APPENDIX R
CUMULATIVE IMPACTS: ASSESSMENT METHODOLOGY

This appendix describes the cumulative impacts methodology for the U.S. Department of Energy's *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*. The appendix is organized into sections on (1) regulations and guidance, (2) previous studies, (3) history of land use at the Hanford Site and in surrounding regions, (4) future land use at the Hanford Site, (5) future land use in surrounding regions, (6) approach to cumulative impacts analysis, (7) uncertainties, (8) selection of resource areas for analysis, (9) resource area methodologies, (10) spatial and temporal considerations, (11) past and present actions, and (12) selection of reasonably foreseeable future actions. The results of the cumulative impacts analysis are presented in Chapter 6. Supporting information for the short-term cumulative impacts analysis is presented in Appendix T; long-term, in Appendix U. The details of inventory development and end states for the cumulative groundwater modeling are described in Appendix S.

The Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA) (40 CFR 1500–1508) define cumulative impacts as impacts on the environment that result from the proposed actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR 1508.7). Thus, the cumulative impacts of an action on a resource (e.g., land, air, water, soil), ecosystem, or human community are the total effects of that action and all other activities affecting that resource no matter what entity (Federal, non-Federal, or private) is taking the action (EPA 1999:2).

Cumulative impacts are analyzed for activities occurring at the Hanford Site (Hanford). Options were evaluated for management and disposition of the Fast Flux Test Facility (FFTF) remote-handled special components (Idaho Option) and bulk sodium (Idaho Reuse Option) at Idaho National Laboratory (INL) as part of the FFTF Decommissioning Entombment and Removal Alternatives. These options involve shipping the remote-handled special components to the INL Remote Treatment Project for treatment and the bulk sodium to the existing INL Sodium Processing Facility for processing to produce a caustic sodium hydroxide solution, which would be returned to Hanford for reuse in the Waste Treatment Plant (WTP) pretreatment processes. The additional materials processing would not contribute substantially to the cumulative impacts of activities at INL because (1) there would be no marked increase in daily effluent emissions from, or waste generation by, the facilities; (2) sodium hydroxide, produced at INL, would be returned to Hanford for use in processing tank waste; (3) hazardous and radioactive wastes would not be disposed of at INL; and (4) impacts of the activities would be small. Accordingly, only the cumulative impacts of transporting materials and waste to and from INL are evaluated in this *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS)*. Cumulative impacts of activities at INL have been evaluated in the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs, Final Environmental Impact Statement* (DOE 1995a:C-4.6.7-1) and *Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems* (DOE 2005a:4-65).

R.1 REGULATIONS AND GUIDANCE

Cumulative impacts analysis in U.S. Department of Energy (DOE) NEPA documents is governed by CEQ regulations (40 CFR 1500–1508) and DOE NEPA implementing procedures (10 CFR 1021). Additional guidance on how to conduct such analyses was obtained from *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997) and *Consideration of Cumulative Impacts in EPA Review of NEPA Documents* (EPA 1999).

As noted, cumulative impacts on the environment result from proposed actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over an extended period of time. They can also result from the spatial or temporal crowding

of environmental perturbations. That is, increased environmental impact can be expected when a second perturbation occurs at a site before that site can fully rebound from the effects of the first.

While there is no universally accepted framework for cumulative impacts analysis, eight general principles (CEQ 1997:8) have gained acceptance and thus inform the methodology adopted for this *TC & WM EIS*. These principles are based on the premise that any resource, ecosystem, or human community can experience stress, and that for each there are thresholds, or levels of stress, beyond which conditions degrade. The following is a summary of the CEQ's eight principles of cumulative effects analysis:

1. Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions. This includes all actions that affect the same resources.

2. Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, or human community of all actions taken, no matter who (Federal, non-Federal, or private entity) has taken the actions. Effects of individual activities may interact to cause additional effects not apparent when looking at individual effects one at a time.

3. Cumulative effects need to be analyzed in terms of the specific resource, ecosystem, or human community being affected, rather than from the perspective of the proposed actions. Analyzing cumulative effects involves developing an understanding of how the resources are susceptible to effects.

4. It is not practical to analyze the cumulative effects of an action on the universe; the list of environmental effects must focus on those effects that are truly meaningful. The boundaries for evaluating cumulative effects should be expanded to the point at which the resource is no longer affected significantly.

5. Cumulative effects on a given resource, ecosystem, or human community are rarely aligned with political or administrative boundaries. Cumulative effects analysis of natural systems must use natural boundaries, and analysis of human communities must use actual sociocultural boundaries to ensure that all effects are included.

6. Cumulative effects may result from accumulation of similar effects or from the synergistic interaction of different effects. Accordingly, the cumulative effect can in some cases be greater than the sum of the individual effects.

7. Cumulative effects may last for many years beyond the life of the action(s) that caused the effects. Radioactive contamination is an example. Cumulative effects analysis must involve application of the best science and forecasting techniques.

8. Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accommodate additional effects, based on its own time and space parameters. The most effective cumulative effects analysis focuses on what is needed to ensure long-term productivity or sustainability of the resource.

In *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements* (known as the *Green Book*) (DOE 2004a:1, 2, 19, 20), DOE expands on the CEQ instruction (40 CFR 1502.2(b)) by stating that impacts should be discussed in proportion to their significance and that this sliding-scale approach applies to all *Green Book* recommendations. The *Green Book* stipulates use of the sliding scale for impact identification and quantification and provides the following basic recommendations:

- Quantify impacts consistent with the sliding-scale approach and available information.

- Provide sufficient information so the validity of analytical methods and results can be reviewed.
- Acknowledge uncertainty and incompleteness in data and how they may affect significance in the analysis.
- Do not quantify impacts when they are virtually absent.
- Define and compare impacts in their appropriate context using both relative and absolute information.
- Define, where possible, the actual impact on health or the environment, not just contaminant concentrations or release rates.

Included in *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997:49–57) is discussion of various techniques for analyzing cumulative effects. Implicit in that discussion is the idea that there is no one appropriate method for such an analysis.

R.2 PREVIOUS STUDIES

Cumulative impacts at Hanford were evaluated in the *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement* (*TWRS EIS*) (DOE and Ecology 1996) and the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement (Hanford Comprehensive Land-Use Plan EIS)* (DOE 1999a). Presented in Table R–1 is a breakdown of the resource areas addressed in those evaluations. While the entries attest to evaluation of certain areas in both documents, they do not necessarily reflect evaluations at the same level of detail.

Table R–1. Resource Areas Evaluated in Recent Major Hanford Site Cumulative Impact Analyses

Resource Area	*TWRS EIS*[a]	*Hanford Comprehensive Land-Use Plan EIS*[b]
Land resources	X	X
Noise and vibration	–	X
Air quality	X	X
Geology and soils	–	X
Water resources	–	X
Ecological resources	X	X
Cultural resources	–	X
Socioeconomics	X	X
Public health and safety—normal operations	X	X
Occupational health and safety	–	X
Long-term groundwater quality	X	–

[a] DOE and Ecology 1996:5-237–5-251.

[b] DOE 1999a:5-65–5-72.

Key: *Hanford Comprehensive Land-Use Plan EIS=Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement; TWRS EIS=Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement.*

R.3 HISTORY OF LAND USE AT THE HANFORD SITE AND IN SURROUNDING REGIONS

This section provides information on past land use in the region to illustrate how the land and its resources have changed since European-American colonization. Such information helps determine the impacts of past actions.

The 151,775-hectare (375,040-acre) Hanford Site is in the Columbia Basin Ecoregion, an area historically including over 6 million hectares (14.8 million acres) of steppe and shrub-steppe vegetation extending across most of central and southeastern Washington and portions of north-central Oregon. In the early 1800s, the dominant plant in the Hanford area was big sagebrush underlain by perennial Sandberg's bluegrass and bluebunch wheatgrass. Many places on Hanford are fairly free of nonnative species and extensive enough to retain characteristic populations of shrub-steppe plants and animals absent or scarce in developed areas of the ecoregion. Hanford's location provides important connectivity with other undeveloped portions of the ecoregion (Neitzel 2005:4.73). Washington State considers pristine shrub-steppe habitat as a priority habitat because it is scarce in the state and important to several state-listed wildlife species (WDFW 2007). Sagebrush communities are also considered a Level III resource under the *Hanford Site Biological Resources Management Plan* (DOE 2001a). Impacts on such resources should be avoided or minimized; however, when avoidance and minimization are not possible, rectification or compensatory mitigation is recommended (DOE 2001a:iii).

In prehistoric and early historic times, American Indians of various tribal affiliations heavily populated the area along the Columbia River in eastern Washington, including the area occupied by Hanford, and some of their descendants still live in the region (DOE 2000a:3-125). When European-American explorers arrived in the early 1800s, people presently referred to as "the Wanapum" (the River People) were observed inhabiting numerous villages and fishing camps scattered throughout this segment of the mid-Columbia River. Neighboring groups known today as the Yakama, Umatilla, Cayuse, Walla Walla, Palus, Nez Perce, and Middle Columbia Salish frequented the area to trade, gather resources, and conduct other activities. Many descendants of these tribes and bands are affiliated with the Wanapum, Confederated Tribes and Bands of the Yakama Nation (Yakama Nation), Confederated Tribes of the Umatilla Indian Reservation, Nez Perce Tribe of Idaho, or the Confederated Tribes of the Colville Reservation (Neitzel 2005:4.102, 4.103). Present-day tribal members retain traditional secular and religious ties to the region, and many have knowledge of their cultural ceremonies and lifeways (DOE 2000a:3-125).

Under separate treaties signed in 1855, the land area of much of what is now eastern Washington, Oregon, and Idaho was ceded to the United States by a number of regional American Indian tribes. The land area includes land occupied by Hanford. Under these treaties, the tribes retained the right to fish in usual and accustomed places. Tribal fishing rights are recognized on rivers within the ceded lands, including the Columbia River, which flows through Hanford. In addition to fishing rights, the tribes retained under the treaties the privilege to hunt, gather roots and berries, and pasture horses and cattle on open and unclaimed lands. It is the position of DOE that Hanford, like other ceded lands that were settled or used for specific purposes, is not open and unclaimed land. While reserving all rights to assert their respective positions regarding treaty rights, the tribes are participants in DOE's land use planning process, and DOE considers tribal concerns in that process. For example, tribal concerns were considered by DOE in the development of this *TC & WM EIS*. American Indian tribal governments' perspectives on the cleanup of Hanford are provided in Appendix W of this *TC & WM EIS*

American Indian traditional cultural places within Hanford include, but are not limited to, a wide variety of places and landscapes: archaeological sites, cemeteries, trails and pathways, campsites and villages, fisheries, hunting grounds, plant-gathering areas, holy lands, landmarks, important places in American Indian history and culture, places of persistence and resistance, and landscapes of the heart

(Neitzel 2005:4.104). Culturally important localities and geographic features include Rattlesnake Mountain, Gable Mountain, Gable Butte, Goose Egg Hill, Coyote Rapids, and the White Bluffs portion of the Columbia River. The Wanapum resided on land that is now part of Hanford until 1942, when the site was established, then moved to Priest Rapids (DOE 1987).

Lewis and Clark were among the first European Americans to visit the Hanford region during their 1804–1806 expedition. They were followed by fur trappers, military units, and miners. It was not until the 1860s that merchants set up stores, a freight depot, and the White Bluffs Ferry on the Hanford Reach, and gold miners began to work the gravel bars. Cattle ranches opened in the 1880s, and farmers soon followed. Land use began to change as settlers populated the area (Neitzel 2005:4.104). By the beginning of the twentieth century, much of the area was used for farming and grazing (DOE 1999a:4-1, 4-3). The Grand Coulee Dam was built on the Columbia River in the 1940s, and the Columbia Irrigation Project brought more water for farming. The population then increased in Franklin County, across the Columbia River from Hanford (DOE 2005b:2.1).

Several small, thriving towns, including Hanford, White Bluffs, and Ringold, grew up along the riverbanks in the early twentieth century. The accessibility of these communities to outside markets expanded with the arrival of the Chicago, Milwaukee, St. Paul, and Pacific Railroad branch line in 1913. These towns, and nearly all other structures, were razed after the U.S. Government acquired the land for the original Hanford Engineer Works in 1943 (part of the Manhattan Project). Although agriculture and livestock production were the primary activities within the region and in Hanford at the beginning of the twentieth century, these activities ceased at the site when it was acquired by the Government (Neitzel 2005:4.73, 4.104). Today, remnants of homesteads, farm fields, ranches, abandoned military installations, and other buildings can be found throughout Hanford. Nearly 5,200 hectares (13,000 acres) of abandoned agricultural lands remain on the site (DOE and Ecology 1996:4-37).

During the Manhattan Project and Cold War era, numerous nuclear reactors and associated reprocessing facilities were constructed at Hanford. The reactor sites cover over 930 hectares (2,300 acres) of land. All reactor buildings still stand, although many ancillary support structures have been removed (DOE and Ecology 1996:4-37; Neitzel 2005:4.107).

Hanford is owned and used primarily by DOE, but portions are owned, leased, or administered by other Government agencies. Only about 6 percent of the land area has been disturbed and is actively used, leaving mostly vacant land with widely scattered facilities (Neitzel 2005:4.144).

Currently, land use within the Hanford vicinity includes wildlife protection areas and areas used for urban and industrial development, recreation, military training, irrigated and dryland farming, and grazing. At the time of the 2007 Census of Agriculture, Benton, Franklin, and Grant Counties had a total of 942,780 hectares (2.33 million acres) of land in farms. Of that farmland, 71 to 77 percent was used as cropland, 11 to 22 percent was pastureland, and 6 to 14 percent had other uses (USDA 2009). In 2006, land committed for the Conservation Reserve Program of the U.S. Department of Agriculture included 49,067 hectares (121,246 acres) in Benton County, 47,819 hectares (118,163 acres) in Franklin County, and 34,756 hectares (85,882 acres) in Grant County (USDA 2006:275).

Residential, commercial, and industrial land uses are predominant in the Tri-Cities area (Richland, Kennewick, and Pasco) southeast of Hanford and around other cities near the southern boundary of Hanford, including Benton City, Prosser, and West Richland (USDA 1997).

R.4 FUTURE LAND USE AT THE HANFORD SITE

This section contains a description of the land use planning at Hanford. An understanding of expected future land use at Hanford sets the stage for reasonably foreseeable actions that may occur.

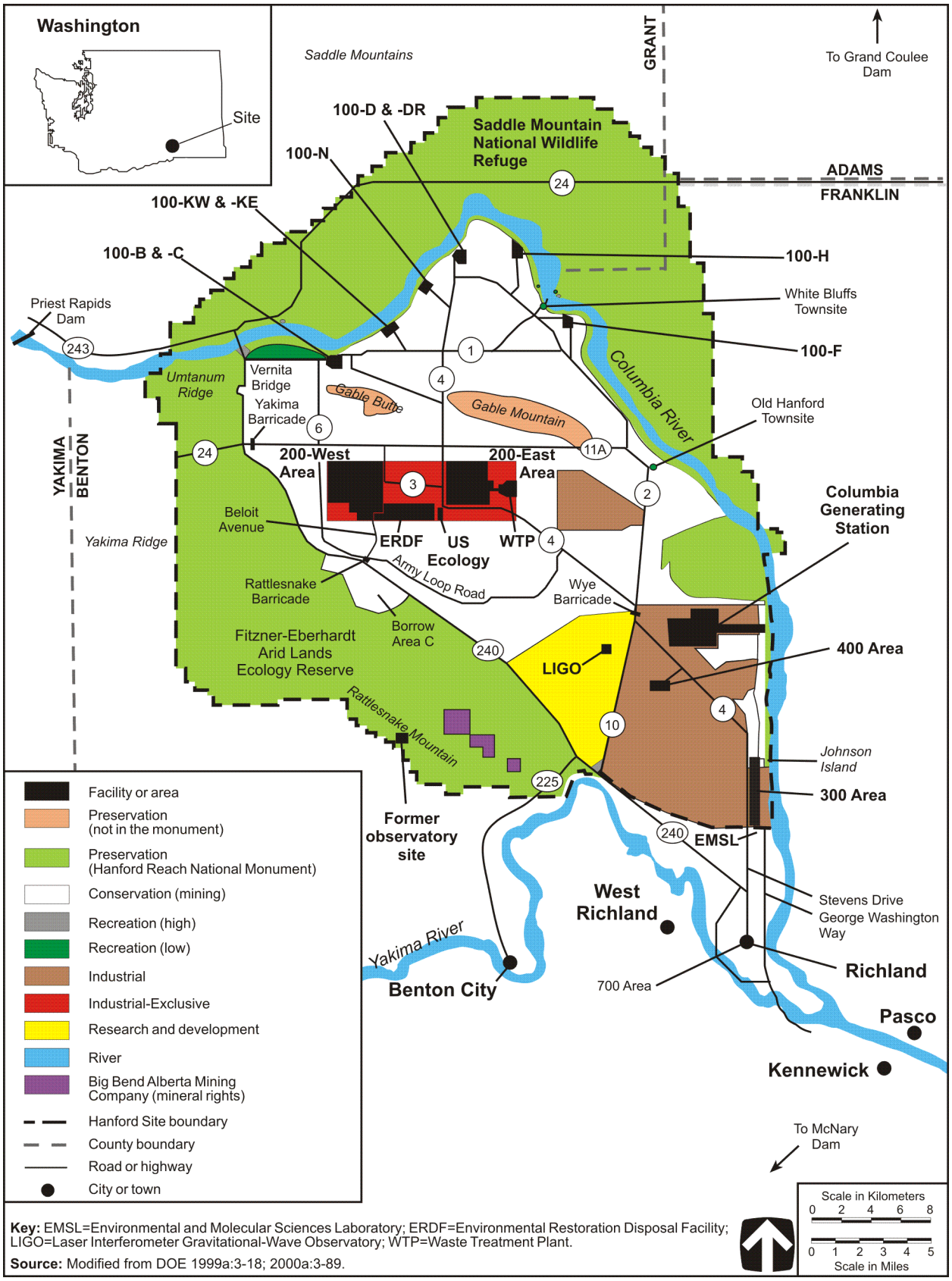
On May 15, 1989, DOE, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) signed a comprehensive agreement for cleaning up Hanford. The Hanford Federal Facility Agreement and Consent Order (Ecology, EPA, and DOE 1989), or Tri-Party Agreement (TPA), is an agreement for achieving compliance with the remedial action provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the treatment, storage, and disposal unit regulations and corrective action provisions of the Resource Conservation and Recovery Act (RCRA). The TPA (1) defines and ranks CERCLA and RCRA cleanup commitments, (2) establishes responsibilities, (3) provides a basis for budgeting, and (4) establishes aggressive goals for site remediation, with enforceable milestones to ensure compliance. Compliance with the TPA necessitates that DOE consider future land use at Hanford.

Recognizing the need for a comprehensive land use plan, DOE issued the *Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a) in September 1999; this document provides the framework within which future use of lands and resources at Hanford would occur. The overall Hanford Comprehensive Land-Use Plan as adopted by the Record of Decision (ROD) (64 FR 61615) is to accomplish the following for Hanford:

- Protect the Columbia River and associated natural and cultural resources and water quality.
- Wherever possible, locate new development, including cleanup- and remediation-related projects, in previously disturbed areas.
- Protect and preserve the natural and cultural resources for the enjoyment, education, study, and use of future generations.
- Honor treaties with American Indian tribes as they relate to land uses and resource uses.
- Reduce exclusive-use zone areas to maximize the amount of land available for alternative uses while still protecting the public from inherently hazardous operations.
- Allow access for other uses (e.g., recreation) outside of active waste management areas, consistent with the land use designation.
- Ensure that a public involvement process is used for amending the *Hanford Comprehensive Land-Use Plan EIS* and land use designations to respond to changing conditions.
- As feasible and practical, remove pre-existing, nonconforming uses.
- Facilitate cleanup and waste management.

These *Hanford Comprehensive Land-Use Plan EIS* policies are intended to provide for the protection of environmental and cultural resources; the siting of new development, utility, and transportation corridors; and economic development (DOE 2008a:2-6).

Figure R–1 shows the generalized land use at Hanford as developed in the *Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a) and modified by establishment of the Hanford Reach National Monument (65 FR 37253). DOE anticipates multiple uses of Hanford, including consolidation of waste management activities in the Central Plateau; industrial development in the eastern and southern portions, including the 400 Area; increased recreational access to the Columbia River; expansion of the Saddle Mountain National Wildlife Refuge to include all of the Wahluke Slope; and management of the Fitzner-Eberhardt Arid Lands Ecology Reserve by the U.S. Fish and Wildlife Service (USFWS) (64 FR 61615).



Key: EMSL=Environmental and Molecular Sciences Laboratory; ERDF=Environmental Restoration Disposal Facility; LIGO=Laser Interferometer Gravitational-Wave Observatory; WTP=Waste Treatment Plant.

Source: Modified from DOE 1999a:3-18; 2000a:3-89.

Figure R–1. Generalized Land Use at the Hanford Site

Important areas within the Preservation land use designation include the 78,900-hectare (195,000-acre) Hanford Reach National Monument, which incorporates a portion of the Columbia River corridor (65 FR 37253). The area known as the Hanford Reach includes the quarter-mile strip of public land on either side of the last free-flowing, nontidal segment of the Columbia River in the United States (DOE 2000a:3-91). USFWS (with DOE as a cooperating agency) prepared the *Hanford Reach National Monument Final Comprehensive Conservation Plan and Environmental Impact Statement, Adams, Benton, Grant, and Franklin Counties, Washington* (USFWS 2008) for all lands within the monument. Alternative E, selected as the Preferred Alternative in that environmental impact statement (EIS), attempts to strike a balance between resource protection and the level of public use and access USFWS believes the public will expect.

Since the issuance of the *Hanford Comprehensive Land-Use Plan EIS* and ROD, numerous actions have been taken and decision documents issued pertaining to Hanford that potentially could impact the land use plan. A supplement analysis to the *Hanford Comprehensive Land-Use Plan EIS* was recently prepared to help inform DOE's determination of whether that EIS remains adequate, or whether a new EIS or supplement to the existing EIS should be prepared (DOE 2008a:Summary-1, Summary-2). The supplement analysis concludes that the information on land use developed since issuance of the *Hanford Comprehensive Land-Use Plan EIS* continues to support the land use designations and stated policies of the land use plan (DOE 2008a:Summary-3). DOE has not identified significant changes in circumstances or substantial new information since 1999 that would affect the basis for its decisions as documented in the *Hanford Comprehensive Land-Use Plan EIS* ROD (64 FR 61615).

The *Hanford Site End State Vision* (DOE 2005b) describes a postcleanup condition for Hanford. That end state is based on the land use plan contained in the *Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a). The following paragraphs describe the end-state vision for the 100, 200, and 300 Areas:

100 Areas. Contamination in the 100 Areas will be remediated according to 50-year Conservation (Mining) and Preservation land use exposure scenarios for recreational, resident park ranger, and tribal activities, including fishing. Unlimited use is anticipated after 50 years. Remediation of waste sites consistent with the current CERCLA Interim Action RODs will continue. There will be no further degradation of the quality of groundwater that is currently above drinking water standards, and groundwater quality will be restored when practicable (DOE 2005b:iv).

Eight of nine reactors will be cocooned and left in place to decay for up to 75 years. B Reactor was recently designated a National Historic Landmark (DOE and DOI 2008). Therefore, B Reactor will not be decommissioned and moved to the Hanford Central Plateau for disposal as analyzed in the *Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1989, 1992) and assumed in this *TC & WM EIS*. DOE will make a final decision on whether to cut up and move the eight reactor cores to the Central Plateau after sufficient decay has occurred. Reactor pipelines will be left in place in the Columbia River if risk levels are acceptable and removal would result in additional impacts. The pipelines will be stabilized if required (DOE 2005b:vi).

200 Areas. A Central Plateau Core Zone will be designated as a permanent waste management area to remain under Federal control for the next 150 years or longer. A buffer area will be maintained between the Core Zone and the remainder of the Central Plateau during cleanup operations. After Core Zone cleanup is complete, the buffer area will be reduced, and land use between the Core Zone and the Columbia River will be similar to that in the 100 Areas (DOE 2005b:v).

Waste sites in the Core Zone will be addressed through the CERCLA process consistent with Industrial-Exclusive, Conservation (Mining), or Preservation land use scenarios identified in the land use plan and within the timeframe identified in the *Hanford Comprehensive Land-Use Plan EIS* ROD

(at least 50 years). Waste sites will be remediated and monitored to achieve human health and environmental protection goals under CERCLA. Small waste sites will be removed and consolidated to optimize placement and minimize the number of surface barriers. Disposition of buried pipelines in the Central Plateau will be achieved through the RCRA and CERCLA remove-treat-dispose of or stabilize-in-place processes. Canyon buildings that are robust will be used as engineered waste disposal facilities. Equipment, debris, and plutonium holdup material are being removed from the Plutonium Finishing Plant (PFP) and disposed of at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, or on site in accordance with waste acceptance criteria and CERCLA decision documents. DOE plans to demolish the PFP to slab-on-grade by 2013 (DOE 2011a).

As of 2009, more than 400 shipments of retrievably stored transuranic (TRU) waste had been transported off the Hanford Site to WIPP, and the equivalent of over 46,000 drums of waste had been removed from the ground (DOE 2011b). The low-level radioactive waste (LLW) portion of the retrieved waste will be treated and disposed of on site. Radioactive waste buried before 1970 containing TRU materials will be managed per CERCLA decisions (DOE 2005b:v).

Groundwater contamination across the Central Plateau Core Zone will be managed in accordance with the *Hanford Site Groundwater Strategy: Protection, Monitoring, and Remediation* (DOE 2004b, 2005b:v; Ecology and EPA 2007:7).

300 Area. Waste sites in the 300 Area will be remediated to achieve remedial action objectives based on industrial land use exposure scenarios. Remediation of waste sites to industrial standards will continue as required under the current CERCLA Interim Action RODs. Remediated sites will be backfilled to support unlimited surface use where practicable, and, depending on the success of future groundwater cleanup activities, irrigation and groundwater use may be restricted. DOE will work to meet the goals of no further degradation of the groundwater that is currently above drinking water standards and restoration of groundwater quality when practicable (DOE 2005b:iv).

The *Plan for Central Plateau Closure* (Fluor Hanford 2004) presents a strategic approach to closing the Central Plateau area of Hanford. That approach addresses nearly 4,000 items requiring closure action consistent with Hanford's environmental restoration mission. It divides the Central Plateau into 22 geographic zones organized around significant processing and waste management facilities, then organizes the major constituents of those zones into five logically grouped closure elements: canyons, underground tanks (the subject of this *TC & WM EIS*), waste sites, structures, and wells. The *Plan for Central Plateau Closure* provides the framework for integrating ongoing operations with the closure of facilities no longer used, all with a view to closing the Central Plateau by 2035. Primary objectives are to demolish structures; remove or stabilize contaminants; and establish institutional controls, such as postclosure groundwater care, consistent with long-term stewardship. The ultimate goals are to minimize risks to groundwater and return the Central Plateau to a state that supports the ecosystem (Fluor Hanford 2004:ES-2). The plan is based on the following assumptions (Fluor Hanford 2004:ES-3, ES-4):

- The Central Plateau will remain under institutional control for the foreseeable future.
- Ninety-five percent of the plutonium currently present on Hanford will be removed and shipped off site.
- Contaminated materials and soils will be left in place, unless removal and disposal are more cost-effective.
- Barriers over contaminated structures and waste sites will effectively minimize biointrusion and reduce the transport rate of contaminants to the groundwater.

This approach represents the first planning effort to identify the full range of actions that must be accomplished to close the Central Plateau and position DOE to complete its environmental management mission (DOE 2010a; Fluor Hanford 2004:ES-9). The closure approaches listed in the *Plan for Central Plateau Closure* (Fluor Hanford 2004) for the waste sites, structures, wells, and canyons closure elements are described below. The closure approach for the underground tanks closure element is not described because it has been superseded by the alternatives for tank closure that are being evaluated in this *TC & WM EIS*.

The waste sites closure element of the *Plan for Central Plateau Closure* focuses on 884 sites, including cribs, ponds, ditches, retention basins, burial grounds, pipelines, and areas of unplanned releases (i.e., areas in which liquid or solid waste contaminated with radioactive materials or hazardous chemicals was disposed of or released). In compliance with CERCLA, remedial actions are being taken at waste sites in groups of operable units as established by the TPA. The closure approach for these waste sites involves a combination of the following actions (Fluor Hanford 2004:ES-5, ES-6):

- Removing, treating, and disposing of contaminated materials, especially soil
- Taking no action for sites that represent minimal hazard
- Maintaining the existing soil cover
- Capping with protective barriers where required to protect groundwater or mitigate intrusion

The structures closure element of the *Plan for Central Plateau Closure* consists of 955 varied structures, including offices, shops, trailers, and water tanks, as well as large processing, storage, or handling facilities such as the PFP. The closure approach for structures is as follows (Fluor Hanford 2004:ES-6):

- Demolish aboveground structures.
- Fill voids in belowground structures.
- Stabilize the surface.
- Cap with protective barriers where required to protect groundwater or mitigate intrusion.

The wells closure element for the *Plan for Central Plateau Closure* includes 1,968 groundwater or vadose zone wells that have been used for monitoring and characterization and are noncompliant with applicable regulations or will not be needed following closure. These wells will be closed to eliminate a pathway for migration of contamination to the groundwater. The closure approach for wells is to decommission through filling or demolition (Fluor Hanford 2004:ES-6).

The canyons closure element for the *Plan for Central Plateau Closure* includes the five major defense production facilities originally designed for fuel-reprocessing operations. Four of the five—the U Plant, B Plant, PUREX [Plutonium-Uranium Extraction] Plant, and REDOX [Reduction-Oxidation] Facility (S Plant)—are currently under surveillance and maintenance. The fifth—T Plant—is being used for waste management. The remedial action for each canyon will be evaluated using the CERCLA process (Fluor Hanford 2004:ES-4).

The Canyon Disposition Initiative is the result of the 1996 Agreement-in-Principle among the signatories of the TPA to define the path forward for determining the final disposition of Hanford's five canyon buildings (i.e., B Plant, S Plant, T Plant, U Plant, and the PUREX Plant). The purpose of the initiative is to investigate the potential for using the canyon buildings as disposal sites for Hanford remediation waste, rather than demolishing the structures and transferring the resulting waste to the Environmental Restoration Disposal Facility (DOE 2004c:4).

The 221-U Facility is the first canyon building to be addressed under the Canyon Disposition Initiative. The selected remedy is to partially demolish 221-U, dispose of contaminated equipment and demolition debris inside and adjacent to the remaining structure, fill void spaces with grout, and cover the remnants

with an engineered barrier (DOE 2005c). Disposition of 221-U is considered to be a pilot project for disposition of the remaining four canyon buildings. However, the complexity and costs of implementation could vary significantly for each building because of varying amounts, types, and locations of radioactive contamination within the five canyon buildings (DOE 2004c:1, 4).

The PUREX tunnels in the 200-East Area contain equipment contaminated with approximately 2.8 million curies of various radionuclides and with other hazardous materials (DOE 2003a:552, 553). These tunnels will be managed as an RCRA storage unit until closure can be coordinated with the final closure plan for the PUREX Plant. The current DOE vision calls for the PUREX tunnels to be filled with grout and covered with a surface barrier (DOE 2005b:vi; Fluor Hanford 2004:A3-2). Final closure of the tunnels will require an evaluation of alternatives (Bergeron et al. 2001:3.26).

The *Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste,* released in February 2011 (DOE 2011c), analyzed various alternatives for the disposal of 12,000 cubic meters (420,000 cubic feet) of waste. Hanford is included as a potential disposal location under three alternatives: an intermediate-depth borehole facility requiring about 44 hectares (110 acres) of land for 930 boreholes and supporting infrastructure, a near-surface trench disposal facility requiring about 20 hectares (50 acres) for 29 trenches and supporting infrastructure, or an above-grade vault disposal facility requiring about 24 hectares (60 acres) of land for 12 vaults and supporting infrastructure. The disposal facility for the three alternatives would be south of the 200-East Area on the Central Plateau (DOE 2011c).

Because most of the 300 Area is within the City of Richland's Urban Growth Boundary, Richland funded a *Preliminary Assessment of Redevelopment Potential for the Hanford 300 Area* (Richland 2005a). The recently issued *Supplement Analysis, Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE 2008a) considered the City of Richland's *Preliminary Assessment of Redevelopment Potential for the Hanford 300 Area* in its review of new information on land use considerations developed since the *Hanford Comprehensive Land-Use Plan EIS* was issued in 1999 (DOE 1999a). The supplement analysis concluded that no significant new information or changes in circumstances had developed since 1999 that would affect the basis for DOE's land use decisions as documented in the ROD for the *Hanford Comprehensive Land-Use Plan EIS* (64 FR 61615).

A Notice of Intent to prepare an Environmental Impact Statement for the Acquisition of a Natural Gas Pipeline and Natural Gas Utility Service at the Hanford Site, Richland, Washington was released in January 2012 (77 FR 3255). The proposed pipeline would provide natural gas to facilities located on the Central Plateau of Hanford. The pipeline would begin at the existing Williams Northwest Pipe transmission line in Franklin County and run westerly across non-DOE lands and under the Columbia River into the 300 Area before turning northwest and paralleling Route 4S. The pipeline would terminate at facilities in the 200-East Area; the length of the proposed pipeline is estimated at approximately 30 miles (48 kilometers). The proposed pipeline is not analyzed in detail in this *TC & WM EIS* because of a lack of information on potential impacts; the EIS has not been issued.

R.5 FUTURE LAND USE IN SURROUNDING REGIONS

This section contains a description of the land use planning in the counties surrounding Hanford. An understanding of expected future land use and development provides the underpinnings for reasonably foreseeable actions that may occur in the region.

The 1990 Washington State Growth Management Act (RCW 36.70A.020) requires counties in the region around Hanford to have comprehensive plans. Cities and other government jurisdictions adopt comprehensive plans to serve as guides for future activities within their jurisdictions. These plans attempt to project 20 years into the future for land development, housing, infrastructure, and community services

needs. Table R–2 describes the 13 broad goals described in the Washington State Growth Management Act that local governments must consider when developing their comprehensive plans.

Table R–2. Washington State Growth Management Act Planning Goals

Goal	Description
Urban growth	Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner.
Reduce sprawl	Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development.
Transportation	Encourage efficient multimodal transportation systems that are based on regional priorities and coordinated with county and city comprehensive plans.
Housing	Encourage the availability of affordable housing to all economic segments of the population of this state, promote a variety of residential densities and housing types, and encourage preservation of existing housing stock.
Economic development	Encourage economic development throughout the state that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens of this state, especially for unemployed and for disadvantaged persons, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the state's natural resources, public services, and public facilities.
Property rights	Private property shall not be taken for public use without just compensation having been made. The property rights of landowners shall be protected from arbitrary and discriminatory actions.
Permits	Applications for both state and local government permits should be processed in a timely and fair manner to ensure predictability.
Natural resources industries	Maintain and enhance natural-resource-based industries, including productive timber, agricultural, and fisheries industries. Encourage the conservation of productive forest lands and productive agricultural lands, and discourage incompatible uses.
Open space and recreation	Encourage the retention of open space and development of recreational opportunities, conserve fish and wildlife habitat, increase access to natural resource lands and water, and develop parks.
Environment	Protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water.
Citizen participation and coordination	Encourage the involvement of citizens in the planning process and ensure coordination between communities and jurisdictions to reconcile conflicts.
Public facilities and services	Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.
Historic preservation	Identify and encourage the preservation of lands, sites, and structures that have historical or archaeological significance.

Source: RCW 36.70A.020; Yakima County 1998:I-4.

The following plans exist for counties in the region around Hanford and for the Cities of Richland and Kennewick:

- *Adams County Comprehensive Plan* (ACPC 2005)
- *Benton County Comprehensive Land Use Plan* (BCPC 2009)
- *City of Richland Comprehensive Land Use Plan* (Richland 2002, 2005b, 2008a)

- *City of Kennewick Comprehensive Plan* 2009, *Executive Document* (Kennewick 2010)
- *Franklin County Growth Management Comprehensive Plan* (Franklin County 2008)
- *Grant County Comprehensive Plan/Environmental Impact Statement* and *A Resolution Relating to Comprehensive Planning in Grant County in Accordance with the Washington State Growth Management Act* (*RCW36.70A*) and *Amending the 2006 Comprehensive Plan and Zone Changes* (GCDCD 1999, GCBOCC 2010)
- *Kittitas County Comprehensive Plan* (Kittitas County 2010)
- *Klickitat County, Washington, Comprehensive Plan* (Dreyer 2007)
- *Plan 2015: A Blueprint for Yakima County Progress* and *2010 Comprehensive Plan Amendment Cycle* (Yakima County 1998, 2010)
- *Walla Walla County Integrated Comprehensive Plan and EIS*, "Comprehensive Plan: Walla Walla County Comprehensive Plan Update 2007 and 2009"and *Walla Walla County Integrated Comprehensive Plan and EIS*, (Walla Walla County 2007, 2009)

These plans are updated periodically. Generally, the plans encourage growth in urban growth areas (UGAs) and discourage growth outside these areas. A comprehensive plan is not a legally enforceable document; zoning is the enforceable means for controlling growth.

Under the Washington State Growth Management Act (RCW 36.70A), the Washington State Office of Financial Management has the responsibility to project population growth rates for local planning purposes. Population projections are used by cities and counties to identify the amounts and locations of rural land needed for conversion to urban use as urban growth occurs (BCPC 2009:4-15).

To set aside or designate lands necessary for future population growth (beyond those undeveloped lands already within city boundaries), the Washington State Growth Management Act requires counties to designate UGAs outside of, but adjacent to, the corporate boundary of each city. UGAs are the land areas that, though not currently within a city's corporate limits, are designated for conversion to urban use in the normal process of urban growth. UGAs must be large enough to accommodate 20 years of urban growth. The identification of amounts of land to be converted to urban use has important economic implications for both cities and counties (BCPC 2009:4-15, 4-16).

The size of UGAs is not determined solely by the projected rate of population growth. Other possible considerations include a city's need for commercial- and industrial-zoned lands to meet the economic goals and objectives identified in its comprehensive plan. Land may also be deemed unsuitable as a UGA because of its value as natural resource land (i.e., agricultural, mineral, and forestland) or its value to local residents as a unique low-density rural community (BCPC 2009:4-16).

Of primary importance to the initial establishment and future expansion of UGAs into unincorporated areas is the projected need for additional lands in relation to the existing available supply of undeveloped land already inside a city's UGA. Equally important; however, is the maintenance of low-enough densities outside the UGA to enable its logical and cost-effective expansion in the distant future (30 to 70 years) (BCPC 2009:4-18).

The phenomenon of city boundary enlargement and expansion into rural county lands will continue with population growth. Designation of UGAs endeavors to set standards and mechanisms whereby legitimate needs for new urban lands are met while rural communities and natural resource lands are protected. Cities can neither annex lands nor generally extend municipal services to lands outside of UGAs (BCPC 2009:4-15).

Because the majority of Hanford lies within Benton County and the majority of Hanford workers live in Benton County and the city of Richland, the following discussion concentrates on future land use in these regions.

Benton County. As described in the *Benton County Sustainable Development: Overall Economic Development Plan* (Benton County 2007), 263,049 hectares (650,000 acres) of the county are planned for agriculture and agribusiness; 2,045 hectares (5,053 acres), for commercial and industrial use; and 5,541 hectares (13,693 acres), for tourism and recreation. This does not include the areas designated for Conservation (Mining) (44,183 hectares [109,179 acres]); Industrial/Industrial-Exclusive use (20,399 hectares [50,217 acres]); Preservation (78,127 hectares [193,056 acres]); Recreation, including both High Intensity and Low Intensity (459 hectares [1,134 acres]); and Research and Development (4,912 hectares [12,138 acres]) in the *Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a:S-46, S-47).

Historically, the Cities of West Richland, Richland, and Kennewick have aggressively pursued annexation of unincorporated lands, largely in response to the boom-and-bust cycles of Hanford. Between 1985 and 1998, 7,328 hectares (18,107 acres) were annexed even though each city still had over half its incorporated acreage undeveloped. Kennewick has 2,428 hectares (6,000 acres) of vacant or undeveloped land designated for low-density residential use; Richland, 549 hectares (1,356 acres); and West Richland, 5,520 hectares (13,641 acres), some of which is actually designated for rural and lesser densities (BCPC 2009:4-15, 4-19).

City of Richland. The City of Richland released an updated *City of Richland Comprehensive Land Use Plan* in 2008 (Richland 2008a). Although this plan is for the period ending in 2035, it contains few quantitative estimates of future changes. Therefore, the 1997 *City of Richland Comprehensive Land Use Plan*, as amended through December 10, 2002 (Richland 2002), was used to obtain the pertinent information. The 1995–2015 planning horizon of that plan (Richland 2002:ES 1-1–ES 1-5) reflects the following projected changes:

- Gain of 11,041 jobs
- Demand for 3,134 residential units requiring 170 hectares (420 acres) of the 1,281 hectares (3,165 acres) of currently vacant land
- Demand for an additional 490 hectares (1,212 acres) of vacant developable land
- Demand for an additional 42 hectares (104 acres) of parkland
- Growth in the student population of 1,504
- Falling level-of-service ratings on 19 roadway segments
- Increasing demand for irrigation water for landscaping as unused open space and agricultural land are converted to public facility and residential uses

Also indicated (Richland 2002:3-6) are the following changes in land use patterns expected between 1995 and 2015:

- Land designated for residential uses will increase from 31 to 33 percent of the total land area.
- Land designated for industrial uses will increase from 19 to 26 percent of the total land area. Most of this increase will be attributable to the addition of Hanford land.
- Land designated for commercial uses will increase slightly to 6 percent of the total land area.
- Land designated for Urban Reserve uses will be approximately 8 percent of the total land area.

The following changes in land use patterns were reflected in the planning horizon of the amended 2008 plan (Richland 2008a:AL-II, AL-III, PF-VII):

- Land designated for agricultural uses will decrease from 21 to 3 percent of the total land area. Most of this decrease will result from continuing the redesignation of lands in the Horn Rapids area from agricultural to Urban Reserve and public facility uses.
- Land designated for public facilities and open space will increase from 12 to 21 percent of the total land area.

The UGA in the *City of Richland Comprehensive Land Use Plan* (Richland 2008a:LU 3-2) covers an area of 10,126 hectares (25,021 acres).

Although changes will inevitably occur due to the pressures of continued population growth, land use in the region surrounding Hanford is not expected to change drastically during the upcoming decades. It is assumed that the largest land use in the region will continue to be agricultural, and that populations will increase mainly around the current urban areas (DOE 2005b:2.2).

R.6 APPROACH TO CUMULATIVE IMPACTS ANALYSIS

A flowchart of the methodology used to estimate cumulative impacts is presented as Figure R–2. This flowchart, which incorporates the CEQ's eight principles of cumulative effects analysis (CEQ 1997:8), is divided into four phases: (1) selection of resource areas and appropriate regions of influence (ROIs), (2) selection of reasonably foreseeable future actions, (3) estimation of cumulative impacts, and (4) identification of monitoring and mitigation.

Phase 1—Selection of Resource Areas and Appropriate ROIs. This phase concentrates on selecting resource areas most likely to incur meaningful cumulative impacts. Steps in this process include the following:

Region of Influence:
A site-specific geographic area in which the principal direct and indirect effects of actions are likely to occur.

1a. Examine resource areas evaluated in recent Hanford NEPA documents, areas evaluated in this *TC & WM EIS* (see Chapter 4), and areas subjected to historically significant impacts to develop a list of resource areas likely to exhibit cumulative effects.

1b. Identify the ROI—i.e., the spatial limits—for each resource area to be evaluated for cumulative impacts. ROIs are described in the introduction to Chapter 3 of this *TC & WM EIS* and are summarized in Section R.9.

Phase 2—Selection of Reasonably Foreseeable Future Actions. In this phase, reasonably foreseeable future actions are examined and screened to determine which must be included in the cumulative impacts analysis. Steps in this process include the following:

2a. Identify future actions—Federal, non-Federal, or private—occurring in the ROI. Typical information sources include RODs, RCRA, CERCLA, NEPA, and Washington State Environmental Policy Act documents; the TPA; permits and permit applications; and land use and development plans.

Reasonably foreseeable actions are ongoing and will continue into the future, are funded for future implementation, or are included in firm, near-term plans.

2b. Examine each future action to determine whether the action is reasonably foreseeable, occurs within the ROI, occurs within the same timeframe as the *TC & WM EIS* action, and is not already accounted for in the baseline impacts.

2c. Retain for analysis future actions meeting the criteria listed in item 2b, and eliminate from further consideration future actions not meeting all those criteria.

Phase 3—Estimation of Cumulative Impacts. In this phase, impact indicators for the proposed actions are added to baseline values and to values for reasonably foreseeable future actions to estimate cumulative impacts. Steps in this process include the following:

3a. Identify and, to the extent possible, quantify baseline impacts. Baseline impacts (i.e., the level of degradation that a resource is currently experiencing) include effects of past and present actions. These impacts are generally those described in Chapter 3 of this *TC & WM EIS*. Present actions include cleanup activities that could reduce impacts of a past action, as well as actions that could add to the degradation of a resource. The importance of past actions to cumulative impacts is resource-specific. For example, past air pollutant releases would not affect the baseline (current) site air quality, whereas liquid releases to the ground could have a lasting effect and could impact the baseline. Therefore, only past actions continuing to have impacts on the resource are considered in the cumulative impacts analysis.

3b. Identify impacts of the *TC & WM EIS* Preferred Alternatives and the *TC & WM EIS* alternative combinations from Chapter 4.

3c. Identify impacts of the reasonably foreseeable future actions identified in Phase 2. If quantitative data are available, incorporate the values into a quantitative or semiquantitative cumulative impacts analysis. If quantitative data are not available, use qualitative data.

3d. Aggregate the effects on each resource of past, present, and reasonably foreseeable future actions, including the proposed actions. Use aggregate effects to estimate cumulative impacts for each resource area. Determine the degree of impact using largely the same impact measures that were used for Chapter 4 of this *TC & WM EIS*.

The results of the cumulative impacts analysis are presented in Chapter 6. Supporting information for the short-term cumulative impacts analysis is presented in Appendix T; long-term, in Appendix U.

Phase 4—Identification of Monitoring and Mitigation. In this phase, resultant estimates of cumulative impacts are examined to determine whether monitoring and/or mitigation activities are needed. Steps in this process include the following:

4a. Determine those resource areas where appreciable cumulative impacts are predicted.

4b. Describe measures that may be used to monitor or mitigate these potentially appreciable cumulative impacts.

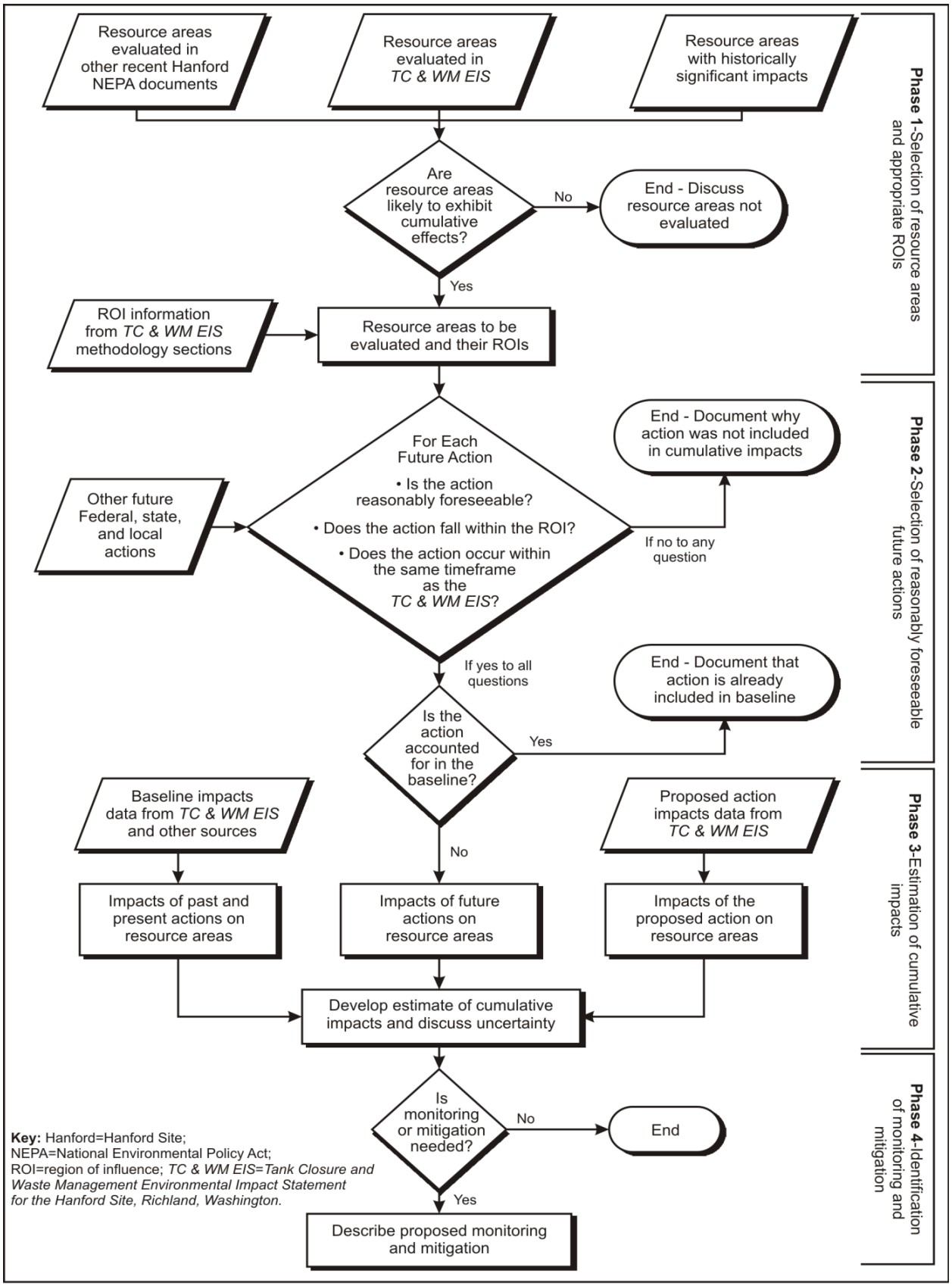


Figure R–2. Flowchart for Identifying and Evaluating Cumulative Impacts

R.7 UNCERTAINTIES

Many uncertainties are inherent in the estimation of cumulative impacts. The uncertainties in the cumulative impacts described in this *TC & WM EIS* are largely the result of the following assumptions and conditions:

- Small changes in current activities are generally not documented and therefore not considered.
- Individual activities disturbing less than 40 hectares (100 acres) are generally not considered.
- Detailed information for many of the future activities considered in this cumulative impacts analysis is limited.
- Information on projects to be implemented 10 or more years in the future is limited.
- Future changes to laws and regulations cannot be considered.
- Future fluctuations and changes to the environment, including climate change and the effects of climate change on water resources, ecological resources, and man, cannot be considered quantitatively.

The contribution of most of these assumptions and conditions to the determination of Hanford's cumulative impacts is believed to be small, at least for the short term. Although not quantified, these assumptions and conditions are unlikely to change the conclusions of the *TC & WM EIS* cumulative impacts analysis. Given the extended duration of the analysis, resulting projections of long-term cumulative impacts are subject to a high degree of uncertainty.

As described in the previous sections, cumulative impacts were assessed by combining the potential effects of *TC & WM EIS* activities with the effects of other past, present, and reasonably foreseeable actions in the ROI. It must be noted, of course, that many actions occur at different times and locations across the ROI—e.g., the set of actions impacting air quality—and thus their impacts are not entirely cumulative. Therefore, this approach should yield a conservative estimate of cumulative impacts for the activities considered.

R.8 SELECTION OF RESOURCE AREAS FOR ANALYSIS

Because of the comprehensive nature of this *TC & WM EIS*, cumulative short-term impacts were evaluated for all resource areas except for the impacts of accidents on public and occupational health and safety. Except under an extremely unlikely catastrophic earthquake scenario, it is highly unlikely that accidents in separate facilities would occur at the same time and be close enough to each other to have appreciable additive effects. The resource areas evaluated for long-term impacts were groundwater, human health, environmental justice, and ecological risk.

R.9 RESOURCE AREA METHODOLOGIES

This *TC & WM EIS* incorporates a range of methods for evaluating cumulative impacts because of differences in the anticipated significance of the impact on a given resource area, the availability of adequate data, and the specific needs of decisionmakers and the public.

In general, long-term impacts, including impacts on groundwater quality, were evaluated quantitatively (i.e., they were modeled). Analyses of short-term impacts were generally semiquantitative (i.e., simple addition of impact indicators) or qualitative (i.e., descriptions were based on nonnumerical data). Where data were not uniformly available or comparable for a particular resource across its ROI; however, analysis entailed a combination of semiquantitative and qualitative methods. In regard to those resource areas for which a detailed analysis was preferable but data were simply insufficient to support that level

of analysis, the analysis was performed qualitatively. Table R–3 identifies, for each resource area, the method of analysis and the rationale for its application.

Table R–3. Methods of Cumulative Impacts Analysis for Different Resource Areas

Resource Area	Region of Influence	Method of Analysis	Indicator	Note
Short-Term Impacts				
Land use	Hanford and nearby offsite areas	Semiquantitative	Land area disturbed or occupied	Amount of land disturbed or occupied for other actions[a] is added to present a total.
Visual resources	Hanford and nearby offsite areas in the viewshed	Qualitative	Visual resource alteration in the viewshed	Resource area does not lend itself to a quantitative analysis.
Infrastructure	Hanford utility infrastructure	Semiquantitative	Utility use (electricity, fuel, and water)	Utility resources used for other actions[a] are added to present a site total.
Noise	Hanford, nearby offsite areas, and access routes to the site	Qualitative	Noise levels	Noise data are not likely to be available to perform a quantitative analysis.
Air quality	Hanford and nearby offsite areas within the airshed	Semiquantitative	Concentrations of criteria and toxic air pollutants	Air quality indicators for other actions[a] are added to present a conservative total, given that the values likely occur at different locations and at different times.
Geology and soils	Hanford and nearby offsite areas where geologic and soil resources may be affected	Semiquantitative	Volumes of geologic and soil resources used	Geologic and soil resources used for other actions[a] are added to present a total.
Water resources	Hanford and nearby offsite areas in the Columbia River and Yakima River watersheds	Semiquantitative Qualitative	Amount of surface water and groundwater used Surface-water and groundwater quality	Water use for other actions[a] is added to present a total.
Ecological resources	Hanford and nearby offsite areas with similar habitat	Semiquantitative Qualitative	Sensitive habitat (e.g., shrub steppe) disturbed or occupied Disturbance of threatened and endangered species	Amount of habitat disturbed for other actions[a] is added to present a total.

Table R–3. Methods of Cumulative Impacts Analysis for Different Resource Areas *(continued)*

Resource Area	Region of Influence	Method of Analysis	Indicator	Note
Short-Term Impacts *(continued)*				
Cultural and paleontological resources	Hanford and nearby offsite areas that may contain significant cultural resources	Qualitative	Disturbance of National Register of Historic Places –listed or –eligible historic properties or archaeologic, American Indian, or paleontologic resources	Potential for cumulative impacts on cultural resources is discussed qualitatively.
Socioeconomics	Hanford and nearby counties where at least 90 percent of Hanford employees reside	Semiquantitative	Direct and indirect employment Traffic from employee and truck trips	Employment and vehicle trips for other actions[a] are added to present a total.
Public and occupational health and safety—normal operations	Hanford and offsite areas within 80 kilometers (50 miles) of the site Occupational impacts limited to Hanford workers	Semiquantitative	Population and MEI doses and LCFs from radioactive air emissions and Hazard Indices for chemical air emissions Worker doses and LCFs from radiological exposure and Hazard Indices for chemical exposure	Public health indicators for other actions[a] are added to present a total. Worker health indicators for other actions[a] are added to present a total, as resource is suitable for addition of impact indicators.
Public and occupational health and safety—transportation	Hanford roads and railroads and selected offsite transportation corridors to waste disposal facilities	Semiquantitative	Population and MEI doses and LCFs for transport crew and public along transportation routes	Transportation indicators for other actions[a] are added to present a total.
Waste management	Hanford waste management facilities and offsite facilities where Hanford waste is managed	Semiquantitative	Waste generation for transuranic, low-level radioactive, mixed low-level radioactive, hazardous, dangerous, and nonhazardous wastes	Waste volumes/weights generated for other actions[a] are added to present a total.
Industrial safety	Industrial safety impacts limited to Hanford workers	Semiquantitative	Total recordable cases (TRCs) and fatalities	TRCs and fatalities are added to present a total.

Table R–3. Methods of Cumulative Impacts Analysis for Different Resource Areas *(continued)*

Resource Area	Region of Influence	Method of Analysis	Indicator	Note
Long-Term Impacts				
Groundwater	Portions of the groundwater basin that may be adversely affected by *TC & WM EIS* activities; bounded by groundwater discharge locations along the Columbia River	Quantitative	Radionuclide and chemical contaminant concentrations	Analysis required by Settlement Agreement re: *State of Washington v. Bodman* (Civil No. 2:03-cv-05018-AAM). Analysis is per the *Technical Guidance Document for Tank Closure Environmental Impact Statement Vadose Zone and Groundwater Revised Analyses*, Final Rev. 0, dated March 25, 2005 (DOE 2005d), due to "significance" of the resource area (groundwater) at Hanford.
Human health	Potential future onsite groundwater users and users of the Columbia River downstream from the site	Quantitative	MEI dose, LCFs, and Hazard Indices for drinking-water well user, resident farmer, American Indian resident farmer, and American Indian hunter-gatherer, and population dose, LCFs, and Hazard Indices for downstream surface-water users	Direct inputs are obtained from long-term groundwater modeling results.
Environmental justice	Potential future onsite subsistence farmers and American Indian users, and users of the Columbia River downstream from the site	Quantitative	MEI dose, LCFs, and Hazard Indices for future onsite subsistence farmers and American Indians	Direct inputs are obtained from long-term groundwater modeling results.

Table R–3. Methods of Cumulative Impacts Analysis for Different Resource Areas *(continued)*

Resource Area	Region of Influence	Method of Analysis	Indicator	Note
Long-Term Impacts *(continued)*				
Ecological risk	Plants and animals using Hanford and the Columbia River adjacent to and downstream from the site	Quantitative	Risk to indicator species at the shore of the Columbia River (terrestrial) and in the river (aquatic)	Direct inputs are obtained from long-term groundwater modeling results.

[a] Other past, present, and future actions in the region of influence that may contribute to cumulative impacts. The proposed approaches for evaluating cumulative impacts described in this table are dependent on the availability of information for other past, present, and reasonably foreseeable future actions. If numerical data are not available, qualitative cumulative impact analyses are performed.

Key: Hanford=Hanford Site; LCF=latent cancer fatality; MEI=maximally exposed individual; *TC & WM EIS=Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*.

Source: Based on Chapter 3, Table 3–1.

R.10 SPATIAL AND TEMPORAL CONSIDERATIONS

Cumulative environmental impacts—i.e., the impacts of all past, present, and reasonably foreseeable actions—have limits in space and time. For cumulative impacts analysis, those recognized spatial limits help determine the specific geographic expanse (ROI) to be evaluated for each resource area. The ROIs used in the cumulative impacts analysis—many are the same as those described in the introduction to Chapter 3—are summarized in Table R–3.

To conclusively address the temporal limits of environmental impact, short- and long-term cumulative impact analyses were performed for each resource area. Short-term cumulative impacts are associated with the active project phase, extending through the applicable administrative control, institutional control, or postclosure care period. Long-term cumulative impacts extend beyond the active project phase, thus beyond the appropriate period of administrative control, institutional control, or postclosure care. For this EIS, long-term cumulative impacts were assessed for approximately 10,000 years into the future.

R.11 PAST AND PRESENT ACTIONS

To determine the baseline impacts on a resource, the impacts of past and present actions must be identified. For most resource areas, baseline impacts were taken from information on the affected environment provided in Chapter 3 of this *TC & WM EIS*. For example, the current air quality in the ROI as described in Chapter 3 adequately reflects both past and present activities. In contrast, current resource use alone may not adequately account for past resource loss, and thus may not be a good indicator of baseline impacts.

Past and present actions that may contribute to cumulative impacts include those conducted by government agencies, businesses, or individuals within the ROIs considered. Examples of past Hanford activities include operation of the fuel fabrication plants, production reactors, the PUREX Plant and other fuel-reprocessing facilities, the PFP, and research facilities, as well as the treatment and disposal of waste. Current Hanford activities include site cleanup, waste disposal, and tank waste stabilization.

Examples of past and present offsite activities that may contribute to cumulative impacts include the clearing of land for agriculture and urban development, water diversion and irrigation projects, waste management, industrial and commercial development, mining, power generation, and the development of transportation and utility networks.

R.12 SELECTION OF REASONABLY FORESEEABLE FUTURE ACTIONS

In *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997), Principle 1 of cumulative effects analysis reads, "Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions." Principle 2 reads, in part, "Cumulative effects are the total effect…of all actions taken, no matter who (Federal, non-Federal, or private) has taken the actions." Therefore, it is important to identify future actions that may appreciably degrade the resources or add to the impacts of the proposed actions, regardless of the agency or individual undertaking the actions.

The *Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a) lays out the future vision for land use at Hanford. Both DOE and non-DOE actions may occur within the current Hanford boundaries. The major DOE activities will include continuation of site cleanup, waste consolidation and disposal, facility closure and decontamination and decommissioning, and the various high-level radioactive waste treatment and tank closure activities. Non-DOE actions are expected within the areas at Hanford set aside for Industrial, Research and Development, Preservation, Conservation (Mining), and Recreation uses (see Figure R–1).

DOE Actions at Hanford

The *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a) describes the major DOE activities that are occurring or would occur at Hanford to achieve the vision set forth in the *Hanford Comprehensive Land-Use Plan EIS*. The list of activities reflected in that plan was modified by eliminating those activities within the scope of this *TC & WM EIS* and those that have already been completed, and adding new activities planned for Hanford (72 FR 40135; 77 FR 3255; DOE 2006a; DOE, EPA, and Ecology 2006, 2007, 2009; PHMC 2006a, 2006b; Poston et al. 2007; Poston, Duncan, and Dirkes 2008, 2009, 2010, 2011). Present and future DOE activities at Hanford include the following:

- Cleanup and restoration activities across all areas of Hanford
- Decommissioning of surplus production reactors and their support facilities in the 100 Areas along the Columbia River[1]
- Deactivation of the PFP in the 200-West Area
- Actions to remove the sludge and decommission the K Basins in the 100-K Area
- U Plant regional closure
- Final disposition of the canyon buildings, PUREX tunnels, and other facilities in the 200 Areas, and cleanup of the Central Plateau to Industrial-Exclusive land use standards
- Transport of sodium-bonded spent nuclear fuel from FFTF in the 400 Area to INL for treatment
- Excavation and use of geologic materials
- Continued disposal of waste in the Environmental Restoration Disposal Facility near the 200-West Area

[1] B Reactor was recently designated a National Historic Landmark (DOE and DOI 2008). Therefore, B Reactor will not be decommissioned and moved to the Hanford Central Plateau for disposal as analyzed in the *Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1989, 1992) and assumed in this *TC & WM EIS*.

- Implementation of the programmatic waste management decisions described in the RODs for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a)
- Retrieval of suspect TRU waste buried after 1970
- Cleanup and protection of groundwater
- Potential disposal of greater-than-Class C LLW
- Transport of TRU waste to WIPP
- Acquisition of natural gas pipeline and natural gas utility service

Non-DOE Actions at Hanford

The aforementioned review of documentation for data bearing on cumulative impacts also entailed consideration of non-DOE activities inside the Hanford boundary. These included Federal, state, or local initiatives; industrial or commercial ventures; utility or infrastructure construction and operation; and waste treatment and disposal. Specific non-DOE activities at Hanford include the following:

- Continued transport of U.S. Navy reactor plants via the Columbia River and disposal thereof in trench 218-E-12B in the 200-East Area
- Continued operation of the Columbia Generating Station (previously Washington Public Power Supply System, Nuclear Project No. 2)
- Continued operation of the US Ecology Commercial Low-Level Radioactive Waste Disposal Site
- Management of the Hanford Reach of the Columbia River as a national monument and a national wildlife refuge

Other Actions in the Region

It was also necessary to consider activities outside Hanford but within the ROI. These included Federal actions, state and local development initiatives, industrial and commercial ventures, residential development, and infrastructure projects. Activities in the region surrounding Hanford include the following:

- Future land use in the region as described in city and county comprehensive land use plans
- Base realignment and closure and other U.S. Department of Defense activities
- Cleanup of toxic, hazardous, and dangerous waste disposal sites
- Columbia River and Yakima River water management
- Power generation and transmission line projects
- Wind energy projects
- Pipeline projects
- Transportation projects

For more information on anticipated future activities that could contribute to cumulative impacts, data were also collected from the Cities of Kennewick, Pasco, Richland, West Richland, and Yakima in Washington; the Counties of Adams, Benton, Franklin, Grant, Kittitas, Klickitat, Walla Walla, and Yakima in Washington; the Counties of Morrow and Umatilla in Oregon; and the Yakama Nation, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation. No additional major

future actions were identified by the city of Pasco in Washington; Adams, Franklin, Kittitas, Klickitat, or Walla Walla County in Washington; Umatilla County in Oregon; or the Nez Perce Tribe (Adams 2007, 2011; Benson 2011; D'Hondt 2011; Jennings 2011; Kelsey 2011; Prentice 2011; Romine 2007, 2011; Smith 2011; Wendt 2011; Wiltse 2011). Future activities that were identified for the region surrounding Hanford include the following:

- The 1,012-hectare (2,500-acre) South Ridge Development Zone in Kennewick, Washington, designated for mixed-use development over the next 5 to 10 years (Romine 2007).

- The 130-hectare (320-acre) Red Mountain Center mixed-use development area in West Richland, Washington, which broke ground in 2007 and will undergo phased construction over the next few years (Gouk 2011).

- The annexation of approximately 648 hectares (1,600 acres) of land near the Apple Tree Golf Course by the City of Yakima for residential development over the next 5 to 10 years (Benson 2007).

- The 567-hectare (1,400-acre) Multi-Purpose Motor Speedway Project 4.8 kilometers (3 miles) west of Boardman, Oregon, that began construction in 2007. Expansions could total 2,833 hectares (7,000 acres) over the next 10 years; however, this project is currently on hold due to a lack of funding (McClane 2007, 2011; PNMP 2007).

- The 115-hectare (284-acre) subdivisions near Pasco, Washington, located northwest and southwest of the airport (Adams 2007).

- The 162-hectare (400-acre) multitenant industrial park for the Port of Morrow in Boardman, Oregon, part of which has been constructed and is in use (McClane 2007; POM 2011).

- The 208-hectare (515-acre) industrial development adjacent to the Port of Morrow in Boardman, Oregon, which could include rail development and a container facility (McClane 2011).

- The 648-hectare (1,600-acre) Destination Resort Complex mixed vacation-style residential development with golf course and marina along the Columbia River 4.8 kilometers (3 miles) west of Boardman, Oregon, which is expected to begin construction within 5 years (McClane 2007).

- The development of biofuels (including ethanol) facilities in Finley, Moses Lake, and Plymouth, Washington, and biodiesel facilities in Burbank, Ellensburg, Sunnyside, Toppenish, and Warden, Washington (Riggsbee 2007; WSU 2008a).

- The construction of a carbon fiber manufacturing plant in Moses Lake, Washington, which broke ground in 2010 (Cooper 2011).

- Boardman Power Plant air emissions reduction by 2020 owing to the installation of new controls and emissions-reduction equipment. Portland General Electric is investigating replacing coal with a carbon-neutral renewable resource after 2020, which could involve converting approximately 40,469 hectares (100,000 acres) into agriculture to grow the biomass (PGE 2011; Skeen 2011).

- Under the Badger Mountain Subarea Plan, the December 2010 annexation of 815 hectares (2,014 acres) from Benton County for conversion to private ownership and incorporation into the City of Richland for mostly residential and some industrial use (Rolph 2011; Shuttleworth 2011).

Because of the distance from Hanford; the routine nature of most actions; and various zoning, permitting, environmental review, and construction requirements, most other actions are not expected to interact with Hanford activities to produce cumulative impacts.

Benton, Franklin, and Grant Counties had a total of 942,780 hectares (2.33 million acres) of farmland in 2007 (USDA 2009). This farmland area is 65 percent of the 1.46 million hectares (3.6 million acres) of the total land area of these counties (WOFM 2007). Little growth in agriculture is expected through 2025 (WSTC 2006:B-8).

Many areas of the Columbia River Basin have the potential for natural gas accumulations in underground sediments. Although significant production has not occurred, small amounts of gas were produced from the Rattlesnake Hills Gas Field north of Richland. No oil or gas production wells have been completed in the state of Washington since 1962 (Lingley 2005), although state and Federal lands in the region around Hanford continue to be leased for natural gas exploration (WDNR 2007a).

As described in Chapter 3, sand, gravel, and basalt are the primary geologic resources extracted from the earth in the region around Hanford. There are many commercial surface mines in the region (WDNR 2006), and it is expected that mines will be expanded and new mines developed to satisfy the future need for these construction materials. Long-term cumulative impacts of these activities are not expected because the Washington State Surface Mining Act (RCW 78.44) ensures that surface mines more than 1.2 hectares (3 acres) in size or with a highwall that is higher than 9.1 meters (30 feet) and steeper than 45 degrees are reclaimed (WDNR 2007b).

The Yakima Training Center is in central Washington in Yakima and Kittitas Counties, approximately 11 kilometers (7 miles) northeast of the city of Yakima (Army 2007:365). Land use at the center is separated into two major areas: the cantonment area (approximately 400 hectares [1,000 acres]) and the training areas (approximately 132,000 hectares [326,000 acres]) (Army 2007:367). The cantonment area, which includes residential, administrative, commercial, light industrial, and open spaces, is in the southwest corner of the installation (Army 2007:365). The training areas include a large maneuver area; a variety of large- and small-caliber live-fire ranges; and a digital, multipurpose range complex (Army 2007:355, 2010:2-20). Units from Fort Lewis and elsewhere use the Yakima Training Center to conduct maneuver and live-fire training, and then return home to their respective installations (Army 2007:355).

Construction activities planned for the foreseeable future at the Yakima Training Center include the following (Army 2007:369; 2010:2-20, A-1, A-2, A-6):

- Construction of a sniper field fire range for fiscal year 2011
- Construction of a multipurpose machine gun range for fiscal year 2014
- Three 5.68-million-liter (1.5-million-gallon) drinking water reservoirs with wells for firefighting needs for fiscal year 2012
- Construction of an air cavalry squadron complex for fiscal year 2014
- Construction of a fire station for fiscal year 2014

In May 2005, the U.S. Department of Defense announced its latest round of base realignment and closure activities (AFIS 2005; BRAC 2005). These activities can impact areas around military facilities by reducing or increasing direct and indirect employment and activities that have environmental impacts. The Umatilla Army Depot is the only major military facility in the Hanford ROI to be closed.

Closure of the depot and the associated loss of 884 regional jobs (512 direct and 372 indirect) (BRAC 2005:Ind-14, C-20) and reduction in activities will have inevitable environmental impacts. In August 2010, the Umatilla Army Depot Reuse Authority (UMADRA) released a reuse plan featuring three principal land use categories: a major training facility for the Oregon National Guard; a U.S. Fish and Wildlife Refuge for habitat protection; and an industrial zone to aid in offsetting the economic impact of base closure on the community (UMADRA 2010). While the precise impacts of closure of the depot have not been evaluated, they will be the subject of future NEPA documentation. Because the depot is over 48 kilometers (30 miles) from the Hanford boundary, little in the way of cumulative impacts is expected.

The sites on EPA's National Priorities List (NPL) (also known as Superfund [Superfund Amendments and Reauthorization Act] sites) were reviewed to determine whether any could contribute to cumulative impacts at Hanford. Seven active NPL sites are in Hanford or within 80 kilometers (50 miles) of the site boundary. Three of these sites are the Hanford 100, 200, and 300 Areas. The closest of the remaining four NPL sites is the Pasco Sanitary Landfill near Pasco, Washington, approximately 19 kilometers (12 miles) southeast of the site boundary (EPA 2006a, 2006b, 2010). The State of Washington also actively pursues the cleanup of contaminated sites through the State Toxics Cleanup Program. A total of 213 State of Washington sites are within 80 kilometers (50 miles) of Hanford, including 4 in Adams County, 70 in Benton County (6 in the city of Richland), 13 in Franklin County, 21 in Grant County, 8 in Kittitas County, 7 in Walla Walla County, and 90 in Yakima County (Ecology 2010). In addition to being some distance from Hanford, most of the NPL and Washington State Toxics Cleanup Program sites are well into the control and cleanup process, and thus would not substantially contribute to cumulative impacts.

The Columbia River Basin Water Supply Act (RCW 90.90) requires Ecology to "aggressively pursue the development of water supplies to benefit both in-stream and out-of-stream uses." Ecology developed a Columbia River Water Management Program to facilitate compliance with the legislation. Applications for 15 projects within the ROI have been submitted to Ecology (Ecology 2011).

The Black Rock Reservoir, a water storage and electric power generation project that was evaluated for the Yakima River Basin, could have substantial environmental and economic effects on the region. This project could include the construction of a 160-meter-high (525-foot-high), central-core rockfill dam, creating a reservoir with an active storage volume of 1.3 million acre-feet. A pipeline would take water from the Columbia River upstream of Priest Rapids Dam, store it in the reservoir, and then discharge it to the Yakima River Valley. The total project construction cost is estimated at $4.5 billion, with an annual operating cost of $60.2 million. This reservoir would be approximately 8 kilometers (5 miles) west of Hanford's nearest boundary (BOR and Ecology 2008:xvi, xxi, xviii, 2-37).

In December 2008, the U.S. Bureau of Reclamation (BOR) issued the *Final Planning Report/Environmental Impact Statement, Yakima River Basin Water Storage Feasibility Study, Yakima Project, Washington* (BOR 2008), which evaluated three action alternatives for Yakima River Basin water storage: a Black Rock Reservoir Alternative, a Wymer Dam and Reservoir Alternative, and a Wymer Dam Plus Yakima River Pump Exchange Alternative. In April 2009, BOR concluded that none of these action alternatives evaluated met Federal criteria for an economically and environmentally sound water project; therefore, the No Action Alternative was identified as the Preferred Alternative (BOR 2009). In June 2009, Ecology issued the *Final Environmental Impact Statement, Yakima River Basin Integrated Water Resource Management Alternative* (Ecology 2009) as a supplement to the final EIS issued by BOR. Ecology prepared the final EIS to evaluate an additional water supply alternative, which incorporated elements from the three State Alternatives evaluated in the 2008 BOR and Ecology draft EIS. The Integrated Water Resource Management Alternative included in the final EIS includes seven general elements to improve water resources in the Yakima River Basin: fish passage improvements, modification of existing operations and facilities, new or expanded storage reservoirs,

groundwater storage, fish habitat enhancement on main-stem rivers and tributaries, enhanced water conservation, and market-based reallocation of water resources. The analysis in the final EIS is programmatic in nature. If the decision is made to implement this alternative, any individual projects that are carried forward will require additional environmental review when they are proposed (Ecology 2009:FS-1, FS-2).

The Priest Rapids Hydroelectric Project, consisting of the Priest Rapids and Wanapum Dams, is directly upstream of Hanford. The project occupies an estimated 1,256 hectares (3,104 acres) of Federal land managed by BOR, the U.S. Bureau of Land Management, the U.S. Department of the Army, USFWS, DOE, and the Bonneville Power Administration. It also occupies an estimated 1,135 hectares (2,804 acres) of Washington State land (FERC 2006:xvi). The project has operated since 1955 under a 50-year license with the Federal Energy Regulatory Commission. In anticipation of license expiration in 2005, the Grant County Public Utility District filed a relicensing application with the commission in October 2003, and an EIS was completed in 2006 (FERC 2006; Grant County PUD 2003). The Grant County Public Utility District proposed to improve the project by installing advanced-design turbines, improving downstream fish bypass facilities, enacting new programs to protect and enhance anadromous and resident fish and wildlife, and implementing additional cultural resources protections (Grant County PUD 2003:1, 2). It is expected that these improvements will reduce the impacts of operation of the Priest Rapids Hydroelectric Project to levels below those currently experienced. A 44-year license extension was granted for the project in April 2008 (FERC 2008:58). In 2009, the fifth of 10 new turbines was installed at Wanapum Dam, with installation of the remaining turbines expected in 2012 (Grant County PUD 2009:6). The improved fish bypass at Wanapum Dam demonstrated excellent results in passing juvenile salmonids downstream in 2009, with research showing that sockeye salmon had migrated through the lake and were successfully spawning in the upper Cle Elum River (Grant County PUD 2009:7).

Information on power generation and transmission line projects was collected to determine whether major projects are planned for the region around Hanford (BPA 2009a, 2011a, 2011b; EFSEC 2011; Grant County PUD 2009; RNP 2011). Long-term planning by the Bonneville Power Administration and the Pacific Northwest Electric Power Planning and Conservation Council suggests a need for up to 8,000 megawatts of electricity in the region (BPA 2003:2). To that end, a number of power generation projects have been proposed for the ROI. Utility projects either proposed or recently completed include the following:

- Plymouth Generation Facility, a 306-megawatt natural-gas-fired turbine electricity-generating facility (Benton and BPA 2003; BPA 2009a)

- Wanapa Energy Center, a 1,200-megawatt gas and steam turbine electricity-generating facility (BIA 2004; BPA 2009a)

- Wind projects, including Big Horn, Combine Hills II, Juniper Canyon I, Juniper Canyon II, and Wild Horse (BPA 2011b, 2011c; EFSEC 2011)

- New transmission lines, including the 127-kilometer (79-mile), 500-kilovolt line between McNary and John Day Substations; the 45-kilometer (28-mile), 500-kilovolt line between Big Eddy and Knight Substations; the 61-kilometer (38-mile), 500-kilovolt line between Central Ferry and Lower Monumental Substations; the 48-kilometer (30-mile), 230-kilovolt line between Walla Walla and McNary Substations; and the approximately 105-kilometer (65-mile), 230-kilovolt line between Vantage and Pomona Heights Substations (BLM 2011; BPA 2010, 2011a; Pacific Power 2011)

- Transmission line upgrades, including the Tucannon River–North Lewiston Rebuild, Big Eddy–Midway Rebuild, and Franklin–Walla Walla Rebuild (BPA 2011a)

The Plymouth Generation Facility would be approximately 40 kilometers (25 miles) south of the Hanford boundary (Benton and BPA 2003); the Wanapa Energy Center, approximately 48 kilometers (30 miles) south (BIA 2004:3.6-4). These facilities would be approximately 64 kilometers (40 miles) from the 200 Areas. As of March 2009, both projects were on hold (BPA 2009a).

Six wind projects would be within 80 kilometers (50 miles) of Hanford's boundary. The Big Horn Wind Project is approximately 72 kilometers (45 miles) southwest of Hanford's boundary, and construction for a 50-megawatt expansion is currently under way (RNP 2011). The Combine Hills I and II Wind Projects are southeast of Hanford's boundary approximately 56 kilometers (35 miles) away. The proposed Juniper Canyon I and II Wind Projects are approximately 64 kilometers (40 miles) from Hanford's boundary. A 22-turbine expansion of the Wild Horse Wind Project, approximately 56 kilometers (35 miles) northwest of Hanford's boundary, was completed in November 2009 (BLM 2005; BPA 2011b; EFSEC 2011). In total, these wind projects involve the construction of 485 wind turbines that would generate 877 megawatts of electricity (EFSEC 2011; NPCC 2010; RNP 2011).

Most transmission line projects are some distance from Hanford's boundary. The McNary–John Day transmission line would be approximately 40 kilometers (25 miles) from Hanford (BPA 2009a). Although this project was on hold for a period of time, in February 2009, the Bonneville Power Administration decided to build the project (BPA 2011a). The Big Eddy–Knight transmission line would be approximately 24 kilometers (15 miles) from Hanford. A draft EIS was published in December 2010 (BPA 2010, 2011a). The Central Ferry–Lower Monumental transmission line would be approximately 56 kilometers (35 miles) from Hanford (BPA 2011a, 2011d). The Walla Walla–McNary transmission line would be approximately 48 kilometers (30 miles) from Hanford (Pacific Power 2010). A conditional-use permit and State Environmental Policy Act checklist were submitted to Walla Walla County in September 2008 (Pacific Power 2008a, 2008b). The Vantage–Pomona Heights transmission line would be approximately 32 kilometers (20 miles) from Hanford (BLM 2011).

In addition, information on water and gas pipeline projects was reviewed. The Blue Bridge Pipeline Project would involve the construction of up to 253 kilometers (157 miles) of 76- or 91-centimeter-diameter (30- or 36-inch-diameter) pipeline from central Clark County to Plymouth, Washington, approximately 48 kilometers (30 miles) from Hanford (FERC 2010a, 2011a; Williams Energy 2011).

Information on road and rail transportation projects was collected to determine whether major projects could impact the region around Hanford (WFLHD 2010, 2011; WSDOT 2011). Some of the more substantial transportation projects in the region include the following:

- Adding 4.8 kilometers (3 miles) of additional lanes to State Route 240 between Kennewick and Richland and constructing two new bridges over the Yakima River (completed in 2007) (WSDOT 2011)

- Widening two connecting highways between Moses Lake and Ephrata, including 13 kilometers (8 miles) of State Route 17 (State Route 17, Grant County Airport North project, completed in 2007) and 8 kilometers (5 miles) of State Route 282 (State Route 282 Ephrata South project, currently on hold due to funding) (WSDOT 2011)

- Constructing a new 16-kilometer (10-mile) road between Interstate 82 and State Route 397 in the Finley area (completed in 2008) (WSDOT 2011)

- Realigning approximately 823 meters (2,700 feet) of the Naches River channel away from U.S. Route 12 in Yakima to protect the roadway from future flooding (completed in 2008) (WSDOT 2011)

- Widening 29 kilometers (18 miles) of State Route 240 between Beloit Road and Kingsgate Way in Hanford (completed in 2009) (WSDOT 2011)

- Widening 64 kilometers (40 miles) of U.S. Route 12 between State Route 124 and the Walla Walla River, in seven construction phases (partially completed; remaining phases on hold due to funding) (WSDOT 2011)

Some of the major development activities planned in Richland over the next several years are described below. Future development beyond the next several years is, for the most part, speculative.

Pacific Northwest National Laboratory (PNNL) selected a parcel of land just north of Horn Rapids Road to construct a new Physical Sciences Facility to replace that which will be lost in the 300 Areas. The parcel, referred to as the "Horn Rapids Triangle," is adjacent to PNNL's existing campus and the Tri-Cities Science and Technology Park (DOE 2004d). Construction of the Physical Sciences Facility was completed in 2010 (PNNL 2010). In addition, ground was broken for the new PNNL Biological Sciences Facility and Computational Sciences Facility in 2008. These facilities were completed in 2009 (PNNL 2009).

Plans have been approved for Richland's Washington State University Tri-Cities (WSU-TC) campus to more than double in size over the next 10 years in three different building phases. The campus, which borders the Columbia River in North Richland, serves about 1,200 students (TVA 2008). WSU-TC partnered with PNNL to open a new Bioproducts, Sciences, and Engineering Laboratory at its North Richland campus in 2008 (WSU 2008b).

The Kadlec Medical Center and Columbia Basin Community College opened a new health science building near the Kadlec Medical Center campus in 2006 (Trumbo 2006). The Kadlec Medical Center broke ground in 2006 on a $70 million expansion of its Richland campus, including a six-story tower (Kadlec 2008; Richland 2006:4). The new tower was completed in 2008 (Kadlec 2008). The hospital's workforce has been increasing rapidly, with 267 new employees added between 2004 and 2008 (Richland 2004, 2008b).

Ground was broken on the Hanford Reach National Monument Heritage and Visitors Center on December 5, 2003. The $40 million center will include interpretive galleries, office space, classrooms, and a 220-seat auditorium, and will focus on increasing understanding and appreciation of the history and resources of the Hanford Reach and the Columbia River (Richland 2004). Construction will begin once $32.4 million has been raised (The Reach 2008).

The Red Mountain American Viticultural Area (AVA), established in 2001, is a 1,781-hectare (4,400-acre) federally designated grape- and wine-producing region on the south-facing slope of Red Mountain. There are at least 10 wineries in the AVA, with about 283 hectares (700 acres) currently planted in wine grapes; more wineries are likely to be constructed in the next 5 years. Visitor projections show that, by the year 2025, the Red Mountain AVA will attract approximately 175,000 wine-oriented visitors—a nearly ninefold increase over the current level. Elements of the Red Mountain AVA conceptual plan include the expansion of existing vineyard and winery operations; a number of new wineries; new visitor-oriented facilities, including recreation and interpretive experiences; and additional development of adjacent areas. When fully developed, the AVA will contain an estimated 20 to 30 additional wineries (Benton County 2007:B-18, B-19, G-4).

Table R–4 shows the activities examined as potential contributors to cumulative impacts at Hanford, the sources used, and why activities were or were not carried forward for cumulative impacts analysis. This determination follows the methodology documented in Figure R–2. Future activities that are speculative or not well defined were not carried forward for analysis. The activities and their end states considered in the cumulative groundwater modeling are described in Appendix S.

A number of actions considered in the cumulative transportation risk analysis are not listed in Table R–4. These other actions are listed in Appendix T, Table T–4, and include transportation of radioactive materials and wastes in the United States from DOE and non-DOE activities. The transportation risk analysis considers information from recently released DOE NEPA documents, including the *Draft Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (DOE 2011d), *Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center* (DOE and NYSERDA 2010), and *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2008b). These actions are not considered elsewhere in the cumulative impacts analysis because (1) they do not include activities at Hanford, (2) the activities that would occur at Hanford are already considered in the *TC & WM EIS* alternatives, or (3) insufficient information is available to analyze their contribution to cumulative impacts at Hanford.

Table R–4. Activities Considered for the Cumulative Impacts Analysis

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities							
Cleanup and restoration activities across all areas of the Hanford Site	• *Draft Hanford Remedial Action EIS and Comprehensive Land Use Plan* (DOE 1996a)[e] • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a) • *Hanford Site End State Vision* (DOE 2005b) • *Plan for Central Plateau Closure* (Fluor Hanford 2004) • *River Corridor Closure Project, TPA Quarterly Review for Period: March–May 2009* (DOE, EPA, and Ecology 2009) • *CERCLA Five-Year Review Report for the Hanford Site* (DOE 2006a) • *River Corridor Closure Project, March 2007 Monthly Performance Report* (WCH 2007) • *Cumulative Impact Data for "Tank Closure and Waste Management EIS"* (CEES 2006, 2011)	2146 (DOE 1996a:S-12, S-20) 2035 (DOE 2002a:8) 2035 (Fluor Hanford 2004:ES-8)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities *(continued)*							
Changes in land use at the Hanford Site	• *Final Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a) • "ROD: *Hanford Comprehensive Land-Use Plan EIS*" (64 FR 61615) • *Supplement Analysis, Hanford Comprehensive Land-Use Plan EIS* (DOE 2008a) • "Amended ROD for the *Hanford Comprehensive Land-Use Plan EIS*" (73 FR 55824) • *Hanford Site End State Vision* (DOE 2005b)	2050 (64 FR 61615)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Decommissioning of the eight surplus production reactors and their support facilities in the 100 Areas along the Columbia River[f]	• *Draft EIS, Decommissioning of Eight Surplus Production Reactors at the Hanford Site* (DOE 1989) • *Addendum (Final EIS), Decommissioning of Eight Surplus Production Reactors at the Hanford Site* (DOE 1992) • "ROD; *Decommissioning of Eight Surplus Production Reactors at the Hanford Site*" (58 FR 48509) • *Surplus Reactor Final Disposition Engineering Evaluation* (DOE 2005e)	2080 (DOE 1989:3.52)	Yes	Yes (on site)	Yes	No (five of the eight reactors have already been cocooned)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities *(continued)*							
Decommissioning of the eight surplus production reactors and their support facilities in the 100 Areas along the Columbia River[f] *(continued)*	• *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a) • "DOI Designates B Reactor at DOE's Hanford Site as a National Historic Landmark" (DOE and DOI 2008)						
Decommissioning of the N Reactor and support facilities	• *Surplus Reactor Final Disposition Engineering Evaluation* (DOE 2005e)	2068 (DOE 2005e:19)	Yes	Yes (on site)	Yes	No	Yes
Safe storage of surplus plutonium at the Plutonium Finishing Plant in the 200-West Area until shipped to the Savannah River Site for disposition	• *Storage and Disposition of Weapons-Usable Fissile Materials Final PEIS* (DOE 1996b) • "ROD for the *Storage and Disposition of Weapons-Usable Fissile Materials Final PEIS*" (62 FR 3014) • *Surplus Plutonium Disposition Final EIS* (DOE 1999b) • "ROD for the *Surplus Plutonium Disposition Final EIS*" (65 FR 1608) • "Amended ROD: Storage of Surplus Plutonium Materials at the Savannah River Site" (72 FR 51807) • *Plutonium Finishing Plant* (DOE 2011a)	2009 (DOE 2011a)	Yes	Yes (on site)	Yes	Yes (ongoing activity)	No

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities *(continued)*							
Deactivation of the Plutonium Finishing Plant in the 200-West Area	• *EA, Deactivation of the Plutonium Finishing Plant, Hanford Site* (DOE 2003b) • *FONSI, "EA, Deactivation of the Plutonium Finishing Plant"* (DOE 2003c) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2009 (DOE 2002a:A-20) 2009 (DOE 2003c:5-7)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Actions to empty the K Basins in the 100-K Area and implement dry storage of the fuel rods in the Canister Storage Building in the 200-East Area	• *Draft EIS, Management of Spent Nuclear Fuel from the K Basins at the Hanford Site* (DOE 1995b) • *Addendum (Final EIS), Management of Spent Nuclear Fuel from the K Basins at the Hanford Site* (DOE 1996c) • "ROD: *Management of Spent Nuclear Fuel from the K Basins at the Hanford Site*" (61 FR 10736) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2036 (61 FR 10736)	Yes	Yes (on site)	Yes (note: the movement of K Basin spent nuclear fuel to the 200 Areas was completed in 2005)	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities *(continued)*							
Complete U Plant regional closure	• *Final Feasibility Study for the Canyon Disposition Initiative (221-U Facility)* (DOE 2004e) • *Proposed Plan for Remediation of the 221-U Facility (Canyon Disposition Initiative)* (DOE 2004c) • *ROD, "221-U Facility (Canyon Disposition Initiative)," Hanford Site* (DOE 2005c) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2014 (DOE 2004e:K-14)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Final disposition of the canyons, PUREX Plant, PUREX tunnels, and other facilities in the 200 Areas and cleanup to Industrial-Exclusive land use standards	• *Plan for Central Plateau Closure* (Fluor Hanford 2004) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2035 (DOE 2002a:8)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Transport of sodium-bonded spent nuclear fuel to INL for treatment	• *Final EIS for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel* (DOE 2000b) • "ROD for the *Treatment and Management of Sodium-Bonded Spent Nuclear Fuel*" (65 FR 56565)	2012 (DOE 2000b:4-21)	Yes	Yes (transportation corridors)	Yes	No	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities *(continued)*							
Deactivation of FFTF in the 400 Area	• *EA, Shutdown of the FFTF, Hanford Site* (DOE 1995c) • *Shutdown of the FFTF, Hanford Site, DOE, FONSI* (DOE 1995d) • *EA, Sodium Residuals Reaction/Removal and Other Deactivation Work Activities, FFTF Project, Hanford Site* (DOE 2006b) • *FONSI, "EA, Sodium Residuals Reaction/Removal and Other Deactivation Work Activities, FFTF Project, Hanford Site"* (DOE 2006c) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2016 (SAIC 2010)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Construction and operation of a PNNL Physical Sciences Facility	• *EA, Construction and Operation of a Physical Sciences Facility at the PNNL* (DOE 2007a) • *FONSI for "Construction and Operation of a Physical Sciences Facility at the PNNL"* (DOE 2007b)	Construction completed in 2010 (PNNL 2010)	Yes	Yes (on site)	Yes	No (relocation of activities from 300 Area)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities *(continued)*							
Excavation and use of geologic materials from existing borrow pits	• *Final Hanford Comprehensive Land-Use Plan EIS* (DOE 1999a) • "ROD: *Hanford Comprehensive Land-Use Plan EIS*" (64 FR 61615) • *EA, Use of Existing Borrow Areas, Hanford Site* (DOE 2001b) • *FONSI, "Use of Existing Borrow Areas, Hanford Site"* (DOE 2001c) • *EA, Reactivation and Use of Three Former Borrow Sites in the 100-F, 100-H, and 100-N Areas* (DOE 2003d) • *FONSI, "Reactivation and Use of Three Former Borrow Sites in the 100-F, 100-H, and 100-N Areas"* (DOE 2003e) • *Supplement Analysis, Hanford Comprehensive Land-Use Plan EIS* (DOE 2008a) • "Amended ROD for the *Hanford Comprehensive Land-Use Plan EIS*" (73 FR 55824)	2050 (64 FR 61615) 2011 (DOE 2001c) 2013 (DOE 2003e)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities *(continued)*							
Construction and operation of the Environmental Restoration Disposal Facility near the 200-West Area	• *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility* (DOE 1994) • *Proposed Plan for an Amendment to the Environmental Restoration Disposal Facility ROD, Hanford Site* (DOE 2001d)	2024 (DOE 1994:9-23)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Implementation of the programmatic waste management decisions described in the RODs for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*	• *Final Waste Management PEIS for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a) • "ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (63 FR 3629) • "ROD for the DOE's Waste Management Program: Treatment of Non-wastewater Hazardous Waste" (63 FR 41810) • "ROD for the DOE's Waste Management Program: Storage of High-Level Radioactive Waste" (64 FR 46661)	2017 (DOE 1997a)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities *(continued)*							
Implementation of the programmatic waste management decisions described in the RODs for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (continued)*	• "ROD for the DOE's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste" (65 FR 10061) • "Revision to the ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (65 FR 82985) • "Revision to the ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (66 FR 38646) • "Revision to the ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (67 FR 56989) • "Revision to the ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (69 FR 39446) • "Revision to the ROD for the DOE's Waste Management Program" (70 FR 60508) • "Amendment to the ROD for the DOE's Waste Management Program: Treatment and Storage of Transuranic Waste" (73 FR 12401)						

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities *(continued)*							
Closure of Nonradioactive Dangerous Waste Landfill and 600 Area Central Landfill[g]	• *EA, Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL), Hanford Site, Richland, Washington* (DOE 2011e)	Not available	Yes	Yes (on site)	Yes	No	Yes
Retrieval of suspect TRU waste buried after 1970	• *EA, Transuranic Waste Retrieval from the 218-W-4B and 218-W-4C Low-Level Burial Grounds, Hanford Site* (DOE 2002b) • *FONSI, "Transuranic Waste Retrieval from the 218-W-4B and 218-W-4C Low-Level Burial Grounds, Hanford Site"* (DOE 2002c) • *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)	2007 (DOE 2002b) 2010 (DOE 2002a:47)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Construction and operation of facilities for disposal of greater-than-Class C low-level radioactive waste	• *Draft EIS for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste* (DOE 2011c)	2083 (DOE 2011c:S-17)	Yes	Yes (on site)	Yes	No	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
DOE Activities *(continued)*							
Cleanup and protection of groundwater	• *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a) • *CERCLA Five-Year Review Report for the Hanford Site* (DOE 2006a) • *Hanford Site Cleanup Completion Framework* (DOE 2010a) • *Hanford Site Groundwater Monitoring and Performance Report for 2009* (DOE 2010b) • *Long-Range Deep Vadose Zone Program Plan* (DOE 2010c) • *Considerations for Cleanup of the Hanford 200 Area National Priorities List Site* (Ecology and EPA 2007)	2018 (DOE 2002a:A-33)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Transport of TRU waste to WIPP near Carlsbad, New Mexico	• *WIPP Disposal Phase Final Supplemental EIS* (DOE 1997b) • "ROD for the DOE's *WIPP Disposal Phase*" (63 FR 3624)	2033 (63 FR 3624)	Yes	Yes (transportation corridors)	Yes	No (ongoing activity)	Yes
Acquisition of natural gas pipeline and natural gas utility service	• "Notice of Intent to Prepare an EIS for the Acquisition of a Natural Gas Pipeline and Natural Gas Utility Service at the Hanford Site, Richland, WA, and Notice of Floodplains and Wetlands Involvement" (77 FR 3255)	Not available	Yes	Yes (on site)	Yes	No (proposed activity)	No

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Non-DOE Activities on Hanford Site							
Transport of Navy reactor plants from the Columbia River and their disposal in trench 218-E-12B in the 200-East Area	• *Final EIS on the Disposal of Decommissioned, Defueled Cruiser, Ohio Class, and Los Angeles Class Naval Reactor Plants* (Navy 1996) • "NEPA ROD for the *Disposal of Decommissioned, Defueled Cruiser, Ohio Class, and Los Angeles Class Naval Reactor Plants*" (61 FR 41596)	2029 (Navy 1996:S-11)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Continued operation and license renewal of the Columbia Generating Station (previously Washington Public Power Supply System, Nuclear Project No. 2)	• *Hanford Site Environmental Report for Calendar Year 2006, 2007, 2008, 2009, and 2010* (Poston et al. 2007; Poston, Duncan, and Dirkes 2008, 2009, 2010, 2011) • *2004 Annual Report* (Energy Northwest 2004) • *Columbia Generating Station 2005 Annual Radiological Environmental Operating Report* (Energy Northwest 2006) • "NOI to Prepare an EIS and Conduct the Scoping Process for the Columbia Generating Station" (75 FR 11576)	2026 (Energy Northwest 2004)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Non-DOE Activities on Hanford Site *(continued)*							
Operation of the US Ecology Commercial Low-Level Radioactive Waste Disposal Site near the 200-East Area	• *Final EIS, Commercial Low-Level Radioactive Waste Disposal Site, Richland, Washington* (Ecology and WSDOH 2004) • *Hanford Site Environmental Report for Calendar Year 2006, 2007, 2008, 2009, and 2010* (Poston et al. 2007; Poston, Duncan, and Dirkes 2008, 2009, 2010, 2011) • *Annual Environmental Monitoring Report for Calendar Year 2006* (US Ecology 2007)	2056 (Ecology and WSDOH 2004:i)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes
Management of the Hanford Reach National Monument and Saddle Mountain National Wildlife Refuge	• *Hanford Reach of the Columbia River: Final River Conservation Study and EIS* (NPS 1994) • *ROD, "Hanford Reach of the Columbia River Final EIS for Comprehensive River Conservation Study"* (DOI 1996) • ROD, "Extension of the Saddle Mountain National Wildlife Refuge Acquisition Boundary" (64 FR 66928) • *Hanford Reach Protection and Management Program Interim Action Plan* (CAP 1998)	2022 (USFWS 2008:i)	Yes	Yes (on site)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Non-DOE Activities on Hanford Site *(continued)*							
Management of the Hanford Reach National Monument and Saddle Mountain National Wildlife Refuge *(continued)*	• "Establishment of the Hanford Reach National Monument" (65 FR 37253) • *Hanford Reach National Monument Final Comprehensive Conservation Plan and EIS* (USFWS 2008)						
Rattlesnake Mountain cleanup	• *EA, Combined Community Communications Facility and Infrastructure Cleanup on the Fitzner/Eberhardt Arid Lands Ecology Reserve, Hanford Site, Richland, Washington* (DOE 2009a) • *FONSI for the "Combined Community Communications Facility Infrastructure Cleanup on the Fitzner/Eberhardt Arid Lands Ecology Reserve, Hanford Site, Richland, Washington"* (DOE 2009b)	Not available	Yes	Yes (on site)	Yes	No	Yes
Operation of the Laser Interferometer Gravitational-Wave Observatory	• *Hanford Site Environmental Report for Calendar Year 2006, 2007, 2008, 2009, and 2010* (Poston et al. 2007; Poston, Duncan, and Dirkes 2008, 2009, 2010, 2011)	Not available	Yes	Yes (on site)	Yes	Yes (ongoing activity)	No

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region							
Changes in land use in the region	• *Adams County Comprehensive Plan* (ACPC 2005) • *Benton County Comprehensive Land Use Plan* (BCPC 2009) • *Benton County Sustainable Development: Overall Economic Development Plan* (Benton County 2007) • *City of Richland Comprehensive Land Use Plan* (Richland 2002, 2005b, 2008a) • *Preliminary Assessment of Redevelopment Potential for the Hanford 300 Area* (Richland 2005a) • *City of Kennewick Comprehensive Plan 2009* (Kennewick 2010) • *Franklin County Growth Management Comprehensive Plan* (Franklin County 2008) • *Grant County Comprehensive Plan/EIS* and *Amending the 2006 Comprehensive Plan and Zone Changes* (GCDCD 1999, GCBOCC 2010)	2024 (Richland 2008a: U 5-2) 2025 (Kennewick 2010:23) 2028 (BCPC 2009:4-15) 2015 (Yakima County 1998, 2010) 2018 (GCDCD 1999; GCBOCC 2010) 2030 (Kittitas County 2010: 61) 2027 (Benton County 2007:1) 2025 (Franklin County 2008) 2025 (Walla Walla County 2007:1-14, 2009)	Yes	Yes (various)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Changes in land use in the region *(continued)*	• *Kittitas County Comprehensive Plan* (Kittitas County 2010) • *Klickitat County, Washington, Comprehensive Plan* (Dreyer 2007) • *Plan 2015: A Blueprint for Yakima County Progress* and *2010 Comprehensive Plan Amendment Cycle* (Yakima County 1998, 2010) • *Walla Walla County Integrated Comprehensive Plan and EIS* and *County Comprehensive Plan and EIS* (Walla Walla County 2007, 2009)						
Operation of the Perma-Fix Northwest (formerly Pacific EcoSolutions) waste treatment facility in Richland, Washington	• *EA, Non-thermal Treatment of Hanford Site Low-Level Mixed Waste* (DOE 1998a) • *FONSI, "Non-thermal Treatment of Hanford Site Low-Level Mixed Waste"* (DOE 1998b) • *Final EIS for Treatment of Low-Level Mixed Waste* (Richland 1998) • *EA, Offsite Thermal Treatment of Low-Level Mixed Waste* (DOE 1999c) • *"EA, Offsite Thermal Treatment of Low-Level Mixed Waste," FONSI* (DOE 1999d)	2019 (Richland 1998:1, 25)	Yes	Yes (0.8 km south)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Operation of the Perma-Fix Northwest (formerly Pacific EcoSolutions) waste treatment facility in Richland, Washington *(continued)*	• *Hanford Site Environmental Report for Calendar Year 2006, 2007, 2008, 2009, and 2010* (Poston et al. 2007; Poston, Duncan, and Dirkes 2008, 2009, 2010, 2011) • *Annual Environmental Monitoring Report for 2006* (Pacific EcoSolutions 2007)						
Operation of the AREVA NP nuclear fuel fabrication facility in Richland, Washington	• *NRC Inspection Report No. 70-1257/2004-001* (NRC 2004) • *NRC Inspection Report No. 70-1257/2005-002* (NRC 2005) • *NRC Inspection Report No. 70-1257/2010-203* (NRC 2010) • *Hanford Site Environmental Report for Calendar Year 2006, 2007, 2008, 2009, and 2010* (Poston et al. 2007; Poston, Duncan, and Dirkes 2008, 2009, 2010, 2011) • *Supplement to Applicant's Environmental Report* (AREVA 2006)	Not available	Yes	Yes (directly south)	Yes	No (ongoing activity)	Yes
Operation of the Westinghouse Service Center decontamination facility in Richland, Washington	• *Hanford Site Environmental Report for Calendar Year 2006, 2007, 2008, 2009, and 2010* (Poston et al. 2007; Poston, Duncan, and Dirkes 2008, 2009, 2010, 2011)	Not available	Yes	Yes (1.5 km south)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Operation of the IsoRay medical facility in Richland, Washington	• Annual NESHAPs reports for 2008 through 2010 (IsoRay 2009, 2011a, 2011b)	Not available	Yes	Yes (1 km south)	Yes	No (ongoing activity)	Yes
Operation of the Moravek Biochemicals facility in Richland, Washington	• *Report on Compliance with the Clean Air Act Limits for Radionuclide Emissions* (Moravek 2005)	Not available	Yes	Yes (2 km south)	Yes	No (ongoing activity)	Yes
Cleanup of EPA NPL sites and state toxic waste sites	• *National Priorities List Sites in Oregon* (EPA 2006a) • *National Priorities List Sites in Washington* (EPA 2006b) • *Proposed National Priorities List Sites—by Proposed Date* (EPA 2010) • *Hazardous Sites List* (Ecology 2010)	Various	Yes	Yes (various)	Yes	No (ongoing activity)	Yes
Oil and gas leasing and exploration	• *Leasing Washington State-Owned Lands for Oil and Gas Exploration* (WDNR 2007a) • *Final Supplemental EIS on the Oil and Gas Leasing Program for State Lands* (WDNR 2005)	Not applicable (ongoing)	Yes	Yes (various)	Yes	No (ongoing activity)	Yes
Surface mining	• *Surface Mining Reclamation Program* (WDNR 2007b) • *Directory of Washington State Surface Mining Reclamation Sites–2006* (WDNR 2006)	Not applicable (ongoing)	Yes	Yes (various)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Operation of the U.S. Army Yakima Training Center	• *Final PEIS for Army Growth and Force Structure Realignment* (Army 2007) • *Final EIS for the Fort Lewis Army Growth and Force Structure Realignment* (Army 2010)	Realignment complete in 2013 (Army 2007:iii)	Yes	Yes (10 km northwest)	Yes	No (ongoing activity)	Yes
DoD base realignment and closure—Umatilla Army Depot	• *2005 Defense Base Closure and Realignment Commission Report* (BRAC 2005) • "Commission Makes More BRAC Decisions" (AFIS 2005) • *U.S. Army Umatilla Chemical Depot Base Redevelopment Plan* (UMADRA 2010)	2012 or later (UMADRA 2010: A-xiv)	Yes	Yes (55 km south)	Yes	No	Yes
Boardman Power Plant upgrades	• *Boardman Plant Air Emissions* (PGE 2011) • *DEQ Regulation of PGE Boardman* (ODEQ 2011)	Air emissions reduction by 2020 (PGE 2011) Switch to biofuel in 2020 (PGE 2011)	Yes	Yes (72 km south)	Yes	No (ongoing activity)	Yes
Construction and operation of the Wanapa Energy Center	• *Wanapa Energy Center Final EIS* (BIA 2004) • "Wanapa Energy Center; Notice of Availability of ROD" (70 FR 10612) • *Generation and Interconnection Projects on Hold* (BPA 2009a)	2055 (BIA 2004:ES-14)	No; project on hold (BPA 2009a)	Yes (48 km south)	Yes	No	No

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Construction and operation of the Plymouth generating facility	• *Final EIS, Plymouth Generating Facility* (Benton and BPA 2003) • ROD, "*Plymouth Generating Facility*" (68 FR 60342) • *Generation and Interconnection Projects on Hold* (BPA 2009a)	Not available	No; project on hold (BPA 2009a)	Yes (40 km south)	Yes	No	No
Big Horn Wind Project	• *How BPA Supports Wind Power in the Pacific Northwest* (BPA 2009b) • *Completed Wind Projects* (BPA 2011c) • *ROD for the Electrical Interconnection of the Big Horn Wind Energy Project* (BPA 2005) • "PPM Announces 200 MW Big Horn Wind Project" (PPM Energy, Inc. 2005) • *Renewable Energy Projects* (RNP 2011)	Not available	Yes	Yes (72 km southwest)	Yes	No (ongoing activity)	Yes
Combine Hills II Wind Project	• *How BPA Supports Wind Power in the Pacific Northwest* (BPA 2009b) • *Current Wind Projects* (BPA 2011b)	Not available	Yes	Yes (56 km southeast)	Yes	No	Yes
Juniper Canyon I and II Wind Projects	• *How BPA Supports Wind Power in the Pacific Northwest* (BPA 2009b) • *Current Wind Projects* (BPA 2011b) • "Notice of Availability of the Revised Final EIS – Juniper Canyon Wind Project" (Dreyer 2010)	Not available	Yes	Yes (64 km south)	Yes	No	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Wild Horse Wind Project	• *How BPA Supports Wind Power in the Pacific Northwest* (BPA 2009b) • *Renewable Energy Projects* (RNP 2011) • *Final PEIS on Wind Energy Development on BLM-Administered Lands in the Western United States* (BLM 2005)	Not available	Yes	Yes (56 km northwest)	Yes	No (ongoing activity)	Yes
Designation of West-wide energy corridors	• *PEIS, Designation of Energy Corridors on Federal Land in the 11 Western States* (DOE and BLM 2008)	Not applicable	Yes	No	Yes	No	No
McNary–John Day transmission line project	• *McNary–John Day Transmission Line Project, Draft EIS* (BPA and DOE 2002a) • *McNary–John Day Transmission Line Project, Abbreviated Final EIS* (BPA and DOE 2002b) • *McNary–John Day Transmission Line Project ROD* (BPA and DOE 2002c) • *Transmission Projects* (BPA 2011a)	2012 (BPA 2011a)	Yes	Yes (40 km south)	Yes	No	Yes
Big Eddy–Knight transmission line project	• *Generation and Interconnection Projects on Hold* (BPA 2009a) • *Big Eddy–Knight Transmission Project Draft EIS* (BPA 2010)	Not available	No; project on hold (BPA 2009a)	Yes (24 km southwest)	Yes	No	No

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Central Ferry–Lower Monumental transmission line project	• *Central Ferry–Lower Monumental 500-kilovolt Transmission Line Project Final EIS* (BPA 2011d) • *Transmission Projects* (BPA 2011a)	Not available	Yes	Yes (56 km east)	Yes	No	Yes
Vantage–Pomona Heights transmission line project	• *Vantage–Pomona Heights 230kV Transmission Line Project* (BLM 2011) • Interested Party Letter, "Vantage to Pomona Heights 230kV Transmission Line Project" (Kelleher 2011)	Not available	Yes	Yes (32 km northwest)	Yes	No	Yes
Walla Walla–McNary transmission line project	• *McNary to Walla Walla Transmission Line Conditional Use Permit Application* (Pacific Power 2008a) • *McNary–Walla Walla 230-kV Transmission Line Expanded SEPA Checklist* (Pacific Power 2008b) • *Walla Walla to McNary 230kV Transmission Line Project* (Pacific Power 2010) • *Segment A – Walla Walla to McNary* (Pacific Power 2011)	2013 (Pacific Power 2011)	Yes	Yes (48 km southeast)	Yes	No	Yes
Columbia River Basin water management	• *Final PEIS for the Columbia River Water Management Program* (Ecology 2007a) • *Upper Columbia Alternative Flood Control and Fish Operations, Columbia River Basin, Final EIS* (USACE 2006)	Ongoing management activities	Yes	Yes (various)	Yes	No (ongoing activity)	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Columbia River Basin water management *(continued)*	• *Potholes Reservoir Supplemental Feed Route Finding of No Significant Impact, EA* (BOR 2007a) • *Initial Alternative Development and Evaluation: Odessa Subarea Special Study* (BOR 2006a)						
Priest Rapids Hydroelectric Project relicensing	• *Priest Rapids Project License Application, FERC No. 2114, Executive Summary* (Grant County PUD 2003) • *Final EIS, Priest Rapids Hydroelectric Project, Washington* (FERC 2006) • *Order Issuing New License* (FERC 2008)	2052 (FERC 2008)	Yes	Yes (6 km northwest)	Yes	No (upgrades not included in baseline)	Yes
Yakima River Basin water management (also see Black Rock Reservoir below)	• *Sunnyside Division Board of Control, Water Conservation Program, Yakima Project, Washington: FONSI and Final EA* (BOR 2004a) • *Phase I Assessment Report, Storage Dam Fish Passage Study, Yakima Project, Washington* (BOR 2005) • *Final EIS, Yakima River Basin Integrated Water Resource Management Alternative* (Ecology 2009)	Ongoing management activities	Yes	Yes (various)	Yes	No	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Construction and operation of the Black Rock Reservoir or Wymer Reservoir	• *Yakima River Storage Enhancement Initiative, Black Rock Reservoir Study* (WIS 2002) • *Summary Report Appraisal Assessment of the Black Rock Alternative,* Executive Summary (BOR 2004b) • *Yakima River Basin Storage Alternatives Appraisal Assessment* (BOR 2006b) • *Recreation Demand and User Preference Analysis: A Component of Yakima River Basin Water Storage Feasibility Study* (BOR 2007b) • *Potential Impacts of Leakage from Black Rock Reservoir on the Hanford Site Unconfined Aquifer* (Freedman 2008) • *Modeling Groundwater Hydrologic Impacts of the Potential Black Rock Reservoir* (BOR 2007c) • *One-Dimensional Hydraulic Modeling of the Yakima Basin* (Hilldale and Mooney 2007) • *Yakima River Basin Storage Study, Wymer Dam and Reservoir Appraisal Report* (BOR 2007d)	10-year construction period, 100-year operations period (McCartney 2007)	No	Yes Black Rock Reservoir (8 km west); Wymer Reservoir (45 km northwest)	Yes	No	No

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Construction and operation of the Black Rock Reservoir or Wymer Reservoir *(continued)*	• *Final Planning Report/EIS, Yakima River Basin Water Storage Feasibility Study* (BOR 2008) • *Final EIS, Yakima River Basin Integrated Water Resource Management Alternative* (Ecology 2009)						
Construction and operation of water pipelines	• *Projects Near You* (FERC 2011a)	Not applicable	Yes	No	Yes	No	No
Construction and operation of biofuels facilities	• *Biofuel Development in Washington* (WSU 2008a) • *NorthWest Biofuels, Inc., SEPA Checklist* (CCH 2006) • *SEPA Environmental Checklist for the Central Washington Biodiesel Ellensburg Plant* (Central Washington Biodiesel, LLC 2006) • *Walla Walla County Mitigated Determination of Non-significance, Gen-X Energy Group Biodiesel Production Facility* (Walla Walla County 2006) • *Determination of Non-significance, Central Washington Biodiesel*, Ellensburg Plant (Ecology 2006a)	Various	Yes	Yes (various)	Yes	No	Yes

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Construction and operation of biofuels facilities *(continued)*	• *SEPA Environmental Checklist, Washington Ethanol Plant, Moses Lake, Washington* (Washington Ethanol, LLC 2006) • "Biofuel or Ethanol Production" (Plummer 2007) • *Mitigated Determination of Non-significance, Liquafaction Corp., Moses Lake Ethanol Plant* (GCPD 2007) • *SEPA Checklist for the Moses Lake Ethanol Plant* (Liquafaction Corporation 2007) • *Mitigated Determination of Nonsignificance, Washington Ethanol LLC, Moses Lake* (Ecology 2007b) • *SEPA Environmental Checklist for the Columbia Ethanol Plant* (Columbia Ethanol Plant Holdings, LLC 2006) • *Revised SEPA Mitigated Determination of Nonsignificance for the Proposed Columbia Ethanol Facility* (Ecology 2006b) • *Notice of Construction, Final Order of Approval No. 2006-0009* (Benton Clean Air Authority 2007)						

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

Activity	Source Document	Completion Date[a]	Evaluation Criteria[b]				Considered in *TC & WM EIS* Cumulative Impacts?[d]
			Reasonably Foreseeable?	Within the Regions of Influence?[c]	Within the Timeframe of *TC & WM EIS*?	Accounted for in Baseline?	
Other Activities in the Region *(continued)*							
Construction and operation of natural gas terminals, pipelines, and storage projects	• *Projects Near You* (FERC 2011a) • *Major Storage Projects on the Horizon* (FERC 2010b) • *Major Pipeline Projects on the Horizon* (FERC 2010a) • *North American LNG Import/Export Terminals, Proposed* (FERC 2011b) • *North American LNG Import Terminals, Existing* (FERC 2011c)	Not applicable	Yes	No	Yes	No	No
Blue Bridge Pipeline project	• *Major Pipeline Projects on the Horizon* (FERC 2010a) • *Projects Near You* (FERC 2011a) • *Blue Bridge Pipeline Project* (Williams Energy 2011) • "NOI to Prepare an EIS and Land and Resource Management Plan Amendment for the Planned Blue Bridge Pipeline Project" (74 FR 38611)	2011 (Williams Energy 2011)	Yes	Yes (48 km southwest)	Yes	No	Yes
Regional road projects	• *Washington Projects* (WFLHD 2011) • *Oregon Projects* (WFLHD 2010) • *Making Every Dollar Count for Benton County* (WSDOT 2007) • *WSDOT – Projects* (WSDOT 2011)	Various	Yes	Yes (various)	Yes	No	Yes
Regional rail projects	• *WSDOT – Projects* (WSDOT 2011)	Not applicable	Yes	No	Yes	No	No

Table R–4. Activities Considered for the Cumulative Impacts Analysis *(continued)*

[a] The "Completion Date" column provides the date the activity is expected to be completed. This information determines if the activity is within the same time period as the *TC & WM EIS* alternatives.
[b] These evaluation criteria are used to help determine if the activity should be considered in the *TC & WM EIS* cumulative impacts analysis. See Figure R–2 (Phase 2) for a description of how the criteria are used.
[c] Because regions of influence vary by resource, the action may lie outside the region of influence for one resource and within it for another. Distances measured using Google Earth Version 4.2.0198.2451.
[d] This column presents the results of the assessment performed in Phase 2 of Figure R–2 for each activity evaluated.
[e] Appendix A of the *Draft Hanford Remedial Action EIS and Comprehensive Land Use Plan* (DOE 1996a) describes the activities analyzed in that EIS. Page A-3 notes that decommissioning of major canyon facilities in the 200 Areas (i.e., T Plant, B Plant, and the PUREX Plant) are not included.
[f] B Reactor was recently designated a National Historic Landmark (DOE and DOI 2008). Therefore, B Reactor will not be decommissioned and moved to the Hanford Site Central Plateau for disposal as analyzed in the *Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE 1989, 1992) and assumed in this *TC & WM EIS*.
[g] The 600 Area Central Landfill is referred to as the "Solid Waste Landfill" in *Environmental Assessment, Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL),* Hanford Site, Richland, Washington (DOE 2011e).

Note: To convert kilometers to miles, multiply by 0.6214.

Key: BLM=U.S. Bureau of Land Management; BRAC=Base Realignment and Closure; CERCLA=Comprehensive Environmental Response, Compensation, and Liability Act; DEQ=Department of Environmental Quality; DoD=U.S. Department of Defense; DOE=U.S. Department of Energy; DOI=U.S. Department of the Interior; EA=environmental assessment; EIS=environmental impact statement; EPA=U.S. Environmental Protection Agency; FERC=Federal Energy Regulatory Commission; FFTF=Fast Flux Test Facility; FONSI=Finding of No Significant Impact; INL=Idaho National Laboratory; km=kilometers; MW=megawatt; NEPA=National Environmental Policy Act; NESHAPs=National Emission Standards for Hazardous Air Pollutants; NOI=Notice of Intent; NPL=National Priorities List; NRC=U.S. Nuclear Regulatory Commission; PEIS=programmatic environmental impact statement; PGE=Portland General Electric; PNNL=Pacific Northwest National Laboratory; PPM=Pacific Core Power Marketing, Inc.; PUREX=Plutonium-Uranium Extraction; ROD=Record of Decision; SEPA=State Environmental Policy Act; *TC & WM EIS=Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*; TPA=Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement); TRU=transuranic; WIPP=Waste Isolation Pilot Plant; WSDOT=Washington State Department of Transportation.

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