

**Bear Creek Valley Watershed Remedial Action Report  
Comprehensive Monitoring Plan  
Oak Ridge, Tennessee**



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**Bear Creek Valley Watershed Remedial Action Report  
Comprehensive Monitoring Plan  
Oak Ridge, Tennessee**

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## ACRONYMS

AWQC	ambient water quality criteria
BCBGs	Bear Creek Burial Grounds
BCK	Bear Creek kilometer
BCV	Bear Creek Valley
BYBY	Boneyard/Burnyard
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CMP	Comprehensive Monitoring Plan
COC	contaminant of concern
DARA	Disposal Area Remedial Action
DNAPL	dense non-aqueous phase liquid
DOE	U.S. Department of Energy
DSWM	Division of Solid Waste Management
ECOC	ecological contaminant of concern
EMWMF	Environmental Management Waste Management Facility
EPA	Environmental Protection Agency
FFA	Federal Facility Agreement
FY	fiscal year
FYR	Five-Year Review
IP	integration point
MCL	maximum contaminant level
NT	North Tributary
OLFSCP	Oil Landfarm Soil Containment Pad
ORR	Oak Ridge Reservation
OU	operable unit
PCB	polychlorinated biphenyl
PCCR	Phased-Construction Completion Report
QAPP	Quality Assurance Project Plan
RAO	remedial action objective
RAR	Remedial Action Report
RCRA	Resource Conservation and Recovery Act of 1976
RER	Remediation Effectiveness Report
RmAR	Removal Action Report
ROD	Record of Decision
TCE	trichloroethene
TDEC	Tennessee Department of Environment and Conservation
VOC	volatile organic compound
WAC	waste acceptance criteria
WAG	Waste Area Grouping
WRRP	Water Resources Restoration Program
Y-12	Y-12 National Security Complex

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# 1. INTRODUCTION

The Oak Ridge Reservation (ORR) Water Resources Restoration Program (WRRP) was established by the U.S. Department of Energy (DOE) in 1996 to implement a consistent approach to long-term environmental monitoring across the ORR. The WRRP provides a central administrative and reporting function that integrates and coordinates the numerous activities associated with this monitoring, including the preparation of watershed-specific Comprehensive Monitoring Plans (CMPs) and a single Quality Assurance Project Plan (QAPP; BJC/OR-235/R3) that applies to all the various CMPs.

This CMP provides the monitoring approach for the Bear Creek Valley (BCV) and consolidates the monitoring requirements and needs for the BCV watershed. The purposes of the CMP include: (1) to provide the data and technical analysis necessary to assess the performance of completed Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) actions in BCV that have been prescribed in decision documents or primary post-decision documents (e.g., Remedial Action Reports [RARs] or Post-Construction Completion Reports [PCCRs]); (2) to provide monitoring to establish a baseline against which the performance of future actions will be gauged; (3) to support the CERCLA Five-Year Review (FYR) evaluation of the remedy protectiveness; and (4) to integrate the substantive requirements of the former Resource Conservation and Recovery Act of 1976 (RCRA) post-closure permit monitoring and site controls for BCV into the CERCLA program.

Remedial actions monitored by the CMP are implemented as required in the *Record of Decision for Phase I Activities in Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee* (DOE/OR/01-1750&D4) [Phase I Record of Decision (ROD)] and the *Remedial Design Work Plan for the Phase I Activities in Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee* (DOE/OR/01-1760&D3). In addition to the actions outlined in the Phase I ROD, several single-project decisions within BCV were performed that predate the Phase I activities. These earlier actions did not contain specific performance criteria for reduction of contaminant flux or risk reduction at the watershed scale. However, the Phase I ROD incorporates the preceding single-project actions and sets specific performance standards for contaminant flux and risk reduction for the entire watershed.

At the Federal Facility Agreement (FFA) Managers Meeting of September 18, 2009, it was agreed among the FFA parties that the necessary baseline sampling will be included in watershed-specific CMP/QAPPs completed under the WRRP. These watershed-specific CMPs will not only include specific monitoring in existing decision documents (RODs, RARs, removal action reports [RmARs]), but also select monitoring referred to as “baseline or trend” monitoring. The technical approach for baseline, or trend, monitoring is related to the hydrology of the watershed. For example, monitoring of a surface water integration point (IP), where all upstream contaminant releases converge, would be included in a baseline monitoring program. Although not all upgradient remedies may have been implemented and performance criteria have not yet been imposed, a baseline trend is nonetheless necessary to track.

This CMP also addresses the environmental monitoring to be performed in the BCV watershed to support each FYR of remedy effectiveness. The last FYR was conducted in fiscal year (FY) 2016; the next FYR is planned for FY 2021. For the most part, the monitoring locations identified to support an evaluation of remedy protectiveness are already being monitored on a routine basis as part of the performance or baseline monitoring network. However, for the FYR evaluations, the suite of analytical parameters is often expanded to include a more comprehensive list to verify human health and ecological risk-based decisions remain protective. Prior to each FYR, existing data are evaluated to determine the most effective network of monitoring locations and analytical parameters needed to assess protectiveness for each implemented remedy.

In May of 2017, DOE requested from the Tennessee Department of Environment and Conservation-Division of Solid Waste Management (TDEC-DSWM) that the re-application of the Bear Creek Hydrogeologic Regime RCRA post-closure permit be denied and the applicable substantive requirements for post-closure care, monitoring, and reporting for the relevant units be integrated into the CERCLA process. TDEC-DSWM granted the request on [INSERT DATE]. Both TDEC and the U.S. Environmental Protection Agency (EPA) regulations for hazardous waste treatment, storage, and disposal facilities allow facilities to use alternate mechanisms, such as CERCLA enforceable documents, to address RCRA closure/post-closure requirements. Under TDEC Rule 0400-12-01-.06(7)(a)(3)(ii) and 40 *Code of Federal Regulations* (CFR) 264.110(c)(2), the application of RCRA post-closure regulatory requirements is not necessary if the requirements of the alternative enforceable document(s) are protective of human health and the environment and meet the RCRA performance standards specified under TDEC Rule 0400-12-01-.06(7)(b) and 40 *CFR* §264.111. The applicable RCRA requirements for post-closure care and monitoring from the BCV RCRA Post-Closure Permit have been integrated into this CMP (see Appendix B for monitoring requirements and Appendix D for site controls). Reporting requirements will be integrated into the Remediation Effectiveness Report (RER) or CERCLA FYR, as appropriate.

A description of BCV is provided in Section 2, as well as an overview of the watershed conceptual model and a summary of the CERCLA actions in BCV. Section 3 provides the monitoring objectives and performance goals of the selected remedy and Section 4 describes the monitoring plan to meet the requirements specified by the ROD. Section 5 includes the data quality specifications for CERCLA monitoring. A list of references used to compile this CMP is provided in Section 6.

The map in Appendix A (Figure A.1) shows the WRRP surface water, groundwater, and biological monitoring locations in the BCV watershed. Data tables in Appendix B and Appendix C summarize relevant sampling and analysis information for each WRRP monitoring location. Technical details regarding specific sampling and analysis requirements are deferred to the QAPP for the WRRP (BJC/OR-235/R3), which identifies the field sampling procedures, laboratory analytical methods, and data management protocols that are followed to ensure that the environmental monitoring data used for the purposes of the WRRP achieve appropriate levels of quality assurance and quality control.

Appendix D provides a list of site controls in table format required by the former RCRA post-closure permit for the applicable units included within the BCV permit. The minimum frequency for each of the controls is also listed.

Appendix E outlines the formal process for updating and modifying this CMP, as needed, to reflect monitoring changes made in response to on-going, real-time evaluation of the WRRP environmental monitoring data for CERCLA actions in the BCV watershed.

## 2. BACKGROUND

### 2.1 SITE DESCRIPTION

The portion of BCV watershed included in the Phase I ROD encompasses the portion of BCV extending from the west end of the Y-12 National Security Complex (Y-12) westward to Highway 95 (Figure 1). The BCV watershed encompasses two principal drainage areas: (1) the catchment area of Bear Creek and its tributaries between the western end of the Y-12 to approximately 0.4 km (0.25 mile) west of Highway 95 (enclosed between Pine Ridge and Chestnut Ridge), and (2) an area between the Bear Creek water gap in Pine Ridge and the confluence with East Fork Poplar Creek (Figure 2). The approach to remediation in the BCV watershed relies on the conceptual model for contaminant transport (see Section 2.2) that was developed during the remedial investigation.

BCV contains three former waste disposal areas that historically accounted for more than 95% of the radiological and inorganic contamination that currently leaves the valley (DOE/OR/01-1455/V1&D2). These sites are the Boneyard/Burnyard (BYBY), the S-3 Site, and the Bear Creek Burial Grounds (BCBGs; Figure 2) and are all located in the upper one-third of the valley. Areas of groundwater contamination and their source areas are provided in the annual RER (DOE/OR/01-2437&D2).

**BYBY:** The BYBY site was one of the first areas established in BCV for disposal of wastes generated at the Y-12 Plant, and included three separate areas: the Boneyard which was active from 1943 to 1970, Burnyard which was active in the 1960s, and the Hazardous Chemicals Disposal Area that received solid, liquid, and gaseous waste materials from 1975 to 1981. Remedial actions at BYBY were completed in 2002 and are described in Section 2.3.

**S-3 Site:** The S-3 Site consisted of four unlined ponds formerly used for managing liquid waste from the Y-12 Plant. Constructed in 1951, the ponds received various liquid wastes until 1983 when the waste water in the ponds were treated through biodegradation processes, leaving a 2 to 5 ft thick sludge layer on the bottom of the ponds. The S-3 Ponds were closed under RCRA in 1988 by stabilizing the ponds and placing a RCRA multilayer cap over the area and covering it with asphalt for a parking lot.

**BCBGs:** The BCBGs received waste from approximately 1955 to 1993. The primary purpose of the burial grounds was the disposal of depleted uranium turnings and industrial wastes composed of or contaminated with depleted uranium. The Oil Retention Ponds at the site received polychlorinated biphenyl (PCB)-contaminated drainage from the burial grounds. The Oil Retention Ponds were capped in 1989 under a RCRA closure plan.

In addition to releases from the three main waste areas, the underlying Maynardville Limestone also contains commingled plumes of volatile organic compound (VOC)-contaminated groundwater from multiple sources. These plumes of groundwater contamination are described in the annual RER (DOE/OR-01-2437&D2).

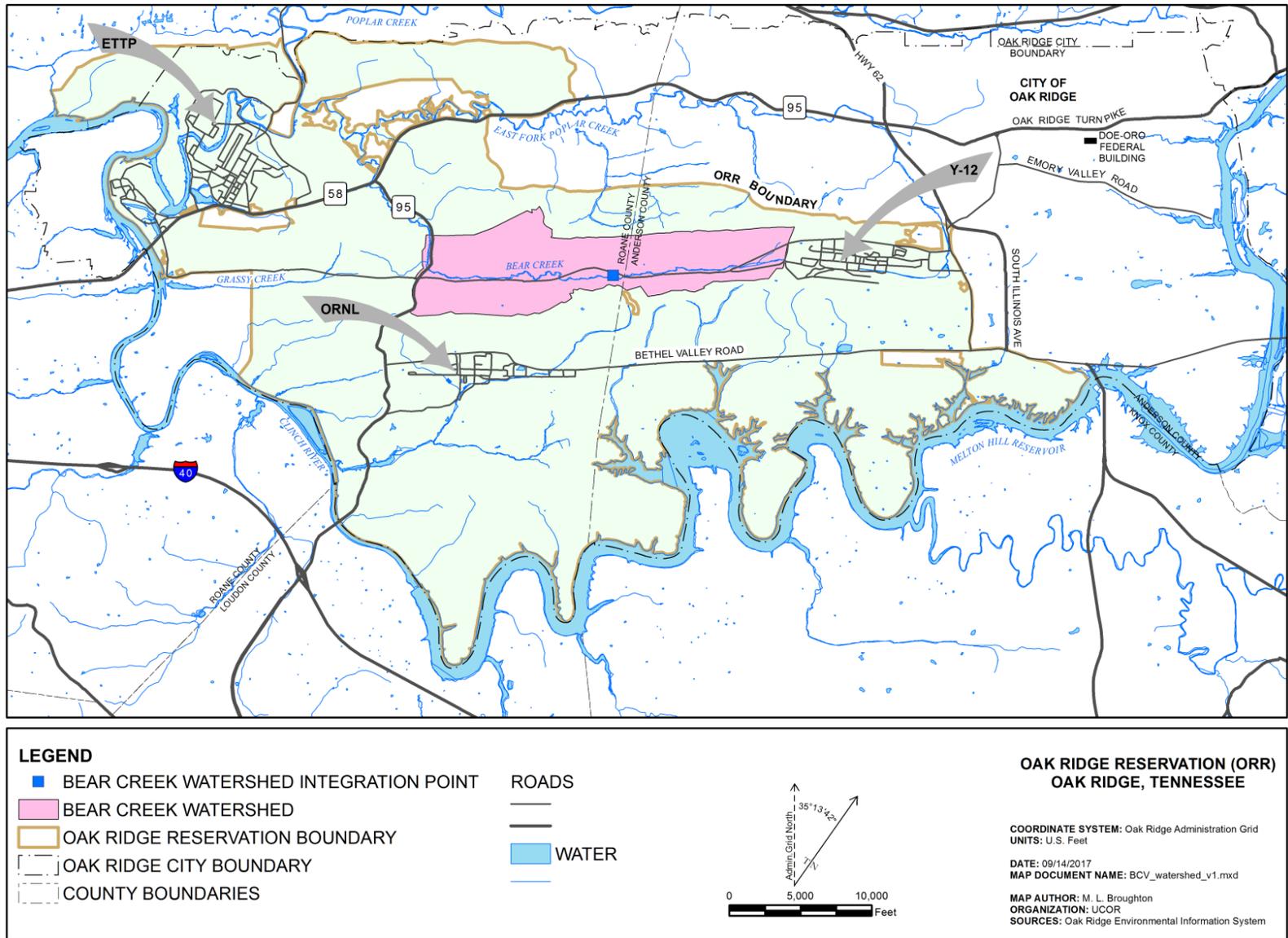


Figure 1. Location of BCV watershed.

Contaminant sources and transport pathways to Bear Creek and the Maynardville Limestone include the following:

- Uranium from the S-3 Site enters Bear Creek and groundwater within the Maynardville Limestone via transport in shallow groundwater. These pathways (Pathways 1 and 2) accounted for approximately 30% of uranium migrating in Bear Creek and the Maynardville Limestone at the IP during FY 2002 monitoring. In addition, nitrate, Tc-99, metals, and VOCs discharge to North Tributary (NT-1) and NT-2 from the S-3 Site via Pathway 3.
- Before remediation of BYBY, uranium- and mercury-contaminated water discharged from the buried wastes at this site to NT-3. This was the largest source for uranium in Bear Creek and the Maynardville Limestone. BYBY also discharged mercury to NT-3. Following completion of the BYBY remediation, the uranium flux contribution from NT-3 to Bear Creek decreased from levels greater than 100 kg/yr in FY 2000 to less than 5 kg/yr in FY 2004 (DOE/OR/01-2211&D2).
- Uranium waste and dense non-aqueous phase liquid (DNAPL) in groundwater at the BCBGs are sources of VOCs and uranium in groundwater, which discharges to NT-7 and NT-8. Most VOCs derived from the BCBGs volatilize before reaching Bear Creek. A proportion of uranium-contaminated leachate is captured by two leachate collection systems installed as part of a RCRA-response action in the BCBGs, although significant uranium-contaminated groundwater discharges are measured in NT-8 downgradient of one of the leachate collection devices.
- Adjacent to BYBY and Sanitary Landfill I, a losing reach of Bear Creek marks a zone of groundwater recharge that is the principal pathway carrying VOCs, uranium, Tc-99, and nitrate in surface water and shallow groundwater to intermediate and deep groundwater in the Maynardville Limestone.
- A past release of trichloroethene (TCE) to groundwater in the vicinity of the Rust Spoil Area (Figure 2) created a plume of TCE in the Maynardville Limestone.

The Maynardville Limestone, Bear Creek, and the tributaries represent the downgradient pathways and receptors of contaminants migrating away from waste sites in the BCV watershed. The principal contaminants of concern (COCs) in the exit pathway are uranium, nitrate, and VOCs. Cadmium is an ecological COC (ECOC) in the section of Bear Creek near the S-3 Site, and mercury has been an ECOC in NT-3. Contamination in surface streams and contaminant plumes in groundwater derived from individual sources commingle in the exit pathway downstream of the sources. The current extent of groundwater contaminant plumes are provided in the annual RER (DOE/OR/01-2437&D2).

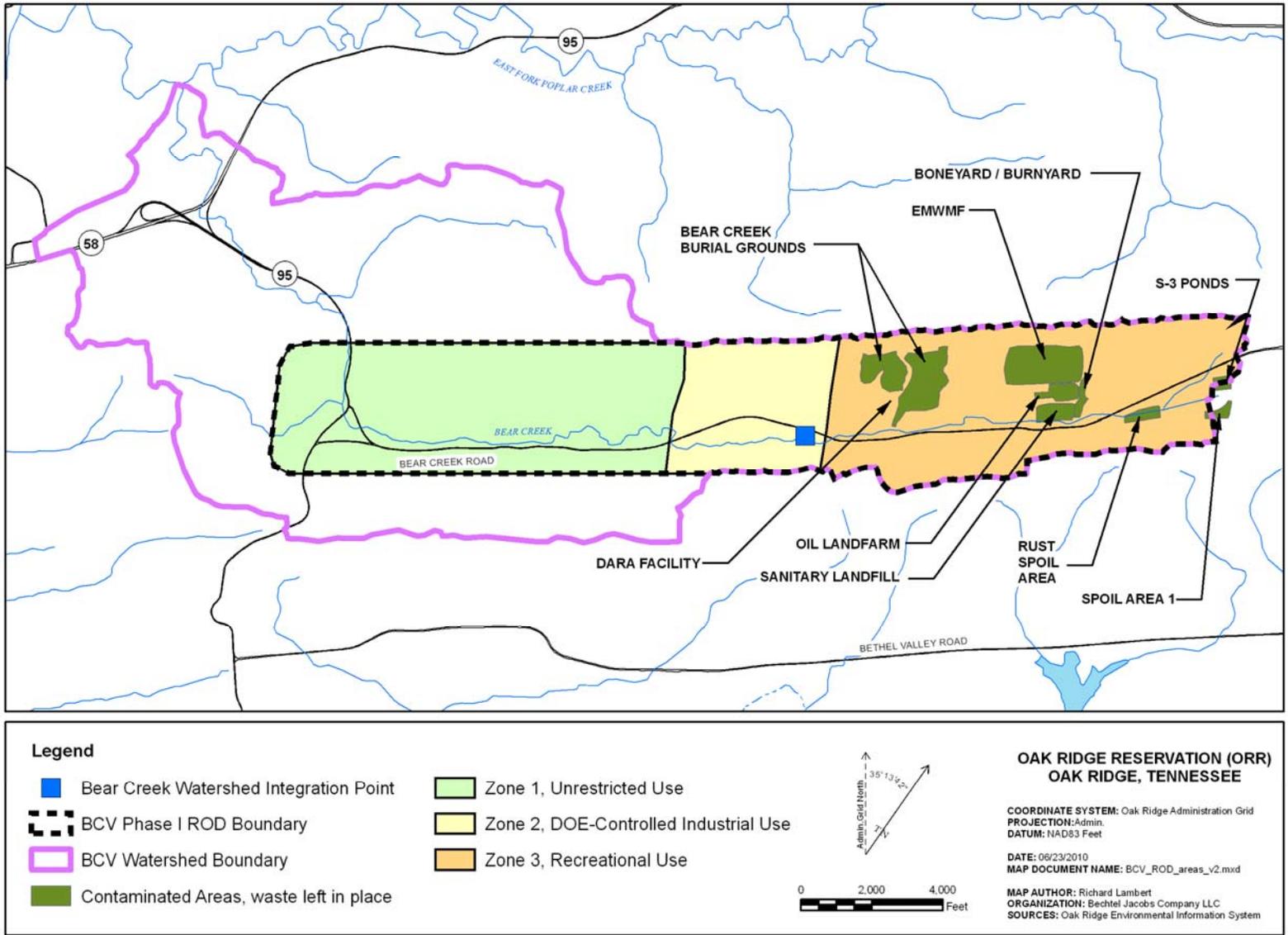


Figure 2. BCV watershed ROD designated areas.

## 2.2 WATERSHED CONCEPTUAL MODEL

The migration pathways for contaminants to exit the watershed are surface water transport in Bear Creek and groundwater transport moving along strike to the west in the Maynardville Limestone (Figure 3). COCs in the exit pathway are uranium, nitrate, and VOCs. Cadmium and mercury are ECOCs in surface water in the section of Bear Creek close to the S-3 Site. Contamination in surface streams and contaminant plumes in groundwater derived from the individual sources commingle in these exit pathways downstream of the sources.

Waste and contamination at the sources in BCV are situated in the subsurface, and shallow groundwater is the principal mechanism and pathway for release of contaminants. After release, most contaminants travel via short pathways in shallow groundwater to be discharged into tributaries to Bear Creek. Some contaminants, in particular those from the S-3 Ponds, remain entrained in groundwater and discharge directly into the Maynardville Limestone. The main groundwater flow and contaminant transport pathways in groundwater within the watershed are along geologic strike to the southwest (parallel to the axis of the valley). BCV has an asymmetric cross-section with the topographic and hydrologic low located on the southern side of the valley coincident with the outcrop of the Maynardville Limestone. Groundwater flow in the Maynardville Limestone, which contains well-developed solution conduits, is both shallow and deep. Large, individual springs or groups of springs mark the locations of discharge from both the shallow and deep flow systems. Flow in this formation is closely connected to Bear Creek, and the interconnected system of stream channel and underlying karst acts as the principal hydraulic drain for the valley.

Storm flow is also an important component of the hydrogeologic system in Bear Creek. The nature, rate, and direction of water flow in both surface water and groundwater are transient and vary based on the rainfall and seasonal conditions. This dynamic nature of the hydrogeology of BCV is extremely important to the rate of contaminant transport, both at the sources and in the exit pathway.

The IP for the watershed (Figure 1), Bear Creek kilometer (BCK) 9.2, measures the total flux of contaminants from all waste disposal sites exiting the watershed in surface water. BCK 9.2 replaced flux monitoring at BCK 9.47 and SS-5 in FY 2006. The IP is located immediately downstream of the BCBGs, and, although periodic detection of site-related COCs in groundwater occur farther to the west in the Maynardville Limestone, the great majority of contaminants exiting the former disposal sites pass through this location.

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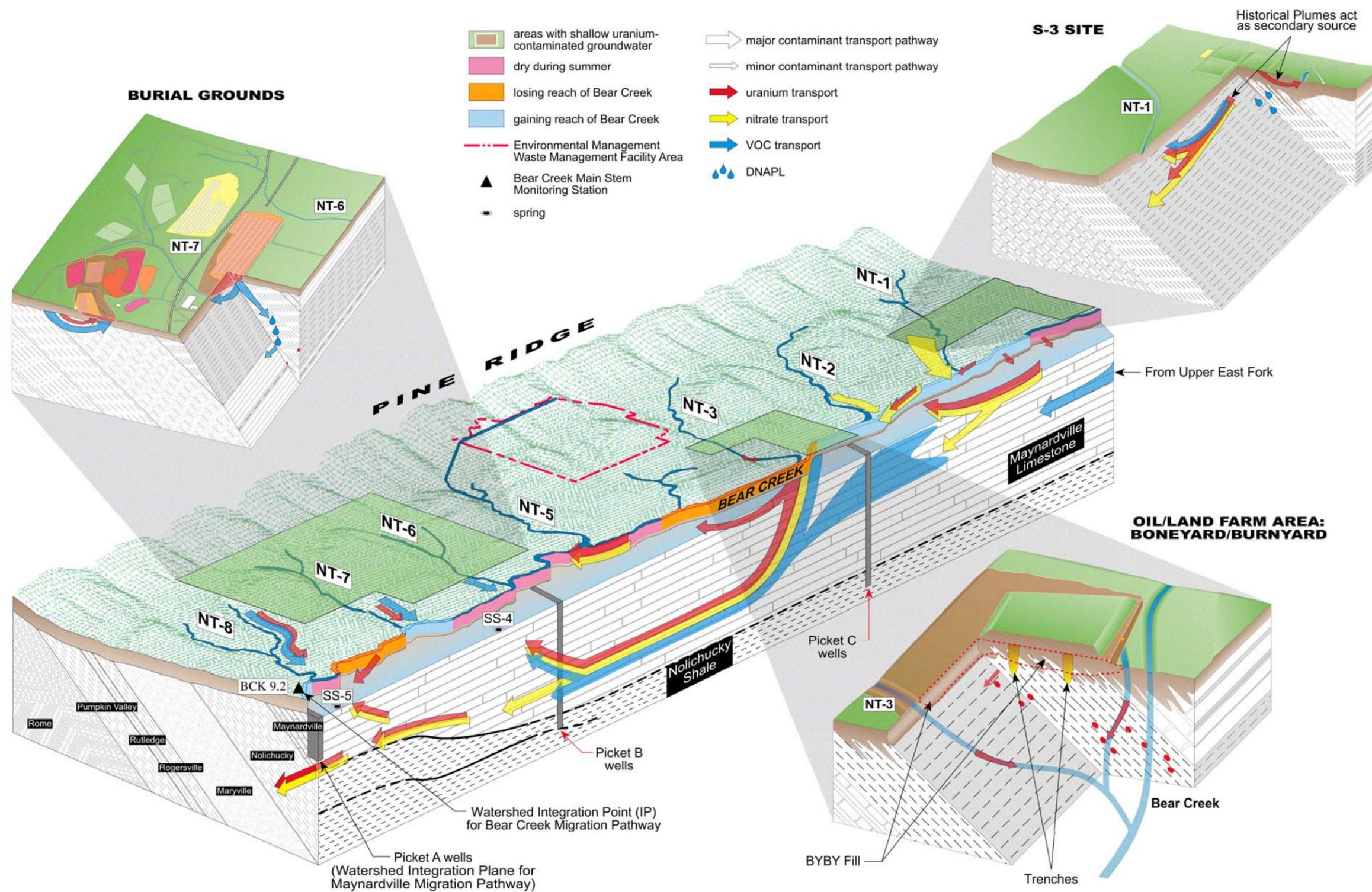


Figure 3. Conceptual model for contaminant migration in BCV.

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Remedial performance monitoring results collected, together with data obtained from Y-12 compliance programs (e.g., National Pollutant Discharge Elimination System and DOE Order 450.1) since the remedial investigation (DOE/OR/01-1455/V1&D2), have not altered the overall conclusions of the BCV watershed conceptual model regarding contaminant sources and fate and transport. Most locations show a continuation of trends established over the previous several years. Uranium discharge in NT-3 was greatly reduced in response to BYBY remedial actions, although a gradual and small rebound of uranium concentration has been observed during FY 2009 and 2010.

### 2.3 CERCLA ACTIONS IN BCV WATERSHED

This section presents the background information for CERCLA actions in the BCV watershed. In April 1993, CERCLA was established as the lead regulatory program with regard to remedial action on the DOE ORR when the Commissioner of TDEC signed an Agreed Order. Under this agreement, RCRA was applied as an applicable or relevant, and appropriate requirement to the extent that post-closure maintenance and monitoring of RCRA-regulated facilities (e.g., the S-3 Site, portions of BCBGs, and the Oil Landfarm) was performed in compliance with the terms of the applicable RCRA post-closure permit. However, any RCRA-driven cleanup of the groundwater in the BCV watershed was deferred to remedial action(s) specified under applicable CERCLA ROD(s). The applicable RODs define the criteria, plan, and schedule for remedial actions at specific source areas, and requirements for groundwater monitoring to gauge the effectiveness of the remedial actions are provided in the applicable post-construction CERCLA documentation. Prior to the Agreed Order, remedial actions were conducted in BCV under RCRA authority. The S-3 Site, Oil Landfarm, and numerous regulated units of the BCBGs were closed and capped in the late 1980s and early 1990s. Until recently, these facilities were included in the RCRA post-closure permit for the Bear Creek Hydrogeologic Regime (permit number TNHW-116). TDEC-DSWM granted DOE's request to transition the implementation of the substantive requirements for post-closure care and monitoring for the relevant units of the BCV watershed into the CERCLA process in [INSERT DATE]. These requirements have been integrated into this CMP (see Appendix B for monitoring requirements and Appendix D for site controls).

The ROD for Phase I activities in BCV (DOE/OR/01-1750&D4) was approved in June 2000. The selected remedy described in the ROD involves actions at four facilities in BCV: the S-3 Site, the BYBY, the Oil Landfarm Soil Containment Pad (OLFSCP), and the Disposal Area Remedial Action (DARA) facility. Remedial actions at the BYBY were completed in December 2002 and involved the excavation and disposal of 64,000 yd<sup>3</sup> of contaminated soil, excavation and capping of an additional 22,000 yd<sup>3</sup> of soil, and restoration of NT-3 following completion of the action. In addition to the Phase I ROD, four CERCLA actions have been completed in the BCV administrative watershed: (1) Spoil Area 1 and SY-200 Yard (Bear Creek Operable Unit [OU] 2 Remedial Action [DOE/OR/02-1435&D2]); (2) S-3 Site Tributary Interception Removal Action Pathways 1 and 2 (DOE/OR/01-1836&D1), although the action was later terminated in FY 2007 (DOE/OR/01-1836&D1/A1); (3) Burial Ground D-East Revegetation Removal Action (DOE/OR/01-2048&D2); and (4) the ROD for the Environmental Management Waste Management Facility (EMWMF; DOE/OR/01-1791&D3). In addition, the Waste Area Grouping (WAG) 11 (White Wing Scrapyard) Surface Debris Remedial Action (DOE/OR/01-1121&D3) is located in the hydraulic catchment area of Bear Creek downstream of the administrative section of the watershed. The actions are summarized in Table 1, and locations of the actions are shown on Figure 2.

The ROD for Phase I activities in BCV (DOE/OR/01-1750&D4) specifies performance monitoring for component actions, as well as monitoring to evaluate attainment of resource use goals for the valley. As of FY 2011, however, only the OLFSCP and the BYBY actions have been completed. The approved PCCR (DOE/OR/01-2077&D2) for these actions referenced the draft Remediation Performance Monitoring Plan for BCV that was included as Appendix C of the Remedial Design Work Plan for Phase I activities in BCV (Appendix C, DOE/OR/01-1760&D3). This Monitoring Plan provided a detailed rationale for selection of

environmental monitoring locations based on actions completed and scheduled at the time of Phase I ROD approval. Although the Monitoring Plan was never approved by the regulators, the monitoring actions relevant to the BYBY are considered required under CERCLA, as the plan was referenced in the approved PCCR for BYBY. Required monitoring includes uranium flux and mercury measurements, and biological monitoring at NT-3, as well as stream channel stability and vegetation recovery monitoring. Because the remediation goal for uranium flux of 4.3 kg/yr at NT-3 was attained every year since the BYBY was remediated, regulator concurrence was obtained to discontinue flow-paced composite sampling at NT-3 and replace it with monthly grab sampling for isotopic uranium in March 2007. In addition, the stream channel stability monitoring was completed in FY 2008. However, flow-paced composite monitoring was re-instated at NT-3 in FY 2011 to determine a potential source of contaminants discharging from the BYBY area as indicated by a slight increase in uranium concentrations and a notable shift in isotope ratios from the site. In addition, flow-paced monitoring at NT-5 and Bear Creek kilometer (BCK) 10.15 were instituted to help determine inputs directly to the Bear Creek channel from groundwater discharges and aid in identifying ungauged uranium flux at the IP, BCK 9.2. Other monitoring included in the BCV Monitoring Plan is conducted at an appropriate frequency for baseline purposes until other Phase I ROD actions are implemented.

**Table 1. CERCLA actions in BCV watershed**

CERCLA action	Decision document, date signed (mm/dd/yy)	Action/document status <sup>a</sup>	Monitoring required
<i>Watershed-scale actions</i>			
BCV Phase I ROD	ROD (DOE/OR/01-1750&D4): 06/16/00	Long-term watershed baseline/performance monitoring <sup>b</sup> Actions complete	Yes
		<ul style="list-style-type: none"> <li>• BYBY PCCR (DOE/OR/01-2077&amp;D2) approved (01/12/04)</li> <li>• OLF Soils Containment Pad RAR (DOE/OR/01-1937&amp;D2) approved 07/16/01</li> </ul>	Yes No
	LUCIP (DOE/OR/01-2320&D1) submitted 9/29/06	Actions not yet implemented	No
		<ul style="list-style-type: none"> <li>• S-3 Site Pathway 3</li> <li>• DARA Facility</li> </ul>	No
BCV Phase II ROD	ROD: TBD <sup>c</sup>		
<i>Single-project actions</i>			
BCV OU 2 RA (Spoil Area 1, SY-200 Yard)	ROD (DOE/OR/02-1435&D2): 01/23/97	No additional actions required; institutional control and S&M ongoing	No
S-3 Site Tributary Interception (Pathways 1 and 2)	AM (DOE/OR/01-1739&D1): 6/25/98 AM Addendum (DOE/OR/01-1739&D1/A1): 10/20/00	RmAR (DOE/OR/01-1945&D2): 02/11/02 RmAR Addendum (DOE/OR/01-1836&D1/A1): 06/20/07 (shutdown Pathways 1 and 2 system)	Terminated

<sup>a</sup>Detailed information of the status of actions is from Appendix E of the FFA and is available at <[http://www.bechteljacobs.com/ettp\\_ffa\\_appendices.shtml](http://www.bechteljacobs.com/ettp_ffa_appendices.shtml)>.

<sup>b</sup>Monitoring that is not associated with a specific action, e.g., IP monitoring at BCK 9.2.

<sup>c</sup>D1 FFS and PP for remediation of the BCBGs submitted in FY 2009. Future decision documents and their respective implementation have not been formalized at this time.

AM = Action Memorandum  
 BCBGs = Bear Creek Burial Grounds  
 BCK = Bear Creek kilometer  
 BCV = Bear Creek Valley  
 BYBY = Boneyard/Burnyard  
 CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980  
 DARA = Disposal Area Remedial Action  
 FFA = Federal Facility Agreement  
 FFS = Focused Feasibility Study  
 FY = fiscal year  
 IP = integration point

LUCIP = Land Use Control Implementation Plan  
 OLF = Oil Landfarm  
 OU = operable unit  
 PCCR = Phased Construction Completion Report  
 PP = Proposed Plan  
 RA = remedial action  
 RAR = Remedial Action Report  
 RmAR = Removal Action Report  
 ROD = Record of Decision  
 S&M = surveillance and maintenance  
 TBD = to be determined

DOE conducted data quality objective meetings in March 2003 to review and optimize the monitoring requirements for BCV. In these meetings, changes were made to the monitoring program based on the results of monitoring reported in the RER. These changes were detailed in a July 2003 letter to the EPA and TDEC and were incorporated into the CMP. The 2006 CERCLA FYR used data collected in accordance with the BCV CMP. Based on remedy performance assessment, recommendations were made in the 2006 FYR (DOE/OR/01-2289&D3) to optimize monitoring. Along with these changes, approval was obtained to shut down the S-3 Site Tributary Interception Removal Action (Pathways 1 and 2) and reduce the associated monitoring. All monitoring associated with the Pathways 1 and 2 treatment system was discontinued when the regulators approved an Addendum to the RmAR. This CMP incorporates those changes. During FY 2008, upgrades were performed at the BCK 12.34 flume, located downgradient of the discontinued treatment system, to improve the downstream flow regimes to obtain more accurate flux measurements. Weekly flow-paced composite samples are analyzed for uranium isotopes at BCK 12.34; and biological monitoring at BCK 12.4, BCK 9.9, and BCK 3.3 continues to measure the quality of aquatic habitat at the watershed scale that are affected, in part, by releases from the S-3 Site. In addition, monitoring at NT-1 specifically targets contamination (e.g., Cd) migrating from Pathway 3. These data are collected to provide sufficient information to develop a future response action.

Bear Creek surface water station BCK 9.47 and spring SS-5 combined flows were originally selected as the contaminant IP for the watershed. The IP is the location for measuring the total flux of contaminants leaving the waste disposal sites in groundwater and surface water. More than 99% of contaminants exiting the former disposal sites pass by the IP, which is located downstream of the BCBGs. In 2001, a new monitoring station was constructed at BCK 9.2, downstream of BCK 9.47/SS-5, to provide a more accurate assessment of contaminant flux leaving the valley. Engineering improvements to BCK 9.2 were conducted in FY 2004, and calibration of flow-rating curves was completed in FY 2005. The transition to BCK 9.2 as the watershed IP was completed during FY 2007, and continuous flow-paced monitoring of BCK 9.47/SS-5 for uranium has been discontinued.

Monitoring conducted for the EMWMF is governed by an Environmental Monitoring Plan (DOE/OR/01-1873&D2/A1/R1) outlining requirements for groundwater, surface water, stormwater, leachate, and ambient air monitoring. EMWMF monitoring is performed by the operating contractor. The ROD for WAG 11 (DOE/OR/01-1121&D3), the ROD for BCV OU 2 (DOE/OR/02-1435&D2), and the Removal Action for Burial Ground D-East (DOE/OR/01-2048&D2) do not have monitoring requirements associated with them.

The BCV remediation strategy, as outlined in the Phase I ROD, is to reduce the flux of uranium and nitrate from the two largest sources of these contaminants, the BYBY and the S-3 Site. Reduction of flux from these two sources will result in reduced flux of these contaminants leaving the valley and improvement of surface water and groundwater quality in the watershed. To monitor remedial performance, the Phase I ROD establishes watershed-scale performance criteria, as well as specific flux goals for these two sites. The Phase I ROD also sets specific water quality goals for groundwater and surface water in terms of ambient water quality criteria (AWQC) and maximum contaminant levels (MCLs). Upon completion of the Phase I ROD, the resulting changes in water quality throughout the valley will be assessed, and additional watershed-level decisions will be evaluated to meet the final goals for the watershed.

### 3. MONITORING OBJECTIVES AND PERFORMANCE GOALS

The selected remedy cited in the Phase I BCV ROD (DOE/OR/01-1750&D4) involves source control and migration control strategies that reduce contaminant migration in shallow groundwater and surface water. These actions are expected to result in a reduction of contamination levels in groundwater and surface water downstream of the waste areas over time.

The remedial action objectives (RAOs) for the BCV ROD (DOE/OR/01-1750&D4) are to:

- *protect future residential users of the valley in Zone 1 from risks from exposure to groundwater, surface water, soil, sediment, and waste sources;*
- *protect a passive recreational user in Zone 2 from unacceptable risks from exposure to surface water and sediment;*
- *and protect industrial workers and maintenance workers in Zone 3 from unacceptable risks from exposure to soil and waste.*
- The three land use zones in BCV were identified previously on Figure 2. Consistent with the RAOs, water quality goals are also established in the ROD for each zone, as stated in Table 2.

**Table 2. Groundwater and surface water goals, BCV Y-12 Plant, Oak Ridge, Tennessee<sup>a</sup>**

<i>Area of the valley (see Figure 2)</i>	<i>Current situation</i>	<i>Goal</i>
<i>Zone 1 – western half of Bear Creek Valley</i>	<i>No unacceptable risk posed to a resident or a recreational user. AWQC and groundwater MCLS are not exceeded.</i>	<i>Maintain clean groundwater and surface water so that this area continues to be acceptable for unrestricted use.  Land use: unrestricted</i>
<i>Zone 2 – a 1-mile-wide buffer zone between zones 1 and 3</i>	<i>No unacceptable risk posed to a recreational user. Risk to a resident is within the acceptable risk range except for a small area of groundwater contamination. Groundwater MCLS are exceeded, but AWQC are not.</i>	<i>Improve groundwater and surface water quality in this zone consistent with eventually achieving conditions compatible with unrestricted use.  Land use: recreational (short-term); unrestricted (long-term)</i>
<i>Zone 3 – eastern half of Bear Creek Valley</i>	<i>Contains all the disposal areas that pose considerable risk. Groundwater MCLS and AWQC are exceeded.</i>	<i>Conduct source control actions to (1) achieve AWQC in all surface water, (2) improve conditions in groundwater to allow Zones 1 and 2 to achieve the intended goals, and (3) reduce risk from direct contact to create conditions compatible with future industrial use.  Land use: controlled industrial</i>

<sup>a</sup>Source: Table 2.1 of BCV ROD (page 2-13).

AWQC = ambient water quality control  
 BCV = Bear Creek Valley  
 MCL = maximum contaminant level  
 ROD = Record of Decision  
 Y-12 = Y-12 National Security Complex

In addition to the watershed-wide water quality goals, the ROD provides site-specific water quality goals for the S-3 Site Pathway 3 and for the BYBY actions, as presented in Table 3.

**Table 3. Site-specific goals for remedial actions at the S-3 Site Pathway 3 and the BYBY<sup>a</sup>**

Remedial action goals for S-3 Site Pathway 3	Remedial action goals for BYBY
<ul style="list-style-type: none"> <li>• Prevent expansion of the nitrate plume into Zone 1.</li> <li>• Reduce concentration of cadmium in NT-1 and upper Bear Creek to meet AWQC.<sup>b</sup></li> <li>• Prevent future increase in release of uranium to Bear Creek to maintain annual flux below 27.2 kg total U at BCK 12.34.</li> <li>• Reduce seasonal nitrate flux at NT-1/Bear Creek confluence by 40%. The seasonal nitrate flux benchmark will be defined by the FFA parties in remedial design.</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce flux of uranium in NT-3 as confluence with Bear Creek to 4.3 kg/yr.</li> <li>• Reduce concentration of mercury in NT-3 to meet AWQC (12 ng/L at the time – now 51 ng/L).</li> </ul>

<sup>a</sup>Source: Table 2.2 of BCV ROD (page 2-14).

<sup>b</sup>The Phase I ROD originally established the cadmium concentration performance standard as 3.9 µg/L. This standard changed to 0.25 µg/L due to change in the promulgated AWQC.

AWQC = ambient water quality criteria  
 BCK = Bear Creek kilometer  
 BCV = Bear Creek Valley  
 BYBY = Boneyard/Burnyard  
 FFA = Federal Facility Agreement  
 NT = North Tributary  
 ROD = Record of Decision

The source removal actions related to principal threat source materials and groundwater control actions specified in the ROD comprise the actions that were envisioned to attain the stated water quality goals. The following components of the selected remedy are listed in the ROD:

- **S-3 Site.** Install trench at Pathway 3 for passive *in situ* treatment of shallow groundwater.
- **Oil Landfarm Area.** Actions in the Oil Landfarm Area include:
  - Remove waste stored in OLFSCP for commercial offsite disposal and dismantle structure.
  - Excavate source areas in BYBY and contaminated floodplain soils and sediments. Excavated materials meeting the waste acceptance criteria (WAC) of the EMWMF will be disposed onsite; materials exceeding EMWMF WAC will be disposed offsite. Install clay cap over uncapped disposal areas at BYBY and maintain existing caps.
  - Implement hydraulic isolation measures at BYBY, including reconstruction of NT-3, elimination of stagnation points, and installation of drains or well points.
- **Other Sites.** Remove waste stored in the DARA facility for offsite disposal and dismantle structure.

Field implementation of actions under the Phase I ROD was initiated in FY 2000. Remedial actions in the Oil Landfarm Area are complete (BYBY and OLFSCP). Other key components of the remedy (S-3 Pathway 3 and DARA) have not yet been implemented.

The ROD included expected outcomes, target risk levels, and timeframes for attainment of goals for each of the BCV land use zones as outlined in Table 4.

**Table 4. Expected outcome of the selected remedy, BCV, Y-12 Plant, Oak Ridge, Tennessee<sup>a</sup>**

	Zone 1	Zone 2	Zone 3		
			S-3 Site/Pathway 3	BYBY/OLF Area	BCBGs
Available land use and time frame	Unrestricted use (compatible with residential use), available immediately. <sup>b</sup>	Presently restricted use (compatible with recreational use); compatible with unrestricted use in 50 years.	Restricted use, long-term waste management area/controlled industrial use	Restricted use; long-term waste management area/controlled industrial use	N/A
Available groundwater use and time frame	Unrestricted use (compatible with residential use) available immediately (MCLs met)	Presently restricted use (MCLs not met for nitrates, compatible with recreational use); with unrestricted use in 50 years.	Restricted use	Restricted use	N/A
Available surface water use and time frame	Unrestricted use (compatible with residential use) available immediately (AWQC met)	Unrestricted use (compatible with recreational use); available immediately (AWQC met)	Recreational use, AWQC met in 5 years following implementation	Recreational use, AWQC met in 5 years following implementation	N/A
Cleanup levels, residual risk	<ul style="list-style-type: none"> <li>- MCLS in groundwater</li> <li>- AWQC in surface water</li> <li>- risk to residential receptor below RAO of <math>1 \times 10^{-5}</math></li> </ul>	<ul style="list-style-type: none"> <li>- TBD for groundwater</li> <li>- AWQC in surface water</li> <li>- risk to residential receptor below RAO of <math>1 \times 10^{-5}</math></li> </ul>	<ul style="list-style-type: none"> <li>- TBD for groundwater</li> <li>- AWQC in surface water</li> <li>- direct exposure risk to industrial/terrestrial receptors eliminated</li> <li>- risk to industrial receptor below RAO of <math>1 \times 10^{-5}</math></li> <li>- Reduce seasonal nitrate flux at the NT-1/Bear Creek confluence by 40%</li> </ul>	<ul style="list-style-type: none"> <li>- TBD for groundwater</li> <li>- AWQC in surface water</li> <li>- risk to industrial receptor below RAO of <math>1 \times 10^{-5}</math></li> </ul>	N/A
Anticipated socioeconomic and community revitalization impacts	Property will meet conditions for residential/recreational/industrial use	Property will meet conditions compatible with recreational/industrial use	Waste area is capped and used as a parking lot to support Y-12 Plant activities; surrounding area available for additional controlled industrial use	Area devoted to waste management; proposed onsite disposal facility provides potential to create new jobs	N/A
Anticipated environmental and ecological benefits	Media not impacted	Slightly impacted groundwater will be restored	Impacted surface water will be restored	Impacted surface water will be restored, capping will protect terrestrial species	N/A

<sup>a</sup>Source: BCV ROD Table 2.22.

<sup>b</sup>Although the selected remedy will allow unrestricted land use for this zone, there are no plans to transfer ownership of this property.

AWQC = ambient water quality criteria

BCBGs = Bear Creek Burial Grounds

**Table 4. Expected outcome of the selected remedy, BCV, Y-12 Plant, Oak Ridge, Tennessee<sup>a</sup> (cont.)**

BCV = Bear Creek Valley  
BYBY = Boneyard/Burnyard  
MCL = maximum contaminant level  
N/A = not applicable  
NT = North Tributary  
OLF = Oil Landfarm  
RAO = remedial action objective  
ROD = Record of Decision  
S-3 = Pathway 3  
TBD = to be determined  
Y-12 = Y-12 National Security Complex

## 4. MONITORING PLAN

The principal goal for the BCV CMP is to meet the monitoring requirements specified by the ROD for Phase I activities in BCV (DOE/OR/01-1750&D4) and the PCCR for the BYBY (DOE/OR/01-2077&D2), as modified by subsequent approved changes. Additional monitoring is conducted to obtain baseline data that will be used to assess current trends and to determine performance of future actions, and to collect data in support of FYR assessments of remedy protectiveness. In FY 2018, substantive requirements for monitoring and site controls for the relevant former RCRA units in BCV were integrated into this CERCLA CMP.

Below is a brief summary of the organization of the CMP appendices, which provide the monitoring specifics and details of sampling and analytical requirements and needs for BCV. Sample collection is subject to schedule deviations due to abnormal demands on resources, adverse weather conditions, access issues, and other applicable circumstances.

### Appendix A – Figures

Appendix A provides a map of BCV showing the locations where monitoring is conducted by the WRRP. Various symbols are used to indicate the different types of sample, e.g., a fish to indicate biological monitoring.

### Appendix B – Planning Tables

Monitoring activities for the BCV watershed are summarized in the Planning Table included as Appendix B of the CMP. The Planning Table provides a summary-level description of specific sample locations within the watershed where monitoring data will be collected. This table presents general information for each sampling location, including media to be sampled (e.g., surface water, groundwater, biological), type of sample (e.g., grab), class of analytes (e.g., VOCs, metals, or radiological), sampling frequency, rationale for sampling (e.g., performance, baseline, FYR), and provides a performance standard, if available. To facilitate cross-referencing, the Appendix C Sample Group is also provided in the Planning Table.

The Planning Table for each watershed-specific CMP includes a page of footnotes that are unique to that table, providing definitions and explanations of table entries. These footnotes provide information to sampling personnel and data managers. Of particular note in Planning Tables, an asterisk in the Primary Station Name column denotes a high-priority location for full data validation. Also, an asterisk in the Sampling Frequency column is used to denote a location that is sampled *only* in the years between the FYR-specific monitoring. This location is listed elsewhere in the table to be sampled in the year prior to the FYR, but usually includes a much broader suite of analytes. It is included in a C-table that is specific to FYR monitoring.

### Appendix C – Administrative Sample Groups

Appendix C includes the Administrative Sample Groups, which are subwatershed-level groups established for managing the sampling work conducted by the WRRP. Monitoring conducted by other programs, when applicable, on the ORR is not included in Appendix C.

Sample groupings are generally based on proximity of sampling locations in the field. However, sample locations may be grouped based on the necessity of obtaining contemporaneous data to measure remedial performance or by the timing of sampling conducted by other programs, etc.

Biological monitoring has been grouped together into a separate table to better track implementation by a specialized group of trained personnel collecting the samples. In addition, monitoring to support evaluations

of remedy protectiveness during the CERCLA FYR has been grouped into a separate table to facilitate implementation and tracking.

The specific analyte/parameter group for each sampling point is also identified in Appendix C. These analytes/parameters are grouped into Administrative Parameter Groups that are defined in Appendix D tables within the approved QAPP (BJC/OR-235/R3). Because a change in an analytical method, detection limit, etc. would precipitate a change to every watershed-specific CMP if these specifications were included in the CMPs, analytical parameter group definitions have been included in a single QAPP, along with other QA components of the program.

Finally, each Appendix C table includes a page of footnotes that provide information to sampling personnel and data managers.

#### **APPENDIX D – SITE CONTROLS**

Appendix D includes a table of site controls for the Oil Landfarm, former S-3 Ponds Site, and the BCBGs Units A-North, A-South, C-West, and the Walk-In Pits. All of these units were included in the former RCRA post-closure permit which has transitioned to the CERCLA process. Minimum controls for each of the units include access controls; inspections of the cap/cover/drainage systems, as well as the site signage; inspection of the unit following a 25-year/24-hour rain event; and inspections of select benchmarks for the unit. For the S-3 Ponds Site, the asphalt cap is also inspected periodically. At a minimum, the integrity of site monitoring wells is evaluated annually. Inspection data are captured in the Land Use Manager, a computer-based application that is used to track and verify site controls (e.g., inspections, treatment system operations, etc.).

#### **APPENDIX E – CHANGE REQUEST PROCESS**

All modifications to the BCV CMP require an approved erratum. The instructions for initiating a change request to the CMP and the necessary form is included in [Appendix E](#). The CMP Administrator will maintain the Watershed CMP Errata Log to track and document all changes to the watershed CMP.

## 5. DATA MANAGEMENT

Monitoring data and meta-data generated by BCV sampling activities, together with appropriate historical data required for data analysis and interpretations are managed using the Project Environmental Measurements System and the Oak Ridge Environmental Information System. The Data Management Implementation Plan (BJC/OR-754/R2) serves as the project-level plan for managing all data collected by the WRRP. This plan outlines the data management requirements for the program, following the requirements of *Developing, Implementing, and Maintaining Data Management Implementation Plans* (BJC-ES-1003). The plan outlines the program's data management activities, roles and responsibilities, and identifies data management interfaces among the various programs on the ORR involved in data acquisition, management, and reporting.

The QAPP for the WRRP (BJC/OR-235/R3) includes requirements for sample collection, laboratory analysis, and data management activities to ensure that appropriate levels of quality assurance and quality control are achieved. This plan identifies the procedures that will be followed in the collection, custody, and handling of samples and environmental/laboratory data used in the WRRP.

## 6. REFERENCES

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**APPENDIX A**  
**MONITORING LOCATIONS**

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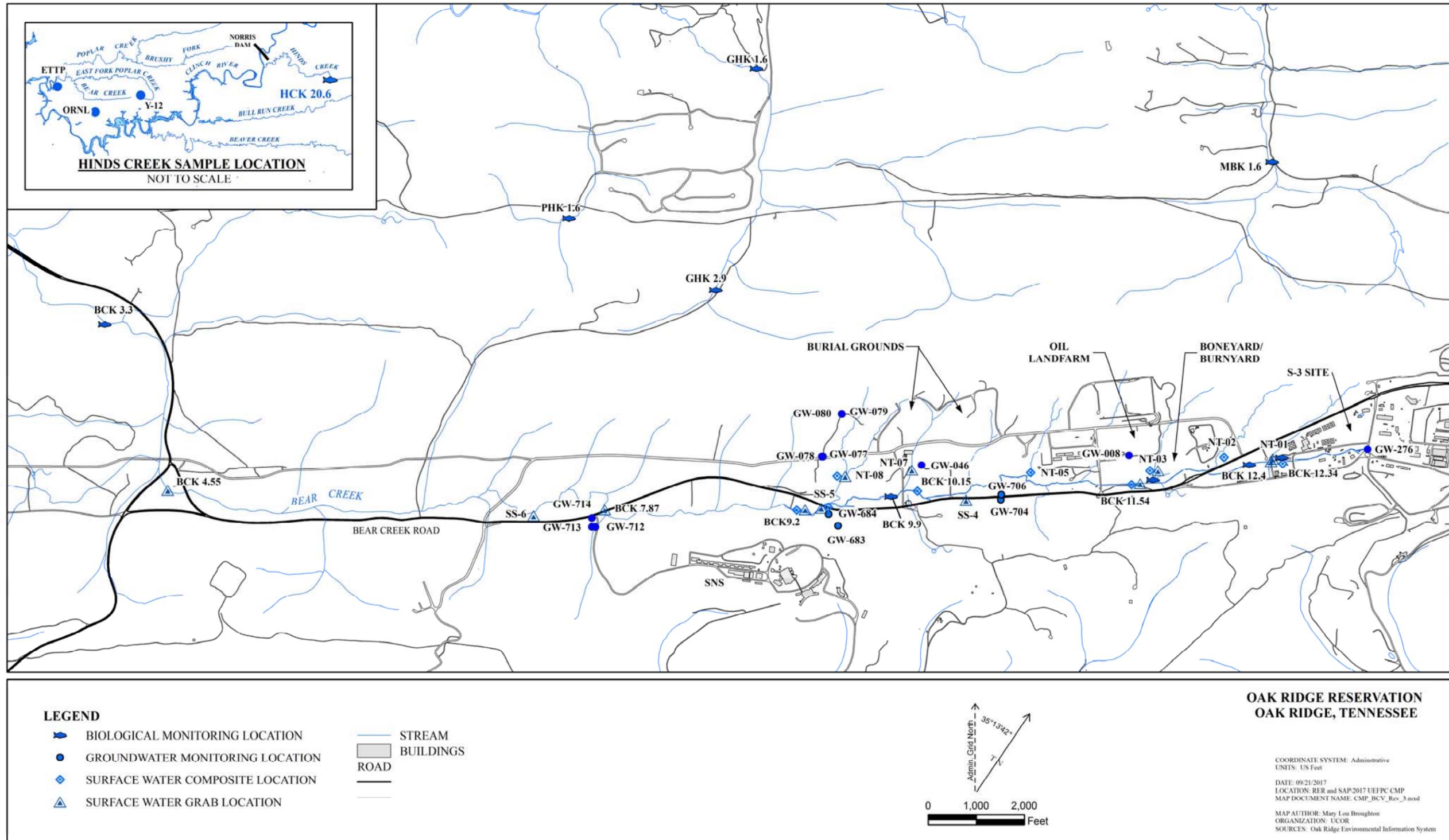


Figure A.1. Sample locations in BCV.

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**APPENDIX B**  
**PLANNING TABLE**

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**Table B. Sample locations and parameters in Bear Creek Valley Watershed**

Sample location	Primary station name*	Sample rationale <sup>a</sup>	Performance standard	Sample medium <sup>b</sup>	Sample type <sup>c</sup>	Appendix C Sample Group <sup>d</sup>	VOCs	PCBs/SVOCs	Metals	Anions	Radiological	AWQC/PEST <sup>e</sup>	Miscellaneous <sup>f</sup>	Biological monitoring	Flow/Precipitation <sup>g</sup>	Sampling program <sup>h</sup>	Sampling Frequency <sup>i</sup>	Comments
<b>Zone 1</b>																		
BCK 3.3	BCK 3.3	PERF BASE	Measure changes in quality of aquatic habitat as compared to reference sites	B	SV	BC-10								2		YWQP	Q1, Q3	Fish and benthic macroinvertebrate species richness and density
BCK 3.3	BCK 3.3	PERF BASE	Measure changes in quality of aquatic habitat as compared to reference sites	B	NA	BC-11								4		YWQP	Q1, Q3	Bioaccumulation of Hg, metals (including uranium), and PCBs in fish [2 species: stoneroller minnows (whole body) and rock bass (fillets - Hg and PCBs only)]
BCK 4.55 (Outfall 304)	BCK 4.55	FYR	AWQC, risk-based	S	G	BC-FYR1	4	4	4	4	4	4			1	YWQP	Q1-Q4 FYR	Watershed performance assessment and exit pathway; Measure compliance with modified AWQC for Zone 1.
<b>Zone 1 – Zone 2 Boundary</b>																		
BCK 7.87	BCK 7.87*	PERF FYR	AWQC, risk-based	S	G	BC-FYR1	4	4	4	4	4	4			1	YWQP	Q1-Q4 FYR	Test for compliance with modified AWQC for Zone 2. Analyze for metals (including Hg and U) and nitrate at the boundary between zones 1 and 2.
GW-712	GW-712	PERF	Trend and compare against drinking water MCLs	G	G	BC-1	2	2	2	2		2				YWQP	Q2	Monitor groundwater annually at the exit pathway, the boundary between zones 1 and 2.
GW-713	GW-713*	PERF		G	G	BC-1	2	2	2	2		2				YWQP	Q2	
GW-714	GW-714	PERF		G	G	BC-1	2	2	2	2		2				YWQP	Q2	
SS-6	SS-6	PERF		S	G	BC-1	2	2	2	2		2				YWQP	Q2	
<b>Zone 2 – Zone 3 Boundary (Integration Plane)</b>																		
BCK 9.2 (IP)	BCK9.2*	FYR	AWQC, risk-based	S	G	BC-FYR1	4	4	4		4	4	4		1	YWQP	Q1-Q4 FYR	Test for compliance with modified AWQC for Zone 3 and analyze for COCs (metals, including Hg) at IP. (Nitrates and isotopic uranium are obtained routinely at the IP at a different frequency in the CMP).
BCK 9.2 (IP)	BCK9.2*	PERF	risk-based	S	G	BC-6				12						YWQP	M	Analyze for nitrate (watershed COC) at the IP
BCK 9.2 (IP)	BCK9.2*	PERF	U flux ≤ 34 kg/yr	S	C	BC-5					52				C	YWQP	W	Measurement of uranium flux reduction at the IP
BCK 9.9	BCK 9.9	PERF	Measure changes in quality of aquatic habitat as compared to reference sites	B	SV	BC-10								4		YWQP	Q1, Q3	Fish and benthic macroinvertebrate species richness and density

**Table B. Sample locations and parameters in Bear Creek Valley Watershed (cont.)**

Sample location	Primary station name*	Sample rationale <sup>a</sup>	Performance standard	Sample medium <sup>b</sup>	Sample type <sup>c</sup>	Appendix C Sample Group <sup>d</sup>	VOCs	PCBs/SVOCs	Metals	Anions	Radiological	AWQC/PEST <sup>e</sup>	Miscellaneous <sup>f</sup>	Biological monitoring	Flow/Precipitation <sup>g</sup>	Sampling program <sup>h</sup>	Sampling Frequency <sup>i</sup>	Comments
BCK 9.9	BCK 9.9	PERF	Measure changes in quality of aquatic habitat as compared to reference sites	B	NA	BC-11								2		YWQP	Q1, Q3	Bioaccumulation of Hg, metals (including uranium), and PCBs in stoneroller minnows (whole body) to evaluate risk to piscivores.
BCK 9.9	BCK 9.9	BASE	NA	B	NA	BC-FYR2								1		YWQP	Q3 only FYR	Bioaccumulation of Hg and PCBs only in rock bass (fillets) to evaluate risks to human health.
BCK 9.9	BCK 9.9	BASE	NA	B	NA	BC-FYR2								1		YWQP	Q3 only FYR	Bioaccumulation of COCs (metals, including Hg, and PCBs) in invertebrates (preferably caddisflies) to evaluate risks to insectivores.
BCK 9.9	BCK 9.9	BASE	NA	B	G	BC-2								2		YWQP	Q1, Q3	Toxicity testing.
GW-683	GW-683	PERF	TBD trend monitoring	G	G	BC-7	2		2	2	2		2			YWQP	Q2, Q4	Measurement of human health risk at the Phase I ROD IP. Analyze for COCs in wells: metals (including Hg and Cd) , nitrate, and U.
GW-684	GW-684	PERF	TBD trend monitoring	G	G	BC-7	2		2	2	2		2			YWQP	Q2, Q4	
GW-077	GW-077	BASE	MCLs, risk-based	G	G	BC-7	2		2	2	2		2			YWQP	Q2, Q4	Monitoring groundwater in the Nolichucky Shale exit pathway along strike from the BCBGs to investigate groundwater flow and contaminant transport in the intermediate and shallow aquifers.
GW-078	GW-078	BASE	MCLs, risk-based	G	G	BC-7	2		2	2	2		2			YWQP	Q2, Q4	
GW-079	GW-079	BASE	MCLs, risk-based	G	G	BC-7	2		2	2	2		2			YWQP	Q2, Q4	
GW-080	GW-080	BASE	MCLs, risk-based	G	G	BC-7	2		2	2	2		2			YWQP	Q2, Q4	
SS-5	SS-5	BASE	NA	S	C	BC-5					52				C	YWQP	W	Determine ungauged uranium flux at the IP
<b>Zone 3</b>																		
<b>Combined S-3 Site, Boneyard/Burnyard, and EMWMF Remedial Actions</b>																		
GW-704	GW-704	BASE	NA	G	G	BC-7	2		2	2	2		2			YWQP	Q2, Q4	Picket B wells provide the first location to monitor change in the groundwater exit pathway downgradient from the S-3 Site and BYBY.
GW-706	GW-706	BASE	NA	G	G	BC-7	2		2	2	2		2			YWQP	Q2, Q4	
NT-5 H Flume	NT-05	BASE	U Trend	S	C	BC-5					52				C	YWQP	W	Collect additional information to increase accuracy of BCK uranium flux calculation.

**Table B. Sample locations and parameters in Bear Creek Valley Watershed (cont.)**

Sample location	Primary station name*	Sample rationale <sup>a</sup>	Performance standard	Sample medium <sup>b</sup>	Sample type <sup>c</sup>	Appendix C Sample Group <sup>d</sup>	VOCs	PCBs/SVOCs	Metals	Anions	Radiological	AWQC/PEST <sup>e</sup>	Miscellaneous <sup>f</sup>	Biological monitoring	Flow/Precipitation <sup>g</sup>	Sampling program <sup>h</sup>	Sampling Frequency <sup>i</sup>	Comments	
<i>S-3 Site Remedial Actions</i>																			
BCK 12.34	BCK 12.34	PERF	AWQC, risk-based within 5 yrs U ≤ 27 kg/yr nitrates-40% seasonal reduction	S	C	BC-5					52	52				C	YWQP	W	Measure uranium (isotopic) and nitrate flux, and Cd (grab) from the S-3 Site.
BCK 12.34	BCK 12.34	PERF	AWQC, risk-based within 5 yrs Cd ≤ 0.25 µg/L	S	G	BC-6			12				12				YWQP	M	
BCK 12.34	BCK 12.34*	FYR	AWQC, risk based within 5 yrs U ≤ 27 kg/yr Cd ≤ 0.25 µg/L nitrates-40% seasonal reduction	S	G	BC-FYR1	4		4		4	4	4		I	YWQP	Q1-Q4 FYR		In upper reaches of Bear Creek, monitor for compliance with modified AWQCs and COCs (Hg and isotopic U) [Note that a monthly grab for MET(1) at BC-6 and a weekly flow-proportionate sample for nitrate and isotopic uranium at BC-5 is obtained].
BCK 12.4	BCK 12.4	PERF	Measure changes in quality of aquatic habitat as compared to reference sites	B	SV	BC-10								4		YWQP	Q1, Q3		Fish and benthic macroinvertebrate species richness and density
BCK 12.4	BCK 12.4	PERF	Measure changes in quality of aquatic habitat as compared to reference sites	B	NA	BC-11								2		YWQP	Q1, Q3		Bioaccumulation of Hg and metals (including uranium) in fish [1 species: stoneroller minnows (whole body)]
BCK 12.4	BCK 12.4	BASE	NA	B	G	BC-2								2		YWQP	Q1, Q3		Toxicity testing.
NT-1	NT-01	PERF	AWQC, risk-based	S	G	BC-14			4							YWQP	Q1-Q4		Quarterly grab samples for metals, including Cd (≤0.25 µg/L).
NT-1	NT-01	PERF FYR	AWQC, risk-based	S	G	BC-FYR1	4		4	4	4	4	4		I	YWQP	Q1-Q4 FYR		Subsequent to completion of remedial action for Pathway 1, monitor compliance with modified AWQC and COCs (nitrates and metals, including Cd and total U). Collect baseline data in year prior to FYR before completion of action.

**Table B. Sample locations and parameters in Bear Creek Valley Watershed (cont.)**

Sample location	Primary station name*	Sample rationale <sup>a</sup>	Performance standard	Sample medium <sup>b</sup>	Sample type <sup>c</sup>	Appendix C Sample Group <sup>d</sup>	VOCs	PCBs/SVOCs	Metals	Anions	Radiological	AWQC/PEST <sup>e</sup>	Miscellaneous <sup>f</sup>	Biological monitoring	Flow/Precipitation <sup>g</sup>	Sampling program <sup>h</sup>	Sampling Frequency <sup>i</sup>	Comments
NT-1	NT-01	BASE	NA	B	G	BC-2								2		YWQP	Q1, Q3	Toxicity testing.
NT-2	NT-02	PERF	AWQC, risk-based	S	C	BC-5				52						YWQP	W	Monitor for nitrate flux in the S-3 Site Pathway 3.
<b>Boneyard/Burnyard Remedial Action</b>																		
NT-3	NT-03	PERF	U flux ≤ 4.3 kg/yr	S	C	BC-5					52					YWQP	W	Measure uranium flux from BYBY area.
NT-3	NT-03	PERF FYR	AWQC, risk-based - within 5 yrs; Hg ≤ 51 µg/L	S	G	BC-FYR1		4	4	4	4	4	4			YWQP	Q1-Q4 FYR	Test for compliance with modified AWQC, analyze for metals (Hg). Location is an effective indicator of releases from Boneyard/Burnyard.
NT-3	NT-03	PERF	Aquatic community data compared to data available for similar reference streams on the ORR	B	SV	BC-10								4		YWQP	Q1, Q3	Fish and benthic macroinvertebrate species richness and density - reevaluate at FYR
BCK 10.15	BCK-10.15	BASE	U Trend	S	C	BC-5					52					YWQP	W	Measure isotopic uranium flux in Bear Creek.
BCK 11.54	BCK 11.54	PERF	U trend	S	C	BC-5					52					YWQP	W	Measure flux of uranium below NT-3; Use BCK 11.54 as upgradient IP for BCBGs.
<b>Bear Creek Burial Grounds</b>																		
NT-7	NT-07	BASE	NA	S	G	BC-6					12		12			YWQP	M	Determine the relative contribution of the BCBGs to uranium flux at BCK 9.2
NT-8	NT-08*	PERF FYR	AWQC, risk-based	S	G	BC-FYR1	4	4	4	4	4	4	4			YWQP	Q1-Q4 FYR	Test for compliance with modified AWQC and analyze for COCs; determine relative contribution of the BCBGs to BCK 9.2.
NT-8	NT-08	PERF	Determine relative contribution of the BCBG to uranium flux at BCK 9.2	S	C	BC-5					52					YWQP	W	Determine relative contribution of the BCBGs to uranium flux at BCK 9.2.

**Table B. Sample locations and parameters in Bear Creek Valley Watershed (cont.)**

Sample location	Primary station name*	Sample rationale <sup>a</sup>	Performance standard	Sample medium <sup>b</sup>	Sample type <sup>c</sup>	Appendix C Sample Group <sup>d</sup>	VOCs	PCBs/SVOCs	Metals	Anions	Radiological	AWQC/PEST <sup>e</sup>	Miscellaneous <sup>f</sup>	Biological monitoring	Flow/Precipitation <sup>g</sup>	Sampling program <sup>h</sup>	Sampling Frequency <sup>i</sup>	Comments	
<i>"Snapshot" of Hg Concentrations in Surface Water</i>																			
BCK 9.2	BCK-9.2*	BASE	NA	S	G	BC-13			2							YWQP	Q1, Q3	Semiannual assessment of mercury and methylmercury in surface water in Bear Creek watershed	
NT-8	NT-08	BASE	NA	S	G	BC-13			2							YWQP	Q1, Q3		
SS-5	SS-5	BASE	NA	S	G	BC-13			2							YWQP	Q1, Q3		
SS-4	SS-4	BASE	NA	S	G	BC-13			2							YWQP	Q1, Q3		
BCK 11.54	BCK 11.54	BASE	NA	S	G	BC-13			2							YWQP	Q1, Q3		
BCK 12.34	BCK 12.34	BASE	NA	S	G	BC-13			2							YWQP	Q1, Q3		
<i>Downgradient Site Performance Wells</i>																			
GW-008	GW-008	PERF	Trend	G	G	BC-FYR2	1		1		1					YWQP	Q2 FYR	Monitor downgradient site performance wells in the year before the CERCLA Five Year Review to gauge any changes in contaminant trends immediately downgradient of the associated former RCRA site.	
GW-046	GW-046	PERF		G	G	BC-FYR2	1		1		1						YWQP		Q2 FYR
GW-276	GW-276	PERF		G	G	BC-FYR2	1		1	1	1						YWQP		Q2 FYR
<i>Biological Reference Sites</i>																			
GHK 1.6	GHK 1.6	REF	NA	B	SV	BC-10								2		YWQP	Q1, Q3	Benthic macroinvertebrate species richness and density	
GHK 2.9	GHK 2.9	REF	NA	B	SV	BC-10								2		YWQP	Q1, Q3		
MBK 1.6	MBK 1.6	REF	NA	B	SV	BC-10								4		YWQP	Q1, Q3	Fish and benthic macroinvertebrate species richness and density	
PHK 1.6	PHK 1.6	REF	NA	B	SV	BC-10								2		YWQP	Q1, Q3	Fish species richness and density	
Hinds Creek	HCK 20.6	REF	NA	B	NA	BC-11								4		YWQP	Q1, Q3	Bioaccumulation of Hg, metals (including uranium), and PCBs in fish [2 species: stoneroller minnows (whole body) and rock bass (fillets - Hg and PCBs only)]	

**Table B. Sample locations and parameters in Bear Creek Valley Watershed (cont.)**

**Notes for Bear Creek Valley Watershed Table B:**

- a **Sample rationale:** PERF = performance monitoring to evaluate remedial actions; BASE = baseline monitoring.  
FYR = five year review monitoring; REF = reference location.
- b **Sample Medium:** G = groundwater, S = surface water, B = biological, and NA = not applicable.
- c **Sample type:** G = grab sample; C = composite sample (e.g., flow proportional); SV = survey; and NA = not applicable.
- d **Sample Group:** Sample locations grouped together for collection within as short a time period as possible per Appendix C tables.
- e **AWQC:** Full suite analysis of water for numeric AWQC constituents requires analysis of AWQC parameter group listed in the Quality Assurance Project Plan (UCOR-4049) including metals, VOCs, SVOCs, PCBs, pesticides, dioxins, and furans, per methods and requested reporting limits contained therein.  
  
For BCV, a modified approach has been devised to measure compliance against Tennessee AWQC by evaluating detections within the last round of analytical sample results. PEST(1) has been expanded to include the following analytes: 4,4'-DDE, dieldrin, heptachlor, alpha-chlordane, gamma-chlordane, chlordane, endosulfan I, endosulfan II, endosulfan sulfate, alpha-BHC, beta-BHC, Lindane (gamma-BHC), and Endrin. Also, a stand-alone Dioxins/Furans parameter group has been added to the WRRP QAPP (UCOR-4049).
- f **Miscellaneous parameters:** For YWQP sample locations in Bear Creek Valley, see Table C.1 for the specific group to be collected.  
Biological monitoring conducted by the YWQP is provided in Table C.2; Table C.3 includes sample groups specifically in support of the Five Year Review monitoring. Miscellaneous parameters may include general water quality parameters such as total dissolved solids, total suspended solids, total organic carbon, temperature, dissolved oxygen, turbidity, pH, conductivity, oxidation-reduction potential, and water level (in wells).
- g **Flow/precipitation:** C = continuous flow measurements I = instantaneous flow measurements
- h **Sampling program:** YWQP = Y-12 Plant Water Quality Program by EMEF  
ECD-WCS = Y-12 Plant Environmental Compliance Department-Water Compliance Section  
BMAP = Biological Monitoring and Abatement Program
- i **Sample Frequency:** W = Weekly Bi-M = Bi-monthly (i.e., every other month)  
M = Monthly Q1..Q4 = lists sample schedule for FY quarters  
FYR = Sampling conducted once every 5 years, at a minimum, in the year prior to the CERCLA Five Year Review (e.g., 2021, 2026, 2031).  
\* = Sample in years other than year prior to Five Year Review (i.e., alternate with Five Year Review -specific monitoring)

Note: Sampling schedule is subject to deviations due to abnormal demands on resources, adverse weather conditions, and other unpredictable events beyond the control of the Water Resources Restoration Program of the U.S. Department of Energy.

\* In "Primary station name" column, denotes high-priority locations for full data validation.

AWQC = ambient water quality criteria	GHK = Gum Hollow Branch kilometer	ROD = Record of Decision
BCBG = Bear Creek Burial Grounds	HCK = Hinds Creek kilometer	SVOC = semivolatile organic compound
BCK = Bear Creek kilometer	IP = Integration Point	VOC = volatile organic compound
BCV = Bear Creek Valley	MBK = Mill Branch kilometer	
BYBY = Boneyard/Burnyard	NT = North Tributary	
COC = contaminant of concern	PCB = polychlorinated biphenyl	
DOE = Department of Energy	PHK = Pinhook Branch kilometer	
FYR = Five Year Review	RCRA = Resource Conservation and Recovery Act of 1976	

**APPENDIX C**  
**ADMINISTRATIVE SAMPLE GROUP TABLES**

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**Table C.1. Sample groups in the Bear Creek Valley Watershed**

Sample group <sup>a</sup>	Location <sup>b</sup>	Sampling point <sup>b</sup>	Monitoring frequency <sup>c</sup>	Matrix <sup>d</sup>	Sample type <sup>e</sup>	Flow/Precip <sup>f</sup>	Dup <sup>g</sup>	Analyte/parameter group <sup>h</sup>
BC-1	EXP	GW-712	Q2	WG	G			FLD(1), ION(2), MET(1,4), VOC(1), ALPHA(1), BETA, RA(1), TC, U
	EXP	GW-713*		WG	G		X	FLD(1), ION(2), MET(1,4), VOC(1), ALPHA(1), BETA, RA(1), TC, U
	EXP	GW-714		WG				FLD(1), ION(2), MET(1,4), VOC(1), ALPHA(1), BETA, RA(1), TC, U
	EXP	SS-6		WS	G			FLD(1), ION(2), MET(1,4), VOC(1), ALPHA(1), BETA, RA(1), TC, U
BC-5	S-3	NT-02	W	WS	C	C		ION(2)
	S-3	BCK-12.34		WS	C	C		ION(2), U
	S-3/BYBY	BCK-11.54		WS	C	C		U
	BCBG	NT-08		WS	C	C		U
	EXP	BCK9.2*		WS	C	C		U
	EXP	SS-5		WS	C	C		U
	S-3/BYBY	NT-05		WS	C	C		U
	S-3/BYBY	BCK-10.15		WS	C	C		U
BC-6	BCBG	NT-07	M	WS	G	I		FLD(1), U
	EXP	BCK9.2*		WS	G			ION(2)
	S-3	BCK-12.34		WS	G			FLD(1), MET(1)
BC-7	BCBG	GW-077	Q2, Q4	WG	G			FLD(1), ION(2), MET(1,4), VOC(1), SLD, RA(1), TC, U
	BCBG	GW-078		WG	G			FLD(1), ION(2), MET(1,4), VOC(1), SLD, RA(1), TC, U
	BCBG	GW-079		WG	G		X	FLD(1), ION(2), MET(1,4), VOC(1), SLD, RA(1), TC, U
	BCBG	GW-080		WG	G			FLD(1), ION(2), MET(1,4), VOC(1), SLD, RA(1), TC, U
	EXP	GW-683		WG	G			FLD(1), ION(1,2), MET(1,4), VOC(1), SLD, ALPHA(1), BETA, TC, U
	EXP	GW-684		WG	G			FLD(1), ION(1,2), MET(1,4), VOC(1), SLD, ALPHA(1), BETA, TC, U
	S-3/BYBY	GW-704		WG	G			FLD(1), ION(1,2), MET(1,4), VOC(1), SLD, ALPHA(1), BETA, RA(1), TC, U
	S-3/BYBY	GW-706		WG	G			FLD(1), ION(1,2), MET(1,4), VOC(1), SLD, ALPHA(1), BETA, RA(1), TC, U
BC-13	EXP	BCK9.2*	Q1, Q3	WS	G			MET(4,6)
	BCBG	NT-08		WS	G			MET(4,6)
	EXP	SS-5		WS	G			MET(4,6)
	EXP	SS-4		WS	G			MET(4,6)
	S-3/BYBY	BCK-11.54		WS	G			MET(4,6)
	S-3	BCK-12.34		WS	G			MET(4,6)
BC-14	S-3	NT-01	Q1-Q4	WS	G		X	MET(1)

**Table C.1. Sample groups in the Bear Creek Valley Watershed (cont.)**

**Notes for Bear Creek Valley Watershed Table C.1:**

**a Sample Group**

BC = Bear Creek Valley Watershed sample group number

Samples in each group will be collected during as short a time period as possible, following the schedule provided.

**b Location and Sampling Point**

BCBG = Bear Creek Burial Grounds

BCK = Bear Creek kilometer

BYBY = Boneyard/Burnyard

EXP = Exit pathway

GW = Groundwater well

NT = Northern tributary

SS = surface spring

**c Monitoring Frequency**

W = Weekly

Q1...Q4 = lists sample schedule for FY quarters

M = Monthly

**d Matrix**

WG = groundwater

WS = surface water

**e Sample Type**

G = grab sample

C = composite sample

**f Flow/Precipitation**

C = continuous flow measurement (often accompanied by a flow-proportional composite sample)

I = Instantaneous flow measurement (often accompanied by a grab sample)

**g Duplicate**

X = field duplicate sample will be collected

**h Analyte/parameter group**

See Table D.1 of the Quality Assurance Project Plan (UCOR-4049) for a list of parameter groups and analytes.

\* In "Sampling Point" column, denotes high-priority locations for full data validation.

Note: Sampling schedule is subject to deviations due to abnormal demands on resources, adverse weather conditions, and other unpredictable events beyond the control of the Water Resources Restoration Program of the U.S. Department of Energy.

AWQC = ambient water quality criteria

FY = fiscal year

PCB = polychlorinated biphenyl

SVOC = semivolatile organic compound

VOC = volatile organic compound

YWQP = Y-12 Water Quality Program

**Table C.2. Sample groups for biological monitoring conducted in the Bear Creek Valley Watershed**

Sample group <sup>a</sup>	Location <sup>b</sup>	Sampling point <sup>b</sup>	Monitoring Frequency <sup>c</sup>	Matrix <sup>d</sup>	Sample Type <sup>e</sup>	Flow/ Precip <sup>f</sup>	Dup <sup>g</sup>	Analyte/parameter group <sup>h</sup>
<b>ROUTINE BIOLOGICAL MONITORING</b>								
BC-2	S-3	NT-01	Q1, Q3	WS	G			TOX TEST
	EXP	BCK-12.4		WS	G			TOX TEST
	EXP	BCK-9.9		WS	G			TOX TEST
BC-10	EXP	BCK-3.3	Q1, Q3	B	SV			FISH, BENTHIC
	EXP	BCK-9.9		B	SV			FISH, BENTHIC
	BYBY	NT-03		B	SV			FISH, BENTHIC
	EXP	BCK-12.4		B	SV			FISH, BENTHIC
	REF	GHK 1.6		B	SV			BENTHIC
	REF	GHK 2.9		B	SV			BENTHIC
	REF	MBK 1.6		B	SV			FISH, BENTHIC
	REF	PHK 1.6		B	SV			FISH
BC-11	EXP	BCK-3.3	Q1, Q3	SRM	NA			B-MET(1,2), B-PCB, LIPIDS
	EXP	BCK-3.3		RB	NA			B-MET(2), B-PCB, LIPIDS
	EXP	BCK-9.9		SRM	NA			B-MET(1,2), B-PCB, LIPIDS
	EXP	BCK-12.4		SRM	NA			B-MET(1,2)
	REF	HCK 20.6		SRM	NA			B-MET(1,2), B-PCB, LIPIDS
	REF	HCK 20.6		RB	NA			B-MET(2), B-PCB, LIPIDS
<b>BIOLOGICAL MONITORING IN SUPPORT OF FIVE YEAR REVIEW (FYR)</b>								
BC-FYR2	EXP	BCK-9.9	Q3	CAD	NA			B-MET(1,2), B-PCB, LIPIDS
	EXP	BCK-9.9	(year prior to FYR)	RB	NA			B-MET(2), B-PCB, LIPIDS

**Table C.2. Sample groups for biological monitoring conducted in Bear Creek Valley Watershed (cont.)**

**Notes for Table C.2, Biological Monitoring:**

**a Sample Group:**

BC = Bear Creek Watershed sample group number

Samples will be collected within each sample group during as short a time as possible, following the schedule indicated.

**b Location and Sampling Point:**

BYBY = Boneyard/Burnyard

NT = Northern Tributary

BCK = Bear Creek kilometer

EXP = Exit pathway

GHK = Gum Hollow Branch kilometer

PHK = Pinhook Branch kilometer

HCK = Hinds Creek kilometer

MBK = Mill Branch kilometer

REF = Reference site

**c Monitoring Frequency:**

Q\_ = Quarter(s) of the fiscal year

FYR = Five Year Review

**d Matrix:**

B = biological

CAD = caddisflies

SRM = stone roller minnow (whole body)

RB = rock bass (fillets)

**e Sample Type:**

NA = not applicable

**f Flow/Precipitation:** not applicable

**g Duplicate:** Field duplicate samples will be collected, as appropriate.

**h Analyte/parameter Group:** See Table D.1 of QAPP (UCOR-4049) for a list of parameter groups and analytes.

FY = fiscal year

QAPP = Quality Assurance Project Plan

**Table C.3. Sample groups for monitoring conducted in Bear Creek Valley Watershed in support of the CERCLA Five-Year Review**

Sample group <sup>a</sup>	Location <sup>b</sup>	Sampling point <sup>b</sup>	Monitoring frequency <sup>c</sup>	Matrix <sup>d</sup>	Sample type <sup>e</sup>	Flow/ Precip <sup>f</sup>	Dup <sup>g</sup>	Analyte/parameter group <sup>h</sup>
BC-FYR1	EXP	BCK9.2*	Q1-Q4	WS	G	I		FLD(1), PEST(1), MET(1,4), VOC(1), SLD, RA(1), TC, PCB
	EXP	BCK-7.87*		WS	G	I		FLD(1), PEST(1), ION(2), MET(1,4), VOC(1), SLD, RA(1), TC, U
	EXP	BCK 4.55		WS	G	I		FLD(1), PEST(1), ION(2), MET(1,4), VOC(1), SLD, RA(1), TC, U
	BYBY	NT-03		WS	G	I		FLD(1), PEST(1), MET(1,4), ION(2), SLD, RA(1), TC
	S-3	BCK-12.34*		WS	G	I		FLD(1), PEST(1), MET(4), VOC(1), SLD, TC, RA(1) [monthly grab for MET(1) at BC-6; weekly flow-proportionate for nitrate and U at BC-5]
	S-3	NT-01		WS	G	I		FLD(1), PEST(1), ION(2), MET(4), VOC(1), SLD, TC, U
	BCBG	NT-08*		WS	G	I	X	FLD(1), PEST(1), ION(2), MET(1,4), VOC(1), SLD, RA(1), TC, PCB
BC-FYR2	OLF	GW-008	Q2	WG	G			FLD(1), MET(1,3), VOC(1), ALPHA(1), BETA
	BCBG	GW-046		WG	G		X	FLD(1), MET(2), VOC(1), ALPHA(1), BETA, TC, U
	S-3 Site	GW-276		WG	G			FLD(1), ION(2), MET(1,4), VOC(1), ALPHA(1), BETA, AM, NP, RA(1), SR(1), TC, U

**Table C.3. Sample groups for monitoring conducted in Bear Creek Valley Watershed in support of the CERCLA Five-Year Review (cont.)**

**Notes for Bear Creek Valley Watershed Table C.3:**

**a Sample Group**

BC = Bear Creek Valley Watershed sample group number

Samples in each group will be collected during as short a time period as possible, following the schedule provided.

**b Location and Sampling Point**

BCBG = Bear Creek Burial Grounds

GW = Groundwater well

BCK = Bear Creek kilometer

NT = Northern tributary

BYBY = Boneyard/Burnyard

SS = surface spring

EXP = Exit pathway

**c Monitoring Frequency**

W = Weekly Q1...Q4 = lists sample schedule for FY quarters

M = Monthly

**d Matrix**

WG = groundwater

WS = surface water

**e Sample Type**

G = grab sample

C = composite sample

**f Flow/Precipitation**

C = continuous flow measurement (often accompanied by a flow-proportional composite sample)

I = Instantaneous flow measurement (often accompanied by a grab sample)

**g Duplicate**

X = field duplicate sample will be collected

**h Analyte/parameter group: See Table D.1 of the Quality Assurance Project Plan (UCOR-4049) for a list of parameter groups and analytes.**

NOTE: Monitoring needs for each CERCLA Five Year Review will be re-evaluated prior to the preparation of the *Comprehensive Monitoring Plan* table providing requirements for the upcoming Five Year Review monitoring. Requirements will be based on past analytical results, completed actions, CERCLA RAOs, and the data needed to determine protectiveness for each action under review.

For BCV, a modified approach has been devised to measure compliance against Tennessee AWQC by evaluating detections within the last round of analytical sample results. PEST(1) has been expanded to include the following analytes: 4,4'-DDE, dieldrin, heptachlor, alpha-chlordane, gamma-chlordane, chlordane, endosulfan I, endosulfan II, endosulfan sulfate, alpha-BHC, beta-BHC, Lindane (gamma-BHC), and Endrin. Also, a stand-alone Dioxins/Furans parameter group has been added to the WRRP QAPP (UCOR-4049).

\* In "Sampling Point" column, denotes high-priority locations for full data validation.

Note: Sampling schedule is subject to deviations due to abnormal demands on resources, adverse weather conditions, and other unpredictable events beyond the control of the Water Resources Restoration Program of the U.S. Department of Energy.

AWQC = ambient water quality criteria

RAO = remedial action objective

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

YWQP = Y-12 Water Quality Program

FY = fiscal year

**APPENDIX D**  
**SITE CONTROLS**

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**Table D.1. BCV watershed site controls for former RCRA post-closure permitted facilities**

Watershed: Site	Site control	Frequency
<i>The following controls are applicable to all the sites listed within the BCV watershed at the stated frequency. Any exceptions to these controls are listed in the following section.</i>		
<b>BCV:</b> Oil Landfarm, Burial Grounds Unit/WIPs, S-3 Ponds Site	Access controls, cap/cover/surface drainage, signage, 25 yr/24 hr rain event inspections, and benchmarks	Semiannually
	Monitoring wells – comprehensive evaluation of well integrity (e.g., condition of cap and casing(s), presence of weep hole, well lock, well identification, concrete pad, guard posts, etc.), including below-grade components (as appropriate)	Annually
<i>In addition to the above site controls, the following additional control or exception to the above requirements apply at the designated site:</i>		
<b>BCV:</b> S-3 Ponds Site	S-3 Ponds asphalt cap inspection	Quarterly

**Note:** Maintenance activities are implemented and documented under CERCLA to maintain the integrity of the facility.

BCV = Bear Creek Valley  
 CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980  
 RCRA = Resource Conservation and Recovery Act of 1976  
 WIPs = Walk-In Pits

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**APPENDIX E  
CHANGE REQUEST PROCESS  
FOR THE  
BEAR CREEK VALLEY WATERSHED  
COMPREHENSIVE MONITORING PLAN**

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**INSTRUCTIONS FOR INITIATING A CHANGE  
TO THE WATER RESTORATION RESOURCES PROGRAM  
WATERSHED-SPECIFIC COMPREHENSIVE MONITORING PLAN**

To implement monitoring changes in response to on-going, real-time data evaluations on and off the Oak Ridge Reservation, the following watershed Comprehensive Monitoring Plan (CMP) erratum process provides an avenue to document changes to the monitoring requirements for a watershed. This erratum process is used only after receiving written approval from appropriate representatives of the U.S. Environmental Protection Agency and the Tennessee Department of Environment and Conservation regarding the U.S. Department of Energy's Federal Facility Agreement (FFA) request to modify the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 decision or post-decision document monitoring requirements.

**1.0 INITIATE A CMP ERRATUM**

The Water Resources Restoration Program (WRRP) Manager notifies the watershed CMP Administrator (WRRP personnel) that the appropriate parties to the FFA have approved an FFA request to change the required monitoring in the watershed. The WRRP Manager provides the necessary documentation to the CMP Administrator, who prepares the CMP Erratum Form (Attachment 1), assigns an erratum number, and attaches a redline markup of the impacted CMP tables and/or text showing the revision, as well as the appropriate change pages for insertion into the CMP. The package is submitted to the WRRP technical lead for the watershed for review and verification, and then to the WRRP Manager for final approval for implementation. The CMP Administrator distributes the approved erratum to copyholders of the watershed CMP, as well as to the sampling personnel for implementation.

**2.0 CMP ADDENDA LOG**

The CMP Administrator enters the CMP erratum into the CMP Addenda Log (Attachment 2) to track its status from issuance as a single erratum until the watershed CMP is eventually re-issued, incorporating all applicable addenda issued to date.

Note that the CMP Erratum number incorporates (1) the fiscal year in which the erratum is issued, (2) the applicable watershed, and (3) a sequential number. For example, the third erratum issued in fiscal year 2018 for the Bear Creek Valley watershed would have the erratum number FY18-BCV-03.

**Attachment 1**  
**WATERSHED COMPREHENSIVE MONITORING PLAN (CMP)**  
**ERRATUM FORM**

**CMP ERRATUM NUMBER:** \_\_\_\_\_ **EFFECTIVE DATE:** \_\_\_\_\_

Watershed affected by change:	<input type="checkbox"/> Melton Valley	<input type="checkbox"/> Bethel Valley
	<input type="checkbox"/> UEFPC	<input type="checkbox"/> Bear Creek Valley
	<input type="checkbox"/> ETTP	<input type="checkbox"/> Offsite
	<input type="checkbox"/> N/A	<input type="checkbox"/> Chestnut Ridge

**DOCUMENT NO. OF WATERSHED CMP AFFECTED BY CHANGE:** \_\_\_\_\_

Sampling Rationale:	<input type="checkbox"/> CERCLA performance	<input type="checkbox"/> Five-Year Review
	<input type="checkbox"/> CERCLA baseline	<input type="checkbox"/> Other _____
	<input type="checkbox"/> N/A	_____

**Description of Change:**

*[Provide a description of the requested change to the sampling and analysis plan. Include details of the change, such as monitoring location(s), parameters, monitoring frequency, relevant quality control, data quality objectives, and data management issues, as appropriate. State whether the change is permanent or temporary. Attach a redline mark-up of existing page(s) of CMP showing changes. Attach revised pages to insert into CMP.]*

**Reason for Change(s):**

*[Provide a brief technical justification to change monitoring in the watershed.]*

**Reviewer:** \_\_\_\_\_  
(WRRP Watershed Technical Lead or authorized designee)

**Date:** \_\_\_\_\_

**Approved by:** \_\_\_\_\_  
(WRRP Manager or authorized designee)

**Date:** \_\_\_\_\_



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