



Y/SUB/01-006512/6

**Y-12 GROUNDWATER PROTECTION PROGRAM
GROUNDWATER AND SURFACE WATER
SAMPLING AND ANALYSIS PLAN
FOR CALENDAR YEAR 2002**

**Y-12
NATIONAL
SECURITY
COMPLEX**

September 2001

Prepared by

**AJA TECHNICAL SERVICES, INC.
Under Subcontract No. 4300006512**

for the

**Environmental Compliance Department
Environment, Safety, and Health Organization
Y-12 National Security Complex
Oak Ridge, Tennessee 37831**

Managed by

**BWXT Y-12, L.L.C.
for the U.S. DEPARTMENT OF ENERGY
under contract No. DE-AC05-00OR22800**

**MANAGED BY
BWXT Y-12, L.L.C.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY**

UCN-13672 (10-00)

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring of the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Y-12 GROUNDWATER PROTECTION PROGRAM
GROUNDWATER AND SURFACE WATER
SAMPLING AND ANALYSIS PLAN
FOR CALENDAR YEAR 2002

September 2001

Prepared by

AJA TECHNICAL SERVICES, INC.
Under Subcontract No. 4300006512

for the

Environmental Compliance Department
Environment, Safety, and Health Organization
Y-12 National Security Complex
Oak Ridge, Tennessee 37831

Managed by

BWXT Y-12, L.L.C.
for the U.S. DEPARTMENT OF ENERGY
under contract No. DE-AC05-00OR22800

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
Figures	iii
Tables	iii
Acronyms and Abbreviations	v
1.0 INTRODUCTION	1
2.0 MONITORING LOCATIONS	3
3.0 FIELD MEASUREMENTS AND ANALYTICAL PARAMETERS	5
4.0 SAMPLE PLANNING, COLLECTION, AND HANDLING	7
5.0 REFERENCES	9

APPENDICES:

A	FIGURES
B	TABLES
C	LABORATORY REQUIREMENTS (Bottle Lists, Holding Times, Turnaround Times)
D	ADDENDA TO THE CY 2002 SAMPLING AND ANALYSIS PLAN
E	CY 2002 GROUNDWATER MONITORING SCHEDULES

Figures

<u>Figure</u>	<u>Page</u>
A.1 Hydrogeologic regimes at the Y-12 National Security Complex	A-1
A.2 Sampling locations in the Bear Creek Hydrogeologic Regime, CY 2002	A-2
A.3 Sampling locations in the Chestnut Ridge Hydrogeologic Regime, CY 2002	A-3
A.4 Sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime, CY 2002	A-4
A.5 Surface water sampling locations north of Pine Ridge, CY 2002	A-5

Tables

<u>Table</u>	<u>Page</u>
B.1 Field measurements and laboratory analytes for CY 2002 groundwater and surface water samples	B-1
B.2 Sampling sequence, frequency, and analytical parameters for groundwater and surface water monitoring during CY 2002	B-5

Acronyms and Abbreviations

ACO	Analytical Chemistry Organization
Bear Creek Regime	Bear Creek Hydrogeologic Regime
BWXT Y-12	BWXT Y-12, L.L.C.
Chestnut Ridge Regime	Chestnut Ridge Hydrogeologic Regime
CY	Calendar Year
DOE	U.S. Department of Energy
East Fork Regime	Upper East Fork Poplar Creek Hydrogeologic Regime
GWPP	Groundwater Protection Program
LMES	Lockheed Martin Energy Systems, Inc.

1.0 INTRODUCTION

This plan provides a description of the groundwater and surface water quality monitoring activities planned for calendar year (CY) 2002 at the U.S. Department of Energy (DOE) Y-12 National Security Complex that will be managed by the Y-12 Groundwater Protection Program (GWPP). Groundwater and surface water monitoring performed by the GWPP during CY 2002 will be in accordance with the following requirements of DOE Order 5400.1:

- ! to evaluate and maintain surveillance of existing and potential groundwater contamination sources;
- ! to provide for the early detection of groundwater contamination and determine the quality of groundwater and surface water where contaminants are most likely to migrate beyond the Oak Ridge Reservation property line;
- ! to identify and characterize long-term trends in groundwater quality at Y-12; and
- ! to provide data to support decisions concerning the management and protection of groundwater resources.

Groundwater and surface water monitoring during CY 2002 will be performed in three hydrogeologic regimes at Y-12: the Bear Creek Hydrogeologic Regime (Bear Creek Regime), the Upper East Fork Poplar Creek Hydrogeologic Regime (East Fork Regime), and the Chestnut Ridge Hydrogeologic Regime (Chestnut Ridge Regime). The Bear Creek and East Fork regimes are located in Bear Creek Valley, and the Chestnut Ridge Regime is located south of Y-12 (Figure A.1). Additional surface water monitoring will be performed north of Pine Ridge, along the boundary of the Oak Ridge Reservation (Figure A.1).

Modifications to the CY 2002 monitoring program may be necessary during implementation. Changes in programmatic requirements may alter the analytes specified for selected monitoring wells, or wells could be added or removed from the planned monitoring network. All modifications to the monitoring program will be approved by the Y-12 GWPP manager and documented as addenda to this sampling and analysis plan.

2.0 MONITORING LOCATIONS

The Y-12 GWPP monitoring network for CY 2002 includes 88 monitoring locations: 48 located in the Bear Creek Regime (Figure A.2), four located in the Chestnut Ridge Regime (Figure A.3), 31 located in the East Fork Regime (Figure A.4), and five located north of Pine Ridge (Figure A.5). Groundwater samples will be collected from a total of 69 monitoring wells, including 39 wells in the Bear Creek Regime (Figure A.2) and 30 wells (one well has 10 discrete sampling points) in the East Fork Regime (Figure A.4). Samples of groundwater discharging from four natural springs will be collected, including three springs (SS-1, SS-4, and SS-5) in the Bear Creek Regime (Figure A.2) and one spring (SCR5.2SP) in the Chestnut Ridge Regime (Figure A.3). Surface water samples will be collected from 15 sampling locations during CY 2002, including six locations in the Bear Creek Regime, three locations in the Chestnut Ridge Regime, one location in the East Fork Regime, and five locations north of Pine Ridge. In the Bear Creek Regime, samples will be collected from Bear Creek at five sampling stations located from about 0.6 to 12 kilometers upstream of the confluence of Bear Creek and East Fork Poplar Creek (BCK-00.63 to BCK-11.97), and from one sampling station along a northern tributary (NT-01) to Bear Creek (Figure A.2). The drainage features located in the Chestnut Ridge Regime have informally been numbered from west to east (SCR1 through SCR5), and samples will be collected from three tributaries at stations (SCR1.5SW, SCR2.2SW, and SCR4.4SW) located along the north side of Bethel Valley Road (Figure A.3). In the East Fork Regime, samples will be collected from the outfall (LRSPW) of the New Hope Pond distribution channel (Figure A.4). The surface water sampling locations north of Pine Ridge include three tributaries (NPR07.0SW, NPR12.0SW, and NPR23.0SW) near the Scarboro Community and two tributaries (GHK2.51ESW and GHK2.51WSW) near Country Club Estates (Figure A.5).

3.0 FIELD MEASUREMENTS AND ANALYTICAL PARAMETERS

Field personnel will measure the static water level in each monitoring well before purging and collecting groundwater samples. Sampling personnel also will record field measurements of pH, temperature, conductivity, dissolved oxygen, and oxidation-reduction potential before collecting samples at each monitoring location (Table B.1). However, field measurement of oxidation-reduction potential will not be obtained for sampling ports of monitoring wells equipped with a Westbay™ multiport sampling system.

For this Sampling and Analysis Plan, specific analytes are grouped by analytical method or by type (e.g., trace metals) and referenced as analytical parameters (Table B.1). In addition to field measurements, all groundwater and surface water samples will be analyzed for the following suite of parameters (identified as the Standard Administrative Parameter Group):

- ! miscellaneous laboratory analytes - pH, conductivity, turbidity, total suspended solids, and total dissolved solids;
- ! major anions;
- ! trace metals (includes major cations);
- ! a comprehensive suite of organic compounds; and
- ! gross alpha and gross beta activity.

In addition to the analytes included in the Standard Administrative Parameter Group, samples from selected locations will be analyzed for specific radionuclides.

4.0 SAMPLE PLANNING, COLLECTION, AND HANDLING

The monitoring wells, springs, and surface water stations included in the GWPP monitoring network for CY 2002 are assembled into sample groups for sample collection, sample tracking, and data management purposes (Table B.2). These sample groups are designated with a prefix that represents the sampling location: BC (Bear Creek Regime), CR (Chestnut Ridge Regime), EF (East Fork Regime), and PR (north of Pine Ridge). Semiannual sample collection for each sample group is specified in Table B.2, and the sampling sequence is generally from least contaminated to most contaminated location within each sampling group. A Groundwater Monitoring Schedule will be prepared for each quarterly sampling event by GWPP personnel based on Table B.1 that includes information necessary for field personnel to collect the required samples (e.g., management of purged groundwater).

Personnel from the Y-12 Analytical Chemistry Organization (ACO) will be responsible for collection, transportation, and chain-of-custody control of the groundwater and surface water samples. Based on the analytical parameters for CY 2002 (Table B.1 and Table B.2), ACO personnel will prepare a set of bottle lists that specify the sample container type, size, preservative, and the laboratory test identification needed for each sampling location (see Appendix C). Sample collection will be performed in accordance with the most recent version of administrative procedures for obtaining groundwater samples (Lockheed Martin Energy Systems, Inc. [LMES] 1999a, 2000a, 2000b), surface water samples (BWXT Y-12, L.L.C. [BWXT Y-12] 2000a), and field measurements (BWXT Y-12 2000b, BWXT Y-12 2001a, and LMES 1999b). All field and laboratory activities will be performed in accordance with applicable requirements of the Y-12 Integrated Safety Management System.

Groundwater samples will be collected from monitoring wells using bladder pumps unless a well is equipped with a Westbay™ multiport sampling system (Table B.1). Typically, a bladder pump is permanently installed in each well that is scheduled for sample collection. If well construction prevents permanent installation (e.g., flush-mounted wells), then the pump and tubing will be installed at least 24 hours before sample collection and will be removed when sampling is completed. During CY 2002, the low-flow minimal drawdown purging and sampling method (low-flow method) will be used to collect groundwater samples from all wells that do not have a Westbay multiport sampling system. In accordance with the procedure for the low-flow method (LMES 1999a), groundwater samples will be collected from the well immediately following the stabilization (minimal variation over four consecutive readings) of field measurements (pH, conductivity, temperature, oxidation-reduction potential, and dissolved oxygen) of the groundwater purged from the well at a low flow rate (<300 milliliters per minute) which ensures minimal drawdown of the water level in the well (<0.1 foot per 15 minutes).

Groundwater sampling using a Westbay™ multiport sampling system at well GW-722 in the East Fork Regime will be performed in accordance with the most recent and approved operating procedures (LMES 2000a and 2000b). The groundwater samples from each sampling port will be collected in 250-milliliter nonvented stainless steel Westbay™ sample collection bottles filled at the designated depth in the well by opening the sampling port valve. Once filled, the bottle is raised to the surface and the sample is transferred to laboratory sample containers. Normally, a Westbay™ sample collection bottle will be filled about seven times at each port to obtain enough groundwater to fill all of the laboratory sample bottles. The first sample bottle is used as a “formation rinse” to obtain field measurements and condition the sample bottle for each particular zone.

Unfiltered samples will be collected semiannually from all of the monitoring wells, springs, and surface water stations during CY 2002. As summarized below, the number of samples to be collected during each quarter will range from 35 to 62, for an annual total of 194 samples.

HYDROGEOLOGIC REGIME/AREA	NUMBER OF SAMPLES PER QUARTER OF CY 2002	
	1st and 3rd	2nd and 4th
Bear Creek Regime	48	0
Chestnut Ridge Regime	4	0
East Fork Regime	10	30
North of Pine Ridge	0	5
TOTAL:	62	35

In addition to the groundwater and surface water samples, field blanks and equipment rinsate samples will be collected at the frequencies and analyzed for the parameters specified on Table B.1. Field blank samples will be collected from at least 10% of the sample groups. A field blank will be collected during each quarter of CY 2002: at BC-2 during the first and third quarters and at EF-1 during the second and fourth quarters. An equipment rinsate sample will be collected from well GW-722 (EF-WB) immediately after field-cleaning the sampling equipment used to collect samples from the last sampling port (Table B.1).

Trip blank samples, field duplicate samples, and laboratory quality assurance samples will be prepared and analyzed as specified in the *Quality Assurance Plan for the Analytical Chemistry Organization* (BWXT Y-12 2001b) using applicable analytical procedures. Trip blank samples will be prepared for each cooler used to transport samples for volatile organic analyses. Duplicate samples will be collected from at least 10% of the sampling locations. A total of 22 field duplicate samples will be collected during CY 2002, including 10 in the Bear Creek Regime, two in the Chestnut Ridge Regime, eight in the East Fork Regime, and two from surface water stations located north of Pine Ridge (Table B.1).

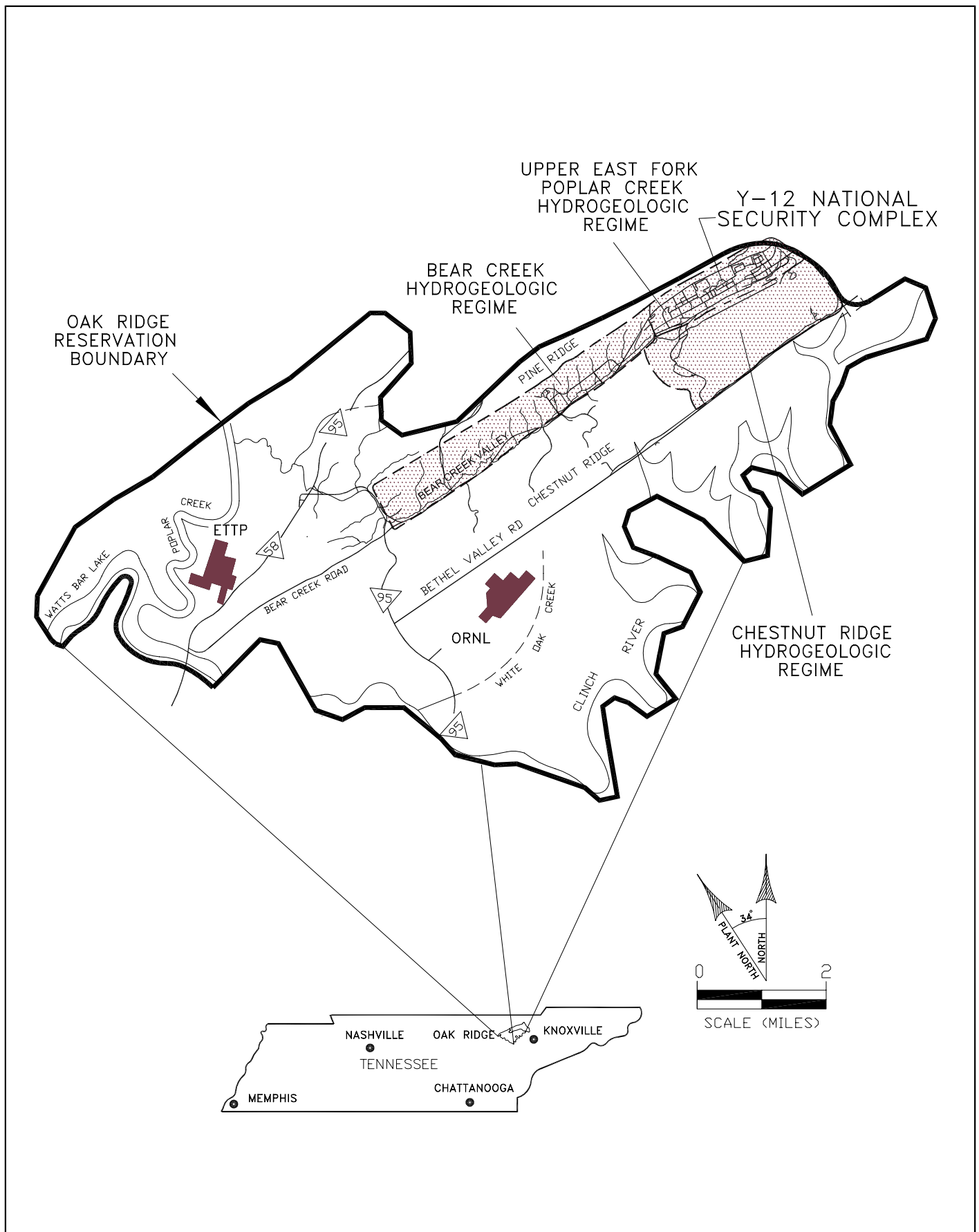
All groundwater and surface water samples will be relinquished to the appropriate Y-12 ACO laboratory that will perform the analyses under chain-of-custody control. The Y-12 ACO laboratories will perform each analyses within established holding times and deliver results within established turnaround times (see Appendix C).

5.0 REFERENCES

- BWXT Y-12, L.L.C. 2000a. *Liquid Grab Sampling*. BWXT Y-12, L.L.C. management requirement prepared by the Environment, Safety, and Health Organization (Y50-71-005).
- BWXT Y-12, L.L.C. 2000b. *Field Measurements of Physical and Chemical Characteristics*. BWXT Y-12, L.L.C. management requirement prepared by the Environment, Safety, and Health Organization (Y50-71-001).
- BWXT Y-12, L.L.C. 2001a. *Redox Meter Calibration and Operation*. BWXT Y-12, L.L.C. management requirement prepared by the Analytical Chemistry Organization (Y/P65-9156).
- BWXT Y-12, L.L.C. 2001b. *Quality Assurance Plan for the Analytical Chemistry Organization*. Prepared by the Analytical Chemistry Organization (Y/P65-9006, Rev. I).
- Lockheed Martin Energy Systems, Inc. 1999a. *Groundwater Sampling*. Oak Ridge Y-12 Plant Procedure prepared by the Environment, Safety, and Health Organization (Y50-71-016).
- Lockheed Martin Energy Systems, Inc. 1999b. *Measurement of Static Water Level Elevation*. Oak Ridge Y-12 Plant Procedure prepared by the Environment, Safety, and Health Organization (Y50-71-015).
- Lockheed Martin Energy Systems, Inc. 2000a. *Groundwater Sampling of Westbay™ Monitoring System Instrumented Wells*. Oak Ridge Y-12 Plant Procedure prepared by the Environment, Safety, and Health Organization (Y50-71-018).
- Lockheed Martin Energy Systems, Inc. 2000b. *Pressure Profiling of Wells Equipped with Westbay™ Monitoring System Instrumentation*. Oak Ridge Y-12 Plant Procedure prepared by the Environment, Safety, and Health Organization (Y50-71-019).
- U.S. Environmental Protection Agency. 1983. *Methods for Chemical Analysis of Water and Wastes*.
- U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*.

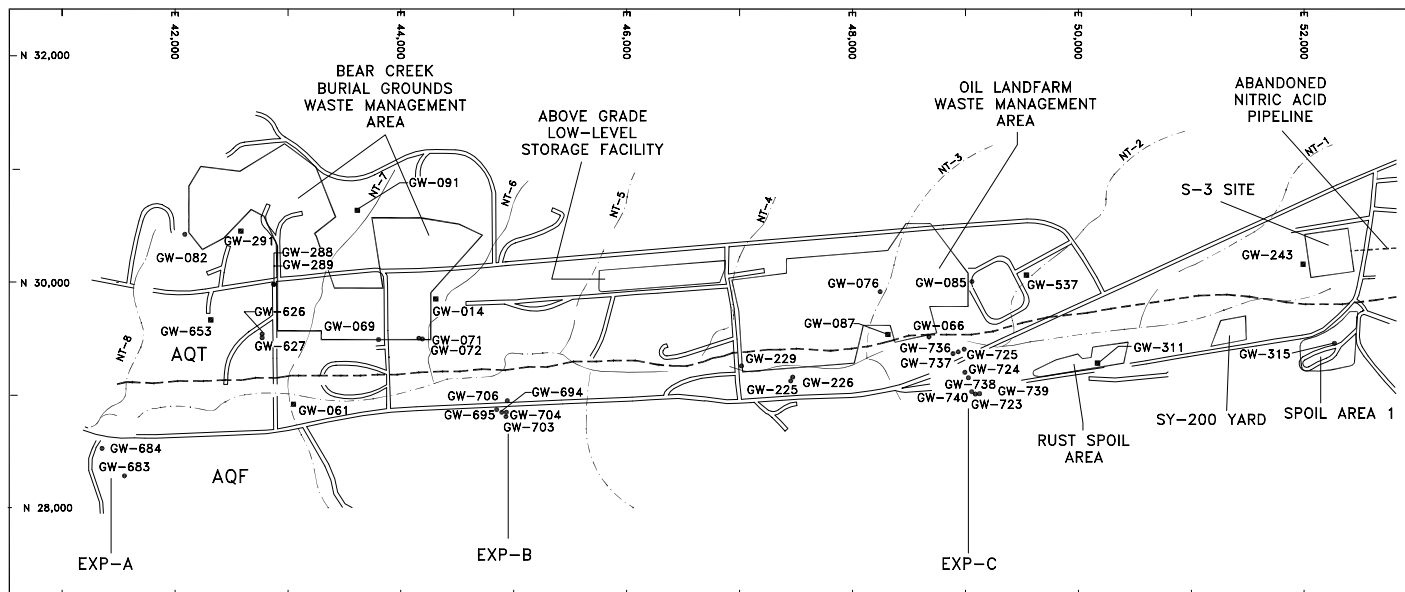
APPENDIX A

FIGURES

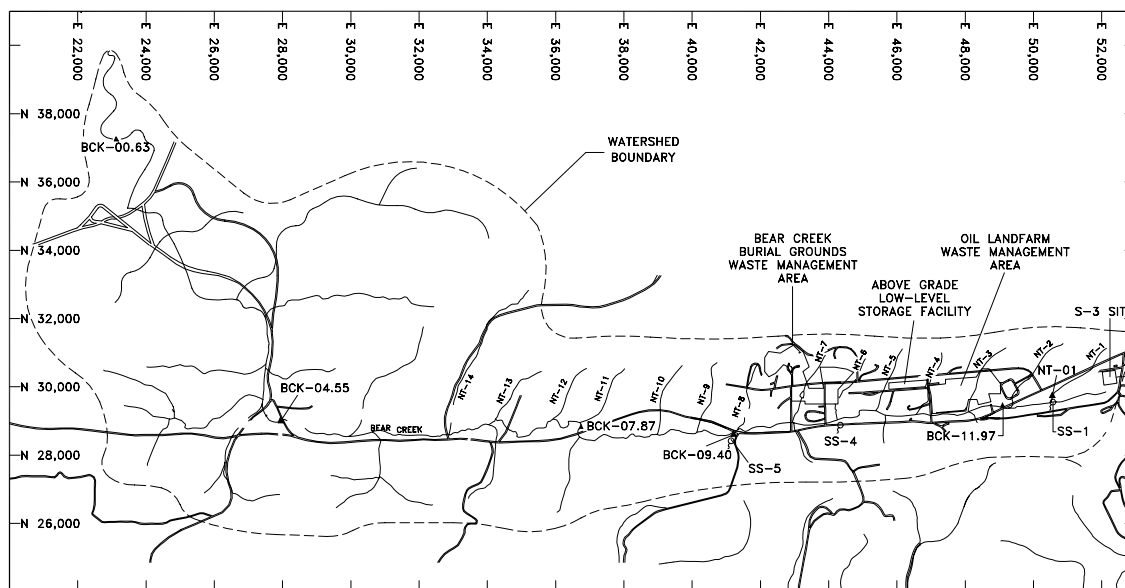


SA002_1.DWG

Fig. A.1. Hydrogeologic regimes at the Y-12 National Security Complex.



MONITORING WELL LOCATIONS



SPRINGS AND SURFACE WATER SAMPLING LOCATIONS

EXPLANATION

- — Water Table Monitoring Well
- — Bedrock Monitoring Well
- ▲ — Surface Water Sampling Station
- — Spring Sampling Station
- EXP-C — Exit Pathway, Maynardville Limestone Picket
- — — — — Surface Drainage Feature
- NT-5 — North Tributary
- AQT — Aquitard
- - - - - Approximate Nolichucky Shale\Maynardville Limestone Contact
- AQF — Aquifer

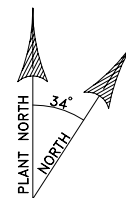
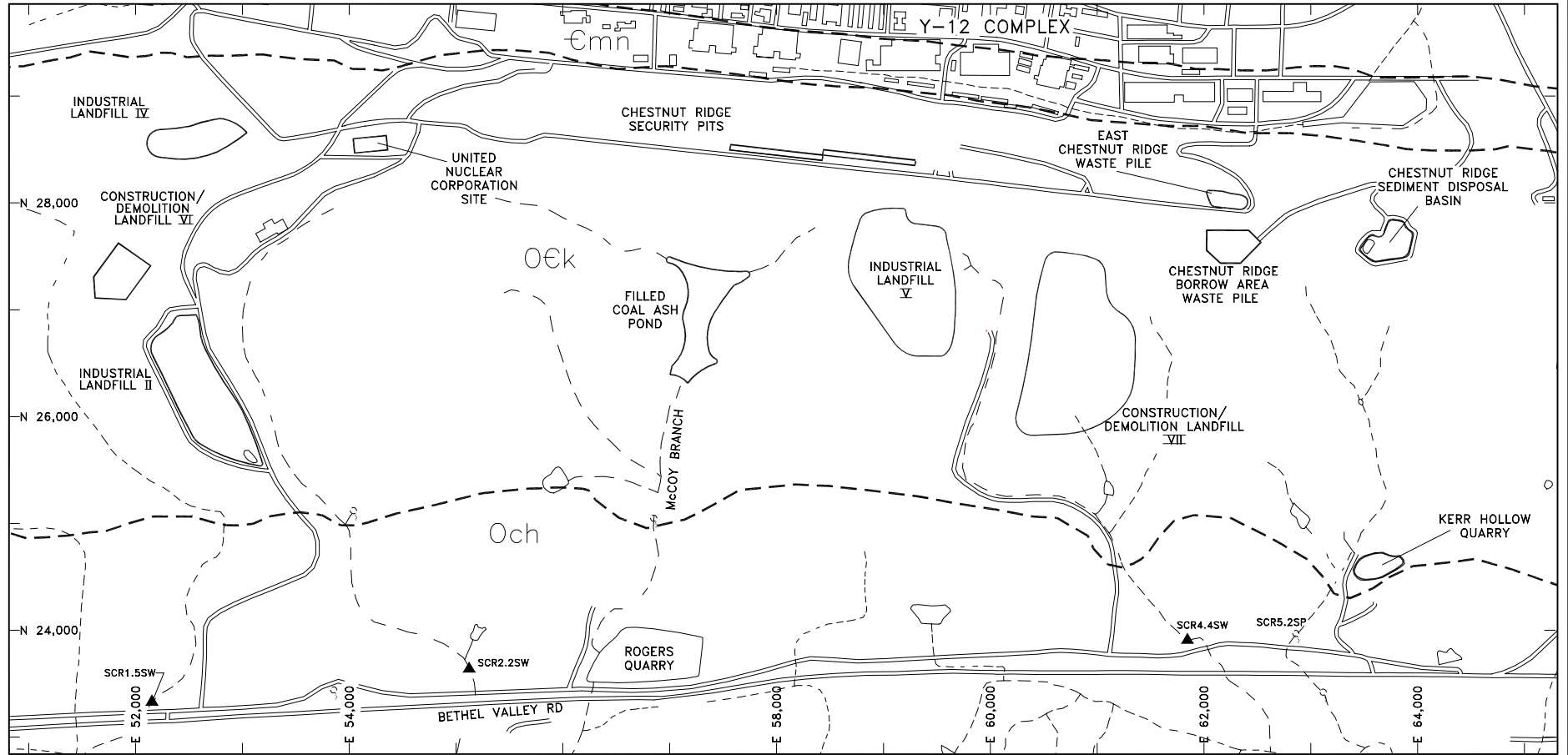


Fig. A.2. CY 2002 sampling locations in the Bear Creek Hydrogeologic Regime.

Fig. A.3. CY 2002 sampling locations in the Chestnut Ridge Hydrogeologic Regime.
A-3



EXPLANATION

- | | |
|-------------------------------------|--------------------------------|
| • — MONITORING WELL | - - - SURFACE GEOLOGIC CONTACT |
| ○ — SPRING SAMPLING LOCATION | Emn — MAYNARDVILLE LIMESTONE |
| ▲ — SURFACE WATER SAMPLING LOCATION | Ock — KNOX GROUP |
| - - - SURFACE DRAINAGE FEATURE | Och — CHICKAMAUGA GROUP |
| — — — BOUNDARY OF SITE | |

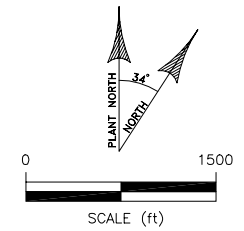


Fig. A.4. CY 2002 sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime.

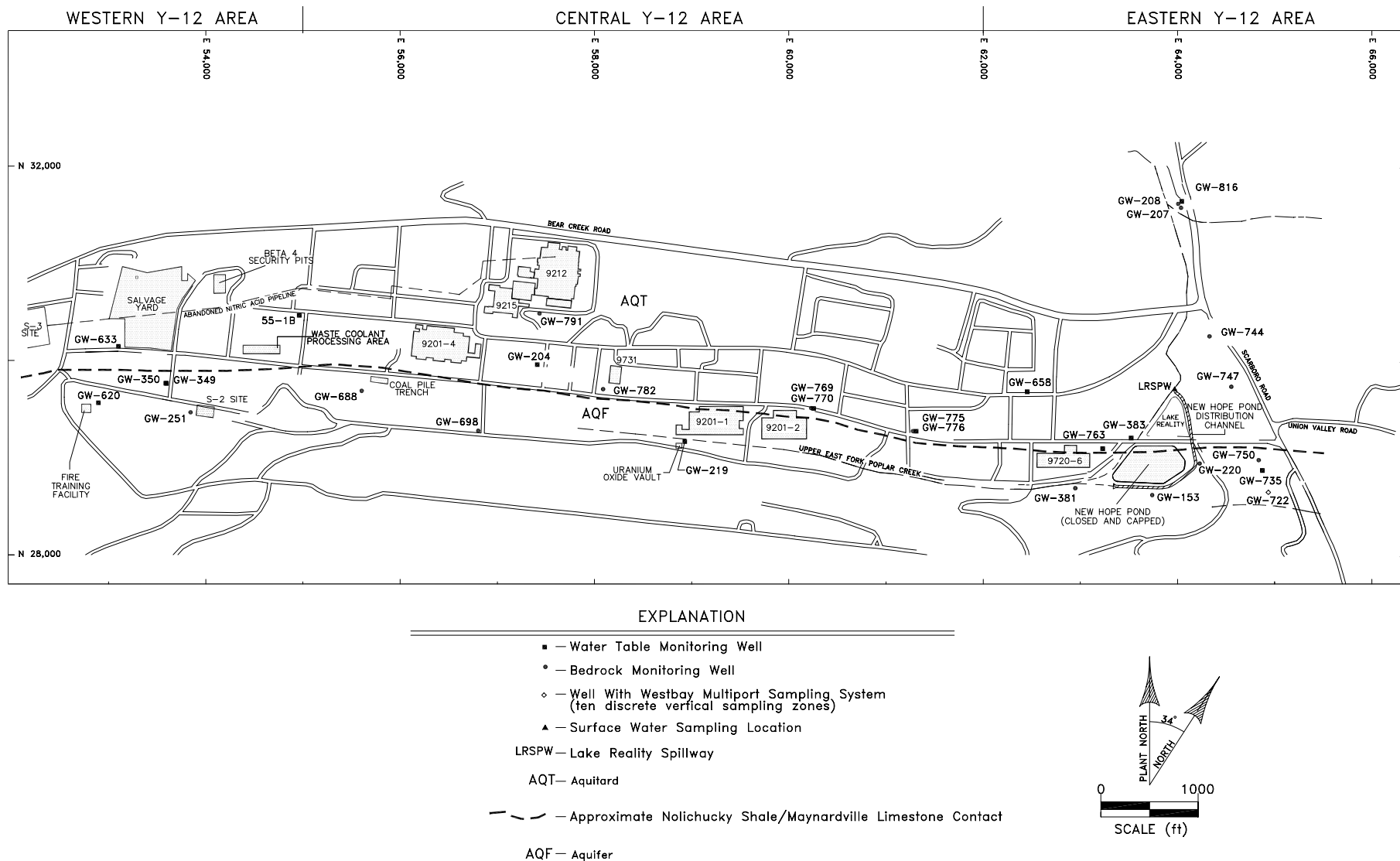
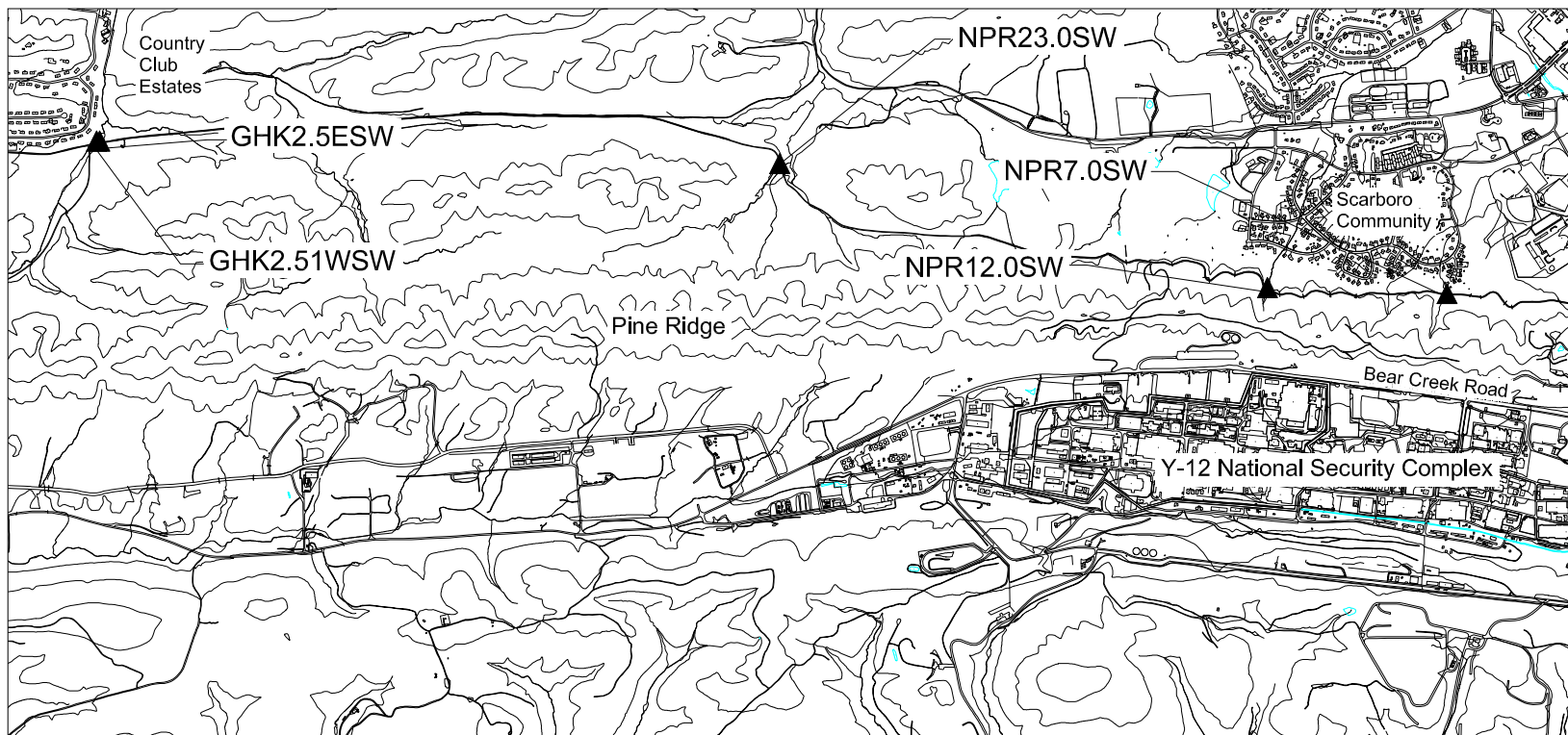
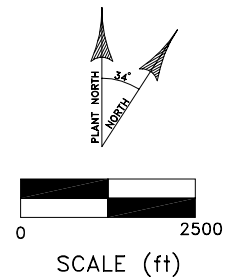


Fig. A.5. CY 2002 surface water sampling locations north of Pine Ridge.



EXPLANATION

▲ Surface Water Sampling Location



APPENDIX B

TABLES

**Table B.1. Field measurements and laboratory analytes for CY 2002
groundwater and surface water samples**

FLD-Field Measurements	Analytical Method¹	Detection Limit²	Units³
Depth to Water	Y50-71-015	NA	ft
Water Temperature	Y50-71-001	NA	centigrade
pH	Y50-71-001	NA	pH units
Conductivity	Y50-71-001	NA	μmho/cm
Dissolved Oxygen	Y50-71-001	NA	ppm
Oxidation-Reduction Potential	Y/P65-9156	NA	mV
CHEM - Miscellaneous Laboratory Analytes			
pH	SW846-9040	NA	pH units
Conductivity	SW846-9050	NA	μmho/cm
Total Dissolved Solids	EPA-160.1	1	mg/L
Total Suspended Solids	EPA-160.2	1	mg/L
Turbidity	EPA-180.1	0.1	NTU
CHEM - Anions			
Alkalinity - HCO ₃	EPA-310.1	1.0	mg/L
Alkalinity - CO ₃	EPA-310.1	1.0	mg/L
Chloride	EPA-300.0	0.2	mg/L
Fluoride	EPA-340.2	0.1	mg/L
Nitrate (as Nitrogen)	EPA-300.0	0.028	mg/L
Sulfate	EPA-300.0	0.25	mg/L
MET(1) - Metals/Cations			
Aluminum	SW846-6010B	0.2	mg/L
Antimony	EPA-200.8	0.0025	mg/L
Arsenic	EPA-200.8	0.005	mg/L
Barium	SW846-6010B	0.004	mg/L
Beryllium	SW846-6010B	0.0005	mg/L
Boron	SW846-6010B	0.1	mg/L
Cadmium	EPA-200.8	0.0005	mg/L
Calcium	SW846-6010B	0.2	mg/L
Chromium	SW846-6010B	0.02	mg/L
Chromium	EPA-200.8	0.0025	mg/L
Cobalt	SW846-6010B	0.02	mg/L
Copper	SW846-6010B	0.02	mg/L
Iron	SW846-6010B	0.05	mg/L
Lead	EPA-200.8	0.0005	mg/L
Lithium	SW846-6010B	0.01	mg/L
Magnesium	SW846-6010B	0.2	mg/L
Manganese	SW846-6010B	0.005	mg/L
Mercury	SW846-7470	0.0002	mg/L
Molybdenum	SW846-6010B	0.05	mg/L
Nickel	SW846-6010B	0.05	mg/L
Nickel	EPA-200.8	0.005	mg/L

Table B.1 (continued)

MET(1) - (continued)	Analytical Method¹	Detection Limit²	Units³
Potassium	SW846-6010B	2	mg/L
Selenium	EPA-200.8	0.01	mg/L
Silver	SW846-6010B	0.02	mg/L
Sodium	SW846-6010B	0.2	mg/L
Strontium	SW846-6010B	0.005	mg/L
Thallium	EPA-200.8	0.0005	mg/L
Thorium	SW846-6010B	0.2	mg/L
Uranium	EPA-200.8	0.0005	mg/L
Vanadium	SW846-6010B	0.02	mg/L
Zinc	SW846-6010B	0.05	mg/L
VOC(1) - Volatile Organic Compounds		CRQL⁴	
Acetone	SW846-8260B-UP	10	µg/L
Acrolein	SW846-8260B-UP	10	µg/L
Acrylonitrile	SW846-8260B-UP	5	µg/L
Benzene	SW846-8260B-UP	5	µg/L
Bromochloromethane	SW846-8260B-UP	5	µg/L
Bromodichloromethane	SW846-8260B-UP	5	µg/L
Bromoform	SW846-8260B-UP	5	µg/L
Bromomethane	SW846-8260B-UP	5	µg/L
2-Butanone	SW846-8260B-UP	5	µg/L
Carbon disulfide	SW846-8260B-UP	5	µg/L
Carbon tetrachloride	SW846-8260B-UP	5	µg/L
Chlorobenzene	SW846-8260B-UP	5	µg/L
Chloroethane	SW846-8260B-UP	5	µg/L
2-Chloroethyl vinyl ether	SW846-8260B-UP	10	µg/L
Chloroform	SW846-8260B-UP	5	µg/L
Chloromethane	SW846-8260B-UP	5	µg/L
Dibromochloromethane	SW846-8260B-UP	5	µg/L
1,2-Dibromo-3-chloropropane	SW846-8260B-UP	10	µg/L
1,2-Dibromoethane	SW846-8260B-UP	5	µg/L
Dibromomethane	SW846-8260B-UP	5	µg/L
1,2-Dichlorobenzene	SW846-8260B-UP	5	µg/L
1,4-Dichlorobenzene	SW846-8260B-UP	5	µg/L
1,4-Dichloro-2-butene	SW846-8260B-UP	5	µg/L
trans-1,4-Dichloro-2-butene	SW846-8260B-UP	5	µg/L
Dichlorodifluoromethane	SW846-8260B-UP	5	µg/L
1,1-Dichloroethane	SW846-8260B-UP	5	µg/L
1,2-Dichloroethane	SW846-8260B-UP	5	µg/L
1,1-Dichloroethene	SW846-8260B-UP	5	µg/L
cis-1,2-Dichloroethene	SW846-8260B-UP	5	µg/L
trans-1,2-Dichloroethene	SW846-8260B-UP	5	µg/L
1,2-Dichloropropane	SW846-8260B-UP	5	µg/L

Table B.1 (continued)

VOC(1) - (continued)	Analytical Method ¹	CRQL ⁴	Units ³
cis-1,3-Dichloropropene	SW846-8260B-UP	5	µg/L
trans-1,3-Dichloropropene	SW846-8260B-UP	5	µg/L
Dimethylbenzene	SW846-8260B-UP	5	µg/L
Ethanol	SW846-8260B-UP	200	µg/L
Ethylbenzene	SW846-8260B-UP	5	µg/L
Ethyl methacrylate	SW846-8260B-UP	5	µg/L
2-Hexanone	SW846-8260B-UP	5	µg/L
Iodomethane	SW846-8260B-UP	5	µg/L
4-Methyl-2-pentanone	SW846-8260B-UP	5	µg/L
Methylene chloride	SW846-8260B-UP	5	µg/L
Styrene	SW846-8260B-UP	5	µg/L
1,1,1,2-Tetrachloroethane	SW846-8260B-UP	5	µg/L
1,1,2,2-Tetrachloroethane	SW846-8260B-UP	5	µg/L
Tetrachloroethene	SW846-8260B-UP	5	µg/L
Toluene	SW846-8260B-UP	5	µg/L
1,1,1-Trichloroethane	SW846-8260B-UP	5	µg/L
1,1,2-Trichloroethane	SW846-8260B-UP	5	µg/L
Trichloroethene	SW846-8260B-UP	5	µg/L
Trichlorofluoromethane	SW846-8260B-UP	5	µg/L
1,2,3-Trichloropropane	SW846-8260B-UP	10	µg/L
Vinyl acetate	SW846-8260B-UP	10	µg/L
Vinyl chloride	SW846-8260B-UP	2	µg/L
Radiological Analytes		Target MDA⁵	
RAD(1) Gross Alpha Activity	EPA-900.0	3.5	pCi/L
RAD(1) Gross Beta Activity	EPA-900.0	7.0	pCi/L
RAD(2) Strontium-89/90	Y/P65-7037	4.0	pCi/L
RAD(2), RAD(12) Technetium-99	Y/P65-7154	10	pCi/L
RAD(2) Tritium	EPA-906.0	300	pCi/L
RAD(3) Uranium-234, 235, & 238	Y/P65-7061	0.4	pCi/L
RAD(4) Americium-241	Y/P65-7226	0.4	pCi/L
RAD(4) Iodine-129	EPA-901.1	3.0	pCi/L
RAD(4) Neptunium-237	Y/P65-7206	0.4	pCi/L
RAD(4) Plutonium-238 & 239/240	Y/P65-7226	0.4	pCi/L
RAD(5) Radium-223/224/226	EPA-903.0 - 904.0	0.5	pCi/L
RAD(8) Thorium-228,230,232, & 234	Y/P65-7052	0.4	pCi/L
RAD(13) Total Uranium and weight % Uranium-234, 235, & 238	Y/P65-8044	0.002	mg/L

Table B.1 (continued)

Notes:

- 1 Analytical/field methods/procedures from:
 - ! Y-12 System Operation Procedures
(BWXT Y-12 2000b, BWXT Y-12 2001a, and LMES 1999b)
 - ! *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*
(U.S. Environmental Protection Agency 1996)
 - ! *Methods for Chemical Analysis of Water and Wastes*
(U.S. Environmental Protection Agency 1983)
 - ! BWXT Y-12, L.L.C. Analytical Chemistry Organization Controlled Procedures:
(Y/P65-7037, Y/P65-7052, Y/P65-7061, Y/P65-7154, Y/P65-7206, Y/P65-7226, and Y/P65-8044)
- 2 NA - not applicable
- 3
 - ft - feet
 - µg/L - micrograms per liter
 - µmho/cm - micromhos per centimeter
 - mg/L - milligrams per liter
 - mV - millivolts
 - NTU - nephelometric turbidity units
 - ppm - parts per million
 - pCi/L - picoCuries per liter
- 4 CRQL - contract-required quantitation limit
- 5 MDA - minimum detectable activity. The target MDA may be obtained under optimal analytical conditions; actual MDAs are sample-specific and may vary significantly from the target value.

**Table B.2. Sampling sequence, frequency, and analytical parameters for
groundwater and surface water monitoring during CY 2002**

Sample Group ¹	Location ²	Sampling Point ³	Duplicate ⁴	Contain ⁵	Monitoring Driver ⁶	Parameters ⁷
Bear Creek Hydrogeologic Regime						
BC-1 (Q1, Q3)	EXP-A	GW-684	Q3	Y	SMP	STD
	EXP-A	GW-683		Y	SMP	STD
	EXP-B	GW-695		Y	SMP	STD, RAD(12)
	EXP-B	GW-703		Y	SMP	STD, RAD(12)
	EXP-B	GW-704	Q1	Y	SMP	STD, RAD(12)
	EXP-B	GW-706		Y	SMP	STD, RAD(12)
	EXP-B	GW-694		Y	SMP	STD, RAD(12)
	EXP-C	GW-723		Y	SMP	STD
	EXP-C	GW-736		Y	SMP	STD
	EXP-C	GW-737		Y	SMP	STD
	EXP-C	GW-739		Y	SMP	STD
	EXP-C	GW-740		Y	SMP	STD
	EXP-C	GW-738		Y	SMP	STD
	EXP-C	GW-724		Y	SMP	STD
	EXP-C	GW-725		Y	SMP	STD
BC-2 (Q1, Q3)	BG	GW-653		Y	SMP	STD
	BG	GW-627		Y	SMP	STD
	BG	GW-626		Y	SMP	STD
	BG	GW-082		Y	SMP	STD
	SPI	GW-315		Y	SMP	STD
	RS	GW-311	Q1	Y	SMP	STD
	OLF	GW-085		Y	SMP	STD
	OLF	GW-537	Q3	Y	SMP	STD
	OLF	GW-226		Y	SMP	STD
	OLF	GW-225		Y	SMP	STD
	FIELD BLANK					VOC(1)

Table B.2 (continued)

Sample Group ¹	Location ²	Sampling Point ³	Duplicate ⁴	Contain ⁵	Monitoring Driver ⁶	Parameters ⁷
BC-3 (Q1, Q3)	EXP-SW	BCK-00.63			EXP	STD, RAD(2,3)
	EXP-SW	BCK-04.55			EXP	STD, RAD(2,3)
	EXP-SW	BCK-07.87			EXP	STD
	EXP-SW	SS-5	Q1		EXP	STD
	EXP-SW	BCK-09.40	Q3		EXP	STD
	EXP-SW	SS-4			EXP	STD, RAD(12)
	EXP-SW	BCK-11.97			EXP	STD, RAD(2,3,4,5,8,13)
	EXP-SW	SS-1			EXP	STD
	EXP-SW	NT-01			EXP	STD
BC-4 (Q1, Q3)	BG	GW-069		Y	SMP	STD
	BG	GW-061		Y	SMP	STD
	BG	GW-072		Y	SMP	STD
	BG	GW-071	Q3	Y	SMP	STD
	BG	GW-291		Y	SMP	STD
	BG	GW-288		Y	SMP	STD
	BG	GW-289		Y	SMP	STD
	BG	GW-091		Y	SMP	STD
	BG	GW-014	Q1	Y	SMP	STD
BC-5 (Q1, Q3)	OLF	GW-076		Y	SMP	STD
	OLF	GW-229	Q1	Y	SMP	STD
	OLF	GW-066	Q3	Y	SMP	STD
	OLF	GW-087		Y	SMP	STD
	S-3	GW-243		Y	SMP	STD, RAD(2,3,4,5,8,13)
Chestnut Ridge Hydrogeologic Regime						
CR-1 (Q1, Q3)	EXP-SW	SCR1.5SW	Q1		EXP	STD
	EXP-SW	SCR2.2SW			EXP	STD
	EXP-SW	SCR4.4SW	Q3		EXP	STD
	EXP-SW	SCR5.2SP			EXP	STD

Table B.2 (continued)

Sample Group ¹	Location ²	Sampling Point ³	Duplicate ⁴	Contain ⁵	Monitoring Driver ⁶	Parameters ⁷
Upper East Fork Poplar Creek Hydrogeologic Regime						
EF-1 (Q2,Q4)	GRID B2	55-1B	O2	Y	SMP	STD
	S2	GW-349		Y	SMP	STD
	S2	GW-350	O4	Y	SMP	STD
	FTF	GW-620		Y	SMP	STD
	S2	GW-251		Y	SMP	STD
	RG	GW-633		Y	SMP	STD
	FF	GW-658		Y	SMP	STD
	GRID JP	GW-763		Y	SMP	STD
	NHP	GW-381		Y	SMP	STD
	NHP	GW-153		Y	SMP	STD
	NHP	GW-383		Y	SMP	STD
	FIELD BLANK					VOC(1)
EF-2 (Q2,Q4)	GRID H3	GW-775			SMP	STD
	GRID H3	GW-776			SMP	STD
	GRID G3	GW-770		Y	SMP	STD
	GRID G3	GW-769		Y	SMP	STD
	GRID D2	GW-791		Y	SMP	STD
	CPT	GW-688		Y	SMP	STD, RAD(3,12)
	GRID E3	GW-782		Y	SMP	STD, RAD(3)
	B8110	GW-698	O2	Y	SMP	STD, RAD(3)
	T0134	GW-204		Y	SMP	STD, RAD(3)
	UOV	GW-219	O4	Y	SMP	STD, RAD(3)
EF-3 (Q2,Q4)	EXP-SW	LRSPW	O2		EXP	STD
	EXP-SR	GW-208			EXP	STD
	EXP-SR	GW-207	O4		EXP	STD
	EXP-SR	GW-816			EXP	STD
	GRID K1	GW-744			EXP	STD
	GRID K2	GW-747			EXP	STD
	EXP-J	GW-750			EXP	STD
	EXP-J	GW-735			EXP	STD
	NHP	GW-220		Y	EXP	STD

Table B.2 (continued)

Sample Group ¹	Location ²	Sampling Point ³	Duplicate ⁴	Contain ⁵	Monitoring Driver ⁶	Parameters ⁷
EF-WB (Q1,Q3)	EXP-J	GW-722-06			EXP	STD
	EXP-J	GW-722-30			EXP	STD
	EXP-J	GW-722-26			EXP	STD
	EXP-J	GW-722-32			EXP	STD
	EXP-J	GW-722-33			EXP	STD
	EXP-J	GW-722-10			EXP	STD
	EXP-J	GW-722-22	Q1	Y	EXP	STD
	EXP-J	GW-722-20	Q3	Y	EXP	STD
	EXP-J	GW-722-14		Y	EXP	STD
	EXP-J	GW-722-17		Y	EXP	STD
	RINSATE SAMPLE					STD
North of Pine Ridge						
PR-1 (Q2,Q4)	EXP-NPR	NPR07.0SW			SMP	STD
	EXP-NPR	NPR12.0SW	Q2		SMP	STD
	EXP-NPR	NPR23.0SW			SMP	STD
	EXP-NPR	GHK2.51ESW			SMP	STD
	EXP-NPR	GHK2.51WSW	Q4		SMP	STD

Notes:

1 Samples will be collected during the calendar year quarter as specified (e.g., Q1). Surface water and spring samples in BC-3 will be collected on or about the same day as groundwater samples will be collected from wells GW-683 and GW-684 in BC-1. Samples in CR-1 will be collected on or about the same day as NPDES surface water stations S17 and S19.

2 **Bear Creek Regime**

BG - Bear Creek Burial Grounds Waste Management Area
EXP - Exit Pathway Monitoring Location:
Maynardville Limestone Picket (-A, -B, -C)
Spring or Surface Water Location (-SW)
OLF - Oil Landfarm Waste Management Area
RS - Rust Spoil Area
S3 - S-3 Site
SPI - Spoil Area I

Chestnut Ridge Regime

EXP-SW - Spring or surface water sampling location

Table B.2 (continued)

Notes: (continued)

East Fork Regime

B8110	-	Building 81-10
B4	-	Beta-4 Security Pits
EXP-J	-	Maynardville Limestone Exit Pathway Picket J
EXP-SR	-	Exit pathway well in the gap through Pine Ridge along Scarboro Road
EXP-SW	-	Surface water station
FF	-	East End Fuel Facility
FTF	-	Fire Training Facility
GRID	-	Comprehensive Groundwater Monitoring Plan Grid Location
NHP	-	New Hope Pond
RG	-	Rust Garage Area
T0134	-	Underground Storage Tank 0134-U
T2331	-	Underground Storage Tank 2331-U
UOV	-	Uranium Oxide Vault
S2	-	S-2 Site

North of Pine Ridge

EXP-NPR	-	Surface water sampling station located where drainage exits the Oak Ridge Reservation
3	BCK	- Bear Creek Kilometer (Surface Water Sampling Station)
	GW	- Groundwater Monitoring Well
	GHK	- Gum Hollow Kilometer (Surface Water Sampling Station)
	LRSPW	- Lake Reality Spillway (Surface Water Sampling Station)
	NPR	- North Pine Ridge (Surface Water Sampling Station)
	NT	- North Tributary to Bear Creek
	SCR	- South Chestnut Ridge (Spring Sampling Station)
	SS	- Spring Sampling Location: South Side of Bear Creek
4	Q_	- Field duplicate samples will be collected at these locations during the quarter specified.
5	Y	- All purged groundwater will be contained at these locations.
6	EXP	- DOE Order 5400.1 Exit Pathway/Perimeter Monitoring
	SMP	- DOE Order 5400.1 Surveillance Monitoring
7	Table B.1 provides a comprehensive list of analytes and analytical methods grouped by parameter.	
	STD	- Standard administrative parameter group. See the following list of parameters that apply to CY 2002 samples.

Table B.2 (continued)

Notes: (continued)

Standard Administrative Parameter Group:

- FLD - Field measurements
- CHEM - Miscellaneous laboratory analytes (e.g., pH) and anions
- MET(1) - Metals
- VOC(1) - Volatile organic compounds
- RAD(1) - Gross alpha and gross beta

Additional Radionuclides:

- RAD(2) - Strontium-89/90, technetium-99, and tritium
- RAD(3) - Uranium-234, -235, and -238
- RAD(4) - Americium-241, iodine-129, neptunium-237, plutonium-238 and -239/240
- RAD(5) - Radium-223/224/226
- RAD(8) - Thorium-228, -230, -232, and -234
- RAD(12) - Technetium-99
- RAD(13) - Total uranium and weight percent of Uranium-234, -235, and -238

APPENDIX C

LABORATORY REQUIREMENTS (Bottle List, Holding Times, Turnaround Time)

STD

Parameter	Chemical Preservative ¹	Bottle Types/Size
Turbidity, pH, Conductivity, Anions, and Fluoride	None	1 - 250 mL polyethylene
Total Suspended Solids	None	1 - 250 mL polyethylene
Total Dissolved Solids	None	1 - 250 mL polyethylene
Carbonate, Bicarbonate	None	1 - 250 mL polyethylene
Total Metals (ICP, ICP-MS, and Hg)	HNO ₃	1 - 500 mL polyethylene
Radiochemistry (UV / Y-12)	HNO ₃	1 – 500 mL polyethylene
VOA	None	2 - 40 mL amber glass with Teflon lined septum lids
Trip Blank (VOA) (one per cooler)	None	1 - 40 mL amber glass with Teflon lined septum lid

STD:

ESLIMS LAB TEST ID

FLD	GWTRSAMP
CHEM	ALKALINITY-I, ANIONS, FLUORIDE, SOLIDS-TOT-S, SOLIDS-TOT-D, PH9040, TURBIDITY and CONDUCTANCE
MET(1)	ICP6010, ICPMSGW and HG7470
VOC(1)	VOA8260GW
RAD(1)	GROSSAB-ENV

¹ Samples chilled to 4 +/- 2C

STD, RAD (2,3,4,5,8,13)

Parameter	Chemical Preservative ¹	Bottle Types/Size
Turbidity, pH, Conductivity, Anions, and Fluoride	None	1 – 250 mL polyethylene
Total Suspended Solids	None	1 – 250 mL polyethylene
Total Dissolved Solids	None	1 – 250 mL polyethylene
Carbonate, Bicarbonate	None	1 – 250 mL polyethylene
Total Metals (ICP, ICP-MS, and Hg)	HNO ₃	1 – 500 mL polyethylene
Total Uranium and ²³⁴ U%, ²³⁵ U%, ²³⁶ U%, ²³⁸ U%	HNO ₃	1 – 250 mL polyethylene
Radiochemistry (UV / Y12)	HNO ₃	5 – liter polyethylene
Tritium	None	1 – 250 mL glass
VOA	None	2 – 40 mL amber glass with Teflon lined septum lids
Trip Blank (VOA) (one per cooler)	None	1 – 40 mL amber glass with Teflon lined septum lid

STD: ESLIMS LAB TEST ID

FLD

GWTRSAMP

CHEM

ALKALINITY-I, ANIONS, FLUORIDE, SOLIDS-TOT-S,
SOLIDS-TOT-D, PH9040, TURBIDITY and CONDUCTANCE

MET(1)

ICP6010, ICPMSGW and HG7470

VOC(1)

VOA8260GW

RAD (1) = Gross Alpha Beta (GROSSAB-ENV) 500 mL preserved w HNO₃

RAD (2) = ^{89/90}Sr, ⁹⁹Tc (TOTALSR-ENV, TC99LS-ENV) 1,000 mL preserved w HNO₃
³H (TRITIUM-ENV) 250 mL **No HNO₃, 4C +/- 2C**

RAD (3) = ²³⁴U, ²³⁵U, ²³⁸U (ASPECU-ENV) 500 mL preserved w HNO₃

RAD (4) = ²⁴¹Am, ²³⁷Np, ¹²⁹I, ²³⁸Pu and ^{239/240}Pu 1,500 mL preserved w HNO₃
(ASPECAM-ENV, ASPECNP-ENV, GAMSPEC-ENV, ASPECPU-ENV)

RAD (5) = Radium total (TOTALRA-ENV) 1,000 mL preserved w HNO₃

RAD (8) = Thorium (^{228/230/232}Th and ²³⁴Th) 1,000 mL preserved w HNO₃
(ASPECTH-ENV)

RAD (13) = Total U and ²³⁵U %, ²³⁴U%, ²³⁶U%, ²³⁸U% 250 mL preserved w
HNO₃
(TIMS - - - U-ISO-TOTAL)

¹ Samples chilled to 4 +/- 2C

Y-12GWPP BOTTLE LISTS CY02

VOC (1)

Parameter	Chemical Preservative ¹	Bottle Types/Size
VOA	None	2 – 40 mL amber glass with Teflon lined septum lid

VOC(1)

VOA8260GW

¹ Samples chilled to 4 +/- 2C

STD, RAD 3

Parameter	Chemical Preservative ¹	Bottle Types/Size
Turbidity, pH, Conductivity, Anions, and Fluoride	None	1 – 250 mL polyethylene
Total Suspended Solids	None	1 – 250 mL polyethylene
Total Dissolved Solids	None	1 – 250 mL polyethylene
Carbonate, Bicarbonate	None	1 – 250 mL polyethylene
Total Metals (ICP,ICP-MS, and Hg)	HNO ₃	1 – 500 mL polyethylene
Radiochemistry (UV / Y12)	HNO ₃	1 – 1L polyethylene
VOA	None	2 – 40 mL amber glass with Teflon lined septum lids
Trip Blank (VOA) (one per cooler)	None	1 – 40 mL amber glass with Teflon lined septum lid

STD: **ESLIMS LAB TEST ID**
 FLD GWSPSAMP
 CHEM ALKALINITY-I, ANIONS, FLUORIDE, SOLIDS-TOT-S,
 SOLIDS-TOT-D, PH9040, TURBIDITY and CONDUCTANCE
 MET(1) ICP6010, ICPMSGW and HG7470
 VOC(1) VOA8260GW

RAD (1) = Gross Alpha Beta (GROSSAB-ENV) 500 mL preserved w HNO₃

RAD (3) = ²³⁴U, ²³⁵U, ²³⁸U (ASPECU-ENV) 500 mL preserved w HNO₃

¹ Samples chilled to 4 +/- 2C

STD, RAD (3, 12)

Parameter	Chemical Preservative ¹	Bottle Types/Size
Turbidity, pH, Conductivity, Anions, and Fluoride	None	1 – 250 mL polyethylene
Total Suspended Solids	None	1 – 250 mL polyethylene
Total Dissolved Solids	None	1 – 250 mL polyethylene
Carbonate, Bicarbonate	None	1 – 250 mL polyethylene
Total Metals (ICP, ICP-MS, and Hg)	HNO ₃	1 – 500 mL polyethylene
Radiochemistry (UV / Y12)	HNO ₃	1 – liter polyethylene & 1 – 500 mL polyethylene
VOA	None	2 – 40 mL amber glass with Teflon lined septum lids
Trip Blank (VOA) (one per cooler)	None	1 – 40 mL amber glass with Teflon lined septum lid

STD: **ESLIMS LAB TEST ID**
 FLD GWTRSAMP
 CHEM ALKALINITY-I, ANIONS, FLUORIDE, SOLIDS-TOT-S,
 SOLIDS-TOT-D, PH9040, TURBIDITY and CONDUCTANCE
 MET(1) ICP6010, ICPMSGW and HG7470
 VOC(1) VOA8260GW

RAD (1) = Gross Alpha Beta (GROSSAB-ENV)	500 mL	preserved w HNO ₃
RAD (3) = ²³⁴ U, ²³⁵ U, ²³⁸ U (ASPECU-ENV)	500 mL	preserved w HNO ₃
RAD (12) = Tc-99 (TC99LS-ENV)	500 mL	preserved w HNO ₃

¹ Samples chilled to 4 +/- 2C

WESTBAY

Parameter	Chemical Preservative ¹	Bottle Types/Size
Turbidity, pH, Conductivity, Anions, and Fluoride	None	1 - 250 mL polyethylene
Total Suspended Solids	None	1 - 250 mL polyethylene
Total Dissolved Solids	None	1 - 250 mL polyethylene
Carbonate, Bicarbonate	None	1 - 250 mL polyethylene
Total Metals (ICP, ICP-MS, and Hg)	HNO ₃	1 - 250 mL polyethylene
Radiochemistry (UV / Y-12)	HNO ₃	1 – 250 mL polyethylene
VOA	None	2 - 40 mL amber glass with Teflon lined septum lids
Trip Blank (VOA) (one per cooler)	None	1 - 40 mL amber glass with Teflon lined septum lid

STD:

FLD

CHEM

MET(1)

VOC(1)

RAD(1)

GWTRSAMP

ALKALINITY-I, ANIONS, FLUORIDE, SOLIDS-TOT-S,
SOLIDS-TOT-D, PH9040, TURBIDITY and CONDUCTANCE

ICP6010, ICPMSGW and HG7470

VOA8260GW

GROSSAB-ENV

ESLIMS LAB TEST ID

¹ Samples chilled to 4 +/- 2C

ESTABLISHED HOLDING TIMES

Parameter	Holding Times
Alkalinity (Carbonate, Bicarbonate)	14 days
Anions (Chloride, Nitrate, Sulfate)	48 hr
Conductance	24 hr
Fluoride	28 days
Mercury	28 days
Metals (ICP, ICPMS)	6 months
pH	analyze immediately
Radiochemistry (except tritium)	6 months
Solids, Total Dissolved	7 days
Solids, Total Suspended	7 days
Tritium	No EPA guidance
Turbidity	48 hours
Uranium by Thermal Ionization Mass Spec	6 months
VOA	7 days

ESTABLISHED TURNAROUND TIMES

The Groundwater Protection Program and the Analytical Chemistry Organization (ACO) laboratory have agreed upon a turnaround time, such that the analytical data generated from all sample locations within a sample group will be transmitted to the Data Manager as a data deliverable. Currently, the turnaround time for all sample groups is 35 days from the receipt of the last sample within a group. Data is transmitted in the form of hard copy of the completed and approved lab reports for each locations, along with an electronic copy in a standardized and compatible format (please see *Y-12 Plant Groundwater Protection Program Data Management Plan, Revision 1*, May 2000, Y/SUB/00-KFX63/C/1)

APPENDIX D

ADDENDA TO THE CY 2002 SAMPLING AND ANALYSIS PLAN (if issued)

APPENDIX E

CY 2002 GROUNDWATER MONITORING SCHEDULES

DISTRIBUTION

U.S. DEPARTMENT OF ENERGY

J.P. Donnelly

ENVIRONMENTAL COMPLIANCE DEPARTMENT

S.M. Field

S.B. Jones

K.G. Hanzelka

C.C. Hill

J.E. Powell

E.R. Schultz

L.O. Vaughan

GWPP-File-RC (2)

AJA TECHNICAL SERVICES, INC.

T.R. Harrison

J.R. Walker

ANALYTICAL CHEMISTRY ORGANIZATION

D.D. Altom

L.E. White (2)

Y-12 Central Files

Y-12 Records Services (Electronic copy-OSTI)

BECHTEL JACOBS COMPANY LLC

H.M. Clancy

C.S. Haase (2)

File-EMEF-DMC

MDM SERVICES CORPORATION

M. Selecman

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

J.M. Coe

D.L. Smith

UT-BATTELLE, LLC

D.B. Watson

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION DOE OVERSIGHT

D. Gilmore (3)