Signs such as this were common in the city of Oak Ridge during the Manhattan Project era and for years afterward.

1

Introduction to the Oak Ridge Reservation

The Oak Ridge Reservation (ORR), located in East Tennessee, was part of the Manhattan Project during World War II. Construction of the reservation began in 1942 and continued during the war and beyond. Today, ORR covers a little over 50 square miles of land in Anderson and Roane counties and is home to two major US Department of Energy (DOE) operating facilities: the Oak Ridge National Laboratory (ORNL) and the Y-12 National Security Complex (Y-12).

Other ORR facilities include the following:

- East Tennessee Technology Park (ETTP), the site of the former K-25 gaseous diffusion plant that has undergone significant environmental cleanup and transitioned to a private sector business and industrial park
- The Oak Ridge Institute for Science and Education (ORISE) South Campus, which includes training, laboratory, and support facilities
- The government-owned, government-operated Agent Operations Eastern Command (AOEC) of the National Nuclear Security Administration (NNSA) Office of Secure Transportation (OST)
- The Transuranic Waste Processing Center (TWPC)
- Small government-owned, contractor-operated environmental cleanup facilities

Due to different permit reporting requirements and instrument capabilities, this report uses various units of measurement. The lists of units of measure and conversion factors on pages xxxiii and xxxiv are included to help readers convert numeric values as needed for specific calculations and comparisons.

1.1. Background

The ORR Annual Site Environmental Report (ASER) is a consolidated report that fulfills the annual reporting requirements of the NNSA and DOE's Office of Environmental Management (EM) under DOE Order 231.1B Chg.1, Environment, Safety, and Health Reporting (DOE 2011).

ORR's ASER summarizes environmental data that characterizes environmental performance, lists environmental occurrences reported during the year, confirms compliance with environmental standards and requirements, and highlights significant environmental program activities. This ASER also demonstrates the site's compliance with the radiological protection requirements of DOE O 458.1 (DOE 2020).

Summary results in this report are based on data collected before and continuing through 2024. Not all results of the environmental monitoring associated with ORR are reported here, so this is not intended to be a comprehensive monitoring report. Data collected for other site and regulatory purposes, such as environmental restoration and remedial investigation reports, waste management characterization sampling data, and environmental permit compliance data, are presented in other documents that have been prepared in accordance with applicable laws, regulations, policies, and guidance. These data are referenced in this report as appropriate.

Environmental monitoring of ORR activities consists primarily of effluent monitoring and environmental surveillance. Effluent monitoring involves the collection and analysis of samples or measurements of liquid and gaseous effluents at the points of their release to the environment. These measurements allow quantification and official reporting of contaminant levels, assessment of public exposures to radiation (see Appendix E) and chemicals (see Appendix F), and demonstration of compliance with applicable standards and permit requirements. Environmental surveillance consists of direct measurement, collection, and analysis of samples taken from the site and its environs, exclusive of effluents. These surveillance activities provide information on contaminant concentrations in air, water, groundwater, soil, foods, biota, and other media. Environmental surveillance data support environmental compliance and, when combined with data from effluent monitoring, also support chemical and radiation dose and exposure assessments of any potential effects of ORR operations on the local environment.

1.2. History of the Area around the Oak Ridge Reservation

Native Americans first inhabited the ORR area during the Woodland Period (c. 900 BC to AD 1000). Their descendants still lived in the East Tennessee region when European settlers arrived in the late 1700s. The Cherokee Nation controlled the region at this time, but the 1791 Treaty of the Holston and the 1798 Treaty of Tellico allowed for European settlement, which forever altered the landscape. As settlements continued to grow in numbers, new counties were formed, including Roane County and Anderson County in 1801. Early European settlers of the area lived on farms or in four small communities named Elza, Robertsville, Wheat, and Scarborough. These villages served primarily as gathering centers and usually had one or two churches and a general store. About one thousand families inhabited the area in the early 1940s (Souza 2001, Hogan 2021).

In 1939, President Franklin D. Roosevelt received the famous Einstein-Szilard letter informing him that German scientists were working on a nuclear weapon. In utmost secrecy, he formed the Advisory Committee on Uranium, a team of scientists and military officials tasked with researching uranium's potential role as a weapon. This committee later evolved into the Office of Scientific Research and Development. After the United States was thrust into World War II following the Japanese attack on Pearl Harbor, the Manhattan Project emerged in 1942 as a full-scale program to build an atomic bomb. Named after the location of its original headquarters at 270 Broadway in New York City's Manhattan district, the super-secret code name of the project gave no indication of the classified activities it carried out. In the summer of 1943, the project moved to East Tennessee where construction of America's first

full-scale gaseous diffusion plant was underway to fulfill the mission of isolating ^{235}U for the first atomic bomb.

The selection of the area now known as ORR for the nuclear development site was largely due to the vision of General Leslie Groves. The original 56,200-acre area was primarily located in Anderson and Roane Counties. The presence of abundant water from the Clinch River, a good source of labor in nearby Knoxville, accessible railroads, and an ample supply of electricity from the Tennessee Valley Authority were viewed as key assets. Moreover, the parallel northeast-to-southwest valleys separated by 200- to 300-foot ridges were seen as useful to segregate the production areas and to provide protection in case of a catastrophe within any one of these areas.

The site's wartime name was Clinton Engineer Works, and the area now known as Oak Ridge was the workers' city on the reservation's northern edge. Although Oak Ridge did not appear on any map until 1949, the city quickly grew to a population of 75,000 to become the fifth largest city in Tennessee. To the south of the residential area at the Y-12 Complex, an electromagnetic method separated ^{235}U from natural uranium. The K-25 gaseous diffusion plant (now ETTP) was built on the reservation's western edge. Near the reservation's southwest corner, about 16 km (10 mi) from the Y-12 Complex, a third facility—known as X-10 or Clinton Laboratories—housed the experimental graphite reactor. X-10 (present-day ORNL) served as a pilot scale facility for the larger plutonium production facilities built at Hanford, Washington (Olwell 1999, Broad 2007, Reed 2014, Johnson 2018).

The missions of the three ORR installations have continued to evolve, and operations have adapted to meet America's changing defense, energy, and research needs. Section 1.4 describes the current missions of these and several smaller ORR facilities and activities.

1.3. Location and Description

Situated in the Great Valley of East Tennessee between the Cumberland and Great Smoky Mountains, ORR borders the Clinch River (see Figures 1.1 and 1.2). The Cumberland Mountains are 16 km (10 mi) to the northwest and the Great Smoky Mountains are 51 km (31.6 mi) to the southeast. Except for the city of Oak Ridge, the land within 8 km (5 mi) of ORR is semirural and is used primarily for residences, small farms, and cattle pasture. Fishing, hunting, boating, water skiing, and swimming are popular recreational activities. ORR currently encompasses approximately 33,069 acres of mostly contiguous, federally owned land in Anderson and Roane Counties and is under the management of DOE (DOE 2025).

1.3.1. Population

As reported in *US Department of Energy FY 2020 Economic Impact in Tennessee* (East Tennessee Economic Council), ORR supports approximately 43,000 members of the region's labor force. The Vintage US Census Population Estimate for the Knoxville Metropolitan Statistical Area, including Oak Ridge, was 957,608[1] (Census Bureau 2025a). The combined US Census Vintage 2024 Population Estimate for the 10 surrounding counties (Anderson, Blount, Campbell, Cumberland, Knox, Loudon, McMinn, Monroe, Morgan, and Roane) was 1,082,997 (Census Bureau 2025b). Knoxville, the nearest major city, is about 40 km (25 mi) to the east and had a population of 198,722 according to the US Census Vintage 2024 Population Estimate (Census Bureau 2025c). Other municipalities within about 30 km (18.6 mi) of the reservation include Oliver Springs, Clinton, Rocky Top, Lenoir City, Farragut, Kingston, and Harriman.

[1] Vintage 2024 is the base population of the 2020 census plus estimates from the time series starting April 1, 2020, through July 1, 2024.

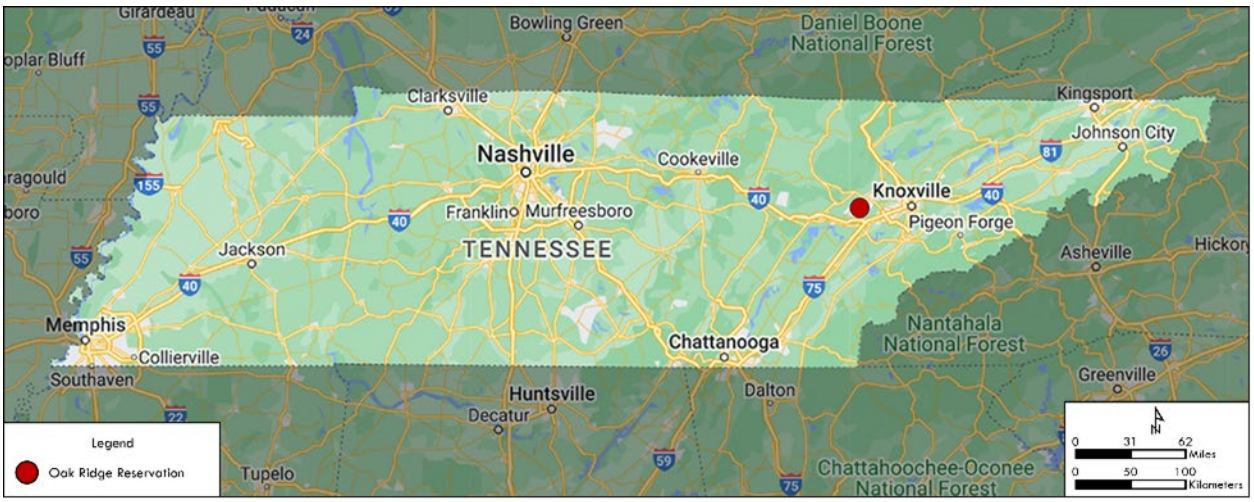

Figure 1.1. Location of the Oak Ridge Reservation in Tennessee

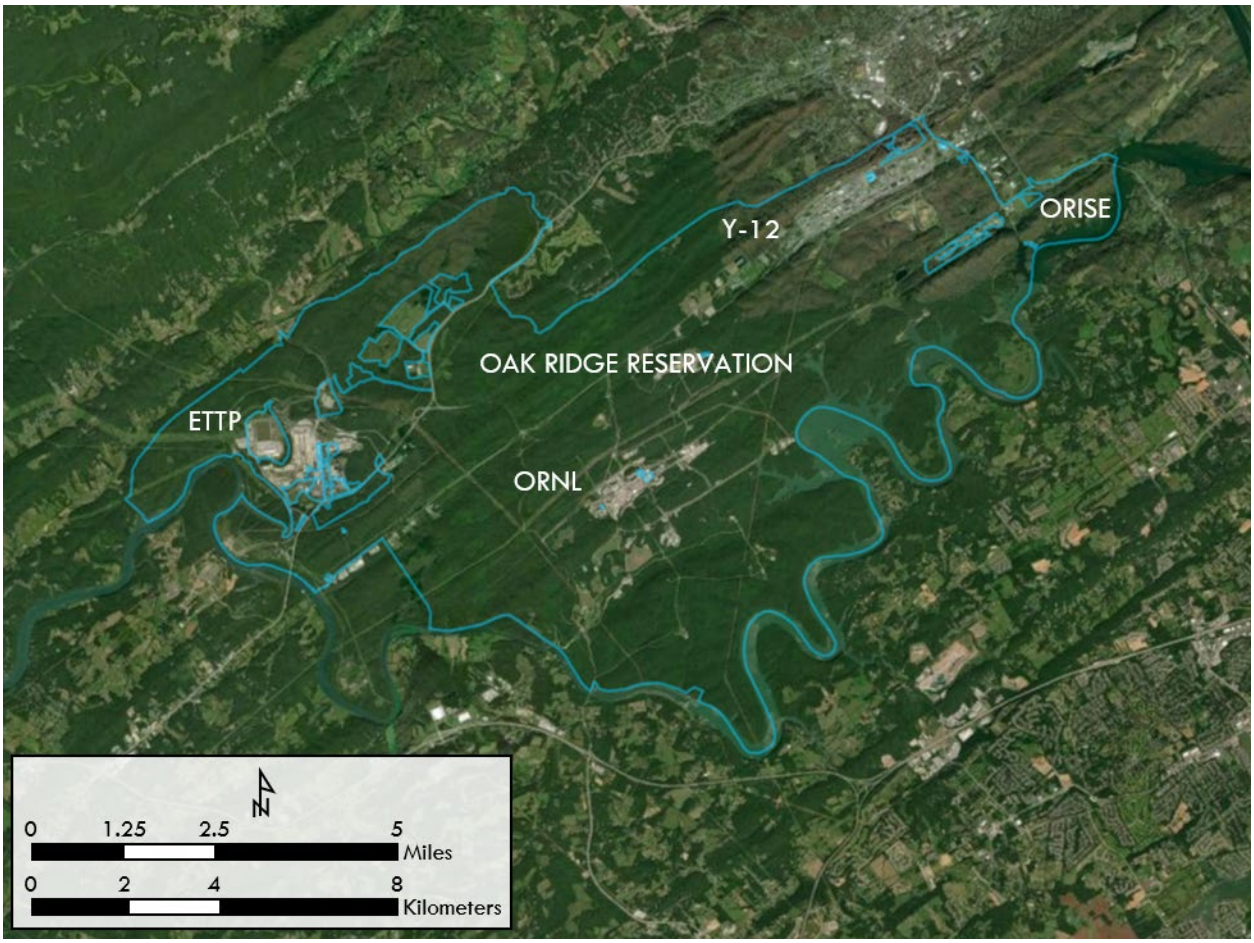

Figure 1.2. Map of the Oak Ridge Reservation

1.3.2. Climate

Although it features significant temperature changes between summer and winter, the climate of the Oak Ridge region qualifies as humid subtropical. The 30-year average temperature for 1991–2020 was 14.9°C (58.8°F). The average temperature for the Oak Ridge area in 2024 was 15.2°C (59.4°F), which is 0.6°C (1.1°F) warmer than normal compared with the 1991–2020 Oak Ridge base period. January temperatures were coldest in 2024, averaging 1.0°C (33.8°F). July was the warmest month, with an average temperature of 25.1°C (77.2°F). Monthly summaries of temperature averages, extremes, and 2024 values are provided in Appendix B, Table B.1.

The average annual precipitation in the Oak Ridge area for the 30-year period from 1991 to 2020 was 1,417.8 mm (55.82 in.), including about 14.5 cm (5.7 in.) of snowfall. Total precipitation during 2024 as measured at meteorological tower (MT)2 was 1227.9 mm (48.3 in.), which is 13 percent below the 30-year average of 1417.8 mm. Monthly summaries of precipitation averages, extremes, and 2024 values can also be found in Appendix B, Table B.1.

The average annual wind data recovery rates (a measure of acceptable data) across locations used for modeling during 2024 were greater than 96 percent for wind sensors at the ORNL towers MT3, MT4, and MT12. Annual wind data recovery during 2024 exceeded 95 percent for ETTP tower MT13. Y-12 tower MT6 recorded an annual recovery rate of 99.6 percent.

In 2024, wind speeds at ORNL Tower D (MT2) measured at 15 m (49 ft) above ground level averaged 1.26 meters per second (2.8 mph). This value was 2.25 meters per second (5.0 mph) for winds at 60 m (198 ft) above ground level. The local ridge-and-valley terrain reduces average wind speeds at valley bottoms, resulting in frequent periods of calm or near-calm conditions, particularly during clear early morning hours in weak synoptic weather environments.

Detailed information on the climate of the Oak Ridge area is available in *Oak Ridge Reservation Physical Characteristics and Natural Resources* (Parr and Hughes 2006) and in Appendix B of this report. An in-depth analysis of wind patterns for ORR conducted from 2009 to 2011 and documented in "Wind Regimes in Complex Terrain in the Great Valley of Eastern Tennessee" (Birdwell 2011) is available online **here**.

1.3.3. Regional Air Quality

The US Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards set national ambient air quality standards (NAAQS) for key pollutants, also known as criteria pollutants. These key pollutants are sulfur dioxide, carbon monoxide, nitrogen dioxide, lead, ozone, particulate matter with an aerodynamic diameter less than or equal to 10 μm (PM_{10}), and fine particulate matter with an aerodynamic diameter less than or equal to 2.5 μm ($PM_{2.5}$). EPA evaluates NAAQS based on ambient, or outdoor, levels of the criteria pollutants. Areas that satisfy NAAQS are classified as attainment areas, while areas that exceed NAAQS for a particular pollutant are considered non-attainment areas for that pollutant.

As of August 30, 2017, EPA designated Anderson, Knox, Blount, and Roane Counties as attainment areas for the $PM_{2.5}$ air quality standard. (ORR is located in Anderson and Roane Counties.) The greater Knoxville and Oak Ridge area is a NAAQS attainment area for all other criteria pollutants for which EPA has made attainment designations (EPA 2025).

1.3.4. Surface Water

The ORR area comprises a series of drainage basins or troughs containing numerous small streams that feed the Clinch River. Surface water drains into a series of tributaries, streams, or creeks in different watersheds. Each of these watersheds drains into the Clinch River, which in turn flows into the Tennessee River. The Tennessee Valley Authority reported 54 inches of precipitation in 2024 for the Tennessee River Valley region, exceeding the average annual rainfall of 51 inches for this region. However, the fall season was very dry, with only 71 percent of

normal rainfall received from October 1 to December 31 (C. Montgomery, Tennessee Valley Authority River System Status Report Archives for 2024, personal communication, June 9, 2025).

ORR's largest drainage basin is Poplar Creek. This creek receives drainage from a 352 km^2 (136 mi^2) area, including the northwestern sector of the reservation. Flow is from northeast to southwest, roughly through the center of ETTP, and the creek discharges directly into the Clinch River.

East Fork Poplar Creek, which discharges into Poplar Creek east of ETTP, originates within the Y-12 Complex and flows northeast along the south side of the complex. Bear Creek also originates within the Y-12 Complex and flows southwest. Bear Creek is affected by stormwater runoff, groundwater infiltration, and tributaries that drain former waste disposal sites in the Bear Creek Valley Burial Grounds Waste Management Area and the current Environmental Management Waste Management Facility (EMWMF).

Both the Bethel Valley and Melton Valley portions of ORNL are in the White Oak Creek (WOC) drainage basin, which covers 16.5 km^2 (6.4 mi^2). The headwaters of WOC originate on Chestnut Ridge, north of ORNL and near the Spallation Neutron Source site. The creek flows west along the southern boundary of the developed area of the ORNL site, then flows southwest through a gap in Haw Ridge to the western portion of Melton Valley, forming a confluence with Melton Branch. The headwaters of Melton Branch originate in Melton Valley east of the High Flux Isotope Reactor complex, and the area of the drainage basin is about 3.8 km^2 (1.47 mi^2). The waters of WOC enter White Oak Lake, an impoundment formed by White Oak Dam. Water flowing over White Oak Dam enters the Clinch River after passing through the WOC embayment area.

1.3.5. Geological Setting

ORR is in the Tennessee portion of the Valley and Ridge Physiographic Province, which is part of the southern Appalachian fold-and-thrust belt. Thrust faulting, associated fracturing of the rock, and differential erosion rates created a series of parallel valleys and ridges that trend southwest to northeast.

Two geologic units on ORR, the Knox Group and the Maynardville Limestone of the Upper Conasauga Group, consist of dolostone and limestone, respectively, and make up the most significant water-bearing geological structures in the Valley and Ridge Province (Zurawski 1978) and on ORR. These bedrock formations are composed of moderately soluble minerals and are prone to dissolution as slightly acidic rainwater and percolating recharge water come in contact with the mineral surfaces. This dissolution increases fracture apertures and can, under some circumstances, form caverns and extensive conduit networks. This geological structure is locally known as the Knox Aquifer. A combination of fractures and solution conduits in the aquifer control flows over substantial areas, and large quantities of water may move long distances. Active groundwater flow can occur at substantial depths (91.5 to 122 m, or 300 to 400 ft) in the Knox Aquifer. The Knox Aquifer is the primary source of groundwater (base flow) for many streams, and most large springs on ORR receive discharge from the Knox Aquifer. Yields of some wells that penetrate larger solution conduits exceed 3,785.4 liters per minute (1,000 gallons per minute). The high productivity of the Knox Aquifer results from the combination of its abundant and sometimes large conduit systems and frequently thick overburden soils that promote recharge and storage of groundwater.

The remaining geologic units on ORR (the Rome Formation, the Conasauga Group below the Maynardville Limestone, and the Chickamauga Group) are composed predominantly of shale, siltstones, and sandstones with a subordinate and locally variable amount of carbonate bedrock. These formations are primarily composed of insoluble minerals such as clays and quartz that were derived from ancient continental erosion. Groundwater occurs in and moves through fractures in these bedrock units. Groundwater availability in such settings depends on the abundance and interconnectedness of fractures and the connection of fractures to sources of

recharge, such as alluvial soils along streams, which can provide some sustained infiltration. The shale and sandstone formations are the poorest aquifers in the Valley and Ridge Province (Zurawski 1978). Well yields are generally low in the Rome, Conasauga, and Chickamauga bedrock formations except in localized areas where carbonate beds may provide greater groundwater storage than adjacent clastic bedrock. Detailed information on ORR groundwater hydrology and flow is available in *Oak Ridge Reservation Physical Characteristics and Natural Resources* (Parr and Hughes 2006).

1.3.6. Natural, Cultural, and Historical Resources

ORR has an exceptional variety of natural, cultural, and historical resources. Ongoing efforts continue to focus on preserving the rich diversity of these resources.

1.3.6.1. Wetlands

Wetlands occur across ORR at low elevations, primarily in riparian zones of headwater streams and receiving streams and in the Clinch River embayments as shown in Figure 1.3. Surveys of wetland resources presented in *Identification and Characterization of Wetlands in the Bear Creek Watershed* (Rosensteel and Trettin 1993), *Wetland Survey of the X-10 Bethel Valley and Melton Valley Groundwater Operable Units at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (Rosensteel 1996), and *Wetland Survey of Selected Areas in the Oak Ridge Y-12 Plant Area of Responsibility, Oak Ridge, Tennessee* (Rosensteel 1997) serve as references to support wetland assessments for upcoming projects and activities.

About 235 hectares (580 acres) of potential wetlands (jurisdictional and non-jurisdictional wetland areas) have been identified on ORR; most are classified as forested palustrine, scrub/shrub, and emergent wetlands (Parr and Hughes 2006). Wetlands identified to date range from several square meters at small seeps and springs to about 10 hectares (25 acres) at White Oak Lake. The Tennessee Department of Environment and Conservation's (TDEC's) wetland mitigation aquatic resource alteration permits, required by Section 401 of the Clean Water Act (CWA 1972), entail monitoring restored or created wetland mitigation sites for 5 years. Activities and conditions in and around the wetlands are verified by site inspections when appropriate.

1.3.6.2. Wildlife and Endangered Species

Animals listed as species of concern by state, federal, or international organizations and known to have appeared on the reservation (excluding the Clinch River bordering the reservation) are listed, along with their status, in Table 1.1. Some of these, such as hellbender, have been seen only once or a few times; others, including wood thrush, are comparatively common and widespread on ORR. As of December 2024, Tennessee had 78 species listed under the federal Endangered Species Act (ESA 1973), including 31 endangered and 47 threatened species. The complete Tennessee Threatened and Endangered List–New Rules is available **here** (TWRA 2024).

Birds, fish, reptiles and amphibians, and aquatic invertebrates are the most thoroughly surveyed animal groups on ORR. Nevertheless, the only federally listed animal species observed on the reservation in recent years are mammals, specifically bat species. For more than 30 years, endangered gray bats have been detected in acoustic surveys and mist net captures. Since 2013, endangered Indiana bats and northern long-eared bats have been detected in acoustic surveys and mist net captures (McCracken et al. 2015). Surveys conducted in 2022 indicate that gray bats and other bat species use several caves on ORR. Suitable roosting and foraging habitat for the three federally listed bat species is abundant across the reservation. Acoustic monitoring continued in 2024 for a select few sites, mostly on development projects. Additionally, ORNL biologists are currently working with US Fish and Wildlife Service (FWS) to develop a Programmatic Biological Assessment that addresses operational activities on the entire ORR. The goal is to streamline the steps to comply with the Endangered Species Act through measures to avoid or minimize harm to the bats during execution of

site cleanups and other DOE mission-critical activities. Bat species of concern found on ORR include the tricolored bat (state-listed as threatened and proposed for federal listing), little brown bat (state-listed as threatened and under consideration for federal listing), Rafinesque's big-eared bat (state-listed as in need of management), and eastern small-footed bat (state-listed as in need of management) (TDEC 2025, TWRA 2024).

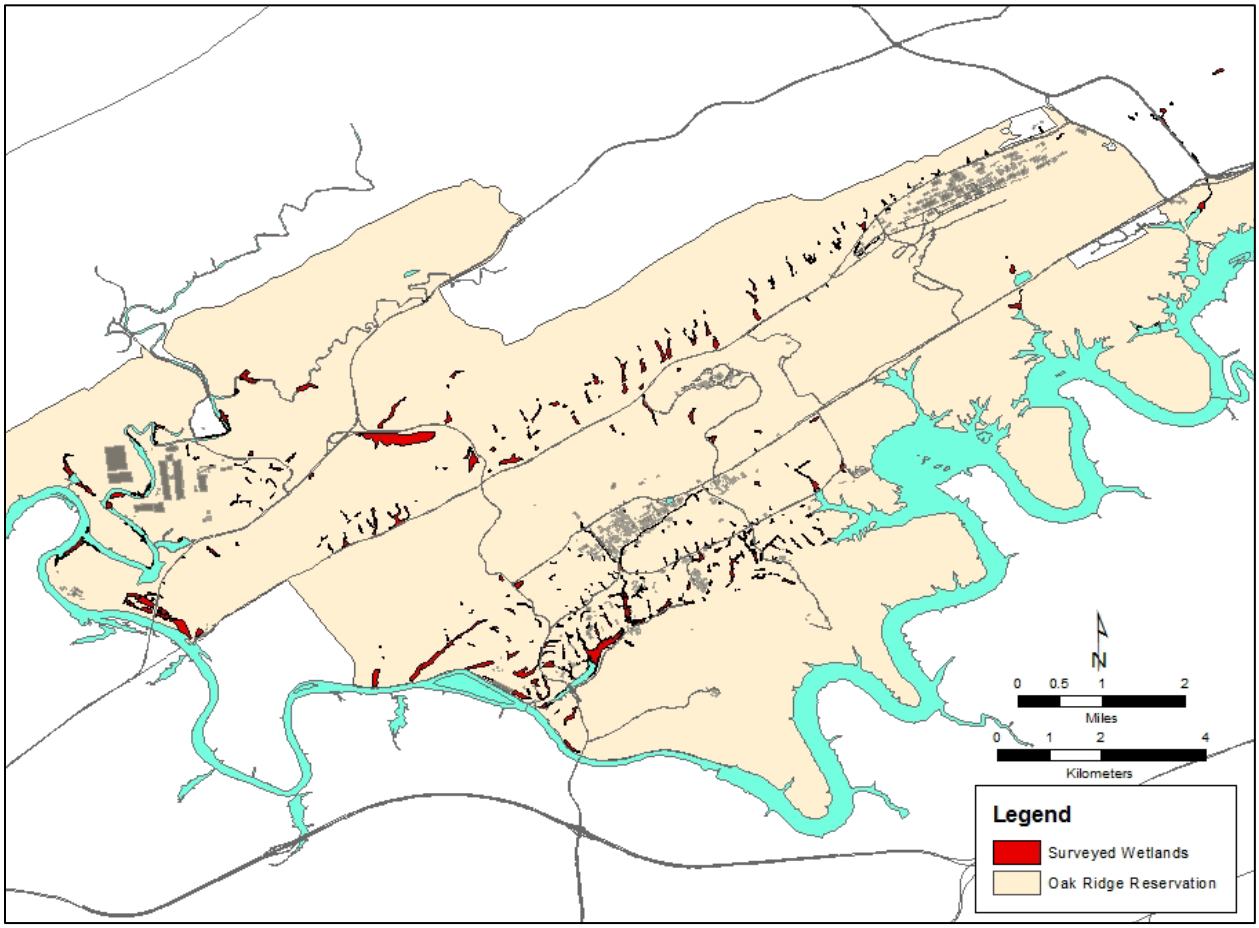

Figure 1.3. Location of ORR wetlands

Table 1.1. Animal species of special concern reported on ORR[a]

Scientific name	Common name	Status[b]			
		Federal	TN	NatureServe[c]	PIF[d]
FISH					
Phoxinus tennesseensis	Tennessee dace		NM	S3	
AMPHIBIANS AND REPTILES					
Cryptobranchus alleganiensis	Hellbender		E	S3	
Hemidactylium scutatum	Four-toed salamander		NM	S3	
Ophisaurus attenuatus longicaudus	Eastern slender glass lizard		NM	S3	
Pituophis melanoleucus	Northern pine snake		T	S3	

Table 1.1. Animal species of special concern reported on ORR[a] (continued)

Scientific name	Common name	Status[b]			
		Federal	TN	NatureServe[c]	PIF[d]
BIRDS					
Swans, Geese, and Ducks					
Branta canadensis	Canada goose	BMC, OA		S5	
Aix sponsa	Wood duck	BMC		S5	
Mareca strepera	Gadwall	BMC		S4	
Mareca americana	American wigeon	BMC		S4	
Anas rubripes	American black duck	BMC		S3	MA
Anas platyrhynchos	Mallard	BMC		S5	
Spatula discors	Blue-winged teal	BMC		S2	
Anas crecca	Green-winged teal	BMC		S4	
Spatula clypeata	Northern shoveler	BMC		S4	
Anas acuta	Northern pintail	BMC		S4	
Aythya valisineria	Canvasback	BMC		S3	
Aythya americana	Redhead	BMC		S4	
Aythya collaris	Ring-necked duck	BMC		S5	
Aythya affinis	Lesser scaup	BMC		S4	
Grebes					
Podilymbus podiceps	Pied-billed grebe	BMC		S4	
Podiceps auritus	Horned grebe	BMC		S4	MA
Frigatebirds, Boobies, Cormorants					
Nannopterum auritum	Double-crested cormorant	BMC, OA		S2	
Bitterns and Herons					
Ixobrychus exilis	Least bittern	BMC	NM	S2	
Egretta caerulea	Little blue heron	BMC	NM	S2	
Nycticorax nycticorax	Black-crowned night heron	BMC		S2	
Butorides virescens	Green heron			S4	MA
Mycteria americana	Wood stork	T		S3	
Kites, Hawks, Eagles, and Allies					
Haliaeetus leucocephalus	Bald eagle	BMC[e]		S3	
Rails, Gallinules, and Coots					
Rallus limicola	Virginia rail	BMC		S1	
Porzana carolina	Sora	BMC		S1	
Fulica americana	American coot	BMC		S2	
Tringa solitaria	Solitary sandpiper	BMC, BCC		S5	
Tringa flavipes	Lesser yellowlegs	BMC, BCC		S5	
Scolopax minor	American woodcock	BMC		S4	MA
Grouse, Turkey, and Quail					
Colinus virginianus	Northern bobwhite	BMC, BCC, E		S2	

Table 1.1. Animal species of special concern reported on ORR[a] (continued)

Scientific name	Common name	Status[b]			
		Federal	TN	NatureServe[c]	PIF[d]
Pigeons and Doves					
Zenaida macroura	Mourning dove	BMC		S5	
Cuckoos and Roadrunners					
Coccyzus americaus	Yellow-billed cuckoo	BMC, BCC, T		S4	PR
Goatsuckers					
Antrostomus carolinensis	Chuck-will's widow	BMC, BCC		S3	IM
Antrostomus vociferus	Eastern whip-poor-will	BMC, BCC		S3	MA
Chordeiles minor	Common nighthawk	BCC		S4	PR
Swifts					
Chaetura pelagica	Chimney swift	BCC		S5	IM
Kingfishers					
Megaceryle alcyon	Belted kingfisher	BCC		S5	MA
Woodpeckers					
Melanerpes erythrocephalus	Red-headed woodpecker	BMC, BCC		S4	PR
Colaptes auratus	Northern flicker	BMC		S5	PR
Tyrant Flycatchers					
Contopus virens	Eastern wood-pewee			S5	MA
Empidonax virescens	Acadian flycatcher			S5	MA
Contopus cooperi	Olive-sided flycatcher	BMC, BCC		S1	
Empidonax traillii	Willow flycatcher	BMC, BCC, E		S2	
Swallows					
Progne subis	Purple martin			S5	
Hirundo rustica	Barn swallow			S5	
Kinglets, Gnatcatchers, and Thrushes					
Hylocichla mustelina	Wood thrush	BMC, BCC		S4	PR
Shrikes					
Lanius ludovicianus	Loggerhead shrike	BMC, BCC, E	NM	S1	
Wood Warblers					
Vermivora chrysoptera	Golden-winged warbler	BMC, BCC	T	S3	IM
Setophaga cerulea	Cerulean warbler	BMC, BCC	NM	S3	MA
Setophaga discolor	Prairie warbler	BMC, BCC		S3	MA
Mniotilta varia	Black-and-white warbler			S4	MA
Protonotaria citrea	Prothonotary warbler	BMC, BCC		S4	
Geothlypis formosa	Kentucky warbler	BMC, BCC		S4	MA
Cardellina canadensis	Canada warbler	BMC, BCC		S3	MA
Icteria virens	Yellow-breasted chat	BCC		S4	MA
Tanagers					
Piranga rubra	Summer tanager	BMC		S4	PR

Table 1.1. Animal species of special concern reported on ORR[a] (continued)

Scientific name	Common name	Status[b]			
		Federal	TN	NatureServe[c]	PIF[d]
Towhees, Sparrows, and Allies					
Pipilo erythrophthalmus	Eastern towhee			S5	MA
Spizella pusilla	Field sparrow	BMC, BCC		S4	MA
Ammodramus savannarum	Grasshopper sparrow	BMC, BCC		S4	IM
Ammodramus henslowii	Henslow's sparrow	BMC, BCC		S1	IM
MAMMALS					
Myotis grisescens	Gray bat	E	E	S2	
Myotis lucifugus	Little brown bat[f]		T	S3	
Myotis sodalis	Indiana bat[g]	E	E	S1	
Myotis septentrionalis	Northern long-eared bat	E	E	S1	
Myotis leibii	Eastern small-footed bat		NM	S2	
Perimyotis subflavus	Tri-colored bat[f]	PE	T	S2	
Corynorhinus rafinesquii	Rafinesque's big-eared bat		NM	S3	
Sorex dispar	Long-tailed shrew		NM	S2	

[a] *Land and surface waters of the Oak Ridge Reservation (ORR) exclusive of the Clinch River, which borders ORR.*

[b] *Status codes:*

E = endangered (TDEC 2025, FWS 2021, TWRA 2024)
PE = proposed endangered (TDEC 2025)
T = threatened (TDEC 2025, FWS 2021)
S1 = critically imperiled (NatureServe 2025, TDEC 2025)
S2 = imperiled (NatureServe 2025, TDEC 2025)
S3 = vulnerable (NatureServe 2025, TDEC 2025)
S4 = apparently secure (NatureServe 2025, TDEC 2025)
S5 = secure (NatureServe 2025, TDEC 2025)
BMC = Birds of management concern (FWS 2011)
BCC = Birds of conservation concern (FWS 2021)
NM = in need of management (TDEC 2025, TWRA 2024)
OA = overly abundant (FWS 2011)
CR = critical recovery for Bird Conservation Region (BCR) 28 (Appalachian Mountains Bird Conservation Region) (PIF 2025)
IM = immediate management for BCR28 (PIF 2025)
MA = management attention for BCR28 (PIF 2025)
PR = planning and responsibility for BCR28 (PIF 2025)

[c] *NatureServe works with over 60 network organizations and over 1,000 conservation scientists to collect, aggregate, and standardize biodiversity statistics.*

[d] *Partners in Flight (PIF) is an international organization devoted to conserving bird populations in the Western Hemisphere.*

[e] *The bald eagle was federally delisted effective August 9, 2007.*

[f] *Under review for federal listing.*

[g] *A single specimen was captured in a mist net bordering the Clinch River in June 2013.*

Birds recorded on the reservation and its boundary waters include the 228 species documented by Roy et al. (2014) plus the cackling goose (*Branta hutchinsii*), purple gallinule (*Porphyrio martinicus*), American bittern (*Botaurus lentiginosus*), and federally threatened wood stork (*Mycteria Americana*) for a total of 236 species. Most of these species are protected under the Migratory Bird Treaty Act (MBTA 1918) and Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (EO 2001). DOE's updated memorandum of understanding on migratory birds with the FWS (DOE-FWS 2013) strengthens migratory bird conservation on ORR through enhanced collaboration between DOE and FWS.

The reservation contains a rich flora and fauna diversity, with observations of more than 1,100 plant species, 72 fish species, 34 mammal species and more than 200 bird species. Breeding bird surveys conducted along varying numbers of up to 10 routes on ORR provide data for the Partners in Flight Program, a collaborative initiative focused on the conservation of landbirds (see Figure 1.4). Six public nature walks organized by ORNL occurred in 2024, which began in the late winter and carried through mid-summer. The series focused on wildflowers and old-growth forests and also included topics including bird watching, frog calls, and reptile inventories. In past years, the reservation has been nominated for the Presidential Migratory Bird Federal Stewardship Award. A technical manuscript, *Oak Ridge Reservation Bird Records and Population Trends* (Roy et al. 2014), documents known bird records since 1950 and population trends for 32 species of birds.

Several state-listed bird species, such as the golden-winged warbler, cerulean warbler, and little blue heron, are uncommon migrants or visitors to the reservation. The cerulean warbler, listed by the state as in need of management, often appears during the breeding season on ORR. But because this bird's actual breeding status is still uncertain, it is currently listed as a potential breeding bird on the reservation (Roy et al. 2014).

Source: Sarah Darling, ORNL

Figure 1.4. American woodcock fledgling on ORR

The bald eagle (Figure 1.5), which was removed from the federal list of threatened and endangered species on August 9, 2007, is a year-round resident in Tennessee, though it can be difficult to find on the reservation from September through November. Two bald eagle nests were confirmed on the reservation in 2024. These nests were located at the Tower Shielding Facility and the Experimental Gas-Cooled Reactor, both at ORNL.

Other bird species of interest include the migratory wood thrush and barn swallow, which have been observed nesting on the reservation. The Lincoln's sparrow (*Melospiza lincolnii*) (no listed status) was sighted on the reservation in May 2014. Barn owls were documented nesting on the reservation in 2019.

Source: Kelly Roy, ORNL

Figure 1.5. Bald eagle photographed on ORR

Uncommon birds for ORR recorded in recent years include several species associated with wetland habitats. Due to efforts in the early 2000s to mitigate ETTP's K1007 P-1 pond into a high-quality wildlife habitat, purple martin (*Progne subis*) and willow flycatcher (*Epidonax tralillii*) make their home here every spring and summer. The limpkin (*Aramus guarauna*), which is not usually observed in Tennessee, was seen utilizing the ponds in June 2023. While collaborating on detection methodologies for secretive marsh birds, researchers from ORNL and Charles Sturt University in New South Wales, Australia, photographed a purple gallinule (*Porphyrio martinicus*) on a trail camera at the Heritage Center Greenway Powerhouse Trail in 2017 (Figure 1.6). This was the first documented appearance of a purple gallinule on the reservation.

ORNL is continuing to monitor state-listed four-toed salamanders (*Hemidactylium scutatum*) at ORR. Although ORR contains some of the highest densities of this species in eastern Tennessee, they are considered by the state as in need of management. Several of their largest subpopulations on the reservation occur in areas that are slated for development, including the Environmental Management Disposal Facility (EMDF) where individuals were translocated to establish a new subpopulation in other areas of similar habitat type. ORNL has also documented what appear to be state-listed black mountain salamanders (*Desmognathus welteri*, considered by the state as in need of management) on ORR, just south of the Horizon Center. Two state-listed reptiles have inhabited ORR: the northern pine snake (*Pituophis melanoleucus melanoleucus*, state-listed as threatened) and the eastern slender glass lizard (*Ophisaurus attenuatus longicaudus*, state-listed as in need of management). However, there is limited evidence to suggest the number of either species on the reservation.

Several fish species listed and noted for management concern are known to inhabit areas in and around ORR. One fish species, the spotfin chub (*Erimonax monachus*), which is listed as threatened by both the state and the federal

Figure 1.6. Purple gallinule caught on a trail surveillance camera at ETTP in 2017

government, has been sighted and collected in the city of Oak Ridge and may be present on the reservation. The tangerine darter (*Percina aurantiaca*), a species listed by the state as in need of management, has also been recorded near ORR. The lake sturgeon (*Acipenser fulvescens*), state-listed as endangered, is known to inhabit the adjacent Clinch River. The Tennessee dace, listed by the state as in need of management, appears in the Bear Creek watershed, tributaries to the lower East Fork watershed, and Ish Creek. The Tennessee dace also occurs in some sections of Grassy Creek upstream of Scientific Ecology Group, Inc. and International Technology Corporation at Clinch River kilometer 23, south of west Bear Creek Road near Grassy Creek sampling point 1.9.

1.3.6.3. Threatened and Endangered Plants

Four plant species known to be on ORR (spreading false foxglove, Appalachian bugbane, tall larkspur, and butternut) have been under review for federal listing and were previously listed under the Category 2 candidate designation (Nature Conservancy 1995). FWS now informally refers to these as special concern species.

The state of Tennessee lists 16 plant species occurring on ORR as endangered, threatened, or of special concern; these are included in Table 1.2. Although currently unconfirmed, an additional 10

threatened, endangered, or special concern species occur in the area and may be present. These species are also included in Table 1.2. Other plant populations currently under study may be added to the table in future years (TDEC 2021, TDEC 2025).

Table 1.2. Vascular plant species of special concern sighted or reported on or near ORR

Species	Common name	Habitat on ORR	Status/rank code[a,b]
Currently known to be or previously reported on ORR			
Aureolaria patula	Spreading false foxglove	River bluff	S, S3
Berberis canadensis	American barberry	Rocky bluff	S, S2
Bolboschoenus fluviatilis	River bulrush	Wetland	S, S1
Delphinium exaltatum	Tall larkspur	Barrens and woodlands	E, S2
Diervilla lonicera	Northern bush-honeysuckle	Rocky river bluff	T, S2
Draba ramosissima	Branching whitlow-grass	Limestone cliff	S, S2
Elodea nuttallii	Nuttall waterweed	Pond, embayment	S, S2
Eupatorium godfreyanum	Godfrey's thoroughwort	Dry woods edge	S, S1
Fothergilla major	Mountain witch-alder	Woods	T, S2
Helianthus occidentalis	Naked-stem sunflower	Barrens	S, S2
Juglans cinerea	Butternut	Lake shore	T, S3
Juncus brachycephalus	Small-head rush	Open wetland	S, S2
Liparis loeselii	Fen orchid	Forested wetland	T, S1
Panax quinquefolius	American ginseng	Rich woods	S, S3
Platanthera flava var. herbiola	Tubercled rein-orchid	Forested wetland	T, S2
Spiranthes lucida	Shining ladies'-tresses	Boggy wetland	T, S1
Rare plants that occur near and could be present on ORR			
Agalinis auriculata	Earleaf false foxglove	Calcareous barren	E, S2
Allium burdickii[c]	Narrow-leaf ramps	Moist woods	T, CE, S1
Allium tricoccum[c]	Ramps	Moist woods	S, CE, S1
Lathyrus palustris	Marsh pea	Moist meadows	S, S1
Liatris cylindracea	Slender blazing star	Calcareous barren	T, S2
Lonicera dioica	Mountain honeysuckle	Rocky river bluff	S, S2
Meehania cordata	Heartleaf meehania	Moist calcareous woods	T, S2
Pedicularis lanceolata	Swamp lousewort	Calcareous wet meadow	S, S1
Pseudognaphalium helleri	Heller's catfoot	Dry woodland edge	S, S2
Pycnanthemum torreyi	Torrey's mountain-mint	Calcareous barren edge	E, S1

[a] *State status codes (TDEC 2021):*
CE = Status due to commercial exploitation
E = Endangered in Tennessee
S = Special concern in Tennessee
T = Threatened in Tennessee

[b] *State conservation status (NatureServe 2025):*
S1 = Critically imperiled
S2 = Imperiled
S3 = Vulnerable

Acronym: *ORR = Oak Ridge Reservation*

[c] *Ramps have been reported near ORR, but there is not sufficient information to determine which of the two species is present or whether the occurrence may have been the result of planting.*

1.3.6.4. Historical and Cultural Resources

Efforts continue to preserve ORR's rich prehistoric and historical cultural resources. Compliance with the National Historic Preservation Act of 1966 (NHPA 1966) is maintained in conjunction with the National Environmental Policy Act (NEPA 1969) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA 1980). The scope of proposed actions is reviewed in accordance with the Cultural Resource Management Plan, DOE Oak Ridge Reservation, Anderson and Roane Counties, Tennessee (DOE 2001). Several facilities on ORR are included on the National Register of Historic Places, part of a National Park Service program to identify, evaluate, and protect historical and archeological resources in the United States. The reservation contains more than 44 known prehistoric sites (primarily archeological evidence of former structures), 254 historic pre-World War II structures, 32 cemeteries, and several historically significant structures from the Manhattan Project era.

The National Defense Authorization Act of 2015 (NDAA 2014), passed by Congress and signed into law on December 19, 2014, included provisions authorizing the Manhattan Project National Historical Park. An agreement by the Secretaries of Energy and Interior established the Manhattan Project National Historical Park on November 10, 2015 (DOE-DOI 2015). The Park includes facilities and lands in Los Alamos, New Mexico; Hanford, Washington; and Oak Ridge, Tennessee. On ORR, the National Park includes the X-10 Graphite Reactor, Buildings 9731 and 9204-3 at the Y-12 Complex, and the K-25 Building Site at ETTP.

The X-10 Graphite Reactor building has been a National Historic Landmark since 1966. Although it was closed to the public in 2024 due to recent ongoing DOE efforts to prioritize cleanup activities and ensure the safety of historic sites, the reactor face and control room have been open for guided tours in the years since obtaining national historic landmark status. Enhancing safe and secure access and improving the visitor experience are important DOE objectives as it moves forward in implementing the National Park.

Buildings 9731 and 9204-3 are also not currently open to the public, but Building 9731 has been open for tours in recent years during the Secret City Festival. As part of their ongoing collaboration, the National Park Service and the DOE will endeavor to develop innovative and virtual approaches to connect park visitors with key resources, as they balance preservation of the historic buildings with the need to ensure safe and secure public access.

A memorandum of agreement (MOA) signed in 2012 among the DOE Oak Ridge Office, the State Historic Preservation Officer, the Advisory Council on Historic Preservation, the City of Oak Ridge, and the East Tennessee Preservation Alliance ensures consistent interpretation of site historic properties at ETTP (DOE 2012). The MOA is being implemented through the National Historic Preservation project that developed the K-25 History Center. The K-25 History Center serves to highlight the historic aspects of ETTP and of the communities that were displaced during the construction of the site.

Construction of the K-25 Interpretive Center, located just north of the K-25 History Center, began on May 11, 2023, and was completed on March 4, 2025. The facility was constructed by the U.S. Army Corps of Engineers using contractor Geiger Brothers Inc. to manage construction and United Cleanup Oak Ridge LLC (UCOR) to provide engineering support. The facility includes a viewing platform with 10-foot-tall wraparound glass windows and exhibits that provide facts and visuals related to the historic importance of the K-25 Building, as well as view scopes and a scale model of the original facility. DOE Oak Ridge Office of Environmental Management (OREM) plans to hold a grand opening for the public in September 2025 that corresponds with the 80th anniversary of the end of World War II.

The K-25 History Center and Interpretive Center complement the Manhattan Project National Historic Park established in 2015, which includes the footprint of the former K-25 Building (DOE-DOI 2015). The National Park Service is assisting in historic interpretation of the site although the K-25 Building site is already undergoing extensive

historic interpretation activities separate and independent from the National Park. As part of the activities to establish the park, DOE launched the K-25 Virtual Museum. The museum details the history of the K-25 Gaseous Diffusion Plant through narrative and photographs that can be viewed **here**.

In addition to the X-10 Graphite Reactor, six additional historic ORR properties are listed individually in the planning for a History Center:

- Freels Bend Cabin
- New Bethel Baptist Church and Cemetery
- Oak Ridge Turnpike Checking Station
- George Jones Memorial Baptist Church and Cemetery
- Bear Creek (Scarboro) Road Checking Station
- Bethel Valley Road Checking Station

Although it is not yet included on the National Register of Historic Places, an area known as the Wheat Community African Burial Grounds was dedicated in June 2000, and a memorial monument was erected at the site.

ORNL and Y-12 programmatic agreements and memorandums of agreement among DOE, the State of Tennessee, the Advisory Council on Historic Preservation, and consulting parties serve to provide a system of review for projects that may potentially affect historical and archaeological resources on ORR. The ORNL and Y-12 programmatic agreements are currently being updated to reflect new architectural building surveys and revisions to each site's Historic Preservation Plans. In 2024, a new MOA was developed to address mitigation activities for the planned demolition of DOE ORNL Office of Science (SC) Buildings 9401-1, 9201-2, 9204-1, 9732-02, 3034, 3036, 3501, 5505, and 2523, and OREM Buildings 3002, 3003, 3018, 3038, 3029, 3030, 3031, 3032, 3033, 3033A, 3118, 3042, 3515, 3542, and 3517. These historic, contaminated buildings were determined to pose excessive environmental risks.

1.4. Oak Ridge Sites

ORR includes a number of sites critical to the mission of DOE. Eight of these sites are described in this section: ORNL, the Y-12 Complex, ETTP, EMWMF, the Oak Ridge National Environmental Research Park, ORISE, the NNSA OST AOEC, and the TWPC.

Led by Amentum, Jacobs, and Honeywell, UCOR is the lead DOE ORR cleanup contractor. In addition to the continuing groundwater remediation at ETTP, UCOR addresses expanded cleanup operations at ORNL and Y-12.

The scope of UCOR activities includes characterization and cleanup of former production facilities, building pads, and impacted environmental media; management and maintenance of active ORR facilities; long-term management of inactive waste disposal sites; and water quality monitoring. The *2024 Cleanup Progress: Annual Report on Oak Ridge Reservation Cleanup* (UCOR 2024) provides detailed information on UCOR activities at ORR and is available **here**.

1.4.1. Oak Ridge National Laboratory

ORNL (shown in Figure 1.7) is managed for DOE by UT-Battelle, LLC (UT-Battelle), a partnership between the University of Tennessee and the Battelle Memorial Institute. The largest science and energy national laboratory in the DOE system, ORNL conducts basic and applied research to deliver transformative solutions to compelling problems in energy and security. The laboratory is home to several of the world's top supercomputers and is a leading neutron science and nuclear energy research facility that includes the Spallation Neutron Source and the High Flux Isotope Reactor. ORNL hosts a DOE leadership computing facility, home of the Frontier supercomputer; one of DOE's nanoscience centers, the Center for Nanophase Materials Sciences; one of DOE's energy research centers; and the Bio-Energy Science Center. UT-Battelle also manages the US ITER project (formerly the International Thermonuclear Experimental Reactor project) for DOE.

Formerly known as X-10, ORNL was established in 1943 to support the Manhattan Project. From an early focus on chemical technology and reactor development, ORNL's research and development portfolio broadened to include programs supporting DOE missions in scientific discovery and innovation, clean energy, and nuclear security. Today ORNL employs about 7,200 workers, and the laboratory's extensive capabilities in scientific discovery and innovation are applied to the delivery of mission outcomes for DOE and other sponsors (Oakridger 2024).

After completing facility upgrades and in-depth safety planning in 2022, OREM and its contractor Isotek Systems, LLC (Isotek) conducted significant processing operations on the remaining inventory of ^{233}U stored at ORNL in 2024. Together, they surpassed EM's 2024 goal by processing 35 canisters of ^{233}U months ahead of schedule. Employees have processed 130 canisters since refurbishing the hot cells inside Building 2026 as part of the U-233 Disposition Project. The effort to process and dispose of the remaining high-dose ^{233}U is OREM's highest priority at ORNL. Additionally, DOE and Isotek have partnered with TerraPower, a private nuclear innovation company, to extract ^{229}Th from the ^{233}U. TerraPower then uses the material to create the ^{225}Ac needed for targeted alpha therapy to treat diseases such as breast, prostate, colon, and neuroendocrine cancers, melanoma, and lymphoma.

UCOR continued to carry out characterization and deactivation of former reactors and isotope production facilities in 2024. A major achievement was shipping the reactor vessel from the Low Intensity Test Reactor (Building 3005) for off-site disposal.

Deactivation work is ongoing in six of the 11 buildings comprising "Isotope Row" that were constructed in the 1950s and early 1960s to process radioisotopes. Highlights of work in 2024 include the following:

- Building 3093 is in its deactivation end state after the removal of four Krypton tanks for disposition.
- Water tanks shielding hot cells were removed from the Alpha Handling Facility of the former Isotope Development Lab (Building 3038).
- In preparation for demolition in 2025, work continued to remove the final hot cell at the Radioisotope Development Laboratory (Building 3026).

Deactivation activities continued at the Oak Ridge Graphite Reactor support facility buildings 3002 (Filter House), 3003 (Fan House) and 3018 (Exhaust Stack) with the process nearing completion and demolition expected to begin in 2025.

At the Fission Production Development Lab (Building 3517), workers are collecting data in preparation for future characterization; they also successfully removed a 500-watt radioisotope thermoelectric generator for recycling into a source of energy for new power systems in partnership with private industry.

ORNL has developed high-level policies that clearly state expectations for continuous improvement and integration of environmental management services through an Environmental Management System for UT-Battelle activities and facilities. These services include waste minimization and pollution prevention, waste management, effluent management, regulatory review, reporting, permitting, and other environmental management programs.

Examples of environmental performance optimization during fiscal year (FY) 2024 include the following:

- The calculated energy use intensity was 250,387 Btu/gross square foot. This is a cumulative reduction of 31.2 percent since FY 2003 and a reduction of 39.1 percent from the FY 2021 baseline, but it is an increase of 5.42 percent from FY 2023. ORNL continues to identify opportunities to reduce energy use intensity by identifying and prioritizing maintenance issues that can improve energy efficiency.

Figure 1.7. Aerial view of the Oak Ridge National Laboratory

- UT-Battelle implemented 28 ongoing and waste minimalization and new pollution prevention projects at ORNL during 2024; these projects eliminated more than 2.6 million kg of waste.
- Eighty percent of all ORNL vehicles are alternative fuel vehicles, with 88 percent of all replacements since FY 2020 being alternative fuel or electric vehicles. Ninety-three percent of light-duty vehicles operate on alternative fuels. ORNL will continue to align its use of alternative fuel vehicles with statutory and regulatory requirements and guidance.

See Section 5.2.1.4 for additional details on ORNL environmental performance data for FY 2024.

1.4.2. Y-12 National Security Complex

The Y-12 Complex (shown in Figure 1.8) was originally constructed as part of the World War II Manhattan Project and began operations in November 1943. The first site mission was the separation of ^{235}U from natural uranium by an electromagnetic separation process. At its peak in 1945, more than 22,000 workers were employed at the Y-12 site.

Today, as part of the NNSA Nuclear Security Enterprise, the Y-12 Complex is a leader in materials science and precision manufacturing. As the main storage facility for the nation's supply of enriched uranium, Y-12 serves as the nation's only source of enriched uranium nuclear weapons components and provides enriched uranium for the US Navy. The Y-12 Complex also supports efforts to reduce the risk of nuclear proliferation and performs complementary work for other government agencies.

In December 2017, UCOR issued the Construction Execution/Management Plan, Outfall 200 Mercury Treatment Facility at the Y-12 National Security Complex, Oak Ridge, Tennessee (UCOR 2017). The Outfall 200 Mercury Treatment Facility is a vital piece of infrastructure that will open the door for demolition of Y-12's large, deteriorated,

mercury-contaminated facilities and subsequent soil remediation by providing a mechanism to limit potential mercury releases into Upper East Fork Poplar Creek. The west end Y-12 storm drain system discharges to Upper East Fork Poplar Creek at Outfall 200, and mercury from historical operations is present at Outfall 200 where storm water enters Poplar Creek.

In FY 2024, progress continued with construction of the Outfall 200 Mercury Treatment Facility, DOE Environmental Management research in new remediation technologies to address mercury releases into the environment from past operations, and contracting for the first mercury remediation technology demonstration. In FY 2024, UCOR assumed construction responsibility for the Outfall 200 Mercury Treatment Facility and began construction of the treatment plant and headworks facility. At the headworks site, workers are building concrete structures for handling normal flows and higher storm flows. In 2024, workers poured approximately 600 yd^3 of concrete. At the treatment site, workers completed construction of a gravity filter and installed additional tanks. A new Technology Demonstration Facility is being developed (formerly the Disposal Area Remedial Action, or DARA, facility) to carry out demonstrations of proposed mercury treatment technologies.

Deactivation activities continued at three large former uranium processing facilities in 2024—Alpha-2, Alpha-4, and Beta-1—with demolition beginning at Alpha-2 later in the year.

The 1940s-era Alpha-2 (Building 9201-02) is one of the largest high-risk excess contaminated facilities at Y-12. Deactivation of the upper floors of Beta-1 (Building 9204-01) was completed in FY 2024 with the pumping and treating of 5.7 million gallons of water from the basement to mitigate weather-based water intrusion. At Alpha-4 (Building 9201-04), crews are addressing mercury vapors and supporting repackaging containers for eventual waste disposition to move the building closer to cold and dark status.

At the end of 2024, the Y-12 Complex had achieved nine of twelve targets that have been established, and the remaining targets were carried into future years. Highlights of achievements include the following (further details and additional successes are presented in Chapter 4 of this report):

- **Energy efficiency.** Y-12 completed chiller plant improvements after obtaining a utility energy service contract and funding approval.
- **Hazardous materials.** A project to disposition and ship legacy mixed waste according to the site treatment plan continued. In 2024, 100 percent of site treatment plan items on the July 28, 2016, baseline inventory were shipped. This was 2 years ahead of schedule.
- **Land, water, and natural resources.** Y-12 upgraded sanitary sewer networks as part of a project to protect the sanitary sewer lines from infill and infiltration.

Figure 1.8. Aerial view of the Y-12 National Security Complex

Y-12 continues to strive to reduce impacts on the environment through increased use of environmentally friendly products and processes and reductions in waste and emissions. In FY 2024, the Y-12 Complex implemented 105 pollution prevention initiatives that resulted in a reduction of more than 8.32 million lbs of waste and projected cost efficiencies of more than $4.4 million. Also in 2024, Y-12 diverted 59.9 percent of municipal waste (over 5.9 million lbs) and 2.8 percent of construction and demolition waste (over 4.0 million lbs) from landfill disposal through source reduction, reuse, and recycle.

Compared to the FY 2003 baseline year, Y-12 has seen an energy intensity reduction of 53.22 percent as of FY 2024. During FY 2024, energy intensity was 195,756 Btu/gross square foot, three-quarters of a percentage lower than the prior year's 197,270 Btu/gross square foot. Continued construction on the new Uranium Processing Facility also contributes to the energy intensity for this year.

Continuing and new construction projects such as the Uranium Processing Facility contribute to energy intensity. Performance goals and status for the Y-12 Complex are listed in Chapter 4, Table 4.1.

1.4.3. East Tennessee Technology Park

ETTP (see Figure 1.9), originally named K-25, is the site of the nation's first gaseous diffusion uranium enrichment plant. It was established as part of the World War II Manhattan Project. Additional uranium enrichment facilities K-29, K-31, and K-33 were built adjacent to K-25 during the Cold War; these facilities formed a complex officially known as the Oak Ridge Gaseous Diffusion Plant. Uranium enrichment operations at the site ceased in 1986, and restoration, decontamination, and decommissioning activities began soon after in preparation for ultimate conversion of the site to a private sector industrial park to be called the Heritage Center. Reindustrialization of the site began in 1996 when

it was renamed the East Tennessee Technology Park.

Crews completed soil remediation at ETTP in calendar year 2024 after the demolition of all unneeded facilities at the site. The site is divided into two cleanup regions: Zone 1, a 1,300-acre area outside the main plant area; and Zone 2, the 800-acre area that comprises the main plant area. The areas in these zones are divided into Exposure Units (EUs) that vary in size from 6 to 38 acres.

The EU-21 trichloroethene (TCE) Project made the final soil shipment from ETTP on May 2, 2024. The project began in July 2021 and was estimated to create 19,000 yd^3 of TCE-contaminated waste. The project shipped more than 102,000 yd^3 of material both on-site and off-site. The project ran into several challenges during the 3-year effort: mercury process piping, multiple high-concentration TCE areas, schedule targets, supply chain issues, and the process for defining the extent of the contamination.

Crews removed two structures from the EU-20 footprint in October as part of the remaining facilities disposition effort. This area included the north end of the previously demolished K-25 Building. The K-2500-J tent, also known as the Segmentation Shop Storage Facility, and the K-2500-AB facility were demolished and hauled to Oak Ridge Reservation Landfills (ORRL). After removing these facilities, radiological surveys on the slabs below the structures were completed in support of national historical preservation and future public access.

Excavation of two remaining soil contamination areas were completed in calendar year 2024: TCE contaminated soil at EU-30 and two "hotspots" in Area B of EU-35. The EU-30 remedial action targeted approximately 500 yd^3 on the southern edge of EU-30, between the former K-1301 and K-1401 facilities. The EU-35 remediation focused on approximately 4,700 yd^3 of contaminated soil around the perimeter of the K-1407-B Pond, which was primarily used as a settling pond for metal hydroxide sludge and other waste streams.

Through the UCOR Efficiency and Stewardship initiative, measures designed to promote environmental resiliency and efficient operations are being incorporated throughout UCOR's processes and activities. The initiative focuses on supporting clean energy technology development through reindustrialization, as well as education and partnerships to leverage resiliency awareness for enhanced operational efficiency. UCOR's partnerships, stakeholder engagement, and efficiency accomplishments towards achieving its environmental stewardship goals in 2024 are detailed further in Section 3.2.1.

OREM continued to see significant momentum in the Reindustrialization Program at ETTP. The former government-owned uranium enrichment complex is being turned into a multiuse industrial park that includes national historical preservation and conservation and green space areas. Reindustrialization efforts at ETTP are expected to generate 1,400 jobs from the $1.35 billion in investments announced by the on-site companies, which are largely focusing on clean energy technology.

OREM has transferred over 1,700 acres for economic development at ETTP, including 470 acres during FY 2024. Marking a significant milestone for the Reindustrialization Program, OREM and UCOR also completed the final transfer of major utilities. ETTP is now served by a public infrastructure system of water, sewer, electric, and natural gas utilities.

Upon regulatory approval, transfer packages are submitted for department and congressional approvals, which finalizes the process. Clean energy and new nuclear businesses are currently under development in these areas and the Oak Ridge Community. For example, Kairos Power has just started construction of the Hermes low-power demonstration reactor at the ETTP Site. This will be the first non-light-water reactor permitted in the United States in over 50 years.

Figure 1.9. Aerial view of the East Tennessee Technology Park

1.4.4. Environmental Management Waste Management Facility

The EMWMF (shown in Figure 1.10) is located in eastern Bear Creek Valley near the Y-12 Complex and is managed by UCOR. The EMWMF was built for the disposal of waste resulting from CERCLA cleanup actions on ORR. The original design was for the construction, operation, and closure of a projected 1.3 million m^3 (1.7 million yd^3) disposal facility. The approved capacity was subsequently increased to 1.8 million m^3 (2.4 million yd^3) to maximize use of the footprint designated in a 1999 Record of Decision (DOE 1999). The facility currently consists of six disposal cells.

The EMWMF is an engineered landfill that accepts low-level, mixed low-level, and hazardous wastes from CERCLA cleanup activities on ORR that meet specific waste acceptance criteria developed in accordance with agreements with state and federal regulators. Waste types that qualify for disposal include soil, dried sludge and sediment, solidified waste, stabilized waste, building debris, scrap equipment, and secondary waste such as personal protective equipment, all of which must meet land disposal restrictions. In addition to the solid waste disposal facility, the EMWMF operates a leachate collection system. In 2024, the facility collected, analyzed, and disposed of approximately 3.42 million gallons of leachate. The leachate is treated at the ORNL Liquids and Gaseous treatment facility, which is also operated by UCOR (UCOR 2024).

Figure 1.10. Aerial view of the Environmental Management Waste Management Facility

In FY 2024, EMWMF received 9,976 waste shipments from cleanup projects at ETTP, ORNL, and Y-12, totaling 131,597 yd^3. The EMWMF landfill has a design capacity of 2.3 million yd^3 and is now over 85 percent filled. Planning continued in FY 2024 for another disposal facility, the Environmental Management Disposal Facility (EMDF), to provide the capacity required to complete Oak Ridge's cleanup mission.

Crews completed fieldwork at the EMDF for the early site preparation activities in May 2024. This work included rerouting portions of Bear Creek Road and the Haul Road and developing other support areas. OREM continues to work with EPA and TDEC on regulatory documents for the EMDF landfill. The Groundwater Field Demonstration Remedial Design Work Plan/Remedial Action Work Plan was approved in October 2023, and the Remedial Design Work Plan for the EMDF design was prepared and reviewed with approval in September 2024.

1.4.5. Oak Ridge Environmental Research Park

DOE established the Oak Ridge National Environmental Research Park (see Figure 1.11) in 1980. Managed for DOE by UT-Battelle, the research park serves as an outdoor laboratory to evaluate the potential environmental consequences of energy use and development and strategies to mitigate those effects. Its large blocks of forest and diverse communities of vegetation offer unparalleled resources for ecosystem-level and large-scale research. Major national and international collaborative research initiatives use it to address issues such as multiple stress interactions, biodiversity, tropospheric air quality, innovative power conductors, solar radiation monitoring, ecological recovery, and monitoring and remediation.

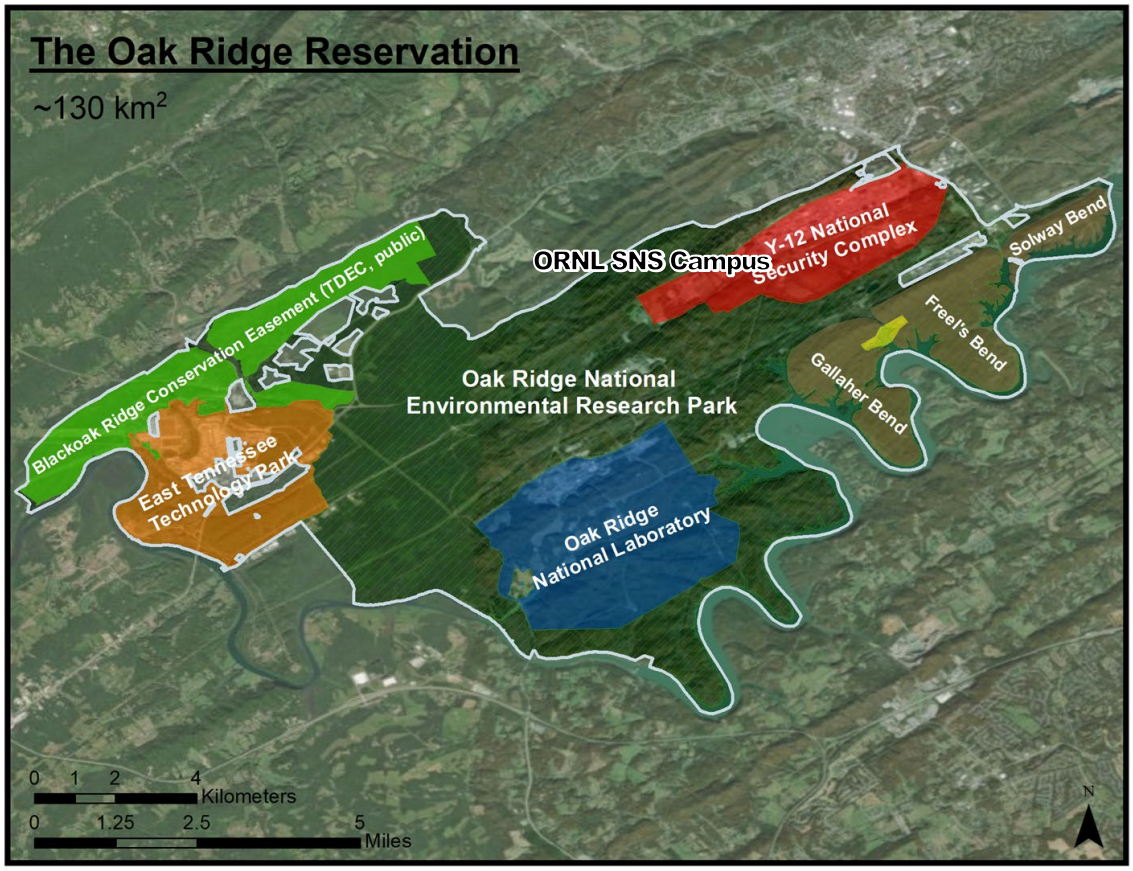

Figure 1.11. Location of the Oak Ridge National Environmental Research Park

Field sites at the research park provide maintenance and support facilities that permit sophisticated and well-instrumented environmental experiments. These facilities include elaborate monitoring systems that enable users to measure environmental factors precisely and accurately for extended periods. Because the park is under the jurisdiction of the federal government, public access is restricted; therefore, experimental sites and associated equipment are not disturbed. National recognition of the research park's value has led to its use in both regional- and continental-scale research projects. Research Park sites offer opportunities for aquatic and terrestrial ecosystem analyses of topics such as biogeochemical cycling of pollutants resulting from energy production, landscape alterations, ecosystem restoration, wetland mitigation, and forest and wildlife management.

1.4.6. Oak Ridge Institute for Science and Education

ORISE is managed for DOE by Oak Ridge Associated Universities. ORISE is located on the southeastern border of ORR in an area that was part of an agricultural experiment station owned by the federal government from the late 1940s to the mid-1980s. The ORISE mission is to develop people and solutions to strengthen our nation's competitive advantage in science. ORISE accomplishes its mission by recruiting and preparing the next generation of our nation's scientific workforce; promoting sound scientific and technical investment decisions through independent peer reviews; facilitating and preparing for the medical management of radiation incidents in the United States and abroad; evaluating health outcomes in workers exposed to chemical and radiological hazards on the job; and ensuring public confidence in environmental cleanup through independent environmental assessments. ORISE creates opportunities for collaboration through partnerships with other DOE facilities, federal agencies, academia, and industry consistent with DOE objectives and the ORISE mission.

In 2024, ORISE's Radiation Emergency Assistance Center/Training Site (REAC/TS) and the Cytogenetic Biodosimetry Laboratory (CBL) hosted a delegation from the Japan Nuclear Regulation Authority, which was originally established to learn the lessons of the Fukushima Daiichi nuclear incident of 2011. The staff of REAC/TS and the CBL continually work to build international relationships such as these in support of radiation safety training and radiation emergency response. Also in the summer of 2024, the ORISE K-12 Science, Technology, Engineering, and Mathematics Education hosted a variety of educator professional development programs, residential research programs, and day camps serving 756 participants in Oak Ridge, Tennessee; Tucson, Arizona; Albuquerque, New Mexico; Towson, Maryland; and elsewhere (ORAU 2025).

1.4.7. National Nuclear Security Administration Office of Secure Transportation, Agent Operations Eastern Command

Beginning in 1947, DOE and its predecessor agencies moved nuclear weapons, weapons components, special nuclear materials, and other important national security assets by commercial and government modes of transportation. In the late 1960s, worldwide terrorism and acts of violence prompted a review of procedures for safeguarding these materials. As a result, a comprehensive new series of regulations and equipment was developed to enhance the safety and security of these materials in transit. Modified and redesigned transport equipment was created to incorporate features that more effectively enhance self-protection and deny unauthorized access to the materials. Also during this time, the use of commercial transportation systems was abandoned, and a totally federal operation was implemented. The organization responsible for this mission within DOE NNSA is the Office of Secure Transportation, or OST.

The NNSA OST AOEC Secure Transportation Center and Training Facility is situated on about 723 hectares (1,786 acres) at ORR. It operates under a user permit agreement with the DOE Oak Ridge Office. The NNSA OST AOEC performs its assigned mission transportation operations, maintains applicable fleet and escort vehicles, and continues extensive training activities for its federal agents.

1.4.8. Transuranic Waste Processing Center

The TWPC is located on an approximately 10.5-hectare (26-acre) tract of land in the Melton Valley area of ORNL about 120 feet west of the existing Melton Valley Storage Tanks; it is managed by UCOR. The TWPC's mission is to receive transuranic waste for processing, treatment, repackaging, and shipment to designated facilities for final disposal.

Transuranic waste consists of materials and debris that are contaminated with elements that have a higher atomic mass and are listed after uranium on the periodic table. The majority of Oak Ridge's inventory of transuranic materials

originated from previous research and isotope production missions at ORNL. Waste determined to be non-transuranic (e.g., low-level radioactive waste or mixed low-level waste) is shipped to the NNSA or other approved facilities. In 2024, the TWPC completed a significant amount of hazardous inventory reduction when it safely and compliantly performed 12 shipments of legacy transuranic waste to the Waste Isolation Pilot Plant in Carlsbad, New Mexico; these shipments resulted in an inventory reduction of 301 drums. The TWPC team also completed 12 shipments of mixed low-level waste, low-level waste, and hazardous industrial waste resulting from the processing and certification of the TRU legacy waste.

Figure 1.12. Aerial view of the Transuranic Waste Processing Center

In FY 2024, TWPC continued its operational focus on management of the challenging waste generated by Nuclear Fuel Services Inc. from its nuclear fuel production activities. This waste, consisting of 4 boxes and 13 drums, was processed and repackaged into 140 drums of compliant soil and debris for disposal.

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