDED FROM AREA OF SPILL UNTIL CLEAN-UP HAS BEEN COMPLETED. STOP SPILL AT SOURCE. DIKE AREA OF SPILL TO PREVENT SPREADING. PUMP LIQUID TO SALVAGE TANK. REMAINING LIQUID MAY BE TAKEN UP ON SAND, CLAY, EARTH, FLOOR ABSORBENT, OR OTHER ABSORBENT MATERIAL AND SHOVELED INTO CONTAINERS.

NOTIFY THE PROPER AUTHORITIES AS REQUIRED THAT A SPILL HAS OCCURRED.

WASTE DISPOSAL METHOD:

SMALL SPILL: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

LARGE SPILL: DISPOSE OF IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.

SECTION VIII-PROTECTIVE EQUIPMENT TO BE USED

RESPIRATORY PROTECTION: IF WORKPLACE EXPOSURE LIMIT(S) OF PRODUCT OR ANY COMPONENT IS EXCEEDED (SEE SECTION II), A NIOSH/MSHA APPROVED AIR SUPPLIED RESPIRATOR IS ADVISED IN ABSENCE OF PROPER ENVIRONMENTAL CONTROL. OSHA REGULATIONS ALSO PERMIT OTHER NIOSH/MSHA RESPIRATORS (NEGATIVE PRESSURE TYPE) UNDER SPECIFIED CONDITIONS (SEE YOUR SAFETY EQUIPMENT SUPPLIER). ENGINEERING OR ADMINISTRATIVE CONTROLS SHOULD BE IMPLEMENTED TO REDUCE EXPOSURE.

VENTILATION: PROVIDE SUFFICIENT MECHANICAL (GENERAL AND/OR LOCAL EXHAUST) VENTILATION TO MAINTAIN EXPOSURE BELOW TLV(S).

PROTECTIVE GLOVES: WEAR RESISTANT GLOVES SUCH AS:, NEOPRENE, POLYVINYL CHLORIDE, BUTYL RUBBER

OSHA REGULATIONS ALSO PERMIT OTHER NIOSH/MSHA RESPIRATORS (NEGATIVE PRESSURE TYPE) UNDER SPECIFIED CONDITIONS (SEE YOUR SAFETY EQUIPMENT SUPPLIER). ENGINEERING OR ADMINISTRATIVE CONTROLS SHOULD BE IMPLEMENTED TO REDUCE EXPOSURE.

VENTILATION: PROVIDE SUFFICIENT MECHANICAL (GENERAL AND/OR LOCAL EXHAUST) VENTILATION TO MAINTAIN EXPOSURE BELOW TLV(S).

PROTECTIVE GLOVES: WEAR RESISTANT GLOVES SUCH AS:, NEOPRENE, POLYVINYL CHLORIDE, BUTYL RUBBER

EYE PROTECTION: CHEMICAL SPLASH GOGGLES AND FACE SHIELD (8" MIN.) IN COMPLIANCE WITH OSHA REGULATIONS ARE ADVISED; HOWEVER, OSHA REGULATIONS ALSO PERMIT OTHER TYPE SAFETY GLASSES. (CONSULT YOUR SAFETY EQUIPMENT SUPPLIER)

OTHER PROTECTIVE EQUIPMENT: TO PREVENT SKIN CONTACT, WEAR IMPERVIOUS CLOTHING AND BOOTS.

SECTION IX-SPECIAL PRECAUTIONS OR OTHER COMMENTS

CONTAINERS OF THIS MATERIAL MAY BE HAZARDOUS WHEN EMPTIED, SINCE EMPTIED CONTAINERS RETAIN PRODUCT RESIDUES (VAPOR, LIQUID, AND/OR SOLID). ALL HAZARD PRECAUTIONS GIVEN IN THIS DATASHEET MUST BE OBSERVED.

THE INFORMATION ACCUMULATED HEREIN IS BELIEVED TO BE ACCURATE BUT IS NOT WARRANTED TO BE WHETHER ORIGINATING WITH THE COMPANY OR NOT. RECIPIENTS ARE ADVISED TO CONFIRM IN ADVANCE OF NEED THAT THE INFORMATION IS CURRENT, APPLICABLE, AND SUITABLE TO THEIR CIRCUMSTANCES.

MATERIAL SAFETY DATA SHEET

ASHLAND CHEMICAL, INC.
Subsidiary of Ashland Oil, Inc.
P.O. BOX 2219
COLUMBUS, OHIO 43216
(614) 889-3333

24-HOUR Emergency Telephone
1(800) 274-5263 or
1(800) ASHLAND

DEFINITIONS

This definition page is intended for use with Material Safety Data Sheets supplied by the Ashland Chemical Company. Recipients of these data sheets should consult the OSHA Safety and Health Standards (29 CFR 1910), particularly subpart G - Occupational Health and Environmental Control, and subpart I - Personal Protective Equipment, for general guidance on control of potential Occupational Health and Safety Hazards.

SECTION I
PRODUCT IDENTIFICATION

GENERAL OR GENERIC ID: Chemical family or product description.

DOT HAZARD CLASSIFICATION: Product meets DOT criteria for hazards listed.

SECTION II
COMPONENTS

Components are listed in this section if they present a physical or health hazard and are present at or above 1% in the mixture. If a component is identified as a CARCINOGEN by NTP, IARC, or OSHA as of the date on the MSDS, it will be listed and footnoted in this section when present at or above 0.1% in the product. Negative conclusions concerning carcinogenicity are not reported. Additional health information may be found in Section V. Components subject to the reporting requirements of Section 313 of SARA Title III are identified in the footnotes in this section, along with typical percentages. Other components may be listed if deemed appropriate.

Exposure recommendations are for components. OSHA Permissible Exposure Limits (PELS) and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) appear on the line with the component identification. Other recommendations appear as footnotes.

SECTION III
PHYSICAL DATA

BOILING POINT: Of product if known. The lowest value of the components is listed for mixtures.

VAPOR PRESSURE: Of product if known. The highest value of the components is listed for mixtures.

SPECIFIC VAPOR DENSITY: Compared to AIR = 1. If the Specific Vapor Density of a product is not known, the value is expressed as lighter or greater than air.

SPECIFIC GRAVITY: Compared to WATER = 1. If Specific Gravity of product is not known, the value is expressed as less than or greater than water.

pH: If applicable.

PERCENT VOLATILES: Percentage of material with initial boiling point below 425 degrees Fahrenheit and vapor pressure above 0.1mm Hg at 68 F.

EVAPORATION RATE: Indicated as faster or slower than ETHYL ETHER, unless otherwise stated.

SECTION IV
FIRE AND EXPLOSION DATA

FLASH POINT: Method identified.

EXPLOSION LIMITS: For product if known. The lowset value of the components is listed for mixtures.

HAZARDOUS DECOMPOSITION PRODUCTS: Known or expected hazardous products resulting from heating, burning or other reactions.

SECTION IV (cont)

EXTINGUISHING MEDIA: Following National Fire Protection Association criteria.

FIREFIGHTING PROCEDURES: Minimum equipment to protect firefighters from toxic products of vaporization, combustion or decomposition in fire situations. Other firefighting hazards may also be indicated.

SPECIAL FIRE AND EXPLOSION HAZARDS: States hazards not covered by other sections.

NFPA CODES: Hazard ratings assigned by the National Fire Protection Association.

SECTION V
HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE LIMIT: For product.

THRESHOLD LIMIT VALUE: For product.

EFFECTS OF ACUTE OVEREXPOSURE: Potential local and systemic effects due to single or short term overexposure to the eyes and skin or through inhalation or ingestion.

EFFECTS OF CHRONIC OVEREXPOSURE: Potential local and systemic effects due to repeated or long term overexposure to the eyes and skin or through inhalation or ingestion.

FIRST AID: Procedures to be followed when dealing with accidental overexposure.

PRIMARY ROUTE OF ENTRY: Based on properties and expected use.

SECTION VI
REACTIVITY DATA

HAZARDOUS POLYMERIZATION: Conditions to avoid to prevent hazardous polymerization resulting in a large release of energy.

STABILITY: Conditions to avoid to prevent hazardous or violent decomposition.

INCOMPATIBILITY: Materials and conditions to avoid to prevent hazardous reactions.

SECTION VII
SPILL OR LEAK PROCEDURES

Reasonable precautions to be taken and methods of containment, clean-up and disposal. Consult federal, state and local regulations for accepted procedures and any reporting or notification requirements.

SECTION VIII
PROTECTIVE EQUIPMENT TO BE USED

Protective equipment which may be needed when handling the product.

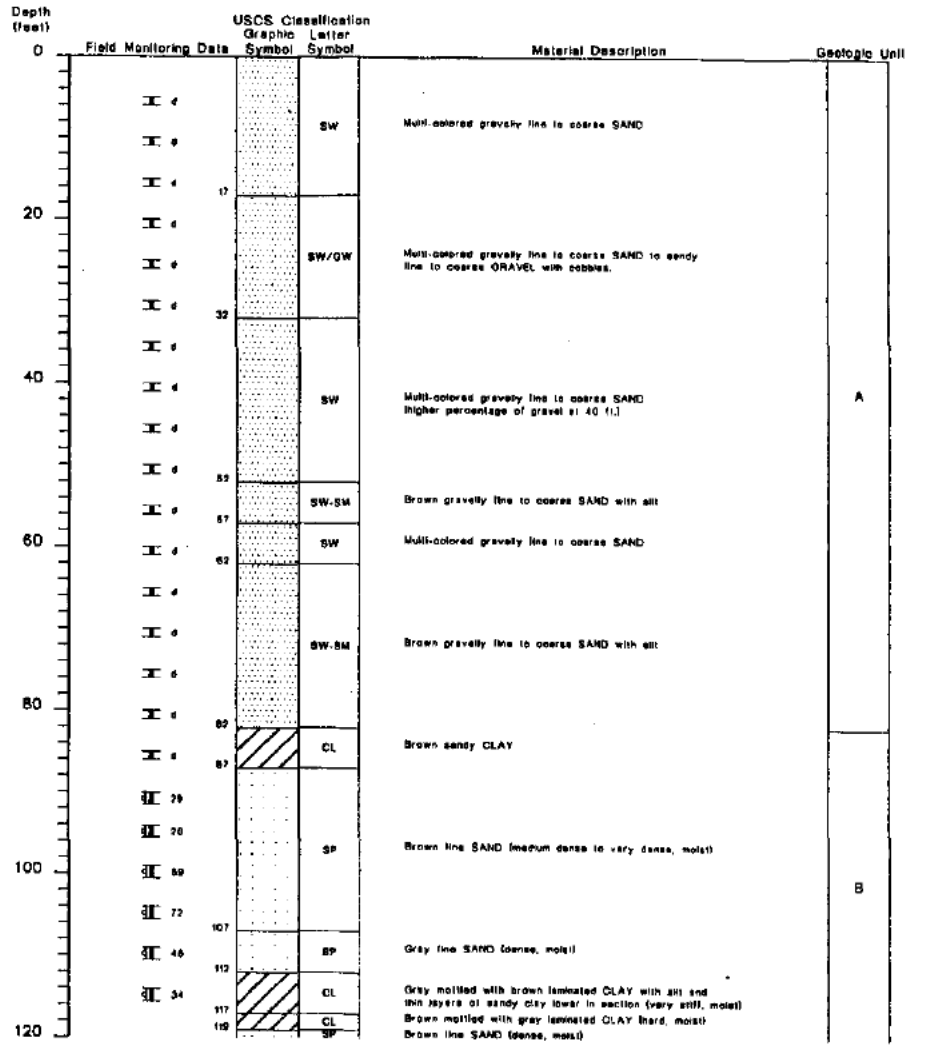
SECTION IX
SPECIAL PRECAUTIONS OR OTHER COMMENTS

Covers any relevant points not previously mentioned.

ADDITIONAL COMMENTS

Containers should be either reconditioned by CERTIFIED firms or properly disposed of by APPROVED firms. Disposal of containers should be in accordance with applicable laws and regulations. "EMPTY" drums should not be given to

Geologic Profile
Boring CP-E1



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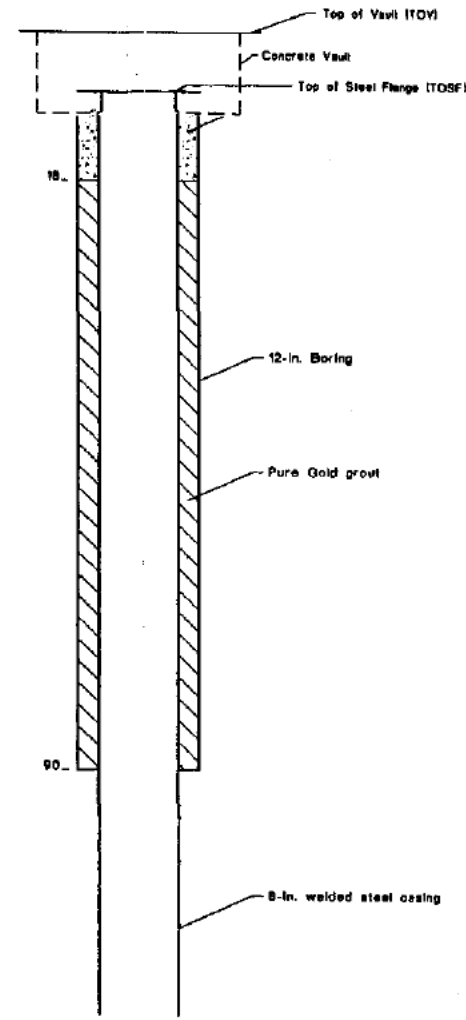
Pilot Extraction Well As-Built Diagram
CP-E1

1860.33 ft. MSL (TOV)
1854.06 ft. MSL (TOSF)



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Boring Log and Well Completion Diagram
For Extraction Well CP-E1

Figure D-1
(1 of 3)

134004.110 Spokane Co./Colbert Landfill/Operations & Maintenance Plan (M) 1/97

Geologic Profile
Boring CP-E1

Depth (feet)	Field Monitoring Data	USCS Classification Graphic Symbol	USCS Classification Letter Symbol	Material Description	Geologic Unit
120		122	SP	See previous page	
		124	CL	Brown mottled with light-brown CLAY (hard, moist)	B
	55	127	ML	Yellowish-brown laminated SILT with fine sand (hard, moist)	
	120		SW-SM	Multi-colored fine to coarse SAND with silt and trace fine gravel (very dark, moist)	
	140	137			
140	105	142	SP	Brown fine to medium SAND (very dense, moist)	
	120	147	SW	Brown fine to coarse SAND with trace silt (very dense, moist)	
	140	152	SM	Brown silty fine to coarse SAND (very dense, moist)	
	130	157	SM	Brown gravelly, silty fine to coarse SAND (very dense, moist)	
160	160	162	SW	Multi-colored fine to coarse SAND with trace silt (very dense, wet)	
	100	167	SM	Brown silty fine to coarse SAND with trace gravel (very dense, moist to wet)	
	110	172	SW-SM	Brown fine to coarse SAND with silt (very dense, moist to wet)	
	120				
180	120				
	100		SW	Brown fine to coarse SAND with trace gravel (medium dense to very dense, moist to wet)	C
	80				
	40	196			
200	100	202	SW	Brown fine to coarse SAND with trace silt (very dense, moist)	
	100	207	SM	Brown silty fine to coarse SAND (very dense, moist to wet)	
	240		SW	Brown fine to coarse SAND with trace silt (very dense, moist to wet)	
	180	217			
220	170	221	SW-SM	Brown fine to coarse SAND with silt (very dense, moist)	
	220		SW	Brown fine to coarse SAND (very dense, moist)	
	180	232			
	260		SW-SM	Brown gravelly fine to coarse SAND with silt and cobbles at 245 ft. (very dense, moist to wet)	
240					

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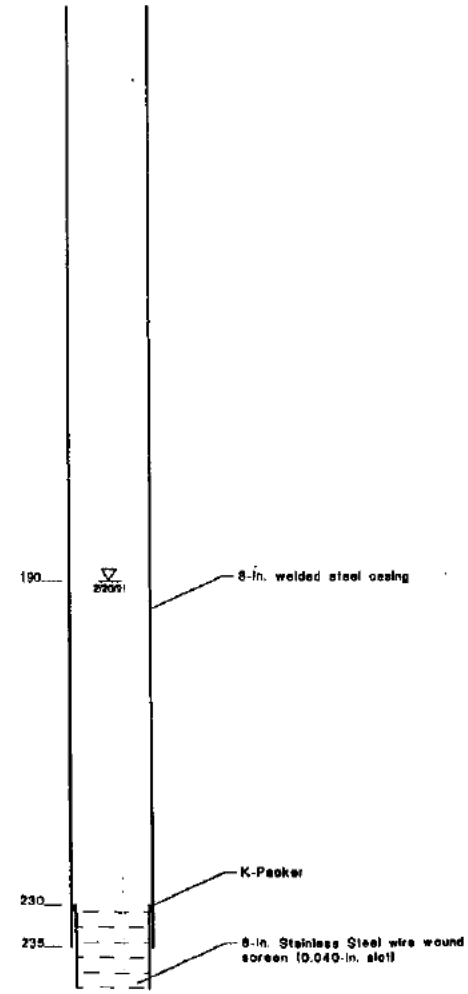
Pilot Extraction Well As-Built Diagram
CP-E1



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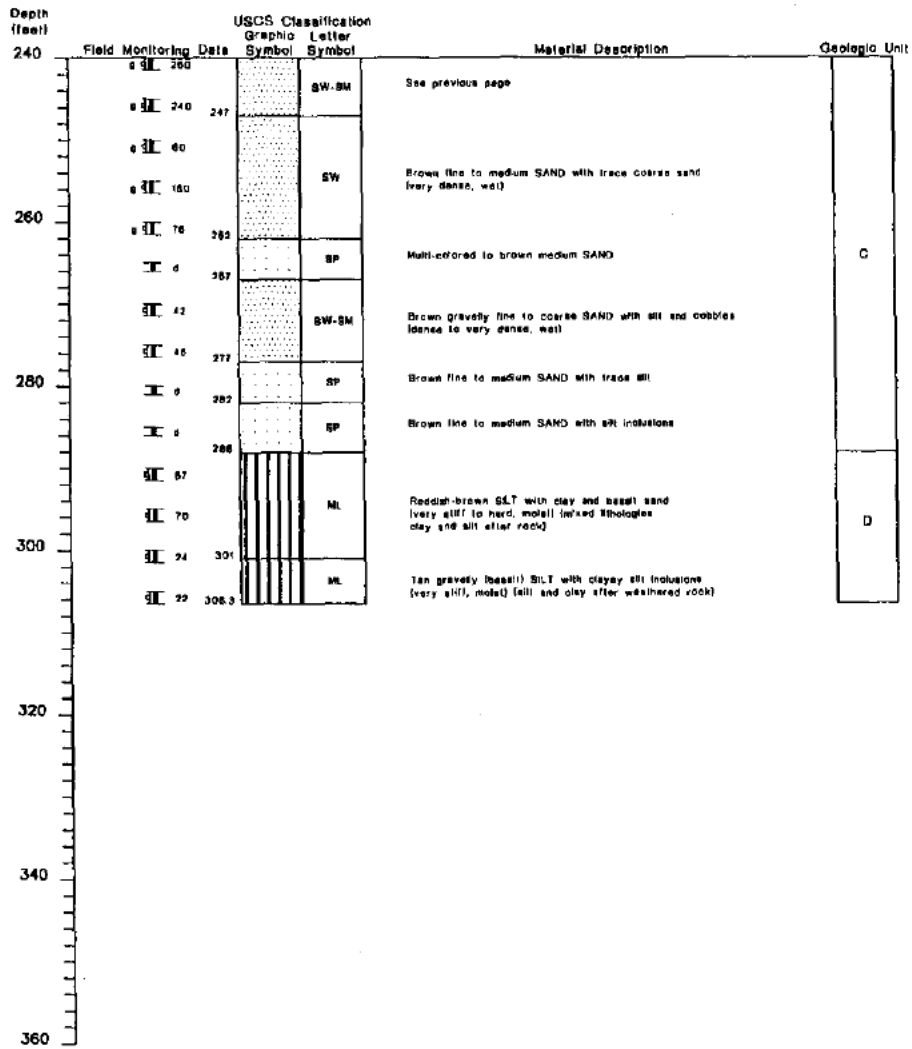
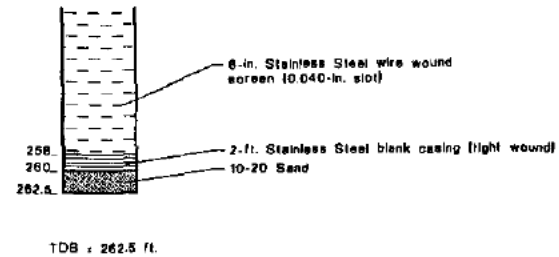
Boring Log and Well Completion Diagram
For Extraction Well CP-E1

Figure D-1
2 of 3

Geologic Profile
Boring CP-E1



Pilot Extraction Well As-Built Diagram
CP-E1



Boring Log and Well Completion Diagram
For Extraction Well CP-E1

Figure D-1
3 of 3

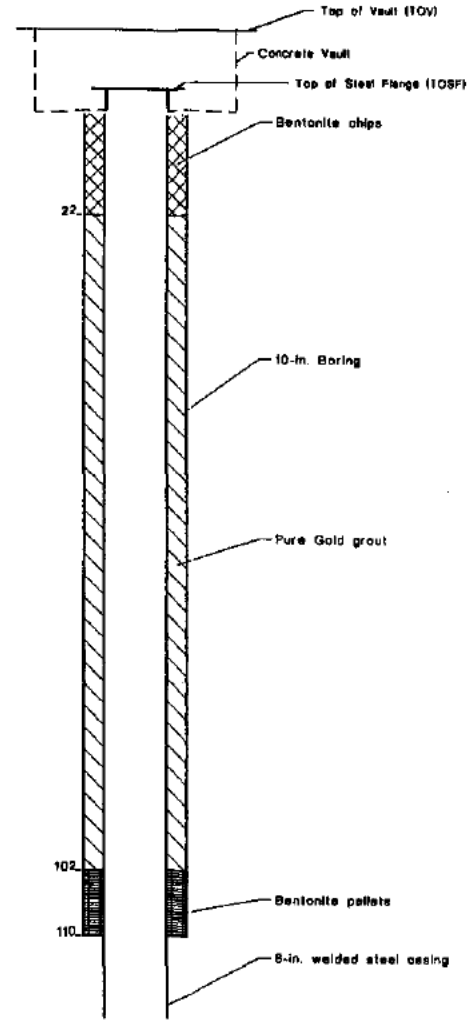
Geologic Profile
Boring CP-E2

Depth (feet)	Field Monitoring Data	USCS Classification Graphic Symbol	USCS Classification Letter Symbol	Material Description	Geologic Unit
0			SW	Multi-colored to brown gravelly fine to coarse SAND	A
			GW	Multi-colored sandy fine to coarse GRAVEL with cobbles	
20			SW	Multi-colored gravelly fine to coarse SAND with cobbles	
40			GW	Multi-colored clean GRAVEL with trace of fine to coarse sand	
			SW	Multi-colored gravelly fine to coarse SAND	
60			SM	Brown silty fine to coarse SAND	
			SW	Brown fine to medium SAND with trace coarse sand and gravel	
			GW	Multi-colored clean fine to coarse GRAVEL with trace coarse sand	
			SM	Brown gravelly silty fine to coarse SAND	
80			GW	Multi-colored sandy fine to coarse GRAVEL with cobbles	
			SW	Brown gravelly fine to coarse SAND with trace silt	
			SW	Multi-colored gravelly fine to coarse SAND	
100			TB	Black massive BASALT	E
			SP	Yellow-brown gravelly (basalt) medium SAND (very dense, moist)	D
120			GM	Brown to tan silty fine to coarse basalt GRAVEL with trace clay (very dense, moist) (some sand higher in section)	

(Continued on next page)

Pilot Extraction Well As-Built Diagram
CP-E2

1864.08 ft. MSL (TOV)
1857.98 ft. MSL (TOSF)



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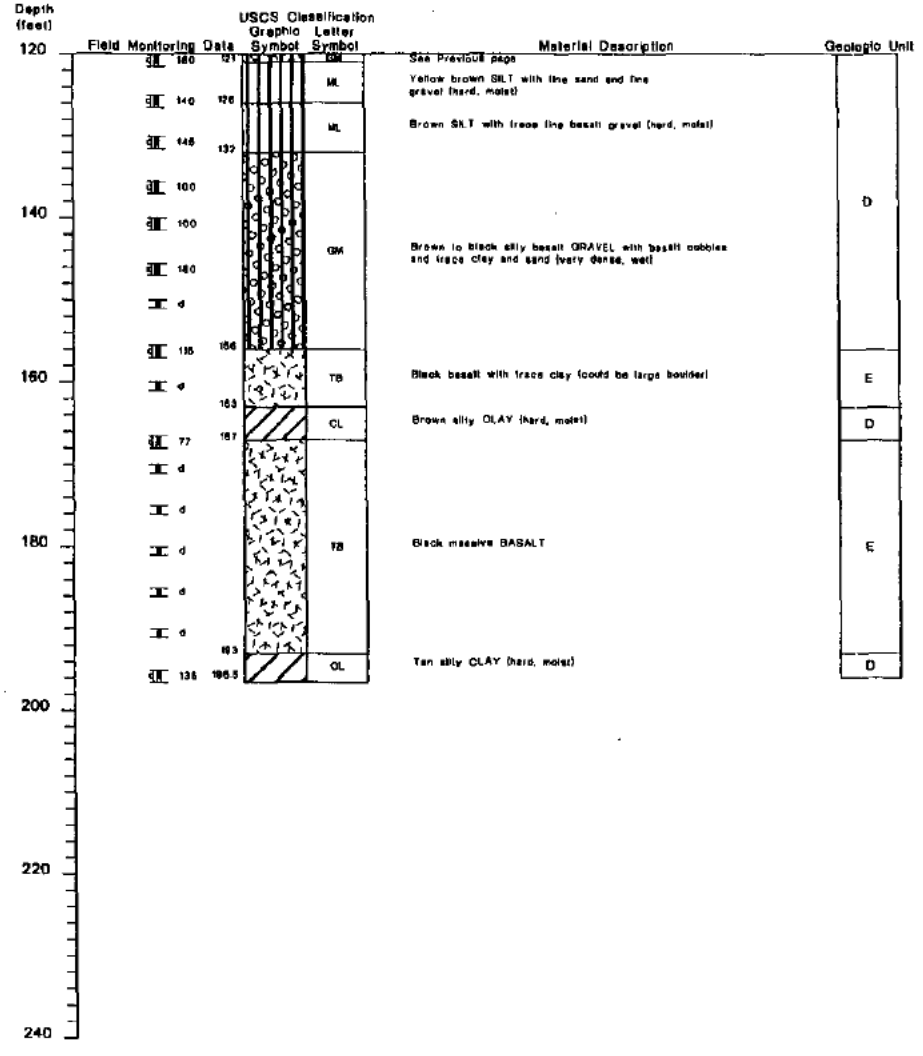
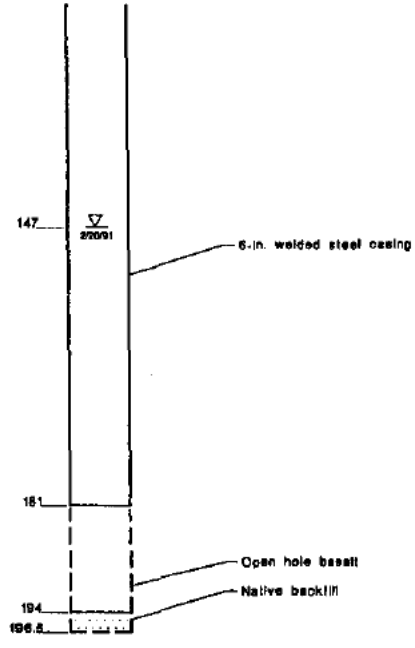
Boring Log and Well Completion Diagram
For Extraction Well CP-E2

Figure D-2
(1 of 2)

Geologic Profile
Boring CP-E2



Pilot Extraction Well As-Built Diagram
CP-E2

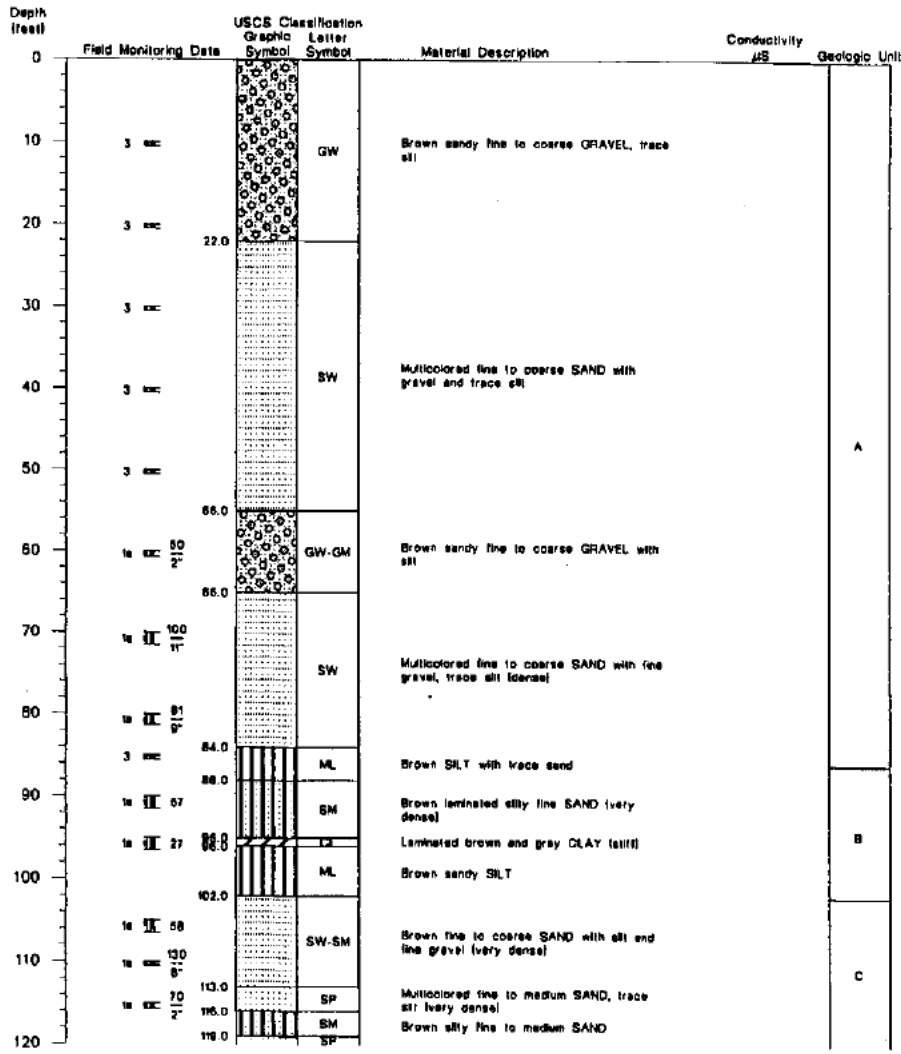


TDB = 196.5 ft.

Boring Log and Well Completion Diagram
For Extraction Well CP-E2

Figure D-2
2 of 2

Geologic Profile
Boring CP-E3



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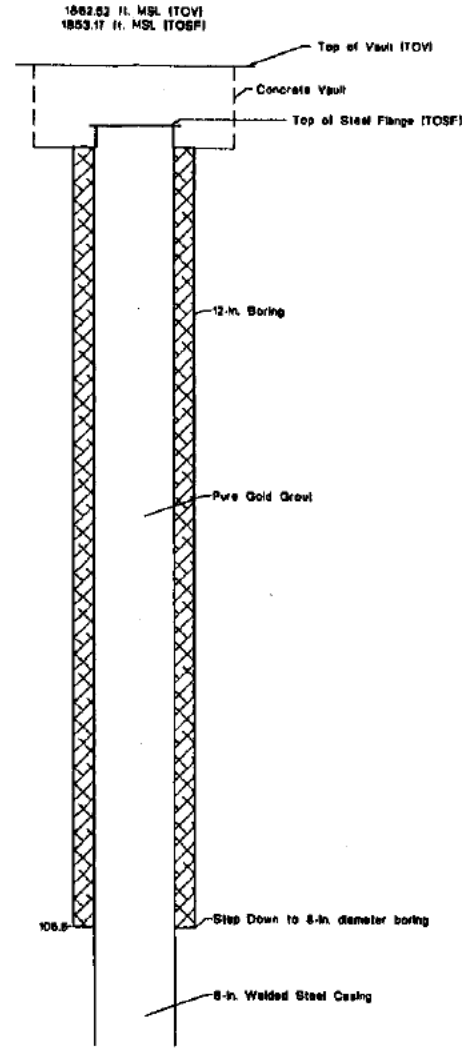
Extraction Well As-Built Diagram
CP-E3



Boring Log and Well Completion Diagram
For Extraction Well CP-E3

Figure D-3
(1 of 3)

Geologic Profile
Boring CP-E3

Depth (feet)	Field Monitoring Data	USCS Classification Graphic Symbol	USCS Classification Letter Symbol	Material Description	Conductivity µS	Geologic Unit
120	50/6"					
	20/6"		SP	Brown fine to medium SAND, trace silt (very dense)		
130	70/6"	129.0				
	55/6"		SW	Brown fine to coarse SAND, trace silt (very dense)		
140	105/2"	139.0	SM	Brown silty fine to medium SAND (very dense)		
	100	142.0				
150	50/2"		SW	Brown fine to coarse SAND with fine gravel, trace silt (very dense)		
	100	155.0				
160	50/3"		SP	Brown fine to medium SAND, trace silt (very dense)		
	100/6"	164.0	SW-SM	Brown fine to coarse SAND with small nodules of silty sand (very dense)		
170	100/6"	168.0	SP	Brown fine to medium SAND, trace silt		
	50/1"	174.0	SP-SM	Brown fine to medium SAND with silt		
180	50/3"	178.0	SM	Brown silty fine to medium SAND (very dense)		C
	40/3"	182.0				
190	110/10"		SP-SM	Brown fine to medium SAND with silt (very dense)		
	60	194.0	SW-SM	Brown fine to coarse SAND with silt and trace fine gravel (very dense)		
200	42	199.0	SW	Brown fine to coarse SAND, trace silt (dense)		
	40/1"	205.0	CL	Light gray-brown CLAY (hard)		
		208.0	SW	Brown fine to coarse SAND, trace silt (dense)		
210	98	209.0				
	63					
220	40		SW-SM	Brown and multicolored fine to coarse SAND with silt, trace fine gravel, reddish brown clay nodules and silty fine to medium sand nodules	788	
	100					
230	90				421	
	70/6"	234.0	SM	Brown silty fine to coarse SAND with fine gravel (very dense)		
240						

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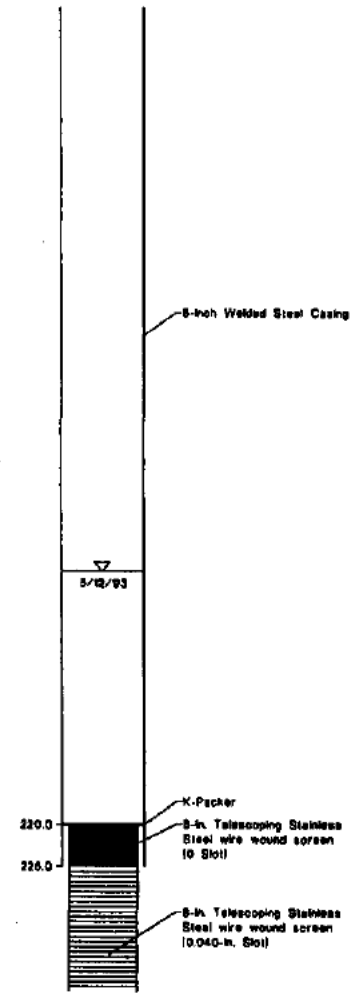
Extraction Well As-Built Diagram
CP-E3

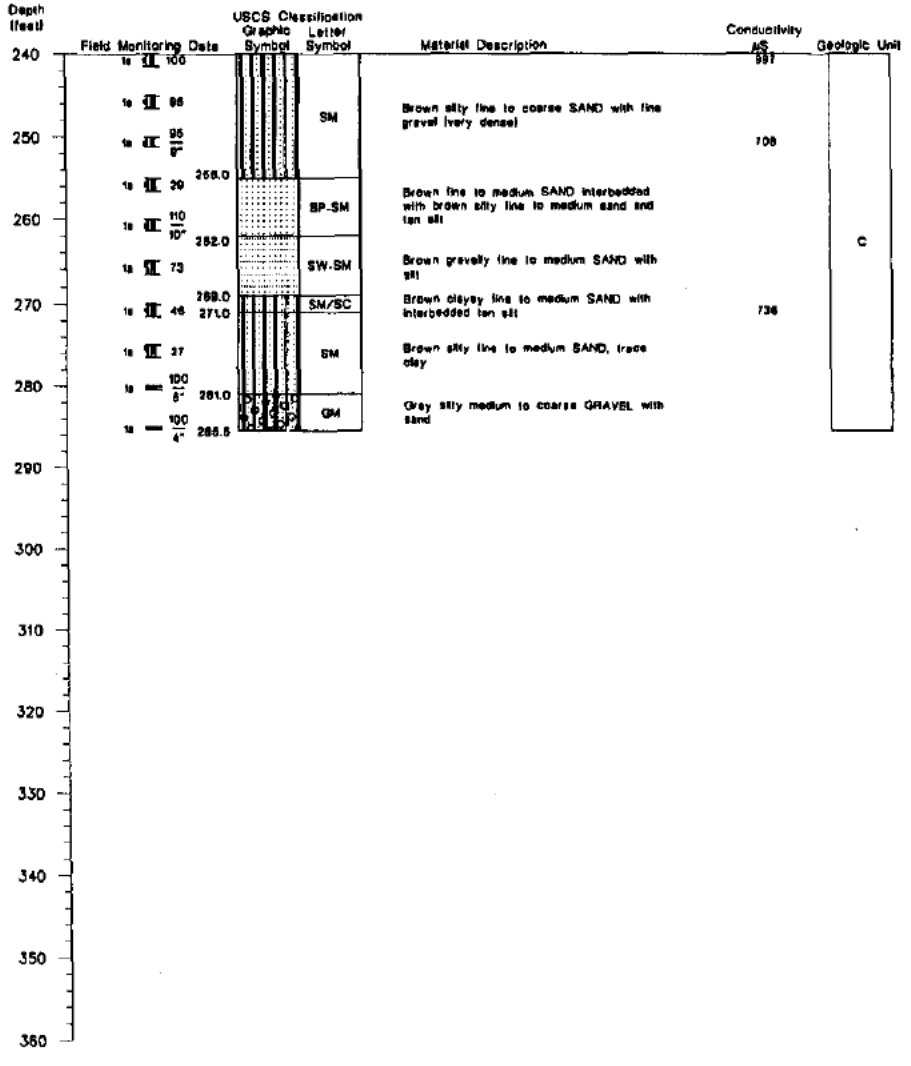


Boring Log and Well Completion Diagram
For Extraction Well CP-E3

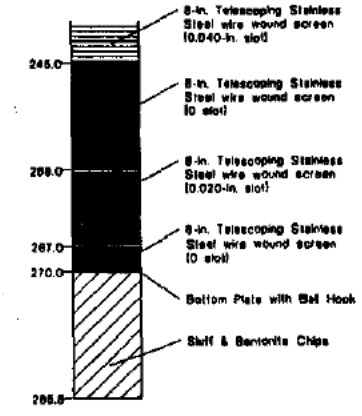
Figure D-3
(2 of 3)

12M204.110 Spokane Co./Colbert Landfill/Operations & Maintenance Plan (4) 1/97

Geologic Profile
Boring CP-E3



Extraction Well As-Built Diagram
CP-E3

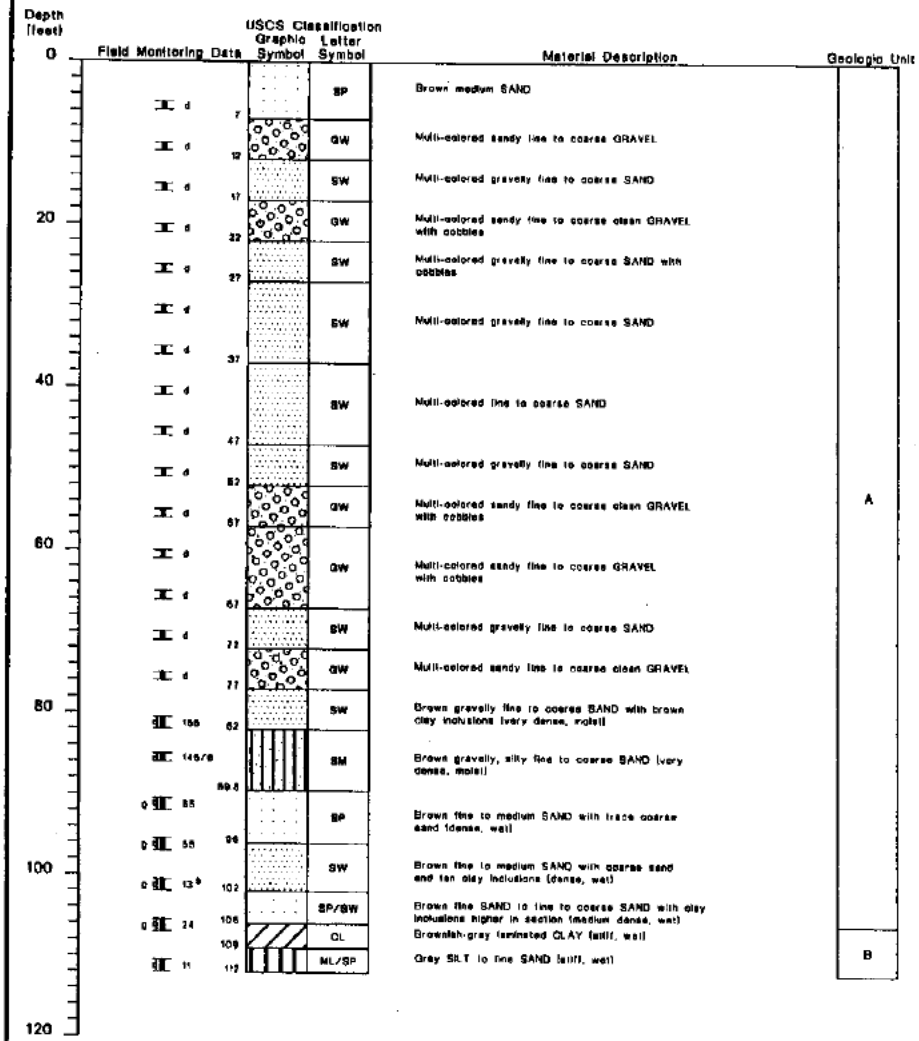


TBD 285.5 ft.
Depth to Water 189.0 ft. (BGS)

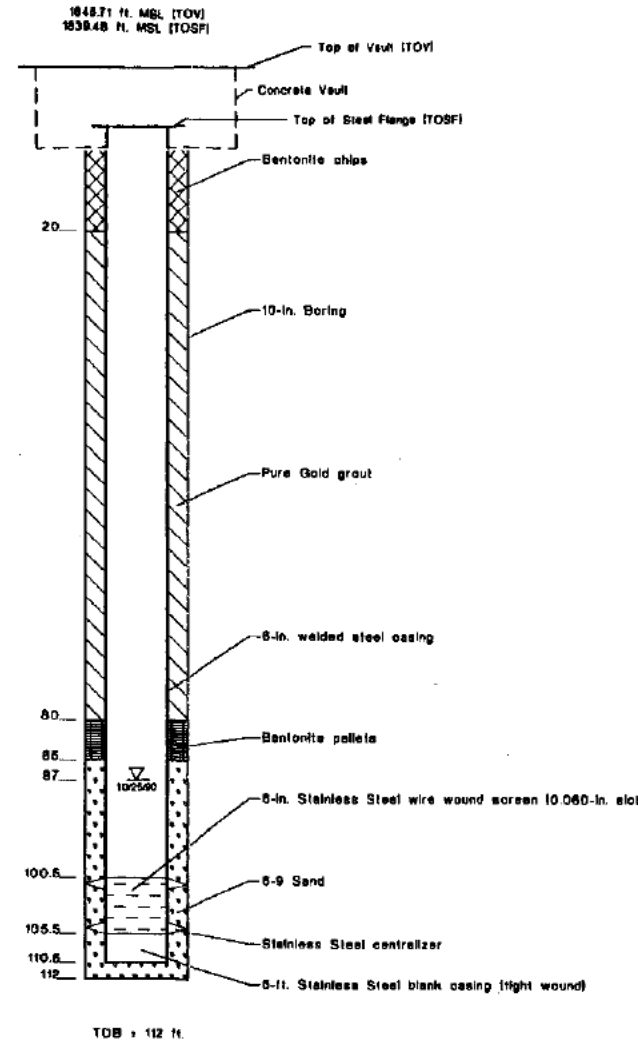
Boring Log and Well Completion Diagram
For Extraction Well CP-E3

Figure D-3
(3 of 3)

Geologic Profile
Boring CP-S1



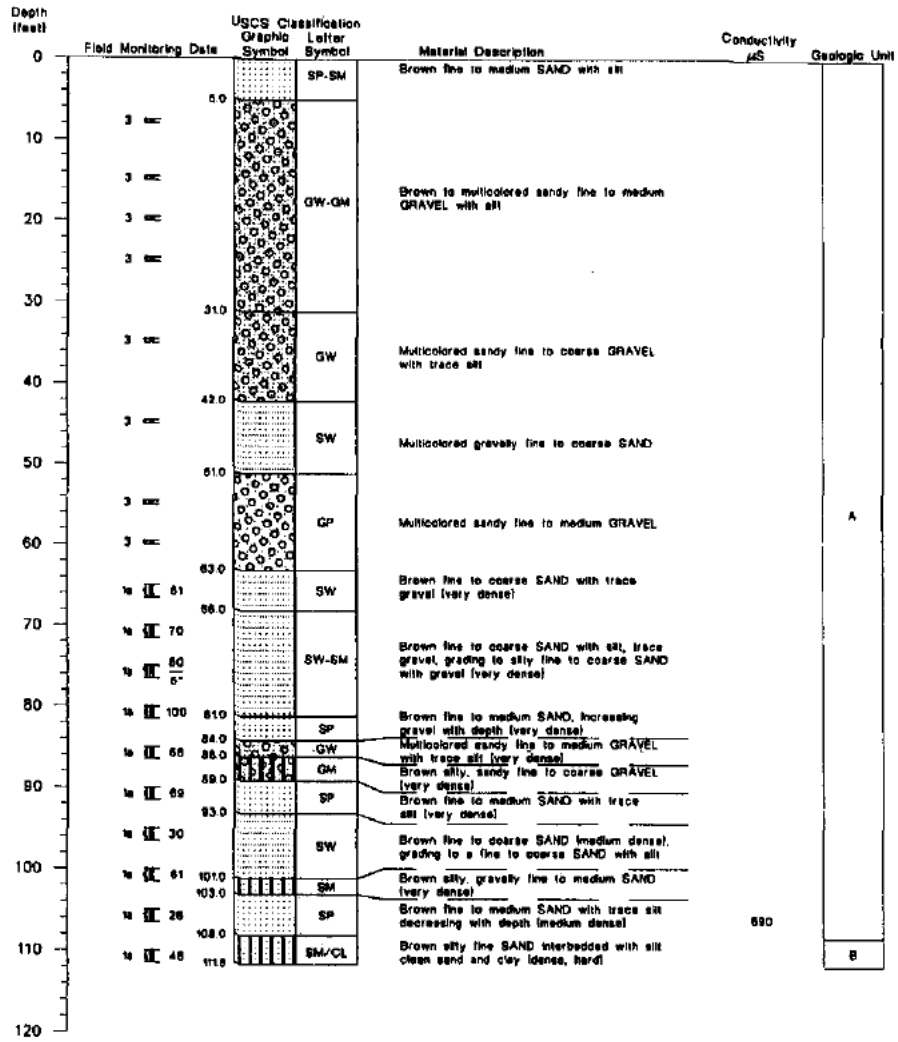
Pilot Extraction Well As-Built Diagram
CP-S1



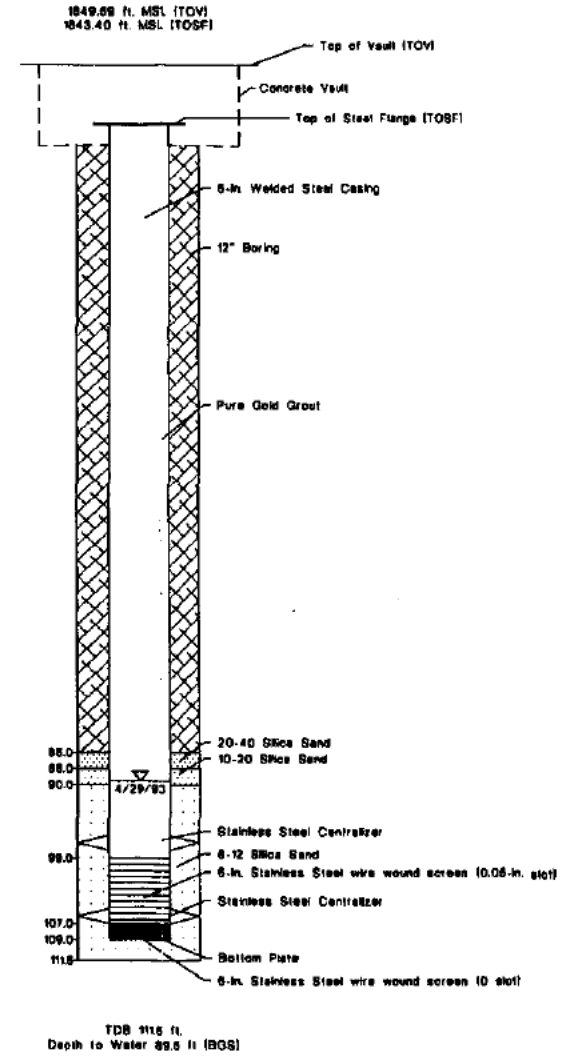
Boring Log and Well Completion Diagram
For Extraction Well CP-S1

Figure D-4

Geologic Profile
Boring CP-S4



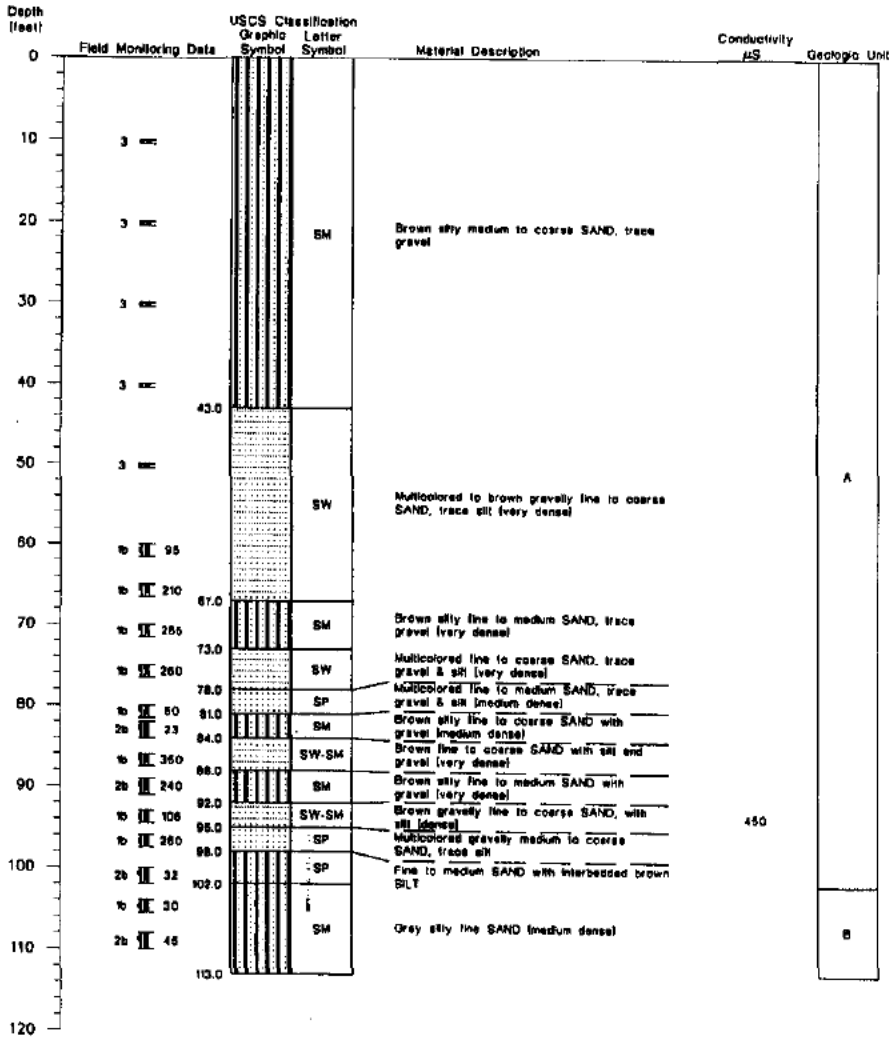
Extraction Well As-Built Diagram
CP-S4



Boring Log and Well Completion Diagram
For Extraction Well CP-S4

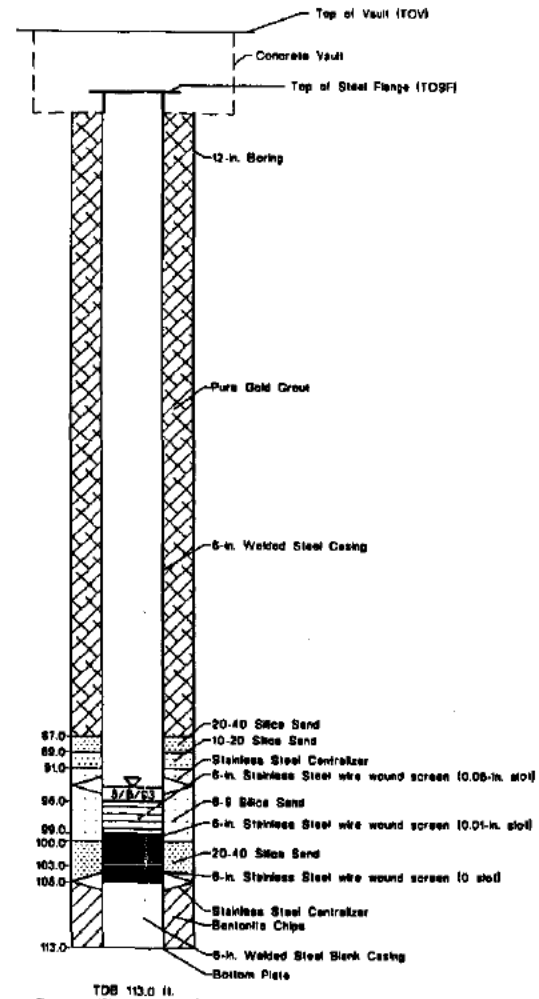
Figure D-5

Geologic Profile
Boring CP-S5



Extraction Well As-Built Diagram
CP-S5

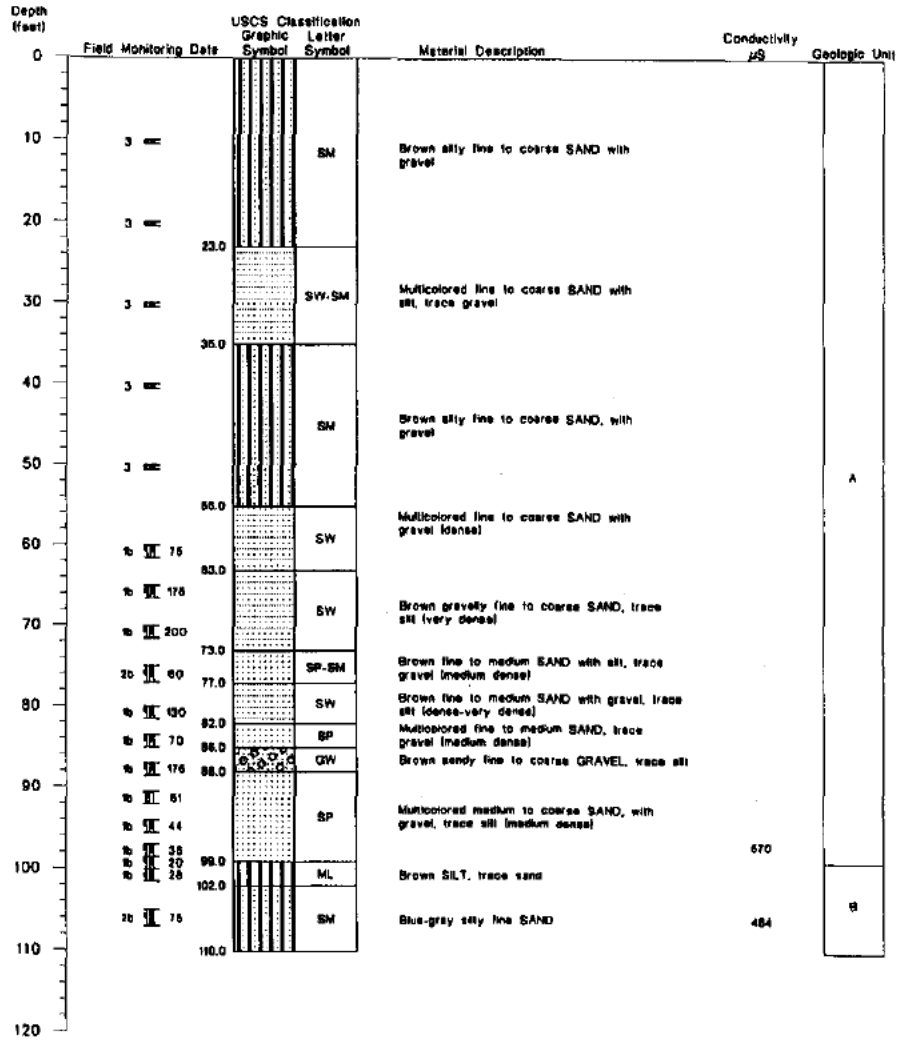
1853.08 ft. MSL (TOV)
1847.37 ft. MSL (TOSF)



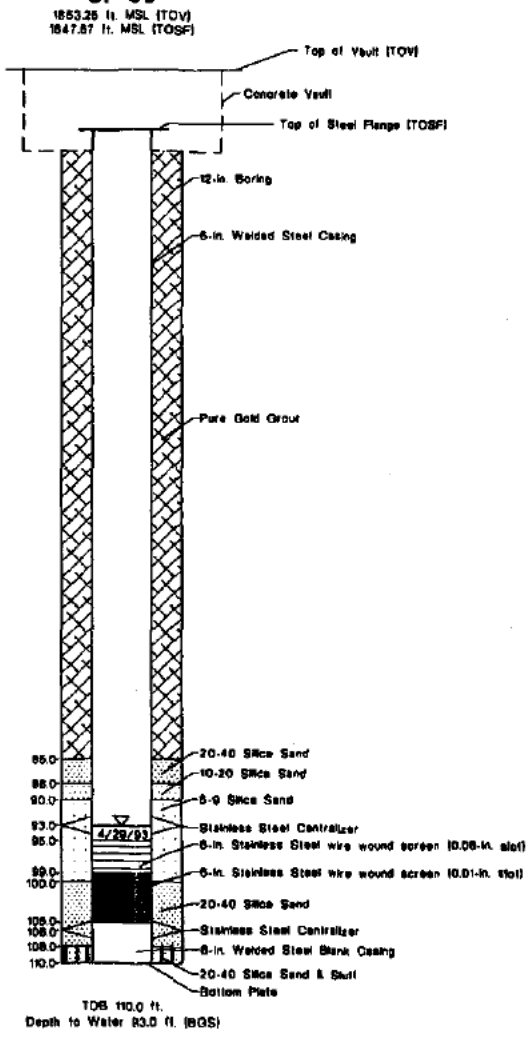
Boring Log and Well Completion Diagram
For Extraction Well CP-S5

Figure D-8

Geologic Profile
Boring CP-S6



Extraction Well As-Built Diagram
CP-S6

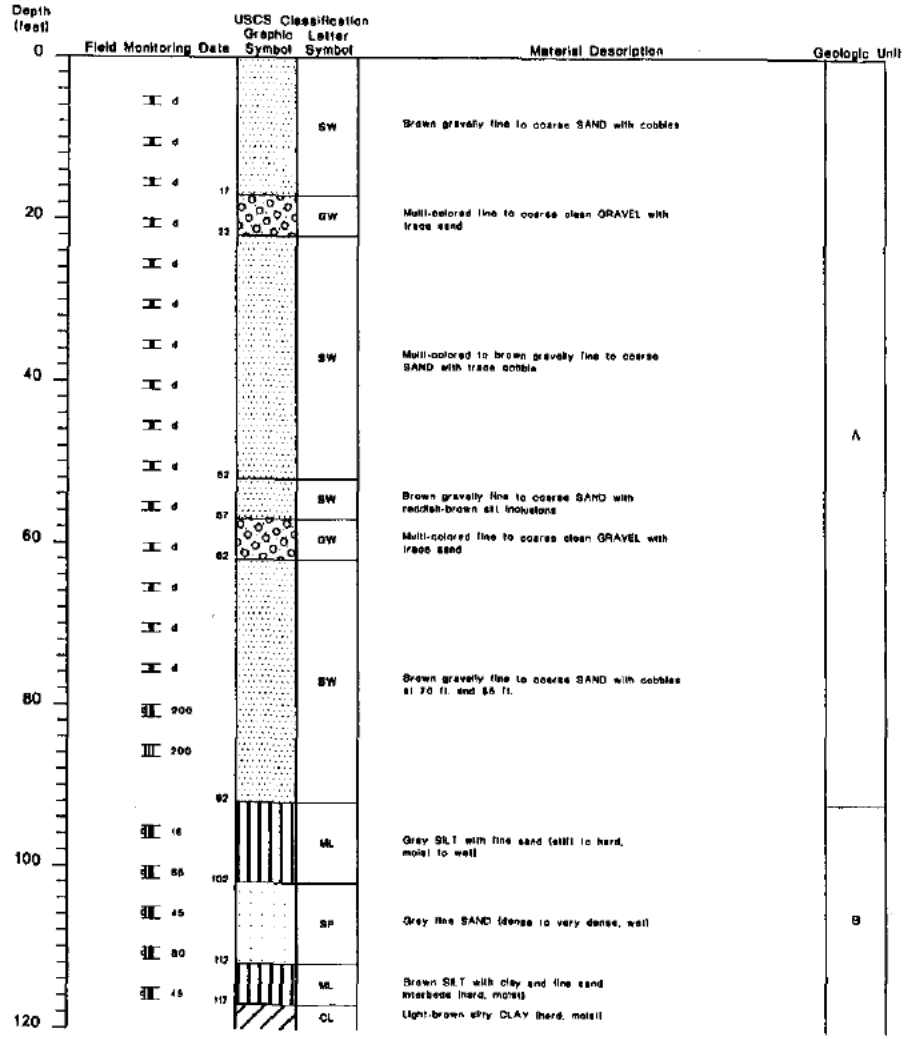


Boring Log and Well Completion Diagram
For Extraction Well CP-S6

Figure D-7

13400A.TTD Spokane Co./Colbert Landfill/Operations & Maintenance Plan (M) 1/97

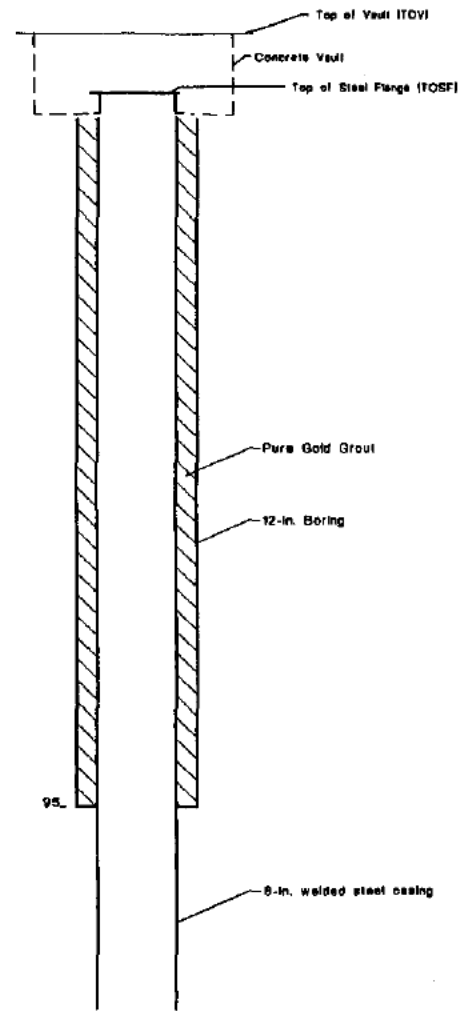
Geologic Profile
Boring CP-W1



(Continued on next page)

Pilot Extraction Well As-Built Diagram
CP-W1

1851.08 ft. MSL (TOV)
1844.92 ft. MSL (TOSF)



(Continued on next page)

Boring Log and Well Completion Diagram
For Extraction Well CP-W1

Figure D-8
(1 of 3)

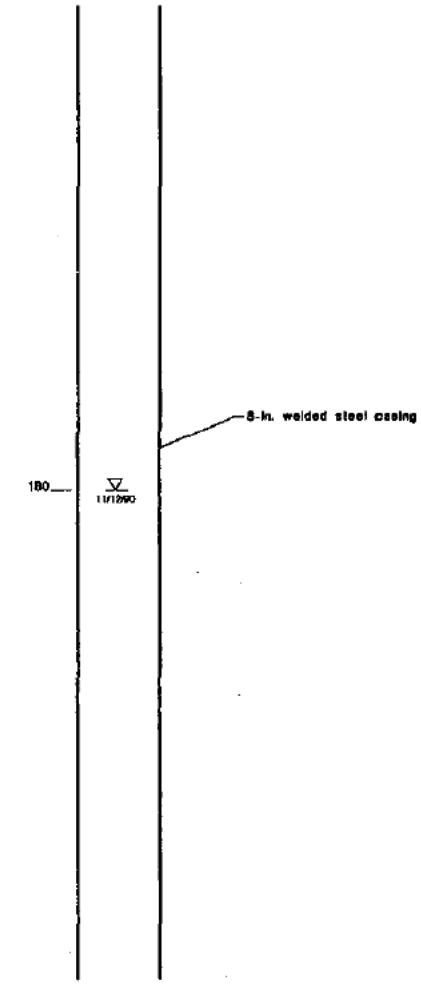
124004.116 Spokane Co./Colbert Landfill/Operations & Maintenance Plan (M) 1/87

Geologic Profile
Boring CP-W1

Depth (feet)	Field Monitoring Data	USCS Classification Graphic Symbol	USCS Classification Letter Symbol	Material Description	Geologic Unit
120	114				
	54		CL	See previous page	
	60	132			
	65	137	CL	Brown mottled with gray-green laminated CLAY with very thin fine sand interbeds (hard, moist)	
140	80		CL	Brown CLAY with very thin silt layers (hard, moist)	
	85	147			
	120	152	SP	Gray fine SAND (very dense, wet)	B
	100				
160	110		CL	Gray to light-brown silty CLAY (hard, moist)	
	150	167			
	130	172	SP	Gray fine SAND (very dense, wet)	
	102	177	SP-SM	Gray fine SAND with silt (very dense, wet)	
180	110	184	CL	Gray to brown CLAY with fine sand and silt interbeds (hard, wet)	
	175	187	SP	Brown fine to medium SAND with trace fine gravel (very dense, wet)	
	195				
	195		SP	Gray to gray-brown fine SAND (very dense, wet)	
200	145	202			
	140		SW	Brown fine to coarse SAND with trace gravel and silt at 210 ft. (very dense, wet)	
	170	212			C
	160		SP	Brown fine to medium SAND (very dense, wet)	
220	195	225			
	220		SW	Brown fine to coarse SAND (very dense, wet)	
	250	232			
	250	237	SP	Brown fine to medium SAND (very dense, wet)	
240			SW-SM	Brown gravelly fine to coarse SAND with silt (very dense, wet)	

(Continued on next page)

Pilot Extraction Well As-Built Diagram
CP-W1



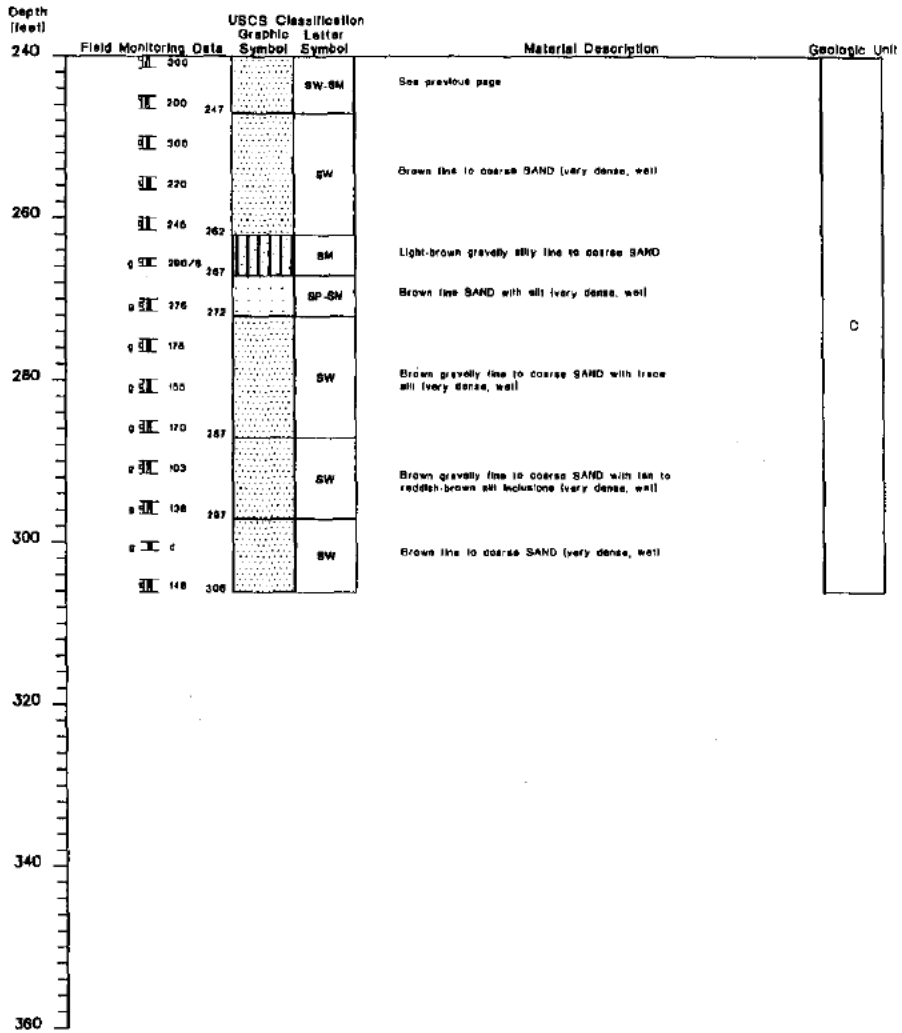
(Continued on next page)

Boring Log and Well Completion Diagram
For Extraction Well CP-W1

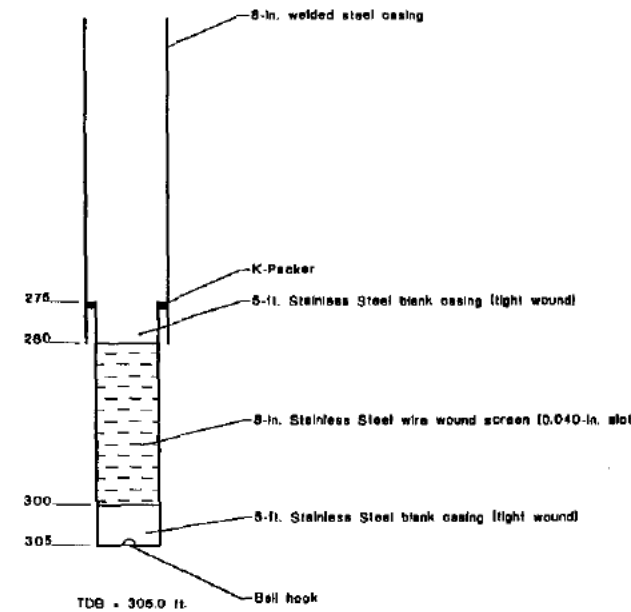
Figure D-8
2 of 3

12600A.110 Spokane Co./Colbert Landfill/Operations & Maintenance Plan (68) 1/97

Geologic Profile
Boring CP-W1



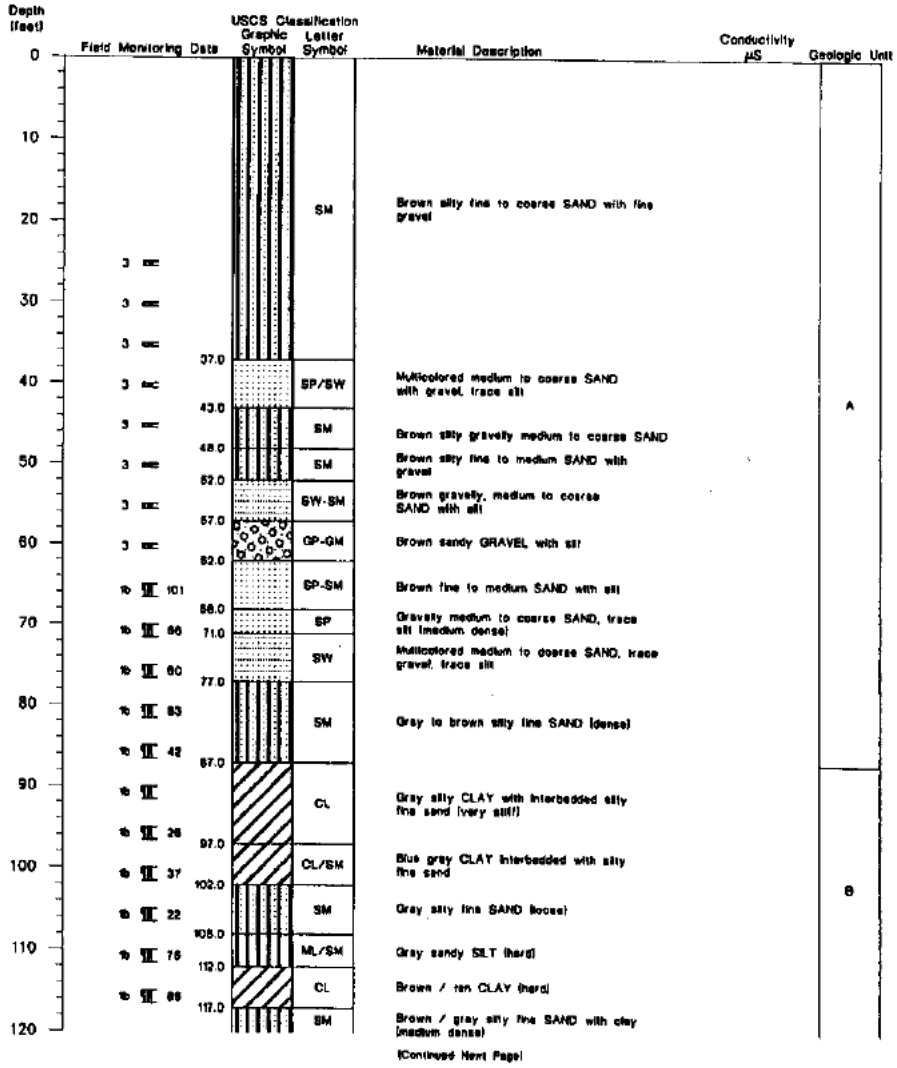
Pilot Extraction Well As-Built Diagram
CP-W1



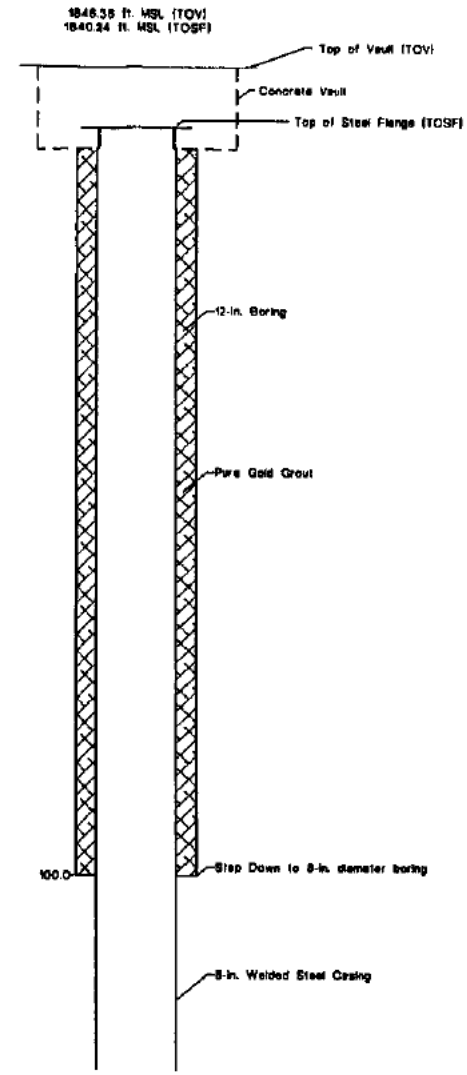
Boring Log and Well Completion Diagram
For Extraction Well CP-W1

Figure D-6
3 of 3

Geologic Profile
Boring CP-W2



Extraction Well As-Built Diagram
CP-W2



Boring Log and Well Completion Diagram
For Extraction Well CP-W2

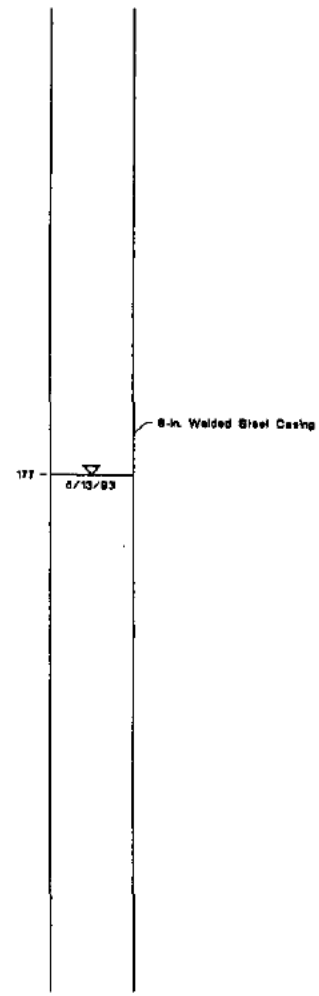
Figure D-9
(1 of 3)

Geologic Profile
Boring CP-W2

Depth (feet)	Field Monitoring Data	USCS Classification Graphic Symbol	USCS Classification Letter Symbol	Material Description	Conductivity µS	Geologic Unit
120	36		SM	Brown-gray silty fine SAND with clay (medium dense)		B
		123.0	SM/CL	Tan silty fine SAND interbedded with tan silty clay		
130	85	128.0				
	110					
140	75		SM	Gray silty fine SAND (dense)		
	120					
150	200	152.0				
	100		CL	CLAY (hard-very stiff)		
160	45	162.0				
	100		CL/SM	Green gray CLAY with interbedded gray silty fine sand (hard)		
170	70	168.0				
	160		CL	Green gray CLAY (hard)		
180	170	178.0	SP	Light brown fine to medium SAND with trace of green brown silt (very dense)		C
	130/6"	183.0				
190	150/6"		SM	Tan to brown silty fine to medium SAND with interbedded clay, some organic material (dense to very dense)		
	200/6"	198.0				
200	200/6"		SP	Brown silty fine to medium SAND with thin layers of black organic material (very dense)		
		203.0	ML	Brown sandy SILT		
		206.0	SP	Fine to medium SAND, trace silt (very dense)	361	
210		212.0				
			SP-SM	Fine to medium SAND with silt (very dense)		
220		223.0	SM	Brown silty fine to medium SAND (very dense)	382	
	200	226.0	SP-SM	Brown fine to medium SAND with silt, trace clay (very dense)		
230	160	232.0	SW-SM	Brown fine to coarse SAND with silt, trace gravel (very dense)		
	150/6"	238.0	SP-SM	Fine to medium SAND with silt (very dense)		
240						

(Continued Next Page)

Extraction Well As-Built Diagram
CP-W2

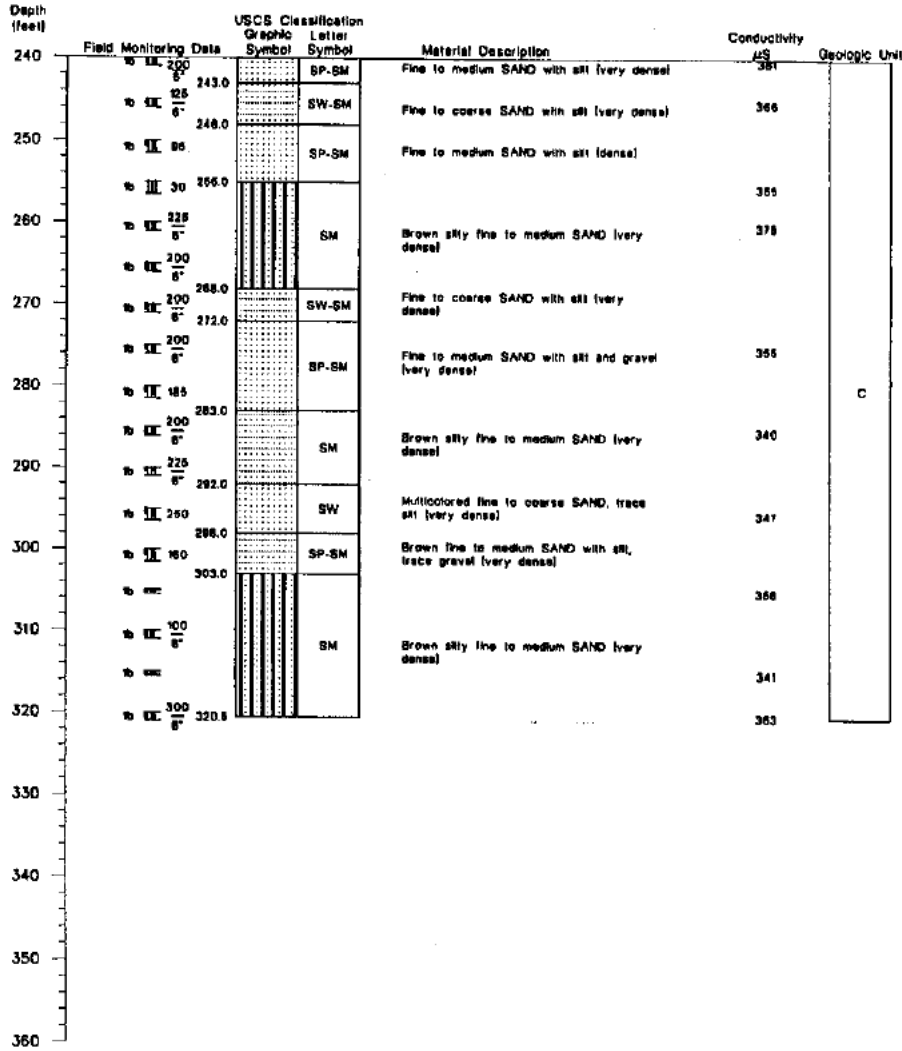


Boring Log and Well Completion Diagram
For Extraction Well CP-W2

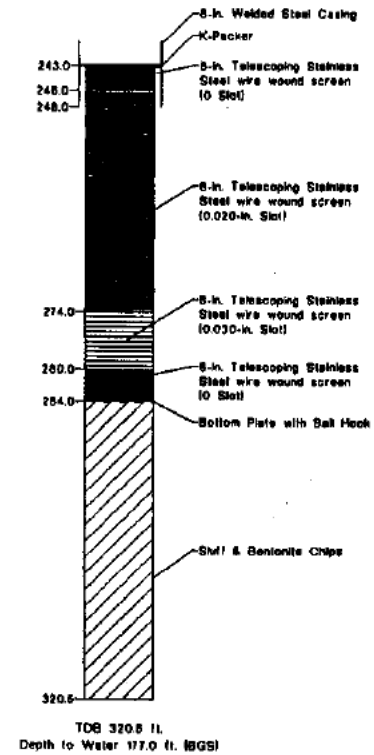
Figure D-9
(2 of 3)

124004.110 Spokane Co./Colbert Landfill/Operations & Maintenance Plan (M) 1/97

Geologic Profile
Boring CP-W2



Extraction Well As-Built Diagram
CP-W2

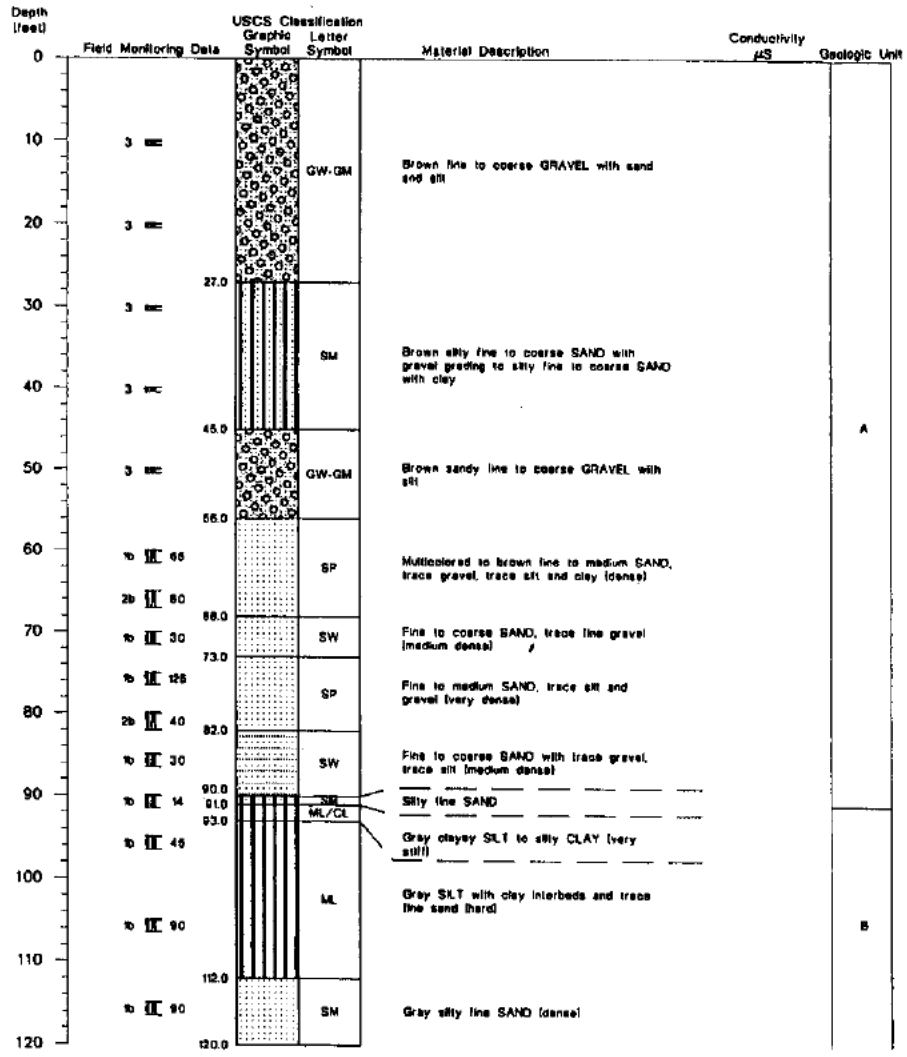


Boring Log and Well Completion Diagram
For Extraction Well CP-W2

Figure D-9
(3 of 3)

12400A.110 Spokane Co/Colbert Landfill/Operations & Maintenance Plan (M) 1/97

Geologic Profile
Boring CP-W3



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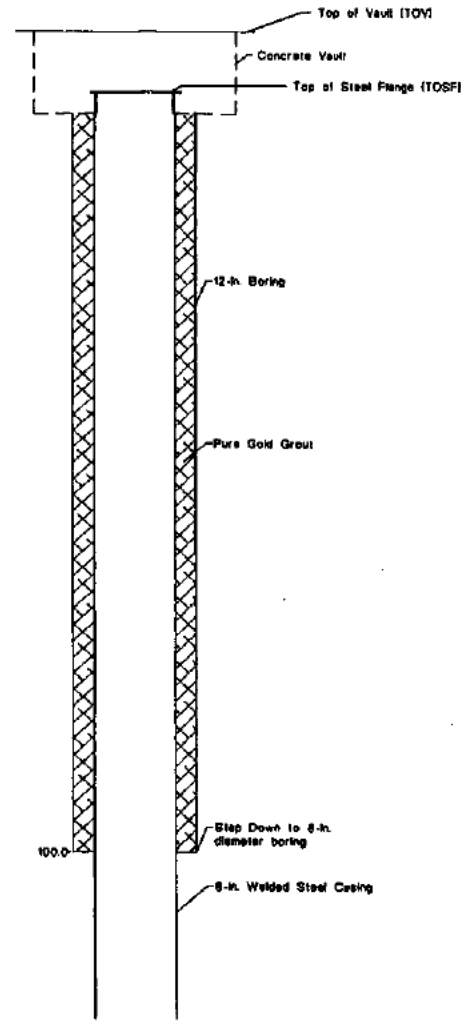
Extraction Well As-Built Diagram
CP-W3

1847.81 ft. MSL (TOV)
1841.62 ft. MSL (TOSF)



(Continued Next Page)

Boring Log and Well Completion Diagram
For Extraction Well CP-W3

Figure D-10
(1 of 3)

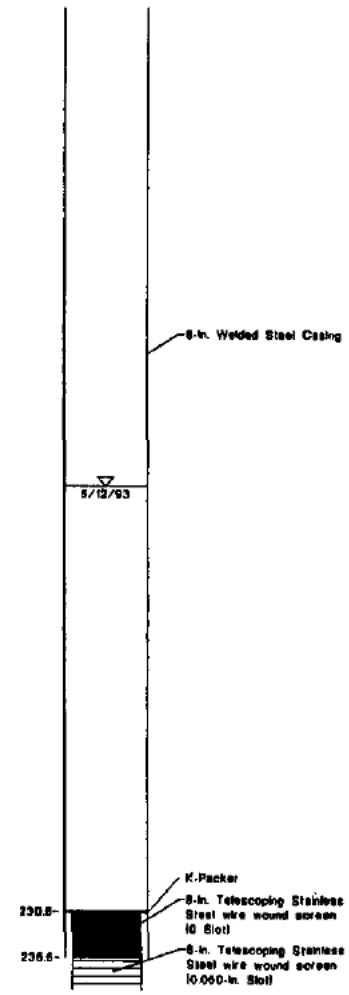
126604.110 Spokane Co./Colbert Landfill/Operations & Maintenance Plan (M) 1/97

Geologic Profile
Boring CP-W3

Depth (feet)	Field Monitoring Data	USCS Classification Graphic Symbol	USCS Classification Letter Symbol	Material Description	Conductivity µS	Geologic Unit
120–135.5	1b 90; 1b 60		CL	Brown CLAY, trace fine sand (hard)		B
135.5–152.0	1b 100; 1b 100		SM	Brown-Gray brown grading to gray silty fine SAND with clay (dense)		B
152.0–172.0	2b 80		ML/CL	Gray clayey SILT (very stiff to hard)		B
172.0–180.0	1b 110		SM	Gray silty fine SAND with clay (dense)		B
180.0–188.0	1b 150/6"		SM	Brown silty fine SAND (very dense)		C
188.0–193.0	1b 170		SP	Brown fine to medium SAND, trace gravel (very dense)		C
193.0–207.0	1b 150; 2b 138		SM	Brown silty fine to medium SAND (very dense)		C
207.0–218.0	1b 40; 2b 60		SP-SM	Brown fine to medium SAND with silt (medium dense)	243	C
218.0–232.0	1b 133; 1b 55; 1b 113		SW-SM	Brown fine to coarse SAND with silt and clay, trace gravel (dense to very dense)		C
232.0–237.0	1b 75		SP-SM	Multicolored fine to medium SAND with silt (very dense)		C
237.0–240			SW-SM			C

(Continued Next Page)

Monitoring Well As-Built Diagram
CP-W3



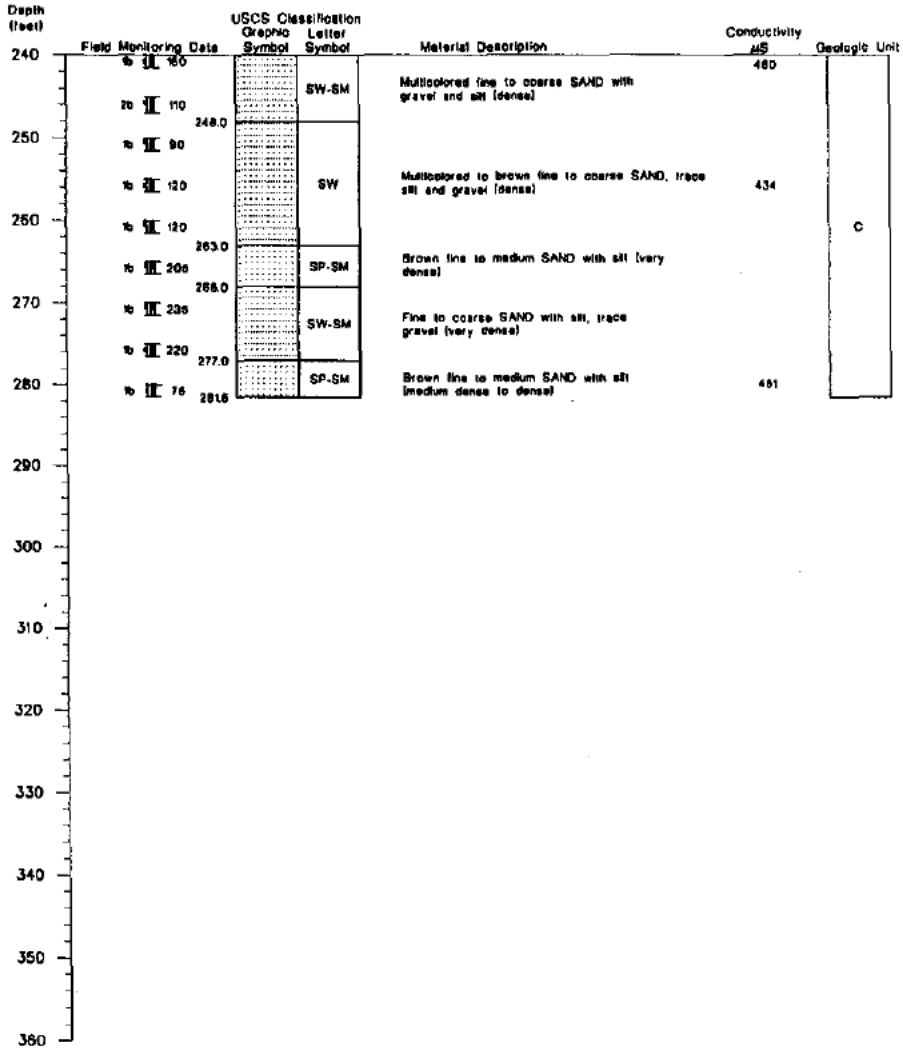
(Continued Next Page)

Boring Log and Well Completion Diagram
For Extraction Well CP-W3

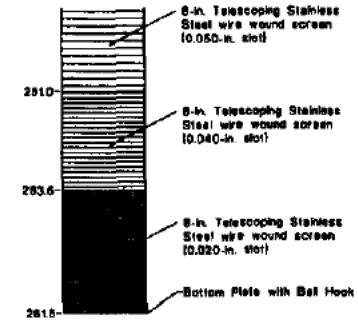
Figure D-10
(2 of 3)

12NOAL.110 Systems Co./Cotter Landfill/Operations & Maintenance Plan (M) 1/97

Geologic Profile
Boring CP-W3



Extraction Well As-Built Diagram
CP-W3



TDB : 281.5 ft.
Depth to Water 178.0 ft. (BGS)

Boring Log and Well Completion Diagram
For Extraction Well CP-W3

Figure D-10
(3 of 3)

Federal Communications Commission
Gettysburg, PA 17325-7245

RADIO STATION LICENSE

Licensee Name: SPOKANE, COUNTY OF

Radio Service: PL LOCAL GOVERNMENT — License Issue Date: 940414

Call Sign: WPES420 — File Number: 9403204484 — License Expiration Date: 990414

Frequency Advisory No:

Number of Mobiles by Category: Vehicular - ****** Portable -******Aircraft -******Marine - ******Pagers*******

940414N 775 1 1Z

SPOKANE, COUNTY OF
PUBLIC WORKS DEPT UTIL DIV D FOWLER
W 1026 BROADWAY
SPOKANE WA 992600170

Station Technical Specifications

FCC I.D.	Frequencies (MHz)	Station Class	No. of Units	Emission Designator	Output Power (Watts)	E.R.P. (Watts)	Ground Elevs	Ant. Hgt. To Tip	Antenna Latitude	Antenna Longitude
1:	72.80000	FXO	1	16K0F2D	1.000	1.000	1850	55	47-51-36	117-21-09
2:	72.80000	FXO	1	16K0F2D	1.000	1.000	1850	55	47-51-48	117-21-06
3:	72.80000	FXO	1	16K0F2D	1.000	1.000	1850	28	47-51-42	117-21-08
4:	72.80000	FXO	1	16K0F2D	1.000	1.000	1860	55	47-51-48	117-20-50
5:	72.80000	FXO	1	16K0F2D	1.000	1.000	1865	55	47-51-38	117-20-50
6:	72.80000	FXO	1	16K0F2D	1.000	1.000	1860	55	47-51-48	117-20-50

	TRANSMITTER STREET ADDRESS	CITY	COUNTY	STATE
1:	CPW1 N22111 ELK CHATTAROY RD	COLBERT	SPOKANE	WA
2:	CPW2 .25 MI NW INT OF YALE & BIG MEADOWS RD	COLBERT	SPOKANE	WA
3:	CPW3 N22123 ELK CHATTAROY RD	COLBERT	SPOKANE	WA
4:	CPE1 N22515 ELK CHATTAROY RD	COLBERT	SPOKANE	WA
5:	CPE2 N22515 ELK CHATTAROY RD	COLBERT	SPOKANE	WA
6:	CPE3 N22515 ELK CHATTAROY RD	COLBERT	SPOKANE	WA

CONTROL POINTS:TREATMENT PLANT N 22515 ELK CHATTAROY RD COLBERT WA
CONTROL POINT PHONE: 509-456-3604

EMISSION DESIGNATOR(S) CONVERTED TO CONFORM TO DESIGNATOR(S) SET OUT IN PART 2 OF THE COMMISSION'S RULES.

FEDERAL COMMUNICATIONS COMMISSION

This authorization becomes invalid and must be returned to the Commission if the stations are not placed in operation within eight months, unless an extension of time has been granted. EXCEPTION: 800 MHz trunked and certain 900 MHz station licenses cancel automatically if not constructed within one year.

CONDITIONS OF GRANT

A. Subject to the provisions of the Communications Act of 1934, as amended, subsequent acts, treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions and requirements set forth in this authorization the licensee or permittee hereof is authorized to use and operate the radio transmitting facilities herein described. This authorization shall not vest in the licensee or permittee any right to operate the station nor any right in the use of the frequencies designated in the authorization beyond the term hereof, nor in any other manner than authorized herein.

B. Neither this authorization nor the right granted herein shall be assigned or otherwise transferred to any person, firm, company, or corporation except by specific authorization of the Commission.

C. This authorization is issued on the licensee's representation that the statements contained in licensee's application are true and that the undertakings therein contained, so far as they are consistent herewith, will be carried out in good faith. The licensee shall, during the term of this license, render such service as will serve public interest, convenience, or necessity to the full extent of the privileges herein conferred.

D. This authorization is subject to the right of use or control by the Government of the United States conferred by Section 706 of the Communications Act of 1934, as amended.

FOR FCC USE ONLY

Federal Communications Commission
Gettysburg, PA 17325-7245

RADIO STATION LICENSE

Licensee Name: SPOKANE, COUNTY OF

Radio Service: PL LOCAL GOVERNMENT — License Issue Date: 940414

Call Sign: WPES424 — File Number: 9403204485 — License Expiration Date: 990414

Frequency Advisory No:

Number of Mobiles by Category: Vehicular - ****** Portable -******Aircraft - ******Marine - ******Pagers*******

940414N 776 1 1Z

SPOKANE, COUNTY OF
PUBLIC WORKS DEPT UTIL DIV D FOWLER
W 1026 BROADWAY
SPOKANE WA 992600170

Station Technical Specifications

FCC I.D.	Frequencies (MHz)	Station Class	No. of Units	Emission Designator	Output Power (Watts)	E.R.P. (Watts)	Ground Elevs	Ant. Hgt. To Tip	Antenna Latitude	Antenna Longitude
1:	72.80000	FXO	1	16K0F2D	1.000	1.000	1855	115	47-51-40	117-21-07
2:	72.80000	FXO	1	16K0F2D	1.000	1.000	1845	55	47-50-14	117-20-46
3:	72.80000	FXO	1	16K0F2D	1.000	1.000	1845	55	47-50-14	117-20-46
4:	72.80000	FXO	1	16K0F2D	1.000	1.000	1845	55	47-50-14	117-20-46
5:	72.80000	FXO	1	16K0F2D	1.000	1.000	1845	55	47-50-14	117-20-46

	TRANSMITTER STREET ADDRESS	CITY	COUNTY	STATE
1:	TREAT FACILITY N 22515 ELK CHATTAROY RD	COLBERT	SPOKANE	WA
2:	CPS1 COR OF 19812 YALE RD	COLBERT	SPOKANE	WA
3:	CPS4 COR OF 19812 YALE RD	COLBERT	SPOKANE	WA
4:	CPS5 COR OF 19812 YALE RD	COLBERT	SPOKANE	WA
5:	CPS6 COR OF 19812 YALE RD	COLBERT	SPOKANE	WA

CONTROL POINTS:TREATMENT PLANT N 22515 ELK CHATTAROY RD COLBERT WA
CONTROL POINT PHONE: 509-456-3604

EMISSION DESIGNATOR(S) CONVERTED TO CONFORM TO DESIGNATOR(S) SET OUT IN PART 2 OF THE COMMISSION'S RULES.

FEDERAL COMMUNICATIONS COMMISSION

This authorization becomes invalid and must be returned to the Commission if the stations are not placed in operation within eight months, unless an extension of time has been granted. EXCEPTION: 800 MHz trunked and certain 900 MHz station licenses cancel automatically if not constructed within one year.

F
Septem

CONDITIONS OF GRANT

A. Subject to the provisions of the Communications Act of 1934, as amended, subsequent acts, treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions and requirements set forth in this authorization the licensee or permittee hereof is authorized to use and operate the radio transmitting facilities herein described. This authorization shall not vest in the licensee or permittee any right to operate the station nor any right in the use of the frequencies designated in the authorization beyond the term hereof, nor in any other manner than authorized herein.

B. Neither this authorization nor the right granted herein shall be assigned or otherwise transferred to any person, firm, company, or corporation except by specific authorization of the Commission.

C. This authorization is issued on the licensee's representation that the statements contained in licensee's application are true and that the undertakings therein contained, so far as they are consistent herewith, will be carried out in good faith. The licensee shall, during the term of this license, render such service as will serve public interest, convenience, or necessity to the full extent of the privileges herein conferred.

D. This authorization is subject to the right of use or control by the Government of the United States conferred by Section 706 of the Communications Act of 1934, as amended.

FOR FCC USE ONLY

SPECIAL CONDITIONS / ADMINISTRATIVE NOTES

NUMBERS NOT LISTED ARE RESERVED

8. For medical ambulance dispatch only. Equipment authorized herein shall not be used in the performance of funeral or other routine operations.

9. Limited for coordinated use in cooperation with hospitals authorized on this frequency.

10. To be used for ambulance and rescue squad work only.

12. Operations authorized in accordance with the Railroad Frequency Assignment Plan.

13. Authorized in accordance with Rule Sections 90.176, 90.621(g), and 90.621(h).

14. Licensee has 90 days to continue operating under parameters of previous authorization.

16. Operations onboard aircraft are subject to the limitations set forth under Rule Section 90.423(a).

17. For nationwide use limited by Rule Section 90.19(a)(14). (Frequency 155.475 MHz)

18. For intersystem communications as limited by Rule Section 90.19(g)(4).

20. This system may not be used for fixed service purposes.

22. This grant does not extend the period within which you must place the station in operation or meet loading requirements. That period begins from the date of your original authorization.

23. This license is for demonstration purposes only and may not be used for day to day business activity. This system is for secondary use and the mobiles licensed herein will not count toward the total mobile loading of these frequencies.

31. The use of radio for demonstration purposes in connection with the sale of radio equipment is limited by the following conditions:

    a. The equipment shall be under the control of the licensee at all times. Purchasers or prospective customers shall not be permitted to operate the equipment in any manner in the absence of authorized employees of the licensee.

    b. No person other than the licensee shall use the assigned call sign(s).

    c. No representation shall be made by the licensee to any person that a radio transmitter may be utilized prior to the issuance of an authorization by the Commission.

    d. Demonstration of radio equipment and/or coverage surveys should be completed within two weeks.

    e. Equipment demonstrated under the terms of this license shall be on frequencies available under Part 90 of the Rules.

    f. The technical parameters of the radio service in which the frequency(ies) is allocated shall be observed.

32. Special Condition for operating interconnected facilities under the provisions of Rule Section 90.261: These frequencies are authorized on a secondary non-interference basis to Land Mobile operations; any unresolved interference resulting from operation on these frequencies will be cause for cancellation. The provisions of Rule Section 90.261 governing antenna directivity and minimum mileage criteria from urbanized areas must be strictly complied with. Antenna structures must fully meet the requirements of Special Condition #35. Transmissions must directly relate to those activities which constitute the licensee's eligibility. Personal communications are expressly forbidden.

33. Special Condition for operating interconnected facilities under the provisions of Rule Section 90.267: These frequencies are authorized for use on a secondary non-interference basis to regularly assigned adjacent channel operations at a maximum of two watts output power. Interference resulting from operation on these frequencies will be cause for cancellation. The provisions of Rule Section 90.267 must be strictly complied with. Directional antennas must be used and their installed height may not exceed twenty feet above ground. Transmissions must directly relate to those activities which constitute the licensee's eligibility. Personal communications are expressly forbidden.

34. 800/900 MHz Loading and Construction Instructions - This authorization is issued subject to these conditions. If this facility is not constructed within one year of the date of this grant, and has not been authorized an extended construction period, the license cancels automatically. If the five year mobile loading requirements applicable to this system (see 90.631) are not met, and if waiting lists for trunked frequencies exist in your geographic area of operation, this license cancels automatically. The Commission will, however, in these circumstances consider authorizing you for one channel (frequency pair) for each existing 100 mobile stations, or fraction thereof, operating on your previously authorized frequencies.

35. Antenna structures for land, base and fixed stations authorized in the Private Radio Bureau for operation at temporary unspecified locations may be erected without specific prior approval of the Commission where such antenna structures do not exceed a height of 200 feet above ground level; provided that the overall height of such antennas more than 20 feet above ground, including their supporting structures (whether natural formation or man-made), does not exceed a slope of 1 foot above the established airport elevation for each 100 feet of distance or fraction thereof from the nearest boundary

(Continued on reverse)

of such airport. Any antenna to be erected in excess of the foregoing limitations requires prior Commission approval. Licensees seeking such approval should file application for modification of license. In addition, notification to the Federal Aviation Administration is required whenever the antenna will exceed 200 feet above the ground and whenever notification is otherwise required by Section 17.7 of the Commission's Rules. Such notification should be given by filing FAA Form 7460-1, Notice of Proposed Construction or Alteration, in duplicate, with the nearest office of the Federal Aviation Administration, which form is available from that office.

36. This license is issued subject to the following condition: Grant of this license is predicated upon Canadian indication that no harmful interference is anticipated to existing Canadian stations. Canada's determination was based upon the results of actual field test transmissions. If interference should arise due to operation of this station in non-conformance with the technical parameters actually employed in conducting the field test transmissions, this license shall automatically cancel and subsequent operations would be unlicensed.

37. This license is issued subject to the condition that the station may only be operated on the specific frequencies paired or associated with SMR system(s) providing mobile relay service to the licensee.

38. Authorized on a secondary basis.

39. Authorized on a secondary basis. Any renewal of this authorization will require that the Commission recoordinate with IRAC.

40. For intersystem communications as limited by Rule Section 90.21(c)(2).

41. A license issued to a corporation or association may not be used for personal communications; Rule Section 95.179(b).

42. Maximum allowable Output Power for Control/ Mobile stations is 100 watts.

43. This license is a conditional grant subject to formal ratification of the US and Mexico agreement which made the frequencies hereon available for assignment. Until ratification of the agreement, this authorization may be cancelled by the Commission without prior notice or right of appeal.

44. Use of this frequency is limited to transmissions that are in compliance with the SPEN Plan. (Frequency 154.680 MHz)

45. Secondary site subject to the condition that no interference is caused to co-channel users in an adjacent communications area.

46. A license issued to an individual may be used only by the licensee and members of the immediate family who reside in the same household, see Rule Section 95.179.

47. This authorization is granted subject to the condition that no harmful interferen is caused to co-channel Canadian stations Furthermore, no protection is afforded to your transmissions from interference that may be caused by these authorized Canadian operations.

48. A review of your previous authorization showed Output Power(s) in excess of the Commission's Rules. Your current authorization reflects the maximum output(s) allowed for your station(s). If you have any questions regarding this change, contact the Consumer Assistance Branch office at (717) 337-1212.

49. Effective Radiated Power (ERP) has been reduced to be in compliance with Rule Section 90.635.

50. Effective Radiated Power (ERP) has been reduced to comply with Rule Sections 90.307, 90.309, and 90.315.

51. Area of operation has been reduced to comply with Rule Section 90.305.

52. The maximum Effective Radiated Power (ERP) allowed for the Control station authorized in this system is 5 watts.

53. Only those frequencies identified by Public Notice are available for use.

54. The use of specific frequencies shall be in accordance with Public Notices issued b the Commission. See Rule Section 90.264.

55. For coordination and cooperation with state police only.

56. Authorized on a non-loading basis.

57. Authorized by inter-pool service.

58. Pagers equal 100,000.

59. These frequencies may not be used within 68.4 miles of the US and Mexico border, nor within 100 miles of the US and Canada border.

60. Authorized pursuant to Rule Section 90.621(b)(4)/(5).

61. Effective Radiated Power (ERP) has been amended to be in compliance with Rule Section 90.619.

OBSTRUCTION MARKING AND LIGHTING SPECIFICATIONS FOR ANTENNA STRUCTURES

It is to be expressly understood that the issuance of these specifications is in no way to be considered as precluding additional or modified marking or lighting as may hereafter be required under the provisions of Section 303(q) of the Communications Act of 1934, as amended.

PAINTING

1 Antenna structures shall be painted throughout their height with alternate bands of aviation surface orange and white, terminating with aviation surface orange bands at both top and bottom. The width of the bands shall be equal and approximately one-seventh the height of the structure, provided however, that the bands shall not be more than 100 feet nor less than 1½ feet in width. All towers shall be cleaned or repainted as oftenas necessary tomaintain good visibility.

TOP LIGHTING

2 There shall be installed at the top of the tower at least two 116- or 125-watt lamps (A21/TS) enclosed in aviation red obstruction light globes. The two lights shall burn simultaneously from sunset to sunrise and shall be positioned so as to insure unobstructed visibility of at least one of the lights from aircraft at any normal angle of approach. A light sensitive control device or an astronomic dial clock and time switch may be used to control the obstruction lighting in lieu of manual control. When a light sensitive device is used it should be adjusted so that the lights will be turned on at a north sky light intensity level of about thirty-five foot candles and turned off at a north sky light intensity level of about fifty-eight foot candles.

3 There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40, Code Beacon type), both lamps to burn simultaneously, and equipped with aviation red color filters. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute with a period of darkness equal to approximately one-half of the luminous period.

INTERMEDIATE LIGHTING (BEACONS)

4 At approximately one-half of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event this beacon cannot be installed in a manner to insure unobstructed visibility of it from aircraft at any normal angle of approach, there shall be installed two such beacons. Each beacon shall be mounted on the outside of the tower at the prescribed height.

5 At approximately two-fifths of the over-all height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event this beacon cannot be installed in a manner to insure unobstructed visibility of it from aircraft at any normal angle of approach, there shall be installed two such beacons. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

6 On levels at approximately two-thirds and one-third of the over-all height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

7 On levels at approximately four-sevenths and two-sevenths of the over-all height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

8 On levels at approximately three-fourths, one-half and one-fourth of the over-all height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of the beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

9 On levels at approximately two-thirds, four-ninths and two-ninths of the over-all height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

10 On levels at approximately four-fifths, three-fifths, two-fifths and one-fifth of the over-all height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be

THIS FORM IS A PART OF AND SHALL BE ATTACHED TO THE CURRENT INSTRUMENT OF AUTHORIZATION

(All previous editions should be destroyed.)

installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

10.1 On levels at approximately eight-elevenths, six-elevenths, four-elevenths and two elevenths of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

10.2 On levels at approximately five-sixths, two-thirds, one-half, one-third and one-sixth of the over-all height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

10.3 On levels at approximately ten-thirteenths, eight-thirteenths, six thirteenths, four-thirteenths and two-thirteenths of the over-all height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

10.4 On levels at approximately six-sevenths, five-sevenths, four-sevenths, three-sevenths two-sevenths and one-seventh of the over-all height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

(SIDE LIGHTS)

11 At the approximate mid point of the over-all height of the tower there shall be installed at least two 116- or 125-watt lamps (A21/TS) enclosed in aviation red obstruction light globes. Each light shall be mounted so as to insure unobstructed visibility of at least one light at each level from aircraft at any normal angle of approach.

12 On levels at approximately two-thirds and one-third of the over-all height of the tower, there shall be installed at least two 116- or 125-watt lamps (A21/TS) enclosed in aviation red obstruction light globes. Each light shall be mounted so as to insure unobstructed visibility of at least one light at each level from aircraft at any normal angle of approach.

13 On levels at approximately three-fourths and one-fourth of the over-all height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in aviation red obstruction light globe shall be installed on each outside corner of the structure.

14 On levels at approximately four-fifths, three-fifths and one-fifth of the over-all height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the structure.

15 On levels at approximately five-sixths, one-half, and one-sixth of the over-all height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of structure.

16 On levels at approximately six-sevenths, five-sevenths, three-sevenths and one-seventh of the over-all height of the tower at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the structure.

17 On levels at approximately seven-eighths, five-eighths, three-eighths and one-eighth of the over-all height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the structure.

18 On levels at approximately eight-ninths, seven-ninths, five-ninths, one-third and one-ninth of the over-all height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the structure.

19 On levels at approximately nine-tenths, seven-tenths, one-half, three-tenths and one-tenth of the over-all height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the structure.

19.1 On levels at approximately ten-elevenths, nine-elevenths, seven-elevenths, five-elevenths, three-elevenths and one-eleventh of the over-all height of the tower at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the structure.

19.2 On levels at approximately eleven-twelfths, three-fourths, seven-twelfths, five-twelfths, one-fourth and one-twelfth of the over-all height of the tower at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the structure.

19.3 On levels at approximately twelve-thirteenths, eleven-thirteenths, nine-thirteenths, seven-thirteenths, five-thirteenths, three-thirteenths and one-thirteenth of the over-all height of the tower at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the structure.

19.4 On levels at approximately thirteen-fourteenths, eleven-fourteenths, nine-fourteenths, one-half, five-fourteenths three-fourteenths and one-fourteenth of the over-all height of the tower at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the structure.

20 All lighting shall be exhibited from sunset to sunrise unless otherwise specified.

21 All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on at a north sky light intensity level of about 35 foot candles and turned off at a north sky light intensity level of about 58 foot candles.

22 During construction of an antenna structure, for which obstruction lighting is required, at least two 116- or 125-watt lamps (A21/TS) enclosed in aviation red obstruction light globes, shall be installed at the uppermost point of the structure. In addition, as the height of the structure exceeds each level at which permanent obstruction lights will be required, two similar lights shall be displayed nightly from sunset to sunrise until the permanent obstruction lights have been installed and placed in operation, and shall be positioned so as to insure unobstructed visibility of at least one of the lights at any normal angle of approach. In lieu of the above temporary warning lights, the permanent obstruction lighting fixtures may be installed and operated at each required level as each such level is exceeded in height during construction.

HIGH INTENSITY OBSTRUCTION LIGHTING SPECIFICATIONS FOR ANTENNA STRUCTURES

It is to be expressly understood that the issuance of these specifications is in no way to be considered as precluding additional or modified marking or lighting as may hereafter be required under the provisions of Section 303(q) of the Communications Act of 1934, as amended

TOP LIGHTING

A. There shall be installed at the top of the antenna structure a white capacitor discharge omnidirectional light which conforms to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. This light shall be mounted on the highest point of the structure. If the antenna or other appurtenance at its highest point is incapable of supporting the omnidirectional light, one or more such lights shall be installed on a suitable adjacent support with the lights mounted not more than 20 feet below the tip of the appurtenance. The lights shall be positioned so as to permit unobstructed viewing of at least one light from aircraft at any normal angle of approach. The light unit(s) shall emit a beam with a peak intensity around its periphery of approximately 20,000 candelas during daytime and twilight, and approximately 4,000 candelas at night.

B. There shall be installed at the top of the skeletal or other main support structure three or more high intensity light units which conform to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. The complement of units shall emit a white high intensity light and produce an effective intensity of not less than 200,000 candelas (daytime) uniformly about the antenna structure in the horizontal plane. The effective intensity shall be reduced to approximately 20,000 candelas at twilight, and to approximately 4,000 candelas at night. The light units shall be mounted in a manner to ensure unobstructed viewing from aircraft at any normal angle of approach, so that the effective intensity of the full beam is not impaired by any structural member of the skeletal framework. The units will normally be adjusted so that the center of the beam is in the horizontal plane.

INTERMEDIATE LIGHTING

C. At the approximate one-half level of the skeletal tower there shall be installed three or more high intensity light units which conform to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. The complement of units shall emit a white high intensity light and produce an effective intensity of not less than 200,000 candelas (daytime) uniformly about the antenna structure in the horizontal plane. The effective intensity shall be reduced to approximately 20,000 candelas at twilight, and to approximately 4,000 candelas at night. The light units shall be mounted in a manner to ensure unobstructed viewing from aircraft at any normal angle of approach, so that the effective intensity of the full beam is not impaired by any structural member of the skeletal framework. The normal angular adjustment of the beam centers above the horizontal shall be two degrees (2°).

D. At the approximate one-third and two-thirds levels of the skeletal tower there shall be installed three or more high intensity light units which conform to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. The complement of units shall emit a white high intensity light and produce an effective intensity of not less than 200,000 candelas (daytime) uniformly about the antenna structure in the horizontal plane. The effective intensity shall be reduced to approximately 20,000 candelas at twilight, and to approximately 4,000 candelas at night. The light units shall be mounted in a manner to ensure unobstructed viewing from aircraft at any normal angle of approach, so that the effective intensity of the full beam is not impaired by any structural member of the skeletal framework. The normal angular adjustment of the beam centers above the horizontal shall be two degrees (2°) at the one-third level and one degree (1°) at the two-thirds level.

E. At the approximate one-fourth, one-half and three-fourths levels of the skeletal tower there shall be installed three or more high intensity light units which conform to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. The complement of units shall emit a white high intensity light and produce an effective intensity of not less than 200,000 candelas (daytime) uniformly about the antenna structure in the horizontal plane. The effective intensity shall be reduced to approximately 20,000 candelas at twilight, and to approximately 4,000 candelas at night. The light units shall be mounted in a manner to ensure unobstructed viewing from aircraft at any normal angle of approach, so that the effective intensity of the full beam is not impaired by any structural member of the skeletal framework. The normal angular adjustment of the beam centers above the horizontal shall be three degrees (3°) at the one-fourth level, two degrees (2°) at the one-half level and one degree (1°) at the three-fourths level.

F. At the approximate one-fifth, two-fifths, three-fifths and four-fifths levels of the skeletal tower there shall be installed three or more high intensity light units which conform to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. The complement of units shall emit a white high intensity light and produce an effective intensity of not less than 200,000 candelas (daytime) uniformly about the antenna structure in the horizontal plane. The effective intensity shall be reduced to approximately 20,000 candelas at twilight, and to approximately 4,000 candelas at night. The light units shall be mounted in a manner to ensure unobstructed viewing from aircraft at any normal angle of approach, so that the effective intensity of the full beam is not impaired by any structural member of the skeletal framework. The normal angular adjustment of the beam centers above the horizontal shall be three degrees (3°) at the one-fifth level, two degrees (2°) at the two-fifths level, one degree (1°) at the three-fifths level and zero degrees (0°) at the four-fifths level.

G. At the approximate one-sixth, one-third, one-half, two-thirds and five-sixths levels of the skeletal tower there shall be installed three or more high intensity light units which conform to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. The complement of units shall emit a white high intensity light and produce an effective intensity of not less than 200,000 candelas (daytime) uniformly about the antenna structure in the horizontal plane. The effective intensity shall be reduced to approximately 20,000 candelas at twilight, and to approximately 4,000 candelas at night. The light units shall be mounted in a manner to ensure unobstructed viewing from aircraft at any normal angle of approach, so that the effective intensity of the full beam is not impaired by any structural member of the skeletal framework. The normal angular adjustment of the beam centers above the horizontal shall be three degrees (3°) at the one-sixth level, two degrees (2°) at the one-third level, two degrees (2°) at the one-half level, one degree (1°) at the two-thirds level and zero degrees (0°) at the five-sixths level.

H. All lights shall be synchronized to flash simultaneously at 40 pulses per minute. The light system shall be equipped with a light sensitive control device which shall face the north sky and cause the intensity steps to change automatically when the north sky illumination on a vertical surface is as follows:

1. Day to Twilight: Shall not occur before the illumination drops to 60 footcandles, but shall occur before it drops below 30 footcandles.

2. Twilight to Night: Shall not occur before the illumination drops to 5 footcandles, but shall occur before it drops to 2 footcandles.

3. Night to Day: The intensity changes listed in 1. and 2. above shall be reversed in transitioning from the night to day modes.

TEMPORARY LIGHTING

I. During construction of an antenna structure for which high intensity lighting is required, at least two lights shall be installed at the uppermost part of the structure. In addition, at each level where permanent obstruction lighting will be required, two similar lights shall be installed. Each temporary light shall consist of at least 1,500 candelas (peak effective intensity) synchronized to flash simultaneously at 40 pulses per minute. Temporary lights shall be operated continuously, except for periods of actual construction, until the permanent obstruction lights have been installed and placed in operation. Lights shall be positioned to ensure unobstructed viewing from aircraft at any normal angle of approach. If practical, the permanent obstruction lights may be installed at each level as the structure progresses. *NOTE:* If battery operated, the batteries should be replaced or recharged at regular intervals to preclude failure during operation.

OPTIONAL LIGHTING

J. Antenna structures shall be equipped with:

1. High intensity lighting for daytime use and red lighting for nighttime use as specified in FCC Form 715, or

2. High intensity lighting, 24 hours a day, which conforms to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems.

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1.0 INTRODUCTION

This field sampling plan (FSP) has been prepared in conjunction with the quality assurance project plan (QAPP) to address remedial action (RA) project sampling activities at the Colbert Landfill Superfund site. The purpose of the FSP is to provide detailed information on the procedures to be implemented when collecting groundwater and influent/effluent samples at the site. These field sampling procedures are intended to provide data that meet the data quality objectives (DQOs) set forth in the QAPP, and will be conducted in accordance with the quality assurance/quality control (QA/QC) requirements of the QAPP.

The FSP provides a general description of sampling frequency. However, the project RA is anticipated to require at least 30 years, and sampling frequency will vary depending on observed conditions during remedial action, based on the operational sampling frequency criteria specified in the project Consent Decree Scope of Work (SOW) (Section V). This FSP also provides for groundwater sampling that also will be conducted to satisfy the requirements set forth in the Minimum Functional Standards (MFS) for Solid Waste Handling chapter 173-304 WAC (Ecology 1988) as specified in the project Consent Decree.

The National Pollutant Discharge Elimination System (NPDES) monitoring requirements presented in this FSP are based on the substantive discharge requirements identified in the Washington State Department of Ecology document (Ecology undated).

2.0 SAMPLING OBJECTIVES

The objective of the FSP is to provide for the acquisition of data, during the RA, that are accurate, reproducible, and comparable. To achieve this objective, this document details sample collection, handling, documentation, and security procedures. These procedures have been written to comply with the *Compendium of Superfund Field Operations* (EPA/540/P-87/001, OSWER 9355.014, September 1987). Standards have been developed for evaluation of the field sampling procedures with respect to the project objectives.

Any changes in sampling procedures as outlined in this document will be described on the Modification to Field Sampling Plan form (Form F-1). Approval from the Field Services Project Manager will be needed prior to implementation of any changes.

3.0 SAMPLING LOCATION, ANALYSIS, AND FREQUENCY

Groundwater and treatment system influent/effluent samples will be collected and analyzed for selected parameters during Phase II of the project. Phase II sampling and analysis consists of:

- Groundwater: to be collected from 24 compliance monitoring wells and 10 extraction wells to provide data to evaluate interception system performance and RA progress. Groundwater samples also will be collected from six additional locations (four from the upper aquifer, and two from the lower aquifer) to meet project MFS requirements. Groundwater samples may also be collected from additional monitoring wells and private wells to evaluate RA progress, at the discretion of Spokane County.
- Influent/Effluent: to be collected from the intake and discharge sides of the treatment system (air stripping tower) to: 1) provide data on the effectiveness of the treatment system in reducing concentrations of the Constituents of Concern to levels specified in the Consent Decree, 2) (in the case of effluent) provide data on selected water quality parameters to assess system compliance with National Pollution Discharge Elimination System (NPDES) requirements governing industrial discharges to surface receiving waters, and 3) determine treatment system air emissions (by groundwater influent/effluent mass balance).
- Receiving Water: if necessary, samples will be collected from one location upstream and one location downstream of the treatment facility outfall in the Little Spokane River to provide data on the impact of effluent discharge on algal growth potential for the Little Spokane River (whether or not samples of the receiving water will be necessary will depend upon the results of the affluent sampling).

Sampling locations, including groundwater monitoring and extraction wells comprising the RA compliance sampling network, the treatment facility, MFS sampling locations, receiving water sampling locations, and the treatment facility outfall, are shown on Figure F-1. Constituents/parameters to be analyzed (for each sampling type and matrix) and the frequency of sampling are presented in Table F-1. Analytical methods are described in Table F-2. In addition to parameters and constituents indicated in Table F-1, influent/effluent and groundwater samples will be field monitored for pH, specific conductivity, turbidity, and temperature by either mechanical or electronic means.

The number of wells at each Phase II monitoring location is provided in Table F-3 (only one well is present at each extraction well location).

4.0 SAMPLE COLLECTION AND ANALYSIS PROCEDURES

This section presents descriptions of the equipment and step-by-step procedures to be used for collecting, handling, and analyzing groundwater (Sections 4.1 and 4.2), treatment system influent and effluent (Section 4.3), and receiving water samples (Section 4.4). A summary of sample containers, preservation requirements, and holding times is presented in Table F-4.

4.1 GENERAL SAMPLING PROCEDURES

This section describes procedures applicable to all sampling performed at the site, including sampling of groundwater monitoring/extraction wells, treatment system influent/effluent, and receiving waters. These procedures are for sample containers; sample labels; field measurements of pH, conductivity, temperature, and turbidity; sample bottle filling; chain-of-custody; chain-of-custody seals; field records; and shipment of samples.

> **CAUTION:** Groundwater extraction well vaults are confined spaces. Well vaults and monitoring wells may accumulate methane gas or toxic vapors in concentrations that are flammable or toxic. Refer to the safety section of the O&M manual (Section 8.0) for confined space entry procedures, air monitoring procedures, and other health and safety procedures.

4.1.1 SAMPLE CONTAINERS

All sample containers will be QC certified according to EPA specifications and will be obtained through the analytical laboratory. The laboratory will add the proper preservatives to the appropriate containers prior to sample collection.

4.1.2 SAMPLE LABELS

Sample labels are necessary to properly identify samples. Gummed paper labels or tags are adequate for RA activities and will include the following information:

- Sample identification number
- Date and time
- Name of sampler
- Pertinent field information

- Analysis requested.

Labels will be completed and affixed to sample containers prior to or at the time of sampling.

4.1.3 FIELD MEASUREMENTS

Conductivity, turbidity, and temperature measuring devices and pH meters will be calibrated following the instrument manufacturer's procedures (Section 5.0). These meters will be calibrated prior to sampling, and at least once for every 4 hours of sampling and at end of day. Calibration adjustments will be recorded in a log book maintained for each meter.

4.1.4 FILLING SAMPLE BOTTLES

Sample bottles will be filled directly from the bailer or pump, or other sampling device. When sampling for volatile organics, bottles will be filled with a minimal amount of air contact. A slow, steady transfer rate will be used during sample collection.

The following procedures and precautions will be adhered to when filling sample bottles:

- Bottle caps will be removed carefully so that the inside of the cap is not touched. Caps will not be placed on the ground. Caps for volatile organics analyses contain a Teflon-lined septum. The Teflon side of the septum must be facing the sample to prevent contamination of the sample through the septum.
- The sample bottles will be filled with a minimal amount of air contact and without allowing the sampling equipment or personnel to contact the inside of the bottles. Tubing or hoses from pumps or sampling nozzles will not be placed into the sample bottles.
- Sample bottles containing preservatives should be filled completely, but not over filled. Bottle caps should be replaced tightly.
- Vials for volatile organics analyses will be filled so that they have no headspace (i.e., no air bubbles in the sample bottle). The caps will be replaced gently, so as to eliminate any air bubbles in the sample. These bottles will then be checked for air bubbles by inverting them and shaking the bottle. If any air bubbles appear, the bottles will be reopened, topped off, and recapped. If an air bubble is present after topping off, the bottle will be discarded and a new bottle will be filled.
- Each set of two or three volatile organics analyses sample bottles will be placed in a plastic bag. Samples should be placed into a cooled ice chest immediately after collection to prevent loss of volatile organics through exposure to sunlight and warm temperatures.

4.1.5 CHAIN OF CUSTODY

To establish the documentation necessary to trace sample possession from the time of collection, a Chain-of-Custody Record similar to that shown on Form F-3 will be filled out and will accompany every sample delivery to the laboratory. The record will contain the following information:

- Sample identification number
- Name of person taking sample
- Number of containers for each sample number
- Date and time of collection
- Signatures of persons involved in the chain of possession (the sampler will be the first person to relinquish custody)
- Inclusive dates of possession.

The Chain-of-Custody Record will be completed by field personnel in triplicate for all sampling. When samples are transferred, the person relinquishing the samples will sign the Chain-of-Custody Record and record the date and time of transfer. The sample collector will sign the form in the first signature space. A designated sample custodian will accept custody of the shipped samples and certify that the sample identification number matches that on the Chain-of-Custody record. The custodian will then enter sample identification number data into the logbook. Copies of the completed Chain-of-Custody Records will be retained by the analytical laboratory, in the project files, and by the QA Coordinator (QAC). The laboratory will include a copy of the Chain-of-Custody Record in its report of analytical results. Project documentation of sample custody will be verified during regular review of the data validation package.

4.1.6 CHAIN-OF-CUSTODY SEAL

A Chain-of-Custody Seal similar to that shown on Form F-4 (used to detect unauthorized tampering with the samples) will be placed on the ice chest after collection of all samples and whenever samples are left unattended. The seal will include, at a minimum, the sampler's name and the date. The seal will be attached such that it must be broken in order to open the ice chest. The seal will be affixed to the ice chest before the sampling personnel relinquish custody of the samples. The seal will be broken only by the designated sample custodian upon receipt of the ice chest at the laboratory.

4.1.7 FIELD RECORDS

Field log books, plus the Sample Collection Forms, will be used to record all information pertinent to the sampling event. The records will contain sufficient information to permit reconstruction of sampling events without reliance on the sampler's memory. All field log books and forms will be retained by the Field Coordinator and secured in a safe place.

4.1.8 SHIPMENT OF SAMPLES

A Sample Analysis Request Packing List (Form F-5) will accompany the samples to the laboratory, if equivalent information is not contained in the Chain-of-Custody Record. This form will be completed by field personnel and will specify the analysis to be performed by the analytical laboratory. Samples will be shipped to the laboratory within 24 hours of sampling, except that samples collected on a Friday will typically be stored in a refrigerator over the weekend and shipped to the laboratory on Monday. Special arrangements will be made with the laboratory for timely receipt of samples collected with short holding times that are collected on a Friday.

The samples will be accompanied by a Chain-of-Custody Record and will be delivered to the laboratory representative authorized to receive samples. The laboratory representative will sign the Chain-of-Custody Record to verify delivery/receipt.

4.1.9 SAMPLE HANDLING

Sample container description, preservation method, and maximum holding time for planned analyses are presented for each sample type in Table F-4. Sample handling procedures will depend upon the required method of preservation. Each sample that is preserved with acid will be placed in a separate plastic bag. As much air as possible will be squeezed from the bags before sealing. Samples preserved with acid will either be transported directly to the laboratory by automobile or will be shipped on an overnight carrier. Samples that are not preserved with acid do not need to be placed in separate bags prior to shipment to the laboratory.

For all samples, an ice chest will be used as a shipping container. In preparation for shipping samples, the drain plug will be taped shut from the inside and outside. Approximately 1 inch of packing material will be placed in the bottom of the ice chest. The sample bottles will be placed in the ice chest. All ice chests will contain ice or frozen gel packs. The ice chest will be filled with sufficient packing material to prevent sample containers from making contact during shipment. The paperwork accompanying the samples to the laboratory will be put into the cooler

inside a plastic bag and put into the cooler above the packing. The ice chest will be taped shut with strapping tape. A Chain-of-Custody Seal (Form F-4) will be placed on the outside of the ice chest.

4.2 GROUNDWATER MONITORING/EXTRACTION WELL SAMPLING

Groundwater monitoring well and extraction well sampling will be conducted in accordance with the procedures described in the following subsections. Dedicated sampling equipment is installed in all RA compliance monitoring wells and extraction wells; however, some monitoring wells that are not part of the RA groundwater compliance monitoring system and do not have dedicated sampling equipment also may be sampled periodically. Therefore, this section presents sampling procedures for both dedicated and nondedicated sampling equipment.

4.2.1 WATER LEVEL MEASUREMENTS

For monitoring wells, water levels will be measured with an electronic water level indicator just prior to purging and sampling. For extraction wells, water levels will be measured using the dedicated water level instruments, and confirmed at least quarterly using a nondedicated electronic water level indicator. Measurements will be made from the surveyed point on the top of the well casing. If a nondedicated water level probe is used, it will be decontaminated before and after each measurement with a distilled water rinse. Depth to water will be recorded to the nearest 0.01 ft on the Sample Collection Form (Form F-2).

4.2.2 PURGING THE WELL

Prior to sampling, monitoring wells will be purged by removing at least three well volumes of water from the casing using an air-driven, piston pump; bladder pump; or submersible pump fitted with Teflon-lined polyethylene tubing. If the pump is nondedicated, the interior of the tubing and the pump will be washed with an Alconox and water solution, rinsed with tap water, and then rinsed with distilled or deionized water following use. The exterior of the tubing will be decontaminated with a high-pressure, hot water pressure washer. During decontamination, rinse water will be contained for proper disposal or treatment (see below).

The well purge volumes for normally sampled groundwater monitoring wells are listed in Table F-5. For other wells, the well purge volume will be calculated based on the following formula: one well volume (gallon) = $\pi r^2 h \times 7.48$ gal/ft^3; where $\pi = 3.14$, r = radius of well casing in feet, and h = height of water column from the bottom of the well in feet. Information on purge volume, date

and [illegible] of initiation and termination of pumping, plus a description of the physical characteristics of pu[illegible]d water (color, turbidity, etc.) based on visual observation, will be recorded on the Sample Collection Form (Form F-2). In most instances, sampling will be completed the same day as well purging. However, if the well becomes dry during purging, it will be sampled as soon as the water level has recovered enough to allow collection of the necessary samples, which may require sampling on a subsequent day. The start and end date and time of purging, as well as the date and time of sample collection, will be recorded on the Sample Collection Form.

Extraction wells will normally be operating and thus will not require purging. However, if an extraction well is not operating at the time of sampling, it will be briefly operated (if possible) to purge the required three well volumes prior to sampling.

Purged water will be disposed of as follows:

- From monitoring wells with a history of contamination below the levels of regulatory concern: water will be discharged to the ground, if appropriate given well location (water will not be discharged to private residence lawns or other "sensitive" areas)
- From extraction wells and from monitoring wells with contamination above or suspected to be above levels of regulatory concern: water will be collected in a tank or other container, transported to the treatment facility, and discharged to one of the treatment facility sumps (sump water is automatically pumped to the air stripping tower).

4.2.3 GROUNDWATER SAMPLING

Groundwater samples from the monitoring wells will be collected with the aid of a submersible pump, bladder pump, piston pump, or a stainless-steel or Teflon bailer. If the pump or bailer is nondedicated, it will be decontaminated by washing with an Alconox and water solution, then rinsing with tap water, and finally, rinsing with distilled or deionized water following each use. The pump (or bailer) externals will also be rinsed with distilled or deionized water prior to use at a new location if use occurs within 24 hours following decontamination. If pump (or bailer) use occurs more than 24 hours following decontamination, the externals will be decontaminated again using the procedures previously described.

The following precautions will be followed when using a nondedicated pump or bailer to collect groundwater samples:

- Between decontamination and placement in the well, the pump or bailer shall not contact any surface except the inside of a clean carrying case, or clean plastic wrapping
- The pump or bailer will be lowered slowly into the well

- The pump or bailer will not be allowed to come into contact with any surface other than the inside of the well casing.

Extraction wells will be sampled from the piping sample valve in the well vault located immediately downstream from the wellhead. Sampling procedures are identical to the influent/effluent sampling procedures described in Section 4.3. The required sample line purge volume prior to sampling is approximately 1/2 gallon (2 L).

4.2.4 MONITORING/EXTRACTION WELL SAMPLE QUALITY CONTROL (QC)—VOLATILE ORGANICS ANALYSES

Approximately 25 percent of the total number of monitoring/extraction well samples will be collected as QC samples. The four types of field QC samples that will be collected for volatile organic Constituents of Concern analyses are: 1) rinsate blank, 2) field duplicate, 3) transfer blank, and 4) trip blank. Whenever possible, every tenth sample will be either a duplicate or a transfer blank. Trip blanks will accompany each ice chest containing groundwater samples for volatile organic analyses. The types of field QC samples are described below:

- Rinsate Blanks: For wells that are not equipped with dedicated sampling equipment, a minimum of 5 percent of the total number of non-QC groundwater samples (collected from monitoring and extraction wells without dedicated sampling equipment) for VOA will be collected as rinsate blanks to check equipment decontamination procedures. Rinsate blanks will be collected following sampling from wells that are expected to contain relatively high concentrations of volatile organics. Equipment rinsate blanks will be prepared without making any special effort when decontaminating the sampling equipment. The rinsate blank will consist of deionized/distilled water poured over the cleaned sampling equipment and collected into septum vials (appropriately sized containers) for laboratory analysis.

- Field Duplicate Samples: A minimum of 5 percent of the total number of water samples will be collected and analyzed as field duplicates. Duplicate samples will be collected by alternately discharging the pump or bailer into duplicate sample bottles. Each duplicate sample will have a separate sample number and Sample Collection Form so that laboratory personnel will not know the sample is a duplicate.

- Trip Blanks: One trip blank will be included in each ice chest containing groundwater samples. A trip blank will consist of a sample bottle filled by the analytical laboratory with deionized/distilled water. The blank will remain with the sample bottles in transit to and around the site during sampling and the return trip to the laboratory. At no time during these sampling activities is the trip blank to be opened. Upon return to the laboratory, the trip blank will be analyzed as if it were another field sample receiving the same QA/QC procedures as ordinary samples. If no volatile organic constituents are detected in any sample in a ice chest, the accompanying trip blank need not be analyzed.

4.3 TREATMENT SYSTEM INFLUENT/EFFLUENT SAMPLING

Samples of treatment system influent/effluent will be collected and analyzed to evaluate the efficiency of the treatment system in removing the Constituents of Concern and to evaluate system compliance with NPDES requirements. Treatment System influent/effluent sampling will be performed in accordance with the procedures described in the following subsections.

4.3.1 SAMPLE COLLECTION PROCEDURES

Samples of treatment system influent/effluent will be collected from sample taps on the influent and effluent piping. There are five influent sample taps, one on each of the three well system influent headers, one on the combined influent pipeline, and one on the treatment system bypass pipeline. The influent sample taps are located in the treatment facility process area at the sample sink. One effluent sample tap is located on the discharge line from the air stripping tower, approximately 4 ft upstream of the discharge line shutoff valve HV 24-3. Each sample tap line terminates with a needle valve that regulates the flow of the water to be sampled.

Samples will be collected as grab samples, as indicated in Table F-1 using the following procedure:

- Open sample line isolation valve at connection to pipeline (influent sample lines only)
- Open needle valve and purge sample line (see Table F-6 for sample line purge volumes)
- Close needle valve partially to adjust flow to gentle stream
- Fill bottles using procedures set forth in Section 4.1.4
- Close needle valve and sample line isolation valve.

All samples will be tested for the field parameters pH, conductivity, temperature, and turbidity.

4.3.2 TREATMENT SYSTEM QUALITY CONTROL (QC) SAMPLES

Approximately 20 percent of the total number of treatment system influent/effluent samples will be collected as QC samples. Whenever possible, every tenth sample will be either a duplicate or blank, and will be collected in the following order: 1) duplicate, 2) transfer blank, and 3) trip blank. Rinsate blanks will not be collected because samples will be collected from dedicated equipment (i.e., sample ports permanently installed on the stripping tower). The types of field QC samples are described below:

- Field Duplicate Samples: A minimum of 5 percent of the total number of influent/effluent samples will be collected and analyzed as field duplicate samples. Field duplicate samples will be collected by alternately filling duplicate sample bottles. Each duplicate sample will have a separate sample number and Sample Collection Form so that laboratory personnel do not know the sample is a duplicate.

NO

- Transfer Blanks: A minimum of one transfer blank will be collected every twentieth sample by transferring DI/distilled water, provided by the analytical laboratory, into a set of sample bottles. Each transfer blank will be identified and logged on a separate Sample Collection Form. Upon return to the laboratory, the transfer blank will be analyzed as if it were a field sample, following the same QA/QC procedures as ordinary samples.

- Trip Blanks: A trip blank will accompany each ice chest containing stripping tower samples to be analyzed for volatile organic compounds. A trip blank will consist of a sample bottle filled with DI/distilled water by the laboratory. The blank will remain with the sample bottles in transit to and around the site during sampling and the return trip to the laboratory. At no time during these sampling activities is the trip blank to be opened. Upon return to the laboratory, trip blanks will be analyzed for at least one out of every five sampling events (about 10 percent of the total number of influent/effluent samples). Additionally, the trip blank will be analyzed if anomalously high concentrations or low detections are reported by the laboratory for the associated effluent sample. The trip blank will be analyzed as if it were another field sample, following the same QA/QC procedures as ordinary samples.

4.4 RECEIVING WATER SAMPLING

If laboratory results for effluent samples show that nitrogen levels have exceeded 7 mg/L for two consecutive sampling events, or phosphorus concentrations have exceeded 0.1 mg/L for two consecutive events, sampling for algal growth potential shall resume monthly between May and October.

Sampling for algal growth potential, if necessary, will be conducted at two locations in the Little Spokane River, as shown on Figure F-1. One location is upstream of the outfall, and one location is approximately 300 ft downstream of the outfall, at the edge of the mixing zone. All receiving water samples will be collected as grab samples. The sample collection procedure is as follows:

- Collect sample from shore or wading zone using a 15-ft telescoping aluminum pole. Affix sample bottle to end of pole using rope or twine (do not use tape), a bottle clamp, or a basket.

  Note: When sampling for volatile organic compounds or for other parameters that require a preservation agent (e.g., acid), collect sample in 1-L glass bottle (or other container as appropriate), and transfer sample to final container immediately following collection.

- When sampling into final container, decontaminate outside of sample bottle before sampling by washing with an Alconox and water solution, then rinsing with tap water, and finally, rinsing with distilled or deionized water. When not sampling directly into final container, decontaminate inside and outside of intermediate container before sampling and between each sample location, as described above.
- Remove cover from sample bottle.
- Using pole, extend bottle over river, to a point slightly upstream from sampler. With bottle opening facing upstream, lower bottle gently into water, and push down until bottle is approximately 1 foot below water surface. Fill bottle slowly and continuously. Keep pole pointing slightly upstream. Gently raise bottle from water, keeping bottle as full as possible. Swing bottle to shore.
- Fill sample bottle from intermediate container using procedures set forth in Section 4.1.4 (if applicable).
- Cap sample bottle and place in ice chest.

Sampling may cease if concentrations of nitrogen and phosphorous drop below 5 mg/L and 0.05 mg/L, respectively, and the algal growth studies indicate no significant difference between upstream and downstream algal growth potential. If, once a study has been triggered, it is found there is no significant stimulation of algal growth potential, the study shall be suspended.

5.0 FIELD INSTRUMENT CALIBRATION PROCEDURES

5.1 pH METER

The pH of water samples will be measured using the instrument manufacturer's instructions for calibration and use. A two-buffer calibration with Automatic Temperature Compensation (ATC) will be used at a minimum of every four hours during sampling. The manufacturer's instructions are attached.

5.2 CONDUCTIVITY METER

The conductivity of the water samples will be measured using the attached instrument manufacturer's instructions.

5.3 THERMOMETER

Model: Taylor Pocket Thermometer #21430-1

(Range = 30° to 50° C)

1. Thermometer Calibration Procedure

   a. Each thermometer is labeled with an identifying number. The thermometer calibration will be documented in a dedicated calibration log book. All instrument calibrations and repairs will be recorded in the calibration log. The log book will describe the thermometer (make, model, purchase date, serial number, probe type, etc.).

   b. All thermometers will be calibrated against an NBS-traceable thermometer, which will not be used in the field but will be retained at the treatment facility as a calibrated standard.

   c. Thermometers will be calibrated immediately after purchase and every six months thereafter, or if any unusual readings are obtained.

2. Temperature Measurement Procedure

   a. Immediately prior to calibration, the operator will enter his or her name, the date, and the time of calibration in the log book. The instrument will be calibrated indoors.

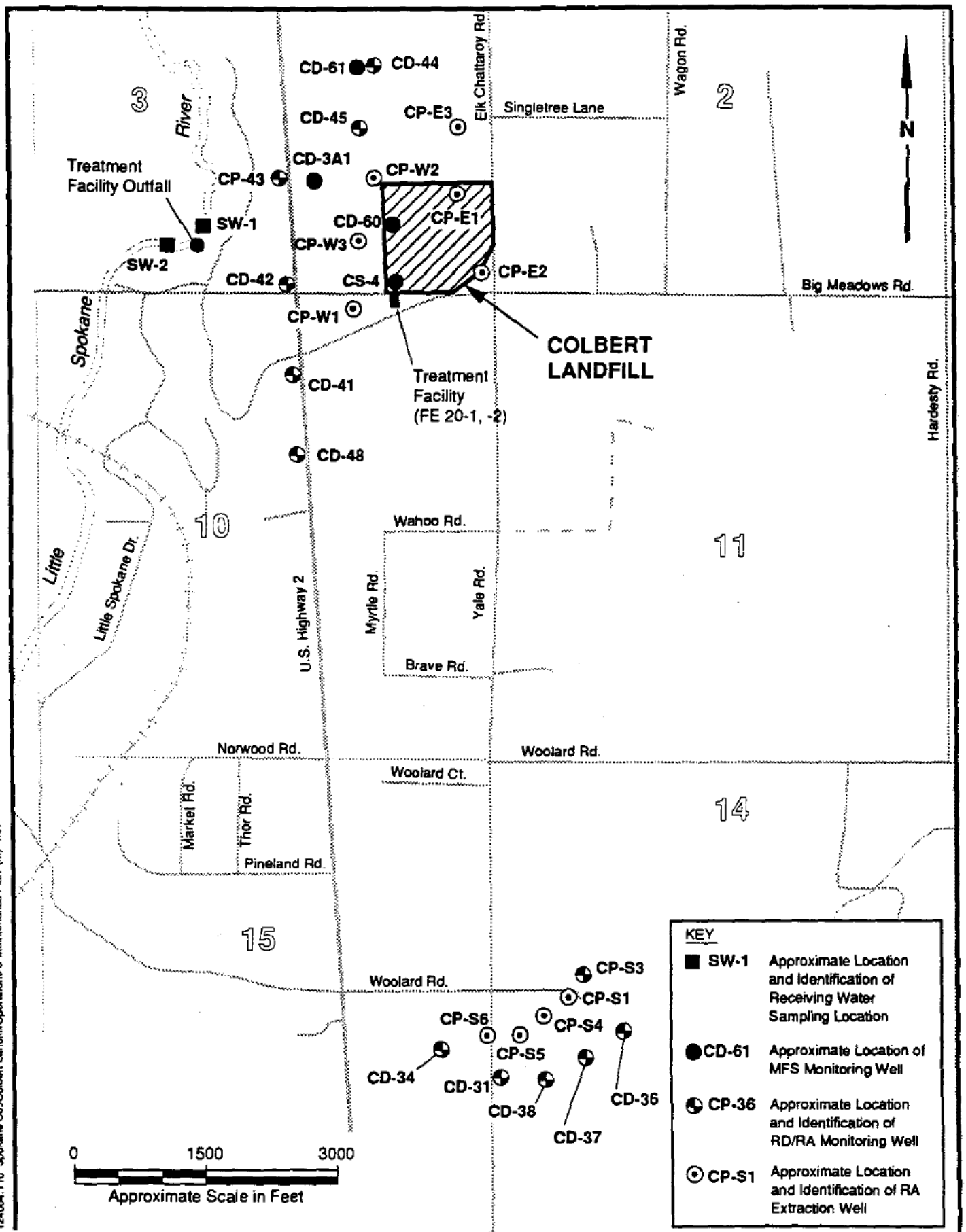
   b. A two-point calibration will be conducted as follows: first, both the thermometer being calibrated (i.e., the field thermometer) and the NBS-traceable thermometer will be immersed in a container of ice and water. After waiting for the reading to stabilize, the operator will record both readings and calculate the error on the field thermometer. The procedure will be repeated with the water at room temperature (approximately 20-25°C).

The field thermometer will be considered to be calibrated if it reads within 1°C of the NBS-traceable thermometer (i.e., ± 1°C). The information will be recorded as follows:

Initials	Date (ddmmyy)	Time	Temp NBS	Temp Field	Error (Field-NBS)
JML	3/3/88	1324	0.5	1	+0.5
JML	3/3/88	1324	18	19	+1.0

5.4 TURBIDIMETER

Turbidity of water samples will be measured using the attached instrument manufacturer's instructions.



124004.110 Spokane Co./Colbert Landfill/Operations & Maintenance Plan (M) 1/97

Extraction, Compliance, and MFS Monitoring Location Map

Figure F-1

Modification To Field Sampling Plan

Sample Program Identification: _____

Material to be Sampled: _____

Measurement Parameter: _____

Standard Procedure for Analysis: _____

_____

Reference: _____

Variation from Standard Procedure: _____

_____

_____

_____

_____

Reasons for Variation: _____

_____

_____

_____

Special Equipment, Material or Personnel Required: _____

_____

_____

Author's Name: _____

Approval: _____ Title: _____ Date: _____

Reviewed by: _____

Comments: _____

_____

_____

Reviewed by: _____

Comments: _____

_____

FORM F-1

LANDAU ASSOCIATES, INC.
Edmonds, WA (206) 778-0907
FAX (206) 778-6409

Project _____
Project No. _____
Collector _____

Sample Collection Form

PURGE DATA

Well Condition: Secure (☐ Yes / ☐ No); Describe Damage _____

Depth to Water (from top of well casing) _____
Begin Purge (mo/dy/yr) _____
End Purge (mo/dy/yr) _____
One Casing Volume (gal) _____
Gallons Purged _____
Well Casing Type/Diameter _____

Volume of Schedule 40 PVC Pipe				
Diameter	O.D.	I.D.	Volume Gal/Linear Ft.	Weight of Water Lbs/Lineal Ft.
1 1/4"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.20
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

(remove 3 well volumes or until pH/conductivity stabilize)

Time	Vol. Purged	pH	Conductivity	Temperature	Turbidity

Purge Water Disposal to _____

SAMPLING DATA

Sample No. _____ Date Collected (mo/dy/yr) _____
Sample Location & Depth _____ Time Collected _____ AM PM
Sample Type (Soil, Ground Water, Other) _____ Weather _____
Sample Collected with ☐ Bailer ☐ Pump ☐ Split Barrel ☐ Other _____
Made of ☐ Stainless Steel ☐ PVC ☐ Teflon ☐ Other _____
Sampler Decon Procedure _____
Sample Description (Color, Texture, Density, Moisture, Turbidity, Etc.) _____

FIELD PARAMETERS

Replicate	pH	Conductivity (µS)	Temperature (°F / °C)	Turbidity (NTU)
1				
2				
3				
4				

Meters Used for Measurement: pH _____ Conductivity _____ Turbidity _____
Conductivity: Range _____, ATC ☐ On ☐ Off pH 7: Reads _____ @ _____ °C
Conductivity Std Solution _____ Measured _____ Turbidity Std Solution _____ Measured _____

ADDITIONAL INFORMATION

Sample Composited Over Time, Distance _____
Quantity, Types of Sample Containers _____

Duplicate Sample Number(s) _____
Comments: (Why Analyze, Calculations, Etc.) _____

Signature _____ Date _____ Check if additional information on back ☐

3/90

1240001.85 Spokane Co./Colbert Landfill RD/RA Phase II/O&M Plan 8/94 DRAFT

LANDAU ASSOCIATES, INC.
Edmonds, WA (206) 778-0907
FAX (206)778-6409

Chain-of-Custody Record

Date _____
Page _____ of _____

Project _____ Job No. _____

Client _____

Project Location _____

Sampler's Name _____

Sample No.	Date	Time	Location	No. of Containers	Testing Parameters										Observations/Comments

Special Shipment/Handling or Storage Requirements

Method of Shipment

Relinquished by	Received by	Relinquished by	Received by
Signature	Signature	Signature	Signature
Printed Name	Printed Name	Printed Name	Printed Name
Company	Company	Company	Company
Date _____ Time _____	Date _____ Time _____	Date _____ Time _____	Date _____ Time _____

3/90

WHITE COPY - Project File YELLOW COPY - Laboratory PINK COPY - Client Representative

FORM F-3

CUSTODY SEAL

LANDAU ASSOCIATES, INC.
P.O. BOX 1029 / EDMONDS, WA 98020-9129
PHONE: (206)778-0907 / FAX: (206)778-6409

Signature _____ Date _____

FORM 4

LANDAU ASSOCIATES, INC
Edmonds, WA (206) 778-0907 FAX (206) 778-6409

Sample Analysis Request Packing List

SAMPLER:	Sampling Date(s):	Ship To:	For Lab Use Only
Sampling Contact:	Date Shipped:		Date Samples Rec'd
(name)	Site Name/Code:		Rec'd By:
(phone number)		Attn:	

Sample Numbers	Sample Description i.e., Requested Analysis, Matrix, Concentration	Sample Condition on Receipt at Lab
1.		
2.		
3		
4.		
5.		
6.		
7.		
8.		
9		
10.		
11.		
12		
13.		
14.		
15.		
16.		
17		
18.		
19		
20.		

For Lab Use Only

FORM 5

TABLE F-1
PHASE II SAMPLING AND ANALYSIS PROGRAM
COLBERT LANDFILL REMEDIAL DESIGN/REMEDIAL ACTION[a]

Project Activity	Sample Type and Location	Total No. of Samples	Purpose of Sampling	Matrix	Analysis	Frequency
Downgradient Groundwater Compliance Monitoring Well Sampling	Grab: Monitoring Well Samples South System (CD-31, CD-36, CD-37, CD-38) West System (CD-41, CD-42, CD-43, CD-44, CD-45, CD-48) East System (none)	 4 18 0 22 per sampling event; or about 3,000 samples for the 30-year life of the project	- Performance monitoring of South and West Interception Systems - Evaluating progress of remedial action	Groundwater	- Indicator compounds (1,1,1-TCA; 1,1-DCE; 1,1-DCA; TCE) - Constituents of Concern (1,1,1-TCA; 1,1-DCE; 1,1-DCA; methylene chloride; TCE; PCE) - Field measurements of pH, specific conductivity, turbidity, and temperature	Quarterly Annually (in lieu of analysis for the indicator compounds), during January or first quarter sampling, as applicable Whenever groundwater samples are collected for water quality analysis
Cross-gradient Groundwater Compliance Monitoring Well Sampling	Grab: Monitoring Well Samples South System (CD-34, CP-53) West System (CD-45, CD-48) East System (none)	 2 6 0 8 per sampling event; or up to about 1000 samples for the 30-year life of the project (Note: West System wells are also down-gradient wells. Therefore, net increase in samples is 2 per event or 240 samples total for project).	- Performance monitoring of South and West Interception Systems - Evaluating Progress of Remedial Action	Groundwater	Same as downgradient monitoring well samples	Quarterly
Groundwater Extraction Well Sampling	Grab: Extraction Well Samples South System West System East System	 4 3 3 10 per sampling event; or up to about 1,500 samples over life of the project	- Operational monitoring of South and West Interception systems - Evaluating Progress of remedial action	Groundwater	Same as for monitoring well samples	At Spokane County's discretion, planned frequency is quarterly
MFS Groundwater Monitoring Upper Aquifer	Grab: CD-50A1, CD-3A1, CS-4, CD-51A1	4 per sampling event, 32 for the first two years	Requirement Minimum Functional Standards (WAC 173-304)	Groundwater	14 compounds listed in WAC 173-304-490(2)(d)(c) - Temp cond, p4 - Chloride, sulfate - Nitrate, nitrite, and ammonia as nitrogen - Dissolved zinc, iron, manganese - COP, TOC, total coliform	Quarterly for 2 yrs, subsequent frequency to be determmined
MFS - Groundwater Monitoring Lower Aquifer	Grab: FE20-2, CD-48C2 Grab: FE20-1	2 per sample event, 16 for first two years 1	Requirement Minimum Functional Standards (WAC 173-304) Requirement Minimum Functional Standards (WAC 173-304)	Groundwater Groundwater		Quarterly for 2 yrs, subsequent frequency to be determined One time only

TABLE F-1
PHASE II SAMPLING AND ANALYSIS PROGRAM
COLBERT LANDFILL REMEDIAL DESIGN/REMEDIAL ACTION

Project Activity	Sample Type and Location	Total No. of Samples	Purpose of Sampling	Matrix	Analysis	Frequency
Treatment System Assessment (Influent/Effluent Sampling)	24-Hour Composite: Treatment System (air stripping tower) Influent samples	1 per sampling event, or up to 400 total samples for the 30-year life of the project	- Evaluate treatment system efficiency - Evaluate effectiveness of scale control measures - Evaluate mass removal of Constituents of Concern	Groundwater (Influent)	- Constituents of Concern (1,1,1-TCA; 1,1-DCE; 1,1-DCA; methylene chloride; TCE; PCE)	At Spokane County's discretion, planned frequency is monthly
					- Hardness and alkalinity	At Spokane County's discretion, planned frequency is monthly
					- Field measurement of pH, specific conductivity, and temperature	Whenever influent samples are collected for water quality analysis
	Grab: Treatment System (air stripping tower) Effluent Samples	same as for influent samples	- Verify effluent meets Evaluation Criteria for GW volatile organic Constituents of Concern (SOW Table IV-1) - Evaluate treatment system efficiency - Evaluate mass removal of Constituents of Concern	Groundwater (Effluent)	- Constituents of Concern (1,1,1-TCA; 1,1-DCE; 1,1-DCA; methylene chloride; TCE; PCE)	Monthly
	Grab: Treatment system effluent samples		- Meet NPDES substantive discharge monitoring requirements		Constituents of Concern (1,1-DCE, . . .)	Monthly (full suite of 8010 compounds quarterly)
					• Phosphorous	Once in June, once in July, once in August, once in winter
					• Nitrate + nitrite	Once in June, once in August, once in winter
					• Chloride, iron, manganese	Quarterly
					• pH, flow	Daily, continuous
					• Conductivity, turbidity, temperature	Weekly
					• Acute and chronic toxicity testing, rapid screening tests, including - pH, total alkalinity, total hardness, dissolved oxygen, conductivity at initiation of test	Semiannually

TABLE F-1
PHASE II SAMPLING AND ANALYSIS PROGRAM
COLBERT LANDFILL REMEDIAL DESIGN/REMEDIAL ACTION[a]

Project Activity	Sample Type and Location	Total No. of Samples	Purpose of Sampling	Matrix	Analysis	Frequency
	Grab: Treatment System (influent conveyance pipelines) Influent samples	2 per sampling event, up to 240 samples over 30-year life of project	- Evaluate the need for treatment before discharge (per Consent Decree SOW)	Groundwater (influent) from conveyance pipelines for South and East/West Systems; sample from CP-W1 pipeline not required	- Constituents of Concern (1,1,1-TCA; 1,1-DCE; 1,1-DCA; methylene chloride; TCE; PCE)	Quarterly
Receiving Water Assessment (surface water sampling)	Grab: Little Spokane River, upstream of outfall	Up to 6 samples over required sampling period, if necessary	- Evaluate impact on receiving water - Meet NPDES discharge monitoring requirements	Surface water	- NPDES Parameters • Algal growth potential	Monthly (May - October only) if nitrogen or phosphorus NPDES action levels exceeded for two consecutive months
	Grab: Little Spokane River, edge of mixing zone downstream of outfall	Up to 6 samples over required sampling period, if necessary	- Evaluate impact on receiving water - Meet NPDES discharge monitoring requirements	Surface water	- NPDES Parameters • Algal growth potential	Monthly (May - October only) if nitrogen or phosphorus NPDES action levels exceeded for two consecutive months

(a) This table presents only that sampling required by the Consent Decree; Spokane County has the option to conduct additional discretionary groundwater sampling and analysis.

TABLE F-2

SUMMARY OF ANALYTICAL METHODS

Analyte	Analysis Method
Volatile Organics	EPA 8010A
Organochlorine Pesticides/PCBs	EPA 8081
Organophosphorus Pesticides	EPA 8141
Metals (total)	
Aluminum	EPA 6010
Antimony	EPA 6010
Arsenic	EPA 7060
Arsenic (V)	EPA 7060
Arsenic (III)	EPA 7060
Barium	EPA 6010
Beryllium	EPA 6010
Cadmium	EPA 6010
Calcium	EPA 6010
Chromium (VI)	EPA 7195/6010
Chromium (total)	EPA 6010
Copper	EPA 6010
Iron	EPA 6010
Lead	EPA 7421
Magnesium	EPA 6010
Manganese	EPA 6010
Mercury	EPA 7470
Nickel	EPA 6010
Potassium	EPA 6010
Selenium	EPA 7740
Silicon	EPA 6010
Silver	EPA 6010
Thallium	EPA 7841
Zinc	EPA 6010
Other Inorganics	
Chloride	300.0
Nitrate	300.0
Ammonia	350.3
Total Kjeldahl nitrogen	351
Total Phosphorus	365.3
Other Analyses	
Alkalinity	310.1
Hardness	6010

TABLE F-2

SUMMARY OF ANALYTICAL METHODS

Analyte	Analysis Method
Biological Analyses	
Algal growth potential (*Selenastrum capricornutum*)	EPA/600/4-89/001
Chronic whole effluent bioassay [fathead minnow (*Pimephales promelas*), alga (*Selenastrum capricornutum*)	EPA/600/4-89/001

TABLE F-3

NUMBER OF WELLS AT EACH PHASE II GROUNDWATER MONITORING LOCATION

Well Location	Number of Wells
CD-3	1
CD-31	1
CD-34	1
CD-36	1
CD-37	1
CD-38	1
CD-41	3
CD-42	3
CD-43	3
CD-44	3
CD-45	3
CD-48	3
CD-50	1
CD-51	1
CS-4	1
CP-S3	1
Total	28

TABLE F-4

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

	Analysis	Sample Container[a]	Preservation	Holding[b] Time
Groundwater	Volatile Organic Compounds	2 each - 40 mL glass vials (leave no headspace), Teflon-lined septum cap	Cool to 4°C, HC1	14 days
Influent/ Effluent	Hardness	4-oz plastic	HNO_3 to pH <2	6 months
	Alkalinity	4-oz plastic	None	14 days
	Semivolatile Organic Compounds	3 each - 1-L amber glass; teflon-lined cap	Cool to 4°C	7 days to extraction; 40 days after extraction
	Organochlorine Pesticides/PCBs	3 each - 1 L amber glass; teflon-lined cap	Cool to 4°C; pH 5-9	7 days to extraction; 40 days after extraction
	Organophorus Pesticides	3 each - 1-L amber glass; teflon-lined cap	Cool to 4°C	7 days to extraction; 40 days after extraction
	Herbicides	3 each - 1-L amber glass	Cool to 4°C	7 days to extraction; 40 days after extraction
	Metals			
	Mercury	1-L polyethylene	HNO_3 to pH <2	28 days
	Other metals[c]	1-L polyethylene	HNO_3 to pH <2	6 months
	Other Inorganics			
	Chloride, Nitrate, Nitrite	1-L polyethylene	Cool to 4°C	28 days, 48 days, 48 hours
	Ammonia, total Kjeldahl nitrogen, total phosphorus	1-L polyethylene	Cool to 4°C H_2SO_4 to pH <2	28 days

(a) Sample container specifications may be modified after consultation with the analytical laboratory.
(b) Holding times are from date of collection. All samples will be shipped to the laboratory within 24 hours (except as noted for samples collected on Friday). Arrangements will be made with the laboratory for timely receipt of samples with short holding times.
(c) Other metals include antimony, arsenic, beryllium, cadmium, calcium, chromium, copper, iron, lead, manganese, nickel, selenium, silver, thallium, and zinc.

TABLE F-5

GROUNDWATER MONITORING AND EXTRACTION WELL PURGE VOLUMES

Well	Well Casing I.D. (inch)	Reference Elevation[a] (MSL)	Depth to Water[b] (ft)	Depth to Bottom[c] of Well (ft)	Purge Volume[d] (gallons)
CD-31	2.3	1853.63	94	108	9
CD-34	2.3	1858.17	98	110	8
CD-36	2.3	1844.28	90	102	8
CD-37	2.3	1846.40	91	104	8
CD-38	2.3	1847.91	91	109	12
CP-S3	6.1	1845.49	87	99	55
CD-41C1	2.3	1848.64	179	232	34
CD-41C2	2.3	1849.10	180	290	71
CD-41C3	2.3	1849.41	180	402	144
CD-42C1	2.3	1844.00	176	225	32
CD-42C2	2.3	1843.72	176	312	88
CD-42C3	2.3	1843.63	175	400	146
CD-43C1	2.3	1839.98	172	228	36
CD-43C2	2.3	1840.01	172	297	81
CD-43C3	2.3	1840.52	172	400	148
CD-44C1	2.3	1844.84	175	200	16
CD-44C2	2.3	1844.28	175	248	47
CD-44C3	2.3	1844.24	175	295	78
CD-45C1	2.3	1840.75	172	200	18
CD-45C2	2.3	1841.40	172	247	49
CD-45C3	2.3	1841.89	173	339	107
CD-48C1	2.3	1849.73	178	243	42
CD-3A1	2	1844.99	46	47	

TABLE F-5

GROUNDWATER MONITORING AND EXTRACTION WELL PURGE VOLUMES

Well	Well Casing I.D. (inch)	Reference Elevation[a] (MSL)	Depth to Water[b] (ft)	Depth to Bottom[c] of Well (ft)	Purge Volume[d] (gallons)
CD-48C2	2.3	1850.42	179	302	80
CD-48C3	2.3	1850.08	179	386	134
CD-50A1	2.0				
CD-51A1	2.0				
CS-4A1	2	1858.38	87	101	
CP-S1	6.0	1839.59	81	103	97
CP-S4	6.0	1843.52	84	104	88
CP-S5	6.0	1847.48	88	110	97
CP-S6	6.0	1847.68	87	107	88
CP-E1	8.0	1854.20	185	253	532
CP-E2	6.0	1857.70	141	186	198
CP-E3	8.0	1853.29	184	280	750
CP-W1	8.0	1845.02	176	299	962
CP-W2	8.0	1840.36	171	278	836
CP-W3	8.0	1841.72	175	276	790

(a) Reference points are: 1) for monitoring wells, the top of the PVC access port nipple on PVC casing, and 2) for extraction wells, the top of the water elevation access port nipple on the steel well flange.

(b) From reference elevation, measured April 1994.

(c) From reference elevation, based on Phase I and Phase II well logs; extraction well depths adjusted for installation of well vaults.

(d) Purge volume listed is three times the volume of the water column in the well.

TABLE F-6

APPROXIMATE SAMPLE TAPS LINE VOLUMES

Source	Sample Line Purge Volume[a]	Purge Flow Rate During Composite Sampling (mL/min)[b]
Influent: Well W1 (North pipeline in process area)	2.5 gal	350
Influent: Wells W2, W3, E1, E2, E3 (Middle pipeline in process area)	2.5 gal	350
Influent: Wells S1, S4, S5, S6 (South pipeline in process area)	2.0 gal	260
Influent: All Wells	1.0 gal	120
Influent: Bypass	1.5 gal	200
Effluent	50 mL	N/A

(a) Purge volume is three times volume of sample line.

(b) Purge flow rate is 10 percent of sample line volume per minute.

INSTRUMENT MANUFACTURERS' INSTRUCTIONS

Model: Orion Research SA230 ph meter

MEASUREMENT PROCEDURES

pH Measurements

For maximum accuracy:

Perform a two buffer calibration once at the beginning of each day. This procedure provides the correct setting for the °C/slope control. Subsequent measurements can be made after a single buffer calibration.

Use ATC probe to automatically compensate for changes in slope due to variations in sample temperature.

Two Buffer Calibration (With ATC)

1. Plug ATC probe into input jacks and adjust °C/slope control knob to 25°C. Slide mode switch to temperature. Verify that ambient temperature is displayed.
2. Place electrodes in pH 7 buffer and stir moderately.
3. Slide mode switch to pH. Allow reading to stabilize, then adjust calib control so that correct buffer value at that temperature is displayed.
4. Remove electrodes from the buffer solution, rinse, and place electrodes in second buffer. Stir moderately. Allow reading to stabilize.
5. Adjust °C/slope control until correct value of second buffer is displayed. Remove electrodes from solution, rinse and place electrodes in sample. Stir moderately. Allow reading to stabilize.
6. Record pH value displayed.

Two Buffer Calibration (Without ATC)

1. Sample and buffer temperature must be equal. Set °C/slope control to buffer temperature (°C).
2. Place electrode in pH 7 buffer and stir moderately.
3. Slide mode switch to pH. Allow reading to stabilize, then adjust calib control so that correct buffer value at that temperature is displayed.
4. Remove electrode from the buffer solution, rinse, and place electrode in second buffer. Stir moderately. Allow reading to stabilize.
5. Adjust °C/slope control until correct value of second buffer is displayed. Remove electrode from solution, rinse and place electrode in sample. Stir moderately. Allow reading to stabilize.
6. Record pH value displayed.

If sample temperature differs significantly from the buffer temperatures used to calibrate, an adjustment can be made. Raise or lower the °C/slope control from its current setting, described in step 5, by the difference between the actual buffer temperature and the sample temperature. For maximum accuracy use ATC probe.

Single Buffer Calibration (With ATC)

The ATC probe replaces the manual temp/slope control on front panel with automatic compensation based on sensed sample temperature.

1. Plug ATC probe into input jacks and adjust °C/slope control knob to 25°C. Slide mode switch to temperature. Verify that ambient temperature is displayed.
2. If incorrect, adjust °C/slope control knob until actual temperature is displayed.
3. Place electrodes in a buffer solution with pH value within 1.5 units of the expected sample value and stir moderately.
4. Slide mode switch to pH. Allow reading to stabilize, then adjust calib control so that pH value of buffer is displayed.
5. Remove electrodes from the buffer solution, rinse, and place electrodes into sample. Stir moderately. Allow reading to stabilize.
6. Record pH value displayed.

Single Buffer Calibration (Without ATC)

1. Sample and buffer temperature must be equal. Set °C/slope control to buffer temperature (°C).
2. Place electrode in a buffer solution with pH value within 1.5 units of the expected sample value and stir moderately.
3. Slide mode switch to pH. Allow reading to stabilize, then adjust calib control so that correct buffer value at that temperature is displayed.
4. Remove electrodes from the buffer solution, rinse, and place electrodes into sample. Stir moderately. Allow reading to stabilize.
5. Record pH value displayed.

Model: Amber Science Series 500 #604 Conductivity Meter

Conductivity Standards - from manufacturer

Approximate Normality	Weight of KCl in grams/1000 grams of Solution	Conductions in Micromhos @ 25°C
1.	71.1352	111,342
.1	7.41913	12,856.0
.01	.745263	1,408.77

MAKING CONDUCTIVITY & TDS MEASUREMENTS
with The Model 604

I Cell Constant determination

Power "ON" (Lo Batt not on)
Cell connected
Function to A. T. C. "ON"
Range to "2000"µ℧

Using three samples of the 718 µ℧ standard solution (shipped with the Model 604), held at 25°C, dip the cell in the first solution. Allow the cell to temperature equilibrate to the standard solution. Withdraw cell and dispose of excess solution. Do not touch or wipe off the cell. Repeat this process in the second solution. Place the cell in the third solution for measurement. Measurement is to be made once cell is in the third solution. This reading will be most accurate if the measurement is made as soon as the cell is dipped in the third solution. Readings may change in some cases due to gases or other impurities absorbed from the atmosphere. Using the calibration tool set the standardize control to display .718. By changing the Function Switch to the standardize position, the constant maybe read directly from the display. (Example: 9.96; 10.00; 10.04). The Instrument is now ready to make percise conductivity measurements. In making measurements of unknown solutions, select '200,000'on Range Switch, ATC "ON" with Function Switch. Using three samples of the 'unknown solution', rinse the cell in the first sample solution.

Allow the cell to temperature equilibrate in the solution. Withdraw cell and dispose of excess solution. Do not touch or wipe off cell. Repeat this process in the second sample solution. Place the cell in the third solution for measurement. Measurement is to be made as soon as cell is in the solution. Having selected the appropriate range for reading, record same.

Preventative Maintenance

1. The Model 604 requires no periodic maintenance.
2. Cleaning of the Model 604 should be done with a mild soap solution and a damp cloth.

CAUTION

DO NOT ALLOW FLUIDS TO RUN INTO THE INSTRUMENT.

ZERO CALIBRATION

Checking for proper Zero of Instrument.

Select ATC "ON"
Power "ON"
Cell connected (Dry & Clean)

Select these two ranges - 2 & 200,000 micromhos. In both positions the Digital Display should read 0 plus or minus a count. If not a Zero Calibration should be performed. Remove four attaching screws on back of cover. Remove back cover. Consult the Component Layout Diagram (Reverse Side) in this publication for the location of R49 & R69. Diagram is found on page 12. R49 & R69 maybe accessed from reverse side of board. Holes are provided in PC Board for this purpose.

Instrument Power "ON"
Function Switch ATC "ON"
Range Switch "200,000"
Cell connected (Dry & Clean)

Adjust R49 for zero reading. Position Range Switch to "2". Adjust R69 for a Zero reading. This completes Zero Calibration. Reassemble the Instrument.

USER INFORMATION

1. Care must be taken to avoid solution 'carry over'. The cell should be rinsed in a sample of the solution to be measured before the actual measurement is made.

2. Equilibrating the Cell - Agitate the cell in the solution to expediate temperature equilibration, and also assists in the dislodging of air bubbles

3. Immersion of Cell - Cell is to be immersed in the solution a minimum of 1½ inches for proper measurement.

4. Therminister Time Constant - The Cell's Therminister time constant is approximately eighteen seconds.

5. Sample Measurements - Minimum amount of solution required for measurement - 1 ml in 10 mm test tube (ID).

COLBERT DOMESTIC WELL SAMPLING PROGRAM
SAMPLING CRITERIA

CONSENT DECREE SAMPLING:

1. Monthly sampling as defined in the Consent Decree

QUARTERLY: (4 times/year)

1. Wells near the leading edge of the plume or in areas where contaminants are not migrating in the direction of ground water flow and contaminants have been detected at levels below Consent Decree evaluation criteria.
2. Wells in areas where contaminants exceeding the Consent Decree evaluation criteria were detected in nearby wells.
3. Multiple User wells where contaminants were previously detected at levels below Consent Decree evaluation criteria.

SEMI-ANNUAL: (2 times/year)

1. Wells in close proximity of the leading edge of the plume that are not separated from the plume by another well currently in the sampling program.

ANNUAL: (1 time/year)

1. Annual sampling for previously contaminated wells that now show non-detectable levels of contaminants.
2. Annual sampling for wells without detectable concentrations of contaminants and do not fall into the Bi-annual category.

3. Colbert Elementary School
   Faith Christian School

BI-ANNUAL: (Every-other year)

1. Wells previously in the sampling program that do not fall into any of the above mentioned categories. This could be used as a transition from annual to no sampling.

NO-SAMPLING: (0 times/year)

1. Any well hooked up to an Alternate Water Supply either by the County or at the owner's expense.
2. Any well not used as a domestic well
3. Any well that the owner requests not be tested.
4. No access to property or sampling site.

ADDITIONAL SAMPLING

1. Requests for additional sampling from the property owner for wells inside the testing area would follow the same criteria as "Outside of the testing area."

(cont.)

NEW WELLS IN THE AREA:

1. Any new domestic well within the Sampling Program's current testing area will be tested as soon as possible and placed in the appropriate category.

OUTSIDE OF THE TESTING AREA:

1. Testing may be conducted but at the expense of the property owner. Each request will be reviewed by the Committee and discussed with the County before a decision is made to test said well. After the well is tested it will be placed in the appropriate category according to the test results.

NOTE: Interpretation of these guidelines will be subject to the discretion of the Sampling Committee. Additional undefined sampling will be conducted as the Committee deems necessary.

Definitions:

Consent Decree Evaluation Criteria

The evaluation criteria are levels of contaminant concentrations defined in the consent decree, that are not to be exceeded without an alternate supply of water being provided.