

1. Introduction to the Oak Ridge Reservation

The Oak Ridge Reservation (ORR) is a federally owned site in Anderson and Roane Counties in eastern Tennessee. The ORR site covers 52.3 square miles of land used for commercial and industrial activities as well as streams, lakes, and woodlands teeming with deer, wild turkey, raccoon, birds of prey (eagles, osprey, great horned owls, red tail and sparrow hawks), squirrels, and rabbits as well as wildlife predators such as coyotes and bobcats. ORR is home to two major US Department of Energy (DOE) operating components, the Oak Ridge National Laboratory (ORNL) and the Y-12 National Security Complex (Y-12 Complex or Y-12). Other facilities on ORR include the East Tennessee Technology Park (ETTP), site of a former gaseous diffusion plant that has undergone significant environmental cleanup and transition to a private sector business and industrial park; the Oak Ridge Institute for Science and Education (ORISE) South Campus, which includes training facilities, laboratories, and support facilities; a variety of smaller government-owned, contractor-operated facilities involved in environmental cleanup; and the government-owned, government-operated Agent Operations Eastern Command (AOEC) of the National Nuclear Security Administration (NNSA) Office of Secure Transportation (OST). Personnel entering ORR must be badged in accordance with current access security requirements.

Originally established in the early 1940s as part of the Manhattan Project to enrich uranium and pioneer methods for producing and separating plutonium, ORR's mission continues to evolve as it adapts to meet the changing basic and applied research and national security needs of the United States.

Due to differing permit reporting requirements and instrument capabilities, various units of measurement are used in this report. The list of units of measure and conversion factors provided on pages xxix and xxx is intended to help readers convert numeric values presented herein as needed for specific calculations and comparisons.

1.1 Background

The ORR Annual Site Environmental Report (ASER) presents summary environmental data that characterizes environmental performance, summarizes environmental occurrences reported during the year, confirms compliance with environmental standards and requirements, and highlights significant environmental program activities. The report fulfills the requirement in DOE Order 231.1B, *Environment, Safety, and Health Reporting*, Attachments 1, 2, 3, 4, and 5 (DOE 2012) requiring the preparation of an integrated annual site environmental report.

Summary results presented in this report are based on data collected before and continuing through 2017. Not all results of the environmental monitoring associated with ORR are reported here, and this report is not intended for that purpose. 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 are referenced herein 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 release to the environment. These measurements allow the 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 measurements, collection, and analysis of samples taken from the site and its environs, exclusive of effluents. Activities such as these provide information on contaminant concentrations in air, water, groundwater, soil, foods, biota, and other media. Other environmental surveillance data support environmental compliance and, when combined with data from effluent monitoring, also support chemical and radiation dose and exposure assessments of the potential effects of ORR operations, if any, on the local environment.

1.2 History of the Oak Ridge Reservation

Historically the ORR area was occupied by Native Americans. Tribes such as the Cherokee, which are descendants of Neolithic and Stone Age people, still lived in the East Tennessee region when European settlers arrived in the late 1700s. These early settlers to the ORR area lived on farms or in four small communities named Elza, Robertsville, Scarboro, and Wheat. All but Elza were founded shortly after the Revolutionary War. In the early 1940s about a thousand families inhabited the area.

The area that became ORR was selected in 1942 for the Manhattan Project, in part, because the Clinch River provided ample supplies of water, the terrain featured linear and partitioned ridges, nearby Knoxville was a good source of labor, and the Tennessee Valley Authority (TVA) could supply ample amounts of needed electricity. Families that had occupied the area's homes and farms for generations received orders to vacate within just a few weeks. More than three thousand individuals were immediately affected by the federal government's acquisition of their property. According to data from the US Department of Agriculture's National Agricultural Statistics Service, the average farm real estate value in 1942 for the 48 contiguous states was \$34 per acre. Some property owners were paid this amount for their land; others were paid less. Many felt they were poorly paid, especially for their homes.

The site's wartime name was Clinton Engineering Works. Although it was not shown on any map, the workers' city, named Oak Ridge, was established on the reservation's northern edge and grew to a population of 75,000, becoming the fifth largest city in Tennessee. To the south of the residential area, an electromagnetic separation method at the Y-12 Complex separated uranium-235 (^{235}U) from natural uranium. A gaseous diffusion plant, K-25, 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—called X-10 or Clinton Laboratories—housed the experimental Graphite Reactor. X-10 served as a pilot scale facility for the larger plutonium production facilities built at Hanford, Washington. Two years after World War II ended, Oak Ridge shifted to civilian control under the authority of the US Atomic Energy Commission. In 1959 the city was incorporated and the community adopted a city manager and city council form of government.

Since that time, the missions of the three major ORR installations have continued to evolve and operations have adapted to meet America's changing defense, energy, and research needs. Their current missions, as well as the missions of several smaller DOE facilities and activities on ORR, are described in Section 1.4.

1.3 Site Description

1.3.1 Location and Population

As shown in Figure 1.1, ORR is situated in the Great Valley of East Tennessee between the Cumberland and Great Smoky Mountains and is bordered by the Clinch River (see Figure 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. ORR encompasses about 13,547 ha (33,476 acres) of mostly contiguous land in Anderson and

Roane Counties that is owned by the federal government, and is under the management of DOE. According to the U.S. Census Bureau, the estimated population of the 10-county region surrounding ORR is 1,180,996 and, as reported in *US Department of Energy FY2017 | Economic Impact in Tennessee*, about 3 percent of the region's labor force is employed on ORR. The 2017 US census population estimate for the official nine-county Knoxville metropolitan statistical area is 967,262. Other municipalities within about 30 km (18.6 mi) of the reservation include Oliver Springs, Clinton, Rocky Top, Lenoir City, Farragut, Kingston, and Harriman.

Knoxville, the major metropolitan area nearest Oak Ridge, is about 40 km (25 mi) to the east and had a population of about 187,347 according to the 2017 US census population estimate. 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 in the area.



Figure 1.1. Location of the Oak Ridge Reservation in Tennessee

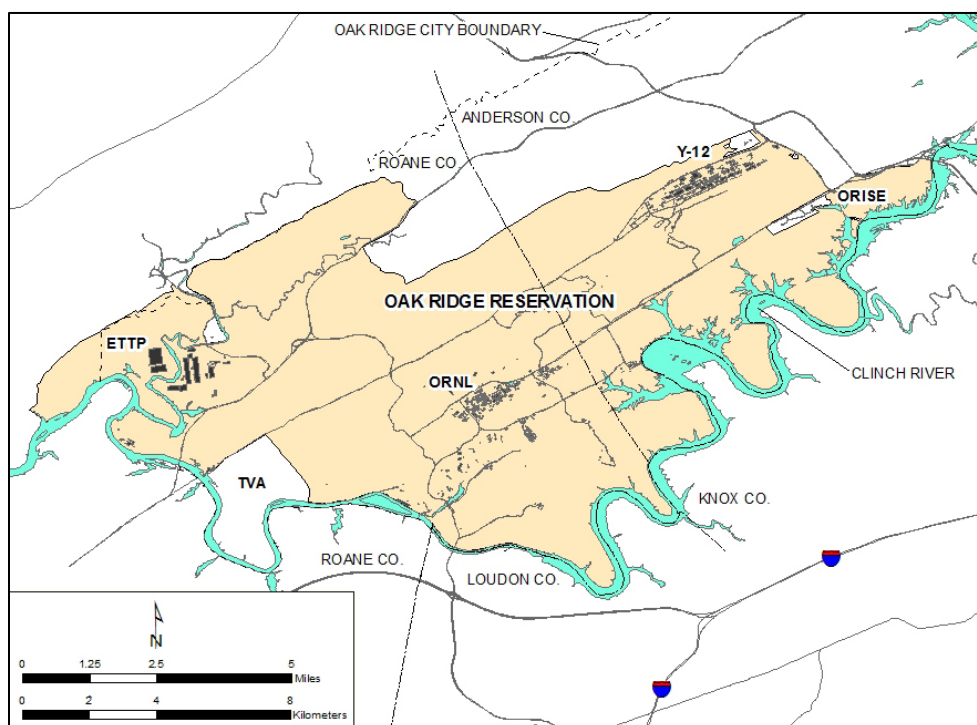


Figure 1.2. Map of the Oak Ridge Reservation

1.3.2 Climate

The climate of the Oak Ridge region may be broadly classified as humid subtropical and is characterized by significant temperature changes between summer and winter. The 30-year mean temperature for 1981–2010 was 14.7°C (58.5°F). The average high temperature for the Oak Ridge area in 2017 was 21.3°C (70.3°F). During 2017, December temperatures were coldest, averaging 9.1°C (48.4°F). July was the warmest month, with average temperatures of 30.9°C (87.6°F). Monthly summaries of temperature averages, extremes, and 2017 values are provided in Appendix B, Table B.1.

Average annual precipitation in the Oak Ridge area for the 30-year period from 1981 to 2010 was 1,337.5 mm (52.64 in.), including about 21.3 cm (8.4 in.) of snowfall annually (NOAA 2011). Total precipitation during 2017 as measured at meteorological tower (MT)2 was 1,485.9 mm (58.48 in.), which is 10 percent above the 30-year average. Monthly summaries of precipitation averages, extremes, and 2017 values are also presented in Appendix B, Table B.1.

The average annual wind data recovery rates (a measure of acceptable data) across locations used for modeling during 2017 stood at 99.2 percent for wind sensors at the ORNL sites (towers MT2, MT3, MT4, and MT10). All other MT2, MT3, and MT4 instrument recoveries were well above 90 percent for both quarterly and annual values.

In 2017 wind speeds at ORNL Tower C/D (MT2), measured at 15 m (49 ft) above ground level, averaged 0.94 m/s (2.2 mph). This value remained unchanged 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. Wind direction frequencies with respect to precipitation hours for the ORR towers may be reviewed [here](#) under the heading 2017 Annual Precipitation Wind Roses—Oak Ridge Reservation.

More 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 document. A detailed analysis of wind patterns for ORR was conducted from 2009 to 2011 and is documented in *Wind Regimes in Complex Terrain in the Great Valley of Eastern Tennessee* (Birdwell 2011), which may be reviewed online [here](#).

1.3.3 Regional Air Quality

National Ambient Air Quality Standards (NAAQS) for key principal pollutants, also known as criteria pollutants, are set by the US Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards. 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 (PM₁₀), 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 (outdoor) levels of the criteria pollutants. Areas that satisfy NAAQS are classified as attainment areas, and areas that exceed NAAQS for a particular pollutant are classified as non-attainment areas for that pollutant.

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

1.3.4 Surface Water

ORR is situated in the Valley and Ridge Physiographic Province, which is composed of a series of drainage basins or troughs containing many small streams that feed the Clinch River. Surface water on ORR drains into a tributary or 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 largest of the drainage basins is Poplar Creek, which receives drainage from a 352 km² (136 mi²) area including the northwestern sector of ORR. 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 mostly affected by storm water 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 drainage basin, which has an area of 16.5 km² (6.4 mi²). White Oak Creek headwaters originate on Chestnut Ridge, north of ORNL and near the Spallation Neutron Source site. At the ORNL site, the creek flows west along the southern boundary of the developed area and 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 km² (1.47 mi²). The waters of White Oak Creek 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 White Oak Creek 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, designated as the Knox Group and the Maynardville Limestone of the Upper Conasauga Group and consisting of dolostone and limestone, respectively, make up the most significant water-bearing hydrostratigraphic units in the Valley and Ridge Province (Zurawski 1978) and on ORR. Composed of fairly soluble minerals, these bedrock formations 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 solution conduit networks. This hydrostratigraphic unit is referred to locally as the Knox Aquifer. A combination of fractures and solution conduits in the aquifer control flow 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 for many streams (base flow), and most large springs on ORR receive discharge from the Knox Aquifer. Yields of some wells penetrating larger solution conduits are reported to exceed 3,785.4 L/min (1,000 gal/min). The high productivity of the Knox Aquifer is attributed to the combination of its abundant and sometimes large solution 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 predominantly 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, that 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 Historic Resources

A unique variety of natural, cultural, and historic resources can be found on ORR. 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.

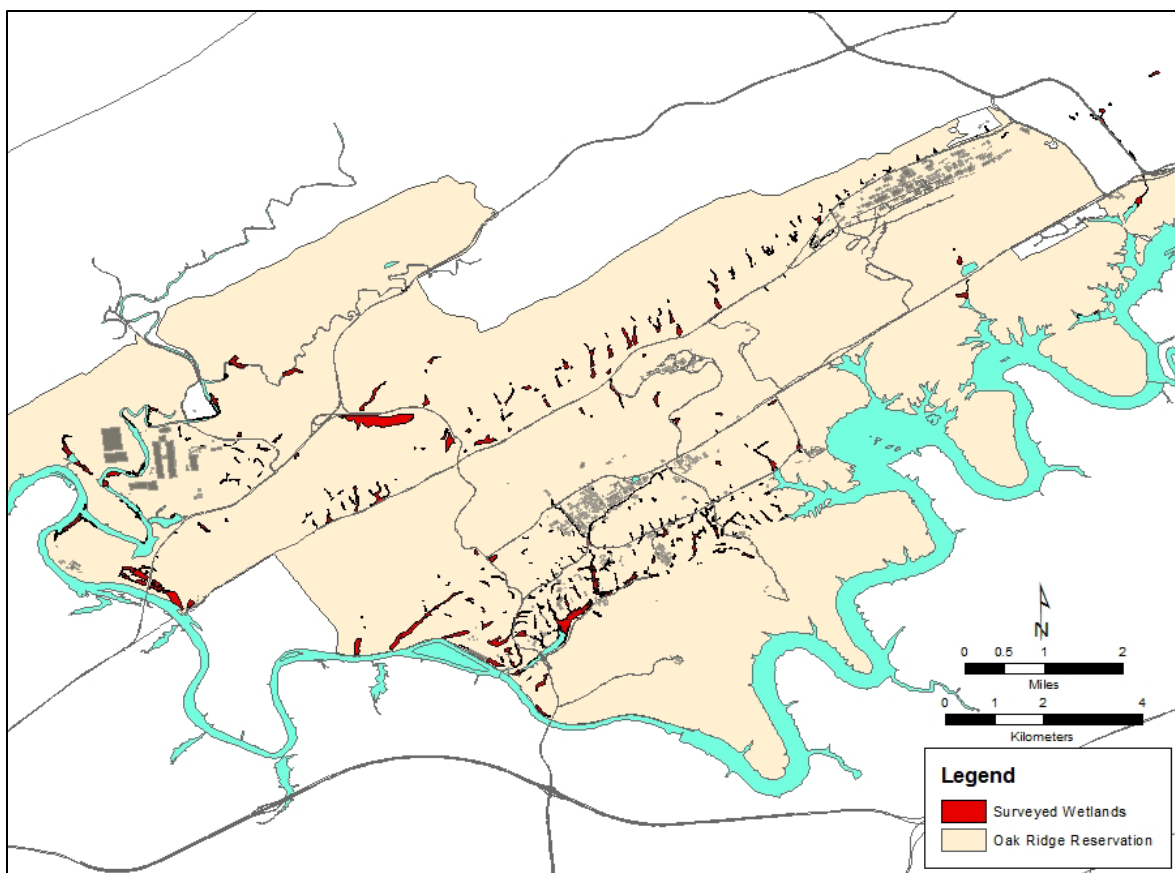


Figure 1.3. Location of Oak Ridge Reservation wetlands

About 243 ha (600 acres) of wetlands have been identified on ORR; most are classified as forested palustrine, scrub/shrub, and emergent wetlands. Wetlands identified to date range from several square meters at small seeps and springs to about 10 ha (25 acres) at White Oak Lake. Monitoring restored or created mitigation sites for five years is a standard requirement of the Tennessee Department of Environment and Conservation's (TDEC's) wetland mitigation Aquatic Resource Alteration Permits (ARAPs) required by Section 401 of the Clean Water Act.

Activities and conditions in and around ORNL wetlands are verified by site inspections when appropriate; see Chapter 5, Section 5.3.12. In 2017 wetlands were delineated in the Copper Ridge Borrow Area and 294 Power Line Area.

In another wetland mitigation effort that began in 2014 as part of the Uranium Processing Facility project at the Y-12 Complex, construction was completed on the Bear Creek Road Bypass Phase II and a haul road extension that modified wetlands on the north side of Bear Creek Road. Details of this activity are provided in Chapter 4, Section 4.5.8.4. The work was performed under an approved US Army Corps of Engineers Section 404 permit and an ARAP issued by TDEC. The wetland mitigation work performed under these permits will result in a more than 3:1 net increase in total wetland area when the multiyear project is complete. Monitoring mitigation in accordance with the permits has been initiated. Annual monitoring of wetland sites through 2017 revealed that, in general, the wetlands continue to respond as intended and have shown remarkable wetland plant coverage.

1.3.6.2 Wildlife and Endangered Species

Animals listed as species of concern by state, federal, or international organizations and known to have occurred 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 anhinga, have been seen only once or a few times; others, including sharp-shinned hawk and southeastern shrew, are comparatively common and widespread on the reservation. As of July 2016, Tennessee had 93 species listed under the federal Endangered Species Act (75 endangered and 18 threatened). The complete Tennessee Threatened and Endangered List–New Rules can be found [here](#).

Table 1.1. Animal species of special concern reported on the Oak Ridge Reservation^a

| Scientific name | Common name | Status ^b | | |
|---------------------------------------|----------------------|---------------------|-------|------------------|
| | | Federal | State | PIF ^c |
| <i>FISH</i> | | | | |
| <i>Phoxinus tennesseensis</i> | Tennessee dace | | NM | |
| <i>AMPHIBIANS AND REPTILES</i> | | | | |
| <i>Cryptobranchus alleganiensis</i> | Hellbender | MC | NM | |
| <i>Hemidactylium scutatum</i> | Four-toed salamander | | NM | |
| <i>BIRDS</i> | | | | |
| Darters | | | | |
| <i>Anhinga anhinga</i> | Anhinga | | NM | |
| Bitterns and Herons | | | | |
| <i>Ixobrychus exilis</i> | Least bittern | MC | NM | |
| <i>Ardea alba</i> | Great egret | | NM | |
| <i>Egretta caerulea</i> | Little blue heron | MC | NM | |
| <i>Egretta thula</i> | Snowy egret | MC | NM | |

Table 1.1. Animal species of special concern reported on the Oak Ridge Reservation^a (continued)

| Scientific name | Common name | Status ^b | | |
|---|--------------------------|---------------------|-------|------------------|
| | | Federal | State | PIF ^c |
| Kites, Hawks, Eagles, and Allies | | | | |
| <i>Haliaeetus leucocephalus</i> | Bald eagle | MC ^d | NM | |
| <i>Circus cyaneus</i> | Northern harrier | | NM | |
| <i>Accipiter striatus</i> | Sharp-shinned hawk | MC | NM | |
| <i>Buteo lineatus</i> | Red-shouldered hawk | | | RI |
| <i>Buteo platypterus</i> | Broad-winged hawk | | | RI |
| Falcons | | | | |
| <i>Falco peregrinus</i> | Peregrine falcon | MC ^e | E | RI |
| <i>Falco sparverius</i> | American kestrel | MC | | RI |
| Grouse, Turkey, and Quail | | | | |
| <i>Bonasa umbellus</i> | Ruffed grouse | | | RI |
| <i>Colinus virginianus</i> | Northern bobwhite | | | RI |
| Rails, Gallinules, and Coots | | | | |
| <i>Rallus limicola</i> | Virginia rail | MC | | |
| <i>Porzana Carolina</i> | Sora | MC | | |
| <i>Gallinula galeata</i> | Common gallinule | | NM | |
| Owls | | | | |
| <i>Aegolius acadicus</i> | Northern saw-whet owl | MC | T | RI |
| <i>Tyto alba</i> | Barn owl | | NM | |
| Goatsuckers | | | | |
| <i>Caprimulgus carolinensis</i> | Chuck-will's-widow | MC | | RI |
| <i>Caprimulgus vociferus</i> | Eastern whip-poor-will | | | RI |
| Swifts | | | | |
| <i>Chaetura pelagica</i> | Chimney swift | | | RI |
| Kingfishers | | | | |
| <i>Megaceryle alcyon</i> | Belted kingfisher | | | RI |
| Woodpeckers | | | | |
| <i>Melanerpes erythrocephalus</i> | Red-headed woodpecker | MC | | RI |
| <i>Sphyrapicus varius</i> | Yellow-bellied sapsucker | MC | NM | |
| <i>Picoides pubescens</i> | Downy woodpecker | | | RI |
| <i>Colaptes auratus</i> | Northern flicker | | | RI |
| Tyrant Flycatchers | | | | |
| <i>Contopus cooperi</i> | Olive-sided flycatcher | MC | NM | RI |
| <i>Contopus virens</i> | Eastern wood-pewee | | | RI |
| <i>Empidonax virescens</i> | Acadian flycatcher | | | RI |
| <i>Empidonax trailii</i> | Willow flycatcher | | | RI |
| Swallows | | | | |
| <i>Progne subis</i> | Purple martin | | | RI |
| <i>Riparia riparia</i> | Bank swallow | | | RI |
| <i>Hirundo rustica</i> | Barn swallow | | | RI |

Table 1.1 Animal species of special concern reported on the Oak Ridge Reservation^a (continued)

| Scientific name | Common name | Status ^b | | |
|---|-------------------------|---------------------|-------|------------------|
| | | Federal | State | PIF ^c |
| Titmice and Chickadees | | | | |
| <i>Poecile atricapillus</i> | Black-capped chickadee | MC | NM | |
| <i>Poecile carolinensis</i> | Carolina chickadee | | | RI |
| Nuthatches | | | | |
| <i>Sitta pusilla</i> | Brown-headed nuthatch | MC | | RI |
| Wrens | | | | |
| <i>Troglodytes</i> | Winter wren | | | RI |
| <i>Thryothorus ludovicianus</i> | Carolina wren | | | RI |
| Kinglets, Gnatcatchers, and Thrushes | | | | |
| <i>Hylocichla mustelina</i> | Wood thrush | MC | | RI |
| Thrashers and Mockingbirds | | | | |
| <i>Toxostoma rufum</i> | Brown thrasher | | | RI |
| Waxwings | | | | |
| <i>Bombycilla cedrorum</i> | Cedar waxwing | | | RI |
| Shrikes | | | | |
| <i>Lanius ludovicianus</i> | Loggerhead shrike | MC | NM | RI |
| Vireos | | | | |
| <i>Vireo flavifrons</i> | Yellow-throated vireo | | | RI |
| <i>Vireo solitarius</i> | Blue-headed vireo | | | RI |
| <i>Vireo griseus</i> | White-eyed vireo | | | RI |
| Wood Warblers | | | | |
| <i>Vermivora chrysoptera</i> | Golden-winged warbler | MC | NM | RI |
| <i>Vermivora cyanoptera</i> | Blue-winged warbler | MC | | RI |
| <i>Setophaga cerulea</i> | Cerulean warbler | MC | NM | RI |
| <i>Setophaga discolor</i> | Prairie warbler | MC | | RI |
| <i>Setophaga dominica</i> | Yellow-throated warbler | | | RI |
| <i>Mniotilta varia</i> | Black-and-white warbler | | | RI |
| <i>Helmitheros vermivorum</i> | Worm-eating warbler | MC | | RI |
| <i>Parkesia motacilla</i> | Louisiana waterthrush | MC | | RI |
| <i>Protonotaria citrea</i> | Prothonotary warbler | MC | | RI |
| <i>Geothlypis formosa</i> | Kentucky warbler | MC | | RI |
| <i>Cardellina canadensis</i> | Canada warbler | MC | | RI |
| <i>Setophaga citrina</i> | Hooded warbler | | | RI |
| <i>Icteria virens</i> | Yellow-breasted chat | | | RI |
| <i>Setophaga pinus</i> | Pine warbler | | | RI |
| <i>Cardellina pusilla</i> | Wilson's warbler | | | RI |
| <i>Setophaga magnolia</i> | Magnolia warbler | | | RI |
| <i>Setophaga fusca</i> | Blackburnian warbler | | | RI |
| <i>Setophaga pennsylvanica</i> | Chestnut-sided warbler | | | RI |

Table 1.1 Animal species of special concern reported on the Oak Ridge Reservation^a (continued)

| Scientific name | Common name | Status ^b | | |
|--------------------------------|---|---------------------|-------|------------------|
| | | Federal | State | PIF ^c |
| <i>Setophaga virens</i> | Black-throated green warbler | | | RI |
| | Tanagers | | | |
| <i>Piranga olivacea</i> | Scarlet tanager | | | RI |
| <i>Piranga rubra</i> | Summer tanager | | | RI |
| | Cardinals, Grosbeaks, and Allies | | | |
| <i>Passerina cyanea</i> | Indigo bunting | | | RI |
| | Towhees, Sparrows, and Allies | | | |
| <i>Pipilo erythrophthalmus</i> | Eastern towhee | | | RI |
| <i>Spizella pusilla</i> | Field sparrow | | | RI |
| <i>Ammodramus savannarum</i> | Grasshopper sparrow | | | RI |
| <i>Pooecetes gramineus</i> | Vesper sparrow | | NM | |
| <i>Ammodramus henslowii</i> | Henslow's sparrow | MC | NM | RI |
| <i>Melospiza Georgiana</i> | Swamp sparrow | | | RI |
| | Blackbirds and Allies | | | |
| <i>Dolichonyx oryzivorus</i> | Bobolink | | | RI |
| <i>Sturnella magna</i> | Eastern meadowlark | | | RI |
| | Finches and Allies | | | |
| <i>Spinus tristis</i> | American goldfinch | | | RI |
| | MAMMALS | | | |
| <i>Myotis grisescens</i> | Gray bat | E | E | |
| <i>Myotis sodalist</i> | Indiana bat ^f | E | E | |
| <i>Myotis septentrionalis</i> | Northern long-eared bat | T | | |
| <i>Sorex longirostris</i> | Southeastern shrew | | NM | |
| <i>Sorex cinereus</i> | Masked shrew | | NM | |
| <i>Zapus hudsonius</i> | Meadow jumping mouse | | NM | |

^aLand and surface waters of the Oak Ridge Reservation (ORR) exclusive of the Clinch River, which borders ORR.

^bStatus codes:

E = endangered

T = threatened

MC = of management concern

NM = in need of management

RI = regional importance

^cPartners in Flight (PIF) is an international organization devoted to conserving bird populations in the Western Hemisphere.

^dThe bald eagle was federally delisted effective August 8, 2007.

^eThe peregrine falcon was federally delisted effective August 25, 1999.

^fA single specimen was captured in a mist net bordering the Clinch River in June 2013.

Birds, fish, and aquatic invertebrates are the most thoroughly surveyed animal groups on ORR. Nevertheless, the only federally listed animal species that have been observed on ORR in recent years are mammals. Gray bats were observed over the Clinch River bordering ORR in 2003 and over a pond on ORR in 2004. Three gray bats were mist-netted outside a cave on ORR in 2006. Several gray bats and one Indiana bat were also captured in mist nets bordering the Clinch River in June and July 2013. Northern

long-eared bats, recently federally listed as threatened, are known to be present on ORR; their calls have been identified in various acoustic surveys of the reservation, and in 2013 their presence was confirmed when a number were captured in mist nets (McCracken et al. 2015).

Two-hundred twenty-nine species of birds have been recorded on ORR and its boundary waters: the 228 species documented by Roy et al. (2014) and the cackling goose (*Branta hutchinsii*), which was recorded in eBird (Sullivan et al. 2009) at the ORNL Swan Pond in November 2014. Most of these species are afforded protection under the Migratory Bird Treaty Act and Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. DOE's 2013 updated memorandum of understanding on migratory birds with the US Fish and Wildlife Service (FWS) (DOE-FWS 2013) strengthens migratory bird conservation on ORR through enhanced collaboration between DOE and FWS. Breeding bird surveys were conducted at 79 points along nine routes on ORR in 2014 for the Partners in Flight Program. Five public nature walks were held on ORR in 2017, including a bird walk, frog calls, bat monitoring, and a wildflower walk. In previous years ORR has been nominated for the Presidential Migratory Bird Federal Stewardship Award, but ORR did not receive a nomination in 2017. A technical manuscript, *Oak Ridge Reservation Bird Records and Population Trends* (Roy et al. 2014), documents all known ORR bird records since 1950, as well as population trends for 32 species of birds.

Several state-listed bird species such as the anhinga, olive-sided flycatcher, and little blue heron are uncommon migrants or visitors to the reservation. The cerulean warbler, listed by the state as in need of management, has been recorded during the breeding season on ORR but is currently listed as a potential breeding bird on ORR (Roy et al. 2014) as its actual breeding status is still uncertain. The bald eagle (shown in Figure 1.4), also listed by the state as in need of management, is a year-round resident in Tennessee, though it can be difficult to find on the reservation from September through November. One bald eagle nest was confirmed on the reservation in 2011, and this pair nested again in 2012, 2013, and 2014. A second bald eagle nest, with an eaglet, was discovered in 2013. Adult eagles were observed at this nest in 2014 and eaglets were successfully fledged from the Poplar Creek nesting location in 2015. More than two dozen eaglets were fledged in East Tennessee during 2017, according to bald eagle information published by the East Tennessee State University College of Arts and Sciences, Biological Sciences department.

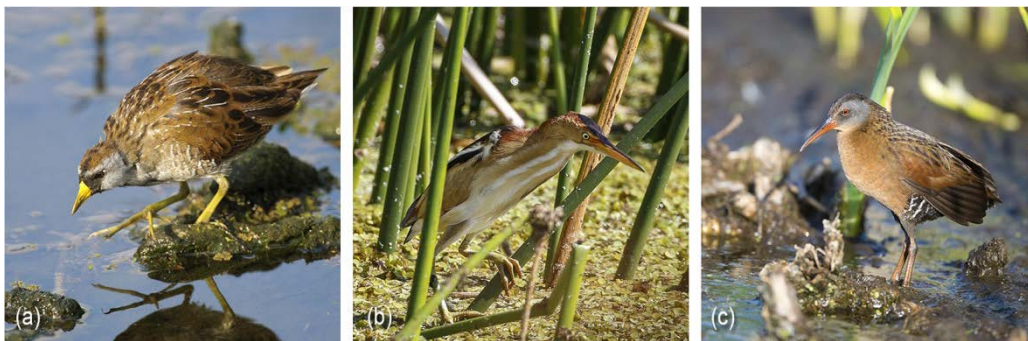
Other species such as the northern harrier, great egret, and yellow-bellied sapsucker are migrants, winter residents, or casual visitors and are not known to nest on the reservation. The golden-winged warbler, listed by the state as in need of management, was sighted once (in May 1998) on the reservation, as was the Lincoln's sparrow (*Melospiza lincolni*, in May 2014, no listed status). Barn owls have been known to nest on the reservation in the past and are still occasionally seen on the reservation.



Source: Jason Richards, ORNL photographer

Figure 1.4. Bald eagle nest on the Oak Ridge Reservation

With many northern lakes freezing solid during the winter of 2013–2014, white-winged scoters (*Melanitta fusca*) and red-necked grebes (*Podiceps grisegena*) made rare appearances in East Tennessee in February and March of 2014, though they were recorded locally only on boundary waters of the reservation. Other uncommon birds for ORR have been recorded in recent years, including several species associated with wetland habitats. The sora, least bittern, and Virginia rail (Figure 1.5) were all observed at the K1007 P1 pond at ETPP in 2013, where high quality wildlife habitat has been established as a result of recent restoration efforts. The sora, seen as recently as December 2013, is considered to be a fairly common migrant throughout Tennessee but it is seldom seen on ORR. The least bittern, heard in July 2012 and then again in May and July of 2013, is an uncommon migrant and summer resident in Tennessee. The Virginia rail, most recently observed in October 2013, was previously known only from historic (early 1950s) records on ORR (Roy et al. 2014). All three species have been listed by FWS as of management concern, and the least bittern is also deemed in need of management by the State of Tennessee as shown in Table 1.1.



Source: Stock images courtesy of iStock.

Figure 1.5. Interesting bird species sighted on the Oak Ridge Reservation in recent years: (a) sora, (b) least bittern, and (c) Virginia rail

One species of fish, the spotfin chub (*Erimonax monachus*), which is listed as threatened by both the state and the federal government, has been sighted and collected in the city of Oak Ridge and may be present on ORR. The tangerine darter (*Percina aurantiaca*), a species listed by the state as in need of management, has also been recorded in close proximity to 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 being in need of management, has been found in the Bear Creek watershed, tributaries to the lower East Fork watershed, and Ish Creek and may occur in some sections of Grassy Creek upstream of Scientific Ecology Group, Inc., and International Technology Corporation at Clinch River kilometer 23 (e.g., south of west Bear Creek Road near Grassy Creek sampling point 1.9).

1.3.6.3 Threatened and Endangered Plants

Four plant species currently known to be on ORR (spreading false foxglove, Appalachian bugbane, tall larkspur, and butternut) have been under review for listing at the federal level and were listed under the formerly used C2 candidate designation. These species are now informally referred to by FWS as special concern species.

Seventeen plant species occurring on ORR are listed by the state as endangered, threatened, or of special concern; these are listed in Table 1.2. (Note that Appalachian bugbane is no longer listed by Tennessee and does not have official federal status; therefore, it does not appear in Table 1.2.) An additional 10 threatened, endangered, or special concern species are known to occur in the area and, although currently unconfirmed on ORR, have the potential to be present; these are also included in Table 1.2. Other plant populations are currently under study on ORR, which may lead to future additions to the table.

The Tennessee Heritage Program scientific advisory committee met in 2012 to revise the state's Rare Plant List. Those changes are now official. This has reduced the number of state-protected species on ORR by six. The protection of these six species on ORR was a factor in their delisting.

Table 1.2. Vascular plant species listed by state or federal agencies and sighted/reported on or near the Oak Ridge Reservation, 2017

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

^aStatus codes:

CE = Status due to commercial exploitation

E = Endangered in Tennessee

FSC = Federal Special Concern; formerly designated as C2.

See Federal Register, February 28, 1996.

S = Special concern in Tennessee

T = Threatened in Tennessee

^bRamps 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. Both species of ramps have the same state status.

Acronyms: ORR = Oak Ridge Reservation

1.3.6.4 Historical and Cultural Resources

Efforts continue to preserve ORR's rich prehistoric and historic cultural resources. Compliance with the National Historic Preservation Act at ETPP is achieved and maintained in conjunction with National Environmental Policy Act (NEPA) compliance. The scope of proposed actions is reviewed in accordance with the ORR cultural resource management plan (Souza et al. 2001). ETPP has 135 facilities that were eligible for inclusion on the National Register of Historic Places (NRHP), a National Park Service program to identify, evaluate, and protect historic and archeological resources in the US, as well as numerous facilities that were not eligible for inclusion on the NRHP. More than 800 facilities have been demolished to date. Artifacts of historical or cultural significance are identified before demolition and are catalogued in a database to aid in the historic interpretation of ETPP. The reservation contains more than 45 known prehistoric sites (primarily burial mounds and archeological evidence of former structures), more than 250 historic pre-World War II structures, 32 cemeteries, and several historically significant Manhattan Project-era structures.

The National Defense Authorization Act of 2015, passed by Congress and signed into law December 19, 2014, included provisions authorizing the Manhattan Project National Historical Park. On November 10, 2015, the Manhattan Project National Historical Park was established with the execution of an agreement by the Secretaries of Energy and Interior. The Park includes facilities and lands in Los Alamos, New Mexico and Hanford, Washington, as well as Oak Ridge. 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 ETPP.

The X-10 Graphite Reactor building has been registered with the NRHP since 1966, and has been open for public access in various ways since that time. Enhancing access and improving the visitor experience are two of DOE's objectives moving forward in implementing the National Park.

Although Buildings 9731 and 9204-3 at the Y-12 National Security Complex were eligible for listing on the NRHP in 2017, at present neither is available for regular public access. Irregular public access to both facilities occurred as recently as Nov. 12, 2015, when DOE facilitated public tours to both buildings to celebrate the establishment of the National Park. Enhancing safe access to these buildings while protecting DOE's mission capabilities is a DOE objective in implementing the National Park.

The K-25 Building site is already undergoing extensive historic interpretation activities implemented separately and independently of the National Park. Enabling safe access to the former site of the K-25 Building is among DOE's objectives in moving forward with the implementation of the National Park. As part of the activities to establish the Park, DOE released the K-25 Virtual Museum, which details the history of the K-25 Gaseous Diffusion Plant through narrative and photographs and can be found [here](#).

Seven historic ORR properties are individually listed in the NRHP:

- Freels Bend Cabin
- Graphite Reactor
- 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 not yet listed in the NRHP, an area known as the Wheat Community African Burial Grounds was dedicated in June 2000, and a memorial monument was erected.

A memorandum of agreement for the interpretation of historic properties at ETTP was signed in 2012 by 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. The memorandum of agreement is being implemented through planning for a museum that will highlight the historic aspects of ETTP and of the communities that were displaced during the construction of the site. During 2017, ETTP continued to operate under site-level, site-specific procedures that include requirements for project reviews and NEPA compliance. These procedures call for a review of each proposed project, activity, or facility to determine the potential for impacts to the environment. To streamline the NEPA review and documentation process, DOE Oak Ridge Office has approved generic categorical exclusion determinations that cover certain proposed activities (i.e., maintenance activities, facility upgrades, and personnel safety enhancements). A categorical exclusion is one of a category of actions defined in 40 Code of Federal Regulations (CFR) Part 1508.4 that does not individually or cumulatively have a significant effect on the human environment and for which neither an environmental assessment nor an environmental impact statement is normally required.

URS | CH2M Oak Ridge, LLC (UCOR) activities on ORR are in full compliance with NEPA requirements, and procedures for implementing NEPA requirements have been fully developed and implemented. At ETTP a checklist incorporating NEPA and environmental management system requirements has been developed to aid project planners. DOE generic categorical exclusion determinations are used for routine, recurring activities. Details are provided in Chapter 3, Sections 3.3.4 and 3.8.2.

The final memorandum of agreement signed in November 2012 finalized the aspects set forth in the mitigation plan. During 2013, a request for proposals was issued for a professional design team and a museum professional as specified in the memorandum of agreement. Nine firms were prequalified, and the selection and award were executed on April 1, 2014. The procurement process for the K-25 Virtual Museum web design firm was also begun in 2013 and a contract was awarded on September 2, 2014. The K-25 Virtual Museum website referenced on the previous page was launched in conjunction with the signing of the memorandum of agreement. No new categorical exclusion determinations for activities at ETTP were issued by DOE in 2017.

The Historic American Engineering Record documentation for the K-1037 Barrier Plant was completed and approved by the National Park Service in May 2017. The Historic American Engineering Record documentation for the K-25 Building is being prepared for transmittal to the National Park Service.

Two site-wide programmatic agreements among the DOE Oak Ridge Office, the State Historic Preservation Officer, and the Advisory Council on Historic Preservation concerning management of historical and cultural properties at ORNL and at Y-12 have been enforced since their respective approvals.

1.4 Oak Ridge Sites

The Oak Ridge Reservation includes a number of sites critical to the mission of DOE. Eight of these sites, including the Oak Ridge National Laboratory, the Y-12 National Security Complex, the East Tennessee Technology Park, the Environmental Management Waste Management Facility, the Oak Ridge Environmental Research Park, the Oak Ridge Institute for Science and Education, the National Nuclear Security Administration Office of Secure Transportation Agent Operations Eastern Command, and the Transuranic Waste Processing Center Sludge Buildout Facility, are described in the following sections.

1.4.1 Oak Ridge National Laboratory

ORNL (shown in Figure 1.6) is managed for DOE by UT-Battelle, LLC, a partnership of the University of Tennessee and Battelle Memorial Institute. It is the largest science and energy national laboratory in the DOE system, conducting 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 Summit 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 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 there are about 4,400 workers at ORNL, and the laboratory's extensive capabilities for scientific discovery and innovation are applied to the delivery of mission outcomes for DOE and other sponsors.



Figure 1.6. Aerial view of the Oak Ridge National Laboratory

During fiscal year 2017, DOE remained focused on disposing of a significant inventory of ^{233}U stored in Building 3019 at ORNL. This special nuclear material requires strict safeguards and security controls to protect against access. The objectives of the ^{233}U Project are to address safeguards and security requirements, eliminate safety and nuclear criticality concerns, and safely dispose of the material. In 2015 DOE successfully resolved the concerns associated with the disposition of the Consolidated Edison Uranium Solidification Project material, which originated from a 1960s research and development test of

thorium and uranium fuel at Consolidated Edison's Indian Point 1 Nuclear Plant in New York. Isotek Systems, LLC manages activities at the Building 3019 complex for DOE and is responsible for activities associated with processing, down-blending, and packaging the DOE inventory of ^{233}U stored in the complex. As of November 2017, all shipments of ^{233}U stored in Building 3019 had been shipped to the National Nuclear Security Site.

UCOR is the DOE ORR cleanup contractor. The scope of UCOR activities at ORNL includes long-term surveillance, maintenance, and management of inactive waste disposal sites, structures, and buildings such as former reactors and isotope production facilities. Other activities include groundwater monitoring, transuranic waste storage, and operation of the liquid low-level and process waste systems and the off-gas collection and treatment system.

1.4.2 Y-12 National Security Complex

The Y-12 Complex (shown in Figure 1.7) 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.



Figure 1.7. Aerial view of the Y-12 National Security Complex

Today, as part of the NNSA Nuclear Security Enterprise, the Y-12 Complex 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 is a leader in materials science and precision manufacturing and serves as the main storage facility for the nation's supply of enriched uranium. The Y-12 Complex also supports efforts

to reduce the risk of nuclear proliferation and performs complementary work for other government agencies.

UCOR is the DOE ORR cleanup contractor responsible for mercury remediation at the Y-12 Complex. In December 2017, UCOR issued the *Construction Execution and Management Plan for the Outfall 200 Mercury Treatment Facility at the Y-12 Nuclear Security Complex, Oak Ridge, Tennessee*. The goal of the Mercury Treatment Facility is to reduce the mercury concentration in water exiting the Y-12 Complex. Outfall 200 is the point at which the west end Y-12 storm drain system discharges to Upper East Fork Poplar Creek, and mercury from historical operations is present in the Outfall 200 storm water entering Poplar Creek. In support of mercury cleanup efforts, research and technology development activities focused on the major factors influencing the accumulation of mercury in fish, which are the major route of both human and wildlife exposure. Three lines of investigation for East Fork Poplar Creek were developed: to examine potential downstream sources such as bank soil and sediment control, to study the ecology and investigate how differences in food chain processes may influence the uptake of mercury in fish, and to investigate the water chemistry and flow characteristics of the creek and their influence. Also in 2017, UCOR awarded a contract to GEM Technologies to perform work for the new Outfall 200 Mercury Treatment Facility at Y-12.

At the end of fiscal year 2017, the Y-12 Complex had achieved seven of its 14 established targets; the remaining targets were carried into future years. Overall, 17 actions were completed through September 2017. Highlights include the following; additional details and successes are presented in other sections of this report.

- **Clean Air:** The Y-12 Complex finalized the evaluation of its uranium monitored-stack infrastructure to identify refurbishment needs for continued safe and compliant operations. Significant progress was made in obtaining a new Title V air permit.
- **Energy Efficiency:** Implementation of five Energy Savings Performance Contract energy conservation measures began in fiscal year 2014 for projects to improve lighting, chilled water, air compressors, and the Y-12 Complex steam system. All five projects were completed in 2017. Significant progress was made on the effort to obtain Leadership in Energy and Environmental Design (LEED) certification on the Uranium Processing Facility Construction Support Building. A Silver Certification was awarded, with the additional credit points required for obtaining a Gold Certification pending occupancy.
- **Hazardous Materials:** A project to improve controls for intermodal storage containers was substantially implemented in 2017, and the contents of more than half of the 128 excess intermodal containers were disposed of or dispositioned. A project to disposition and ship nine items of legacy mixed waste per Site Treatment Plan milestones was completed in 2017.
- **Reduce/Reuse/Recycle/Buy Green:** The Y-12 Complex completed a project to strengthen the site-wide procedure for handling universal waste in 2017, and began a project to install a drum crusher in one facility to greatly reduce the quantity of empty drum waste.

The Mercury Treatment Facility is being designed to treat up to 3,000 gallons of storm water per minute. It includes a 2 million gallon storage tank to collect storm water during peak flow conditions of up to 40,000 gallons per minute, and then treat the stored water after storm flow subsides. Captured storm water will be piped to a treatment facility located on an available site east of Outfall 200. Mercury treatment will be accomplished using chemical precipitation, clarification, and media filtration. Treated water will be discharged back into Upper East Fork Poplar Creek. The design of the Outfall 200 Mercury Treatment Facility incorporates flexibility, and treatment processes for mercury can be expanded if required in the future. Y-12 treated 115 million gallons of wastewater during fiscal year 2017.

Understanding the movement of mercury in the East Fork Poplar Creek system was deemed essential to the development of new technologies and ultimately to the development of remedial options and strategies for the creek. Early studies have pointed to the importance of bank soils and sediments as a source of mercury to the creek, especially during high-flow events. Research is under way to examine potential technologies that may limit mercury erosion. Stream management changes—such as controlling nutrients or algae growth or managing fish populations—are also under investigation. A March 2015 report titled *Mercury Remediation Technology Development for Lower East Fork Poplar Creek* (ORNL 2014) offered science-based approaches and ideas for research and technology development activities that may lead to new mercury remediation projects.

1.4.3 East Tennessee Technology Park

What is now known as ETTP (see Figure 1.8), and was originally named K-25, is the site of the nation's first gaseous diffusion plant for enriching uranium as part of the Manhattan Project. Additional uranium enrichment facilities K-29, K-31, and K-33 were built adjacent to K-25 during the Cold War, forming a complex officially known as the Oak Ridge Gaseous Diffusion Plant. Uranium enrichment operations at the site ceased in 1987, and restoration and 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. Today restoration of the environment, decontamination and decommissioning of facilities, disposition of wastes, and reindustrialization are the major activities at the site.



Figure 1.8. Aerial view of East Tennessee Technology Park

During 2017, ETTP landlord contractor functions and the majority of the ETTP cleanup program actions were managed by UCOR. ETTP had no reportable releases of hazardous substances or extremely hazardous substances, as defined by the Emergency Planning and Community Right-to-Know Act of 1986, in 2017. As of the end of 2017 all debris and the concrete pad of the final demolished gaseous diffusion building had been removed. The annualized levels of chromium and lead during 2017 were below the indicated annual standards. The K-1423 Repacking Facility, which was once used to store polychlorinated biphenyls (PCBs) and was in standby status, was officially closed in 2017. One noncompliance occurred in 2017 when an unknown volume of sanitary wastewater was potentially discharged to Mitchell Branch via Outfall 210. However, no regulatory issues were encountered in fiscal

year 2017 during two separate TDEC site visits, and no regulatory issues were identified during two separate Contracting Officer's Representative assessments and inspections.

In 2017 a proposed plan to build an airport on the ETTP site reached a major milestone with the completion of a master plan, which was submitted to the Federal Aviation Administration for approval. Metropolitan Knoxville Airport Authority is leading the project.

1.4.4 Environmental Management Waste Management Facility

The Environmental Waste Management Facility, or EMWMF (shown in Figure 1.9), is located in eastern Bear Creek Valley near the Y-12 Complex and is managed by UCOR. EMWMF was built for the disposal of waste resulting from Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup actions on ORR. The original design was for the construction, operation, and closure of a projected 1.3 million m³ (1.7 million yd³) disposal facility. The approved capacity was subsequently increased to 1.8 million m³ (2.4 million yd³) to maximize use of the footprint designated in a 1999 record of decision. The facility currently consists of six disposal cells. EMWMF will reach its capacity before the Oak Ridge Office of Environmental Management completes its cleanup at Y-12 and ORNL. Planning continued throughout fiscal year 2017 for a new facility, the Environmental Management Disposal Facility, that will provide the additional disposal capacity needed to complete the cleanup at Oak Ridge.

During fiscal year 2017 the EMWMF received 5,309 waste shipments, accounting for 71,534 tons, from cleanup projects at ETTP, ORNL, and Y-12.



Figure 1.9. Aerial view of the Environmental Management Waste Management Facility

EMWMF is an engineered landfill that accepts low-level, mixed low-level, and hazardous wastes from CERCLA cleanup activities on the DOE 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, EMWMF operates a leachate collection system. In fiscal year 2017 the facility collected, analyzed, and disposed of approximately 4.46 million gallons of leachate. The leachate is treated at the ORNL Liquids and Gaseous Treatment Facility, which is also operated by UCOR.

1.4.5 Oak Ridge Environmental Research Park

In 1980 DOE established the Oak Ridge Environmental Research Park (see Figure 1.10) managed for DOE by UT-Battelle, which serves as an outdoor laboratory to evaluate the environmental consequences of energy use and development and the strategies to mitigate those effects. It contains large blocks of forest and diverse communities of vegetation that 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, sustainable development, tropospheric air quality, global climate change, innovative power conductors, solar radiation monitoring, ecological recovery, and monitoring and remediation.

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 precisely and accurately measure environmental factors for extended periods of time. Because the park is under the jurisdiction of the federal government, public access is restricted and experimental sites and associated equipment are therefore not disturbed.

National recognition of the value of the research park has led to its use as a component of both regional- and continental-scale research projects. Various 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.

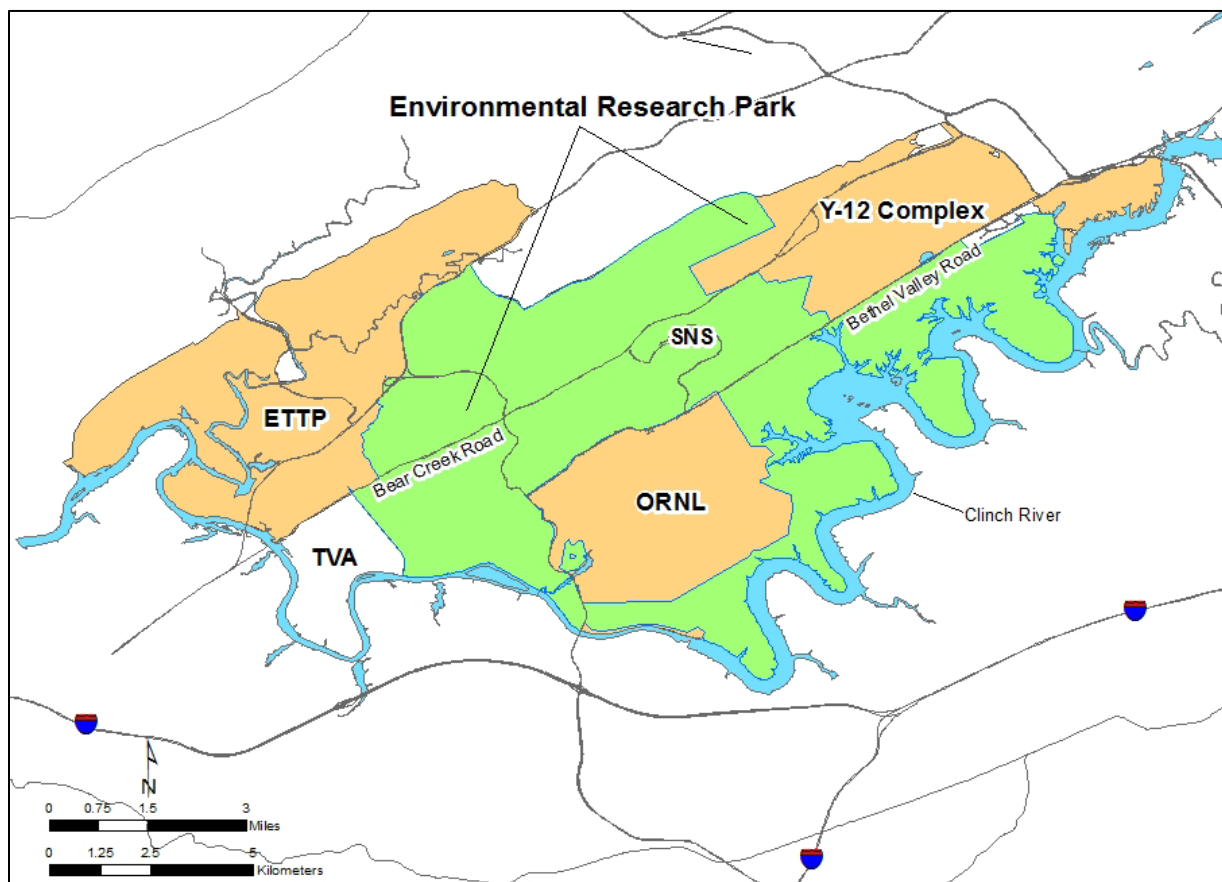


Figure 1.10. Location of the Oak Ridge Environmental Research Park

1.4.6 Oak Ridge Institute for Science and Education

The Oak Ridge Institute for Science and Education (ORISE) is managed for DOE by Oak Ridge Associated Universities. The ORISE mission is to develop people and solutions to strengthen our nation's competitive advantage in science. ORISE accomplishes their 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 US 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.

ORISE is in an area on the southeastern border of ORR that was part of an agricultural experiment station owned by the federal government from the late 1940s to the mid-1980s and, until 1981, was operated by the University of Tennessee. The site houses offices, laboratories, and storage areas for ORISE program offices and support departments.

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 (OST).

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

1.4.8 TWPC Sludge Buildout Facility

The Transuranic Waste Processing Center (TWPC) is located on an approximately 10.5 ha (26 acre) tract of land in the Melton Valley area of ORNL about 120 feet west of the existing Melton Valley Storage Tanks. North Wind Solutions, LLC manages the TWPC for DOE. TWPC's mission is to receive transuranic waste for processing, treatment, repackaging, and shipment to DOE's Waste Isolation Pilot Plant near Carlsbad, New Mexico.

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 Nevada National Security Site or other approved facilities.

Key progress for the project during fiscal year 2017 included the following actions:

- Released a request for information to potential vendors for the sludge mobilization system.
- Completed initial development of a design package for the Sludge Test Area, design of the density test element skid, and the specification package for offsite vendor testing of the slurry mixing and characterization tanks and measurement system. These were issued to the Oak Ridge Office of Environmental Management for review.
- Completed process chemistry modeling and issued a Chemistry Modeling Report (calculation) to support an update of the Integrated Systems Test Plan.
- Conducted quarterly Safety Design Integration Team meetings.

1.5 References

- Birdwell, Kevin Ray 2011. *Wind Regimes in Complex Terrain of the Great Valley of Eastern Tennessee*. PhD dissertation, University of Tennessee, May 2011.
- DOE 2012. *Environment, Safety, and Health Reporting*. DOE O 231.1B. Approved: 06-27-11. US Department of Energy, Washington, DC.
- DOE-FWS 2013. “Memorandum of Understanding between the United States Department of Energy and the United States Fish and Wildlife Service Regarding Implementation of Executive Order 13186, ‘Responsibilities of Federal Agencies to Protect Migratory Birds’.” US Department of Energy and US Fish and Wildlife Service, Washington, DC; available online at <http://energy.gov/sites/prod/files/2013/10/f3/Final%20DOE-FWS%20Migratory%20Bird%20MOU.pdf>.
- McCracken, M.K., N.R. Giffen, A.M. Haines, and J.W. Evans 2015. *Bat Species Distribution on the Oak Ridge Reservation*. ORNL/TM-2015/248, Oak Ridge National Laboratory, Oak Ridge, Tennessee. (Note: Draft report; contact author for access.)
- NOAA 2011. *Annual 2011 Local Climatological Data Report for Oak Ridge, Tennessee (Site KOQT)*. Published by the National Oceanic and Atmospheric Administration National Climatic Data Center, Asheville, North Carolina.
- ORNL 2014. *Mercury Remediation Technology Development for Lower East Fork Poplar Creek*. ORNL/SPR-2014/645, Oak Ridge National Laboratory, Oak Ridge, Tennessee.
- Parr, P.D. and J.F. Hughes 2006. *Oak Ridge Reservation Physical Characteristics and Natural Resources*. ORNL/TM-2006/110, Oak Ridge National Laboratory, Oak Ridge, Tennessee.
- Rosensteel, Barbara A. 1996. *Wetland Survey of the X-10 Bethel Valley and Melton Valley Groundwater Operable Units at Oak Ridge National Laboratory, Oak Ridge, Tennessee*. ORNL/ER-350, Oak Ridge National Laboratory, Oak Ridge, Tennessee.
- Rosensteel, Barbara A. 1997. *Wetland Survey of Selected Areas in the Oak Ridge Y-12 Plant Area of Responsibility, Oak Ridge, Tennessee*. Y/ER-279, Y-12 National Security Complex, Oak Ridge, Tennessee.
- Rosensteel, Barbara A. and Carl C. Trettin. 1993. *Identification and Characterization of Wetlands in the Bear Creek Watershed*. Y/TS-1016, Oak Ridge National Laboratory, Oak Ridge, Tennessee.
- Roy, W.K., N.R. Giffen, M.C. Wade, A.M. Haines, J.W. Evans, and R.T. Jett. 2014. *Oak Ridge Reservation Bird Records and Population Trends*. ORNL/TM-2014/109, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

- Souza, Peter A., Glyn D. DuVall, and Melisa J. Hart. 2001. *Cultural Resource Management Plan, DOE Oak Ridge Reservation, Anderson and Roane Counties, Tennessee*. DOE/ORO/2085. US Department of Energy, Washington, DC.
- Sullivan, B.L., C.L. Wood, M.J. Iliff, R.E. Bonney, D. Fink, and S. Kelling. 2009. “eBird: A Citizen-Based Bird Observation Network in the Biological Sciences.” *Biological Conservation* 142, 2282–2292.
- Zurawski, A. 1978. Summary Appraisals of the Nation’s Ground-Water Resources—Tennessee Region. US Geological Survey Professional Paper 813-L.