DRAFT

DOE/EA-1618

Environmental Assessment for the Oak Ridge National Laboratory Modernization Initiative Oak Ridge, Tennessee

June 2008

U. S. Department of Energy
Oak Ridge Office

08-054(E)/052808

DOE/EA-1618

Environmental Assessment for the Oak Ridge National Laboratory Modernization Initiative Oak Ridge, Tennessee

Date Issued—June 2008

Prepared for
U. S. Department of Energy
Oak Ridge Office
Oak Ridge, Tennessee

08-054(E)/052808

CONTENTS

FIGURES

TABLES

This page intentionally left blank.

ACRONYMS

ACAM	Air Conformity Applicability Model
ACM	asbestos-containing material
BJC	Bechtel Jacobs Company LLC
C&D	construction and demolition
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	*Code of Federal Regulations*
CNS	Center for Neutron Scattering
CRK	Clinch River kilometer
CROET	Community Reuse Organization of East Tennessee
D&D	decontamination and decommissioning
DBH	diameter at breast height
DOE	U. S. Department of Energy
EA	Environmental Assessment
ECM	energy conservation measure
EDE	effective dose equivalent
EIS	Environmental Impact Statement
EM	Environmental Management
EPA	U. S. Environmental Protection Agency
ES&H	environment, safety, and health
ETTP	East Tennessee Technology Park
FDDI	fiber distributed data interface
FONSI	finding of no significant impact
FRP	Facilities Revitalization Program
FY	fiscal year
HFIR	High Flux Isotope Reactor
HI	hazard index
HQ	hazard quotient
HVAC	heating, ventilating, and air conditioning
IFDP	Integrated Facility Disposition Project
LEED	Leadership in Energy and Environmental Design
LLLW	liquid low-level waste
LLW	low-level (radioactive) waste
MBR	membrane bioreactor
MCDC	Multi-Program Computational Data Center
MRF	Multi-Program Research Facility
MVST	Melton Valley Storage Tank
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NEPA	National Environmental Policy Act of 1969
NERP	National Environmental Research Park
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Office
ORR	Oak Ridge Reservation

This page intentionally left blank.

1. INTRODUCTION

1.1 PURPOSE AND NEED FOR ACTION

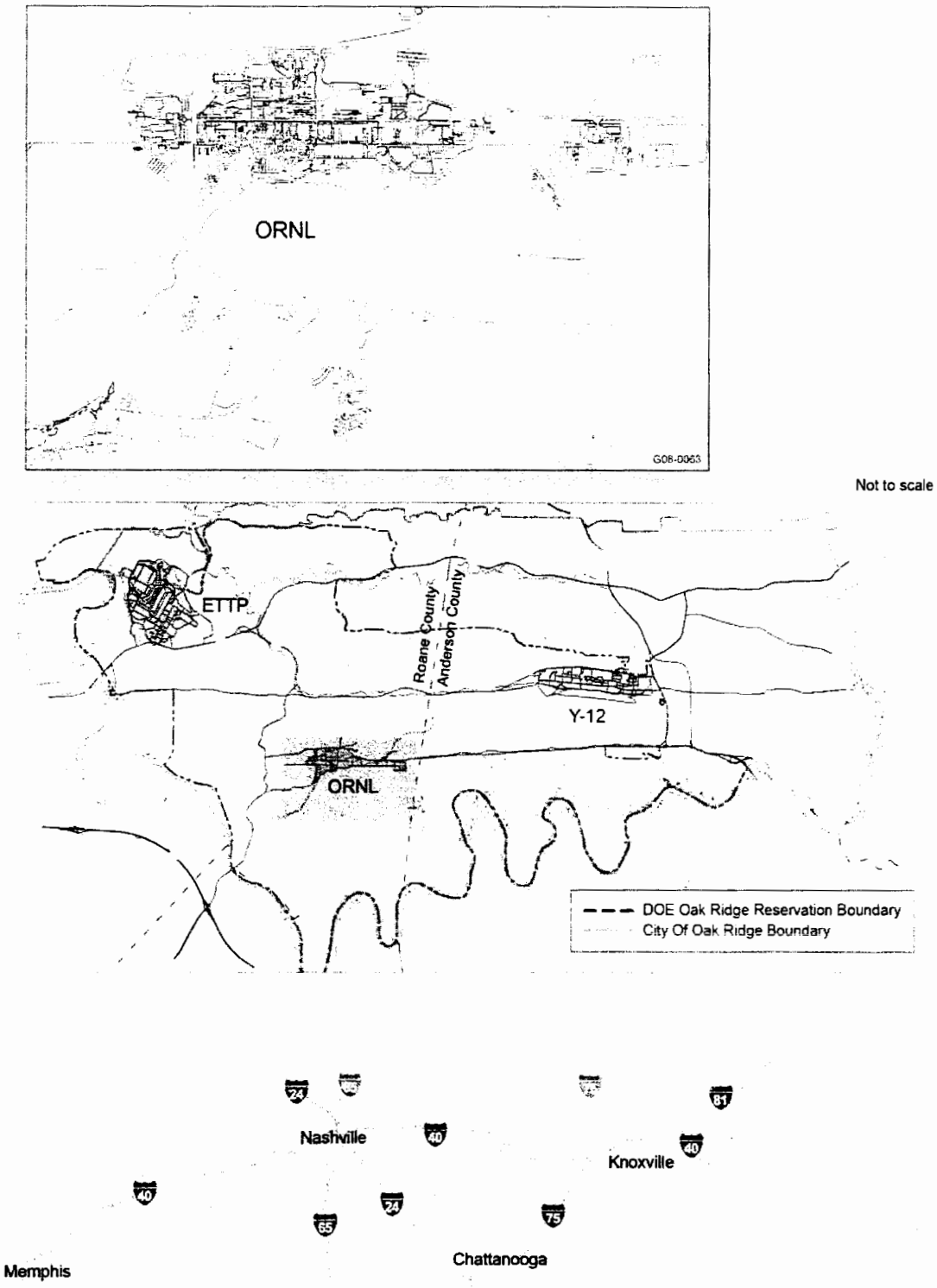
The purpose of the proposed action evaluated in this Environmental Assessment (EA) is to implement the Oak Ridge National Laboratory (ORNL) Modernization Initiative. Since 2002, ORNL has been consolidating staff on the main laboratory campus; vacating old, expensive space; and building new and refurbishing key facilities under the Facilities Revitalization Program (FRP). The Modernization Initiative would continue the construction of new facilities/infrastructure and the upgrade, replacement, or removal from service of existing facilities and infrastructure that were not part of the initial FRP or covered by the existing FRP EA (DOE/EA-1362). The proposed action would provide the facilities and infrastructure to accomplish the U. S. Department of Energy (DOE) Office of Science (SC) research mission at ORNL. The proposed action would also enhance the health and safety of workers, while reducing operating costs. Designing additional replacement buildings to industry standards and upgrading and expanding utility systems to meet growing demand would increase utilization of the DOE-SC-owned footprint. This would accommodate projected program growth and allow relocation out of the Central Campus and other facilities that are in less than "mission ready" condition.

The need for infrastructure replacement and upgrades under the proposed action is associated with the dependence of programs at ORNL upon the availability of a wide variety of facilities and equipment to accomplish the Laboratory's scientific research mission. Many of ORNL's physical facilities are old and outdated, and many are nearing the end of their useful operating life. The declining condition of facilities increases overhead costs due to additional controls required to ensure worker safety, high energy consumption, increased maintenance requirements, and research inefficiencies. The continued success of existing research programs, as well as newer ones (e.g., National Security and Computational Sciences Programs), is dependent upon the research facilities remaining current with constant advances in technology. New, specialized space for offices, laboratories, and equipment are required in addition to upgrades and expansion of current facilities. ORNL also seeks to reduce utility costs and improve efficiency as a result of the proposed action.

1.2 BACKGROUND

ORNL, located on the DOE Oak Ridge Reservation (ORR), is DOE's largest science and energy laboratory (Fig. 1.1). Managed since April 2000 by a partnership of the University of Tennessee (UT) and Battelle, ORNL was established in 1943 as a part of the secret Manhattan Project to pioneer a method for producing and separating plutonium. During the 1950s and 1960s, ORNL became an international center for the study of nuclear energy and related research in the physical and life sciences. With the creation of DOE in the 1970s, ORNL's mission broadened to include a variety of energy technologies and strategies. Today, the laboratory supports the nation with a peacetime science and technology mission that is just as important as, but very different from, its role during the Manhattan Project.

ORNL has a staff of more than 4,200 and annually hosts approximately 3,000 guest researchers who spend 2 weeks or longer in Oak Ridge, Tennessee. Annual funding exceeds $1.2 billion. As an international leader in a range of scientific areas that support the DOE mission, ORNL has six major mission roles: neutron science, energy, high-performance computing, systems biology, materials science at the nanoscale, and national security. ORNL's leadership role in the nation's energy future includes hosting the United States project office for the ITER international fusion experiment and the SC-sponsored Bioenergy Science Center.



1

Fig. 1.1. The Oak Ridge Reservation and location of the Oak Ridge National Laboratory.

In 2000, the DOE Oak Ridge Office (DOE-ORO) authorized the FRP as one of the high-priority initiatives of the new UT-Battelle management and operating contract. The program utilized a combination of DOE, state of Tennessee, and private sector funding to accomplish near-term revitalization goals. The project was assessed in the *Final Environmental Assessment for the Oak Ridge National Laboratory Facilities Revitalization Project* (DOE/EA-1362); a Finding of No Significant Impact (FONSI) was issued in June 2001. The FRP strategy was and continues to include: (1) consolidate staff on the main site; (2) vacate old, expensive space; and (3) build new and refurbish key facilities. Since fiscal year (FY) 2000, approximately 1.9 million ft^2 have been vacated, 1.0 million ft^2 have been constructed, and the average age of buildings decreased by 10 years. Over one-half of the site population work is in facilities that were constructed or renovated within the last 7 years. Also, over 15% of ORNL's square footage is Leadership in Energy and Environmental Design (LEED) certified.

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

This EA presents information on the potential impacts associated with the ORNL Modernization Initiative that may occur over the next 10 years. DOE has prepared this EA to assess the potential consequences of its activities on the human environment in accordance with the Council on Environmental Quality (CEQ) regulations [40 *Code of Federal Regulations* (*CFR*) Parts 1500–1508] implementing National Environmental Policy Act of 1969 (NEPA) and DOE NEPA Implementing Procedures (10 *CFR* 1021). If the impacts associated with the proposed action are not identified as significant as a result of this EA, DOE shall issue a FONSI and will proceed with the action. If impacts are identified as potentially significant, an Environmental Impact Statement (EIS) will be prepared.

This EA: (1) describes the affected environment relevant to potential impacts of the proposed action and alternatives; (2) analyzes potential environmental impacts that could result from the proposed action; (3) identifies and characterizes cumulative impacts that could result from the proposed action in relation to other on-going or proposed activities within the surrounding area; and (4) provides DOE with environmental information for use in prescribing restrictions to protect, preserve, and enhance the human environment and natural ecosystems.

The proposed action does not include changes to the existing research missions or process operations. Therefore, process operations for research missions are not the focus of this evaluation and are only discussed if potentially affected by changes to the facilities. Actions addressed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), such as environmental restoration and decontamination and decommissioning (D&D), as well as actions that have already been reviewed or will be reviewed under separate NEPA documentation, are not within the scope of this EA.

Conservative estimates were used to bound the analysis of potential impacts since the exact footprints of the new facilities and the associated infrastructure construction are not known. General locations and areas, identified for facility siting, were evaluated and, as long as the actual construction footprint falls within these areas, the analysis of potential impacts would be bounded. To ensure that activities associated with the proposed action fall within the bounding analysis in this EA, DOE would review each specific project activity associated with the ORNL Modernization Initiative as planning progresses. If changes or additions to the project fall outside the bounds of the analysis conducted in this EA, including locating facilities in areas that were not evaluated, DOE would determine the appropriate level of additional review that would be required prior to implementation.

Certain aspects of the proposed action have a greater potential for creating adverse environmental impacts than others. For this reason, CEQ regulations (40 *CFR* 1502.1 and 1502.2) recommend a "sliding-scale" approach so that those actions with greater potential effect can be discussed in greater

detail in NEPA documents than those that have little potential for impact. Issues with minimal or no impacts were identified through a preliminary screening process. The following describes the issues that were not carried forward for a detailed analysis and the rationale associated with their elimination.

Geology. Minimal effects to underlying geological resources would be anticipated because low geological impact foundations (e.g., shallow footings, micro piles, etc.) would typically be used to minimize excavation. Activities associated with most of the proposed actions would occur within previously disturbed areas, which are currently used for industrial applications. Hazards posed by geological conditions are expected to be minor. Bedrock at ORNL is adequate to support structures using standard construction techniques.

Groundwater. Groundwater use for operations within the new facilities would be prohibited, but it is possible that sumps could be needed to collect groundwater intrusion into a building. However, no impacts to groundwater are anticipated. Sanitary wastewater from new or existing facilities would be discharged to the ORNL sewage treatment plant (STP) and would be required to meet the STP flow and waste acceptance criteria. Process wastewater would be contained and either transported off-site to a commercial treatment facility or to the ORNL Process Wastewater Treatment Complex (PWTC). Therefore, no impacts to groundwater are anticipated from normal facility operations. Groundwater monitoring is conducted at selected areas of ORNL for various purposes, including DOE environmental surveillance, Water Resources Restoration Program, plume monitoring, and research projects. Groundwater monitoring wells are present in some areas of the ORNL Modernization Initiative. Care would be taken to avoid removal or damage to these wells during construction activities. The ORNL Environmental Protection and Waste Services Division would be contacted should questions arise regarding existing monitoring wells.

Noise. Construction noise would cause a temporary and short-term increase to the ambient sound environment. Workers associated with the construction activities would be expected to wear appropriate hearing protection as required by the Occupational Safety and Health Administration (OSHA). Construction activities would be occurring in active industrialized areas and there are no sensitive receptors located within the vicinity of the construction projects. As a result, noise would have no adverse effects.

Environmental Justice. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations," requires federal agencies to identify community issues of concern during the NEPA process, particularly those issues relating to decisions that may have an impact on low-income or minority populations. The construction and operational activities proposed would occur within established areas of the ORR and would not affect communities outside the ORR in any appreciable manner, including low-income or minority populations. Therefore, DOE does not anticipate impacts associated with environmental justice from implementation of the proposed action.

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

DOE proposes to utilize a combination of DOE, state of Tennessee, and private sector funds to upgrade and to construct new facilities at ORNL including, but not limited to, offices, laboratories, and maintenance and support facilities. Construction of new buildings and associated infrastructure would take place at various locations within the ORNL complex in Bethel Valley including the West and Central Campus areas, the 7000 Area, and at sites located in the 7900 Area of Melton Valley. Figure 2.1 shows the general locations of the new facilities and infrastructure improvements that would be constructed as part of the ORNL Modernization Initiative. The scope of the proposed action would also include relocation of personnel and equipment. Development under the ORNL Modernization Initiative would be implemented using a phased build-out approach, and a master land-use plan would guide a campus-like environment of facilities consistent with other new development occurring at ORNL. The ORNL Modernization Initiative would also be coordinated and integrated with environmental cleanup activities under the DOE Office of Environmental Management's (EM's) Integrated Facility Disposition Project (IFDP).

Accomplishing the Modernization Initiative in the timeframe proposed would require resources beyond those normally provided by DOE capital construction programs and a funding arrangement similar to what was used for the FRP is proposed. To accomplish this, both private sector and state of Tennessee funds would be incorporated into an integrated construction plan, along with available DOE Line Item, General Plant Project, and Institutional General Plant Project funds. A key component of this approach is the possible transfer of land ownership from DOE to allow for construction of buildings by the state and the private sector. After construction, the facilities would be used for DOE-related mission activities and operated under DOE rules and conditions. This approach would also focus DOE capital funding on capabilities that are not likely to be financially or technically feasible by third parties, use state funds for the type of shared scientific facilities appropriate for collaborative research, and use private sector construction for light laboratory and office support need that accompany research efforts.

Common ground disturbance activities for the new construction would include: (1) placement and compaction of earth backfill to establish the required building elevations, (2) excavation for the installation of concrete foundations/footings, and (3) belowground utility connections. Construction activities would also include asphalt-paved parking lots, vehicle access roads, and concrete pedestrian walkways. Where necessary, temporary fencing would be installed during construction activities.

2.1.1 New Facility Construction and Utility Infrastructure Improvements

The proposed action would involve construction of new facilities in Melton and Bethel Valleys and the implementation of two major utility infrastructure improvements. Table 2.1 provides a summary of these facilities and improvements along with the facility type, approximate square footage, and general location.

Bethel Valley Facilities

Multi-Program Computational Data Center (MCDC). The MCDC is planned to support computational data processing needs and would be developed on land located east of the 7000 Area (Fig. 2.2). The buildings would have approximately 260,000 ft^2 of space for computer rooms and general purpose office and support services. Electrical substations and chilled water systems to support the computational power demands would be located near the facility as part of the project.

This page intentionally left blank.

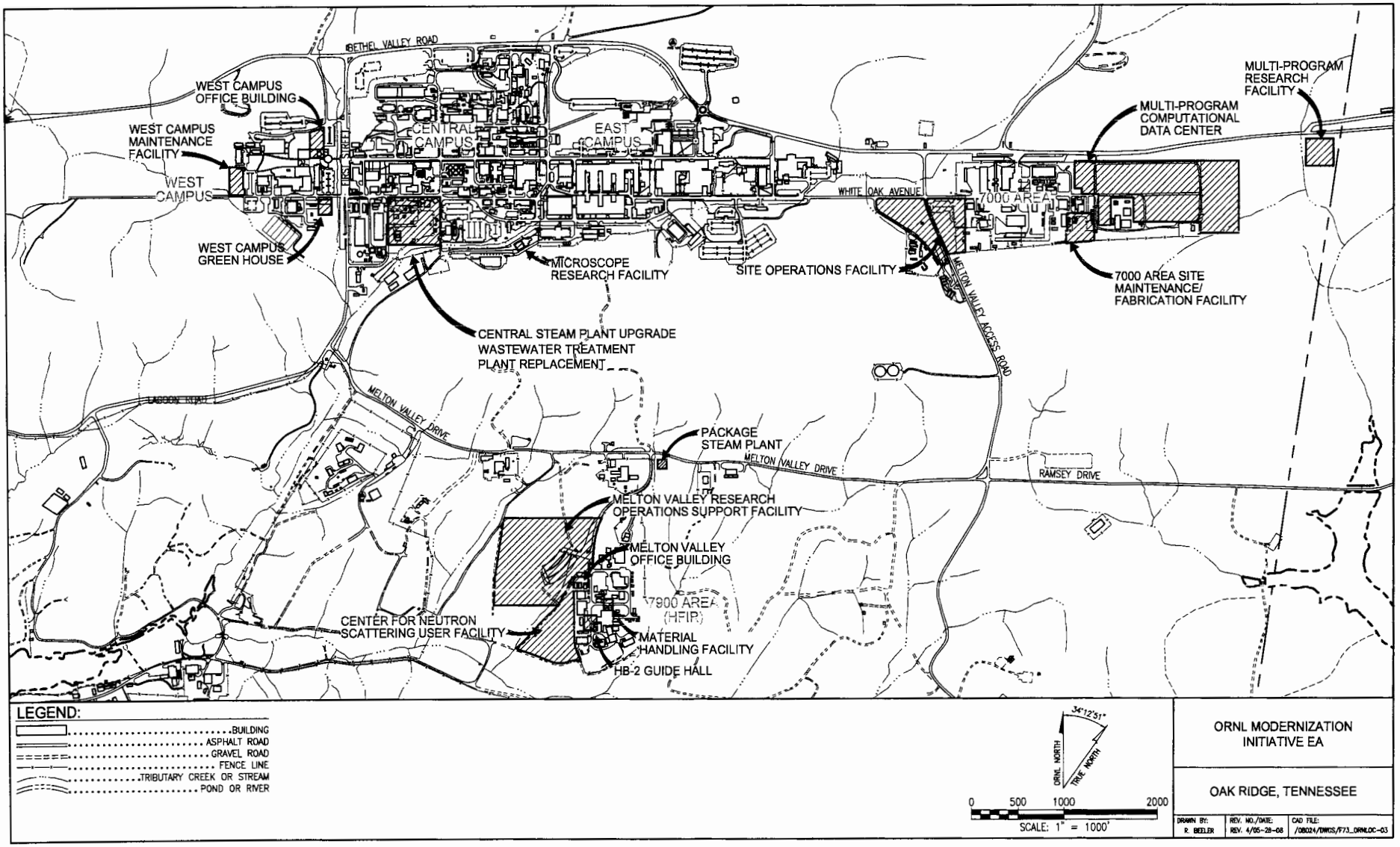


Fig. 2.1. Location of the ORNL Modernization Initiative Project areas.

Table 2.1. New facilities and utility infrastructure improvements

Facility name	Facility type	Approximate square footage	Location
Multi-Program Computational Data Center	Research	260,000	Bethel Valley (7000 Area)
Multi-Program Research Center-2	Research/Training	214,000	Bethel Valley (East of 7000 Area)
7000 Area Site Maintenance/Fabrication Facility	Maintenance/Fabrication	100,000	Bethel Valley (7000 Area)
Site Operations Facility	Security/Emergency Response	75,000	Bethel Valley (7000 Area)
Microscope Research Facility	Research	7,000	Bethel Valley (Central Campus)
West Campus Greenhouse	Research	10,000	Bethel Valley (West Campus)
West Campus Maintenance Facility	Maintenance	30,000	Bethel Valley (West Campus)
West Campus Office Building	Offices	30,000	Bethel Valley (West Campus)
ORNL Wastewater Treatment Plant	Industrial – Utility Infrastructure		Bethel Valley (Central Campus)
HB-2 Guide Hall	Research	40,000	Melton Valley (HFIR)
Material Handling Facility	Industrial	10,000	Melton Valley (HFIR)
Center for Neutron Scattering User Facility	Research/Offices	50,500	Melton Valley (7900 Area)
Research Operations Support Facility	Maintenance/Operations	80,000	Melton Valley (7900 Area)
Melton Valley Office Building	Offices	15,000	Melton Valley (7900 Area)
Steam Plant Upgrade	Industrial – Utility Infrastructure	26,000	Bethel Valley (Central Campus)
Select Steam Decentralization of Remote Buildings	Utility Infrastructure		Bethel Valley and Melton Valley
Package Steam Plant	Industrial – Utility Infrastructure	2,500	Melton Valley

HFIR = High Flux Isotope Reactor.
ORNL = Oak Ridge National Laboratory.

Multi-Program Research Center-2. Research programs housed in the recently completed Multi-Program Research Facility (MRF) are growing at a rapid rate; indications are that additional space will be needed within the next 10 years. The proposed MRF-2 would be located on approximately 2 acres east of the area proposed for the MCDC (Fig. 2.2). The approximately 214,000-ft^2 facility would house laboratories, training spaces, offices, and necessary support infrastructure for non-proliferation research, training, and operations; cyber security research and development; geospatial analysis; and other activities.

7000 Area Site Maintenance/Fabrication Facility. This industrial facility would be the anchor facility for modernization of the 7000 Area and would consolidate many fabrication and maintenance operations into one facility. A Central Shop for the 7000 Area would eliminate existing old inefficient facilities. It would also improve energy savings through more efficient construction, improve staff safety,

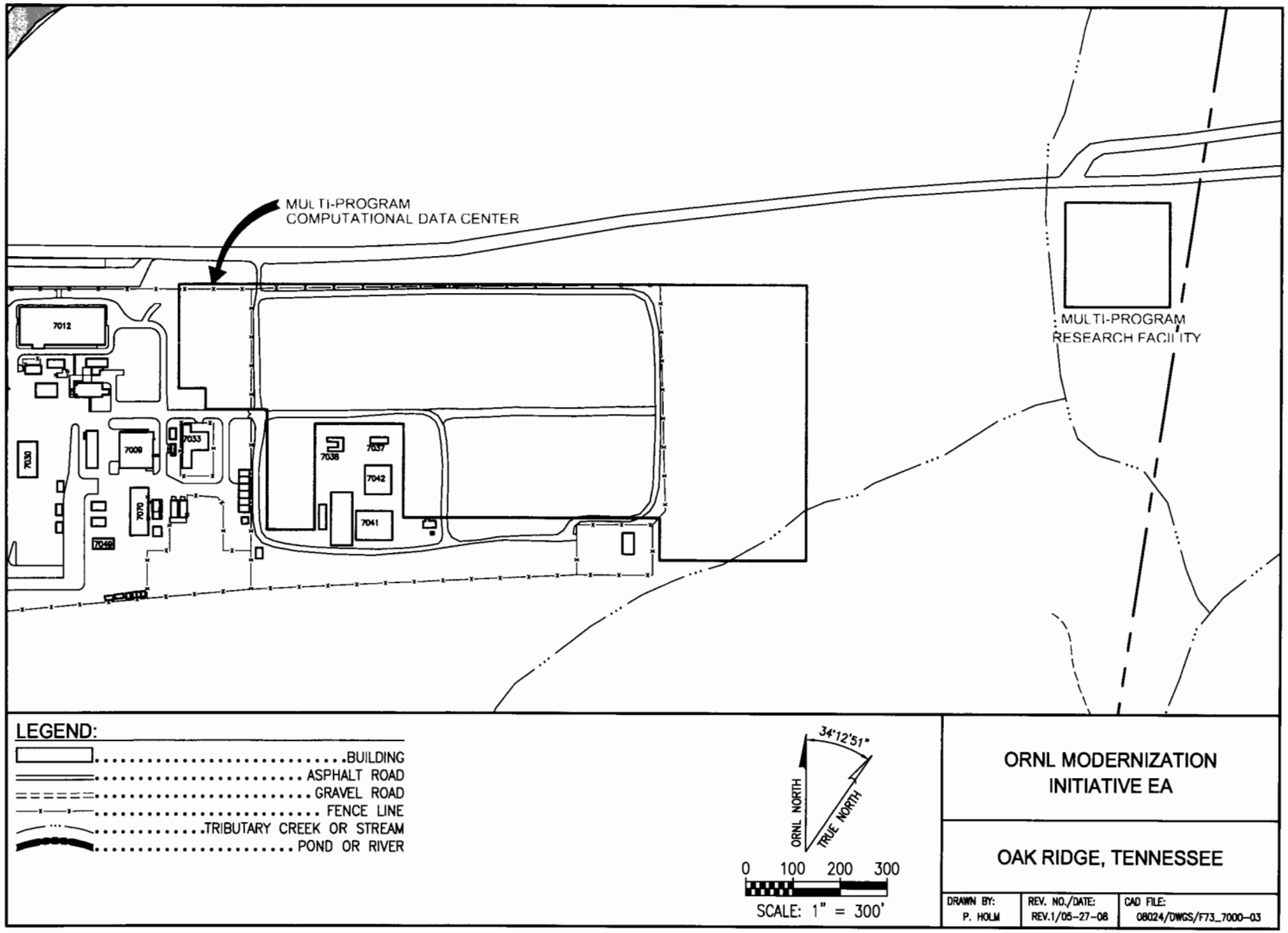


Fig. 2.2. Multi-Program Computational Data Center and Research Facility.

extend equipment life through a controlled environment, and improve staff morale through an improved work environment. The shop would avoid ever-increasing costs to repair and update aging facilities and would avoid costs to update old facilities to new safety standards. The maintenance/fabrication facility would be approximately 100,000 ft^2 and the general site location is shown on Fig. 2.3.

Site Operations Facility. This approximately 75,000-ft^2 new center of ORNL site operations would be located adjacent to the 7000 Area near the intersection of White Oak Avenue and the Melton Valley Access Road (Fig. 2.3). The project constructs a "first responder" facility to deliver emergency, fire, security, and other services. Co-locating first responder services would provide better integrated and coordinated emergency response. The new facility would accommodate the 24-hr/7-day schedules and provide specialty space such as storage for emergency response vehicles and equipment, a security vault, a decontamination area, and medical response facilities. The facility would provide improved response times for the Spallation Neutron Source (SNS) and Center for Nanophase Materials Sciences and still meet the required response times for the west end of ORNL.

Currently, these site services are housed in older facilities scattered around the ORNL main campus (Bldgs. 3037, 3027, 2500, 2628, 3504, and 2648). Many of these facilities are slated for removal as part of the IFDP to aid in the final disposition of contaminated facilities and soil in the Central Campus. Of considerable concern is the ORNL fire station, which was constructed in 1943 and is well beyond its 30-year life. It is located on the west end of Bethel Valley. With the construction of the SNS and the new East Campus Complex, the fire station is no longer central to ORNL operations.

Microscope Research Facility. This new 7,000-ft^2 facility would provide adequate space and meet the seismic design requirements for use of the extremely sensitive research microscope. Figure 2.4 shows the general site location for the facility, an addition to Bldg. 3625.

West Campus Greenhouse. This new greenhouse facility would be located next to Bldg. 1503 (Fig. 2.5) and would provide additional research capability for the Biological and Environmental Sciences Directorate. The facility would be approximately 10,000 ft^2 in size. The existing 1506 Greenhouse was upgraded in FY 2003 and is now filled to capacity. The new building would contain a head house with sample preparation space and building utility systems that could support up to four greenhouse sections.

West Campus Maintenance Facility. This 30,000-ft^2 industrial facility would allow for relocation of the current maintenance facilities in the Central Campus to the vicinity of Bldg. 1505 in the West Campus (Fig. 2.5).

West Campus Office Building. This new office building is needed for housing the growing ORNL research and research support staff. The building would be located near the Joint Institute for Biological Sciences at the end of West End Road (Fig. 2.5) and would be approximately 30,000 ft^2 in size.

ORNL Wastewater Treatment Plant. ORNL's existing sanitary STP cannot handle the total flow during periods of unusually heavy rain. During those times, part of the influent is diverted into two clay-lined lagoons, where it is held until it can be processed during periods of lower flow. Occasionally, during periods of heavy rainfall, the inflow exceeds the capacity of the STP and the lagoons and partially treated wastewater must be discharged directly to White Oak Creek, which sometimes results in National Pollutant Discharge Elimination System (NPDES) permit non-compliances. Permit violations are likely to occur more frequently as more waste is added to the system, unless the capacity of the system is increased. With even conservative growth projections, the existing facility is expected to be at 80% of plant capacity in the 2009 timeframe, the point at which experts recommend plant expansions begin to avoid permit violations.

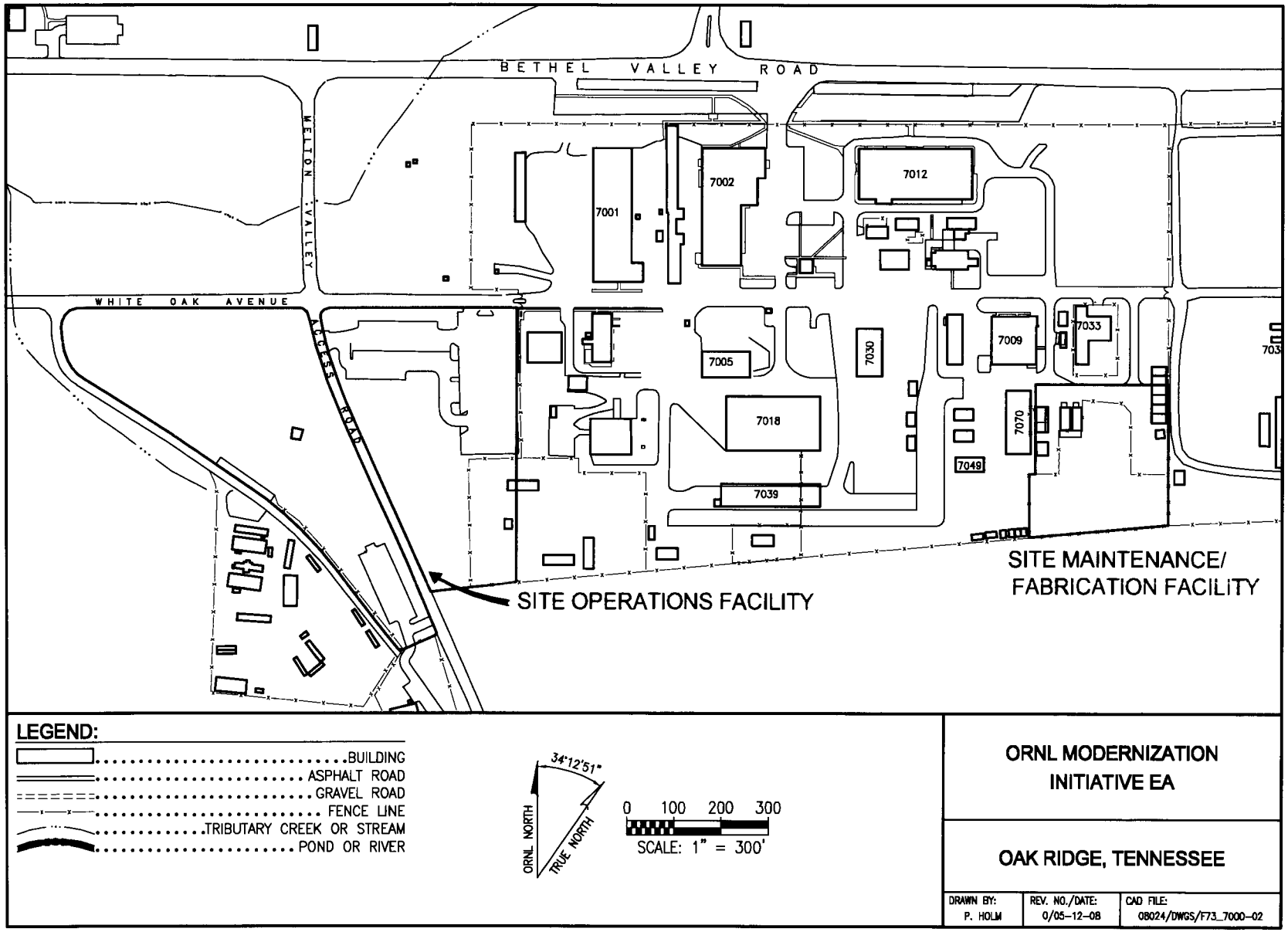


Fig. 2.3. Location of the 7000 Area Site Maintenance/Fabrication Facility and Site Operations Facility.

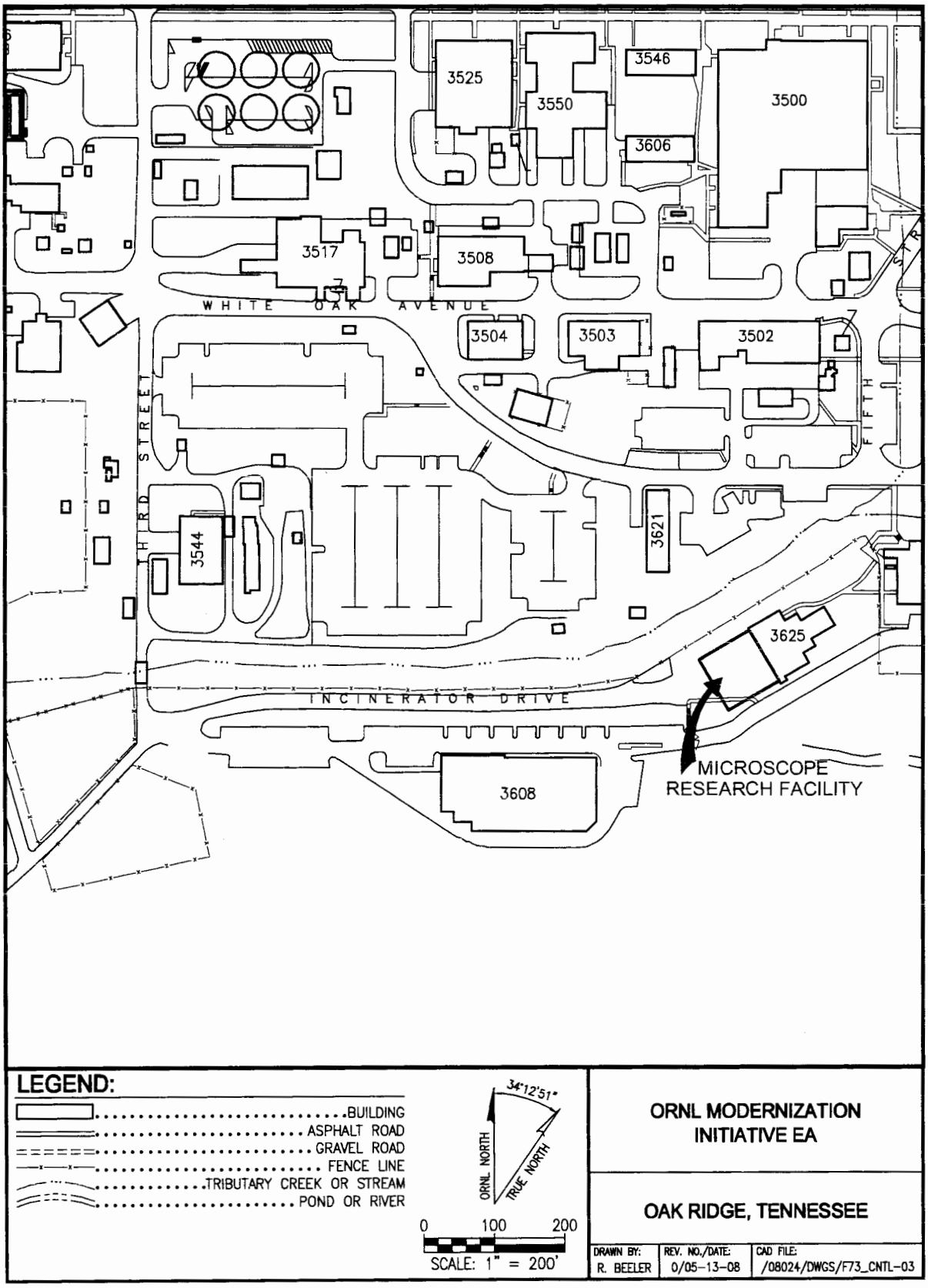


Fig. 2.4. Central Campus Microscope Research Facility.

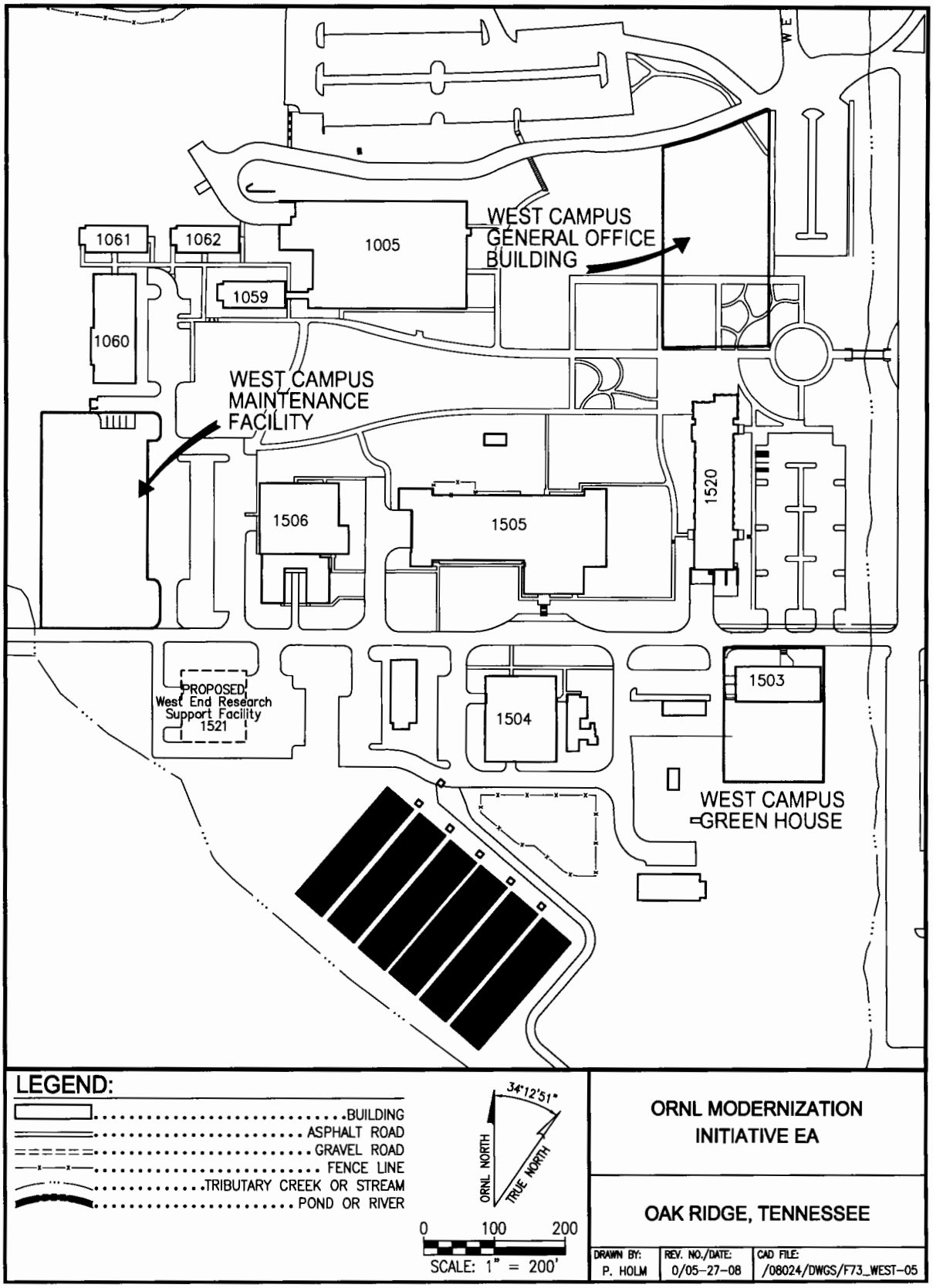


Fig. 2.5. Location of the West Campus Greenhouse, Maintenance Facility, and Office Building.

A membrane bioreactor (MBR) would replace the existing plant. MBR systems can run at very high biosolid concentrations, thus resulting in efficient treatment within a small footprint and low production of excess sludge. The recommended STP facility would include installing: (1) a new influent pump station; (2) headworks with screening and grit removal; (3) Sequencing Batch Reactor-activated sludge technology; (4) effluent filters; (5) ultraviolet disinfection; (6) effluent flow measurement; (7) aerobic digestion of waste sludge; (8) an STP control system; and (9) an operations building. The proposed location for the new STP facilities is the old coal yard site south of the central steam plant (Fig. 2.6).

Melton Valley Facilities

HB-2 Guide Hall. The High Flux Isotope Reactor (HFIR) HB-2 Guide Hall is a new experimental facility planned to meet the national need for state-of-the-art neutron science research. It would be open for use by scientists from universities, industry, and other federal laboratories. The new facility would provide the highest cold neutron fluxes in the world for neutron science. The project would include a new cold source for the HFIR facility, a 40,000-ft^2 Guide Hall, a cold neutron guide system that would transport the neutrons from the reactor cold source to the Guide Hall, and an initial complement of neutron instruments. The Guide Hall facility would provide a high-bay area with sufficient floor space for up to nine cold neutron guides and nine scientific instruments, user laboratories, and other necessary support space. As a national user facility, it is anticipated that these new experimental facilities would be used by hundreds of scientists from universities, industries, and other federal laboratories each year for neutron scattering experiments in solid state physics, chemistry, metallurgy, ceramics, polymers, colloids, and biology. The facility would be located adjacent to Bldg. 7900 at the HFIR (Fig. 2.7).

Material Handling Facility. This 10,000-ft^2 facility would be an addition to the north side of Bldg. 7900 at the HFIR (Fig. 2.7). The facility would allow for radioactive material handling, waste characterization, and material and equipment staging for materials moving in and out of Bldg. 7900. These activities are currently conducted within various areas in the HFIR. A building physically attached to the 7900 Building would provide the proper engineering controls to consolidate all of these activities in one location, increase personnel safety, and reduce the potential environmental impact.

Center for Neutron Scattering (CNS) User Facility. The HFIR CNS at ORNL is the highest flux reactor-based source of neutrons for condensed matter research in the United States. The Center is a national user facility operated by ORNL for DOE. Thermal and cold neutrons produced by the HFIR are used to study physics, chemistry, materials science, engineering, and biology. As part of the national user program, CNS expects more than 750 individual users a year to perform neutron scattering experiments at the facility. At present, the users number around 50 unique individuals per year. The anticipated staff to support the users would grow from the current number (~30 members) to around 75 staff. New building space is needed to accommodate the growth in the user program and to move people from temporary space. The proposed 50,500-ft^2 building would also allow the consolidation of all of the staff in one place, which would enable more efficient user service. Also, there are needs for more laboratory space and an auditorium to support a world-class user program and a world-class scientific program, which would be part of the proposed facility. Finally, office space and dining facilities for the users themselves would be needed while they are on-site performing experiments. The general site location for the new facility is shown in Fig. 2.8.

Research Operations Support Facility. This approximately 80,000-ft^2 facility would include both contaminated and non-contaminated operations and would allow for consolidation of maintenance and operations support functions currently located in the ORNL Central Campus and Melton Valley. The proposed location for the facility is adjacent to the existing parking area for the HFIR (Fig. 2.8).

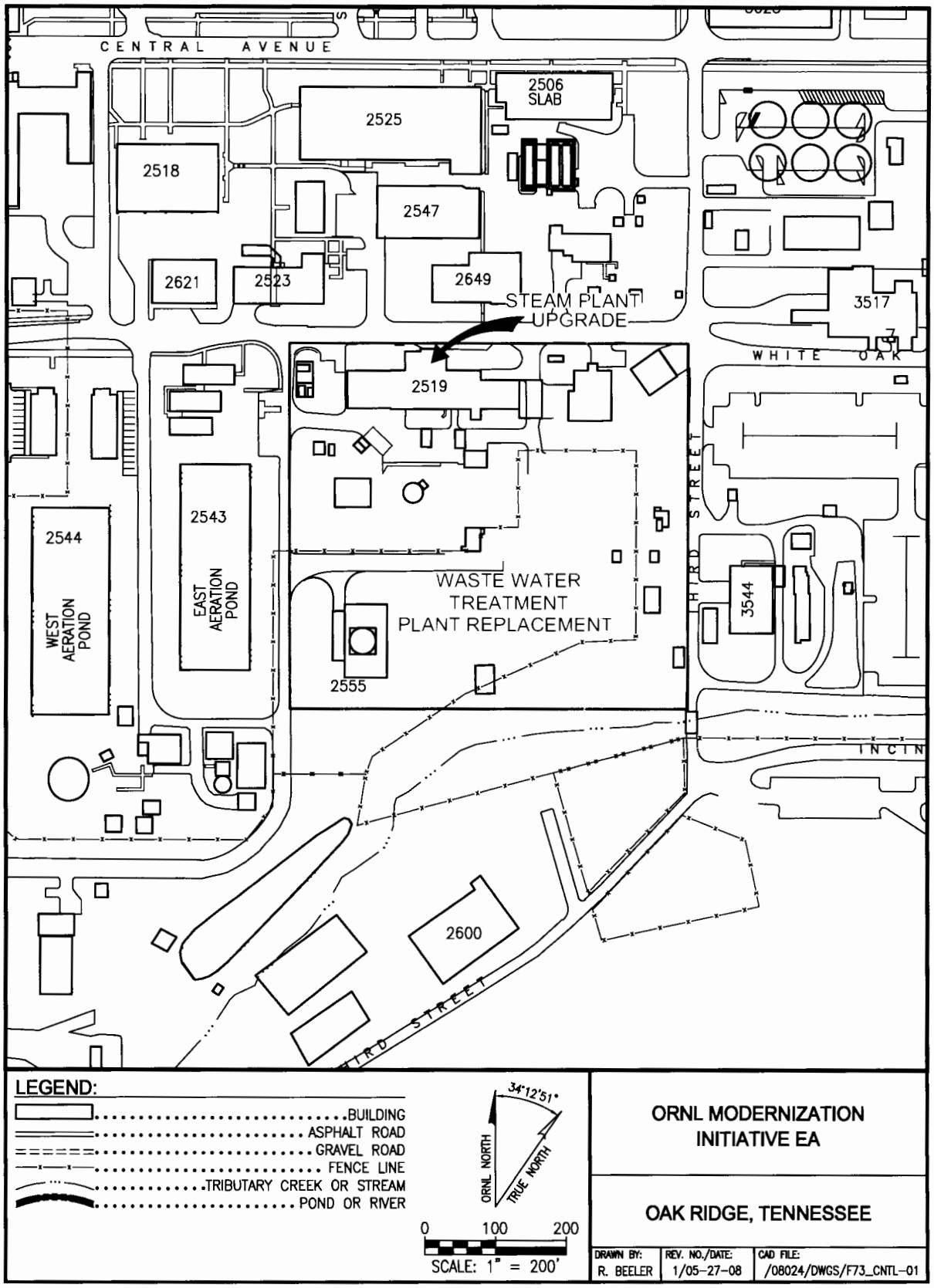


Fig. 2.6. Central Campus steam plant upgrade and wastewater treatment plant replacement.

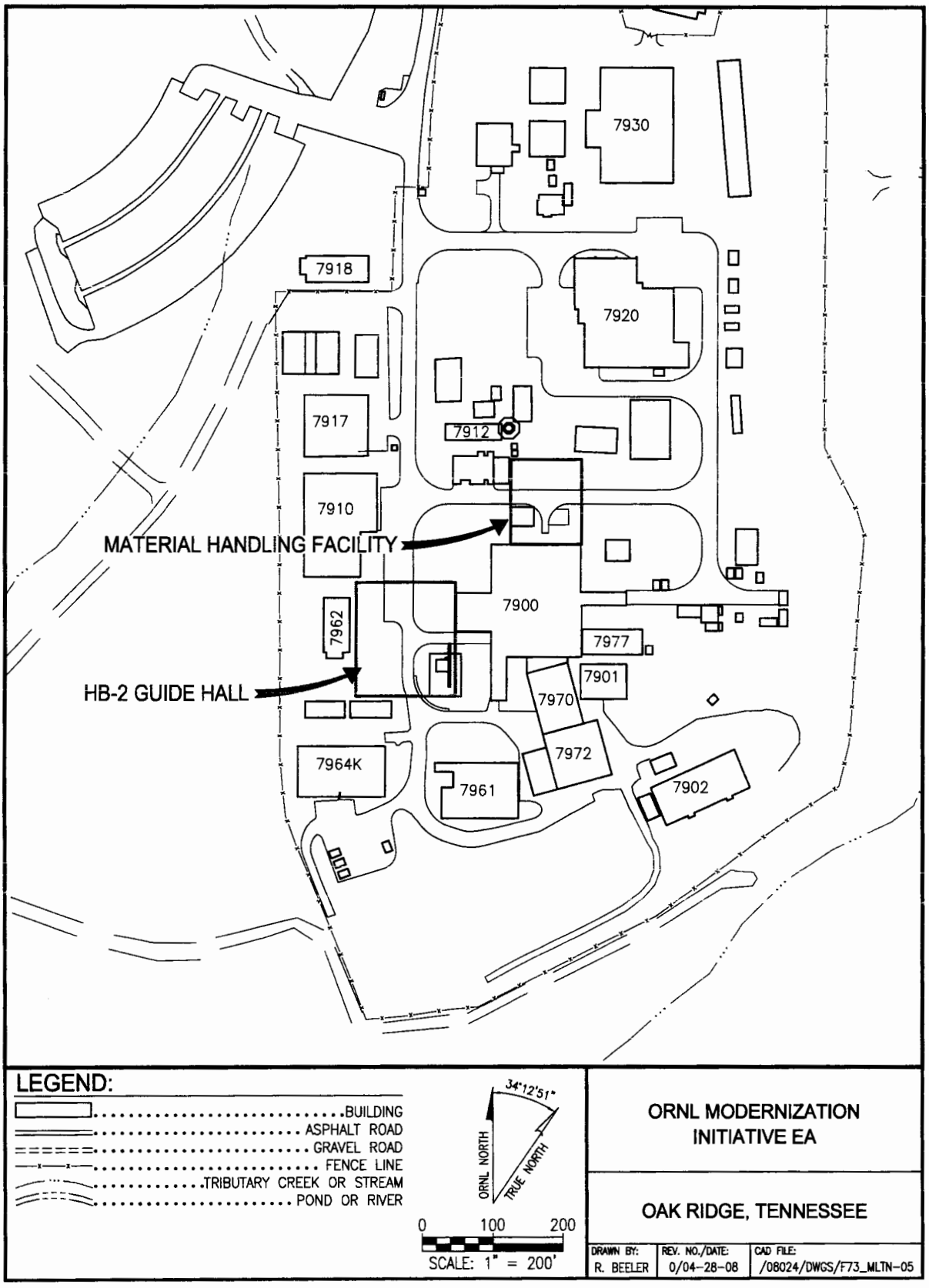


Fig. 2.7. Location of the Melton Valley HB-2 Guide Hall and Material Handling Facility.

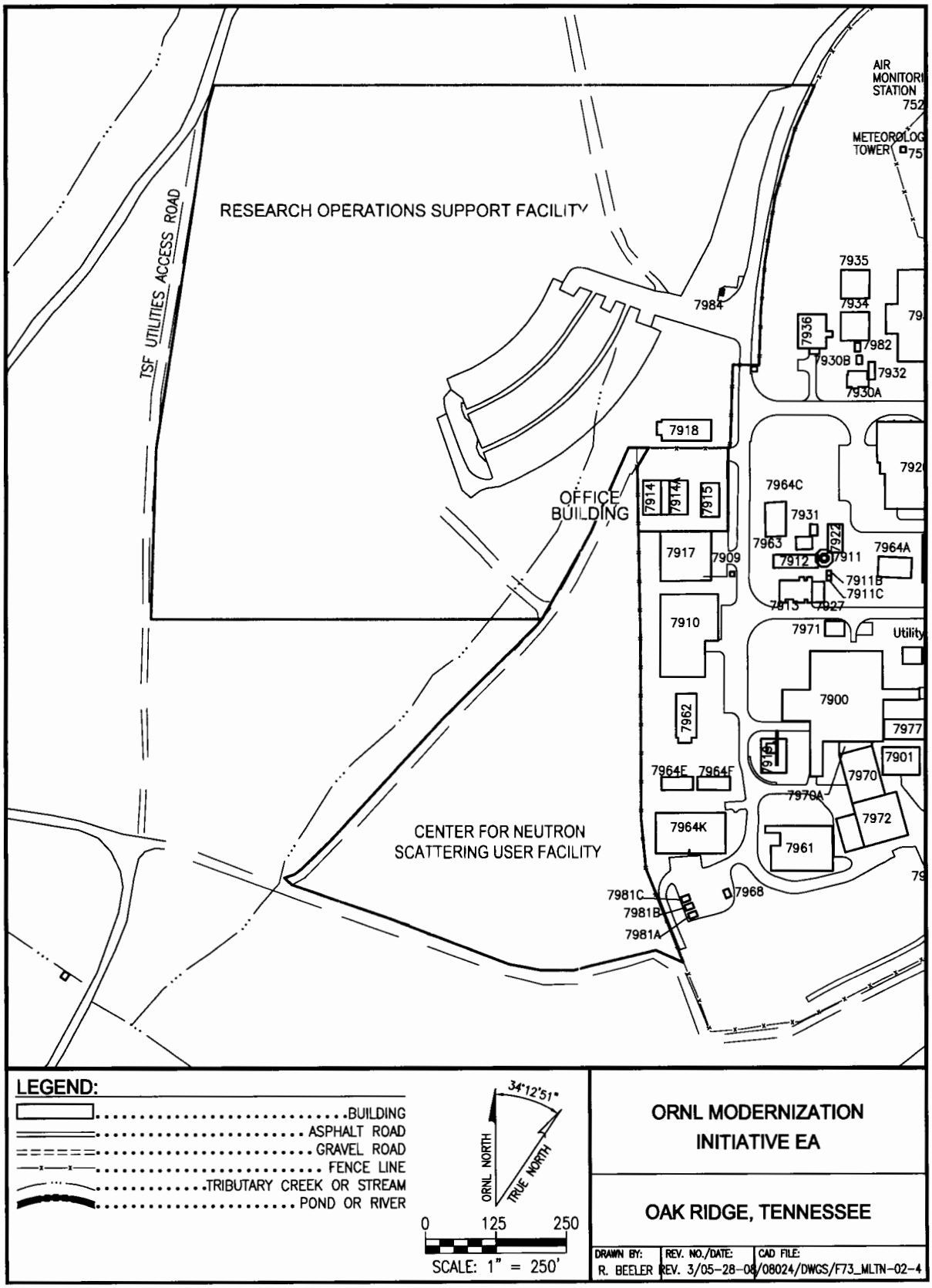


Fig. 2.8. Location of the Melton Valley Office Building, Research Operations Support Facility, and Center for Neutron Scattering User Facility.

Melton Valley Office Building. This new office building is needed for housing the growing ORNL research and research support staff. The building would be located north of the proposed CNS User Facility (Fig. 2.8) and would be approximately 15,000 ft^2 in size.

Utility Infrastructure Improvements

Steam Plant Upgrade. The ORNL central steam plant (Fig. 2.6) services both the Bethel Valley and Melton Valley facilities. The plant was constructed in 1948; parts of the plant have been upgraded. This project would upgrade and/or replace the ORNL steam generating system to increase system and energy efficiency as well as production reliability.

This energy conservation measure (ECM) project would involve modification to Bldg. 2519 that would include: (1) removing and disposing of up to four (64-million-Btu/hr capacity each) boiler units and associated piping and support systems; and (2) modifying the existing steam plant building to include a biomass facility that would include installing a biomass gasification boiler and support systems, control room, visitor and research center, maintenance shop and storage area, water systems, and personnel offices. This would be accomplished by constructing a new addition on the south side of Bldg. 2519. The new addition would be approximately 200 ft long by 150 ft wide by 50 ft high and would be used to house the main equipment of the biomass system. The new biomass gasification boiler would be operated to meet base load steam demands in the Bethel Valley area. Two existing natural gas-fired boilers would be retained for meeting peak demand and to provide system redundancy.

The wood to be used as a fuel source would be obtained from local/regional saw mills and similar source suppliers. It would consist of logging and post-industrial ground/chipped wood waste products (i.e., bark, wood pieces, some saw dust, possibly pallets, etc.).

Waste wood fuel would be fed into gasifiers, which would then be directed through an oxidizer and then through a waste heat recovery boiler, which in turn would generate steam for ORNL. Resulting byproducts of the "air-starved" combustion process would include wood ash and airborne emissions. The ash residuals would be collected daily for disposal every 2 to 3 days at the Centralized Sanitary Landfill site. Airborne emissions would consist of nitrogen oxides, sulfur dioxide, carbon monoxide, volatile organic compounds, and particulate matter. Air pollution control devices would be installed to reduce particulates and nitrogen oxides. Operation activities would involve the delivery of 10 to 12 truckloads of wood chips per work day and off-loading in a wood fuel storage facility. During the summer months, there exists the possibility of a reduced number of daily deliveries of wood.

Select Steam Decentralization of Remote Buildings. This ECM project would partially decentralize the central steam system by disconnecting many of the outlying buildings from the existing system. The existing system is old, with many inefficiencies and safety issues. Reducing the footprint of the distribution system to a minimum and converting existing buildings to simpler heating systems would improve overall efficiency and operations. The buildings impacted by this ECM are relatively distant from the central steam plant, adding to the cost of distributing steam to these facilities.

To implement the project, steam line connections to the 7000s, 7500s, and 7900s building sets would be severed. In total, 20 buildings would be disconnected from the steam plant and the longest steam distribution runs on-site eliminated. Appropriate replacement heating systems local to each building or groups of building would be installed based on the existing building design, mission, and potential energy savings. It is anticipated that the replacement heating systems would be a combination of individual, natural gas, direct-fired heating units and a small, local package steam plant that would be located just southeast of Melton Valley Drive and the HFIR Access Road (Fig. 2.9). A new gas line would be installed in the existing utility corridor and the plant would be connected to the existing steam distribution

lines that currently supply the Melton Valley facilities. Throughout the ORNL campus, the affected distribution systems would be dismantled down to the footings once the improvements to all the buildings are completed and commissioned.

2.2 NO ACTION ALTERNATIVE

The no action alternative provides an environmental baseline with which impacts of the proposed action and alternatives can be compared and is required by the DOE NEPA Regulations.

Under the no action alternative, the ORNL Modernization Initiative would not be implemented. This could result in fewer opportunities for new research programs, impact the space needs of employees and ORNL's research partners, and have a negative impact on long-term staff recruitment and retention. On-going operations including research and development (R&D) activities, projects with already completed NEPA reviews, general maintenance, repairs, and other types of "landlord" projects would continue. Employees would continue their research in the facilities they now occupy. On-going surveillance and maintenance (S&M) on buildings that have already been deactivated would be conducted. Occupied buildings would be repaired as funds are available. Utility and other infrastructure needs, including some upgrades, would be met to the extent required to maintain systems in good working order and ensure worker health and safety. Environmental cleanup and facility disposition activities primarily in the Central Campus area would be expected to continue primarily under the IFDP.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED

Other alternatives to establishing the ORNL Modernization Initiative, as described in the proposed action, were considered. These included locating new facilities within another portion of the ORR and only renovating existing facilities instead of using a combination of new construction and renovation. Although these alternatives were considered, they were eliminated from further consideration primarily because they did not meet the purpose and need to accomplish the scientific research mission at ORNL, enhance the health and safety of workers, and reduce operating costs. Locating facilities on other portions of the ORR would not support consolidation of ORNL research and support activities into common geographic areas and would result in a loss of efficiency. There would be a loss of synergy/creativity due to similar research programs being located in different parts of the ORR. It would also not be practical for the proposed steam plant and wastewater treatment plant upgrades because these facilities are located within the main ORNL campus. Only renovating existing facilities would not enable ORNL to enhance/expand certain research programs/capabilities (e.g., computing and national security). Renovation would also not support consolidation of research and support operations into a single area. For example, the proposed Site Operations Facility would consolidate fire and emergency services currently located in six older facilities around ORNL. A new facility would provide a more convenient location with better response times to new research facilities such as the SNS and Center for Nanophase Materials Sciences. To maximize the research mission at ORNL, it is necessary to locate the new facilities in close proximity to the other research facilities and resources of the Laboratory and utilize the existing ORNL utility infrastructure.

3. AFFECTED ENVIRONMENT

This chapter provides background information for evaluating the potential environmental impacts of the proposed action and no action alternative.

3.1 LAND USE

ORNL (also commonly referred to as X-10) encompasses facilities in two valleys (Bethel and Melton) on approximately 1100 acres of land within the ORR. ORNL facilities are also located on other parts of the more than 21,000 acres of the ORR for which ORNL is responsible, including some at the nearby Y-12 National Security Complex (Y-12 Complex) and field research areas. At the northeastern end of the main ORNL site is the SNS facility site, which is located on Chestnut Ridge.

ORNL supports six major mission roles: neutron science, energy, high-performance computing, systems biology, materials science, and national security. The DOE land use designation for the ORNL Main Campus in Bethel Valley is "institutional and research." The Main Campus is generally divided into three research campuses each having a different mix of facilities by research type. The West Campus primarily contains facilities dedicated to biological and environmental sciences. Major new facilities include the Joint Institute for Biological Sciences and the Center for Comparative and Functional Genomics. The Central Campus is heavily industrialized and contains a mix of facilities used for administration and support, energy and engineering sciences, physical sciences, and management and integration. This area also contains a number of facilities currently in the EM D&D Program or planned for other non-EM surplus programs. The East Campus also contains a mix of research facilities and is where the majority of the new facilities under the FRP have been constructed. Primary buildings include the Central Research and Administration Buildings (4500N and 4500S), Computational Sciences Building, Research Office Building, Engineering Technology Facility, and the ORNL Visitor Center. Located further east along Bethel Valley Road is the 7000 Area, which primarily contains administration and support facilities for stores, shipping, and fabrication.

Land and facility use patterns in Melton Valley differ greatly from those in Bethel Valley. Melton Valley is characterized by large areas of land devoted to environmental research or waste management with widely dispersed clusters of facilities. The DOE designation for the Melton Valley area of ORNL is institutional/research and mixed research/future initiatives. Land accommodating Life Sciences missions includes watersheds throughout Melton Valley and research areas at its far west end. Technology Development is concentrated in the eastern portion of Melton Valley in several small facilities in the 7500 and 7900 Areas. The 7900 Area containing the HFIR facilities and a laboratory at the Robotics and Process Systems Complex are devoted to nuclear technology. Buildings 7920 and 7930 house the Radiochemical Engineering Development Center, which is the production, storage, and distribution center for heavy-element research programs and the main center for production of transuranic elements in the United States.

The largest amount of space in Melton Valley is used for environmental operations. This includes small facilities and research sites toward the east end of the Valley, several sections of the 7900 Area, and the large waste storage and disposal areas of the western part of the Valley. Only a few facilities contain support services.

Melton Valley is also part of the Tennessee Wildlife Resources Agency (TWRA) Oak Ridge Wildlife Management Area through an agreement between DOE and TWRA. The agreement provides for protection of wildlife habitat and species and restoration of other wildlife habitat and species. The area

designated as mixed research/future initiatives is less developed. Land use in this area is primarily associated with research and education although utilities and some activities associated with cleanup and remediation are present. Portions of Melton Valley are also within the Oak Ridge National Environmental Research Park, which was established in 1980 and consists of approximately 20,000 acres. The research park serves as an outdoor laboratory to evaluate the environmental consequences of energy use and development as well as the strategies to mitigate these effects.

3.2 SOIL

The heterogeneous soil overlying bedrock in the ORNL area includes a mixture of fill, reworked soil, and native residual soil. During construction of site facilities, soil was extensively modified by excavation and refilling of areas around waste storage tanks, underground piping, and buildings (DOE 1999). Because much of the Bethel Valley portion of ORNL has had construction activities, most of the natural soil structure has been disturbed. However, fewer disturbances of soil have occurred in the Melton Valley portion of ORNL where developed areas are more sparsely located.

The original soil in the Bethel Valley portion of ORNL was generally classified as either Colbert Series or Upshur Series silty clay loams based on the Soil Survey for Roane County (USDA 1942). Soil thicknesses generally range from 0 to 30 ft over the area. Colbert surface soil is described as heavy silt loam or silty clay loam. The subsoil is tough, tenacious, sticky, plastic clay, or silty clay. This subsoil layer rests on bedrock in many areas, or elsewhere there is an intervening layer of similar material, but it is noticeably mottled in only gray and green. External drainage is generally good, but internal drainage is rather poor due to the heavy plastic and impervious character of the subsoil. Soil of the Upshur Series is characterized by heavy texture and shallowness over bedrock. The Upshur silty clay loam has a friable silty clay loam surface soil. The subsoil consists of tight, sticky, plastic clay or silty clay. The subsoil layer generally rests on partly disintegrated shaley limestone. Surface drainage is usually good, but internal drainage is somewhat limited (USDA 1942). Soil of the Roane Series occupies strips of bottomland along the streams. The most conspicuous character of this soil is a semi-cemented layer of angular chert fragments occurring from 15 to 30 in. below the surface. This soil is fairly well drained and has a moderate content of organic matter and a rather low water-holding capacity.

Soil in the Melton Valley area has generally been classified as either Lehew Series or Apison Series fine to very fine sandy loams (USDA 1942). It was observed during excavation for the HFIR complex that the residuum over bedrock averaged about 20 ft in thickness and was overlain by only a thin (less than 1 ft) layer of topsoil (ORNL 2005). Apison soil is derived from interbedded shale and sandstone. This soil is well drained, shallow over bedrock, and highly susceptible to accelerated erosion. The primary Apison Series soil in the Melton Valley area is of the very fine sandy loam eroded slope phase. Erosion has removed practically all of the original surface soil and most of the original subsoil (USDA 1942). The surface soil is very fine sandy loam, and the subsoil is rather firm but friable clay loam or very fine sandy clay. The Lehew Series soil is shallow, stony, excessively drained, and has a steep or hilly relief; this soil has been derived from shale and sandstone. The Lehew stony fine sandy loam surface soil is loose fine sandy loam overlying an 8- to 14-in. subsoil layer of fine sandy clay. In many places, the subsoil rests directly on the shale and sandstone bedrock, but in areas where it does not, the intervening layer consists of friable fine sandy clay a few inches to 1 ft thick. Different quantities of sandstone and shale fragments are scattered over the surface and throughout the soil mass.

3.3 SURFACE WATER RESOURCES

Surface water drainage from the ORNL area eventually reaches the Tennessee River via the Clinch River, which is located to the south and west. Water levels in the Clinch River are regulated by the Tennessee Valley Authority (TVA). Surface water in this area is in hydraulic communication with the upper portion of the aquifer underlying ORNL. Water levels and flow rates in the tributaries and other surface water bodies are influenced by the position of the water table (Bonine and Ketelle 2001). Under natural conditions, flow in the Clinch River, White Oak Creek (which drains the majority of the main plant area of ORNL), and their tributaries is derived from groundwater discharge and surface water runoff. Surface water at ORNL is classified by the state of Tennessee to support fish, aquatic life, and recreation as well as livestock and wildlife under Use Classification for Surface Water (1200-4-4). Surface water is not used for human consumption within the boundaries of ORNL. Water used at ORNL for drinking and cooling is supplied by the city of Oak Ridge. The city of Oak Ridge's water intake is located on the Clinch River upstream of ORNL.

ORNL occupies portions of two watersheds of tributaries to the Clinch River. The majority of the area, including the West, Central, and East Campus areas of Bethel Valley, and the Melton Valley area, are located in the White Oak Creek (WOC) watershed. The easternmost portion (7000 Area) of ORNL is partly located in the Bearden Creek watershed.

The Bethel Valley basin of the WOC watershed includes the following tributaries: Northwest Tributary (runs along the west side of the West Campus area), First Creek (divides the West Campus of ORNL from the Central Campus and receives drainage from both), and Fifth Creek (runs along the eastern portion of the Central Campus). Flow from WOC in Bethel Valley flows downstream to White Oak Lake, and eventually discharges to the Clinch River. Surface runoff from the impervious surfaces throughout the ORNL Main Research Campus area is primarily routed to First Creek and Fifth Creek via storm drains. The southern portion of the Central Research Campus area drains directly to WOC. Flow data for FY 2005 for First Creek indicate average flows of >23 million gal per month for this stream.

The Melton Valley basin of the WOC watershed includes Melton Branch and numerous small unnamed tributaries that discharge to Melton Branch. Melton Branch flows west to discharge into WOC approximately 800 ft east of White Oak Lake. Base flow discharge in Melton Branch is typically low, and historically, extended periods of zero discharge have occurred in the upper reaches of Melton Branch. Stream flow in lower Melton Branch is augmented by discharges from HFIR. HFIR discharges enter Melton Branch about 0.87 miles above the confluence of Melton Branch with WOC. Stream flow in Melton Branch, measured 0.1 mile above the confluence with WOC between 1955 and 1963, averaged 2.5 ft^3/s; maximum flow during that period was 242 ft^3/s, although this may underestimate actual flood flows (Campbell et al. 1989). Data analysis by Tucci (1992) found that, during the period from 1986 to 1988, base flow represented 37% of the total discharge in Melton Branch at a monitoring station located approximately 1200 ft southeast of HFIR.

Surface runoff from the easternmost portion of ORNL (7000 Area) flows into several unnamed tributaries that discharge to the Bearden Creek Embayment located southeast of the 7000 Area. Bearden Creek drains a small mostly forested watershed on Chestnut Ridge to the north before flowing south through a water gap in Haw Ridge and into the Bearden Creek embayment on the Clinch River. The Bearden Creek watershed is estimated at less than 1 $mile^2$ (NUS 1980). The water level of the embayment is indirectly controlled by TVA as it regulates flow of the Clinch River (Meyers-Schöne and Walton 1990).

The predominant mechanisms for surface water contamination in the ORNL Modernization Initiative area are diffuse discharges of contaminated groundwater and point source discharge from ORNL outfalls. The primary contaminants found in surface water are radionuclides (^{90}Sr, ^{3}H, and ^{137}Cs), mercury, chlorine, and thermal discharges. Samples are routinely collected from First Creek, Fifth Creek, WOC, and Melton Branch and analyzed for selected parameters, including radionuclides, under the ORNL Surface Water Surveillance Monitoring Program (DOE 2008).

3.4 AIR QUALITY

Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. The levels of pollutants are generally expressed in terms of concentration, either in units of parts per million or micrograms per cubic meter.

The baseline standards for pollutant concentrations are the National Ambient Air Quality Standards (NAAQS) and state air quality standards. These standards represent the maximum allowable atmospheric concentration that may occur and still protect public health and welfare. The state of Tennessee has adopted NAAQS [Tennessee Department of Environment and Conservation (TDEC) 1200-3-3].

Based on measured ambient air pollutant concentrations, the U. S. Environmental Protection Agency (EPA) designates whether areas of the United States meet NAAQS. Those areas demonstrating compliance with NAAQS are considered "attainment" areas, while those that are not are known as "non-attainment" areas. Those areas that cannot be classified on the basis of available information for a particular pollutant are "unclassifiable" and are treated as attainment areas until proven otherwise.

The proposed action would occur in Roane County, which is used as the region of influence (ROI) for this analysis. For comparison purposes, Table 3.1 presents EPA's 2002 National Emissions Inventory (NEI) data for Roane County (EPA 2002). The county data include emissions data from point sources, area sources, and mobile sources. Point sources are stationary sources that can be identified by name and location. Area sources are point sources whose emissions are too small to track individually, such as a home or small office building or a diffuse stationary source, such as wildfires or agricultural tilling. Mobile sources are any kind of vehicle or equipment with gasoline or diesel engine, an airplane, or a ship. Two types of mobile sources are considered: on-road and non-road. On-road mobile sources consist of vehicles such as cars, light trucks, heavy trucks, buses, engines, and motorcycles. Non-road sources are aircraft, locomotives, diesel and gasoline boats and ships, personal watercraft, lawn and garden equipment, agricultural and construction equipment, and recreational vehicles (EPA 2005).

Table 3.1. Roane County emissions for 2002

	Emissions (tons/year)					
Source Type	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**VOC**
Area source	648	116	3,516	845	149	1,209
Non-road mobile	3,703	1,167	2,092	624	124	827
On-road mobile	21,386	4,381	2,175	620	106	1,548
Point source	1,150	26,280	4,394	3,583	77,882	240
Total	*26,887*	*31,943*	*12,177*	*5,672*	*78,262*	*3,824*

Source: EPA 2002.

CO = carbon monoxide; NOx = nitrogen oxide; PM_{10} and $PM_{2.5}$ = particulate matter with an aerodynamic diameter less than 10 microns and 2.5 microns, respectively; SOx = sulfur oxide; and VOC = volatile organic compound.

TDEC operates air quality monitors in various counties throughout the state (TDEC 2008). There is a particulate matter with an aerodynamic diameter less than 2.5 microns ($PM_{2.5}$) monitor in Roane County and an ozone monitor in the neighboring Anderson County; Oak Ridge area air quality is relatively good. Part of Roane County is designated non-attainment for the new, stricter federal $PM_{2.5}$. The neighboring county, Anderson County, is non-attainment for the 8-hr ozone and $PM_{2.5}$ standard.

3.5 BIOLOGICAL RESOURCES

3.5.1 Vegetation

The ORR is located within the Ridge and Valley Physiographic Province and may contain the best examples of natural vegetation for this province in Tennessee (Mann et al. 1995). Over 1100 vascular plant species have been found on the ORR, which is nearly as many species as are found in the Great Smoky Mountains National Park (Mann et al. 1995). Of the vascular plants found on the ORR, 168 species are non-native and 54 of them have been identified as aggressive. Drake et al (2002) identified 18 of these non-native plants that pose the greatest threat for natural areas (i.e., ORR habitats with rare plants or wildlife). Invasive plants on the ORR have spread from old home site plantings, past erosion control efforts, forage enhancement projects, and adjacent farm or residential property.

The proposed locations for the new facilities that would be constructed contain a variety of habitats and vegetation. Some of the sites are highly disturbed from past and present ORNL activities and contain very little in the way of natural vegetation. Vegetation primarily consists of planted grass lawns, shrubs, and trees that are mainly used for landscaping near buildings. In Bethel Valley, these disturbed sites include the proposed areas for the Site Operations Center, 7000 Area Site Maintenance/Fabrication Facility, Microscope Research Facility, West Campus Greenhouse, West Campus Office Building, and Central Steam Plant Area. In Melton Valley, the highly disturbed locations include the areas for the HB-2 Guide Hall and Material Handling Facility, which are located within the main HFIR area.

In Bethel Valley, natural vegetation and habitat are found in the proposed areas for the MCDC and the MRF-2. These two project areas are adjacent and have similar vegetation. They are transected by two mowed right-of-ways, which join together on the west end. However, as a result of infrequent mowing, there are meadows with many species of grasses, goldenrods, and asters, though exotic fescue (*Festuca* L.) is dominant. Elsewhere there are areas of recently clear-cut forest (formerly mostly pine plantation). The pine plantation was decimated by pine beetles and logged in 1993 to salvage timber. The forest is growing back with many species, including redcedar (*Juniperus virginiana*), box elder (*Acer negundo*), and tulip poplar (*Liriodendron tulipifera*). In addition, an exotic shrub honeysuckle (*Diervilla* Mill.) is present in this area and the fern ebony spleenwort (*Asplenium platyneuron*) is common. There are also older forest areas dominated by deciduous trees including boxelder, red maple (*Acer rubrum*), and tulip poplar. The ground is dominated by the exotic Nepal grass (*Microstegium vimineum*), but native plants, adder's tongue fern (*Ophioglossum vulgatum*), and perfoliate bellwort (*Uvularia perfoliata*) are also found here.

The ORR Natural Area, Bethel Valley Small-Head Rush Wetland (Natural Area 38), is within this project area (Awl et al. 1996). Two special plant communities are found in this natural area. One is a mostly open wetland fed by a limestone spring through a culvert under Bethel Valley Road. The small-head rush (*Juncus brachycephalus*), which is a species of special concern on the Tennessee list for protection, is found in this wetland. Young green ash (*Fraxinus pennsylvanica*) is establishing itself in the wetland area and exotic water cress (*Nasturtium officinale*) is found in a small portion of the wetland. The other special community is a small cedar glade on a calcareous shale substrate. Redcedar, rusty haw (*Viburnum rufidulum*), Virginia pine (*Pinus virginiana*), and redbud (*Cercis canadensis*) grow around the

open glade. Hoary puccoon (*Lithospermum canescens*), heart-leaved golden alexander (*Zizia aptera*), pale blue-eyed grass (*Sisyrinchium pallidum*), and New Jersey tea (*Ceanothus americanus*) grow in the glade with two species that are considered to be characteristic of cedar glades and barrens: straggling St. Johnswort (*Hypericum dolabriforme*) and grooved yellow flax (*Linum sulcatum*). Grooved yellow flax is known to exist only on this site on the ORR.

The West Campus Maintenance Facility site has a parking area, a recently built right-of-way with a transmission line, and some bottomland forest near a stream. Sweet gum (*Liquidambar styraciflua*) is the most common tree in the forest but green ash, American elm (*Ulmus americana*), and tulip poplar are also present. Herbaceous plants include bearded meadow parsnip (*Thaspium barbinode*), spring cress (*Cardamine bulbosa*), American groundnut (*Apios americana*), two-flowered melica (*Melica mutica*), leathery rush (*Juncus coriaceus*), and the exotic Nepal grass. Tag alder (*Alnus serrulata*) is found in the understory.

In Melton Valley, the area west of HFIR is an undisturbed area with natural vegetation and habitat. While some of the area is a parking lot, storage containers, or mowed grass, more than one-half of the area is forested. The southern end of the area is of lower elevation and has immature forest, while the northern end is higher with mature forest. The southern forest is mostly sweet gum, sycamore (*Platanus* L.), black willow (*Salix nigra*), tulip poplar, and red maple. Japanese honeysuckle (*Lonicera japonica*) is common on the forest floor. Most of the northern forest is dominated by oaks (white, northern, and scarlet) with white pine (*Pinus strobes*), shortleaf pine (*Pinus echinata*), sweet gum, and red maple. Some of the trees are large [white pine is 30 in. diameter at breast height (DBH), white oak is 19 in. DBH, and scarlet oak is 21 in. DBH]. Understory trees include flowering dogwood (*Cornus florida*), deerberry (*Vaccinium stamineum*), paw-paw (*Asimina* Adans.), and black haw (*Viburnum prunifolium*). Some herbaceous plants are violet wood sorrel (*Oxalis violacea*), rue anemone (*Thalictrum thalictroides*), spring beauty (*Claytonia* L.), squaw root (*Conopholis americana*), and the exotic Nepal grass and crown vetch (*Securigera varia*). The proposed Package Steam Plant area is nearly all forested with Virginia pine, red maple, blackjack oak (*Quercus marilandica*), and sweet gum. Herbaceous species include black snakeroot (*Sanicula* L.) and ebony spleenwort. The exotic Japanese honeysuckle is dominant in some spots.

3.5.2 Wildlife

The large, relatively unfragmented area of mature eastern deciduous hardwood forest on the ORR provides a variety of other habitats for numerous wildlife species (Parr and Hughes 2006). The resulting diversity of wildlife species ranges from common species found in urban and suburban areas of eastern Tennessee to species with more restrictive requirements, such as interior forest bird species. The ORR hosts more than 70 species of fish; about 45 species of reptiles and amphibians; more than 200 species of migratory, transient, and resident birds; and more than 30 species of mammals, as well as innumerable invertebrate species. Current lists of the fish; reptiles, amphibians, and mammals; and birds can be found on the ORR National Environmental Research Park (NERP) website at http://www.esd.ornl.gov/facilities/nerp/data.html.

Limited habitat is available for native animals within the ORNL Main Campus and 7000 Area in Bethel Valley. These areas host urbanized species that adapt well to disturbance and the presence of humans. These include small rodents, groundhogs (*Marmota monax*), birds such as starlings (*Sturnus vulgaris*), pigeons (*Columba livia*), Canada geese (*Branta canadensis*), and small reptiles. Large wildlife such as white-tailed deer (*Odocoileus virginianus*) and turkey (*Meleagris gallopavo*) are frequently seen in the vicinity. Large areas of deciduous hardwoods to the east, north, and south of the Main Campus and 7000 Area provide habitat for additional native wildlife that may include a portion of the ORNL Main Campus and 7000 Area for part of their home range.

The 7900 Area (HFIR) is made up of buildings, roads, mowed areas, and commercial landscaping. Melton Branch and its tributaries are a source of water and serve as a riparian corridor for wildlife. This habitat potentially supports wildlife such as mammals, birds, reptiles, and amphibians that would be expected to occur in urban settings. In addition, interior forest habitat to the north and east of the 7900 Area and Copper Ridge Landscape Complex to the southeast provide habitat for native species such as the gray bat (*Myotis grisescens*), white-footed mouse (*Peromyscus leucopus*), short-tailed shrew (*Blarina brevicauda*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), white-tailed deer, cotton rat (*Sigmodon hispidus*), and various bird species.

All of the streams in the WOC watershed in Bethel Valley and Melton Valley provide aquatic habitat. Aquatic biota includes 13 species of fish and numerous communities of invertebrates and periphyton (Parr and Hughes 2006). The riparian area of WOC, Melton Branch, and their tributaries provides shelter and food for many aquatic and terrestrial species. These riparian habitats support wildlife such as frogs, salamanders, snakes, fish, and benthic macroinvertebrates. Species richness, especially for fish, is largely determined by stream size and intermittent or perennial flow.

Most habitats in the ORNL Main Campus and HFIR area are highly disturbed, precluding the presence of rare, threatened, and endangered animal species as discussed in Sect. 3.5.3.

3.5.3 Threatened and Endangered Species

Twenty-three species of vascular plants, which have been observed recently on the ORR, are on the Tennessee state list for protection. The small-head rush (*Juncus brachycephalus*), a species of special concern in Tennessee, is found in a small wetland near the area proposed for the MCDC west of the 7000 Area. There are five other Tennessee-listed plants known to occur in the Bethel Valley region on the ORR: tall larkspur (*Delphinium exaltatum*), Canada lily (*Lilium canadense*), nuttall waterweed (*Elodea nuttalii*), golden seal (*Hydrastis canadensis*), and ginseng (*Panax quinquefolius*). In Melton Valley, pink lady's slipper (*Cypripedium acaule*) and Canada lily are found near the area proposed for the Package Steam Plant. In Tennessee, pink lady's slipper is listed as endangered due to commercial exploitation and Canada lily is a threatened species. There are two other Tennessee-listed plants known to occur in the Melton Valley region on the ORR [river bulrush (*Scirpus fluviatilis*) and ginseng (*Panax quinquefolius*)]. During field surveys, no new sites for listed plants were found. Also, no likely sites for occurrences of listed plants were found on the project sites. No federally listed plants or their habitat are known on the ORR.

Seventeen species of federally or state-listed (endangered, threatened, or in need of management) vertebrate species have been confirmed on other parts of the ORR in recent surveys (Mitchell et al. 1996; Parr and Hughes 2006). Furthermore, appropriate habitat for approximately 20 additional species has been identified on the ORR. In addition, 13 of the recorded bird species are listed by Partners in Flight as species of concern. Monitoring by Partners in Flight has also determined that 11 of the 16 species that are of top conservation priority in the region are present on the ORR during the breeding season.

There are no records of federal- or state-listed animals from any of the sites evaluated. The presence of rare, threatened, and endangered wildlife occurring within the ORNL Main Campus and 7900 Area (HFIR) is unlikely because of the lack of suitable habitat. However, WOC may attract some wildlife species of concern, including migratory birds, due to its riparian coverage and nearby deciduous forest.

Of the listed species, the gray bat is the most likely to use parts of Melton Valley. Gray bats are known to roost in caves on nearby Copper Ridge and these bats would likely forage occasionally along the streams and forested wetlands within Melton Valley. Some of the mature hardwood forests along the upper slopes of Pine Ridge; Solid Waste Storage Area (SWSA) 7; and the area between Ramsey Drive,

Bearden Creek, and Melton Valley Access Road have habitat suitable for tree-roosting bats such as the Indiana bat (*Myotis sodalis*). Updated information on ORR wildlife is maintained online at the NERP's website, www.esd.ornl.gov/facilities/nerp.

State-listed species in need of management that have been observed in Bethel Valley include the sharp-shinned hawk (*Accipiter striatus*), cerulean warbler (*Dendroica cerulean*), great egret (*Ardea alba*), yellow-bellied sapsucker (*Sphyrapicus varius*), anhinga (*Anhinga anhinga*), and southeastern shrew (*Sorex longirostris*). Of these, the sharp-shinned hawk and southeastern shrew are fairly common (DOE 1999). State-listed bird species such as the double-crested cormorant (*Phalacrocorax auritus*) and little blue heron (*Egretta caerulea*) are reported to be increasing in numbers on the ORR. Common migrants or winter residents, which are state-listed in need of management but do not nest on the reservation, include the cerulean warbler, northern harrier (*Circus cyaneus*), great egret, and yellow-bellied sapsucker (DOE 2008).

3.5.4 Wetlands

Within the study area for the MCDC and the MRF-2, one small (0.22 acre) wetland, the Bethel Valley Small-Head Rush Wetland, is adjacent to Bethel Valley Road and forms a major component of ORR Natural Area 38. This wetland provides habitat for small-head rush, a Tennessee-listed species of special concern. The wetland includes components of emergent, scrub-shrub, and forested wetland communities. The wetland is connected hydrologically to an unnamed tributary to Melton Branch.

There is also a forested wetland on the west side of the proposed site for the West Campus Maintenance Facility. Approximately 0.26 acres of the eastern side of the wetland is within the project study area. Some of this area was recently disturbed for construction of a transmission line right-of-way. The wetland extends an undetermined distance to the west of the proposed facility. The wetland is connected hydrologically to an unnamed tributary to WOC.

In Melton Valley, there are two wetlands located in the study area west of the HFIR. A 0.43-acre forested wetland has formed along a stream between the HFIR parking lot and the Construction Fill Access Road in the southeastern corner of the site. This wetland is hydrologically connected to an unnamed tributary to Melton Branch. A forested wetland has developed along the southern boundary of the study area. While the entire wetland covers about 1.8 acres, only 0.002 acres are within the project area. A groundwater seep within the project area contributes to the hydrology of this wetland, which is hydrologically connected to an unnamed tributary to Melton Branch.

There are two wetlands in the proposed project area for the CNS User Facility. One is a small (0.005 acre) emergent wetland associated with a wet weather conveyance that drains into an unnamed tributary to Melton Branch. The wetland is located at the northern tip of the project area. The second wetland is located along the southern edge of the proposed project area. The wetland has formed in a depression adjacent to a graveled access road. The road acts as a berm that enhances wetland hydrology. This hydrologically isolated wetland covers 0.33 acres and includes areas of emergent, scrub-shrub, forested, and unconsolidated wetland habitat.

3.6 CULTURAL RESOURCES

Cultural resources include "historic properties" as defined in the National Historic Preservation Act (NHPA), "archaeological resources" as defined in the Archaeological Resources Protection Act, and

"cultural items" as defined in the Native American Graves Protection and Repatriation Act. Cultural resources thus include, but are not limited to, the following broad range of items and locations:

- archaeological materials (i.e., artifacts) and sites that date to the prehistoric, historic, and ethnohistoric periods that are currently located on, or are buried beneath, the ground surface;
- standing structures and/or their component parts that are over 50 years of age or are important because they represent a major historical theme or era (e.g., the Manhattan Project and the Cold War);
- structures that have an important technological, architectural, or local significance;
- cultural and natural places, select natural resources, and sacred objects that have importance for Native Americans; and
- American folk life traditions and arts.

An extensive discussion of cultural resources of the ORR region can be found in the DOE-ORO Cultural Resource Management Plan (DOE 2001a). An archaeological reconnaissance and evaluation of the proposed project study areas was previously conducted (DuVall 1994). Because of the topography and the amount of prior disturbance associated with ORNL during the past 50+ years, no archaeological sites or prehistoric artifacts are known to exist or have been identified within the project study areas.

Based on previous fieldwork and research (Carver and Slater 1994), several properties at ORNL have been determined to be eligible for inclusion in the National Register of Historic Places (NRHP). The properties that are located nearest to the areas being considered in the proposed action include the ORNL Historic District, Bldgs. 7001 and 7002 in the ORNL East Support Area, and the Aircraft Reactor Experiment Building now referred to as the Molten Salt Reactor Experiment Facility. One of the properties in the ORNL Historic District, the Graphite Reactor (Bldg. 3001), is included in the NRHP and it is also identified as a National Historic Landmark. Figure 3.1 shows the location of these properties.

3.7 SOCIOECONOMICS

The economic ROI for this analysis includes Anderson, Knox, Loudon, and Roane Counties. The region includes the cities of Clinton, Oak Ridge, Knoxville, Loudon, Lenoir City, Harriman, and Kingston.

3.7.1 Demographic and Economic Characteristics

Table 3.2 summarizes population, per capita income, and wage and salary employment from 2001 to 2006, the most recent year for which data are available. Population has increased slightly over the period, with Knox and Loudon Counties accounting for most of the growth. Employment for the region rose about 2% from 360,318 in 2001 to 398,257 in 2006. Per capita income grew from $27,870 to $32,961 over the same period, generating a total regional income of $19.3 billion in 2006 (Bureau of Economic Analysis 2008).

3.7.2 Fiscal Characteristics

City of Oak Ridge general fund revenues and expenditures for FY 2006, projections for 2007, and budgeted revenues and expenditures for FY 2008 are presented in Table 3.3. The general fund supports the on-going operations of local governments, as well as community services, such as police protection and

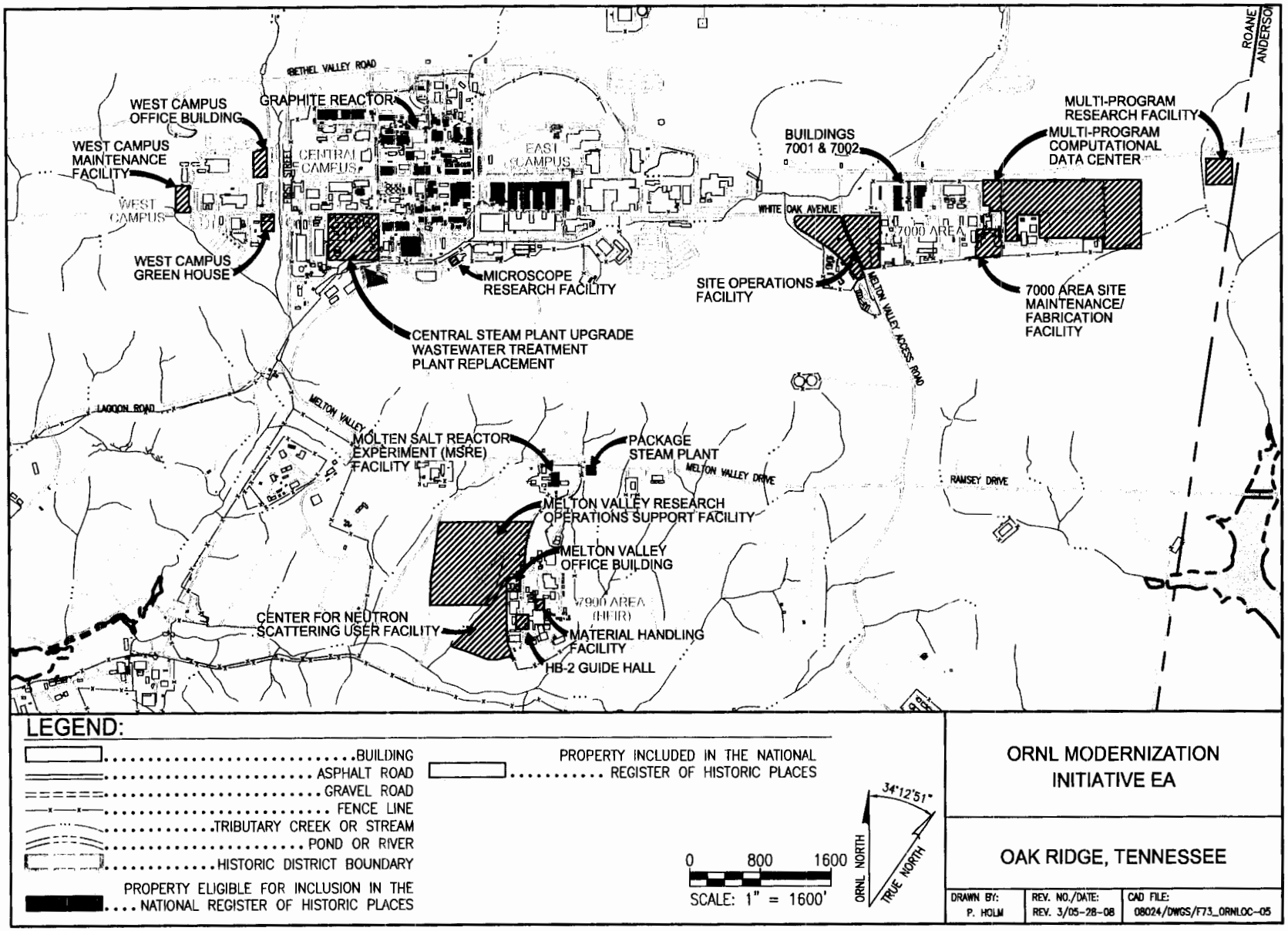


Fig. 3.1. ORNL Historic District and properties eligible for inclusion in the National Register of Historic Places.

Table 3.2. Demographic and economic characteristics: Oak Ridge region of influence

County	2001	2002	2003	2004	2005	2006	Annual growth 2001–2006 (%)
			Anderson				
Population	71,336	71,377	71,407	71,381	71,801	72,873	0.43%
Per capita income ($)	26,027	26,905	27,739	28,111	29,204	30,218	3.03%
Total employment	50,975	50,601	51,904	52,021	52,897	53,598	1.01%
			Knox				
Population	387,775	392,858	398,760	403,080	409,116	416,352	1.43%
Per capita income ($)	29,134	29,478	29,893	31,295	32,391	33,963	3.11%
Total employment	272,556	275,868	277,453	289,337	294,873	303,185	2.15%
			Loudon				
Population	39,970	40,755	41,418	42,155	43,242	44,362	2.11%
Per capita income ($)	25,712	26,381	27,628	29,718	30,788	32,715	4.94%
Total employment	15,834	16,075	17,253	17,857	18,607	19,341	4.08%
			Roane				
Population	52,056	52,120	52,440	52,676	52,624	53,076	0.39%
Per capita income ($)	22,603	23,984	24,862	26,331	27,845	29,074	5.16%
Total employment	20,953	20,975	21,023	21,141	21,688	22,133	1.10%
			Region Totals				
Population	551,137	557,110	564,025	569,292	576,783	586,663	1.26%
Per capita income ($)	27,870	28,407	28,986	30,320	31,459	32,961	3.41%
Total employment	360,318	363,519	367,633	380,356	388,065	398,257	2.02%

Source: Bureau of Economic Analysis 2008.

Table 3.3. City of Oak Ridge revenues and expenditures, FY 2006, projected 2007, and budgeted FY 2008 ($)

	2006 Actual	2007 Projected	2008 Budgeted
Revenues			
Taxes	28,837,918	29,364,075	30,842,955
Licenses and permits	465,364	276,500	223,000
Intergovernmental revenues	2,961,272	2,991,505	3,067,300
Charges for services	321,438	319,000	330,500
Fines and forfeitures	323,480	369,000	338,000
Other revenues	714,689	744,000	653,500
Total revenues	33,624,161	34,064,080	35,455,255
Expenditures and other financing			
Expenditures	(15,306,580)	(16,284,362)	(17,345,717)
Other financing uses[a]	(17,920,082)	(18,506,328)	(19,794,647)
Total expenditures and other financing	(33,226,662)	(34,790,690)	(37,140,364)

[a] Includes items such as the capital projects fund, solid waste fund, economic diversification fund, debt service, and schools.

FY = fiscal year.

Source: City of Oak Ridge 2007.

parks and recreation. The largest revenue sources have traditionally been local taxes (which include taxes on property, real estate, hotel/motel receipts, and sales) and intergovernmental transfers from the federal or state government. Roughly 95% of the 2006 general fund revenue came from these combined sources (City of Oak Ridge 2007). For FY 2008, the property tax rate was $2.65 per $100 of assessed value. The assessment rate is 40% for industrial and commercial property and 25% for residential property (City of Oak Ridge 2006). The city also receives a payment-in-lieu-of-tax (PILT) for ORR acreage that falls within the city limits. The PILT is based on its value as farmland and assessed at the farmland rate of 25%

(City of Oak Ridge 2006 and 2007). In 2006, the payment was based on a value of $6,450 per acre (Hunter 2006).

3.8 UTILITIES

ORNL has its own infrastructure to support its activities and includes a dedicated fire department, a medical center, a security force, a wastewater treatment plant, and a steam plant. The water supply system is a shared supply system between the Y-12 Complex and the city of Oak Ridge. The water treatment plant is operated by the city of Oak Ridge. Utility service for electricity, natural gas, water, and telecommunications that are required for ORNL to operate are supplied by other entities. ORNL produces steam and compressed air and operates and maintains systems for the collection and treatment of sanitary, process, and industrial-type wastes. Utilities required for the facilities described under the proposed action would typically be comparable to those already in place for current ORNL facilities. These include steam, potable, process and fire water, electricity, plant air, storm sewer, and sanitary sewer. The following information about the utility infrastructure serving ORNL reflects existing conditions at Bethel Valley and Melton Valley locations, as appropriate.

3.8.1 Electrical

Bethel Valley

Electrical power to ORNL is supplied from the TVA Oak Ridge area 161-kV network through three 161-kV feeders via a new (161-kV/14-kV) primary substation (constructed in 2006). No on-site electrical power generation is conducted at ORNL; however, backup generators have been installed at specific facilities. These standby generators provide essential power to allow functions associated with environment, safety, health, security, quality, and infrastructure to continue unaffected during power outages. The reliability of the ORNL electric system is being improved through the replacement of obsolete equipment and through expansion and updating of the local distribution system. These actions will not only improve the reliability, but also provide the capability to meet ORNL's future power needs. The operating practice at ORNL is not to exceed 50% of design megavolt-amperage to maintain switching flexibility in the event of an outage.

Melton Valley

Power to Melton Valley facilities is fed overhead at 13.8 kV via two separate feeds. Circuit 294 serves the reactor systems and is backed up by circuit 234. Circuit 234 serves all other non-critical loads. In addition, a new circuit 118 will assume about one-half of the load of circuit 234. Much of the southwestern loop of circuit 234 is planned to be relocated to a newly proposed utility corridor in an underground duct bank/manhole system as part of the Melton Valley Master Plan (DOE 2006).

3.8.2 Natural Gas

Bethel Valley

Sempra Energy Trading Company provides natural gas for Bethel Valley facilities via a receiving station in the vicinity of the 7000 Area. The ORNL natural gas tap is at Metering Station B located North of Bethel Valley Road at the Melton Valley Access Road intersection. The gas supply for the remainder of ORNL runs to a pressure-reducing station at the steam plant. From the ORNL Steam Plant, gas is further supplied to various ORNL users. The distribution system consists of approximately 23,000 ft of

piping and about 350 valves. The ORNL Steam Plant uses 95% of the total natural gas supply received from Sempra Energy Trading Company.

Melton Valley

Natural gas is not currently available to the Melton Valley facilities; future natural gas hook-ups are proposed (DOE 2006).

3.8.3 Potable Water

Bethel Valley

Treated water is supplied to ORNL by the city of Oak Ridge from the water treatment plant located across from the Y-12 Complex, on the east end of Bear Creek Road. Water to ORNL is provided via a single 24-in. gravity line from the water plant into the ORNL plant site. ORNL is responsible for compliance with the rules of TDEC, Division of Water Supply and operates and maintains the water distribution system. The water line feeds the ORNL reservoir system, which consists of one 3-million-gal concrete reservoir, a 1.5-million-gal steel reservoir on Chestnut Ridge, and two 1.5-million-gal steel reservoirs on Haw Ridge. From these reservoirs, water flows by gravity through the plant distribution grid. The water is used for potable, fire protection, and process purposes. In addition to the mentioned reservoirs, a 0.3-million-gal elevated tank was constructed as part of the SNS project. Although constructed for the primary use of the SNS, it is part of the ORNL distribution grid. The potable water and process water distribution system at ORNL consists of ~212,000 ft of piping. The general condition of the system can be described as good. System breaks are sporadic and the cause of the failure is primarily due to mechanical loading and deterioration.

Melton Valley

Potable water is provided from a 16-in. water line entering the northeast side of the facilities. This line is backed up by a 12-in. water line, also from the northeast, following Melton Valley Drive. As part of the Melton Valley Master Plan, the water line on the southwest side of the existing facilities would be relocated to the south of Phase I of the new CNS User Facility and a new loop created for the HFIR HB-2 Guide Hall and Cold Source (DOE 2006).

3.8.4 Sanitary Wastewater

Bethel Valley/Melton Valley

The ORNL sewage system includes the main system, the 7900 Area system, and the other minor systems. The main system serves Bethel Valley, Melton Valley, and the Spallation Neutron Source site. Sewage flows to an on-site treatment facility located in the southwest area of the ORNL site. The sewage collection system consists of pumping stations and over 50,000 lin. ft of gravity-flow and force sewer mains of clay, cast iron, ductile iron, and polyvinyl chloride pipe ranging in size from 4 to 12 in. There is approximately 20,000 lin. ft of building lateral piping. Access to this system is obtained through brick and concrete manholes. The ORNL sanitary STP, built in 1985, consists of a DAVCO 300,000-gal per day package extended aeration plant that provides primary and secondary treatment. Sand/gravel filtration and ozonation provide tertiary treatment. The STP wastewater effluent is discharged through one of the ORNL NPDES-permitted outfalls into WOC. Permit-limit compliance is facilitated via a waste acceptance criteria (WAC) document that must be followed for all wastewater proposed for treatment.

Adequate capacity exists for the PWTC to treat projected levels of R&D-generated wastewater, but portions of the system could need to be upgraded or replaced with newer, more efficient treatment technologies or modified based on the types of R&D-generated wastes it may handle in the future.

Melton Valley

There are various process wastewater streams from the HFIR facility that are piped into a tank farm in the 7900 Area at Melton Valley and then piped to the PWTC for treatment. In addition, there is also contaminated groundwater from Melton Valley SWSAs that is piped to the PWTC for treatment. Cooling tower blowdown at HFIR is cooled/dechlorinated and discharged to Melton Branch in Melton Valley (Valentine 2008).

3.8.7 Stormwater Collection System

Bethel Valley/Melton Valley

The stormwater collection system consists of drainage ditches, catch basins, manholes, and collection pipes that convey stormwater, condensate, and cooling water flows to the receiving streams. WOC traverses the ORNL site and ultimately receives all of the discharges from ORNL, as well as normal flows from the four tributaries that feed it. Rainfall, snowmelt, and other authorized flows are directed to the gravity-drainage system that conveys the water from buildings, parking lots, streets, and roofs to specific outfalls. Each of these outfalls must be periodically sampled and characterized to determine the makeup of the discharge stream and to ensure that it complies with NPDES permit requirements.

3.8.8 Fire Protection

Bethel Valley/Melton Valley

Most ORNL facilities are protected from fire by remotely monitored fire alarm and sensing systems coupled with automatic sprinkler devices. Fire protection is provided primarily through the potable water system and is crucial to the facilities and personnel protection. During the winter months, space heating, of various system types, protects the fire protection water lines from freezing. Many of the old, outdated fire alarm systems are being updated, and new systems are being added to facilities currently not covered. These improvements will enhance fire protection capability at ORNL and ensure compliance with requirements in fire protection standards.

3.8.9 Compressed Air

Bethel Valley/Melton Valley

Compressed air supplies most of ORNL's major pneumatically operated control systems located in the Bethel Valley and Melton Valley locations, which include experimental programs and processes, as well as building ventilation systems. Clean, dry, instrument-quality, compressed air is produced at the ORNL Steam Plant, which supplies the Central and Bethel Valley facilities. There are five air compressors available to meet the airflow demand. These compressors are backed up with diesel generators or steam turbines to enable uninterrupted service during electrical power outages. The compressed air is distributed through an arterial-looped underground and aboveground piping system. Compressed air at Melton Valley is provided locally at the respective facilities via air compressors (Skipper 2008).

3.8.10 Steam Plant

Bethel Valley/Melton Valley

The steam production system consists of six natural gas/fuel oil, dual-fired boilers, all of which are housed in the Steam Plant (Bldg. 2519). Total capacity of the six boilers is slightly over 300,000 lb/hr of saturated steam at 250 pounds per square inch gage. The steam plant supplies steam to both the Bethel Valley and Melton Valley facilities. The plant was converted from coal firing to natural gas/fuel oil firing in late 1999. As part of the conversion, a new natural gas/fuel oil-fired boiler was installed. The steam distribution system is generally in good condition due to major refurbishments of the system in 1988 and 1998. About 90% of the steam produced is used primarily for heating approximately 135 buildings and the remainder is used for process steam. Steam is available to drive the off-gas turbines in the 3039 stack area during electrical power outages.

3.8.11 Heating, Ventilating, and Air Conditioning

Bethel Valley/Melton Valley

The heating, ventilating, and air conditioning (HVAC) systems in each building are maintained per the heating, cooling, and humidity control requirements applicable for each facility. The HVAC design in each building would include refurbishment of HVAC system heating and cooling equipment, ductwork, filters, stacks, scrubbers, and alarm and backup systems. The ORNL central chilled water system located in Bldg. 4509 generates the cooling water used in the air conditioning of some 4500, 5500, and 6000 series buildings. Furthermore, chiller plants located in Bldgs. 5300, 5309, and 5600 generate the cooling water used in the air conditioning of Bldgs. 5100, 5200, 5300, 5600, 5700, and 5800. Regardless of outside temperatures, several facilities require year-round cooling from the chilled water system for computers, accelerators, and some laboratories.

3.8.12 Steam Plant Wastewater Treatment Facility

The Steam Plant Wastewater Treatment Facility, formerly known as the Coal Yard Runoff Treatment Facility, was constructed in 1985 to treat wastewater from steam plant boiler blow down, runoff from the coal storage yard, ash handling water, and wastewater from various water softener/ion exchange/demineralizer regeneration systems at the ORNL Steam Plant. The system was designed by Alar Engineering Corporation of Mokena, Illinois. The treatment equipment is in Bldg. 2644, located south of the Sanitary STP, along First Street, in the southwest area of the ORNL site. The plant now primarily only treats wastewater from the Steam Plant water softener regeneration and boiler blow down. Effluent from the treatment plant is discharged through an NPDES-permitted outfall.

3.8.13 Telecommunications

Bethel Valley

Double coaxial cables connect selected facilities in Bethel Valley with selected ORNL facilities at Y-12. The ORNL network backbone will remain fiber-optic-based, but will evolve from its current fiber distributed data interface (FDDI) technology base to a set of parallel FDDI, Gigabit Ethernet, and ATM networks that provide the flexibility to accommodate almost any network-intensive computing project while holding the line on costs for less demanding applications.

Melton Valley

A communications hub is located in Bldg. 7910. Fiber for data and copper for telephones are routed to Bldg. 7910 from Bldg. 4500. Extension of these systems will follow the utility corridor pathway in an underground duct bank/manhole system (DOE 2006).

3.9 TRANSPORTATION

ORNL main site locations are accessible only by road. Although portions of the site border the Clinch River, there is no barge facility. Rail access is also limited as well, as no tracks run to the ORNL site. Vehicle circulation at ORNL may be divided into two sectors: off-site and on-site circulation. Off-site circulation consists of staff movements to and from work and between the various Oak Ridge installations on work assignments and materials delivery. Off-site roads include State Route (SR) 95 (White Wing Road), which provides access to the west end of the Bethel Valley area, and SR 62 and Scarboro Road, which provide access to the eastern end of Bethel Valley. On-site circulation consists of materials handling, movement of personnel between buildings and to and from parking lots, and contractor and vendor personnel movement.

The main road in the vicinity of the Main Campus is Bethel Valley Road, which is currently closed to non-authorized traffic. This east-west road provides access to the site from the surrounding SRs. Completion of several construction and expansion projects has helped alleviate some of the chronic parking problems experienced at the Bethel Valley site. Several main roads and access roads provide on-site transportation. The primary north and south corridors are First, Second, Third, Fourth, and Fifth Streets. The major east and west corridors are White Oak and Central Avenues. Materials are transported via the same routes used by employees and visitors.

The main roads in Melton Valley are Melton Valley Drive, Ramsey Drive, and Melton Valley Access Road. These roads lead to the principal experimental facilities, including the HFIR, the Consolidated Fuel Reprocessing Center, and the Robotics and Process Systems Complex. Several other access roads serve the numerous SWSAs located at the west end of the Melton Valley portion of ORNL.

By far, the largest portion of the off-site traffic circulation generated by ORNL is personnel commuting to and from work. The average commute of an ORNL employee working in Bethel Valley is about 35 miles. Peak traffic occurs between 7 and 8 a.m. with the arrival of workers at the site, and between 4 and 5 p.m. with their departure. Minimal traffic delays are experienced during these peaks because work shifts are staggered, car and vanpooling are practiced, and most deliveries to and shipments from ORNL are timed to avoid the rush hour. Road maintenance and the movement of heavy equipment or escorted shipments typically occur during the workday after traffic flow has subsided.

3.10 WASTE MANAGEMENT

The Solid Waste Management Program in Tennessee was implemented in 1971 with the promulgation of the Regulations Governing Solid Waste Processing and Disposal. Within the state of Tennessee there are four distinct classes of solid waste landfills that are permitted by TDEC for disposal of various types of solid waste generated within the state. The four classes of landfills and wastes that may be disposed of within the various classes of landfills include:

- Class I landfills – municipal solid waste, household waste, shredded/waste tires, etc.;

- Class II landfills – industrial waste;
- Class III landfills – farming wastes, landscaping and land clearing wastes, etc.; and
- Class IV landfills – construction and demolition waste.

Solid waste landfills are governed by federal and state environmental regulations that are found at 40 *CFR* Part 258 (governs only municipal solid waste landfills) and Rules of the TDEC Chap. 1200-1-7. These provisions specify the operational and permit requirements for disposal of solid waste within the state of Tennessee. Located within the boundary of the Y-12 Complex are two Class II operating industrial solid waste disposal landfills and one operating Class IV construction demolition landfill. These facilities are permitted by TDEC and accept solid waste from DOE operations on the ORR. The nearest commercial Class I landfill to the ORR is the Chestnut Ridge Landfill and Recycling Center in Anderson County operated by Waste Management, Inc. of Tennessee.

On the ORR, Bechtel Jacobs Company LLC (BJC) assumed responsibilities for waste storage, transport, and disposal at ORNL in 1999. The types of wastes that are expected to be generated or have the potential to be generated during the construction and operation of the new facilities and utility infrastructure improvements are briefly described below.

3.10.1 Sanitary/Industrial

Sanitary wastes consist of both liquid and solid forms. Sanitary and process wastewater collection and treatment is discussed in Sect. 3.8. Sanitary/industrial solid wastes consist of paper, garbage, wood, metal, glass, plastic, demolition and construction debris, sanitary and food wastes from cafeteria operations, sludge from water and air treatment, and other special wastes. The Y-12 Complex Centralized Sanitary Landfill II is used for disposal of non-hazardous materials such as construction debris and other solid sanitary wastes (ORNL 2002).

3.10.2 Hazardous Waste

Hazardous waste is a waste or surplus material with negligible value that may cause or contribute to an increase in mortality or to an increase in serious irreversible illness, or pose a substantial present or potential hazard to human health or the environment when improperly stored, treated, disposed of, or transported. These wastes are regulated pursuant to the Resource Conservation and Recovery Act of 1976 (RCRA). Hazardous wastes are defined and regulated by RCRA regulations by specific source lists, non-specific source lists, characteristic hazards, and discarded commercial chemical product lists. The regulations generally divide hazardous wastes into two categories: characteristic hazardous wastes and listed hazardous wastes. Characteristic hazardous wastes are those that exhibit the characteristics of ignitability, corrosivity, reactivity, or toxicity, as defined in 40 *CFR* 261 Subparts C. Listed hazardous wastes are those found within the specific waste listings provided at 40 *CFR* Part 261 Subpart D.

Hazardous wastes are generated throughout ORNL and are stored in generator satellite accumulation areas or in (90-day) accumulation areas operated by the generator or Laboratory Waste Services pending pickup. Based on the characteristics and certification of the waste, the waste may be: (1) transported to an off-site commercial facility for treatment and/or disposal, (2) stored in one of several storage facilities permitted for hazardous waste, or (3) utilized for other on-site treatment. Most of ORNL's permitted storage of hazardous waste is consolidated in the 7650 series buildings on Melton Valley Access Road.

3.10.3 Low-Level Radioactive Waste

Low-level radioactive waste (LLW) is waste that contains radioactivity but is not classified as high-level waste, TRU waste, spent nuclear fuel, or byproduct material, as defined by DOE Order 435.1,

"Radioactive Waste Management." LLW does not contain hazardous waste as regulated by RCRA and as defined in 40 *CFR* 260–268 (or state of Tennessee equivalent standards). Some polychlorinated biphenyl (PCB)-contaminated or PCB-detectable waste as regulated by the Toxic Substances Control Act of 1976 (TSCA), and as defined in 40 *CFR* 761, may be accepted and handled as LLW. DOE Order 435.1 and the Atomic Energy Act, as amended, provide the primary regulatory guidance and requirements for the management of LLW.

LLW is generated throughout ORNL, and after characterization and waste certification, it is staged at the generating location until it is certified and accepted by the receiving facility. BJC, the DOE waste management contractor, determines the most suitable management option for all LLW generated by ORNL. Based on the characteristics and certification of the waste, BJC may: (1) store the waste in one of several storage facilities dedicated to LLW; (2) utilize treatment options, such as compaction and incineration, offered by commercial facilities or in-house treatment options; or (3) ship the waste to an approved off-site disposal facility such as the Nevada Test Site or Envirocare (ORNL 2002).

3.10.4 TRU Waste

TRU waste is waste that is contaminated with alpha-emitting transuranium (atomic number greater than 92) with half-lives greater than 20 years and concentrations greater than 100 nanocuries per gram at the time of assay. WAC and an implementing procedure are in place for treatment and disposal of TRU wastes generated at ORNL (ORNL 2002).

TRU waste is generated by a limited number of generators and facilities at ORNL. All TRU waste generated is stored in on-site storage facilities operated by BJC or Foster-Wheeler. Most of these facilities are RCRA-permitted and store some RCRA-contaminated TRU waste, as well as some RCRA-contaminated LLW that exceeds the dose limits for BJC's other RCRA-permitted storage facilities. A very small quantity of TRU waste is also PCB contaminated (ORNL 2002). Limited treatment options are, or will be, conducted by Foster-Wheeler and/or BJC, including stabilization, amalgamation, and/or macroencapsulation. Most TRU waste will eventually be disposed of at off-site facilities.

3.10.5 TSCA Waste

TSCA waste consists of PCB waste and asbestos waste and is regulated by EPA under TSCA. In accordance with 40 *CFR* 761, Subpart D, TSCA regulates PCB materials (wastes/contaminated equipment) based on PCB concentration and waste type (such as PCB remediation waste or PCB bulk product waste). TSCA also regulates PCB/radioactive wastes. The ORR PCB Federal Facilities Compliance Agreement between EPA Region 4 and DOE-ORO addresses PCB compliance issues at ORNL. This agreement specifically addresses the pre-TSCA use of PCBs, storage and disposal of PCB wastes, spill cleanup and/or decontamination, PCBs mixed with radioactive materials, and records and reporting requirements. Some of ORNL's PCB/radioactive wastes are treated at the TSCA Incinerator at East Tennessee Technology Park (ETTP), whereas other PCB wastes are sent to commercial facilities within 1 year of generation.

TSCA also addresses the manufacturing, importing, and processing of asbestos and establishes requirements for asbestos abatement projects not covered by: (1) the Asbestos Standard of OSHA, 29 *CFR* 1926.58; (2) an asbestos standard adopted by a state as a part of a plan approved by OSHA under Sect. 18 of the Occupational Safety and Health Act of 1970; or (3) a state asbestos regulation, which EPA has determined to be comparable to, or more stringent than, that established in 40 *CFR* 763.120. Because ORNL does not manufacture, import, or process asbestos, and because asbestos activities are covered by an approved Asbestos Standard, any waste with asbestos-containing material (ACM) is not regulated

under TSCA. ACM is either managed as sanitary waste, LLW, TRU waste, TSCA/RCRA waste, or TSCA/RCRA mixed waste if the ACM has come into contact with such constituents. Accordingly, asbestos is managed as a TSCA (PCB) waste only if it has come into contact with PCBs.

Generators initially store these wastes until transfer for on-site storage, off-site storage, or disposal. PCB wastes received, treated, and disposed are routinely included in the totals for hazardous and mixed wastes (ORNL 2002).

3.11 HUMAN HEALTH AND SAFETY

Past activities at ORNL have resulted in releases of radionuclides and chemicals to the environment. Such releases combine with natural sources and can augment the exposure to humans both on- and off-site. Natural background sources include cosmic radiation and uranium and thorium in native soil. Inorganic elements, such as arsenic, beryllium, and manganese, are also found in native soil on the ORR, including ORNL. These naturally existing sources of radiological and chemical exposures become the background exposure to which the effects of the man-made releases would be added. The ORR Annual Site Environmental Report for 2006 (DOE 2008) summarizes releases of environmental contamination levels of chemicals and radiation and resulting exposures for calendar year 2006. In general, human exposure pathways include direct contact, inhalation, and ingestion. Radiation exposure is commonly categorized as either external (exposure to penetrating radiation) or internal (ingestion and inhalation). Ingestion of radionuclides can be through the intake of water or foodstuffs (e.g., vegetation and fish).

DOE Order 5400.5, "Radiation Protection of the Public and the Environment," limits the effective dose equivalent (EDE) that an off-site individual may receive from all exposure pathways and all radionuclides released from the ORR during 1 year to no more than 100 mrem. DOE regulations (10 *CFR* 835, Occupational Radiation Protection) establish radiation protection standards and program requirements for DOE and DOE contractor operations with respect to the protection of workers from ionizing radiation. DOE's limiting control value for a worker's radiation dose is 5000 mrem/year total EDE from combined internal and external sources.

With the exception of a few new facilities, the majority of facilities associated with the modernization effort are proposed to provide consolidation of processes and activities located in several different locations throughout the ORR; no new or unusual processes that would result in unique health or safety issues are proposed as part of this modernization effort. Operations associated with ORNL activities are conducted in strict compliance with DOE regulations and OSHA standards.

3.11.1 Radiological Exposure to the Public

The average annual background radiological EDE from natural and man-made sources to an individual residing in the United States is approximately 360 mrem. Approximately 300 mrem of the 360 mrem are from natural sources (e.g., radon and cosmic radiation) and about 55 mrem of which are from natural external radiation sources (i.e., cosmic and terrestrial radiation) (National Council on Radiation Protection and Measurements 1987). External radiation exposure rates from background sources have been measured in Tennessee. The measured rates are equivalent to an average annual EDE of 42 mrem, ranging between 19 and 72 mrem (Myrick et al. 1981). This average is less than the United States annual average of 55 mrem.

DOE (2008) provides estimates of radiological doses from ORNL; information from this report is summarized here. The calculated radiation dose to the maximally exposed off-site individual resulting from airborne releases from ORNL was about 0.8 mrem during 2006, which is less than 1% of the natural

external radiation background EDE to an average Tennessee resident. The maximally exposed individual for ORNL is assumed to be located about 3.1 miles east of the 3039 Stack and 2.6 miles east-northeast of the 7911 Stack. The maximum estimated dose that any member of the public could have received from activities on the ORR in 2006 was 6 mrem. This includes eating deer, turkey, fish, and geese harvested on or near the reservation; drinking the most contaminated water; and breathing the most contaminated air. It is very unlikely any one person could have actually received this dose. When compared to the background EDE, the maximum dose a single member of the public could have received is approximately 2% of that naturally occurring.

3.11.2 Radiological Exposure to Workers

Workers at selected buildings on the ORR are potentially exposed to radioactive hazards. Some facilities contain out-of-date, service-contaminated equipment remaining from former operations and other work involving spent fuel, plutonium, uranium, thorium, and other radionuclides. An extensive health physics program is used to track any migration of contamination, which is impeded by a combination of engineered physical boundaries (e.g., gloveboxes, cells, and multi-zoned ventilation controls).

Constructing additions to or upgrading existing facilities may pose legacy issues that have generated key environment, safety, and health (ES&H) concerns. While legacy contamination is generally addressed under CERCLA, they are of interest here. Some of the primary concerns include legacy contamination in ductwork and structures and poor indoor air quality issues that require stringent institutional controls to mitigate potential health hazards. Workers or visitors in these areas are protected from exposure to hazards through adherence to Health and Safety Plans, the use of personal protective equipment when necessary, and OSHA training. Additionally, sampling, monitoring, and the use of administrative controls are in place to limit worker exposure to radionuclides and chemical hazards through Radiological Control Organization and industrial health and safety policies, standards, and procedures.

3.11.3 Chemical Exposure to the Public

Health effects attributed to chemical exposures can be categorized as carcinogenic or non-carcinogenic. Chemical carcinogenic risks are reported here as a lifetime probability of developing an excess cancer. EPA defines a target cancer risk range of 10^{-4} (1 in 10,000) to 10^{-6} (1 in 1,000,000), which defines when cleanup actions are to be considered under CERCLA. Non-carcinogenic hazards are reported as hazard quotients (HQs) where unity (1) or greater represents a potential for adverse health effects. An HQ less than unity indicates an unlikely potential for adverse health effects. The sum of more than one HQ for multiple toxicants and/or multiple exposure pathways is called a hazard index (HI). Pathways of concern for non-carcinogens are defined as those with an HI greater than 1. DOE (2008) estimates the human health risks from chemicals found in the environs of the ORR. The primary exposure pathways considered are ingestion of drinking water and fish. For ingestion of drinking water, HQs were estimated upstream [Clinch River kilometer (CRK) 70] and downstream (CRK 16) of ORR discharge points. HQs were less than 1 for detected chemical analytes for which there are reference doses or maximum contaminant levels (i.e., barium, manganese, zinc, etc.).

3.11.4 Chemical Exposure to Workers

Potential chemical hazards to personnel working on the ORR include uncoated lead shielding, lead paint, PCBs, asbestos, combustible foam insulation, perchlorate contamination, hazardous chemicals used in R&D and routine operations and maintenance, and legacy beryllium contamination. RCRA hazardous and TSCA wastes are produced in the course of routine operations and maintenance of the facility. Oversight for control of occupational chemical exposures at existing facilities currently is under the

Oversight for control of occupational chemical exposures at existing facilities currently is under the responsibility of the UT-Battelle Environment, Safety, and Health organization or BJC, both of whom must ensure compliance with the provisions of DOE Order 440.1, "Worker Protection Management for DOE Federal and Contractor Employees." This Order includes a requirement that contractors comply with Federal OSHA regulations.

4. ENVIRONMENTAL CONSEQUENCES

This chapter includes the impact analysis and discussion of project attributes that could have the potential for significant impacts.

4.1 LAND USE

4.1.1 Proposed Action

New facilities and utility infrastructure improvements under the ORNL Modernization Initiative would be constructed in previously disturbed and undeveloped areas in Bethel Valley and Melton Valley. This would include facilities and infrastructure improvements funded by DOE, the state, and by the private sector. No adverse land use impacts would occur because the existing DOE institutional/research and mixed research/future initiatives land use designation would not change. Transfers of property from DOE to the private sector or the state of Tennessee would change its use classification from the DOE-designated categories to non-DOE municipal zoning, but would have little effect on how the land is actually used.

The proposed locations of the new facilities and utility infrastructure improvements and their proximity to existing ORNL facilities and resources would minimize the area required for new development. Some of the new facilities would also consolidate activities that currently are spread among several buildings. Some visual impacts would result from the proposed action because the demolition of existing facilities and construction of new ones would change the current visual landscape. However, architectural consistency would be provided within Bethel Valley and Melton Valley, to the extent practicable, to ensure blending of construction with the existing strategic structures while allowing state-of-the-art improvements in building sustainability designs and efficiency.

4.1.2 No Action

There would be no major changes in land use at ORNL or the surrounding area under the no action alternative because the ORNL Modernization Initiative would not occur. Planned remedial actions and construction of new FRP facilities would be expected to continue. Also, DOE could choose to construct new facilities or continue to use existing facilities for on-going missions regardless if the Modernization Initiative is implemented or not.

4.2 SOIL

4.2.1 Proposed Action

Potentially affected soil is generally stable and acceptable for standard construction requirements. Because the soil is predominantly residual clay, which generally is not susceptible to liquefaction during a seismic event, soil-supported foundations should remain stable against liquefaction during and after a seismic event, should one occur.

Construction activities involving ground disturbance would be conducted incrementally to limit the potential for soil erosion and the amount of land under construction at any one time would not exceed 20 acres. To minimize the potential for adverse impacts and limit the potential for soil erosion, erosion prevention and sediment control management practices (e.g., silt fences, sediment ponds, erosion control

mattings and blankets, etc.) would be implemented. Vegetation clearing for the project would be limited to the minimum area required for construction of the project and disturbed areas would be revegetated with native species. Grading activities, earth moving, and slope reduction in areas that are transferred to the state or a third-party for construction would require a Grading Permit from the city of Oak Ridge.

4.2.2 No Action

Under the no action alternative, the Modernization Initiative would not take place at ORNL. However, environmental cleanup activities, as part of EM's proposed IFDP, would be conducted irrespective of whether the proposed action or no action occurs. These cleanup activities would be conducted under CERCLA, and the required studies would address any potential impacts to soil. In addition, the area would continue to be part of the ORNL Main Campus and would be used to support appropriate activities consistent with ORNL's mission. Thus, there would be no difference from a soil perspective.

4.3 WATER RESOURCES

4.3.1 Proposed Action

Based on the water resources described previously in Sect. 3.3, there are no impediments to constructing and operating new facilities or performing utility infrastructure upgrades in the proposed areas. Surface water resources including any associated floodplains and wetlands would be avoided and direct impacts to these resources are not expected. However, if any activities occur within, or have the potential to impact, these features, the appropriate regulatory process would be followed including obtaining any required permits. Physical alterations to streams or stream banks typically require a TDEC Aquatic Resource Alteration Permit. If 1 acre or more is disturbed for development, a Tennessee Construction Stormwater General Permit would be required for discharges of stormwater. For any new or modified discharges to surface water, existing NPDES permits would need to be modified or a new permit obtained. These permits and approvals are routinely obtained for a variety of activities that occur at ORNL and would be coordinated through the ORNL Water Quality Protection Group.

Erosion prevention and sediment control practices (silt fences, sediment ponds, erosion control mattings and blankets, vegetative strip buffer zones, etc.) would be implemented to minimize potential adverse impacts to surface water from construction activities requiring ground disturbance. State and federal stormwater regulations to minimize erosion and sedimentation would be met. As applicable, notification of any ground disturbance would be made to DOE and/or TDEC prior to construction activities.

The addition of new impervious surfaces would likely result in a cumulative increase in the rate and volume of stormwater runoff at ORNL; however, the overall change in existing land cover would be minimal. Increases in surface water runoff as a result of new construction would be attenuated through the use of temporary or permanent stormwater controls such as detention or retention basins and other structures and stabilization of disturbed areas through landscaping and vegetation. The use of these measures would also increase groundwater recharge through direct percolation, offsetting the loss of pervious surface due to construction and minimizing downstream effects.

Existing potable and process water systems would likely be modified as part of any new development to support the new facilities. Sanitary wastewater from potential new facilities would be discharged to the ORNL STP. Therefore, no impacts to surface water are anticipated from normal facility operations.

Some ORNL stormwater collection systems would require minor changes to accommodate the design of new facilities; but no net effect is expected in the downstream watershed because the fundamental land use would remain the same. Water discharged into the ORNL stormwater collection system ultimately discharges into WOC via NPDES-permitted stormwater outfalls. Concentrations of toxic and conventional pollutants and radionuclides would be expected to remain within the existing permit limits.

4.3.2 No Action

The Modernization Initiative at ORNL would not take place under the no action alternative. However, environmental cleanup activities planned for ORNL, as part of EM's proposed IFDP, would be conducted irrespective of whether the proposed action or no action occurs. These cleanup activities would be conducted under CERCLA, and the required studies would address any potential impacts to water resources at ORNL. In addition, the Modernization Initiative area would continue to be part of the ORNL research campus and would be used to support appropriate activities consistent with ORNL's mission. Thus, there would be no difference from a water resources perspective.

4.4 AIR QUALITY

4.4.1 Proposed Action

To evaluate air emissions and their impact on the overall ROI, the emissions associated with the project activities were compared to the total county emissions on a pollutant-by-pollutant basis, using the ROI's 2002 NEI data. Potential impacts to air quality were determined by the total emissions of any criteria pollutant that exceeds 250 tons per year (tpy) and does not exceed 10% of the total ROI's emissions for that pollutant compared to the ROI's 2002 NEI data. The 250-tpy criterion is used in EPA's New Source Review standards as an indicator for impact analysis for listed new major stationary emissions sources (such as a chemical process plant) in attainment areas for prevention of significant deterioration (PSD), while the 10% criterion is used in EPA's General Conformity Rule as an indicator for impact analysis for non-attainment and maintenance areas. Although the ROI is an attainment area for all criteria pollutants except $PM_{2.5}$, the General Conformity Rule's impact analysis was utilized to provide a consistent approach to evaluating the impact of construction emissions.

The Air Conformity Applicability Model (ACAM) version 4.3.0 was also utilized to provide a level of consistency with respect to emissions factors and calculations. ACAM provides estimated air emissions from proposed federal actions in areas designated as non-attainment and/or maintenance for each criterion and precursor pollutant, as defined in NAAQS. ACAM was utilized to provide emissions for construction, demolition, grading, and paving activities by providing user inputs for each.

To identify impacts, calculated air emissions were compared to the established 250-tpy PSD criterion and, using the General Conformity Rule, were also compared to Roane County data as represented in the 2002 NEI. The air quality analysis focused on emissions associated with the construction activities. The quantitative analysis did not address air quality issues associated with operational activities at ORNL after the completion of construction.

Construction of the new facilities and the utility infrastructure upgrades would be completed using a phased approach planned for FYs 2010, 2011, 2012, 2016, 2017, and 2019. It was assumed that no more than 20 acres of land would be under construction per year. To complete the analysis, it was assumed that 100% of the square footage needed to be graded and 10% of the specified area would be paved. Construction emissions were calculated for those years and are summarized in Table. 4.1.

The steam plant upgrade would require the removal of four of the existing boilers and replacing those with one biomass boiler. This would decrease the use of fossil fuels by using locally available renewable fuel sources (i.e., wood, wood chips, etc.) to supply steam to the ORNL facilities. Emissions are expected to increase with the implementation of the biomass boiler (Wolfe 2008), particularly NO_2 from the combustion of wood fuel because this fuel type does not burn as cleanly as natural gas. Emission control devices would be used to control NO_2 and particulate matter emissions. Changes to the current Title V permit would be required and a detailed emission analysis would be completed and submitted for the permitting process.

Woody materials for the biomass boiler would be delivered via trucks from local suppliers within 50 to 60 miles of ORNL. It was assumed that 10 to 12 trucks per day would deliver the material 5 days a week. During the summer months when the demand for steam is less, there exists the possibility of a reduced number of daily deliveries. Truck emissions would result in a negligible increase in the pollutant emissions to the regional air quality annually and are summarized in Table 4.1.

Table 4.1. Construction and vehicle emissions

	Emissions (tpy)				
Emission activities	**CO**	**NO_x**	**PM_{10}**	**SO_2**	**VOC**
Construction emissions	35.27	13.18	111.54	1.46	3.14
Point source	2.48	3.04	0.22	0.02	0.15
Vehicle emissions	2.41	1.34	0.41	1.60	0.11
Total	40.16	17.56	112.17	3.07	3.40
County emissions	26,886.69	31,943.17	12,176.61	78,261.76	3,823.64
Percentage of county emissions	0.15%	0.05%	0.92%	0.00%	0.09%

CO = carbon monoxide, NOx = nitrogen oxide, PM_{10} = particulate matter with an aerodynamic diameter less than 10 microns, SOx = sulfur oxide, TPY = tons per year, and VOC = volatile organic compound.

Emissions would be minimal from construction activities and the vehicle emissions associated with supplying fuel for the steam plant. For each of the years evaluated, emissions for each of the pollutants are well below the 250-tpy criteria and the percent of the county emissions would not exceed 1% for any one pollutant. Particulate matter from grading activities would present the greatest pollutant emission at 111 tpy and 0.92% of Roane County emissions. Construction emissions would cause a temporary and minimal increase to air quality emissions. Adverse impacts are not expected to regional air quality from the proposed action.

4.4.2 No Action

Under the no action alternative, air pollutants would continue to be emitted at current permitted rates. Because the emissions meet permitting regulations and DOE and EPA standards and do not result in a violation of air quality standards, no adverse effects to air quality are expected.

4.5 BIOLOGICAL RESOURCES

4.5.1 Proposed Action

The majority of the proposed locations for the new facilities and utility infrastructure improvements are located in areas that are disturbed and have little natural vegetation. In undeveloped areas, development would result in the removal of native vegetation and minor habitat fragmentation. However,

the actual footprint of disturbance in these areas would be relatively small and there are large areas of similar habitat adjacent to these sites. There are two special plant communities that have the potential to be impacted by this action. The Bethel Valley Small-Head Rush Wetland and a small cedar glade are located adjacent to Bethel Valley Road within the MCDC study area. These areas would be avoided to the extent practicable and possible impacts would be controlled by fencing the area and maintaining the hydrology for the wetland. On-going monitoring during construction would be conducted to minimize the potential for adverse impacts.

It is expected that all of the new facilities and utility infrastructure improvements would be sited so that there would be no direct adverse impacts to wetlands in the proposed project areas. Measures such as silt fences and vegetation buffers would protect wetlands near construction sites from indirect impacts due to sedimentation. If construction activities cannot be conducted without direct or indirect adverse wetland impacts, the responsible party would be required to comply with the DOE floodplain and wetland environmental review requirements (10 *CFR* Part 1022), secure all required Sect. 404 and/or Aquatic Resource Alteration Permits, and comply with all compensatory mitigation requirements.

Construction impacts could include direct mortality or injury to wildlife. Wildlife impacts would be minimal because many of the species that likely occur in the affected areas are common in the Oak Ridge area and some species could relocate to similar habitats located immediately adjacent to the disturbed sites. Any air emissions and liquid effluent discharges from the new facilities are expected to be minor and controlled and are not expected to have any adverse impacts to wildlife or aquatic habitat or to pose any ecological risk.

No adverse impacts to any federal- or state-listed threatened and endangered plants or animals would occur from the proposed action. The state-listed small-head rush (species of special concern) occurs within the MCDC project area and the pink lady slipper (state endangered) and Canada lily (state threatened) are know to occur adjacent to the area in Melton Valley proposed for the package steam plant. These species would be protected by avoidance and would be monitored during construction activities to ensure their protection. Habitat for Indiana and gray bats in the Bethel Valley and Melton Valley areas that would be disturbed is considered low quality and no adverse impacts to either species are expected to occur.

4.5.2 No Action

Under the no action alternative, current ORNL facility operations within Bethel Valley and Melton Valley would continue in support of assigned missions. Environmental cleanup activities as part of EM's proposed IFDP would be conducted irrespective of whether the proposed action or no action occurs. These cleanup activities would be conducted under CERCLA, and the required studies would address any potential impacts to biological resources at ORNL. In addition, the area would continue to be part of the ORNL campus and would be used to support appropriate activities consistent with ORNL's mission. Thus, there would be no difference from a biological perspective.

4.6 CULTURAL RESOURCES

4.6.1 Proposed Action

DOE has determined that the planned new construction and upgrade activities would have no adverse impact to historic properties and that no archaeological resources would be affected by the construction of new facilities. The new facilities proposed for construction in the West Campus, Central Campus (2500 Area), and the 7900 Area in Melton Valley would take place near existing facilities that

have been determined to not be eligible for inclusion in the NRHP. In addition, the proposed facilities are not within the ORNL Historic District. New construction in the 7000 Area would not have any adverse impacts on Bldgs. 7001 and 7002, which are considered to be eligible for inclusion in the NRHP. The new facilities would be constructed to the southwest and east and are not immediately adjacent to the two NRHP-eligible buildings.

If during construction activities, an unanticipated discovery of cultural materials (e.g., human remains, pottery, bottles, weapon projectiles, and tools) or sites is made, the DOE-ORO Cultural Resource Manager would be notified immediately and all excavation would cease in the immediate vicinity. A further determination would be made by the DOE-ORO Cultural Resource Manager and appropriate consultation requirements with the Tennessee State Historic Preservation Office (SHPO) would be initiated and completed prior to any further disturbance of the discovery-site area.

4.6.2 No Action

Under the no action alternative, impacts to contributing properties within the ORNL Historic District would still occur from anticipated environmental cleanup activities planned for the Central Campus and elsewhere within ORNL as part of EM's proposed IFDP. Environmental cleanup activities would be conducted primarily under CERCLA and potential impacts to historical resources would be evaluated through the Sect. 106 process including consultation with the Tennessee SHPO. Additionally, routine maintenance actions, building modifications, minor construction projects, etc., that could possibly be covered by a Categorical Exclusion would be required to evaluate any potential impacts on historic resources.

4.7 SOCIOECONOMICS

4.7.1 Proposed Action

This section assesses the potential socioeconomic impacts of the ORNL Modernization Initiative. For the purpose of this analysis, it is assumed that DOE would retain ownership of the land and would continue to make PILT on the affected land.

Employment and Income

This analysis assumes that the ORNL Modernization Initiative would create up to 50 direct, full-time equivalent jobs per year, for a total of 450 jobs by 2016 (Skipper 2008). This figure represents a negligible increase (0.1%) from the 2006 total employment shown in Table 3.2. The proposed action is also expected to increase annual user visits from 1,500 to 3,500 by 2016 (Skipper 2008). Most user visits last 2 weeks or more (ORNL 2008), and the cost of local hotel rooms ranges from less than $60 to $150 per night (Hotel-guides.us 2008), for an estimated increase in local hotel revenues of up to $4.2 million (2000 x 14 days x $150/day). This also represents less than 1% of the $19.6 billion regional income for 2006.

While the ORNL Modernization Initiative may also result in additional indirect employment, the size of the impacts is uncertain. Such impacts can vary widely, depending on the specific industries and companies involved and the mix of other industries within the region. Changes in regional income from the proposed action would depend on the actual compensation paid but are expected to be proportional to the number of jobs generated.

Population

Based on the small number of estimated jobs created, no impact on population is anticipated.

Fiscal Impacts

Potential positive impacts include increased local revenue from real estate or sales taxes, but the size of the impact is expected to be small, based on the limited changes in regional employment and income.

4.7.2 No Action

Under the no action alternative, there would be no major change in anticipated population, employment, income, or fiscal characteristics, and no disproportionate effect on minority or low-income populations within the ROI.

4.8 UTILITIES

4.8.1 Proposed Action

It should be noted that many of the proposed new facilities would result in the consolidation of several other facilities located throughout ORNL. As a result, in most cases, the net impact to utility systems and associated consumption within the area would be negligible and, in some cases, would decline due to development of more energy-efficient facilities. Specific details about the utility requirements for facilities and improvements associated with the proposed action are still in the preliminary planning stages; however, the anticipated utility requirements would be typical of standard light industrial and research operations. Utility upgrades or replacements at existing facilities where additions occur would be conducted as needed. Any future utility additions or upgrades/modifications as a result of activities associated with the modernization would not have a major environmental impact. Current plans are for the construction of extensions to existing utility systems, such as water and sanitary sewer systems, steam, electrical power distribution systems, and natural gas, to accommodate modernization development. Telecommunication services would be provided from existing lines. Storm drain collection systems for the stormwater lines, hydrants, valving for the potable water distribution, and valving and a metering station for the new natural gas line to Melton Valley would likely be a part of these new utility requirements.

Sanitary wastewater resulting from activities associated with the modernization effort would be discharged to the ORNL STP and the newly proposed STP (once on-line) for subsequent treatment. The new STP is expected to enhance the existing ORNL STP capacity, thereby accommodating anticipated sewage discharge from the proposed facilities. Wastewater collection and transfer systems or facilities could be needed for wastewater other than sanitary wastewater, or for sanitary wastewater that would need to be transported to the STP rather than being facility-drain-disposed to the STP.

The majority of wastewater generated from operations associated with new facilities would be suitable for sanitary sewer discharge to the STP as with other similar processes/effluents at ORNL. However, there may be an incremental increase in process wastewater requiring treatment resulting from new facilities at the 7000 Area Site Maintenance/Fabrication Facility or the HB-2 Guide Hall facility at HFIR. In such cases, process wastewater that could not be discharged to the sewer and STP would be contained and transported to an approved off-site treatment facility or possibly the ORNL PWTC. Other major utility systems (i.e., HVAC, process, potable, and fire protection water, compressed air, and steam

that might be serving facilities in Bethel Valley and Melton Valley areas) are also anticipated to be capable of accommodating expected new activities associated with the modernization effort.

Overall, it is anticipated that improvements to utilities and infrastructure and implementation of energy conservation measures and utility upgrades associated with the proposed action would improve working conditions, reduce energy consumption, and improve operating costs at consolidated ORNL facilities, although quantitative estimates of this benefit would be speculative. The steam plant upgrade and decentralization of remote buildings would serve to reduce the extent of the steam plant distribution system to a minimum and convert existing buildings to new heating systems, thus improving efficiency and reliability. The Melton Valley facilities would be connected, via existing steam lines, to a new package steam plant. Consequently, overall beneficial impacts would result with regard to decreases in energy consumption and utility use.

4.8.2 No Action

If the no action alternative were implemented, infrastructure and utility repairs and upgrades would be conducted as part of on-going operations and landlord activities. Existing utilities, the electric distribution system, processed/chilled water systems, ventilation and exhaust systems, sanitary water treatment system, stormwater collection system, water supply system, fire protection system, natural gas, compressed air systems, and steam supply systems at each site would remain. Upgrades to the potable water systems and to electrical distribution systems are among the projects that are scheduled to occur within the next 10 years. However, not implementing the energy conservation measures and utility upgrades associated with the steam plant and STP identified as part of the proposed action would result in continued inefficiencies and unnecessary operating costs in these utility areas; cost and energy savings as described under the proposed action would not be realized under the no action alternative.

4.9 TRANSPORTATION

4.9.1 Proposed Action

The transport of materials and equipment associated with any construction and upgrade activities would be over regional and local roadways to the various sites. The construction of new facilities would be phased and spread out over several years and no adverse transportation impacts are expected. Operation activities at the new biomass-fueled Steam Plant would involve the delivery of 10 to 12 truckloads of wood chips per work day. This additional amount of truck traffic would have a negligible affect on existing traffic.

Employee traffic to ORNL along Bethel Valley Road would likely increase to a slight degree over current levels because the ORNL Modernization Initiative would result in a small employment increase over current levels (450 new employees by FY 2016) and an increase in the number of visiting researchers to the various ORNL user facilities (2,000 additional visiting researchers by FY 2016). Thus, some impacts to traffic loading would occur and commute times would possibly increase.

4.9.2 No Action

Traffic would likely continue to remain close to current levels and no impacts are expected. Implementation of the IFDP could have some temporary transportation effects as cleanup activities are conducted. While cleanup activities are on-going, there could be temporary street closures, detours, and increases in the amount of truck traffic to and from the affected areas.

4.10 WASTE MANAGEMENT

4.10.1 Proposed Action

Waste volumes from additional personnel and the increase in population within the ROI that would result from the proposed action are considered negligible and were not calculated.

Construction and demolition (C&D) debris includes materials such as construction materials for buildings, concrete and asphalt rubble, and land-clearing debris. Sampling studies documented in *Characterization of Building-Related Construction and Demolition Debris in the United States* (EPA 1998) indicate that the solid waste generation rate during non-residential construction activities is 3.89 lbs/ft^2 of debris. Estimated quantities of C&D waste generated were established using the following equation:

Construction: [(3.89 lbs/ft^2) x (square footage)] ÷ 2000 lbs = C&D waste (in tons)

The construction of new facilities would result in approximately 950,510 ft being constructed at ORNL. Of this total square footage, it is anticipated that the MCDC, MRF-2, Steam Plant Upgrade, and the Select Steam Decentralization of Remote Buildings could be conducted by a third party and/or the private sector. These facilities comprise approximately 474,000 ft^2 of the projected construction. C&D wastes generated from these activities might not be eligible for disposal at the Central Landfill operated by DOE and would be required to be disposed of at a commercial landfill located within the ROI such as Chestnut Ridge Landfill located in Anderson County.

Based upon the total square footage associated with the proposed action, it is anticipated that approximately 1849 tons of debris would be generated during facility construction. Of this total, approximately 922 tons would be generated and could be required to be disposed of at a commercial facility located within the ROI. Because the proposed action is phased, all anticipated debris would not be generated within 1 single year. It is anticipated that the largest single year impact would occur in FY 2010 with the construction of the MCDC, Microscope Research Facility, and the Steam Plant Upgrade. These construction efforts would result in the construction of approximately 294,000 ft^2 of facilities, which are anticipated to generate approximately 572 tons of C&D wastes. It is assumed that the landfills located on the ORR and commercial landfills within the ROI have adequate capacity to handle the anticipated waste and no adverse impacts would occur.

In addition to the debris associated with construction activities, additional wastes would be generated upon completion of the Steam Plant Upgrade project and Select Steam Decentralization of Remote Buildings. Metal debris would be generated as a result of these projects in the form of equipment and piping. The exact quantity of metallic debris is unable to be calculated at this time. It is estimated that metallic debris would be sold as scrap metal. Ash would be generated from operation of the steam plant after construction at a rate of approximately 5000 lb/day or 912.5 tpy, assuming the steam plant would operate year round (Garrett 2008). For purposes of this EA, it is assumed that this material would require disposal; however, the quantity may be lessened through re-use of the ash in materials such as fertilizer or other activity.

Land clearing wastes would also be generated where construction of facilities occurs in vegetated or forested areas. Land clearing wastes consist of soil and woody wastes associated with site preparation prior to construction activities. Although land clearing activities would generate soil and wood debris, it is assumed that none of the soil and debris generated from tree removal and land clearing would require disposal in a C&D or solid waste landfill. Therefore, these materials would not be expected to impact solid waste resources. This is based upon the assumptions that soil generated from grubbing activities

would be used as fill during the construction projects and woody wastes would be: (1) used by the wood or woodpulp industry; (2) chipped and re-used as mulch, compost, or fuel; or (3) burned in place under an open burning permit.

4.10.2 No Action

Under the no action alternative, there would be no change to current waste generation and handling from routine operations at ORNL. Waste storage, transport, and disposal activities associated with ORNL would continue to be handled under ORNL's Waste Management Program. No additional impacts would occur.

4.11 HUMAN HEALTH AND SAFETY

4.11.1 Proposed Action

With the exception of a few new facilities, the majority of facilities associated with the modernization effort are proposed to provide consolidation of processes and activities located in several different locations throughout ORNL; no new or unusual processes that would result in unique health or safety issues are proposed as part of this modernization effort. Falls, spills, vehicle accidents, confined-space incidents, and injuries from tool and machinery operation could occur during operational activities. Workers would be expected to receive applicable training, be protected through appropriate controls and oversight, and be afforded the typical level of safety and health protection found throughout ORNL. Operations associated with ORNL activities are conducted in strict compliance with DOE regulations and OSHA standards. As an example, DOE Order 5400.5, "Radiation Protection of the Public and the Environment," limits the EDE that an off-site individual may receive from all exposure pathways and all radionuclides released from the ORR during 1 year to no more than 100 mrem. DOE regulations (10 *CFR* 835, "Occupational Radiation Protection") establish radiation protection standards and program requirements for DOE and DOE contractor operations with respect to the protection of workers from ionizing radiation.

Co-located individuals not employed by DOE working at these facilities (e.g., university researchers) would receive applicable training and are protected through appropriate controls and oversight. Issues related to public and worker exposures to effluents and emissions from any new facilities would be addressed by permits and regulations under the state of Tennessee. Handling of radioactive material is regulated by the Nuclear Regulatory Commission or the state of Tennessee. Facilities handling such materials (such as the Material Handling Facility at the HFIR) would be required to comply with the terms and conditions of the ORNL radioactive materials license, if applicable.

It is anticipated that the types of research and maintenance activities that would be established within the new facilities as part of this effort would have minimal emissions and effluents common to other similar activities at ORNL and would be required to have the appropriate environmental permits intended to protect human health and the environment.

Construction workers would be subject to the typical hazards and occupational exposures faced at other industrial construction sites. DOE minimizes standard construction hazards through strict adherence to 29 *CFR* 1926, OSHA Standards for Construction, and DOE and ORNL health and safety policies and procedures. Construction companies conducting these types of activities would be required to: (1) implement procedures to ensure that equipment guards, housekeeping, and personal protective equipment are in place; (2) establish programs and procedures for lockout, right-to-know, confined space, hearing

conservation, forklift operations, and so on; (3) conduct employee safety orientations; (4) perform regular safety inspections; and (5) develop a plan of action for the correction of any identified hazards.

Care would be required during the installation and hook-up of utilities for new facilities to ensure that proper precautions and procedures were followed if trenching might approach any contaminated areas. Provided that these precautions were taken, no adverse effects to construction workers or staff as a result of potential exposure to contaminated media would be anticipated. Potential ES&H hazards associated with asbestos and legacy contamination in ductwork and structures would be identified to the extent necessary for infrastructure upgrades and expansions.

Overall, potential operational ES&H impacts would be negligible, would be consistent with current operational risks at ORNL, and would be mitigated though adherence to established DOE ES&H protocols. It is likely that the ES&H environment at ORNL would be improved due to operational improvements associated with new and consolidated facilities. Construction-related ES&H risks would be typical of this type of activity and would be mitigated through implementation of standard construction safety practices as required by OSHA and DOE.

4.11.2 No Action

Under the no action alternative, current facility operations would continue in support of assigned missions and adherence to existing ES&H protocols would continue. In the short-term, exposures of workers and the public would be bounded by existing conditions. However, as buildings continue to age, increasing controls could be needed to ensure worker health and safety. Many of the existing facilities are slated to undergo D&D (including deactivation, decontamination, decommissioning, and demolition) as part of EM's plan for remediating the Central Campus and other areas. Potential impacts that could result from any environmental cleanup actions would be addressed in the appropriate CERCLA documents that would be required and are not included in the scope of this analysis. Overall, improved ES&H conditions that would be realized under the proposed action through modernization and facility consolidation would not be realized under the no action alternative.

4.12 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Table 4.2 provides a comparative summary of the potential environmental consequences that could result from implementing the proposed action or no action alternative.

Table 4.2. Summary of impacts by resource

Environmental impact	Proposed action	No action alternative
Land use	New facilities and utility infrastructure would be constructed in Bethel and Melton Valleys. Land use designation would remain institutional/research and mixed research/future initiatives. Transfers of DOE property to the private sector or state would change use classification to non-DOE municipal zoning.	No major land uses would occur. Planned remedial actions for ORNL would continue. DOE could choose to construct new facilities or continue to use existing facilities for on-going missions.
Geology and soil	Adverse impacts to site geology are not expected. Affected soil is generally stable and acceptable for standard construction requirements. Erosion prevention and sedimentation control management practices would be implemented and adverse impacts would be negligible.	Cleanup activities would continue and required studies would address any potential impacts to geology and soil.
Water resources	Erosion and sedimentation controls would limit potential impacts to surface water. No impacts to surface water are anticipated from normal facility operations. No impacts to groundwater are anticipated from any construction activities or normal facility operations and groundwater use would be prohibited.	Cleanup activities would continue and required studies would address any potential impacts to water resources.
Air quality and noise	Construction would be phased and air emissions would be short-term, sporadic, and localized. Fugitive dust would be controlled to minimize emissions. Air emissions from operations would be minor and typically controlled within the facility. External effects would be negligible. The overall balance of air emissions for operations should be approximately the same as current levels and could be less depending on the specific design features of the new and remodeled facilities. The delivery of woody biomass materials to the steam plant would have a negligible impact on air quality. No adverse noise impacts are anticipated.	Air pollutants would continue to be emitted at current rates in the vicinity of ORNL. No adverse effects to air quality are predicted assuming that existing emission control systems are efficiently maintained. No changes in existing noise levels are expected. Noise levels within the Central Campus are associated with on-going operations, traffic, and construction activities typical of other industrial areas.
Biological resources	The proposed action would have little effect on biological resources and no impacts to wetlands or threatened and endangered species have been identified.	Cleanup activities could have a long-term beneficial impact for biological resources.
Cultural resources	New construction and upgrade activities would have no adverse impact to historic properties and no archaeological resources would be affected.	Potential impacts to historical resources as a result of cleanup activities would be addressed through consultation with the Tennessee SHPO.

Table 4.2. Summary of impacts by resource (continued)

Environmental impact	Proposed action	No action alternative
Socioeconomics	Minor positive employment and income impacts. No impact on population. Potential positive fiscal impacts include increased revenue from real estate or sales taxes. No disproportionate adverse health or environmental impacts would occur to any low-income or minority population.	No major change is anticipated in population, employment, income, or fiscal characteristics, and no disproportionate effect on minority and low-income populations.
Infrastructure	Utility infrastructure would be improved. New facilities would connect to existing utilities and capacity is expected to be adequate. The net impact to utility systems and associated consumption within the area would be negligible and, in some cases, would decline due to the development of more energy-efficient facilities.	Utility repairs and upgrades would be conducted as part of on-going research and landlord activities. Additional impacts would not occur.
Transportation	Construction would be phased and the increase in truck traffic would be minor and short-term. Employee traffic to ORNL would likely increase to some degree over current levels, possibly resulting in longer commute times along Bethel Valley Road. Daily truck shipments of woody biomass materials to the steam plant would have a negligible impact on local traffic.	Implementation of the IFDP could have some temporary transportation effects as cleanup activities are conducted. While cleanup activities are on-going, there could be temporary street closures, detours, and increases in the amount of truck traffic to and from the affected areas.
Waste management	Construction and demolition debris would be generated and disposed of at DOE or commercial landfills. Because construction activities would be staged over several years, no adverse impacts would occur. New facilities would produce wastes typical of standard light industrial and research operations. Existing licensed and/or permitted treatment, storage, and disposal facilities would be used.	There would be no change to current waste generation and handling from routine operations at ORNL.
Human health and safety	Construction workers would be subject to the typical hazards and occupational exposures faced at other industrial construction sites. No unique occupational health and safety hazards would be expected from the new facilities. Individuals not employed by DOE working at new facilities would be considered co-located workers.	Current facility operations would continue in support of assigned missions and no major changes in worker and public exposures would be expected. Potential impacts that could result from any environmental cleanup actions would be addressed in the appropriate documents.
Cumulative impacts	The cumulative contribution of impacts that the proposed action would make on the various environmental resources is minor.	No additional cumulative impacts would occur.

DOE = U. S. Department of Energy.
IFDP = Integrated Facility Disposition Project.
ORNL = Oak Ridge National Laboratory.
SHPO = State Historic Preservation Office.

This page intentionally left blank.

5. INTENTIONAL DESTRUCTIVE ACTS

DOE is required to consider intentional destructive acts, such as sabotage and terrorism, in each EIS or EA that it prepares. After review, it was determined that the likelihood of such acts for activities that would be carried out under the ORNL Modernization Initiative is extremely low. However, it is possible but highly unlikely that random acts of vandalism could occur. Appropriate measures would be implemented to control facility access and provide security (e.g., identification badges, proximity cards, alarms, cameras, etc.). Also, the risk of intentional destructive acts is further minimized because public access to ORNL is controlled by force protection/anti-terrorism measures such as security fences, vehicle patrols by security guards, and security checkpoints at the portals on Bethel Valley Road.

This page intentionally left blank.

6. CUMULATIVE IMPACTS

Cumulative impacts are those that may result from the incremental impacts of an action considered additively with the impacts of other past, present, and reasonably foreseeable future actions. Cumulative impacts are considered regardless of the agency or person undertaking the other actions (40 *CFR* 1508.7, CEQ 1997) and can result from the combined or synergistic effects of individually minor actions over a period of time.

6.1 POTENTIALLY CUMULATIVE ACTIONS

This section describes present actions as well as reasonably foreseeable future actions that are considered pertinent to the analysis of cumulative impacts for the proposed ORNL Modernization Initiative. The actions are as follows and the location of the actions is shown on Fig. 6.1.

ORNL Revitalization Program. DOE is implementing a revitalization project at ORNL to consolidate staff on the main ORNL campus; vacate old, expensive to maintain space; and build new, and refurbish key, facilities. Conceptual plans included construction of up to 24 new facilities totaling approximately 1.2 million ft^2 in Bethel Valley near the main ORNL entrance, near the West Portal in Bethel Valley, and within the footprint for the SNS. Some of the new construction is being funded by the state of Tennessee and the private sector. About 20 acres of brownfield property in Bethel Valley have been transferred from DOE to the private sector in support of this proposed action. The environmental consequences of this project were reviewed in an EA (DOE/EA-1362) and a FONSI was signed on June 1, 2001. Since FY 2000, approximately 1.9 million ft^2 have been vacated, 1.0 million ft^2 constructed, and the average age of buildings decreased by 10 years. Over one-half of the site population work in facilities that were constructed or renovated within the last 7 years. Also, over 15% of ORNL's square footage is LEED certified.

Oak Ridge Science and Technology Project. DOE recently completed an EA (DOE/EA-1575) for the creation of the Oak Ridge Science and Technology Project (ORSTP) at ORNL. The proposed action would advance technology transfer and other missions at ORNL by supporting technology commercialization, creating new companies, and stimulating technology-based recruitment.

To establish the ORSTP, DOE would lease underutilized facilities and land parcels at ORNL within the Central Campus area, which is located in the western portion of the Laboratory. ORSTP would be within the northwest quadrant of the Central Campus and includes approximately 12 acres of currently leased property along Bethel Valley Road. New buildings would be constructed, but existing facilities could also be modified or renovated to accommodate new users. ORSTP would be intended primarily for R&D facilities, high-technology and science-based companies, engineering support services, technology commercialization incubation space, and prototype manufacturing facilities. Reasonably foreseeable uses could include, but are not limited to, the following technologies: energy, environmental, computational, materials and chemistry, biological systems and genetics/genomes, medical/pharmacological, nanotechnology, and national security.

SNS. SNS is a new, state-of-the-art, accelerator-based science facility occupying an approximately 80-acre site atop Chestnut Ridge on the ORR. The facility consists of accelerator buildings, the target building, the central laboratory and office building, and miscellaneous support buildings totaling about 600,000 ft^2. Once fully operational, SNS will be the world's foremost neutron scattering facility, providing important scientific capabilities for basic research in many fields, including

material sciences, life sciences, chemistry, solid state and nuclear physics, earth and environmental sciences, and engineering sciences. Furthermore, the facility is expected to employ about 500 people and host over 2000 visiting scientists and engineers per year.

IFDP. IFDP integrates the cleanup scope resulting from modernization of ORNL and the Y-12 Complex with the existing Oak Ridge EM baseline. The scope for IFDP, among other activities, is to demolish excess facilities, dispose of legacy materials/waste, and address environmental cleanup, resulting in risk reduction, S&M cost reduction, and release of strategic real estate for modernization initiatives. The IFDP estimated cost ranges from $4 to $8 billion and the duration ranges from 15 to 20 years. The IFDP scope includes:

- D&D of over 400 facilities;
- remedial actions;
- facility reconfiguration, adaptive re-use, and utility modifications;
- waste treatment and storage facilities operations;
- ORR Landfill operation;
- CERCLA Cell (Environmental Management Waste Management Facility) operation, expansion, and closure;
- S&M;
- legacy material/waste and remedial action and D&D waste disposition;
- associated regulatory and planning documentation, including final CERCLA Records of Decision (RODs); and
- project management, administration, and support.

Horizon Center. DOE has transferred title of the developable portion (approximately 426 acres) of what was previously referred to as Parcel ED-1 to Horizon Center LLC, a subsidiary of the Community Reuse Organization of East Tennessee (CROET), for the continued development as an industrial/business park for research and development, as well as manufacturing, distribution, and corporate headquarters office facilities. DOE maintains ownership of the remainder of the parcel, which includes the Natural Area (approximately 491 acres). Horizon Center LLC, under a lease agreement with DOE, leases the Natural Area.

ETTP-Heritage Center. DOE has made some of its underutilized facilities at ETTP available for lease or title transfer. They are, in turn, subleased to private sector firms. With the onset of the accelerated cleanup plan for ETTP, DOE has also transferred title to some buildings and land parcels. To date, six buildings, totaling over 300,000 ft^2, have been transferred and work is progressing on the transfer of additional facilities (CROET 2006). As cleanup is progressing, DOE and CROET are transitioning the former gaseous diffusion plant to a private industrial park known as the Heritage Center. Commercial use of these facilities does not constitute a change of the primary use of the property, which has been industrial for over 60 years.

Y-12 Complex Modernization Program. DOE has issued a Final Site-Wide EIS and ROD on the operation of the Y-12 Complex and modernization of facilities (DOE 2001b). Major actions include construction of a Highly Enriched Uranium Materials Facility, which will replace multiple aging facilities within a single state-of-the-art storage facility; a Purification Facility, which was completed in 2004 and was the first major production facility built at the Y-12 Complex in more than 30 years; a Uranium

Processing Facility, which will replace current enriched uranium and other processing operations; an Enriched Uranium Manufacturing Facility to replace current enriched uranium and other processing operations; and the Beryllium Capability project, which will upgrade an existing facility, installing modern equipment that will protect workers from exposure to beryllium and improve efficiency and reliability, Many existing facilities have been demolished to prepare for the new construction that began in 2003. By 2013 when the Uranium Processing Facility becomes operational, the Y-12 Complex will have reduced its defense manufacturing footprint by almost one-half.

Roane Regional Business and Technology Park. This industrial park is located north of Interstate 40 in Roane County approximately 3 miles southwest of the ORSTP site. The 655-acre site includes areas for industrial development and greenbelt uses. The park will be developed in three phases. Phase I development of 200 acres was completed in late 2001 and is expected to house industries that will provide about 500 jobs. Industries located at the site include instrumentation, light metalwork, and materials handling. Additional types of industries expected to locate at the park include information technology, automotive transportation, and corporate administrative offices (Human 2000; TECD 2006).

Pine Ridge Development. In 1969, the city of Oak Ridge acquired 230 acres of property, identified as Site X, from the then Atomic Energy Commission. The property included the current Valley Industrial Park and a portion of Pine Ridge. In 1999, the city transferred approximately 71 acres of Pine Ridge between South Illinois Avenue, Union Valley Road, and Scarboro Road to the Industrial Development Board, which in turn sold the property to a private developer. The area is now being developed for office space, light manufacturing, and storage facilities.

Oak Ridge Industrial Center. The Oak Ridge Industrial Center is located at the site partially developed by TVA for the Clinch River Breeder Reactor prior to 1983. The 1245-acre property is for sale by TVA and has been considered for development by several manufacturing industries. TVA has graded a 150-acre tract on the property to <2% slope. The remaining land is rolling to rough terrain, having an 8 to 20% slope (ORCC 1999). The developable land contains tracts with hardwood forests and pine plantations impacted by the Southern pine beetle. The site also contains cultural resources. TVA has also designated a 103-acre tract bordering Grassy Creek as the Grassy Creek Habitat Protection Area to be reserved for protection of bugbane (*Cimicifuga rubifolia*) habitat (TVA 1988). A feeder road may be constructed by the Tennessee Department of Transportation (TDOT) to improve access from SR 58, pending the sale and further industrial development of the property (ORCC 1999).

Parcel ED-6. DOE has determined that Parcel ED-6 (approximately 336 acres) is excess property and is considering conveyance to the city of Oak Ridge for new residential development. Under the mixed development alternative, a portion of the land could also be used for commercial development (offices and retail establishments). The general location of the property is west of Wisconsin Avenue, south of Whippoorwill Drive, north of the Oak Ridge Turnpike (SR 95), and east of the Horizon Center Industrial Park. A portion of the North Boundary Greenway is located on the parcel and is maintained by the city under a license from DOE. Parcel ED-6 is part of the area included in the ORR Land Use Planning Process conducted during 2001 and 2002 (Focus Group 2002).

6.2 CUMULATIVE IMPACTS BY RESOURCE AREA

Land Use. Of the original 58,582 acres of land acquired in 1942 by the federal government, 31,770 acres have been conveyed and approximately 26,800 acres remain within the ORR. The purposes for which the ORR land has been conveyed include:

- 16,855 acres for residential, commercial, and community development;
- 1,031 acres to federal agencies and for transportation easements;

- 9,626 acres for preservation and recreation;
- 4,247 acres for industrial development; and
- 11 acres for mission-related purposes.

Current land outgrants (lease/license/permit areas) include:

- 2966 acres for the Black Oak Ridge Conservation Easement,
- 2920 acres for the Three Bend Scenic and Wildlife Management Refuge Area, and
- 468 acres for the Parcel ED-1 Natural Area.

Title transfer of land and facilities at ETTP could potentially remove an additional 500 to 1300 acres of land. However, the majority of the ETTP area being considered for title transfer has already been developed for industrial purposes or has been impacted in some other way. Further development would not result in significant changes from this industrial land use.

A few changes in the acreage of NERP have occurred over the past 23 years. NERP serves as an outdoor laboratory to evaluate the environmental consequences of energy use and development as well as the strategies to mitigate these effects. When designated in 1980, the size of NERP was about 13,590 acres. Some research land was lost with the sale of the former Boeing property for residential use (Rarity Ridge) and some other land areas. In 1998, the NERP designation was removed from the ETTP area of responsibility and the Horizon Center property. Since then, NERP has been expanded to include most of the undeveloped area of the ORR and is currently about 20,000 acres. The Black Oak Ridge Conservation Easement, executed in 2005, resulted in approximately 3000 acres of the ORR land being set aside for conservation and recreation purposes. It is assumed that the NERP designation for this area would remain.

The ORNL Modernization Initiative would not add to the cumulative impacts resulting from other property leased or conveyed from DOE to public or private entities because much of the affected area has already been developed and ORNL employees or visitors would occupy the facilities regardless of funding source.

Soil. The most frequent effect of surface disturbance with regard to soil in this region is accelerated erosion. Implementation of past, current, and reasonably foreseeable future projects would add to the total acreage of soil disturbed and would permanently alter the soil within the footprint of the projects, adding to the overall loss of soil productivity. However, the majority of actions described within this document are within the areas where similar construction of roads and buildings has occurred or has been planned. As long as all construction projects comply with state and federal laws and regulations, including the Clean Water Act and the Construction General Permit under the NPDES program, mitigations would be implemented to minimize erosion from construction activities and sediment delivery to nearby surface water. Additionally, landscaping after construction completion would serve to stabilize soil once the projects have been completed. These actions would minimize the cumulative impacts of construction projects in the region that may otherwise result in accelerated erosion.

Surface Water Resources. The most frequent effect of surface disturbance in this region associated with surface water is increased surface water runoff, all of which may affect downstream water bodies by contributing sediment or increasing flooding. The primary cumulative impacts on surface water would result from an increase in the acreage of earthmoving activities and increased impervious areas that have the potential to increase sediment delivery and surface water runoff downstream.

As long as all construction projects comply with state and federal laws and regulations, mitigations would be implemented to minimize erosion from construction activities and sediment delivery to nearby

surface water. This would minimize the cumulative impacts of construction projects in the region that may otherwise result in increased sediment delivery.

The addition of new impervious surfaces would likely result in a cumulative increase in the rate and volume of stormwater runoff at ORNL; however, the overall change in existing land cover would be minimal. The use of temporary or permanent stormwater controls such as detention or retention basins and other structures, and stabilization of disturbed areas through landscaping and vegetation, would attenuate increases in surface water runoff and increase groundwater recharge through direct percolation, thus offsetting the loss of pervious surface due to construction in the region and minimizing downstream cumulative effects.

Air Quality. The additional construction and demolition activities involved in the projects already in progress or expected in the foreseeable future would cause temporary increases in air pollutant emissions. The primary pollutant from construction activities would be particulate matter in the form of fugitive dust. This source of emissions is short-term and the impacts are localized to the immediate area. To minimize these emissions, application of wetting agents during dry periods may be used as mitigation. Although impacts to air quality presented in this EA would be negligible to Roane County, the increase in industry, traffic, and population growth in the county could impact air quality.

Biological Resources. The greatest threat to reduced biodiversity of an area or region is conversion of cover types from natural systems to completely different and maintained systems. Growth and development in the region surrounding the ORR is putting increased pressure on the biodiversity of the Ridge and Valley Ecoregion. Development within the ORR (e.g., SNS, Horizon Center, and Parcel ED-6) has removed some additional land from the Reservation. However, much of the core area of the ORR and most sensitive areas have been avoided or potential impacts have been mitigated. Approximately 491 acres of the Horizon Center are not available for development and contain natural area corridors and buffers for native vegetation and wildlife species. There are 103 acres along Grassy Creek reserved for habitat protection at the Oak Ridge Industrial Center (TVA 1988). About 61 acres of the Roane Regional Business and Technology Park are being left as a greenbelt area. The SNS project created wetland habitat to replace habitat lost during construction, and cooling water is dechlorinated prior to discharge to minimize effects on aquatic resources (DOE 1999). Also, much of the development and reindustrialization on the ORR is taking place within previously disturbed and/or developed areas within and surrounding the major plant areas. Actions such as the Black Oak Ridge Conservation Easement and the Three Bend Scenic and Wildlife Management Refuge have the potential to provide long-term protection for some of the most ecologically sensitive areas on the Reservation and the ORR continues to be a biologically rich resource that provides protection for large land areas and the biodiversity found within those protected areas.

Socioeconomics. Major industrial initiatives include reindustrialization of the ETTP-Heritage Center, development of the Horizon Center, the SNS project at ORNL, the Roane Regional Business and Technology Park, and the potential development of the Oak Ridge Industrial Center. The cumulative impact of new development is likely to result in increased population, employment, and income. The proposed action is expected to represent a small part of the total acreage proposed for development and its effect on the cumulative impacts is expected to be correspondingly small.

Actual employment and income impacts from cumulative development would depend on the success of each of these developments and the overall rate at which development proceeds, both of which are uncertain. Developers have recently scaled back plans for some of these projects based on current market conditions (Huotari 2006). Property tax revenue would depend on the value of the properties, future tax rates, and any tax abatements that may be negotiated.

Utilities. Addition of the identified reasonably foreseeable future projects would result in incremental increases in utility usage. However, there is currently sufficient excess capacity to meet the demand, and continued upgrades and improvements in the local and regional utility systems would serve to offset/accommodate any potential utility use increases. Additionally, the individual projects described above would likely be implemented in phases over the course of several years, thus enabling the utilization of new, more energy efficient technologies to minimize energy consumption and to provide utility systems sufficient opportunity to meet demand through upgrades and improvements. As a result, the cumulative impact on local and regional infrastructure is expected to be minimal.

Transportation. Cumulative transportation impacts in Roane and Anderson Counties could occur from increased development and growth. These potential impacts could be combined with on-going environmental restoration and D&D activities on the ORR and with the planned expansion of the state highways by TDOT. The main transportation impact of commercial and industrial development would be an increase in average daily traffic volumes.

Associated with increases in traffic is the potential for an increased number of accidents, additional noise and air pollution, and road deterioration and damage. The increase in average daily traffic volumes could result in inconveniences for other vehicles (personal and commercial) on affected routes and connecting roads. Commercial operations could suffer temporarily reduced business while customers avoid affected areas because of traffic delays. Increased pavement deterioration and damage could increase costs associated with maintaining or resurfacing roads and highways. Although noise associated with increases in traffic is normally not harmful to hearing, increased traffic noise is considered by the public to be a nuisance. Increased accidents put an additional strain on local emergency response personnel. Increased vehicular traffic also has the greatest potential to increase air pollution in the local area because emissions from motor vehicles are poorly regulated.

Solid Waste. As discussed in Sect.6.1, there are a number of activities within the ROI that are, or will, generate solid waste requiring disposal. Although additional construction, demolition, and/or renovation will occur under many of the projects outlined in Sect. 6.1, specific quantities of C&D wastes cannot be estimated. Because the specific timing of each project is unknown, it is unclear the extent of project overlap that would occur between the potential cumulative actions and the proposed action in this EA. If the projects occur within the same timeframe, there could be a potential adverse cumulative impact on landfills in the ROI. However, it is anticipated that the projects would be phased over a 10-year period and landfill capacity is assumed to be adequate to handle the anticipated amounts of solid waste requiring disposal.

Human Health. No operations included under the proposed action would increase chemical or radiological emissions for ORNL because operations would be the same or similar to the current operations. In addition, the new or expanded facilities under the proposed action would be of modern design with engineered controls for improved ES&H operation, thus resulting in improvements to the ES&H environment. It is likely that any new facilities developed, as described, under the reasonably foreseeable actions would follow the same principle of improvements in operational ES&H environments. Consequently, there would be no cumulative human health effects to workers or off-site populations.

1

2

THIS PAGE INTENTIONALLY LEFT BLANK.

7. LIST OF AGENCIES AND PERSONS CONTACTED

The following agencies and persons were contacted for information and data used in the preparation of this EA.

Name	Affiliation	Location	Topic
Karla Gaither	ORNL	Oak Ridge, TN	ORNL Facilities
Joseph Garrison	Tennessee Historical Commission	Nashville, TN	NHPA, Sect. 106 Compliance
James Hall	ORNL	Oak Ridge, TN	Cultural Resources
Pat Parr	ORNL	Oak Ridge, TN	Natural Resources
David Skipper	ORNL	Oak Ridge, TN	ORNL Site Information
Charles Valentine	ORNL	Oak Ridge, TN	Utilities
Joe Wolfe	ORNL	Oak Ridge, TN	Air Quality

This page intentionally left blank.

8. REFERENCES

Awl, D.L., L.R. Pounds, B.A. Rosensteel, A.L. King, and P.A, Hamlet. 1996. *Survey of Protected Vascular Plants on the Oak Ridge Reservation*, ES/ER/TM-194, Oak Ridge National Laboratory, Environmental Restoration Division, Oak Ridge, TN, June.

Bonine, T.M. and R.H. Ketelle, 2001. *ORNL Groundwater Protection Plan Description,* ORNL/TM-2001/183, Oak Ridge National Laboratory, Oak Ridge, TN.

Bureau of Economic Analysis 2008. *Table CA30 Regional Economic Profiles*, available at http://www.bea.gov/bea/regional/reis/, Accessed May 10.

Campbell, A.W., G.F. Cada, R.H. Ketelle, R.L., Kroodsma, R.R. Lee, L.R. Pounds, 1989. *Site Characterization Report for the Proposed Transuranic Waste Handling and Packaging Plant, Oak Ridge National Laboratory, Oak Ridge, Tennessee*, ORNL/TM-10965, Oak Ridge National Laboratory, Oak Ridge, TN.

Carver, M. and Slater, M. 1994. *Architectural/Historical Assessment of the Oak Ridge National Laboratory, Oak Ridge Reservation, Anderson and Roane Counties, Tennessee*, ORNL/M-3244, Oak Ridge, TN, January.

City of Oak Ridge 2006. "City of Oak Ridge Proposed Budget Fiscal 2007."

City of Oak Ridge 2007. "City of Oak Ridge, Tennessee, Fiscal Year 2008 Annual Budget."

CROET (Community Reuse Organization of East Tennessee) 2006. Personal communication from Jeff Deardorff, CROET, to Sharon Bell, SAIC, October 12.

DOE (U. S. Department of Energy) 1999. *Remedial Investigation/Feasibility Study for Bethel Valley Watershed at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, DOE/OR/01-1748/V1&D2, Office of Environmental Management, Oak Ridge, TN.

DOE 2001a. Cultural Resource Management Plan, Department of Energy–Oak Ridge Operations Office, Anderson and Roane Counties, Tennessee, DOE/ORO-2085, July.

DOE 2001b. *Final Site-Wide Environmental Impact Statement for the Y-12 National Security Complex*, Volume I, September.

DOE 2006. *Oak Ridge National Laboratory, Melton Valley Master Plan*, June.

DOE 2008. *Oak Ridge Reservation Annual Site Environmental Report for 2006*, DOE/ORO/2233, September.

Drake, S.J., Weltzin, J.F., and Parr, P.D. 2002. *Assessment of Non-native Invasive Plants In the DOE Oak Ridge National Environmental Research Park*, ORNL/M-2001/113, Oak Ridge, TN, October.

DuVall, G.D. 1994. *An Archaeological Reconnaissance and Evaluation of the Oak Ridge National Laboratory, Oak Ridge Reservation, Anderson and Roane Counties, Tennessee*, ORNL/M-3245, Oak Ridge, TN, January.

EPA (U. S. Environmental Protection Agency) 1998. *Characterization of Building-Related Construction and Demolition Debris in the United States*, EPA Municipal and Industrial Waste Division, Office of Solid Waste, June.

EPA 2002. U. S. Environmental Protection Agency 2002 National Emissions Inventory Microsoft Access Database, Accessed May 2006.

EPA 2005. Transportation and Air Quality, Retrieved from http://www.epa.gov/otaq/ on February 10, 2005.

Focus Group 2002. *Final Report of the Oak Ridge Land Use Planning Focus Group*, September.

Garret 2008. Email communication from Donald Garrett (ORNL) to Jerry Truitt (SAIC) with estimated ash volumes from Steam Plant operation after upgrade, April.

Hotel-guides.us 2008. Online lodging search for Oak Ridge, Tennessee, Available at hotel-guides.us.com, Accessed April 25.

Human 2000. Personal communication from Gary Human, Roane County Industrial Development Board, to Julia Gartseff, SAIC, July.

Hunter 2006. Personal communication from Cindy Hunter, DOE Real Estate Office, to Sharon Bell, SAIC, September 5.

Huotari 2006. "Rarity Ridge plans revised, scaled back," *The Oak Ridger*, March 22, Available at http://oakridger.com/stories/032206/com_20060322009.shtml, Accessed March 22, 2006.

Mann, L.K., Parr, P.D., Pounds, L.R., and Graham, R.L. 1995. *Protection of BIOTA on Non-park Public Lands: Example from the U.S. Department of Energy, Oak Ridge, Tennessee*, Environmental Management, Vol. 20, No. 2, pp.207-218.

Meyers-Schöne, L., and Walton, B.T., 1990. *Comparison of Two Freshwater Turtle Species as Monitors of Environmental Contamination*, ORNL/TM-11460, Environmental Sciences Division Publication No. 3454, Oak Ridge National Laboratory, Oak Ridge, TN.

Mitchell, J.M., Vail, E.R., Webb, J.W., King, A.L., and Hamlett, P.A. 1996. *Survey of Protected Terrestrial Vertebrates on the Oak Ridge Reservation*, ES/ER/TM-188, Oak Ridge National Laboratory, Oak Ridge, TN, May.

Myrick, T.E., et al. 1981. *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, ORNL/TM-7343, Oak Ridge National Laboratory, Oak Ridge, TN.

National Council on Radiation Protection and Measurements 1987. *Ionizing Radiation Exposure of the Population of the United States*, NCRP Report No. 93, Washington, D.C.

NUS (NUS Corporation) 1980. *Site Evaluation Report for the Hot Experimental Facility on the Oak Ridge Reservation*, ORNL/Sub-80/13829/3, NUS-3647, NUS Corporation, Rockville, MD.

ORCC (Oak Ridge Chamber of Commerce) 1999. Personal communication from Kim Denton, ORCC, to Julia Gartseff, SAIC, November 4.

ORNL (Oak Ridge National Laboratory) 2002. *Oak Ridge National Laboratory Land and Facilities Plan*, ORNL/TM-2002/1, Oak Ridge, TN, August.

ORNL 2005. *High Flux Isotope Reactor Updated Safety Analysis Report*, ORNL/HFIR/USAR/2344/Rev. 5, Oak Ridge National Laboratory, Research Reactors Division, Oak Ridge, TN, May.

ORNL 2008. "Fact Sheet" available at http:/www.ornl.gov., Accessed April 22.

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, TN.

Skipper, D.D 2008. Personal Communication between David Skipper, UT-Battelle and SAIC regarding utilities at the ORR Melton Valley location, April.

TDEC (Tennessee Department of Environment and Conservation) 2008. Tennessee Air Quality Forecasting Program, http://www.state.tn.us/environment/apc/ozone/, Accessed on April 28.

TECD (Tennessee Department of Economic and Community Development) 2006. "Tennessee Prospector: Available Buildings and Sites," available at http://www.tennesseeprospector.com, Accessed October 10.

Tucci, P. 1992. *Hydrology of Melton Valley at Oak Ridge National Laboratory, Tennessee*, U. S. Geological Survey Water Resources Investigations Report 92-4131.

TVA (Tennessee Valley Authority) 1988. *Watts Bar Reservoir Land Management*, August (reprinted September 1992).

USDA (U. S. Department of Agriculture) 1942. *Soil Survey of Roane County Tennessee*, Series 1936, 35 No. 18, Bureau of Plant Industry.

Valentine, C.K. Jr. 2008. Personal Communication between Charles Valentine, UT-Battelle and SAIC regarding utilities at the ORR Melton Valley location, April.

Wolfe, J., 2008. Personal communication via phone between Joe Wolfe (Air Quality) and Alysia Baumann (SAIC) regarding steam plant conversion to biomass fueled steam plant at ORNL, April.

This page intentionally left blank.