DOE/EIS-0222D

Executive Summary

Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan

April 1998

U.S. Department of Energy

THIS PAGE INTENTIONALLY
LEFT BLANK

Figures

ES-1. Location of the Hanford Site ES-2
ES-2. No-Action Alternative ES-17
ES-3. Preferred Alternative ES-18
ES-4. Alternative One ES-19
ES-5. Alternative Two ES-20
ES-6. Alternative Three ES-21
ES-7. Alternative Four ES-22

Tables

ES-1. Hanford Site Land-Use Designations ES-8
ES-2. Comparisons of Affected Areas by Alternative ES-23
ES-3. Impacts of Each Land-Use Alternative ES-24

ES5.7.1 Unavoidable Adverse Impacts ES-42
ES5.7.2 Irreversible and Irretrievable Commitments of Resources ES-43

ES6.0 Implementation of the Comprehensive Land Use Plan ES-43
ES6.1 Definitions and Descriptions of Land-Use Map Designations ES-43
ES6.2 Hanford CLUP Policies ES-43
ES6.2.1 Policy 1, Overall Policy ES-44
ES6.2.2 Policy 2, Protection of Environmental Resources ES-44
ES6.2.3 Policy 3, Protection of Cultural Resources ES-44
ES6.2.4 Policy 4, Siting New Development ES-45
ES6.2.5 Policy 5, Utility and Transportation Corridors ES-45
ES6.2.6 Policy 6, Economic Development and Diversification ES-45
ES6.3 Organizational Structure and Procedure for Review and Approval of Use Requests ES-46

ES3.6.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) ES-15
ES3.7 Alternative Maps and Tables ES-16

ES4.0 Affected Environment ES-25
ES4.1 Land Uses ES-25
ES4.2 Geological and Soil Resources ES-26
ES4.3 Water Resources ES-26
ES4.4 Air Resources ES-27
ES4.5 Biological Resources ES-27
ES4.6 Cultural Resources ES-28
ES4.8 Socioeconomic Environment ES-29
ES4.9 Visual and Aesthetic Resources ES-30
ES4.10 Contaminated Areas ES-30

ES5.0 Environmental Consequences ES-30
ES5.1 Analysis Approach ES-31
ES5.1.1 Methods and Assumptions for Estimating Environmental Impacts ES-31
ES5.1.2 Methods and Assumptions for Estimating Socioeconomic Impacts ES-31
ES5.1.2.1 Industrial Land Use ES-32
ES5.1.2.2 Industrial-Exclusive ES-32
ES5.1.2.3 Agricultural ES-32
ES5.1.2.4 Research and Development ES-32
ES5.1.2.5 High-Intensity Recreation ES-32
ES5.1.2.6 Low-Intensity Recreation ES-32
ES5.1.2.7 Conservation (Mining and Grazing) and Conservation (Mining) ES-32
ES5.1.2.8 Preservation ES-33
ES5.2 Human Health Impacts ES-33
ES5.3 Resource Impacts ES-33
ES5.3.1 Geologic Resources ES-33
ES5.3.2 Water Resources ES-33
ES5.3.3 Impacts to Biological Resources ES-34
ES5.3.4 Mitigation Measures ES-34
ES5.3.5 Cultural Resources ES-35
ES5.3.6 Aesthetic Resources ES-35
ES5.3.7 Socioeconomic Impacts ES-35
ES5.3.7.1 No-Action Alternative ES-35
ES5.3.7.2 Preferred Alternative ES-36
ES5.3.7.3 Alternative One ES-36
ES5.3.7.4 Alternative Two ES-36
ES5.3.7.5 Alternative Three ES-36
ES5.3.7.6 Alternative Four ES-37
ES5.4 Environmental Justice Impacts ES-37
ES5.4.1 Health Impacts from Subsistence Consumption of Fish and Wildlife ES-38
ES5.4.2 Environmental Impacts to Low-Income and Minority Populations ES-38
ES5.4.3 Environmental Justice Impacts to American Indians ES-38
ES5.5 Cumulative Impacts ES-39
ES5.5.1 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) ES-39
ES5.5.2 Wahluke Slope ES-39
ES5.5.3 Columbia River ES-40
ES5.5.4 200 Areas ES-40
ES5.5.5 Other Hanford Site Areas ES-42
ES5.6 Present and Reasonably Foreseeable Actions Adjacent to the Hanford Site ES-42
ES5.7 Other NEPA Considerations ES-42

Executive Summary

ES1.0 Introduction ES-1
ES1.1 National Environmental Policy Act ES-1
ES1.2 Other Ongoing Major Federal Actions and National Environmental Policy Act Documents ES-3
ES1.2.1 NEPA Reviews Affecting the Hanford Site ES-3
ES1.2.2 SEPA Reviews Affecting the Hanford Site ES-4
ES1.2.3 CERCLA Reviews Affecting the Hanford Site ES-4
ES1.3 Hanford Site Planning Efforts ES-5
ES1.4 Planning Efforts by Other Governments and Agencies ES-6
ES1.4.1 Confederated Tribes of the Umatilla Indian Reservation ES-6
ES1.4.2 Other Federal Agencies ES-6
ES1.4.3 Local Governments ES-7

ES2.0 Purpose and Need ES-7

ES3.0 Proposed Action and Alternatives ES-8
ES3.1 No-Action Alternative ES-9
ES3.1.1 Wahluke Slope ES-9
ES3.1.2 Columbia River Corridor ES-9
ES3.1.3 Central Plateau ES-9
ES3.1.4 All Other Areas ES-10
ES3.1.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) ES-10
ES3.2 Agency Preferred Alternative ES-10
ES3.2.1 Wahluke Slope ES-10
ES3.2.2 Columbia River Corridor ES-10
ES3.2.3 Central Plateau ES-11
ES3.2.4 All Other Areas ES-11
ES3.2.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) ES-11
ES3.3 Alternative One ES-11
ES3.3.1 Wahluke Slope ES-11
ES3.3.2 Columbia River Corridor ES-11
ES3.3.3 Central Plateau ES-12
ES3.3.4 All Other Areas ES-12
ES3.3.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) ES-12
ES3.4 Alternative Two ES-12
ES3.4.1 Wahluke Slope ES-12
ES3.4.2 Columbia River Corridor ES-13
ES3.4.3 Central Plateau ES-13
ES3.4.4 All Other Areas ES-13
ES3.4.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) ES-13
ES3.5 Alternative Three ES-13
ES3.5.1 Wahluke Slope ES-13
ES3.5.2 Columbia River Corridor ES-14
ES3.5.3 Central Plateau ES-14
ES3.5.4 All Other Areas ES-14
ES3.5.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) ES-14
ES3.6 Alternative Four ES-14
ES3.6.1 Wahluke Slope ES-14
ES3.6.2 Columbia River Corridor ES-15
ES3.6.3 Central Plateau ES-15
ES3.6.4 All Other Areas ES-15

ES1.0 Introduction

The U.S. Department of Energy (DOE) prepared this *Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* (HRA-EIS) to evaluate the potential environmental impacts associated with implementing a comprehensive land-use plan for the Hanford Site over the next 50 years. Working with Federal and state agencies, American Indian tribes, and other key stakeholders, DOE evaluated several land-use alternatives.

The Hanford Site occupies 1,517 square kilometers (km^2) (586 square miles [mi^2]) in southeastern Washington (Figure ES-1). For over 40 years, the primary mission at Hanford was the production of nuclear materials for national defense. The DOE developed infrastructure and facilities to accomplish this work, but large tracts of Hanford Site land remained undisturbed. These undisturbed areas preserved a biological and cultural resource setting that is now unique in the Columbia Basin region. In the late 1980s, the primary DOE mission changed from defense production to environmental restoration.

Today, the Hanford Site has a diverse set of mission elements associated with environmental restoration, waste management, and science and technology. These mission elements have resulted in the growing need for a comprehensive, long-term approach to planning and development for the Site.

ES1.1 National Environmental Policy Act

The *National Environmental Policy Act of 1969* (NEPA) requires consideration of environmental impacts associated with Federal agency actions, and provides opportunities for public involvement in the decision-making process.

In August 1996, the DOE published the *Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* (HRA-EIS) for public review. Based on comments received on the Draft HRA-EIS, the DOE decided to issue a Revised Draft HRA-EIS that more directly evaluates the potential environmental impacts associated with establishing future land uses at the Hanford Site over the next 50 years. The major differences between the Revised Draft HRA-EIS, and the August 1996 Draft HRA-EIS are as follows:

- The revised draft focuses on land use rather than remediation.

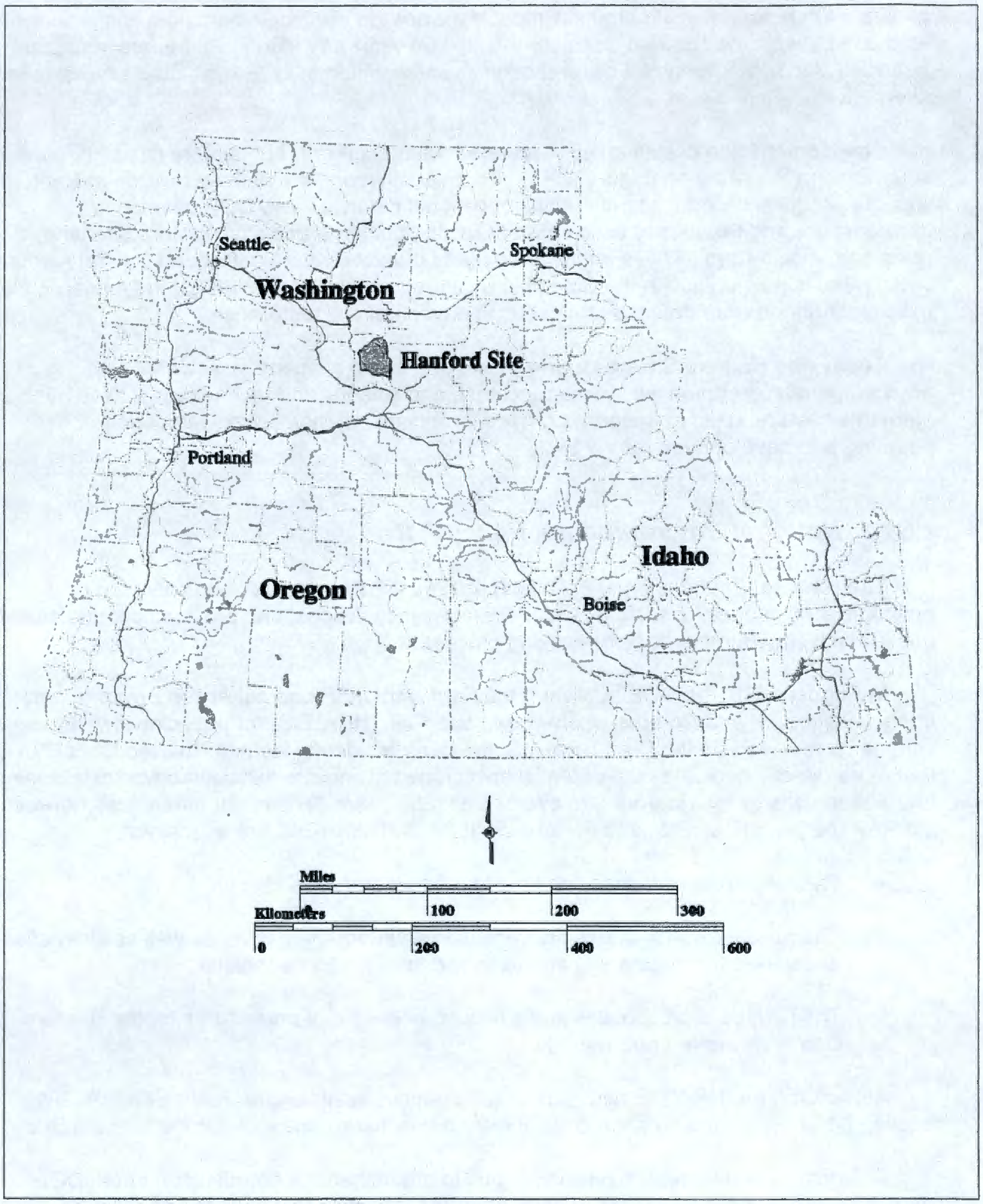
- The revised draft includes an identified Preferred Alternative, as well as alternatives developed by cooperating agencies and the Americans Indians.

- The revised draft contains implementing policies and procedures for the Hanford Comprehensive Land Use Plan (CLUP).

Refocusing the HRA-EIS also fulfills DOE's requirements under Public Law 104-201, Section 3153, which requires the development a final future-use plan for the Hanford Site.

To encourage a variety of viewpoints and to strengthen the coordination effort, DOE involved representatives of other Federal agencies, affected American Indian Tribal governments, and state and local governments in ongoing planning efforts.

Figure ES-1. Location of the Hanford Site.



BHI:rpp 04/22/96 clup/region1.amlDatabase: 08-SEP-1997

Since January 1997, DOE has worked with these groups to develop the environmental analyses presented in this Revised Draft HRA-EIS. The differences among the groups led to the development of alternatives that *better* reflect the range of land-use values held by the participants.

ES1.2 Other Ongoing Major Federal Actions and National Environmental Policy Act Documents

Decisions made in other NEPA Records of Decision (RODs), as well as *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) RODs addressing remediation, have had a direct impact on the development of the land-use alternatives presented in the Revised Draft HRA-EIS. These documents are identified in the following sections.

ES1.2.1 NEPA Reviews Affecting the Hanford Site

- *Waste Management Operations, Hanford Reservation, Richland, Washington* (ERDA-1538, December 1975)
- *Waste Management Operation, Double-Shell Tanks for Defense High-Level Radioactive Waste Storage, Hanford Site, Richland, Washington* (DOE/EIS-0062, April 1980)
- *Decommissioning of the Shippingport Atomic Power Station, Hanford Site, Richland, Washington* (DOE/EIS-0080, May 1982)
- *Operation of PUREX and Uranium Oxide Plant Facilities, Hanford Site, Richland, Washington* (DOE/EIS-0089, February 1983)
- *Disposal and Decommissioning, Defueled Naval Submarine Reactor Plants*
- *Disposal of Hanford Defense High-Level, Transuranic and Tank Waste, Hanford Site, Richland, Washington* (DOE/EIS -113, December 1987)
- *Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE/EIS-0119, December 1992)
- *Tank Waste Remediation System, Hanford Site, Richland, Washington* (DOE/EIS-0189, February 1997)
- *Office of Environmental Management Programmatic Environmental Impact Statement* (DOE/EIS-0200, May 1997)
- *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs* (DOE/EIS-203, 1995)
- *Safe Interim Storage of Hanford Tank Waste, Hanford Site, Richland, Washington* (DOE/EIS-0212, October 1995)

- *Plutonium Finishing Plant Stabilization Environmental Impact Statement* (DOE/EIS-0244, May 1996)

- *Management of Spent Nuclear Fuel from the K Basin at the Hanford Site, Richland, Washington* (DOE/EIS-0245, February 1996)

- *Disposal and Decommissioned, Defueled Cruiser, Ohio Class, and Los Angeles Class Naval Reactor Plants Environmental Impact Statement* (DOE/EIS-0259, April 1996)

- *Hanford Reach of the Columbia River, Comprehensive River Conservation Study and Final Environmental Impact Statement* (Hanford Reach EIS) (NPS 1994)

- *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement* (DOE/EIS-0229, December 1996)

- *Surplus Plutonium Disposition Environmental Impact Statement* (DOE/EIS-0283)

- *Geologic Repository for the Disposal of Spent Nuclear Fuel and High Level Radioactive Waste at Yucca Mountain* (DOE/EIS-250)

- *Interim Storage of Plutonium at the Rocky Flats Environmental Technology Site* (DOE/EIS-0276)

- *Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement* (DOE/EIS-0286)

- *Columbia River System Operation Review Environmental Impact Statement* (November 1995)

ES1.2.2 SEPA Reviews Affecting the Hanford Site

- Commercial Low-Level Radioactive Waste Disposal Site (U.S. Ecology) on the Hanford Site

- Proposal to Farm Privately Held Land on Two Columbia River Islands *(at this time, the decision has not been made to require an EIS, and a title has not been set)*

- City of Richland Comprehensive Plan/EIS

- 1997 Draft Benton County Comprehensive Plan (SEPA EIS Addendum)

ES1.2.3 CERCLA Reviews Affecting the Hanford Site

- 1100 Area Remediation -- 1100-EM-1, 1100-EM-2, 1100-EM-3, and 1100-IU-1 - Final Record of Decision (ROD) issued September 24, 1993, certified remedial action - July 1996, delisted from National Priorities List (NPL).

- 300 Area Remediation -- 300-FF-1, 300-FF-5 - Final ROD issued July 17, 1996. Remedial action/feasibility study (RI/FS) for NPL Site - to be completed after all operable units are addressed.

- 100 Area Remediation -- 100-BC-1, 100-HR-1, and 100-DR-1 - Interim ROD for 37 high-priority waste sites issued September 1995. The ROD was amended May 14, 1997, to include additional waste sites. 100-HR-3/100-KR-4 (groundwater operable units) - Interim ROD issued April 1, 1996, 100-IU-1, 100-IU-3, 100-IU-4, 100-IU-5 - Interim ROD issued February 12, 1996. RI/FS for NPL Site - to be completed after all operable units are addressed.

- 200 Area Remediation -- Environmental Restoration Disposal Facility - Final ROD issued January 1995, 200-ZP-1 (groundwater operable unit) - Interim ROD issued June 5, 1995, 200-UP-1 (groundwater operable unit) - Interim ROD issued February 24, 1997, RI/FS for NPL site - to be completed after all operable units are addressed

The restrictions posed by approved CERCLA RODs were taken into consideration in the development of land-use alternatives in this Revised Draft HRA-EIS. In the future, the land-use alternative selected for implementation in the ROD for this EIS would inform remediation decisions to be made in other areas of the Hanford Site. The U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), and DOE would consider the land-use designation for a given area in determining cleanup levels. If the desired land use cannot be attained because of technical or economic constraints, this land-use plan would be modified to the next best use that can be attained.

ES1.3 Hanford Site Planning Efforts

Several Hanford Site planning documents have been developed to address the information needs of DOE managers. These include the following:

- ***Baseline Environmental Management Report* (BEMR) (DOE 1996c)** -- The BEMR addressed activities and potential costs required to address the waste, contamination, and surplus nuclear facilities across the country that are the responsibility of DOE's Office of Environmental Management. The BEMR provided the life-cycle cost estimates, tentative schedules, and projected activities necessary to remediate DOE sites.

- **Draft *Hanford Cultural Resources Management Plan* (PNL 1989)** -- This establishes guidance for the management of archaeological, historic, and traditional cultural resources. The plan specifies methods of consultation with affected Tribes, government agencies, and interested parties.

- **Draft *Hanford Biological Resources Management Plan* (BRMaP) (DOE-RL 1996c)** -- The BRMaP provides DOE and DOE contractors with a consistent approach for protecting, managing, and mitigating biological resources. The BRMaP provides a comprehensive direction that specifies DOE biological resource policies, goals, and objectives.

- ***Hanford Strategic Plan* (DOE-RL 1996b)** -- This plan articulates the DOE vision and commitments to a long-range strategic direction for the Hanford Site. The strategic plan provides a basis for decisions and actions necessary to achieve DOE goals.

These planning documents are periodically updated to reflect new information and DOE decision making, such as the decision that DOE will make based on the information contained in the HRA-EIS.

The Revised Draft HRA-EIS builds on past efforts to address land-use planning at the Hanford Site and presents a range of alternative land uses that represent several different visions of potential future uses.

ES1.4 Planning Efforts by Other Governments and Agencies

This section includes information supplied to DOE by representatives of other local governments and agencies about their respective planning efforts.

ES1.4.1 Confederated Tribes of the Umatilla Indian Reservation

In their treaty with the United States, members of the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) retained the right to fish at all of their usual and accustomed fishing stations and to erect support buildings for this activity. The lower Yakima River and the Hanford Reach of the Columbia River are usual and accustomed fishing areas for the members of the CTUIR. In the same treaty, members of the CTUIR retained the right to hunt, gather plant resources, and pasture livestock on unclaimed lands. In the opinion of the CTUIR, Hanford lands are unclaimed lands.

The CTUIR anticipates that, with the adoption of a comprehensive land-use plan for Hanford, members of the CTUIR will gradually resume treaty-reserved activities on much of the Hanford Site. The CTUIR anticipates that the CTUIR's regulation of its members' treaty-reserved activities will be consistent with the designations made in the CLUP adopted by the ROD.

ES1.4.2 Other Federal Agencies

In addition to private lands acquired by DOE through condemnation during World War II, the Hanford Site includes Bureau of Land Management (BLM) and Bureau of Reclamation (BoR) lands acquired during and after World War II. These lands form a checkerboard pattern over large portions of the Hanford Site.

When DOE relinquishes its withdrawals on lands that were historically Federal, those lands will revert to management by the BLM or BoR. The BoR retains an interest in the ultimate development of the irrigable lands within the Wahluke Slope as part of the Columbia Basin Reclamation Project. This interest pertains not only to irrigation development, but also to other project purposes such as fish and wildlife protection, resource management, and environmental concerns.

The DOE lands on the Wahluke Slope are managed in part by the Washington Department of Fish and Wildlife (WDFW) as the Washington State Wahluke Slope Wildlife Recreation Area and by the U.S. Fish and Wildlife Service (USFWS) as the Saddle Mountain National Wildlife Refuge. In 1997, the USFWS began managing the Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) under a cooperative agreement with DOE. The USFWS will prepare an Area Management Plan for the ALE Reserve.

In 1994, the U.S. National Park Service (NPS) completed the *Hanford Reach of the Columbia River, Comprehensive River Conservation Study and Final Environmental Impact Statement* (Hanford Reach EIS) (NPS 1994). The NPS examined alternatives for preservation of the Hanford Reach, including the addition of the Hanford Reach to the National Wild and Scenic Rivers System. The ROD recommended that Congress designate Federally owned and privately owned lands within 0.4 km (0.25 mi) of the Hanford Reach as a Recreational River under the Wild and Scenic Rivers System; and the portion of the Hanford Site that lies north and east of the river, as a National Wildlife Refuge. Congress is contemplating actions that are necessary to implement the ROD.

ES1.4.3 Local Governments

Portions of the Hanford Site lie within Benton, Franklin, Adams, and Grant counties. The primary portion of the Site falls within Benton County, and parts of the Wahluke Slope fall within Franklin, Grant, and Adams counties. The City of Richland is located at the southern boundary of the Hanford Site, and considerable development within the city limits and adjacent to the Site have already occurred.

Most planning by local governments falls under the *State of Washington Growth Management Act of 1990* (GMA), which established a statewide planning framework and created roles and responsibilities for planning at the local, regional, and state level. The GMA required the largest and fastest growing counties and cities within those counties to develop new comprehensive plans (counties not required to plan may elect to do so). Benton, Franklin, and Grant counties, as well as the City of Richland, have elected to plan under the GMA requirements.

Benton County is preparing a comprehensive land-use plan that covers the entire county, including a portion of the Hanford Site. As part of its planning effort, Benton County has developed a proposed critical areas map. Critical areas include wetlands, areas with a critical recharging effect on aquifers used for potable water, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas.

The Port of Benton, which must comply with county land-use plans, has expressed interest in the industrial development of the 1100 Area, portions of the 300 Area, and the area south of Washington Public Power Supply System (WPPSS) Plant Number 2. Some conceptual development plans for this area have been completed.

The City of Richland plans in coordination with Benton County under the GMA. Future land use at the Hanford Site has the potential to affect the economic development of Richland. The City of Richland has identified portions of the southern Hanford Site suitable for urban development and possible annexation.

Grant, Franklin, and Adams counties coordinate local land-use planning for the Wahluke Slope. The three counties, along with the Port of Mattawa, have expressed a desire to implement a land-use plan that would accommodate increased agricultural activities, including irrigated cropping systems, along with wildlife and cultural resource protections.

ES2.0 Purpose and Need

The DOE has several missions to fulfill at the Hanford Site that have competing natural resource consumption needs and management values. Governments and stakeholders within the region have an interest in Hanford resources and in management of those resources over the long term. DOE needs to conduct a process to assess the relative qualities of Hanford's resources, compare the priorities and needs of Hanford's missions, and reach decisions concerning the most efficient way to manage and use those resources. The purpose of this *Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* (HRA-EIS) (DOE/EIS-0222D) is to provide a mechanism to conduct this analysis and make decisions.

The role of the HRA-EIS is to determine the best combination of potential land uses required to meet DOE mission needs over the next 50 years.

ES3.0 Proposed Action and Alternatives

The proposed action for the HRA-EIS is to develop a comprehensive future land-use plan for the Hanford Site. Public Law 104-201, Section 3153, requires that the land-use plan address a 50-year planning period. Once established, this land use plan would provide a framework for making land-use and facility-use decisions.

Alternatives for potential future use of the Hanford Site lands were developed through a cooperative effort with DOE; the CTUIR; the Nez Perce Tribe Department of Environmental Restoration and Waste Management; the U.S. Department of Interior (DOI); the WDFW; the City of Richland; and Benton, Franklin, and Grant counties.

The following land-use designations and their definitions were co-developed by these governments so alternative land-use plans could be commonly developed and compared:

Table ES-1. Hanford Site Land-Use Designations. (2 pages)

Land-Use Designation	Definition
Industrial-Exclusive	An area suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes. Includes related activities consistent with Industrial-Exclusive uses.
Industrial	An area suitable and desirable for activities, such as reactor operations, rail, barge transport facilities, mining, manufacturing, food processing, assembly, warehouse, and distribution operations. Includes related activities consistent with Industrial uses.
Agricultural	An area designated for the tilling of soil, raising of crops and livestock, and horticulture for commercial purposes along with all those activities normally and routinely involved in horticulture and the production of crops and livestock. Includes related activities consistent with Agricultural uses.
Research and Development	An area designated for conducting basic or applied research that requires the use of a large-scale or isolated facility. Includes scientific, engineering, technology development, technology transfer, and technology deployment activities to meet regional and national needs. Includes related activities consistent with Research and Development.
High-Intensity Recreation	An area allocated for high-intensity, visitor-serving activities and facilities (commercial and governmental), such as golf courses, recreational vehicle parks, boat launching facilities, Tribal fishing facilities, destination resorts, cultural centers, and museums. Includes related activities consistent with High-Intensity Recreation.
Low-Intensity Recreation	An area allocated for low-intensity, visitor-serving facilities, such as improved recreational trails, primitive boat launching facilities, and permitted campgrounds. Includes related activities consistent with Low-Intensity Recreation.

Table ES-1. Hanford Site Land-Use Designations. (2 pages)

Land-Use Designation	Definition
Conservation (Mining and Grazing)	An area reserved for the management and protection of archeological, cultural, ecological, and natural resources. Limited and managed mining and grazing could occur as a special use (e.g., a permit would be required) within appropriate areas. Limited public access would be consistent with resource conservation. Includes activities related to Conservation (Mining and Grazing), consistent with the protection of archeological, cultural, ecological, and natural resources.
Conservation (Mining)	An area reserved for the management and protection of archeological, cultural, ecological, and natural resources. Limited and managed mining could occur as a special use (e.g., a permit would be required) within appropriate areas. Limited public access would be consistent with resource conservation. Includes activities related to Conservation (Mining), consistent with the protection of archeological, cultural, ecological, and natural resources.
Preservation	An area managed for the preservation of archeological, cultural, ecological, and natural resources. No new consumptive uses (e.g., mining) would be allowed within this area. Public access controls would be consistent with resource preservation requirements. Includes activities related to Preservation uses.

Based on visions, goals, and objectives of the cooperating agencies, the land-use designations were applied to specific tracts of land on the Hanford Site. This process resulted in the development of the five alternatives (six, including the No-Action Alternative) that are presented and analyzed in the Revised Draft HRA-EIS.

ES3.1 No-Action Alternative

The No-Action Alternative is "no change" from current management direction or activity management intensity. The No-Action Alternative provides a baseline that presents the future status of land use and land management on the Hanford Site, and provides a basis for comparing the alternatives against the baseline.

ES3.1.1 Wahluke Slope

The area of the Wahluke Slope currently managed by the USFWS would continue to be managed as Preservation. The area managed by the WDFW would continue to be managed as Conservation (Mining and Grazing). Limited public access would be allowed for hunting, fishing, or recreation; permitted mining and grazing would be allowed; and agricultural leases would continue.

ES3.1.2 Columbia River Corridor

The Columbia River would continue to be managed to allow limited public access and use as a Low-Intensity Recreation area. Access to the Columbia River's islands would remain restricted to protect cultural and biological resources. Public access to the Reactors on the River area (i.e., the 100 Areas) would remain restricted.

ES3.1.3 Central Plateau

Lands within the Central Plateau area would continue to be used for the management of radioactive and hazardous waste materials.

ES3.1.4 All Other Areas

These areas would be available for other Federal and non-Federal uses, which are consistent with safety requirements and cultural and biological resources protection requirements. The area north of the City of Richland would be used for industrial purposes. The lands in and adjacent to the 300 and 400 Areas would remain under Federal ownership but could be leased for private and public uses to support industrial and economic development. Other Federal uses would be allowed by permit (e.g., the Laser Interferometer Gravitational-Wave Observatory [LIGO]). Excess land within the 1100 Areas would be targeted for transition to non-Federal ownership.

ES3.1.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve)

The ALE Reserve geographic area would continue to be managed as Preservation. The Big Bend Alberta Mining Company holds mineral rights on about 5.2 km^2 (2 mi^2) under the southern portion of the ALE Reserve.

ES3.2 Agency Preferred Alternative

Land-use designations identified for the DOE Preferred Alternative are Industrial-Exclusive, Industrial, Research and Development, High-Intensity Recreation, Low-Intensity Recreation, Conservation (Mining and Grazing), Conservation (Mining), and Preservation.

ES3.2.1 Wahluke Slope

The majority of the Wahluke Slope would be designated as Conservation (Mining and Grazing). Approximately one-eighth of the land would be designated for Preservation to provide protection for sensitive areas or species of concern.

ES3.2.2 Columbia River Corridor

The Columbia River Corridor would include High-Intensity Recreation, Low-Intensity Recreation, Conservation (Mining and Grazing), and Preservation. The river islands would be designated as Preservation.

Four sites would be designated as High-Intensity Recreation for visitor-serving activities and facilities development. The B Reactor would be converted into a museum and the surrounding areas would be available for museum-support facilities. The area near the Vernita Bridge would be expanded to include a boat ramp and other visitor facilities. Two areas on the Wahluke Slope would be designated as High-Intensity Recreation for exclusive Tribal fishing villages.

The area west of the B Reactor would be designated Low-Intensity Recreation and used as a corridor between the High-Intensity Recreation areas associated with the B Reactor and Vernita Bridge. A White Bluffs boat launch would be a Low-Intensity Recreation area located between the H and F Reactors. Other areas would include visitor facilities near the old Hanford High School, and hiking and biking trails just north of WPPSS.

The remainder of the land within the Columbia River Corridor would be designated for Conservation (Mining and Grazing). Grazing would be used for fire and weed management and mining would be permitted only in support of the cleanup mission.

ES3.2.3 Central Plateau

The Central Plateau would be designated for Industrial-Exclusive use. This would allow for continued waste management operations within the Central Plateau geographic area.

ES3.2.4 All Other Areas

Within the All Other Areas geographic area, the Preferred Alternative would include Industrial, Research and Development, High-Intensity Recreation, Low-Intensity Recreation, Conservation, and Preservation land-use designations.

Washington State land that is deed restricted to waste management would be designated as Conservation (Mining and Grazing). Two areas, one located east of the 200 Area and the other located north of Richland, would be designated for Industrial use. An area west of Highway 10 and east of State Highway 240 would be designated for Research and Development. Gable Mountain, Gable Butte, the area from Umtanum Ridge to the ALE Reserve, and the active sand dunes areas would be designated as Preservation.

ES3.2.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve)

Nearly all of the ALE Reserve geographic area would be designated as Preservation. A portion of the ALE Reserve would be managed as Conservation (Mining) during the remediation of the Hanford Site.

ES3.3 Alternative One

Alternative One represents a stewardship role for managing resources at the Hanford Site. The objective of Alternative One is to promote protection and recovery of state and federally listed species, a wide range of fish and wildlife recreational opportunities, aquatic and terrestrial habitats, and associated fish and wildlife population. The vision of Alternative One is to conserve the Hanford Site shrub-steppe ecosystem and to maintain a habitat link between the Hanford Site and the Yakima Training Center.

ES3.3.1 Wahluke Slope

The Saddle Mountain National Wildlife Refuge would be designated Preservation. The Wahluke Slope Wildlife Area would be designated as Low-Intensity Recreation, Conservation (Mining and Grazing), Conservation (Mining), and Preservation. The Low-Intensity Recreation area would be used for primitive overnight camping.

The Washington State Wahluke Slope Wildlife Area management would implement; road and trail system closures (i.e., seasonal and permanent) to protect sensitive plant and animals, grazing as a management tool, and regulation of primitive overnight camping.

ES3.3.2 Columbia River Corridor

The Columbia River islands would be designated for Preservation to maintain important areas for wildlife. The Columbia River Corridor includes Low-Intensity Recreation and High-Intensity Recreation areas, including an existing trail/road system, an existing unimproved boat ramp facility on the Franklin County side of the river for public river access, and an unimproved boat ramp on the Benton County side at the White Bluffs that would be restricted to emergency response. The High-Intensity area currently includes an existing highway rest area. A boat ramp facility would be built on the opposite side of State Highway 240 across from the rest stop. The Preservation designation would provide protection for ecologically and culturally sensitive areas being considered for protection under the Wild and Scenic Recreation River designation (NPS 1996).

The 100 Areas would include High-Intensity Recreation, Conservation (Mining), and Preservation land-use designations. The B Reactor would be designated High-Intensity Recreation consistent with the B Reactor museum proposal.

ES3.3.3 Central Plateau

The Central Plateau would include Industrial-Exclusive and Preservation land-use designations. Research and development projects specific to DOE's waste management activities would be allowed. Lands located to the west of the 200 West Area within the Central Plateau geographic area that contain high-quality mature sagebrush would be designated as Preservation. This designation encourages siting of new projects between the 200 East and 200 West Areas.

ES3.3.4 All Other Areas

The All Other Areas geographic area would include Industrial, Research and Development, Low-Intensity Recreation, Conservation (Mining), and Preservation land-use designations. All development would occur south of the WPPSS. This would include transition of existing facilities in the 1100, 300, and 400 Areas and the WPPSS site to Industrial, and Research and Development designations. The majority of the non-Federal uses would occur offsite or within the southeast portion of the Hanford Site. Wildlife corridors would be located around this industrial development. Located to the west of the Industrial designation is an extensive tract of seral shrub-steppe habitat that has been designated as Conservation (Mining).

Within a proposed wildlife corridor north of the Yakima River, a small area would be designated Conservation (Mining) to allow potential extraction of geologic materials for use in site remediation.

ES3.3.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve)

The ALE Reserve geographic area would be designated for Preservation and Conservation (Mining). Two areas of the ALE Reserve along State Highway 240 would be designated as Conservation (Mining). The DOE would reclaim the site after removing materials.

ES3.4 Alternative Two

Alternative Two presents the vision of the Nez Perce Tribe Department of Environmental Restoration and Waste Management. This vision calls for the preservation of the natural and cultural resources at Hanford. Traditional tribal use is consistent with the Preservation land-use designation.

ES3.4.1 Wahluke Slope

Alternative Two would designate the entire Wahluke Slope as Preservation.

ES3.4.2 Columbia River Corridor

The Columbia River Corridor would include High-Intensity Recreation, Low-Intensity Recreation, Research and Development, and Preservation land-use designations. The Columbia River (surface water only) would be designated for Low-Intensity Recreation. The river islands would be designated as Preservation. The B Reactor and surrounding area would be designed for High-Intensity Recreation, and would allow conversion of the reactor into a museum. The K Reactor area would be designated for Research and Development and could be used by the Tribes and others for fish farming or for aquaculture and aquatic research. The remainder of the land within the 100 Areas would be designated Preservation.

ES3.4.3 Central Plateau

Lands within the Central Plateau geographic area would be designated as Industrial-Exclusive, allowing for continued management of radioactive and hazardous waste and other related and compatible uses.

ES3.4.4 All Other Areas

The All Other Areas would include Industrial, Research and Development, and Preservation designations. Alternative Two designates the City of Richland Urban Growth Area (UGA), and 400 Area (including the Fast Flux Test Facility [FFTF]), and the WPPSS site as Industrial. The area around LIGO would be designated as Research and Development. The remainder of the All Other Areas would be designated as Preservation to protect natural, aesthetic, geologic, cultural, and archaeological features.

ES3.4.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve)

The ALE Reserve geographic area would be designated as Preservation in accordance with its management as the Rattlesnake Hills Research Natural Area.

ES3.5 Alternative Three

Benton, Franklin, and Grant counties and the City of Richland contain portions of the Hanford Site. Alternative Three represents the planning efforts of these local governments. Alternative Three would accommodate both future Federal missions and private activities such as business-related industry and research and development enterprises in the southeastern portion of the Site. Accommodation for the expansion of public and commercial recreational activities would be focused on the northern portion of the Site (i.e., primarily in the vicinity of the Vernita Bridge). The Conservation (Mining) designation would extend over most geographic areas except the southern portion of the Hanford Site and the Wahluke Slope.

ES3.5.1 Wahluke Slope

Approximately two-thirds of the Wahluke Slope would be designated as Agricultural. Land designated as Agricultural within the "Red Zone" would be conserved under a "no-action" scenario pending the completion of geotechnical studies analyzing the impacts of irrigation on the White Bluffs and the Columbia River. Approximately one-third of the Wahluke Slope is designated as Conservation, providing land for wildlife and Low-Intensity Recreation. Approximately 261 ha (645 ac) of BoR wetlands would be designated as Preservation.

ES3.5.2 Columbia River Corridor

The Preservation land-use designation would extend 0.4 km (0.25 mi) from the average high-water line of the river. In Franklin and Grant counties, the boundary would extend further inland to include sensitive features such as the White Bluffs and several upland wetlands. Permitted uses would be similar to those within the Conservation land-use designation, except mining would be allowed as a conditionally permitted use. Agriculture would be prohibited.

The areas outside of the KE, KW, N, D, DR, and H Reactor sites would be designated as Low-Intensity Recreation. A hiking and biking recreational trail along the entire river corridor would extend from North Richland to the Vernita Bridge.

ES3.5.3 Central Plateau

The DOE would be expected to continue all waste management and disposal activities in the Central Plateau. The Central Plateau would be designated for Industrial-Exclusive Use.

ES3.5.4 All Other Areas

The majority of the All Other Areas geographic area would be designated Conservation (Mining). Within the Conservation land-use designation, mining would be allowed as a conditionally permitted use. Agricultural uses would be prohibited. A small area along the southern boundary of the Site near the Yakima River would be designated High-Intensity Recreation. The area adjacent to the Vernita Rest Stop, east of State Highway 24 (which includes the B Reactor Site) would also be designated as High-Intensity Recreation. The strip designated for the west 135 ha (333 ac) of the Vernita Terrace would be designated Low-Intensity Recreation, primarily for limited activities such as biking, hiking, fishing, hunting, boat launching facilities, primitive camping, and nature viewing.

Areas north of the City of Richland would be designated as Industrial and Research and Development.

ES3.5.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve)

The ALE Reserve would be designated as Conservation (Mining) under Alternative Three.

ES3.6 Alternative Four

Alternative Four represents the vision of the CTUIR for the management of the Hanford Site over the next 50 years. In the view of the CTUIR, the greatest value provided to the region and the nation by the Hanford Site is its role as a natural resources reserve. The Hanford Site contains numerous places of religious important to members of the CTUIR who practice traditional Indian religions. These places include the major basalt outcrops, the active dunes area, and other sites. Protection of these sites and of Tribal members' access to these sites are of great important to the CTUIR and its members (as well as to other Hanford-affected Tribes) and will be an issue of great importance.

ES3.6.1 Wahluke Slope

Alternative Four would manage the entire Wahluke Slope area as Preservation Under the Preservation designation, grazing would not be allowed.

ES3.6.2 Columbia River Corridor

Alternative Four would designate almost the entire Columbia River Corridor as Preservation. The Preservation designation would allow managed recreation within the Corridor. This activity would include the continued operation of the White Bluffs boat launch on the east side of the river. A High-Intensity Recreation public boat launch would be located near the Vernita Bridge on the south side of the river. Alternative Four would also provide another High-Intensity Recreation boat launch, located at the White Bluffs boat launch on the Benton County side of the river, to support Tribal treaty-reserved fishing activity throughout the Hanford Reach.

ES3.6.3 Central Plateau

The Central Plateau would be used for waste management activities. All permanent waste disposal at the Hanford Site and research and development activities associated with waste management would take place within the Central Plateau.

ES3.6.4 All Other Areas

While Low-Intensity Recreation generally does not appear as a separate land use in this geographic area, it is anticipated that compatible Low-Intensity Recreation would be established throughout much of the All Other Areas geographic regions.

Alternative Four designates the area within 3.2 km (2 mi) of the Columbia River as Preservation to protect archaeological resources. Areas north of Gable Butte and Gable Mountain would be designated Preservation to protect sagebrush-steppe habitat. The area north of the ALE Reserve and south of Umtanum Ridge (also known as McGee Ranch) would be designated as Preservation to avoid habitat fragmentation and to provide a wildlife corridor between Hanford and the Yakima Training Center.

Gable Mountain in the east and moving west through Gable Butte, and Umtanum Ridge would be designated Preservation because of their cultural and biological importance. Alternative Four also recognizes the religious, cultural, and habitat significance of active dunes north of WPPSS by designating them as Preservation.

Alternative Four designates a large area near the Central Plateau and between the Plateau and the southeastern border of the Hanford Site as Conservation (Mining). This area contains large areas of high quality mature sagebrush communities; therefore, DOE would need to make prudent choices regarding the removal of needed material. If these geologic materials are not needed, the land-use designation for this area should revert to Preservation.

Alternative Four treats LIGO as a pre-existing, nonconforming use. The area south and east of the Wye Barricade (between State Highway 10 and the Hanford Site rail line) is designated as Research and Development, and Industrial.

Alternative Four designates a 3.2-km (2-mi) corridor along the Yakima River as Preservation because of the density of archaeological sites and the area's value as a wildlife corridor.

ES3.6.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve)

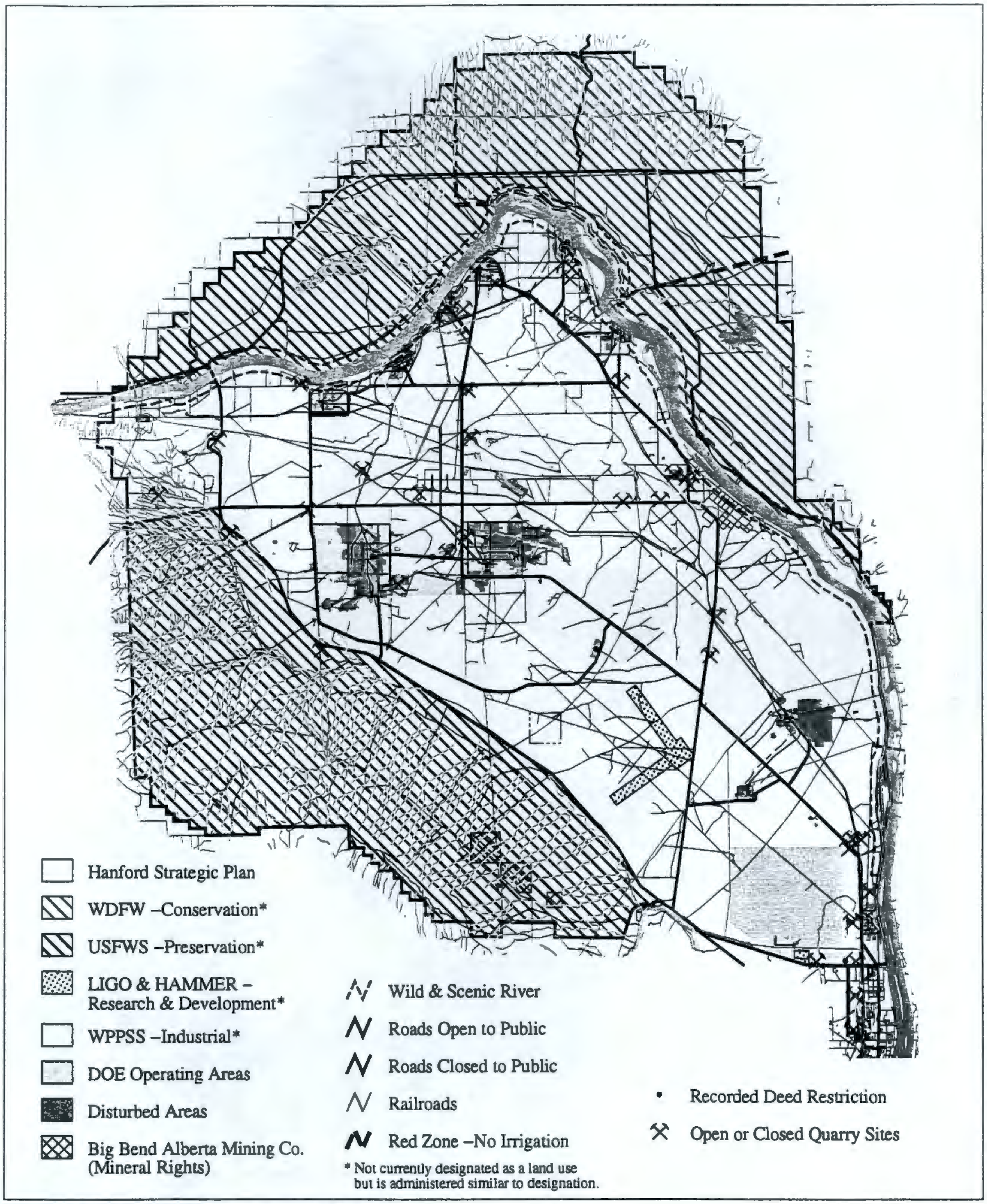
Alternative Four would continue to manage the ALE Reserve in a manner consistent with the Preservation designation. The sole exception is an area of the ALE Reserve bordering

State Highway 240 near the 200 West Area that would be designated Conservation (Mining). If the site is not used as a source for waste site capping material, the land-use designation should revert to Preservation.

ES3.7 Alternative Maps and Tables

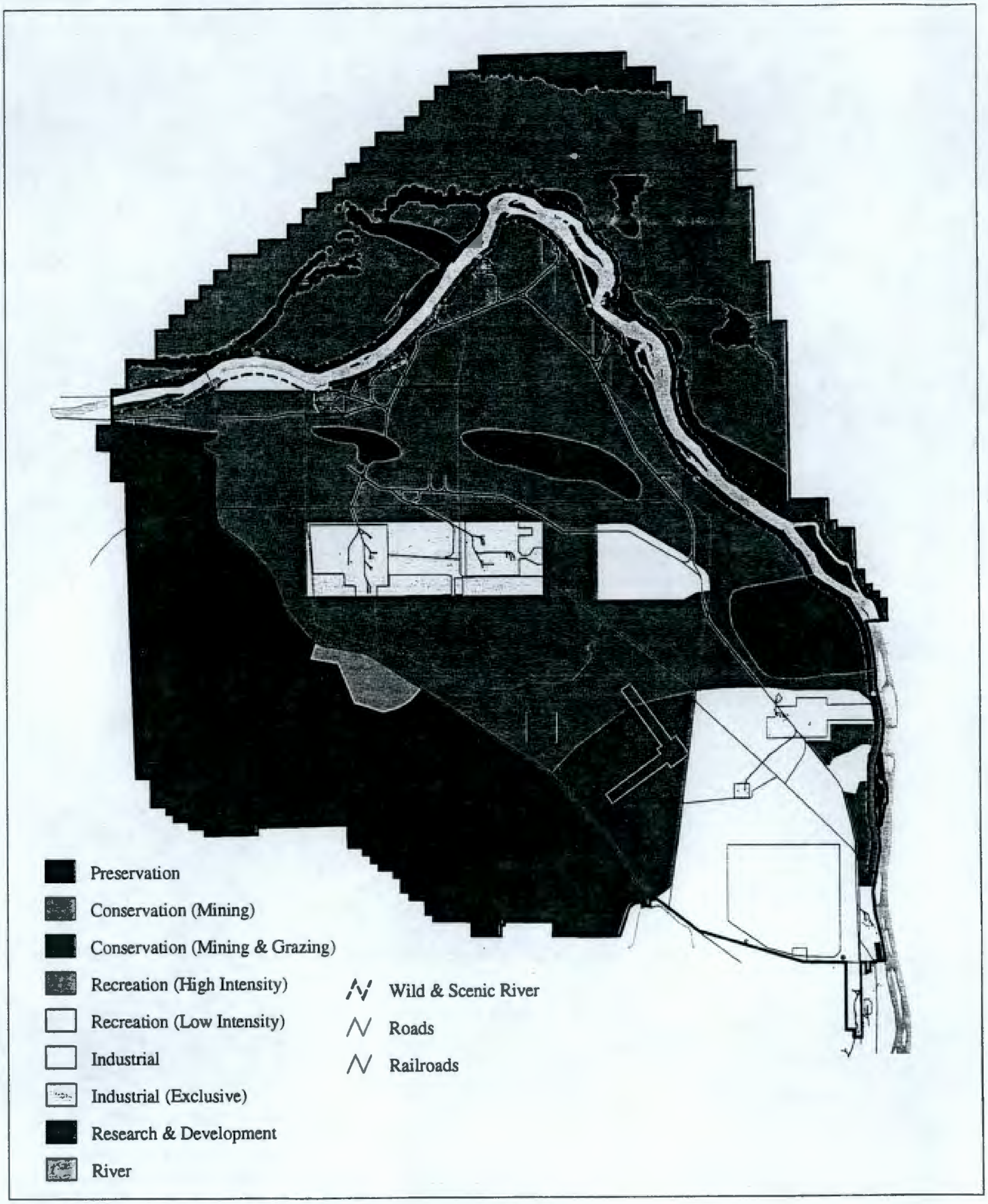
Figures ES-1 through ES-6 provide maps for each of the alternatives. Table ES-2 shows comparisons of the affected areas by alternative, and Table ES-3 shows the impacts of each of the land-use designations.

Figure ES-2. No-Action Alternative.



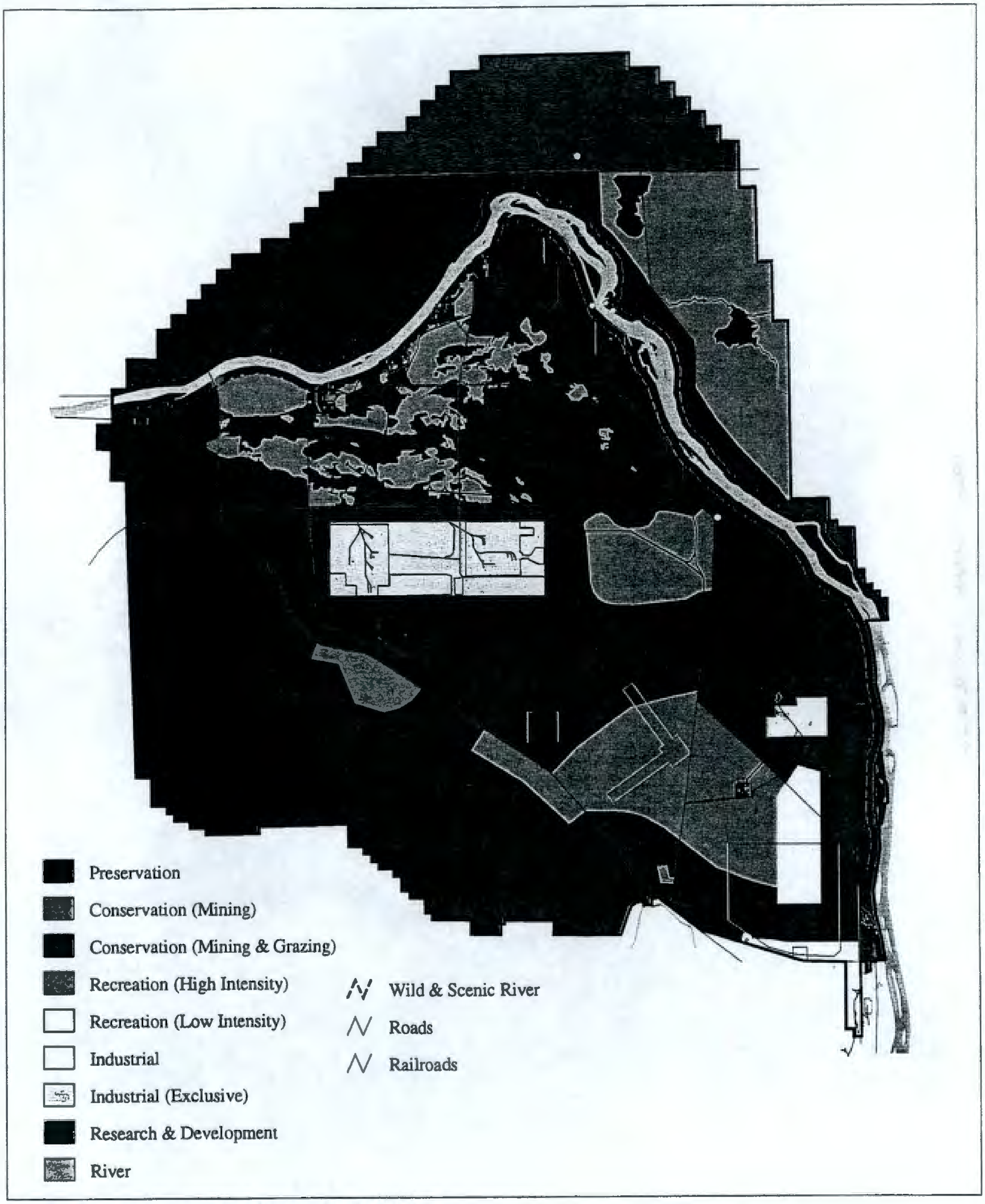
BHI:rpp 04/23/98 clup/noactionalt.aml Database: 23-APR-1998

Figure ES-3. Preferred Alternative.



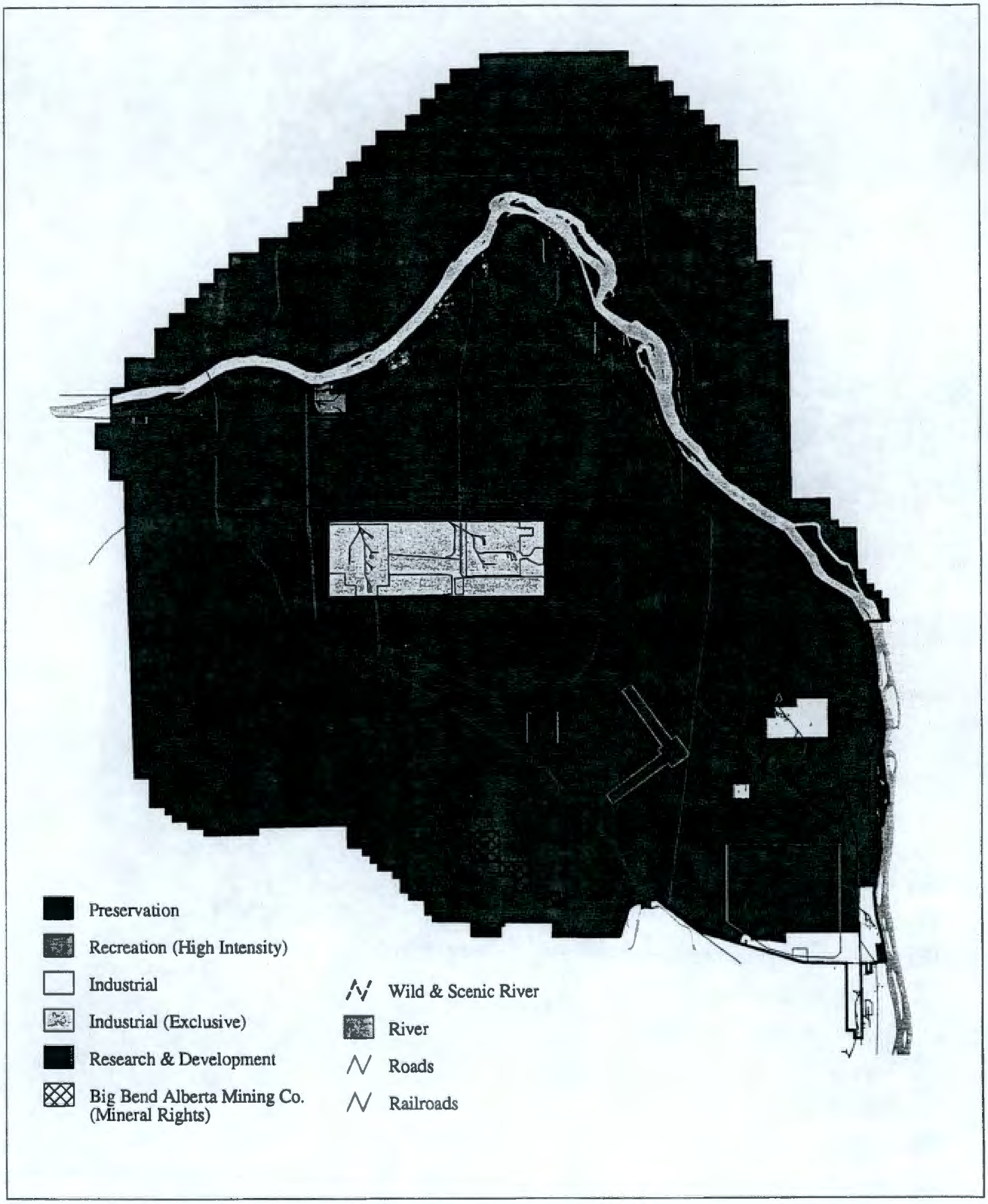
BHI:rpp 04/23/98 clup/prefalt.aml Database: 23-APR-1998

Figure ES-4. Alternative One.



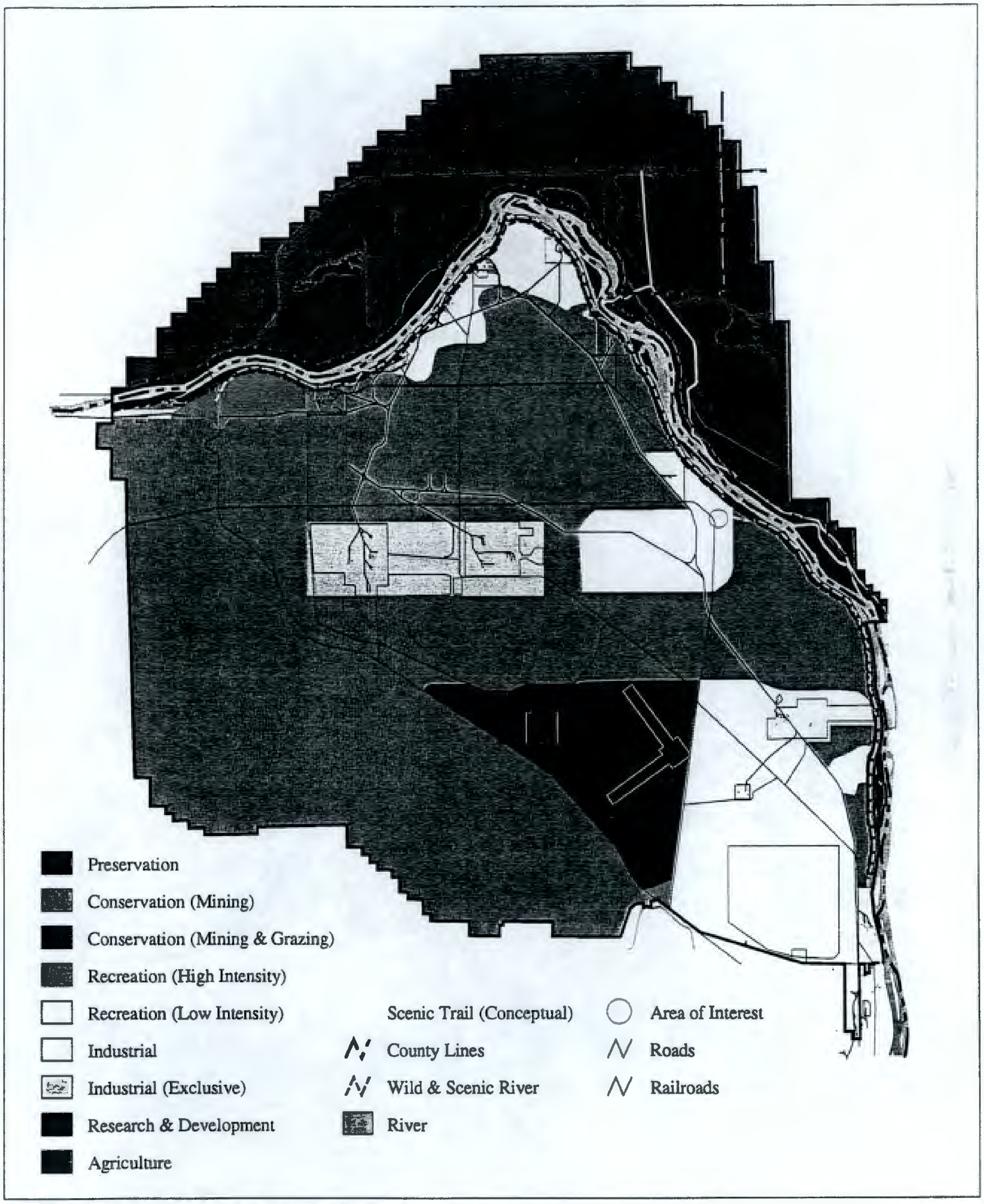
BHI:rpp 04/23/98 clup/alternative1.aml Database: 23-APR-1998

Figure ES-5. Alternative Two.



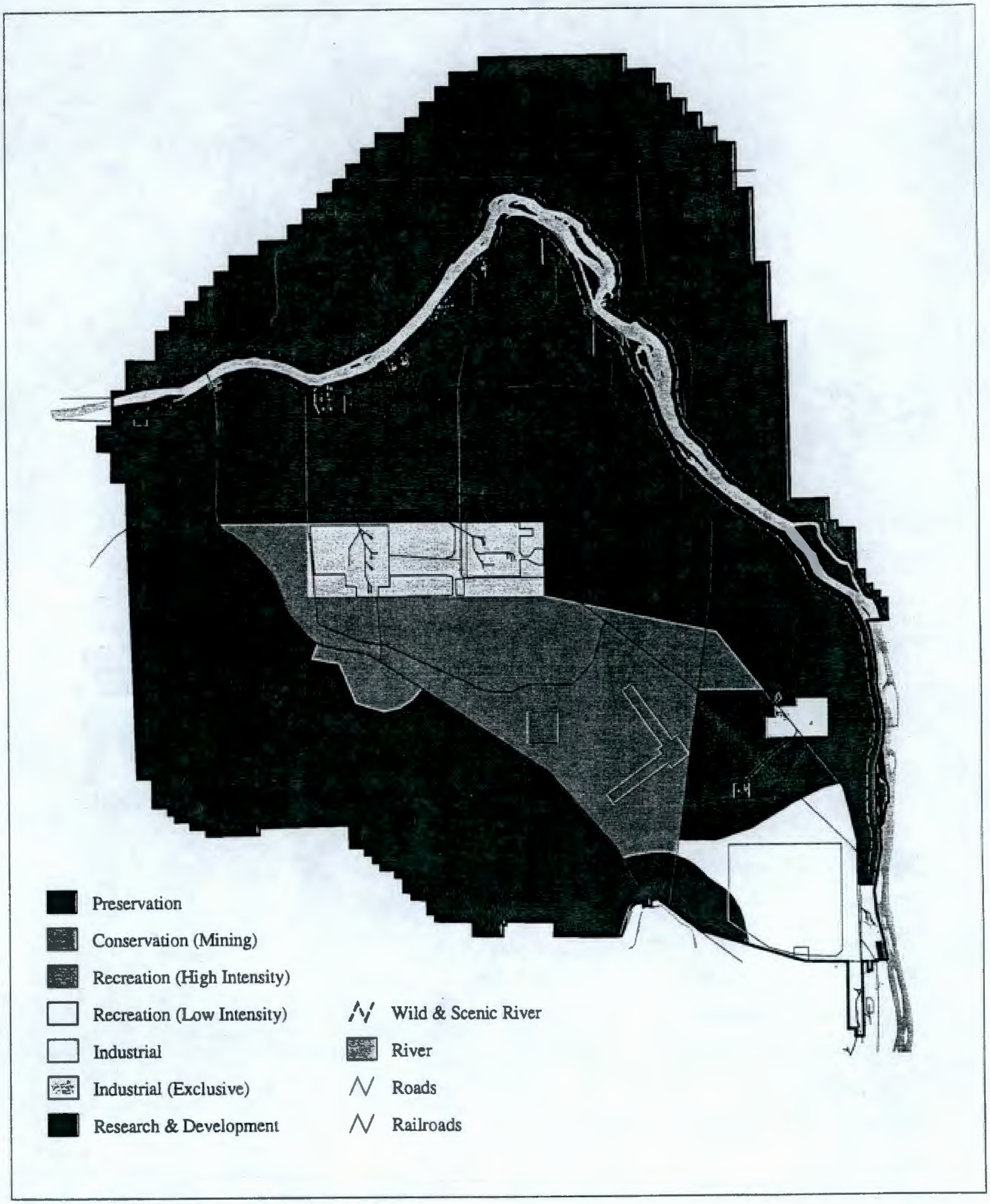
BHI:rpp 04/23/98 clup/alternative2.aml Database: 23-APR-1998

Figure ES-6. Alternative Three.



BHI:rpp 04/23/98 clup/alternative3.aml Database: 23-APR-1998

Figure ES-7. Alternative Four.



BHI:rpp 04/23/98 clup/alternative4.aml Database: 23-APR-1998

Table ES-2. Comparisons of Affected Areas by Alternative.

	No-Action	Preferred	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Areas in Hectares						
Agriculture	0	0	0	0	24,371	0
Conservation (Mining and Grazing)	74,115	71,813	9,738	0	6,232	0
Conservation (Mining)	0	1,005	24,992	0	73,544	19,336
Industrial	22,535	16,669	3,661	2,090	17,860	6,881
Industrial-Exclusive	5,064	5,064	4,593	4,593	5,064	5,064
Preservation	46,366	47,961	103,001	140,507	7,967	112,320
High-Intensity Recreation	0	64	64	191	1,768	77
Low-Intensity Recreation	1	593	37	1	3,098	15
Research and Development	0	4,912	1,995	699	8,177	4,388
TOTAL	148,081	148,081	148,081	148,081	148,081	148,081
	No-Action	Preferred	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Areas in Acres						
Agriculture	0	0	0	0	60,222	0
Conservation (Mining and Grazing)	183,142	177,454	24,063	0	15,400	0
Conservation (Mining)	0	2,483	61,757	0	181,731	47,780
Industrial	55,685	41,190	9,047	5,165	44,133	17,003
Industrial-Exclusive	12,513	12,513	11,350	11,350	12,513	12,513
Preservation	114,573	118,514	254,521	347,200	19,687	277,549
High-Intensity Recreation	0	158	158	472	4,369	190
Low-intensity Recreation	2	1,465	91	2	7,655	36
Research and Development	0	12,138	4,930	1,727	20,206	10,843
TOTAL	365,915	365,915	365,915	365,915	365,915	365,915
	No-Action	Preferred	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Areas in Square Miles						
Agriculture	0	0	0	0	94	0
Conservation (Mining and Grazing)	286	277	38	0	24	0
Conservation (Mining)	0	4	96	0	284	75
Industrial	87	64	14	8	69	27
Industrial-Exclusive	20	20	18	18	20	20
Preservation	179	185	398	542	31	434
High-Intensity Recreation	0	0	0	1	7	0
Low-Intensity Recreation	0	2	0	0	12	0
Research and Development	0	19	8	3	32	17
TOTAL	572	572	572	572	572	572
	No-Action	Preferred	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Percentage of Area						
Agriculture	0.00%	0.00%	0.00%	0.00%	16.46%	0.00%
Conservation (Mining and Grazing)	50.05%	48.50%	6.58%	0.00%	4.21%	0.00%
Conservation (Mining)	0.00%	0.68%	16.88%	0.00%	49.66%	13.06%
Industrial	15.22%	11.26%	2.47%	1.41%	12.06%	4.65%
Industrial-Exclusive	3.42%	3.42%	3.10%	3.10%	3.42%	3.42%
Preservation	31.31%	32.39%	69.56%	94.89%	5.38%	75.85%
High-Intensity Recreation	0.00%	0.04%	0.04%	0.13%	1.19%	0.05%
Low-Intensity Recreation	0.00%	0.40%	0.02%	0.00%	2.09%	0.01%
Research and Development	0.00%	3.32%	1.35%	0.47%	5.52%	2.96%
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table ES-3. Impacts of Each Land-Use Alternative.

Alternative	Land-Use Designation	Geologic Features	Groundwater	Surface Water	Biological Resources	BRMaP Level II	BRMaP Level III	BRMAP Level IV	Cultural Resources	Aesthetic Resources
No-Action	Agriculture									
	Development	x	x	x	x	x	x	x	x	x
	Recreation			x					x	x
	Mining	x	x	x	x	x	x	x	x	x
	Grazing	x		x	x				x	x
Preferred Alternative	Agriculture									
	Development	x	x			x	x		x	x
	Recreation			x			x	x	x	x
	Mining	x	x		x	x	x	x	x	x
	Grazing	x	x		x	x	x	x		x
Alternative One	Agriculture									
	Development	x	x	x					x	x
	Recreation			x					x	x
	Mining	x								x
	Grazing				x	x				x
Alternative Two	Agriculture									
	Development			x						
	Recreation			x						
	Mining									
	Grazing									
Alternative Three	Agriculture	x	x	x	x	x	x	x	x	x
	Development	x	x		x	x			x	x
	Recreation			x	x	x			x	x
	Mining	x	x	x	x	x	x	x	x	x
	Grazing			x	x	x				x
Alternative Four	Agriculture									
	Development	x	x		x	x			x	x
	Recreation			x			x	x	x	x
	Mining					x				x
	Grazing									

ES4.0 Affected Environment

The Hanford Site lies within the semi-arid Pasco Basin of the Columbia Plateau in southeastern Washington State. The Hanford Site occupies an area of approximately 1,517 km^2 (586 mi^2) north of the confluence of the Yakima River with the Columbia River. The Columbia River flows through the northern part of the Hanford Site and, turning south, forms part of the Hanford Site's eastern boundary. This section of the Columbia River is known as the Hanford Reach and is the last unimpounded, nontidal segment of the Columbia River in the United States. The Yakima River runs near the southern boundary and joins the Columbia River below the City of Richland, which bounds the Hanford Site on the southeast.

The production of defense nuclear materials at the Hanford Site since the 1940s has necessitated the exclusion of public access and most nongovernment-related development on the Hanford Site. As a result of its defense-related mission, the Hanford Site has also provided *de facto* protection of the natural environment and cultural resources (NPS 1994); however, the defense nuclear production mission has left the Hanford Site with an extensive legacy of waste. Nuclear weapons material production and associated activities at the Hanford Site during the past five decades have generated a variety of radioactive, hazardous, and other wastes that have been disposed of or discharged to the air, soil, and water at the Hanford Site.

ES4.1 Land Uses

For many years, the area along the Columbia River was used extensively by American Indian tribal members for fishing, hunting, gathering, and pasturing of livestock. Land uses at the Hanford Site have changed dramatically over the past 100 years. By the turn of the century, settlers had moved into the area, developing irrigated farmland and practicing extensive grazing. In the early 1940s, the Federal government acquired the Hanford Site for production of nuclear materials to be used in the development of the atomic bomb.

Land uses within the vicinity of the Hanford Site include urban and industrial development, wildlife protection areas, recreation, irrigated and dryland farming, and grazing. Other land uses in the vicinity of the Hanford Site include radioactive waste decontamination, waste packaging facilities, and a commercial nuclear fuel fabrication facility. Much of the Hanford Site is undeveloped, providing a safety and security buffer for the smaller areas used for operations.

The area north of the Columbia River consists of 357 km^2 (138 mi^2) of relatively undisturbed or returning shrub-steppe habitat known as the Wahluke Slope (see Figure ES-1).

The 200 East and 200 West Areas are approximately 115 km^2 (44 mi^2). Facilities located in the Central Plateau were built to process irradiated fuel from the production reactors. The operation of these facilities resulted in the storage, disposal, and unplanned release of radioactive and nonradioactive waste. The primary land uses are waste operations and operations support.

The 300 Area is located north of the City of Richland, encompasses 1.5 km^2 (0.6 mi^2), and is used for research and technology development facilities. The 400 Area, located southeast of the 200 East Area, is the site of the FFTF, which was used to test reactor systems. The 1100 Area, located north of Richland, served as the central warehousing, vehicle maintenance, and transportation operations center for the Hanford Site.

The ALE Reserve encompasses 308 km^2 (119 mi^2) in the southwestern portion of the Hanford Site and is managed as a habitat and wildlife reserve and environmental research center.

Additional land uses include the Hazardous Materials Management and Emergency Response Training Center (HAMMER), WPPSS Plant Number 2 (WNP-2), and the LIGO (which is used to detects gravitational waves for scientific research).

ES4.2 Geological and Soil Resources

The Hanford Site lies within the Columbia intermountain physiographic province, which is bordered on the north and east by the Rocky Mountains and on the west by the Cascade Range. The dominant geologic characteristics of this province are the thick accumulation of basaltic lava flows.

A series of bluffs, known as the White Bluffs, occur along 56 km (35 mi) of the eastern and northern shores of the Columbia River. The entire area of the bluffs along the northern and eastern shores of the Columbia River is susceptible to landslides. Recent landslides have occurred in four areas along the bluffs. A slide near Locke Island caused the loss of cultural artifacts on the island by changing the channel of the river and causing erosion. These slides can also disturb and destroy salmon spawning beds by siltation. Irrigation is a contributing factor to these landslides.

Natural gas was discovered on Rattlesnake Mountain in 1913. The small, shallow field was developed in 1929 and produced natural gas until the field was closed in 1941. The mineral rights to a 518-ha (1,280-ac) area of the ALE Reserve are still owned by a private company.

The Hanford Dune Field, located north of WNP-2, is one of three great dune fields in the Columbia River Basin. The Heritage Conservation and Recreation Service recommended inclusion of the dunes in the National Natural Landmark System (NPS 1994).

Earthquake hazards are relatively low. Several major volcanos are located in the Cascade Range to the west of the Hanford Site. Mount St. Helens is located approximately 220 km (136 mi) west-southwest of the Hanford Site. The major concern is that ashfall could disrupt communication and travel on the Site.

There are 15 different soil types on the Hanford Site that vary from sand to silty and loamy sand. The most common soil type is Quincy sand. No soils on the Hanford Site are currently classified as prime or unique farmlands because they would require irrigation.

ES4.3 Water Resources

Primary surface-water features associated with the Hanford Site are the Columbia and Yakima Rivers. In addition, several surface ponds and ditches are associated with Hanford Site operation. Cold Creek and its tributaries are ephemeral springs within the Yakima River drainage. Rattlesnake Springs, located on the western portion of the Site, forms a small surface stream that flows for approximately 3 km (1.9 mi) before disappearing into the ground.

Flow along the Hanford Reach is controlled by the Priest Rapids Dam. The likelihood of recurrence of large-scale flooding has been reduced by the construction of flood control and water storage dams upstream of the Hanford Site. Artificial wetlands (caused by irrigation) exist on the Wahluke Slope. Ecology has classified the Hanford Reach as Class A (Excellent). Class A waters are suitable for essentially all uses, including drinking water, recreation, and wildlife habitat. Radionuclide concentrations in the Columbia River are well below drinking water standards at all monitoring locations.

The quality of the groundwater at the Hanford Site has been affected by activities related to the production of nuclear materials. Large areas underlying the Hanford Site have elevated levels of both radiological and nonradiological constituents.

Water use in the area is primarily from surface diversion, with groundwater sources accounting for less than 10 percent of the total use (DOE 1988a). The first downstream drinking water intake below the Hanford Site is the City of Richland's intake.

ES4.4 Air Resources

The Hanford Site climate is semi-arid with an average annual precipitation of 16 cm (6.3 in). Summers are warm and dry with abundant sunshine. Prevailing wind directions are from the northwest during all months of the year. Regional air quality is generally good, with the occasional particulate exception due to blowing dust.

ES4.5 Biological Resources

The Hanford Site is a relatively large, mostly undisturbed area of shrub-steppe habitat containing numerous plant and animal species adapted to the semi-arid environment of the region characterized as a shrub-steppe ecosystem. In the early 1800s, the dominant plant in the area was big sagebrush with an understory of perennial bunchgrasses, especially Sandberg's bluegrass and bluebunch wheatgrass. With the advent of settlement that brought livestock grazing and crop raising, the natural vegetation has been invaded by non-native annual species, especially cheatgrass. The dryland areas of the Hanford Site were treeless in the years before land settlement; however, trees were planted and irrigated on most of the farms to provide windbreaks and shade. Some of the trees died when the farms were abandoned in 1943. Today these trees serve as nesting platforms for several species of birds (e.g., hawks, owls, ravens, magpies, and great blue herons), and as night roosts for wintering bald eagles (DOE 1995b).

Several large portions of the Hanford Site are administered in a manner to protect and preserve biological resources, such as the ALE Reserve and the Wahluke Slope. The ALE Reserve has been used for ecological research dating back to 1952. As a result of a Federal interagency cooperative agreement, the ALE Reserve was designated as the Rattlesnake Hills Research Natural Area in 1971. The ALE Reserve is a protected environmental and valuable ecological study site.

The Hanford Site and the Department of Defense Yakima Training Center (located to the west of the Hanford Site) contain the largest remaining remnant of shrub-steppe vegetation in the Columbia Basin. Washington State is rapidly losing shrub-steppe habitat. The State of Washington has designated shrub-steppe habitat as priority habitat because shrub-steppe areas possess unique or significant value to many species. The DOI National Biological Service identifies native shrub and grassland steppe in Washington and Oregon as endangered ecosystem (with an 85 to 98 percent decline). The ALE Reserve supports one of the largest remnants of relatively undisturbed shrub-steppe ecosystem in the State of Washington. A herd of Rocky Mountain elk is present on the ALE Reserve.

Mule deer are found throughout the Hanford Site, although areas of the highest concentrations are on the ALE Reserve and along the Columbia River. Islands in the Hanford Reach are used extensively as fawning sites by deer (DOE 1995b).

There are three species of birds and one fish species that are on the Federal List of Endangered and Threatened Species, and several species of plants and animals are under consideration for formal listing by the State of Washington. State endangered plants and state threatened plants are found on the Hanford site. The state endangered plants are the northern wormwood and the Columbia yellowcress; state-threatened plants are the Columbia milk-vetch, Hoover's desert-parsley, and white eatonella. State-sensitive plant species occurring along the Hanford Reach include Piper's daisy, the southern mudwort, dense sedge, shining flatsedge, false pimpernel, gray crypthana, and the dwarf evening primrose.

The Columbia River and other water bodies on the Hanford Site provide valuable habitat for aquatic organisms. The Hanford Reach represents the only remaining significant mainstream Columbia River spawning habitat for stocks of upriver bright fall chinook salmon and white sturgeon (PNL 1990a). The Upper Columbia River run of steelhead trout has been Federally listed as endangered. These fish spawn in and migrate through the Hanford Reach.

The DOE is currently in the process of developing and implementing an overall management strategy for the conservation of fish, wildlife, and plant populations and their habitats on the Hanford Site. The Draft *Hanford Site Biological Resources Management Plan* (BRMAP) (DOE-RL 1996c) provides a broad, but comprehensive, direction that specifies DOE biological resources policies, goals, and objectives; and prescribes how they will be met.

ES4.6 Cultural Resources

The Hanford Site is rich in cultural resources, with well-preserved archaeological sites. The Draft *Hanford Cultural Resources Management Plan* (PNL 1989) was developed to establish guidance for the identification and management of archaeological, historic, and traditional cultural resources. Hanford Site cultural resources include American Indian historic and prehistoric sites, historic properties representing early Euro-American settlements, and more recent structures associated with the Manhattan Project and Cold War eras.

Because of the construction of dams and the resulting development elsewhere along the Columbia River, many of the original cultural resources have been destroyed or are under water. The Hanford Site is one of the few remaining archaeologically rich areas in the western Columbia Plateau. Locations along the Columbia River played a central role in the development of the Washane religion, which is still practiced by American Indian tribes in the region. The Hanford Site is considered to be culturally important by many American Indians. Certain sites demonstrate traditional cultural significance because of traditional beliefs, religious practices, and cultural practices.

Recent historic structures are the defense reactors and associated materials-processing facilities that are present on the Hanford Site. Plutonium for the first atomic explosion and the bomb that destroyed Nagasaki to end World War II were produced at the B Reactor on the Hanford Site as part of the Manhattan Project.

ES4.8 Socioeconomic Environment

Activity on the Hanford Site plays a dominant role in the socioeconomics of the Tri-Cities and other parts of Benton and Franklin counties. The Tri-Cities serves as a market center for a much broader area of eastern Washington and northeastern Oregon. Socioeconomic impacts of changes at Hanford are mostly confined to the immediate Tri-Cities community and Benton and Franklin counties (and Yakima County, to a lesser extent).

The 1996 estimated population of the three Tri-Cities was as follows: Richland, 35,990; Pasco, 22,370; and Kennewick, 48,010. Estimates for 1996 placed population totals for Benton and Franklin counties at 131,000 and 43,700, respectively.

Approximately 384,000 people reside within an 80-km (50-mi) radius of the Hanford Site. The minority population within the area consists of about 95,000 people and represents approximately 25 percent of the population. The ethnic composition of the minority population is primarily Hispanic (approximately 80 percent) and American Indian (8 percent). Low-income population represents approximately 42 percent of the households in the area.

Three major sectors have been the principal driving forces of the economy in the Tri-Cities since the early 1970s:

- **DOE and Hanford Site contractors** -- Approximately 11,400 employees worked for DOE and its Hanford contractors in 1996. This number is down from over 19,000 in 1994 due to downsizing activities. An additional approximately 2,000 employees support site cleanup though the "enterprise companies." Future downsizing in Hanford Site employment is anticipated, although the extent of this downsizing is unknown at this time.

- **Washington Public Power and Supply System (WPPSS)** -- In 1995 and 1996, downsizing activities at the WPPSS headquarters decreased employment to about 1,164 workers (down from more than 1,900 in 1994). The decommissioning of the mothballed WPPSS plants (WNP-1 and WNP-4) within the next few years is expected to reduce the number of employees further.

- **Agriculture** -- In 1995, agricultural activities in Benton and Franklin counties were responsible for approximately 9,739 jobs, or 12 percent of the total employment in the area. Area farms and ranches generate a sizable number of jobs in supporting sectors, such as agricultural services (e.g., application of pesticides and fertilizers or irrigation system development) and sales of farm supplies and equipment. More than 20 food processors in Benton and Franklin counties produce items such as potato products, canned fruits and vegetables, wine, and animal feed.

Per capita income in 1994 for Benton County was $22,053, Franklin County was $16,999, and Washington State was $22,526. The median household income in 1994 for Benton County was estimated to be $43,684, Franklin County was estimated to be $31,121, and the State of Washington was estimated at $38,094 (Neitzel et al. 1997).

In 1996, 91 percent of all housing (44,488 total units) in the Tri-Cities was occupied. Single-unit housing, which represents nearly 59 percent of the total units, has a 95 percent occupancy rate throughout the Tri-Cities.

The Hanford Site infrastructure is a significant resource for furthering industrial development of the region. Key elements of this infrastructure include facilities, road and rail systems, utilities, and support services (DOE-RL 1994a).

ES4.9 Visual and Aesthetic Resources

The land in the vicinity of the Hanford Site is generally flat with little relief. Rattlesnake Mountain, rising to 1,060 m (3,477 ft) above sea level, forms the southeastern boundary of the Hanford Site. Gable Mountain and Gable Butte are the highest land forms within the Hanford Site. The view toward Rattlesnake Mountain is aesthetically appealing, particularly in the spring when wildflowers are in bloom. Large rolling hills are located to the west and north. The Columbia River, flowing across the northern part of the Hanford Site and forming the Site's eastern boundary, is scenic with its contrasting blue against a background of brown basaltic rocks and desert sagebrush. The White Bluffs, steep whitish-brown bluffs adjacent to the Columbia River, are a striking natural feature of the landscape.

ES4.10 Contaminated Areas

Three operating areas of the Hanford Site (the 100, 200, and 300 Areas) have been included on the EPA's National Priorities List. Radioactive and hazardous materials have been disposed onsite throughout the period of active Hanford Site operations, resulting in extensive contamination of the vadose zone and groundwater.

The Columbia River has received radiological and chemical contamination as a result of past operations at the Hanford Site. Sediments in the Columbia River contain low levels of Hanford radionuclides (e.g., cobalt-60 and europium-154), metals, and radionuclides from nuclear weapons testing fallout, which collect in slack water habitats.

In the 100 Area, extensive contamination (e.g., strontium-90, tritium, nitrate, and chromium) exists in some areas of surface soils, subsurface soils, and groundwater.

The Central Plateau has been used for fuel reprocessing, waste management, and disposal activities and is the most extensively contaminated area at the Hanford Site. Contaminants include extensive groundwater plumes of technetium-99, iodine-129, nitrate, tritium, uranium, and chlorinated hydrocarbons (e.g., carbon tetrachloride, chloroform, and trichloroethylene).

The 600 Area presents a diverse range of existing contamination. Portions of the 600 Area vadose zone are essentially uncontaminated, while nearby operating areas, such as the 300 Area, present significant environmental remediation challenges. Extensive groundwater contamination (e.g., nitrate, tritium, technetium-99, and iodine-129) is present in the 600 Area.

ES5.0 Environmental Consequences

The future land-use alternatives developed by DOE and the cooperating agencies would have impacts to natural and cultural resources and could affect the socioeconomic environment in the region. The environmental impacts of each land use would depend on its nature, location, and amount of land affected.

ES5.1 Analysis Approach

ES5.1.1 Methods and Assumptions for Estimating Environmental Impacts

The analysis of impacts of alternatives focused on important resource elements are as follows:

- **Key resources**, such as surface water (e.g., the Columbia River), groundwater, and geologic resources
- **Unique features**, such as basalt outcrops, sand dunes and ripple marks, vistas, viewsheds, archaeological and historic sites, and areas of cultural and religious importance to American Indians
- **Species and habitats**, such as plant communities of concern, wildlife and wildlife habitat, aquatic species and habitat, wetlands, and biodiversity.

Plant communities of concern were identified using the classification under the BRMAP (DOE-RL 1996c):

- **Level I** -- Biological resources that require some level of status monitoring because of the recreational, commercial, or ecological role or previous protection status
- **Level II** -- Biological resources that require consideration of compliance with laws such as NEPA and CERCLA
- **Level III** -- Biological resources that require mitigation because the resource is listed by the State of Washington, is a candidate for Federal or state listing, has unique or significant value, has a special administrative designation, or is environmentally sensitive
- **Level IV** -- Biological resources justify preservation because these resources are Federally protected or have regional and national significance. These include high quality or rare plant communities, habitats, and species.

The possible impacts under the nine land-use designations were organized into five impacting activities:

- Mining
- Livestock grazing
- Cultivated agriculture
- Development
- Recreation.

These five impacting activities were used to identify and describe the potential impacts to resource elements under each land-use designation.

ES5.1.2 Methods and Assumptions for Estimating Socioeconomic Impacts

The socioeconomic analysis focused on opportunities for economic development.

ES5.1.2.1 Industrial Land Use. The socioeconomic impacts of the Industrial land use designation were evaluated by comparing the industrial use land area under each alternative to the estimated land needed for industrial development. The Benton County Planning Department estimated industrial land development needs for the next 50 years to be 1,620 ha (4,050 ac).

The area of land designated for Industrial was then correlated with potential employment levels expressed as three ranges: less than 100 employees, 100 to 1,000 employees, and over 1,000 employees. The potential for future Federally sponsored industrial projects was also considered by estimating land available for industrial development land in excess of identified needs.

ES5.1.2.2 Industrial-Exclusive. The Industrial-Exclusive land-use designation applies to the Central Plateau, where DOE would continue to manage Hanford Site waste. In general, this designation involves the same land and activities for all alternatives.

ES5.1.2.3 Agricultural. The evaluation of these impacts was based on the increase in land available for agriculture use, as a percentage of agricultural land in Benton, Franklin, and Grant counties.

Three scenarios for agricultural development on the Wahluke Slope were identified:

- **Scenario 1** -- All agricultural lands would be used to produce a mix of crops similar to those currently produced in the three-county study area. Lands in the BoR's Red Zone would be used for grazing.

- **Scenario 2** -- All agricultural lands would be used to produce a mix of crops similar to those currently produced in the three-county study area.

- **Scenario 3** -- All agricultural lands would be used to produce specialty crops such as irrigated fruits and vegetables. Lands in the BoR's Red Zone would be used for grazing.

ES5.1.2.4 Research and Development. The Research and Development land-use designation involves the siting of large-scale or isolated facilities. This land use designation was evaluated by estimating potential employment levels that could be supported under each alternative.

ES5.1.2.5 High-Intensity Recreation. The High-Intensity Recreation land-use designation would involve intensive development of the Vernita Terrace area along the Columbia River including a B-Reactor Museum, golf course, and a recreational vehicle park at Vernita Terrace. The economic impacts of intensive recreational use were estimated using regional averages of recreational expenditures and data from golf courses in the area.

ES5.1.2.6 Low-Intensity Recreation. The socioeconomic impacts of the Low-Intensity Recreation land-use designation were evaluated using the data for sport fishing and day-use activities.

ES5.1.2.7 Conservation (Mining and Grazing) and Conservation (Mining). Limited mining and grazing would be allowed under this land use. The economic impact of grazing was based on the increase in the number of cattle that could be supported over the current baseline. The economic effects of limited mining under the Conservation land-use designation could not be quantified because of the lack of data on mining in the study area.

ES5.1.2.8 Preservation. The Preservation land-use designation would have little direct impact, but may have indirect impacts in the quality of life, new educational and research opportunities, and ecologically based tourism.

ES5.2 Human Health Impacts

This EIS does not include an extensive analysis of possible human health impacts associated with future land uses under the alternatives. Some health risks from residual contamination are reiterated from the August 1996 Draft HRA-EIS based on a no-action scenario, while other health risks are based on activities that would be expected to occur under different land-use scenarios (e.g., farming versus recreational). Human health risk associated with contamination at the Hanford Site will continue to be addressed through the RCRA and CERCLA processes.

ES5.3 Resource Impacts

ES5.3.1 Geologic Resources

Impacts to unique geologic features would occur from mining under the Conservation land-use designations. Development under the Industrial, Research and Development, and High-Intensity Recreation land-use designations could also result in destruction of unique features. Grazing is not anticipated to have impacts on these features, although overgrazing could result in increased erosion of some features and terracing on the hillsides.

Except for the No-Action Alternative, mining activities would be consistent with the CLUP policies requiring protection of natural and cultural resources. These policies are designed to minimize future impact on unique geologic features. Other mitigation measures that could reduce impacts to unique geologic features include the following:

- Performing scientific investigation of unique features so the scientific value would not be lost
- Regulating recreational uses to protect areas containing unique geologic features
- Employing irrigation methods to minimize groundwater recharge in the White Bluffs area.

ES5.3.2 Water Resources

Surface water resources could be impacted by future land uses in several ways. Water quality could be degraded as a result of industrial wastewater discharges or runoff of agricultural chemicals from cultivated fields or golf courses. Surface water could also be degraded by livestock congregating in the vicinity of the water during dry periods.

Impacts to groundwater could occur as a result of consumptive use or contamination. Contamination could result from infiltration of chemicals from spills or infiltration of agricultural chemicals applied to crops, landscaped areas, or golf courses.

The CLUP planning process would be used to screen development proposals for Hanford Site lands. Some activities would not be permitted and others would be required to incorporate mitigation measures to reduce impacts. Examples of these activities include the following:

- Minimize the use of groundwater
- Restrict irrigated agriculture on the Wahluke Slope or require efficient irrigation methods to protect the White Bluffs
- Designate "no-wake" zones along areas of the Columbia River vulnerable to erosion
- Employ agricultural practices that minimize the use of agricultural chemicals
- Employ agricultural practices that minimize soil erosion
- Using silt fences to contain soil erosion at development sites
- Implement water conservation measures wherever possible
- Implement spill control and cleanup measures to minimize the risk from accidental releases
- Manage grazing activities to minimize livestock access to wetlands and riverbanks.

ES5.3.3 Impacts to Biological Resources

Sensitive biological resources are present on the Hanford Site in association with the Columbia River, basalt outcrops, and other unique features. Biological resource elements considered for each alternative include terrestrial vegetation and habitat, plant communities of concern, wildlife and wildlife habitats, aquatic species and habitats, wetlands, and biodiversity.

ES5.3.4 Mitigation Measures

The CLUP planning process would screen development proposals for Hanford Site lands. Some activities would not be permitted and others would be modified or required to incorporate mitigation measures to reduce impacts. Examples of mitigation measures include the following:

- Eliminate all disturbances around winter roosts for bald eagles and avoid habitat alteration within 402 m (0.25 mi) of bald eagle roosts
- Minimize disturbance of wetlands and replace disturbed wetlands through purchase, construction, or restoration of wetlands
- Compensate for adverse impacts to habitats by restoration of comparable habitats on the Hanford Site
- Revegetate disturbed areas using native vegetation.

ES5.3.5 Cultural Resources

Impacts to cultural resources include damage or destruction of archaeological and historic sites and artifacts, and disruption of religious and traditional uses of the American Indians.

The CLUP planning process described would screen development proposals for Hanford Site lands. Some projects would not be permitted and others may be required to incorporate mitigation measures. Mitigation measures to reduce impacts to cultural resources include the following:

- Conduct cultural resource surveys of proposed project locations
- Avoid conflicts with American Indian traditional and religious uses
- Conduct consultations with the DOE Cultural Resources Program Manager, the Washington State Historic Preservation Office, and American Indian tribal representatives.

ES5.3.6 Aesthetic Resources

Key aesthetic resources include viewing locations, viewsheds, visibility (ambient air quality), and ambient noise levels. Impacts to aesthetic resources would result from altering viewing locations, viewsheds, or visibility through mining or development; releasing atmospheric pollutants from industrial activities; releasing fugitive dust from construction and agricultural activities, and resulting new noise impacts from development, mining, or recreation.

Under all alternatives, new development projects would be subject to a New Source Review (*Washington Administrative Code* [WAC] 173-400) that would identify probable air emissions and air emission control technology required to comply with state air quality standards.

The CLUP planning process would screen development proposals. Proposed projects would be planned to be consistent with the CLUP policies requiring protection of aesthetic resources. Potential mitigation measures for aesthetic resources include the following:

- Implementing dust control measures, such as use of water or other dust suppressants
- Covering loads when hauling materials away from construction or excavation sites
- Siting development or mining activities in areas with the least impact on the viewshed
- Minimizing noise impacts to wildlife.

ES5.3.7 Socioeconomic Impacts

ES5.3.7.1 No-Action Alternative. Under this alternative, facility planning and siting would continue on a project-by-project basis. The potential socioeconomic impacts from this alternative cannot be predicted. The lack of a land-use plan may discourage new uses for the Hanford Site. In the absence of a land-use plan, it is also unlikely that new recreational opportunities would be developed. It is assumed that this alternative would allow industrial development and research and development activities to occur in the southern portion of the

600 Area. The impacts of research and development and industrial development could exceed the City of Richland's capacity to provide supporting infrastructure.

ES5.3.7.2 Preferred Alternative Plan. This alternative would increase the land base available for industrial uses and research and development, which would allow the siting of manufacturing facilities with a total employment of 1,000 or more. Lands under the Research and Development land-use designation could support 100 to 300 employees.

Future industrial development on Hanford Site lands would require additional infrastructure such as roads and utilities. Additional industrial development on Hanford Site lands under the Preferred Alternative could exceed the City of Richland's capacity to provide supporting infrastructure.

The Preferred Alternative would also make much of the Hanford Site available for grazing and mining. This could support approximately 71,813 ha (177,454 ac) grazing with a value of approximately $149,000. This alternative could support existing claims and new claims for sand, gravel, and natural gas development. The possible socioeconomic effects were not estimated in this analysis.

Increased access for recreation under the Preferred Alternative would double the amount of use and result in an additional $1.4 million per year.

ES5.3.7.3 Alternative One. Alternative One would allow continued industrial development and limited recreational uses on Hanford Site lands. The areas allowed for industrial development would exceed the estimated need and would provide land to support possible future DOE missions. This would allow the siting of several manufacturing facilities, with a total employment of 100 to 1,000. Additional industrial development on Hanford Site lands under this alternative could exceed the City of Richland's capacity to provide supporting infrastructure.

Alternative One would allow grazing on the Wahluke Slope, with a value of $23,800. The alternative would allow High-Intensity Recreational uses at the B Reactor and Vernita Bridge, along with additional boat launches along the Columbia River Corridor, which would have economic impacts similar to the Preferred Alternative.

ES5.3.7.4 Alternative Two. Alternative Two would allow limited industrial development and recreational uses on the Hanford Site and would have the least economic potential of the alternatives being considered. The relatively small amount of vacant land designated for industrial development under this alternative would probably limit new industrial employment to less than 100. The Research and Development land uses would be limited to existing uses at LIGO and the K Reactor Basins.

This alternative would allow High-Intensity Recreation associated with the B Reactor museum only. It would not increase recreational access to the river. The economic benefit would be substantially less than those estimated for the recreational uses under the other alternatives.

An economic benefit may be realized from the Preservation land-use designation, which could increase interest in the Hanford Site in the ecologically based tourism market.

ES5.3.7.5 Alternative Three. Alternative Three would have the highest potential for economic development. The economic impact of agricultural development on former Hanford Site lands would increase from 1.7 to 9.4 percent corresponding to $16 million to $88 million (using 1992 prices) in additional revenues. Livestock grazing on the Wahluke Slope would increase the total grazing by 2 percent with an approximate value of $15,000.

Alternative Three would increase the land base available for industrial and research and development uses in Benton County in excess of estimated need. This amount of land would allow the siting of facilities, with a total employment of 1,000 or more. Lands under the Research and Development land-use designation would support total employment of 300 or more. Additional industrial development on Hanford Site lands under this alternative could exceed the City of Richland's capacity to provide supporting infrastructure.

High-Intensity Recreational development of the Vernita Terrace may include a golf course, destination resort, recreational vehicle (RV) park, boat launch, Tribal fishing facilities, cultural centers, and the B Reactor museum. Such developments combined with expanded Low-Intensity Recreation areas along the Columbia River and additional High-Intensity Recreational use near Horn Rapids could contribute to the economy in the study area.

A RV park could generate approximately $1.3 million annually. A golf course could generate approximately $1.4 million annually. Increased access to the Columbia River Corridor under Alternative Three could also generate revenues from sport fishing and other day uses that would be similar to those estimated for the Preferred Alternative.

ES5.3.7.6 Alternative Four. Land for industrial development would exceed the estimated need and provide additional land to support possible future DOE missions. This amount of land would allow the siting of facilities, with a total employment of 100 to 1,000. Land under the Research and Development land-use designation could support 100 to 300 employees.

Alternative Four would provide increased boating access to the Columbia River, which would generate increased revenues from sport fishing and recreational boating, similar to those estimated for the Preferred Alternative.

ES5.4 Environmental Justice Impacts

Under the Executive Order for Environmental Justice (Executive Order 12898, 59 FR 32), Federal agencies are required to identify and address disproportionately high and adverse human health or environmental effects of programs on minority and low-income populations.

Disproportionately high and adverse human health effects occur when the risk or rate for a minority population or low-income population from exposure to an environmental hazard significantly exceeds the risk or rate to the general population and other appropriate comparison groups. A disproportionately high environmental effect refers to an impact (or risk of an impact) in a low-income or minority community that significantly exceeds the impact on the larger community.

A total population of approximately 384,000 people reside within an 80-km (50-mi) radius of the Hanford Site. The minority population within the area consists of approximately 95,000 people and represents approximately 25 percent of the population. The ethnic composition of the minority population is primarily Hispanic (approximately 80 percent) and American Indian (8 percent). Census tracts where the percentage of minority persons within the population exceeds 20 percent are located to the southwest and northeast of the Hanford Site and within the City of Pasco, Washington.

The low-income population within the 80-km (50-mi) area of impact represents approximately 42 percent of households within the area. Census tracts where the percentage of the population consisting of low-income households exceeds 25 percent are principally located to the southwest and north of the Hanford Site and within the City of Pasco, Washington. Considerable overlap between low-income populations and minority populations exists in the vicinity of the Hanford Site.

Increased human health risk would be associated with Agricultural, Industrial, and Research and Development processes and High-Intensity Recreation uses. Of these, the Agricultural land-use designation is the most likely to have disproportionately high human health effects in minority or low-income populations because agricultural jobs generally have higher health risks and are often filled by minority or low-income individuals. Alternative Three is the only alternative that involves agriculture. The other alternatives would have lesser human health risk, mainly associated with Industrial processes, and High-Intensity Recreation uses.

ES5.4.1 Health Impacts from Subsistence Consumption of Fish and Wildlife

Data from monitoring programs have not indicated that excessive health risks would be associated with consumption of fish and game. The radiation dose received by a person who was subsisting on wild game and fish would be higher than the 2.3×10^{-2} mrem reported by Pacific Northwest National Laboratory (PNNL) (PNL 1996b). However, this additional dose would be unlikely to be sufficiently high to cause adverse health effects.

The *Screening Assessment and Requirements for a Comprehensive Assessment, Columbia River Comprehensive Impact Assessment* (CRCIA) (DOE 1998) evaluated both chemical and radiological health risk potential for a variety of site use scenarios including Native American subsistence scenarios. In these Native American scenarios, people who live along the Columbia River were assumed to eat substantial quantities of food grown in the riparian zone, fish and wildlife from the river, and to drink seep water would have a much larger potential exposure and, thus, estimated health risk. Lifetime health risk greater than 1 in 10,000 were found for many sections of the river for chromium, copper, strontium-90, uranium-238, lead, and tritium. Although many cultural differences exist between the general population and American Indians, the common pathways of food and water consumption could affect both groups.

ES5.4.2 Environmental Impacts to Low-Income and Minority Populations

Low-income and minority populations in the vicinity of the Hanford Site could be affected by potential socioeconomic impacts and impacts to biological and cultural resources valued by American Indians.

ES5.4.3 Environmental Justice Impacts to American Indians

Under separate treaties signed in 1855, lands occupied by the present Hanford Site were ceded to the United States by the Confederated Tribes and Bands of the Yakama Indian Nation and by the CTUIR. Under these treaties, the Tribes retained the right to fish in their usual and accustomed places in common with the citizens of the Territories. The treaties also retained to the Tribes the privilege of hunting, gathering roots and berries, and pasturing horses and cattle on open unclaimed lands. The 1855 Treaty with the Nez Perce also retained the right to fish at usual and accustomed places. The Wanapum People did not sign a treaty with the United States and are not a Federally recognized tribe; however, the Wanapum

People were historical residents of what would become the Hanford Site and their interests in the area have been acknowledged.

The Tribal fishing rights reserved under the treaties have been recognized as effective within the Hanford Reach. The Tribes also have an interest in renewing traditional uses, such as gathering of foods and medicines, hunting, and pasturing horses and cattle on Hanford Site lands.

Future opportunities of the Tribes to exercise reserved treaty rights are dependent upon the health of the ecosystems. The Tribes assert that a treaty-given right to hunt, fish, or gather plants is diminished (if not voided) if the fish, wildlife, or plants have vanished or are contaminated to the extent that they threaten human health. These resources, particularly the resources with cultural and religious connotations, do not have equivalent value for the general population. Consequently, impacts to these resources represent an environmental justice impact to American Indian populations.

Cultural and biological resources valued by American Indians have, in effect, been preserved by the presence of the Hanford Site. The Conservation and Preservation land-use designations would continue to protect these resources and may allow the tribes to resume traditional uses of these resources. However, the Agricultural, Industrial, and High-Intensity Recreation land-use designations are likely to result in damage or destruction of cultural and biological resources important to the Tribes. The Industrial-Exclusive, Research and Development, and Low-Intensity Recreation designations would be less likely to result in resource destruction. However, these uses may not be compatible with traditional subsistence uses by the Tribes.

High promontories that provide a commanding and panoramic view of the surrounding terrain are culturally significant to American Indian tribes, which historically used the land that would become the Hanford Site. Alteration of the viewshed from these sites could disproportionately impact American Indians. This alteration could occur under the Agricultural, Industrial, Research and Development, and High-Intensity Recreation land-use designations. Mining activities under the Conservation designation could also have adverse effects, either directly by mining of basalt outcrops or indirectly by altering the viewshed. Mining of the basalt outcrops would be considered an environmental justice impact, because these sites are sacred to American Indians but are of less significance to the general population.

ES5.5 Cumulative Impacts

Cumulative impacts result from the incremental impact of the action when added to other future actions, regardless of what agency or individual is involved.

ES5.5.1 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve)

No new actions are presently planned for the ALE Reserve.

ES5.5.2 Wahluke Slope

No new actions are presently planned for the Wahluke Slope.

ES5.5.3 Columbia River

Present and reasonably foreseeable actions with the Columbia River include the following:

- **U.S. Department of Interior Hanford Reach of the Columbia River Final EIS for Comprehensive River** -- The selected alternative would combine a Wild and Scenic River designation for the river and its immediate corridor with a National Wildlife Refuge (NWR) designation for the upland areas north and east of the river.

- **Decommissioning of eight surplus production reactors** -- DOE actions will involve continued surveillance and maintenance, followed by transport of reactor blocks from the 100 Areas to the 200 Areas for disposal. Portions of the B Reactor may be preserved for display in recognition of the cultural significance of the reactor.

- **Management of spent nuclear fuel from the K Basins** -- Fuel from the K Basins would be removed, packaged, and moved to the 200 Areas for treatment and storage.

- **Deactivation of the N Reactor** -- The N Reactor would be shutdown and deactivated to prepare the reactor for decommissioning.

ES5.5.4 200 Areas

Present and reasonably foreseeable actions include the following:

- **Tank Waste Remediation System (TWRS)** -- DOE plans to store tank wastes until retrieved in a demonstration phase. The successful completion of this phase would lead to the full-scale production phase. Potential impacts include worker exposures to radiological and hazardous waste, and disturbance of 138 ha (340 ac) of shrub-steppe habitat.

- **Plutonium Finishing Plant Stabilization** -- DOE plans to stabilize and store all forms of plutonium in the facility. Potential impacts include a 14 person-rem exposure to the offsite population, and 155 person-rem exposure to Hanford Site workers. During this action, the Plutonium Finishing Plant workforce would increase from 592 to 654 workers and eventually decline after 2002 to approximately 254.

- **Environmental Restoration Disposal Facility (ERDF)** -- The ERDF provides for storage and disposal of waste generated during environmental restoration activities. The ERDF will be expanded, as needed, ultimately covering as much as 4.1 km^2 (1.6 mi^2) of priority shrub-steppe habitat. Operation of the ERDF provides up to 167 full-time positions at the Hanford Site.

- **Programmatic Spent Nuclear Fuel Management EIS** -- The ROD for this EIS establishes DOE's policies for management of spent nuclear fuels. The selected alternative -- regionalization of spent nuclear fuel storage by fuel type -- requires management of Hanford Site spent fuel at the Hanford Site and transport. Land disturbance associated with this action at the Hanford Site is estimated at 7 ha (18 ac) of shrub-steppe habitat. Estimates of employment range from 176 to 1,065 employees during the years from 1997 to 2000, declining to approximately 208 to 230 employees through 2004, with levels gradually declining to 50 to 60 workers beyond the year 2004.

- **Hanford Spent Nuclear Fuel Management EIS** -- Fuel from the K Basins will be treated, packaged, and stored for up to 40 years at a new facility being built at Hanford. A total of 3.5 ha (8.7 ac) of land and native vegetation would be disturbed or destroyed for this project.

- ***Management of Hanford Site Non-Defense Production Reactor Spent Nuclear Fuel* (DOE/EA-1185)** -- The approved action would result in approximately 28 metric tonnes (31 tons) of nondefense spent nuclear fuel being stored at the Canister Storage Building Complex at the Plutonium Finishing Plant. The approved action includes the construction of a 200 Area Interim Storage Area.

- **200 Area Effluent Treatment Facility Environmental Assessment** -- The 200 Area Effluent Treatment Facility provides effluent treatment and disposal capability required to reduce tank waste volume. Environmental impacts of this project include habitat destruction associated with the construction of the treatment facility and associated features.

- **Operation of Low-Level Burial Grounds** -- The low-level burial grounds cover 225 ha (556 ac) in the 200 Areas. Impacts associated with operation of the burial grounds include habitat disturbance or loss.

- **Treatment and Storage of Transuranic Waste EIS** -- According to the ROD, the Hanford Site will store its transuranic waste onsite. In the future, DOE may decide to ship transuranic waste from sites where it is impractical to prepare them for disposal to sites where DOE has or will have this capability. The sites that could receive such shipments include the Hanford Site.

- **Hanford Site Solid (Radioactive and Hazardous) Waste Programs EIS** -- This EIS will provide a comprehensive analysis of the impacts of alternatives for managing radioactive and hazardous waste on the Hanford Site. Some of the alternatives being considered include disposal of this waste on the Hanford Site.

- **Operation of the U.S. Ecology, Inc., Commercial Low-Level Radioactive Waste Landfill for offsite commercial waste** -- U.S. Ecology, Inc., operates a radioactive waste landfill that accepts commercially generated low-level wastes. Habitat disturbance is the primary impact associated with the facility.

- **Solid Waste Retrieval Complex, Enhanced Radioactive and Mixed Waste Storage Facility, infrastructure upgrades, and Central Waste Support Complex** -- This environmental assessment addressed the construction of the solid waste retrieval complex, enhanced radioactive and mixed waste storage facility, infrastructure upgrades, and Central Waste Support Complex. These projects involve approximately 36 ha (89 ac) in the 200 West Area. Although most activities will occur in previously disturbed areas, the waste storage facility will be constructed on relatively undisturbed shrub-steppe habitat.

- **Disposal of decommissioned, defueled cruiser, Los Angeles Class, and Ohio Class Naval Reactor Plants** -- This final EIS, prepared by the U.S. Navy, evaluates the potential impacts of disposing of approximately 100 defueled reactor plants from decommissioned naval vessels. The selected alternative is to transport the reactor plants, by barge, to the low-level burial grounds at the Hanford Site.

ES5.5.5 Other Hanford Site Areas

Present and reasonably foreseeable actions in other Hanford areas include the following:

- **Laser Interferometer Gravitational-Wave Observatory (LIGO) on the Hanford Site** -- The LIGO site occupies approximately 6 km^2 (2.3 mi^2). The facility accommodates 10 to 20 permanent staff, with an additional 10 visiting scientists.

- **Inert/Demolition Waste Landfill (Pit 9)** -- DOE is proposing using an existing gravel pit, approximately 3 km (1.9 mi) north of the 300 Area, as a new inert and demolition waste landfill for the Hanford Site. Impacts associated with this action include minor habitat disturbances.

- **Fast Flux Test Facility (FFTF)** -- The FFTF is a 400-megawatt thermal liquid, metal-cooled (sodium) nuclear test reactor located in the 400 Area. Deactivation of the FFTF was initiated in 1995. However, in November 1995, irreversible deactivation activities were halted. In January 1997 the U.S. Secretary of Energy announced the decision to maintain the FFTF in a standby capacity to evaluate the potential use of FFTF for a tritium source and to produce medical isotopes.

- **Plutonium Disposition EIS** -- This EIS will examine alternatives and environmental impacts for the construction and operation of facilities for plutonium disposition. The proposed action includes facilities to disassemble weapon components and convert plutonium into an oxide, a facility to immobilize plutonium in a glass or ceramic form for disposition in a geologic repository, and a facility to fabricate mixed oxide nuclear fuel. Hanford Site facilities in the 400 Area are under consideration for each of these three types of facilities.

ES5.6 Present and Reasonably Foreseeable Actions Adjacent to the Hanford Site

- **Offsite thermal treatment of low-level mixed waste** -- The Allied Technology Group (ATG) facility would be located adjacent to the Hanford Site boundary in the northeast corner of the City of Richland. Approximately 5,120 m^3 (6,696 yd^3) of contact-handled low-level mixed waste would be shipped from the Hanford Site to the ATG facility for treatment.

Land-use planning efforts for areas outside of and surrounding the Hanford Site are currently being undertaken by Benton, Franklin, and Grant counties; and by the City of Richland. These planning efforts will establish land uses that will be permitted by local governments in areas surrounding the Hanford Site.

ES5.7 Other NEPA Considerations

ES5.7.1 Unavoidable Adverse Impacts

Unavoidable adverse impacts are impacts that would occur after implementation of all feasible mitigation measures. The greatest potential for unavoidable adverse impacts is associated with more intensive land uses and the area extent of those uses in each alternative. These impacts would principally be associated with the degree of disturbance of sensitive habitats and loss of cultural resources.

ES5.7.2 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources are related to use of nonrenewable resources and the effects that consumption of those resources could have on future generations. Irreversible effects occur as a result of use or destruction of a resource (e.g., energy and minerals) that cannot be replaced within a reasonable time. Irretrievable resources commitments involve the loss in value of an affected resource that cannot be restored (e.g., extinction of a species or disturbance of a cultural site).

ES6.0 Implementation of the Comprehensive Land-Use Plan

This section provides an overview of the procedures and guidance for implementing the CLUP. The CLUP would provide the framework within which future use of the Hanford Site's lands and resources would occur. This framework consists of four basic elements:

1. ***Hanford CLUP land-use map***, depicting the desired future pattern of land
2. ***Hanford CLUP land-use definitions***, describing the purpose, intent, and principal use(s) of each of the land-use designations on the map
3. ***Hanford CLUP policies***, directing future land-use actions
4. ***Hanford CLUP implementing procedures***, which include
   - Administrative procedures for reviewing and approving Use Requests
   - A Site Planning Board (SPB) consisting of representatives from the cooperating agencies and the affected Tribes.

For DOE projects, the above procedures and actions shall be integrated with existing DOE land-use review procedures (e.g., biological, cultural, and NEPA procedures).

ES6.1 Definitions and Descriptions of Land-Use Map Designations

The land-use designations of each alternative land-use map depict land uses that could occur on the Site. The definitions of the various land-use designations are provided in Table ES-1. These land-use designations and their definitions and descriptions were co-developed by the cooperating agencies and are discussed in greater detail in Chapter 3 of this HRA-EIS.

ES6.2 Hanford CLUP Policies

The Hanford CLUP policies connect all other CLUP elements as follows:

- Establish hierarchies, priorities, and standards relating to land use, resource use, and values
- Integrate competing land and resource goals and objectives

- Provide reference points for addressing unanticipated circumstances and making actual amendments to the CLUP when necessary

- Identify which Resource Management Plans (RMPs) or Area Management Plans (AMPs) shall be developed or undertaken as part of the CLUP implementation.

ES6.2.1 Policy 1, Overall Policy

The CLUP policy is to accomplish the following for the Hanford Site:

1. Protect the Columbia River and associated natural and cultural resources and water quality.

2. Wherever possible, locate new development in previously disturbed areas.

3. Protect and preserve the natural and cultural resources of the Hanford Site for the enjoyment, education, study, and use of future generations.

4. Honor treaties with the American Indians as the treaties relate to land and resource uses.

5. Reduce the area of the 200 Area exclusive use zone (EUZ) (safety boundary).

6. Allow access for other uses consistent with administrative controls.

7. Ensure that a public-involvement process is used for implementing and amending the CLUP.

8. As possible, remove pre-existing, nonconforming uses.

9. Facilitate the accomplishment of cleanup and waste management objectives.

ES6.2.2 Policy 2, Protection of Environmental Resources

The CLUP policy is to accomplish the following for the Hanford Site:

1. Protect and sustain native species and their habitats on the Site. The Conservation and Preservation land-use designations are the primary land-use controls to accomplish this policy.

2. Within land-use designations other than Conservation and Preservation, mitigate avoidable impacts to enhance habitats within the Conservation or Preservation designations.

3. Require that projects be set back from the Preservation and Conservation boundaries.

ES6.2.3 Policy 3, Protection of Cultural Resources

The CLUP policy is to accomplish the following for the Hanford Site:

1. Protect and sustain cultural resources on the Site. The Conservation and Preservation land-use designations are the primary land-use controls to accomplish this policy.

2. Proposed developments within areas of cultural sensitivity (e.g., the Columbia River Corridor), should be reviewed and approved in accordance with the CRMP.

ES6.2.4 Policy 4, Siting New Development

The CLUP policy is to accomplish the following for the Hanford Site:

1. Locate and approve new developments consistent with the CLUP.

2. Locate proposed DOE projects in those areas where the CLUP and the local cities' and counties' land-use maps are consistent.

3. Within all land-use designations, previously disturbed areas should be developed first, followed by the acreages with the least sensitive biological and cultural resources.

4. Focus on using existing infrastructure and developed areas for new projects and locate, plan, and design the development to avoid significant impacts on resources.

ES6.2.5 Policy 5, Utility and Transportation Corridors

The CLUP policy is to accomplish the following for the Hanford Site:

1. Existing corridors are preferred for expanded capacity and new infrastructure.

2. Existing corridors that are in use are "conforming" uses in land-use designations.

3. Nonconforming corridors shall be identified in the RMP or AMP.

4. Avoid establishing new corridors within the Conservation and Preservation designations.

5. Avoid the location of new corridors in the viewshed of an American Indian sacred site. Prioritize, for removal, existing nonconforming corridors and systems in such areas.

ES6.2.6 Policy 6, Economic Development and Diversification

It is the CLUP policy to promote the following for the Hanford Site:

1. Multiple land uses of both the private and public sector.

2. Protection and maintenance of existing infrastructure and utilities for economic diversification and Site transition.

3. Future Federal missions and programs, consistent with the provisions of the CLUP.

4. Protection of natural, historic, and cultural resources as essential elements of a recreation and tourism economy.

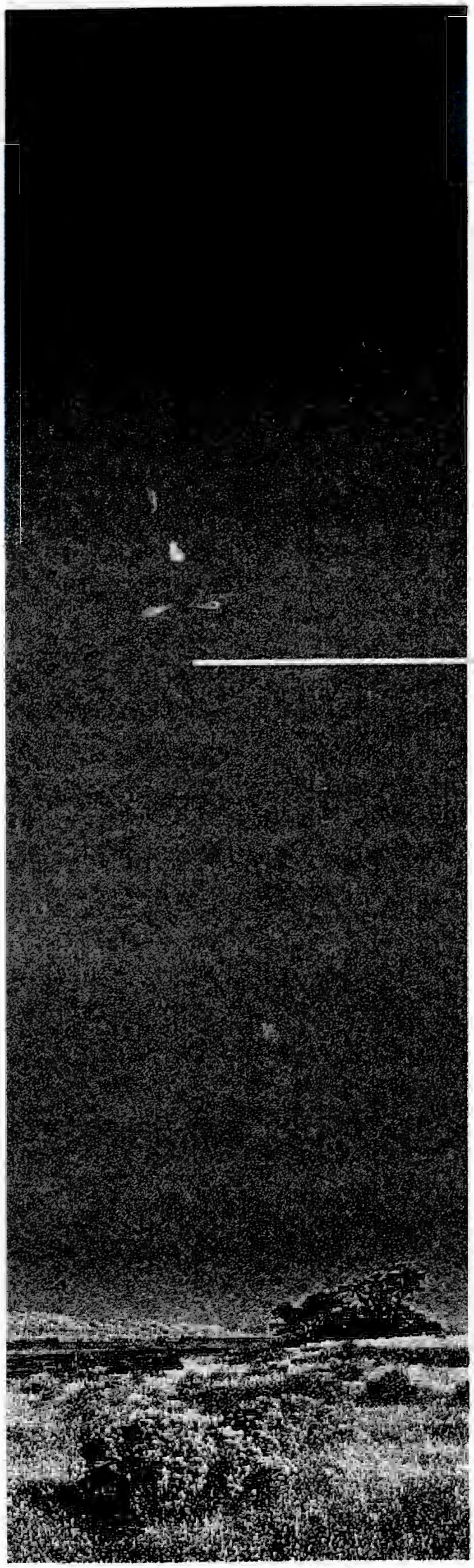
5. Reduction or elimination of existing conditions which are impediments to the realization of the land-use designations.

ES6.3 Organizational Structure and Procedure for Review and Approval of Use Requests

It is intended that the existing organizational structure within DOE be used to implement the Hanford CLUP, augmented with the SPB consisting of representatives from cooperating agencies and affected Tribal governments.

It is recommended that the CLUP map and policies be integrated with and addressed at the threshold decision points of all authorizations, operational plans (e.g., the Hanford Strategic Plan), and actions. This includes contracts and budget proposals that directly or indirectly effect land use on the Site so they will not create conflicts with the CLUP, or fail to forward its map and policy objectives where the opportunity and ability to do so exists.

DOE/EIS-0222D



Revised Draft Hanford Remedial Action Environmental Impact Statement

April 1998

U.S. Department of Energy

Washington, D.C.

THIS PAGE INTENTIONALLY
LEFT BLANK

Cover Sheet

Lead Federal Agency: U.S. Department of Energy

Cooperating Agencies: U.S. Department of the Interior- Bureau of Land Management, Bureau of Reclamation, and Fish and Wildlife Service; Benton, Franklin, and Grant counties; and the City of Richland

Consulting Agencies: Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation

Title: *Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan*

Contacts: For further information on this Environmental Impact Statement call or contact:

Thomas W. Ferns, NEPA Document Manager
Hanford Remedial Action
Environmental Impact Statement
U.S. Department of Energy,
Richland Operations Office
P.O. Box 550, MSIN HO-12
Richland, Washington 99352
(509) 372-0649 or thomas_w_ferns@rl.gov

For general information on the U.S. Department of Energy's *National Environmental Policy Act of 1969* (NEPA) process, call 1-800-472-2756 to leave a message, or contact:

Carol Borgstrom, Director
Office of NEPA Policy and Assistance (EH-42)
U.S. Department of Energy
1000 Independence Avenue SW
Washington, D.C. 20585
(202) 586-4600

Abstract: The U.S. Department of Energy (DOE) prepared this *Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* (HRA-EIS) to evaluate the potential environmental impacts associated with implementing a comprehensive land-use plan for the Hanford Site over the next 50 years. Working with Federal, state and local agencies, and American Indian tribal governments, DOE evaluated six land-use alternatives.

The Hanford Site occupies 1,517 square kilometers (km^2) (586 square miles [mi^2]) in southeastern Washington. For over 40 years, the primary mission at Hanford was the production of nuclear materials for national defense.

Today, the Hanford Site has a diverse set of mission elements associated with environmental restoration, waste management, and science and technology. These mission elements have resulted in the growing need for a comprehensive, long-term approach to planning and development for the Site.

Public Comments: The Revised Draft Environmental Impact Statement is available for review and comment on the internet at: . Written comments on the Revised Draft Environmental Impact Statement will be accepted from xxxx to xxxx, 1998, at the Washington State or internet address provided above. The U.S. Department of Energy will consider these public comments in preparing the Final Environmental Impact Statement and Record of Decision.

This page intentionally left blank.

Table of Contents

1.0 Introduction 1-1

1.1 Historic Background 1-2
1.1.1 Early Land Use of the Region 1-2
1.1.2 Establishment of the Hanford Site 1-5
1.1.3 Change in Mission from Defense Production to Environmental Restoration 1-5

1.2 The *National Environmental Policy Act* Process 1-7
1.2.1 Scope of the *Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* 1-7
1.2.1.1 Public Review of the *Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* 1-8
1.2.2 External Coordination/Involvement in the Preparation of the *Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* 1-8
1.2.3 Identification of Public Land-Use Values 1-9
1.2.4 Development of the August 1996 *Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* . . . 1-10
1.2.5 Public Review of the August 1996 *Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* . . . 1-11
1.2.5.1 Major Issues 1-11
1.2.6 Biodiversity in the *National Environmental Policy Act* Process 1-12
1.2.7 Environmental Justice in the *National Environmental Policy Act* Process . 1-13

1.3 Other Ongoing Major Federal Actions and *National Environmental Policy Act* Documents 1-13

1.4 Hanford Site Planning Efforts 1-21
1.4.1 Hanford Site Planning Documents 1-21
1.4.2 Integrating Planning Efforts by Other Governments and Agencies 1-22
1.4.2.1 A Tribal View of Tribal Rights. 1-22
1.4.2.2 DOE's View of Tribal Rights. 1-22
1.4.2.3 Other Federal Agencies 1-23
1.4.2.4 Confederated Tribes of the Umatilla Indian Reservation (CTUIR) . 1-24
1.4.2.5 Local Governments 1-25
1.4.3 Federal Land Transfer Procedures 1-28

Figures

1-1. Location of the Hanford Site 1-3
1-2. Pre-Hanford Benton County Lands - 1943 1-6
1-3. Benton County Proposed Critical Areas Map 1-26
1-4. City of Richland Urban Growth Area 1-27
1-5. Wahluke 2000 Plan Map 1-29

Tables

1-1. NEPA Reviews Affecting the Hanford Site 1-14
1-2. SEPA Reviews Affecting the Hanford Site 1-18
1-3. CERCLA Reviews Affecting the Hanford Site 1-20
1-4. Regulations Affecting Land Transfer 1-30

1.0 Introduction

The U.S. Department of Energy's (DOE) Hanford Site is a geographically diverse land area in southeastern Washington State. About 6 percent of the site is pockets of radioactive and hazardous material contamination (listed on the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* [CERCLA] National Priorities List), surrounded by large areas of pristine shrub-steppe habitat. The last free-flowing stretch of the Northwest's Columbia River bisects this land of contrast extremes.

The DOE has prepared this *Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land-Use Plan* (HRA-EIS) to evaluate the potential environmental impacts associated with implementing a comprehensive land-use plan for the Hanford Site. The DOE will use this land-use plan in its decision-making process to establish what is the best use of the land.

From this land-use plan, there are three benefits for DOE:

- As a Natural Resource Trustee, DOE is required to further the goals of biodiversity and actively manage the land's intrinsic resources and future development.

- Federal regulations require that executive agencies hold only that land necessary to economically and efficiently support agency missions[1].

- This land-use plan can be used to set a goal for the CERCLA/*Resource Conservation and Recovery Act of 1976* (RCRA) cleanup (i.e., remediation) processes. In turn, the CERCLA/RCRA processes evaluate the technical and economic feasibility of remediating the area to support the proposed land use. If the remediation process cannot support the proposed land use, then this EIS contains a proposed process for changing the desired land use (see Chapter 6).

In this EIS, DOE is working with Federal, state, and Tribal agencies to evaluate several land-use alternatives; specifically, the potential environmental consequences associated with each alternative plan over the next 50-year time frame. These individual future land-use plans, together with a common set of policy statements, represent the distinct alternatives developed by the cooperating agencies.

---

[1]Specifically, Executive Order 12312, *Federal Real Property Management*, requires executive agencies to ensure the effective use of real property in support of mission-related activities. Also, to stimulate the identification and reporting of excess real property and to achieve maximum utilization, the *Federal Property and Administrative Services Act of 1949*, as amended, requires all executive agencies to periodically review their real property holdings. These reviews identify property which is "not needed," "underutilized," or "not being put to optimum use." Property determined to be excess should be promptly reported to the General Services Administration (DOE 1997c).

The HRA-EIS provides environmental review for the following DOE actions:

- Designation of existing and future land uses for the Hanford Site.
- Incorporation of site-specific CERCLA Record of Decision (ROD) decisions into a regional land-use planning process.

1.1 Historic Background

> ***How Big is Hanford?***
>
> The Hanford Site is 1,517 square kilometers (586 square miles). Each square mile is 1,609 meters (5,280 feet) to a side. A square mile is also known as a section; equal to 259.2 hectares (640 acres). Typically, in eastern Washington agriculture, four 65 ha (160 ac) center-pivot circle irrigation systems would occupy each section.
>
> In this document, all measurements are in metric units, followed by the British equivalents. Department of Energy documents use metric units as required by Executive Order 12770, "Metric Usage in Federal Government Programs"; the Metric Conversion Act of 1975 (Public Law 94-168, as amended by Public Law 100-418); and various Title 15, Code of Federal Regulations parts and subparts.

The Hanford Site occupies 1,517 square kilometers (km^2) (586 square miles [mi^2]) in the southeastern portion of the State of Washington (see *"How Big is Hanford?"* and Figure 1-1, Location of the Hanford Site). Established by the Federal government in 1943, the Hanford Site is owned by the Federal government and is managed by the U.S. Department of Energy, Richland Operations Office (RL).

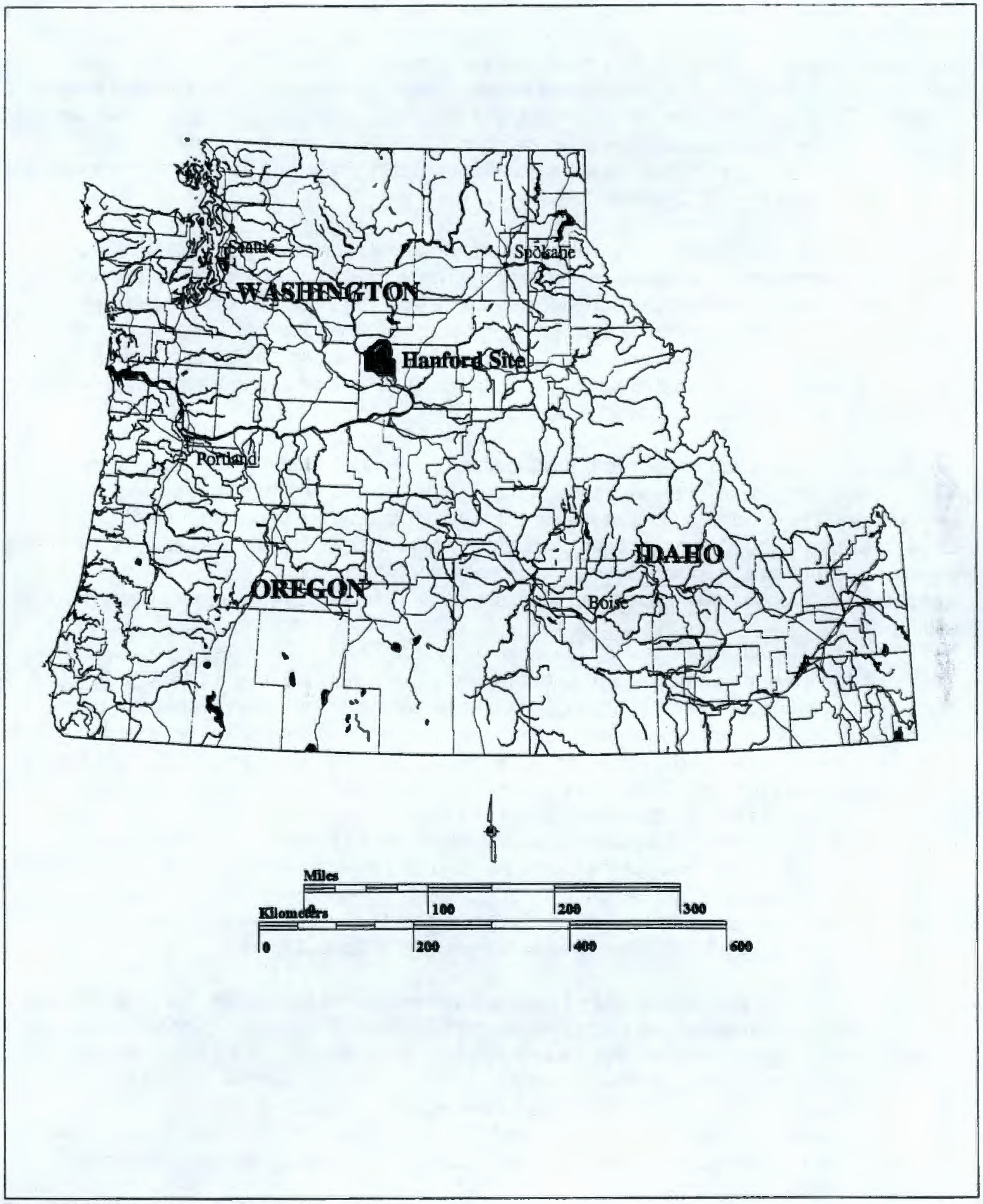
1.1.1 Early Land Use of the Region

The Hanford Site is located within the Pasco Basin, a unique feature of the Columbia Plateau. The basin is the only area along the mid-Columbia River where the river is not confined within a gorge. Instead, the river is bounded by wide expanses of uplands. During the pre-contact era, these uplands contained abundant natural resources, including native plants, wildlife, and geologic resources. In addition, the Pasco Basin is where the Snake River and the Yakima River join the Columbia River, providing a wealth of riparian areas as well as an excellent means of transportation throughout the semi-arid inland northwest. These rivers once contained enormous fisheries of salmon, steelhead, sturgeon, eels, and other aquatic resources.

These physical features of the Pasco Basin made the basin highly attractive to America Indian tribes. Archeologic evidence has demonstrated their presence in the area for more than 10,000 years. Tribal oral histories confirm that tribes have been in the region for a very great period of time. The near-shore areas of these rivers contained many village sites, fishing and fish processing sites, hunting areas, plant gathering areas, and religious sites, while upland areas were used for hunting, plant gathering, religious practices, and overland transportation.

For at least the past several thousand years, the Pasco Basin was a major economic hub in the larger Columbia River Basin trading region. The Pasco Basin's location along the main travel corridor between Puget Sound and the Great Plains meant American Indian tribes in the area were extensively involved in inter-regional economic activity. As a result, the Pasco Basin was relatively densely populated and contained a diversity of tribes and bands. The arrival of the horse in the region around 1700 greatly increased the distances that could be traveled by

Figure 1-1. Location of the Hanford Site.



BHI:rpp 01/13/98 draft_2/region1.aml Database: 13-JAN-1998 individuals, and by tribes and bands, further increasing the intensity of trade, warfare, and other interaction between groups. The arrival of the horse also initiated a period during which American Indians of the region began keeping large herds of domesticated horses.

The first European-American trappers and traders began arriving in the region around 1800. Their goals were to acquire furs to sell in Asia and Europe. Lewis and Clark arrived in the fall of 1805 to establish the United States' territorial claim to the region. Trapping organizations such as the Hudson's Bay Company and the Northwest Bay Company became increasingly active in the years after the Lewis and Clark expedition. These arrivals were followed by Catholic and Protestant missionaries. Catholic missionaries briefly established a mission at Columbia Point (the confluence of the Yakima and Columbia Rivers). Although the Oregon Trail was established in 1843, and large numbers of non-Indians came to the Northwest via that trail, very few settled in the Pasco Basin, preferring instead to continue on to the Willamette Valley of Oregon.

In 1855, U.S. Representatives Isaac Stevens and Joel Palmer negotiated treaties with many of the American Indian tribes in the region. These treaties called for the relocation of those tribes to permanent reservations located away from the Pasco Basin. The tribes retained in their treaties, however, the right to travel to "usual and accustomed fishing areas" and to hunt, gather plants, and pasture livestock on "open and unclaimed lands" where they traditionally had conducted these activities. As a result, American Indian travel to the Pasco Basin to use its resources continues to this day.

There were other exceptions to the relocation of American Indians. Peopeomoxmox, a Walla Walla negotiator of the treaty between the United States and the Cayuse, Walla Walla, and Umatilla Tribes, retained in that document the right to operate a trading post at Columbia Point. In addition, the Wanapum Band, which did not negotiate a treaty with the United States, remained resident in the Pasco Basin. Nevertheless, over the following 88 years, the Wanapum came under ever-increasing pressure as non-Indian homesteaders seized much of their lands.

Significant non-Indian settlement of the region began relatively late. In 1888, small irrigation companies and farmer cooperatives began to develop irrigation systems in the Columbia Basin. The agricultural economy of the region saw upswings and downswings, from agricultural price increases during World Wars I and II, drought during the 1920s, and the Great Depression during the 1930s. As a result, by the end of 1942, approximately one-half of the lands that would become the Hanford Site were still publicly owned. While, principally, non-Indian farmers lived on the adjacent private lands, members of the Wanapum Band continued to reside on portions of the future Hanford Site that remained in Federal ownership. In 1942, approximately 19,000 people lived in Benton and Franklin counties. Pasco was the largest population center, with approximately 3,900 people (Gerber 1992). The City of Richland had a population of approximately 200 people (Relander 1986).

In the 1940s, almost all of the land that would at some time be considered part of Hanford was being used for crops or grazing. More than 88 percent (about 152,971 ha [378,000 ac]) was sagebrush range land interspersed with volcanic outcroppings, where some 18,000 to 20,000 sheep grazed during winter and spring. Some 11 percent (almost 19,830 ha [49,000 ac]) was farmland, much of it irrigable but not all under cultivation. Less than 1 percent (less than 809 ha [2,000 ac]) consisted of town plots, rights of way, school sites, cemeteries, and similarly used land, most of it in or near the three small communities of Richland, Hanford, and White Bluffs (Jones 1985).

More than one-third of the Hanford area at the time was government-owned. The Federal government owned nearly 28,733 ha (71,000 ac); the State of Washington over 18,211 ha (45,000 ac); and the five local counties (i.e., Benton, Yakima, Grant, Franklin, and Adams) about 16,592 ha (41,000 ac). More than 91,054 ha (225,000 ac) belonged to private individuals or to corporate organizations, including over 2,428 ha (6,000 ac) owned by several irrigation districts (Jones 1985). Figure 1-2 provides an example of pre-Hanford Benton County lands in 1943.

1.1.2 Establishment of the Hanford Site

The entry of the U.S. into World War II and the race to develop an atomic bomb led to a search for a suitable place to locate plutonium production and purification facilities. The U.S. Army Corps of Engineers (USACE) selected the site near the towns of White Bluffs and Hanford because of the remote location, good climate, and, most important, the abundant supply of hydroelectric power and clean water from the Columbia River. The selection was made in early 1943 and land acquisition proceedings began. The War Department began with condemnation of private lands, followed by appraisals, negotiations, and payments to landowners. Some property owners protested the offered purchase prices and won larger settlements through the courts. Originally, 1,605 km^2 (620 mi^2) were acquired through a combination of withdrawal of lands from the Public Domain and the acquisition of state and privately owned lands. The towns of Hanford and White Bluffs were vacated, the Wanapum were relocated to above the Priest Rapids area, and Richland was transformed into a government town. The U.S. Atomic Energy Commission (AEC) leased an additional 70,000 ha (173,000 ac) as secondary control zones. These secondary zones were released in 1953 and 1958 (Ecology 1993).

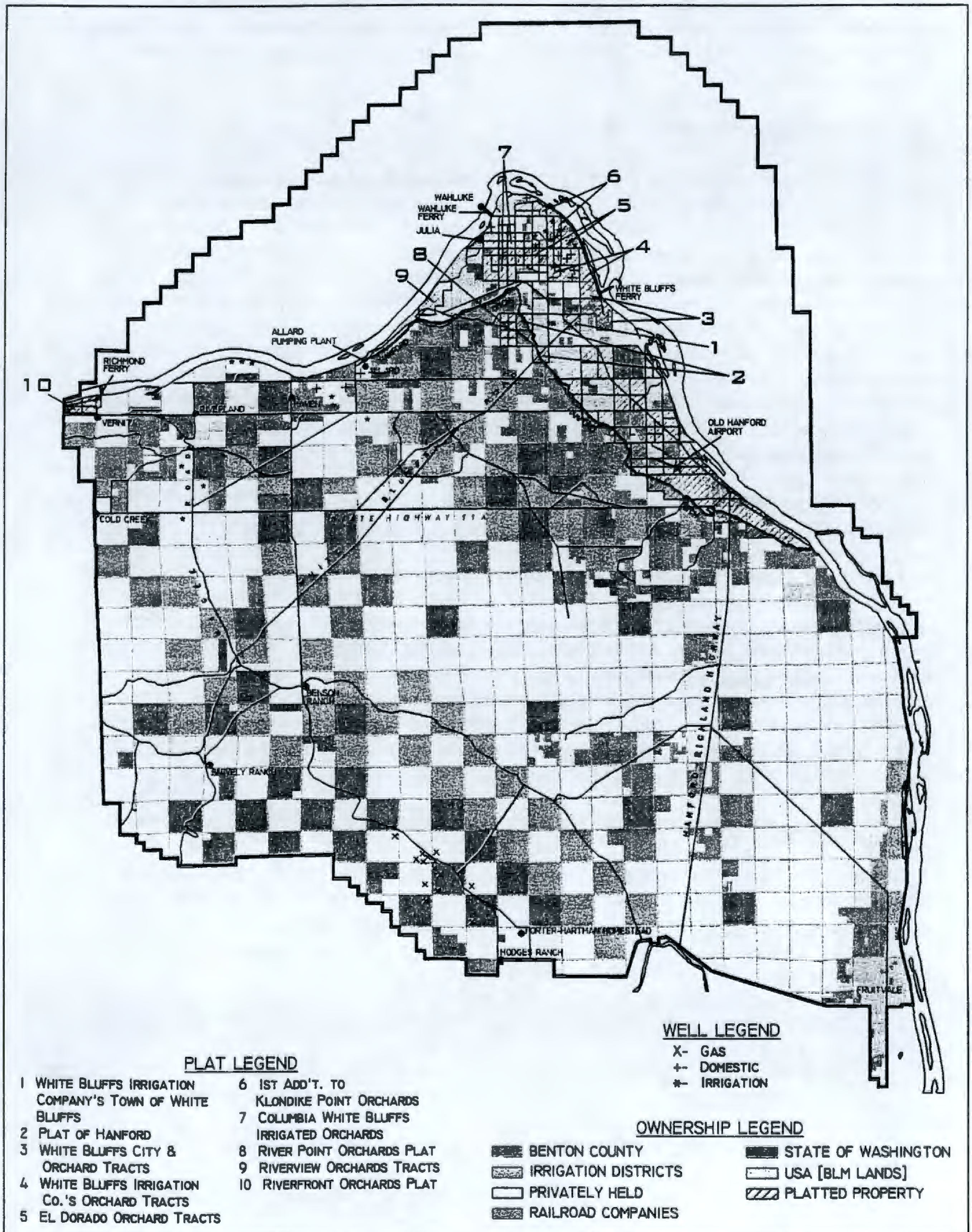
For over 40 years, the primary mission at Hanford was associated with the production of nuclear materials for national defense. Land management and development practices at the Hanford Site were driven by resource needs for nuclear production, chemical processing, waste management, and research and development (R&D) activities. The DOE developed infrastructure and facility complexes to accomplish this work, but large tracts of land used as protective buffer zones for safety and security purposes remained undisturbed. As the rest of the original Columbia River shorelines were submerged under dam reservoirs, these buffer zones preserved a biological and cultural resource setting unique in the Columbia Basin region.

1.1.3 Change in Mission from Defense Production to Environmental Restoration

In the late 1980s, the primary DOE mission changed from defense materials production to environmental restoration. In 1989, DOE entered into the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) with the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) (Ecology et al.1989). This agreement is intended to accomplish the following:

- Define EPA's CERCLA cleanup provisions for remediation of hazardous substances.
- Define the RCRA waste treatment, storage, and disposal requirements and corrective actions for hazardous waste management as administered by Ecology.
- Establish the responsibilities for each agency (DOE, EPA, Ecology).
- Establish milestones for achieving remediation and regulatory compliance.

Figure 1-2. Pre-Hanford Benton County Lands - 1943.



Today, the Hanford Site has a diverse set of mission elements associated with environmental restoration, waste management, and science and technology. These mission elements have resulted in the growing need for a comprehensive, long-term approach to planning and development for the site. Additionally, DOE Order 430.1, *Life-Cycle Asset Management*, requires the development of a comprehensive land-use plan (CLUP) for the Hanford Site, in compliance with Public Law 104-201, Section 3153.

To comply with these requirements, the DOE has developed a process for implementing a Hanford CLUP, and has integrated this process into this Revised Draft HRA-EIS (see Chapter 6). The NEPA ROD issued for this EIS will create the CLUP by documenting a final future land-use map and adopting the final Hanford procedures and policies. Together, these pieces will form the CLUP. The CLUP will consider the role of the Hanford Site in a regional context, and will integrate mission requirements and other factors as directed by the Secretary of Energy (see text box, *"Land- and Facility-Use Policy"*) (DOE 1994).

DOE's Land- and Facility-Use Policy

On December 21, 1994, the Secretary of Energy issued a land- and facility-use policy for DOE, which contains the following statement:

"It is Department of Energy policy to manage all of its land and facilities as valuable national resources. Our stewardship will be based on the principles of ecosystem management and sustainable development. We will integrate mission, economic, ecological, social, and cultural factors in a comprehensive plan for each site that will guide land and facility use decisions. Each comprehensive plan will consider the site's larger regional context and be developed with stakeholder participation. This policy will result in land and facility uses which support the Department's critical missions, stimulate the economy, and protect the environment."

1.2 The National Environmental Policy Act Process

The *National Environmental Policy Act of 1969* (NEPA) requires consideration of environmental impacts associated with Federal agency actions and provides opportunities for public involvement in the decision-making process. In accordance with NEPA requirements, the DOE has prepared this Revised Draft HRA-EIS to help decision makers and the public understand the potential environmental impacts associated with establishing future land uses at the Hanford Site over the next 50 years.

1.2.1 Scope of the Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan

The DOE received more than 2,000 comments on the August 1996 Draft HRA-EIS. Response was mixed. Many commenters felt land-use planning was poorly integrated into the public scoping process and the Draft HRA-EIS. EPA and Ecology's comments centered around disagreements with the CERCLA/RCRA assumptions that were used for the volume, cost, and risk assessments. Several key stakeholders (i.e., the Department of Interior [DOI], City of Richland, Benton County, and the Nez Perce Tribe) felt that with the magnitude of the land-use decision, they needed to be invited into the process as cooperating agencies.

The DOE realized that, without stakeholder support, EPA would not be able to use the land-use plan as presented in the Draft HRA-EIS to develop remediation decisions. The DOE then formally invited affected Tribes and local land-use planning authorities to be cooperating agencies. From January through March 1997, DOE worked with the cooperating agencies to clarify and resolve the issues, still with the intent of incorporating comments on the August 1996 Draft HRA-EIS to produce a Final HRA-EIS. However, through this consultation process, DOE determined that stakeholders wanted an EIS emphasizing land-use maps as alternatives (as opposed to alternatives representing levels of access independent of the land use(s), as presented in the August 1996 Draft HRA-EIS). The DOE concluded that although a good

NEPA case could be made for proceeding to a Final HRA-EIS, it was best to respond to the unified desires of the stakeholders and produce a Revised Draft HRA-EIS.

This Revised Draft HRA-EIS evaluates the potential environmental impacts from establishing future land uses at the Hanford Site over the next 50 years, defers (to Tri-Party Agreement documents) the evaluation of impacts associated with remedial actions, and includes the entire Hanford Site within the scope of the document. In general, the differences between the Revised Draft HRA-EIS, and the August 1996 Draft HRA-EIS can be summarized as follows:

- This Revised Draft HRA-EIS focuses on land-use impacts decisions rather than remediation input decisions.

- Each alternative in the Revised Draft HRA-EIS features a site-wide map designating future land uses, whereas the alternatives in the August 1996 Draft HRA-EIS focused on individual geographic areas and required the reader to develop a site-wide alternative.

- The Revised Draft HRA-EIS includes an agency (DOE) Preferred Alternative, as well as alternatives developed by cooperating agencies.

- The Revised Draft HRA-EIS contains proposed implementing procedures and guidelines to be integrated into the final Hanford CLUP (see Chapter 6).

Refocusing the HRA-EIS is consistent with Public Law 104-201, Section 3153, which requires the development of a final future use plan for the Hanford Site, and it is consistent with Council on Environmental Quality (CEQ) NEPA regulations, which require Federal agencies to fully assess and consider public comments and to modify, supplement, or improve EIS alternatives and analysis as necessary.

1.2.1.1 Public Review of the Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan

Once DOE made the decision to redirect the focus of the August 1996 Draft HRA-EIS and issue a Revised Draft, the agency announced it would hold a formal 45-day public review and comment period following release of the document to the public. This public review and comment period will include a formal public hearing. The hearing will be held in accordance with DOE's implementing regulations for NEPA, including notifying the public 15 days in advance of the time and place for the hearing. The DOE will accept public comments on the Revised Draft HRA-EIS, and respond in writing to those comments in the Final EIS.

1.2.2 External Coordination/Involvement in the Preparation of the Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan

During the public comment period on the August 1996 Draft HRA-EIS, several agencies and American Indian Tribes expressed an interest in working with DOE to establish alternative visions for future land use. To encourage a variety of viewpoints and to strengthen the coordination effort, DOE involved representatives of other Federal agencies, American Indian Tribes, and state and local governments in ongoing planning efforts.

Since March 1997, DOE has worked with the cooperating agencies to establish an acceptable framework for the environmental analyses presented in this Revised Draft HRA-

EIS. Substantial agreement between the participants was reached on the development of land-use designations carried forward in this EIS, and on the format for determining potential environmental impacts associated with future land uses (see Chapter 3). The participants also worked together to develop the proposed procedures and policies for implementing the CLUP (see Chapter 6). Alternatives that *better* reflect the range of land-use values were developed because participants represent organizations with different goals.

1.2.3 Identification of Public Land-Use Values

Through cooperative activities during the past seven years, diverse stakeholder groups have developed values to provide guidance to Congress, the states of Oregon and Washington, DOE, Ecology, and the EPA. It is from this guidance that the proposed policies for the CLUP have been developed. The first set of values was formulated in 1992 by the Hanford Future Site Uses Working Group (FSUWG 1992) and includes the following statements:

- Protect the Columbia River.
- Deal realistically and forcefully with groundwater contamination.
- Use the Central Plateau wisely for waste management.
- Do no harm during cleanup or with new development.
- Cleanup of areas of high future use value is important.
- Clean up to the level necessary to enable the future use option to occur.
- Transport waste safely and be prepared.
- Capture economic development opportunities locally.
- Involve the public in future decisions about the Hanford Site.

After the success of the Working Group, other similar stakeholder groups were formed, including the Hanford Tank Waste Task Force and the Hanford Advisory Board (HAB). In 1993, the Hanford Tank Waste Task Force reinforced the first set of values by adding the following statements (Hanford Waste Tank Task Force 1993):

- Protect the environment.
- Protect public/worker health and safety.
- "Get on with the cleanup" to achieve substantive progress in a timely manner.
- Use a systems design approach that keeps endpoints in mind as intermediate decisions are made.
- Establish management practices that ensure accountability, efficiency, and allocation of funds to high priority items.

The first major action taken by the HAB in early 1994 was to endorse and adopt both previously issued sets of values. In September 1994, acting on a recommendation from the Cultural and Socioeconomic Committee, the HAB adopted the following additional values (Takaro 1995):

- Historic and cultural resources have value and should not be degraded or destroyed. Appropriate access to those resources is a part of that value.

- Workforce stability and reasonable stability in the demand for public services are important for the affected communities. In decisions on projects and contractors, consideration should be given to affected workforce and population shifts.

- Cleanup and waste management decisions should be coordinated with the efforts of the affected communities, to shift toward more private business activity and away from dependence on Federal projects that have adverse environmental or economic impact.

- The importance of ecological diversity and recreational opportunities should be recognized; those resources should be enhanced as a result of cleanup and waste management decisions.

- These concerns should be considered while promoting the most effective and efficient means that will protect environmental quality, and public health and safety, now and for future generations.

- Cleanup activities should protect, to the maximum degree possible, the integrity of all biological resources, with specific attention to rare, threatened, and endangered species and their related habitat.

1.2.4 Development of the August 1996 Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan

The Notice of Intent (NOI) to prepare the HRA-EIS was published in the *Federal Register* (57 FR 37959) on August 21, 1992. The NOI stated that the EIS would evaluate a range of reasonable alternatives to accomplish the scope of the Tri-Party Agreement within the framework of potential future site use/cleanup strategies.

Public scoping meetings were held at four locations in the Northwest: Spokane, Washington, on September 29, 1992; Pasco, Washington, on October 1, 1992; Seattle, Washington, on October 5, 1992; and Portland, Oregon, on October 8, 1992. The public scoping period for the HRA-EIS ended on January 15, 1993.

As mentioned in Section 1.2.3, in 1992 the EPA, Ecology, and DOE, in cooperation with other interested parties, organized a process to involve stakeholders in the development of a vision for the future of the Hanford Site. A committee consisting of representatives of labor, environmental, governmental, Tribal, agricultural, economic development, and citizen interest groups was established and became known as the Hanford Future Site Uses Working Group (Working Group). The Working Group was charged with three related tasks (see text box, *"Working Group's Objectives"*). The result of the Working Group's efforts, a report titled "The Future for Hanford: Uses and Cleanup *The Final Report of the Hanford Future Site Uses Working Group*," was issued in December 1992 (FSUWG 1992), and was submitted to DOE as a formal scoping comment for the HRA-EIS.

Working Group's Objectives

- Identify a range of potential future uses for the Hanford Site.
- Select cleanup scenarios enabling the future uses in light of potential exposure to contaminants, if any, after cleanup.
- Probe for convergence among the cleanup scenarios to identify priorities or criteria that could prove useful in focusing or conducting the cleanup.

The August 1996 Draft HRA-EIS was developed to assess the potential environmental impacts, primarily from remediation activities, associated with establishing future land-use objectives for the Hanford Site. The future land-use objectives were developed by DOE using concepts developed by the Working Group. In 1996, DOE decided to expand the land-use planning initiative into a formal CLUP in the August 1996 Draft HRA-EIS.

1.2.5 Public Review of the August 1996 Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan

The August 1996 Draft HRA-EIS, which addressed impacts associated with remedial actions and land-use planning, was released to the public during the week of August 26, 1996. A public hearing was held in Richland, Washington, on October 17, 1996, and additional public meetings were held throughout the Northwest during the public comment period, which ended December 10, 1996.

1.2.5.1 Major Issues. The DOE received over 2,000 comments from approximately 233 commenters on the August 1996 Draft HRA-EIS. Numerous public agencies, American Indian Tribes, interest groups, and members of the public provided comments that indicated a diverse range of values and objectives. Several major issues and concerns were identified by commenters during the August 1996 Draft HRA-EIS formal public comment period. The primary issues identified by the commenters include the following:

- The August 1996 Draft HRA-EIS did not identify DOE's Preferred Alternative although there was only one land-use map presented.

- Remedial action cost and volume of contaminated material estimates in the August 1996 Draft HRA-EIS were not considered to be consistent with similar estimates made in support of CERCLA documentation.

- Analyses of potential impacts associated with remediation were considered duplicative with the CERCLA process.

- The combination of a land-use plan with remedial action evaluations was confusing. Suggestions were made to reduce or eliminate emphasis on remedial actions and focus instead on those elements of the HRA-EIS pertaining to land-use planning. Widespread support for the development of a comprehensive land-use plan was evident, though not necessarily for the "Hanford Site Comprehensive Land Use Plan," presented in Volume 4 of the August 1996 Draft HRA-EIS.

- The Comprehensive Land-Use Plan was considered by commenters to be a major Federal action that was not only inadequately integrated in the August 1996 Draft HRA-EIS, but also was out of the scope of the EIS.

- Land-use alternatives, other than the plan presented in Volume 4 of the August 1996 Draft HRA-EIS, were not evaluated.

- Tribal treaty rights and authority were inadequately addressed in the August 1996 Draft HRA-EIS.

- Cumulative impact analyses were considered inadequate.

- The August 1996 Draft HRA-EIS did not adequately address the need of the local community to diversify and strengthen the economy to offset the decline of Hanford Site employment and did not sufficiently emphasize the role that agriculture and related industries play in the region.

- Many commenters requested that the entire Hanford Site be cleaned up to a level that would allow for unrestricted use.

- The DOE should coordinate with Benton County and the City of Richland to develop an integrated land-use planning process.

- The level-of-access alternatives (unrestricted, restricted, and exclusive) were confusing without an actual land-use designation.

All of the comments received on the August 1996 Draft HRA-EIS, as well as transcripts from the public hearing are provided for review in the Comment and Response Volume of this Revised Draft HRA-EIS.

1.2.6 Biodiversity in the National Environmental Policy Act Process

In January 1993, the CEQ issued a report titled, *Incorporating Biodiversity Considerations Into Environmental Impact Analysis Under the National Environmental Policy Act* (CEQ 1993). This report was designed with the following objectives:

- Provide an overview of major issues related to biodiversity
- Outline general concepts regarding biodiversity analysis and management
- Describe how biodiversity is addressed in NEPA analyses
- Provide options for agencies undertaking NEPA analyses that consider biodiversity.

The CEQ report indicated that physical alteration, as a result of changing land use, is the most profound cause of biodiversity loss. When natural, undisturbed lands (resembling much of the land at the Hanford Site) are converted to industrial, residential, agricultural, or recreational uses, ecosystems are disrupted and biodiversity is diminished. The CEQ report further states that, "Beyond the direct removal of vegetation and natural landforms in local areas, development of sites for human use fragments larger ecosystems and produces isolated patches of natural areas. Activities such as timber harvesting and grazing also may fragment natural areas but, more important, they result in simplification of ecosystems."

It is the goal of DOE to ensure that the Hanford Site lands are managed in a way that allows biodiversity to be considered prior to finalizing any land-use or land-management decision. To further the biodiversity goal, DOE contacted the Interior Columbia Basin Ecosystem Management Project (ICBEMP)[1], and provided the Geographic Information System (GIS) database developed for this EIS as a contribution to that project.

---

[1]The Interior Columbia Basin Ecosystem Management Project is a Federal land- and ecosystem-management plan commissioned in 1993. The plan affects 100 counties in seven states (including all of eastern Washington and eastern Oregon), and includes more than 54 million acres of private property. Federal agencies involved are the Bureau of Land Management (BLM), National Marine Fisheries Service, Forest Service, and the EPA. Much of the plan deals with water. The plan also proposes aggressive ecosystem restoration practices (including some road closures, more forest thinning and burning, and enhanced streamside vegetation and noxious weed patrols) in order to better control fire, insect outbreaks, and noxious disease spread. More than 75,000 comments, mostly form letters, have been received on the project to date.

1.2.7 Environmental Justice in the National Environmental Policy Act Process

On February 11, 1994, the President of the U.S. issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. This Executive Order mandates each Federal agency to make environmental justice part of the agency mission. To the greatest extent practicable and permitted by law, Federal agencies must identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations.

As stated in the President's February 11, 1994, memorandum that accompanied the Executive Order, "Each Federal agency shall analyze the environmental effects, including human health, economic, and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by NEPA, 42 U.S.C. Section 4321, et seq. Mitigation measures outlined or analyzed in an environmental assessment, environmental impact statement, or record of decision, whenever feasible, should address significant and adverse environmental effects of proposed Federal actions on minority communities and low-income communities." The memorandum and Executive Order ensure that minority and low-income communities will have a voice in the development and implementation of any Federal action that might adversely affect those communities.

In addition, the memorandum and Executive Order indicated that all Federal agencies were to be proactive in identifying and, to the extent practicable, mitigating any potential adverse impact on minority and low-income communities that could result from proposed Federal actions. In order to implement the provisions of Executive Order 12898, the *U.S. Department of Energy Environmental Justice Strategy, Executive Order 12898* (DOE 1995a) was prepared. Guidance provided in this publication was used, to the extent practicable, in the HRA-EIS.

1.3 Other Ongoing Major Federal Actions and National Environmental Policy Act Documents

Decisions made in other NEPA RODs, as well as CERCLA RODs addressing remediation, have had a direct impact on the development of the land-use alternatives presented in this Revised Draft HRA-EIS. Table 1-1 summarizes the Hanford-related EISs and RODs and shows the relationships these documents have to land-use planning. Table 1-2 summarizes the regional *State Environmental Policy Act of 1971* (SEPA) EISs. Table 1-3 summarizes CERCLA RODs.

The restrictions posed by CERCLA RODs signed to date were taken into consideration in the development of land-use alternatives in this Revised Draft HRA-EIS. Conversely, the land-use alternative selected for implementation in the ROD for this EIS would inform remediation decisions to be made in other areas of the Hanford Site. The EPA, Ecology, and DOE would consider the land-use designation for a given area in determining cleanup levels. If the desired land use cannot be attained because of technical or economic constraints, the land-use designation would be modified to the next best use that can be attained. Such a modification would require amendment of the land-use plan, and a deed restriction would be filed with the local jurisdictional agency.

Table 1-1. NEPA Reviews Affecting the Hanford Site. (5 pages)

NEPA EISs	Purpose	Status	Potential Mission Impacts on Hanford	Relationship to Land-Use Planning
Waste Management Operations, Hanford Reservation, Richland, Washington. (ERDA-1538, December 1975)	To provide information for use in planning and decision making to ensure that future waste management practices would be conducted to minimize adverse environmental consequences	Final EIS issued December 1975. Predates final Council on Environmental Quality (CEQ) NEPA regulations; therefore, Record of Decision (ROD) not required.	Reassessed the environmental impacts associated with continuing the Hanford Site Waste Management Operations Program to provide information for use in planning and decision making. Addressed waste generated by nuclear defense production, research and development, and other programs and activities at the Hanford Site. The high-level waste preferred alternative was to continue solidifying liquid tank waste to a salt cake form and construct additional double-shell tanks.	Committed portions of the 100, 200, and 300 Areas to continued waste management (Industrial-Exclusive use).
Waste Management Operation, Double-Shell Tanks for Defense High-Level Radioactive Waste Storage, Hanford Site, Richland, Washington (DOE/EIS-0062, April 1980)	To complete construction and operation of 13, 1-million gallon double-shell waste tanks. These tanks would be used to manage defense high-level radioactive wastes resulting from the chemical processing of spent nuclear fuel in the 200 East Area.	The ROD was published in the *Federal Register* on July 9, 1980	The double-shell tanks were constructed and are currently in operation.	Committed the 200 Areas to continued waste management (Industrial-Exclusive use).
Decommissioning of the Shippingport Atomic Power Station, Hanford Site, Richland, Washington (DOE/EIS - 0089, February 1983)	Dismantle and remove all fluids, piping, equipment, components, structures, and waste to a waste disposal facility.	The ROD was published in the *Federal Register* on August 19, 1982	The Shippingport Atomic Power Station Waste was disposed at the Hanford Site.	Committed the 200 Areas to continued waste management (Industrial-Exclusive use).
Operation of PUREX and Uranium Oxide Plant Facilities, Hanford Site, Richland, Washington (DOE/EIS - 0089, February 1983)	This EIS analyzed the environmental effects of the DOE proposal to resume operations of the PUREX and Uranium Trioxide chemical processing plant.	The ROD was published in the Federal Register on May 16, 1983	In 1990, DOE determined that the PUREX Facility would no longer operate. The plant has been shutdown, deactivated, and readied for Decontamination and Decommissioning (D&D). Operation up until 1990 resulted in discharge of liquid effluents to the ground in the 200 East Area.	Committed the 200 Areas to continued waste management (Industrial-Exclusive use).
Disposal and Decommissioning, Defueled Naval Submarine Reactor Plants	Evaluated disposition of defueled reactor compartments from decommissioned nuclear submarines (See also DOE/EIS-0259)	The ROD was published in the *Federal Register* in December 1984.	Land disposal of reactor compartments in the 200 East Areas	Committed the 200 East Area to waste management (Industrial-Exclusive use).

Table 1-1. NEPA Reviews Affecting the Hanford Site. (5 pages)

NEPA EISs	Purpose	Status	Potential Mission Impacts on Hanford	Relationship to Land-Use Planning
Disposal of Hanford Defense High-Level, Transuranic and Tank Waste, Hanford Site, Richland, Washington (DOE/EIS-113, December 1997)	Examined the potential impacts for final disposal of existing high-level TRU and tank waste stored at the Hanford Site.	The ROD was published in the *Federal Register* on April 14, 1988	Committed to dispose of double-shell tank waste, cesium and strontium capsules, retrievably stored and newly generated transuranic waste in the 200 Areas. Also committed to construct and operate facilities associated with high-level waste vitrification; construct and operate the WRAP facility for transuranic soil waste, and a grout facility for low-level waste.	Committed to waste management (Inclusive-Exclusive use) in the 200 Area. Many of the tank waste issues were superseded by the *Tank Waste Remediation System EIS* (DOE/EIS-189).
Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington (DOE/EIS-0119, December 1992)	Evaluated decommissioning alternatives for the eight surplus plutonium production reactors at the Hanford Site.	The ROD was published in the *Federal Register* in September 1993	The DOE determined that the reactor blocks for the eight plutonium reactors will be kept at their present sites for 75 years until their radiation level lowers through natural decay. The reactors block would then be moved to the 200 Areas for burial.	Commits to restrictive land use of the 100 Areas surrounding the reactors until about 2068. Constitutes a future committed land use, waste management (Industrial-Exclusive use), for the 200 Areas.
Tank Waste Remediation System, Hanford Site, Richland, Washington (DOE/EIS-0189, February 1997)	This EIS addressed management and disposal of the contents of 177 high-level radioactive waste tanks and cesium and strontium capsules.	The ROD was published in the *Federal Register* on February 27, 1997	The DOE would implement the Preferred Alternative to retrieve, separate, vitrify, and dispose of the tank waste. The low-level fraction of the separation process would be disposed of onsite in subsurface vaults. The high-level fraction would be disposed of offsite at the potential geologic repository. A decision on the cesium and strontium capsules was deferred.	Commits the 200 Areas to waste management (Industrial-Exclusive use) during the retrieval, separation, and vitrification process. It also constitutes a long-term commitment of the 200 Areas for onsite disposal of low-level waste.
Office of Environmental Management Programmatic Environmental Impact Statement (DOE/EIS-0200, May 1997)	This EIS is a nationwide study that examines the management of five types of radioactive and hazardous waste; TRU, hazardous waste, high-level waste, and low-level and low-level mixed waste.	The TRU Treatment ROD was published in the Federal Register on Jan. 23, 1998. Other RODs are scheduled to be issued: hazardous waste, July 1996; high-level waste, Dec. 1998; low-level and low-level mixed waste, Feb. 1999.	Alternatives considered include centralizing or regionalizing the waste at one or two sites. Those sites that have the largest volumes of a given waste type generally were considered as sites for treatment, storage, or disposal.	A decision to centralize the waste could commit the 200 Areas to waste management (Industrial-Exclusive use).
Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs (DOE/EIS-203, 1995)	EIS evaluated programmatic alternatives to managing spent nuclear fuel until 2035. This EIS did not evaluate the final disposition of the spent nuclear fuel.	The ROD was published in the *Federal Register* on June 2, 1995. An amended ROD was published in the *Federal Register* on February 28, 1996.	According to this ROD, Hanford production reactor fuel would remain at the Hanford Site pending ultimate disposition. Fast Flux Test Facility (FFTF) fuel will be sent to the Idaho National Engineering and Environmental Laboratory (INEEL). The amended ROD reduced the number of shipments of sodium-bonded fuel from Hanford to the INEEL from 524 to 12.	This decision commits to onsite storage of spent fuel in the 200 Areas until as late as 2035.

Table 1-1. NEPA Reviews Affecting the Hanford Site. (5 pages)

NEPA EISs	Purpose	Status	Potential Mission Impacts on Hanford	Relationship to Land-Use Planning
Safe Interim Storage of Hanford Tank Waste, Hanford Site, Richland, Washington (DOE/EIS-0212, October 1995)	EIS evaluated alternatives for addressing near-term safety issues in the Hanford Site priority Watchlist tanks. Accumulation of flammable gas in three tanks had been identified as a safety issue.	The ROD was published in the *Federal Register* on November 21, 1995.	Construction of a replacement Cross-Site Transfer System (pipeline) for moving waste from the 200 West Area to the 200 East Area. Construction of a waste retrieval system in one tank and continuation of mitigation actions to control flammable gas.	This decision creates infrastructure support to tank waste management in the 200 East Area, and commits the new Cross-Site Transfer System pipeline (Industrial-Exclusive use).
Plutonium Finishing Plant Stabilization Environmental Impact Statement (DOE/EIS-0244, May 1996)	To reduce potential health risks and environmental risks associated with 3800 kg (8400 lbs) of plutonium within the Plutonium Finishing Plant.	The ROD was published in the *Federal Register* on July 10, 1996.	Stabilized forms of plutonium would be stored within vaults at the Plutonium Finishing Plant pending ultimate disposition.	Commits the 200 West Area to long-tem storage of plutonium and other transuranic materials (Industrial-Exclusive use).
Management of Spent Nuclear Fuel from the K Basin at the Hanford Site, Richland, Washington (DOE/EIS-0245, February 1996)	Evaluated alternatives for spent nuclear fuel stored in the 100-K Area Basins to reduce risk to public health and the environment.	The ROD was published in the *Federal Register* on March 15, 1996.	Irradiated fuel will be removed from 100 K-basins, treated, and sealed in canisters and stored in the 200 Area. Sludge from the K Basins will be disposed of in existing double-shelled tanks or grouted and packaged for disposal in the 200 Areas.	Commits the 200 Area to the storage of the K Basin fuels and conversion of sludge. Future uses must accommodate restoration after 105-K fuel storage basins are remediated (Industrial-Exclusive use).
Disposal and Decommissioned, Defueled Cruiser, Ohio Class, and Los Angeles Class Naval Reactor Plants Environmental Impact Statement (DOE/EIS-0259, April 1996)	Evaluated alternatives for the disposal of defueled reactor compartments from cruisers and submarines.	The ROD was published in the *Federal Register* on August 9, 1996	Approximately 100 cruiser and submarine reactor compartments would be disposed of in a 70-hc (173-ac) waste disposal unit in the 200 East Area.	Commits the 200 East Area to waste management activities (Industrial-Exclusive use).
Hanford Reach of the Columbia River, Comprehensive River Conservation Study and Final Environmental Impact Statement	The Department of the Interior (DOE) and DOE evaluated alternatives for protecting and managing the Hanford Reach of the Columbia River.	The DOE ROD was published in the Federal Register in July 1996. Congressional action is required for the recommended Wild and Scenic River and National Wildlife Refuge designations	Wild and Scenic designation (recreational) would eliminate certain land uses (residential, agricultural, and waste management) within the study area. Establishes wildlife and habitat management access for other areas.	Compatible land uses with the recommendation include: recreation, wildlife, and habitat management for the river corridor and areas north of the river (Low-Intensity Recreation use). Incompatible land uses include: industrial, waste management, and agricultural.

Table 1-1. NEPA Reviews Affecting the Hanford Site. (5 pages)

NEPA EISs	Purpose	Status	Potential Mission Impacts on Hanford	Relationship to Land-Use Planning
Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement (DOE/EIS-0229, December 1996) *Surplus Plutonium Disposition Environmental Impact Statement* (DOE/EIS-0283)	DOE/EIS-0229 evaluated alternatives of facilities for plutonium disposition. Include conversion of bomb components into plutonium oxide, immobilization of surplus plutonium in glass, and mixed oxide fuel fabrication. Site-specific decisions will be made in DOE/EIS-0283.	The ROD for DOE/EIS-229 was published in the *Federal Register* on January 14, 1997. The Notice of Intent for DOE/EIS-0283 was published in the *Federal Register* on May 18, 1997. The Draft EIS is scheduled for April 1998.	May result in plutonium or highly enriched uranium storage in the 200 West or 400 Areas. Under EIS-0283, the Hanford Site is one of the sites being considered for siting the facility for weapons-useable plutonium disposition.	EIS-0283 may commit the 200 and 400 Areas to waste management (Industrial-Exclusive use).
Geologic Repository for the Disposal of Spent Nuclear Fuel and High Level Radioactive Waste at Yucca Mountain (DOE/EIS-250)	Will evaluate the suitability of Yucca Mountain at the Nevada Test Site for the disposal of commercial and defense high-level radioactive waste.	The Notice of Intent (NOI) was published in the Federal Register in August 1995. The Draft EIS is in preparation and is expected to be published in 1999.	The Yucca Mountain site would accept up to 7000 metric tonnes (7,700 tons) of vitrified defense waste from Hanford and other DOE sites.	Until the Yucca Mountain facility is licensed by the Nuclear Regulatory Commission, high-level radioactive waste would be stored in the 200 Areas (Industrial-Exclusive use).
Interim Storage of Plutonium at the Rocky Flats Environmental Technology Site (DOE/EIS-0276)	Evaluated alternative for the management of weapons usable fissile materials currently stored at the Rocky Flats Environmental Technology Site.	The Notice of Availability (NOA) for the Draft EIS appeared in the Federal Register in November 1997. The public comment period on the draft ended January 5, 1998.	The alternatives being proposed include transportation and storage of weapons-useable fissile materials to other DOE sites including Hanford.	May require waste management in the 200 Areas (Industrial-Exclusive use).
Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement (DOE/EIS-0286)	To update NEPA coverage for ongoing waste management activities, to implement programmatic RODs that result from the Final Waste Management Programmatic EIS (DOE/EIS-0200), and to facilitate decisions on the future operation of Hanford waste treatment, storage, and disposal facilities.	The NOI was published in the Federal Register on October 27, 1997. The Scoping period closed January 30, 1998. The draft EIS is expected in 1998.	May result in unchanged, minimized, or maximized levels of waste storage, treatment, and disposal of low-level, low-level mixed, transuranic, and hazardous waste and contaminated equipment at Hanford.	Is expected to require continued use of the 200 Areas for waste management purposes (Industrial-Exclusive use).
Columbia River System Operation Review Environmental Impact Statement (November 1995)	To develop Bureau of Reclamation (BoR), U.S. Army Corps of Engineers (USACE), DOE, and Bonneville Power Administration (BPA) management strategy for multiple uses of the Columbia River System.	The ROD was approved on March 10, 1997. This was prepared by the BPA, USACE, and the BoR.	May control Columbia River flows.	May limit land use along the Columbia River (Low-Intensity Recreation use).

Table 1-2. SEPA Reviews Affecting the Hanford Site. (2 pages)

SEPA EISs	Purpose	Status	Potential Mission Impact on Hanford	Relationship to Land-Use Planning
Commercial Low-Level Radioactive Waste Disposal Site (U.S. Ecology) on the Hanford Site Environmental Impact Statement	To provide sufficient information to allow state agencies to make the following key decisions: approval of a site closure plan, renewal of the operating license, and an amendment to the regulations limiting the receipt of naturally occurring and accelerator-produced radioactive materials (NARM).	The lead agencies are the Washington Department of Ecology (Ecology) and the Washington Department of Health (DOH). Public scoping - February 1997 through March 27, 1997. A public meeting was held March 5, 1997 at Ecology's office in Kennewick, WA. Ecology and Health have invited DOE Richland Operations Office (RL) to consult with them on issues, concerns, and potential impacts that should be considered in the EIS. The three agencies met on March 25, 1997, and on April 8, 1997, RL sent a response letter to DOH and Ecology outlining DOE's issues and concerns, and RL's role.	May allow additional amounts of low-level radioactive wastes and NARM to be disposed in the Central Plateau at the privately owned US Ecology site, which was leased by the State from the Federal government.	Expected to continue to require waste management in the 200 Areas (Industrial-Exclusive use).
Proposal to Farm Privately Held Land on Two Columbia River Islands *(At this time, the decision has not been made to require an EIS, and a title has not been set.)*	To develop commercial orchards on the private upland portions of two islands in the Columbia River.	The lead agencies are Benton and Franklin counties (one island lies in each county). Public scoping - August 1997 through September 22, 1997	May affect DOE natural resource stewardship responsibilities, as the project may adversely impact regional salmon habitat.	May affect recreational use in the Columbia River (Agriculture use).
City of Richland Comprehensive Plan/EIS	When adopted, the Comprehensive Plan will include the mandated elements on land use, housing, transportation, capital facilities, and utilities, with an optional element on economic development.	The lead agency is the City of Richland Final EIS - issued August 27, 1997	The City of Richland's Comprehensive Plan is consistent with current and proposed future land uses at Hanford and DOE missions.	The City of Richland's Comprehensive Plan addresses land use within the City boundary, directly south of the Hanford Site and zones land within the City of Richland's Urban Growth Area that extends into the 300 Area of the Hanford Site (Industrial use).
SEPA EIS on Treatment of Low-Level Mixed Wastes (ATG) City of Richland EIS (EA6-97)	ATG is to build a gasification and vitrification Treatment, Storage and Disposal (TSD) facility in Richland, Washington.	Final SEPA EIS - March 9, 1998	Effect of construction and overall operation of the building was evaluated under SEPA. The action is being undertaken as a private action in anticipation of future work for a variety of contracts, including DOE. ATG would proceed with the facility whether or not the Hanford Site low-level mixed waste is included.	A mixed waste TSD facility (Industrial-Exclusive) is being built in an area offsite that is incompatible with the proposed future land use (Industrial).

Table 1-2. SEPA Reviews Affecting the Hanford Site. (2 pages)

SEPA EISs	Purpose	Status	Potential Mission Impact on Hanford	Relationship to Land-Use Planning
Draft Benton County Comprehensive Plan (SEPA EIS Addendum) (September 1997)	To revise the Benton County Comprehensive Plan in accordance with the State Growth Management Act and SEPA. The Comprehensive Plan is being updated to address land-use planning for all of Benton County, including the portion of the Hanford Site that lies within Benton County. The Comprehensive Plan includes an addendum to the Final SEPA EIS, dated March 1981, prepared for the 1985 Benton County Comprehensive Plan.	The Revised Draft HRA-EIS will provide the basis for the Benton County SEPA review for the Hanford sub-area plan of the Benton County Comprehensive Plan The lead agency is Benton County.	The Benton County Comprehensive Plan will not affect DOE missions at Hanford while DOE retains management of the Site. If, however, land is turned over to state or local governments, such as the Port of Benton, then the stipulations identified in the Benton County Comprehensive Plan will apply. Such transfers might help to fulfill the DOE mission of economic transition and diversification of the local economy.	The Benton County Comprehensive Plan addresses land uses for the County, including the portion of the Hanford Site that lies within Benton County (Industrial-Exclusive, Industrial, Research and Development, High-Intensity Recreation, and Low-Intensity Recreation use).

SEPA = *State Environmental Policy Act of 1971*

Table 1-3. CERCLA Reviews Affecting the Hanford Site.

CERCLA RODs	Purpose	Status	Potential Mission Impact on Hanford	Relationship to Land-Use Planning
1100 Area	Remediation of the 1100 Area	1100-EM-1, 1100-EM-2, 1100-EM-3, and 1100-IU-1 - Final Record of Decision (ROD) issued September 24, 1993 Certified remedial action - July 1996 Delisted from National Priorities List	1100 Area remediated and available for other compatible uses	Institutional controls required to prevent disturbance of the asbestos landfill barrier and groundwater. A deed restriction for the Horn Rapids asbestos landfill has been filed with the Benton County Auditor's Office. Industrial-Exclusive use designation.
300 Area	Remediation of the 300 Area	300-FF-1, 300FF-5 - Final ROD issued July 17, 1996 RI/FS for NPL Site - to be completed after all operable units are addressed	Remediation will allow industrial use	Institutional controls required to prevent disturbance of soil below 15 ft and groundwater Restricted subsurface and groundwater use. Industrial-Exclusive use designation
100 Area	Remediation of the 100 Areas	100-BC-1, 100-HR-1, and 100-DR-1 - Interim ROD for 37 high-priority waste sites issued September 1995. The ROD was amended May 14, 1997, to include additional waste sites. 100-HR-3/100-KR-4 (Groundwater OUs) - Interim ROD issued April 1, 1996 100-IU-1, 100-IU-3, 100-IU-4, 100-IU-5 - Interim ROD issued February 12, 1996 RI/FS for NPL Site - to be completed after all operable units are addressed	100 Areas to be remediated to allow unrestricted residential use: - Unrestricted surface use - Restricted subsurface and groundwater use - Support facilities for groundwater pump-and-treat remediation systems must be maintained	Institutional controls required to prevent disturbance of soil below 15 feet and groundwater. A deed restriction has been filed for the 183-H Solar Basin RCRA closure with the Benton County Auditor's Office. Industrial-Exclusive use designation. Restricted subsurface and groundwater use
200 Areas	Remediation of the 200 Areas	Environmental Restoration Disposal Facility - Final ROD issued January 1995 200-ZP-1 (Groundwater OU) - Interim ROD issued June 5, 1995 200-UP-1 (Groundwater OU) - Interim ROD issued February 24, 1997 RI/FS for NPL Site - to be completed after all operable units are addressed	200 Areas to be remediated to industrial-exclusive use Support facilities for groundwater pump-and-treat remediation systems must be maintained	Institutional controls required to prevent disturbance of barriers and groundwater Restricted surface, subsurface, and groundwater use. A deed restriction has been filed for an asbestos trench in the Central Waste Landfill with the Benton County Auditor's Office. Industrial-Exclusive use designation.

1.4 Hanford Site Planning Efforts

1.4.1 Hanford Site Planning Documents

Several Hanford Site planning documents have been developed to address the various information needs of DOE managers. The *Baseline Environmental Management Report* (BEMR) (DOE 1996c), the *Draft Hanford Cultural Resources Management Plan* (CRMP) (PNL 1989), the *Draft Hanford Biological Resources Management Plan* (BRMaP) (DOE-RL 1996c), and the *Hanford Strategic Plan* (DOE-RL 1996b) are summarized below. These planning documents are periodically updated to reflect new information and DOE decision making, such as the decision DOE will make based on the information in the HRA-EIS.

The BEMR was the first annual report required by Congress on the activities and potential costs required to address the waste, contamination, and surplus nuclear facilities across the country that are the responsibility of DOE Office of Environmental Management. The BEMR provided the life-cycle cost estimates, tentative schedules, and projected activities necessary to remediate DOE sites. Many broad assumptions were required to estimate the long-range costs and schedules, including assumptions regarding future land uses, cleanup levels, and priority rankings. The BEMR should not be interpreted as final DOE policy or as a long-term plan; instead, the BEMR should be considered as a tool to help Congress understand the DOE complex's fiscal liability.

The CRMP establishes guidance for the identification, evaluation, recordation, curation, and management of archaeological, historic, and traditional cultural resources. The plan specifies methods of consultation with affected Tribes, government agencies, and interested parties, and includes strategies for the preservation and/or curation of representative properties, archives, and objects. This plan is currently being revised with the active participation of affected Tribes and government agencies. Upon completion of the revised draft plan, expected during the fall of 1998, an opportunity for public participation will be provided.

The BRMaP provides DOE and DOE contractors with a consistent approach for protecting biological resources and for monitoring, assessing, and mitigating impacts to biological resources from site development and environmental restoration activities. Primarily, the BRMaP supports DOE's Hanford missions; provides a mechanism for ensuring compliance with laws protecting biological resources; provides a framework for ensuring that appropriate biological resource goals, objectives, and tools are in place to make DOE an effective steward of the Hanford biological resources; and implements an ecosystem management approach for biological resources on the Site.

Hanford Strategic Plan

The *Hanford Strategic Plan* identifies six critical success factors to achieve the Hanford vision and missions.

Protect worker safety and health
- reduce accidents and radiological exposure
- achieve voluntary protection program "star" status

Protect public health and the environment
- reduce or eliminate emissions and effluents
- regulatory and Tri-Party Agreement compliance

Manage Hanford to achieve progress
- projectize Hanford for clear management accountability, responsibility, and authority
- establish and control project baselines
- link key performance measures to results
- maintain a well-trained and qualified workforce

Optimize the Hanford Site infrastructure
- develop cost-competitive infrastructure commensurate with mission needs
- involve staff and community in the outsourcing process

Contribute to economic diversification
- blend economic diversification strategies with all Hanford activities and contractors
- involve local community and leaders in projects

Build and strengthen partnerships for progress
- include American Indian Tribes, regulators, and stakeholders in planning processes
- champion the public right to know with prompt, accurate information

The BRMaP provides a comprehensive direction that specifies DOE biological resource policies, goals, and objectives.

The *Hanford Strategic Plan* is an operational plan that articulates the DOE vision and commitments to a long-range strategic direction for the Hanford Site. The Strategic Plan provides a basis for decisions and actions necessary to achieve DOE goals (see text box, *"Hanford Strategic Plan"*).

This Revised Draft HRA-EIS builds on past efforts to address land-use planning at the Hanford Site and presents a range of alternative land uses that represent different visions.

1.4.2 Integrating Planning Efforts by Other Governments and Agencies

This section includes information supplied to DOE by representatives of other governments and agencies about their respective planning efforts. Key to setting aside institutional differences that allowed planning to proceed was the concept of agreeing to disagree on issues such as tribal rights.

Tribal governments and DOE agree that the treaty-reserved rights of Tribal members to fish at usual and accustomed fishing areas applies to the Hanford Reach of the Columbia where it passes through Hanford.

Nevertheless, Tribal governments and DOE disagree over the applicability to the Hanford Site of Tribal treaty-reserved rights to hunt, gather plants, and pasture livestock. Both the Tribes and DOE can point to legal justification for their positions in this dispute (see below). As this dispute could take years to resolve, the Tribes and DOE have decided not to delay completion and implementation of land-use planning for the Hanford Site while awaiting the resolution of this dispute. Instead, the Tribes and DOE have gone ahead with the land-use planning process while reserving all rights to assert their respective positions regarding treaty rights. Neither the existence of this EIS nor any portion of its contents is intended to have any influence over the resolution of the treaty rights dispute.

1.4.2.1 A Tribal View of Tribal Rights. The Tribes' treaties with the United States reserve the rights of tribal members to hunt, gather plants, and pasture livestock on open and unclaimed lands. Under standard Federal Indian law practice, such treaty provisions are interpreted using the U.S. Supreme Count-defined "canons of construction" for the interpretation of Indian treaties. The application of those canons of construction to the Tribes' treaties indicates that the term "open and unclaimed lands" means public lands of any type. The management status of those lands at any given time is irrelevant. Likewise, the prior ownership status of those lands is irrelevant.

The fact that Tribal members have these treaty rights does not mean that Tribal members' exercise of these rights is unregulated. Tribal governments may regulate their members' exercise of off-reservation treaty rights in the same ways that state governments regulate non-Indian fishing and hunting: by establishing seasons, bag limits, and other administrative controls. As part of their decision making, Tribal governments typically share information and coordinate with other interested governments, such as state fish and wildlife agencies. In certain situations, such as when a resource is threatened with extinction, tribal members' exercise of off-reservation treaty rights can also be subjected to state and Federal regulation.

1.4.2.2 DOE's View of Tribal Rights. The DOE agrees that the "canons of construction" apply to the interpretation of treaty rights. However, DOE does not agree with the Tribes' reasoning regarding the application of the canons to the circumstances at the Hanford Site.

Under the canons, the courts would look to the Tribes' contemporary understanding of the treaty terms at the time of the signing of the treaty. There exists substantial documentation that indicates that the Tribes understood at the time of the signing that lands were no longer "unclaimed" when they were claimed for purposes of the white settlers' activities. Most of Hanford had been so "claimed" at the time it was acquired for government purposes in 1943. The DOE is not aware of any judicially recognized mechanism which would allow these lands to revert to "unclaimed" status merely through the process of being acquired by the Federal government. The portion of the Hanford Site that remained in the Public Domain in 1943 (those lands now having underlying BLM ownership) arguably could have been considered unclaimed at the time the Hanford Site was established. However, those lands, as well as all of the acquired lands were closed to all access initially under authority of the *War Powers Acts* and then under the authority of the *Atomic Energy Act.* In order for the Tribes' view that these lands should be considered "open" to prevail, a court would have to find that Congress, in enacting the *War Powers Acts* and the *Atomic Energy Act*, did not intend to authorize the Executive Branch to close these vital sites to Tribal access when it granted plenary authority to restrict access under these laws. It is, therefore, DOE's position that the Hanford Site lands are neither "open" nor "unclaimed" and that the treaty reserved rights, by their own terms, do not apply.

Aside from rights reserved by treaty, Tribes have significant other rights under Federal statues, executive orders, Federal court determinations, and executive branch policies. These include rights concerning cultural resource management access to religious sites, and the Federal trust responsibility to Indian tribes (see Chapter 7).

1.4.2.3 Other Federal Agencies. In addition to lands acquired by DOE through condemnation during World War II, the Hanford Site includes: (1) BLM-administered lands withdrawn from the Public Domain by DOE during and following World War II, (2) BLM lands withdrawn from the Public Domain by the Bureau of Reclamation (BoR) prior to World War II as part of the Columbia Basin Reclamation Project (CBRP), and (3) lands acquired in fee by the BoR prior to World War II as part of the CBRP. The withdrawn lands and nonwithdrawn lands form a checkerboard pattern over large portions of the Hanford Site.

The lands in category 2 (above) were subsequently affected by a second, overlapping withdrawal by DOE during and following World War II. When DOE relinquishes its withdrawals on lands that were historically Federal, those lands withdrawn only by DOE will revert to the Public Domain and management by BLM, while those lands withdrawn by the overlapping DOE and BoR withdrawals will remain withdrawn and managed by the BoR.

The BoR's use of the withdrawn Public Domain lands after the relinquishment of DOE's overlapping withdrawal must be consistent with the purposes for which they were originally withdrawn from BLM by BoR. If they are not, the BoR would be expected to relinquish or renegotiate its withdrawal notice and the lands could be returned to the Public Domain for BLM management.

The BoR continues to retain an interest in the ultimate development of the irrigable lands within the Wahluke Slope as part of the CBRP. This interest pertains not only to irrigation system maintenance and development, but also to other project purposes such as fish and wildlife protection, resource management, and environmental concerns.

In addition to BoR's irrigation system maintenance activities, the DOE lands on the Wahluke Slope are managed in part by the Washington Department of Fish and Wildlife (WDFW) as the Wahluke Slope Wildlife Recreation Area, and in part, by the U.S. Fish and Wildlife Service (USFWS) as the Saddle Mountain National Wildlife Refuge.

The USFWS is managing the Fitzner-Eberhardt Arid Lands Ecology Reserve (ALE Reserve) under a cooperative agreement with DOE that was signed on August 27, 1997. The USFWS will be preparing an Area Management Plan (AMP) (see Chapter 6) for the ALE Reserve.

Aside from BoR, BLM and the USFWS current management responsibilities, the U.S. National Park Service (NPS) has, with DOE as a co-preparer, completed an EIS for the Hanford Reach of the Columbia River in 1994. The *Hanford Reach of the Columbia River, Comprehensive River Conservation Study and Final Environmental Impact Statement* (Hanford Reach EIS) (NPS 1994) examines alternatives for preservation of the resources and features of the Hanford Reach, including addition of the Hanford Reach to the National Wild and Scenic Rivers System, and evaluates impacts that could result from various uses of the river. The DOI's ROD recommends that the Congress designate Federally owned and privately owned lands within 0.4 km (0.25 mi) of the Columbia River, on both banks from river mile 396 to 346.5 as a Recreational River under the Wild and Scenic Rivers System; and the portion of the Hanford Site that lies north of the river, as a National Wildlife Refuge, to be managed by the USFWS. Congress is still contemplating actions that are necessary to implement the ROD and there has been competing legislation introduced in Congress.

1.4.2.4 Confederated Tribes of the Umatilla Indian Reservation (CTUIR). In their treaty with the U.S., members of the constituent Tribes and Bands of the CTUIR retained the right to fish at all of their usual and accustomed fishing stations and erect support buildings for this activity, regardless of those stations' distance from the Umatilla Indian Reservation or their location on public or private lands. The lower Yakima River and the Hanford Reach of the Columbia River are usual and accustomed fishing areas for the members of the CTUIR. In the same treaty, members of the CTUIR retained the right to hunt, gather plant resources, and pasture livestock on unclaimed lands. In the opinion of the CTUIR, Hanford lands are unclaimed lands.

As a sovereign, the CTUIR regulates the exercise of treaty-reserved rights by its members. Under the CTUIR's Wildlife Code, the CTUIR Fish and Wildlife Commission sets seasons and limits for on- and off-reservation fishing and hunting by CTUIR members. These seasons and limits are based on data gathered by CTUIR staff, staff of other Tribes, Oregon and Washington wildlife agencies, the Columbia River Inter-Tribal Fish Commission, and Federal agencies. The CTUIR also regulates on-reservation fishing, hunting, plant gathering, livestock grazing, and other land uses through the CTUIR's Land Development Code, the CTUIR Range Management Plan, and other provisions of CTUIR law. Under these Tribal laws, the CTUIR limits the exercise of treaty rights by its members for various reasons, including public safety and resource conservation.

The CTUIR anticipates that with the adoption of a comprehensive land-use plan for Hanford, members of the CTUIR will gradually resume treaty-reserved activities on much of the Hanford Site. The CTUIR will regulate its members' exercise of their treaty-reserved rights at Hanford to ensure that: (1) CTUIR members will not be placed at risk by Hanford contamination, (2) the exercise of treaty-reserved rights is consistent with conservation of natural resources, and (3) the exercise of the hunting right is consistent with public safety. The CTUIR intends to coordinate closely with DOE concerning these matters. The CTUIR anticipates that the CTUIR's regulation of its members' treaty-reserved activities will be consistent with the designations made in the Comprehensive Land-Use Plan adopted by the ROD for the HRA-EIS and the implementation process described in Chapter Six. Whether the CTUIR's regulation of its members will be consistent with this process will depend, in part, on the continuing quality of consultation on these matters between the CTUIR and DOE.

1.4.2.5 Local Governments. Portions of the Hanford Site lie within Benton, Franklin, Adams, and Grant counties. The primary portion of the Site falls within Benton County, and parts of the Wahluke Slope fall within Franklin, Grant, and Adams counties. The City of Richland abuts the southern boundary of the Hanford Site with the Cities' Urban Growth Area extending into the Hanford Site's 300 Area, and considerable development within the city limits and adjacent to the Site having already occurred.

Most planning by local governments falls under the *State of Washington Growth Management Act of 1990* (GMA), which established a statewide planning framework and created roles and responsibilities for planning at the local, regional, and state level. The GMA required the largest and fastest growing counties (counties with more than 50,000 people or population growth of more than 20 percent in the past 10 years), and cities within those counties to develop new comprehensive plans. Counties not required to plan may elect to do so. Benton, Franklin, and Grant counties, along with the City of Richland, have elected to plan under the GMA requirements.

Under the GMA, any county or city that implements the GMA is required to: (1) have the county legislative authority adopt a county-wide planning policy under the *Revised Code of Washington* (RCW) 36.70A.210, (2) have the county and each city located within that county adopt development regulations conserving agricultural lands, forest lands, mineral resource lands, and critical areas which must be designated by the local government within one year of the date the county legislative authority adopts its resolution of intention, (3) have the county designate the urban growth areas in cooperation with each city under RCW 36.70A.110, and (4) have the county and each city located within the county produce a comprehensive plan and development regulations within four years of the county announcing its intention to plan.

1.4.2.5.1 Benton County. The relationship between DOE and Benton County differs from its relationship to other counties with an interest in Hanford because most of the Hanford Site is located within Benton County. Benton County is preparing a comprehensive land-use plan that covers the entire county, which includes a portion of the Hanford Site. The DOE is committed to cooperating with the Benton County's planning effort. As part of its planning effort, Benton County has developed a proposed critical area's map, which depicts lands identified as critical areas under the GMA (Figure 1-3). The county has completed its SEPA review of the critical area's map and draft implementing ordinance provisions, which would be amended to the county's adopted Critical Resources Protection Ordinance. The Benton County Planning Commission has reviewed and approved the map and ordinance amendments at public hearings, and has forwarded them to the Board of County Commissioners for action, which is pending. Critical areas include wetlands areas with a critical recharging effect on aquifers used for potable water, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas.

The Port of Benton, which must comply with county land-use plans, has expressed interest in the industrial development of the 1100 Area, some of the 300 Area, and the area south of Washington Public Power Supply System, Plant Number 2. Some conceptual development plans for this area have been completed.

1.4.2.5.2 City of Richland. The City of Richland plans in coordination with Benton County under the GMA. Richland is greatly influenced by activities at the Hanford Site and has gone through several boom-and-bust cycles in response to employment levels at Hanford. Future land use at Hanford has the potential to affect the economic development of Richland. The city currently provides services such as water, electricity, and sanitary sewers to the southern portion of the Hanford Site. The City of Richland has identified portions of the southern Hanford Site (Figure 1-4) suitable for urban development and possible annexation.

Figure 1-3. Benton County Proposed Critical Areas Map

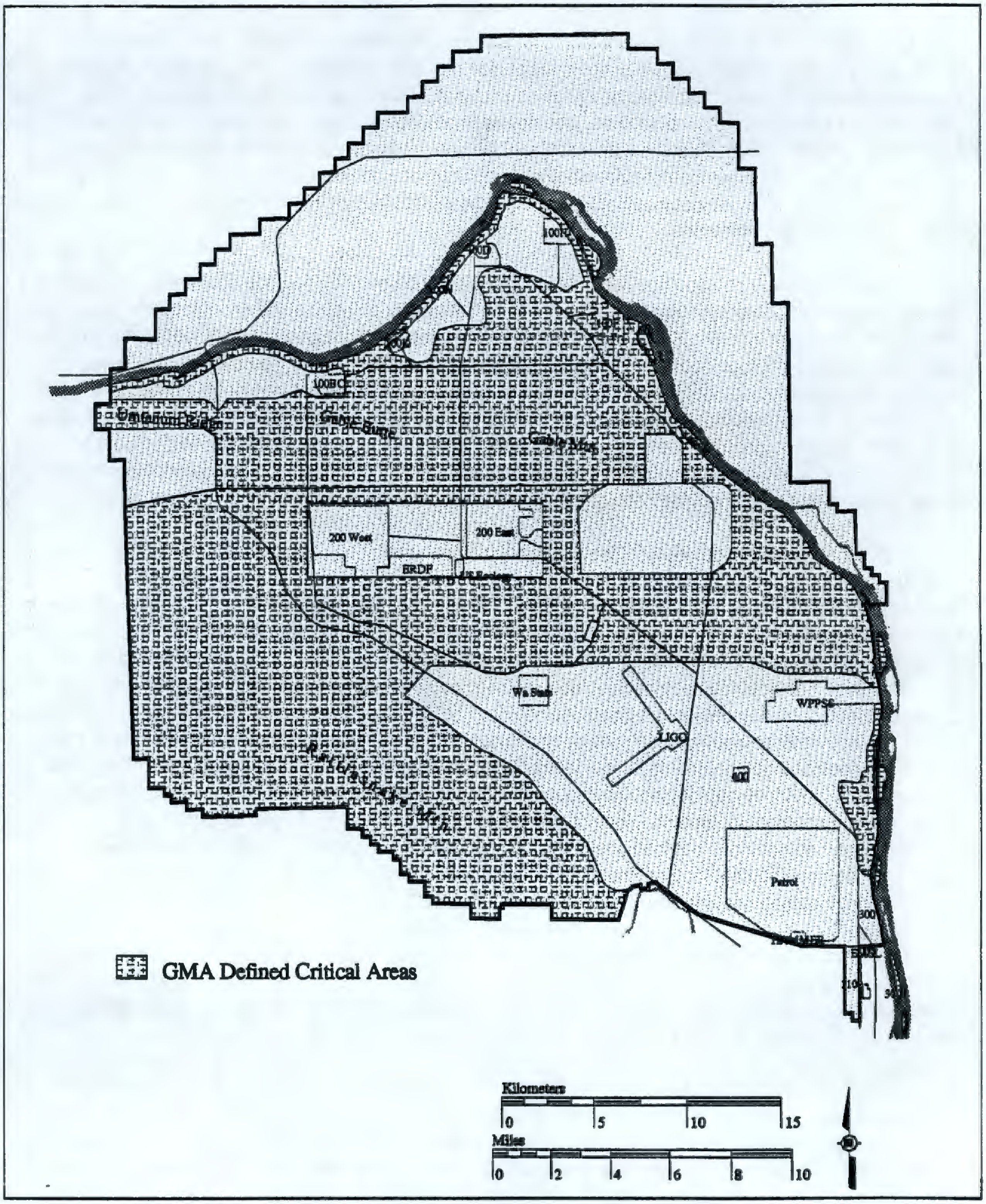
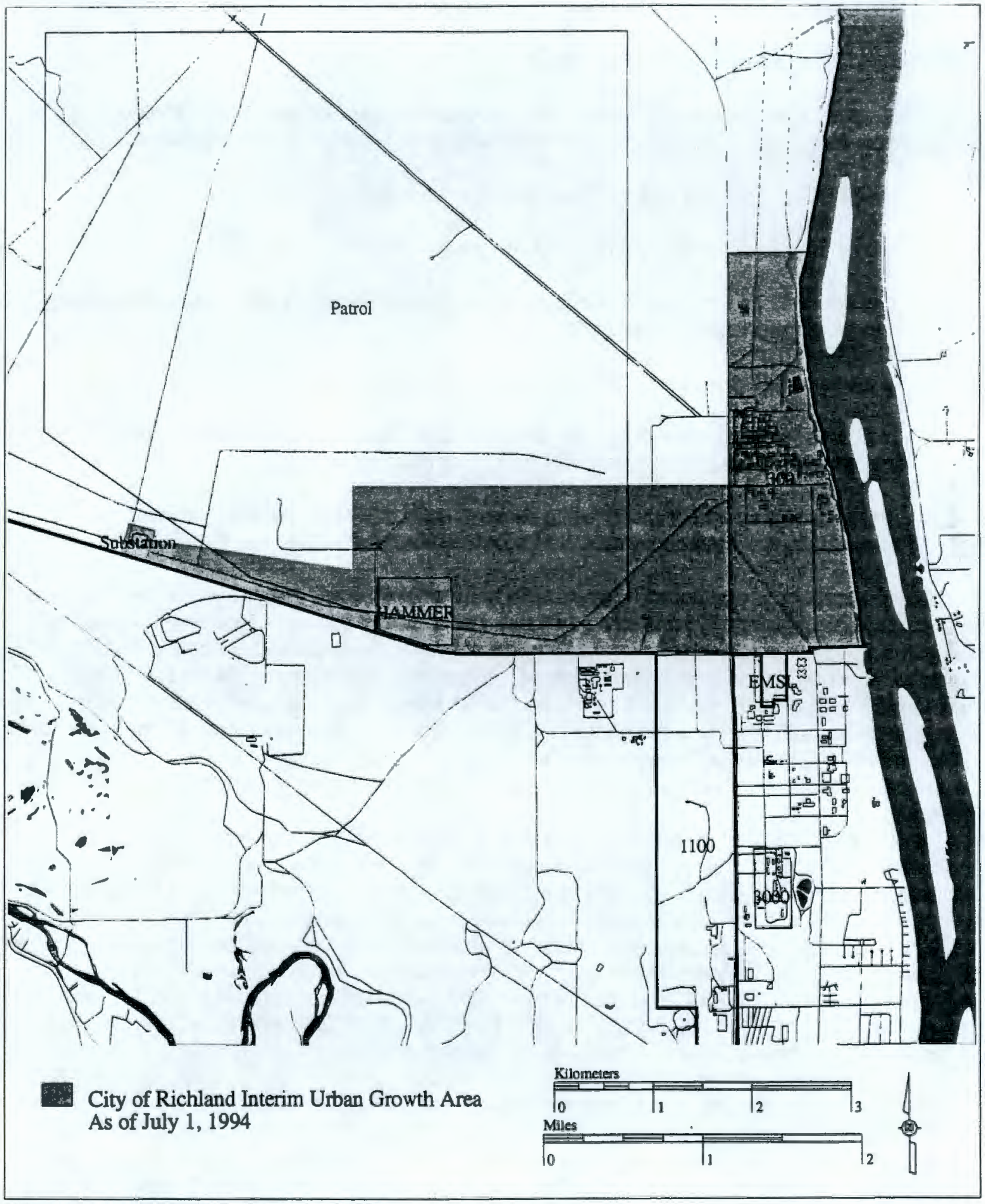


Figure 1-4. City of Richland Urban Growth Area



BHI:rpp 01/13/98 draft_2/urban1.aml Database: 13-JAN-1998

1.4.2.5.3 Grant, Franklin, and Adams Counties. Grant, Franklin, and Adams counties coordinate local land-use planning for the Wahluke Slope. The three counties, along with the Port of Mattawa, have expressed a desire to implement a land-use plan similar to the Wahluke 2000 Committee Plan (Figure 1-5). The Wahluke 2000 Committee Plan proposes multiple-use land uses for the Wahluke Slope that would accommodate increased agricultural activities, including irrigated cropping systems, along with wildlife and cultural resource protections.

1.4.3 Federal Land Transfer Procedures

Following are some of the questions the Federal General Services Administration developed for executive agencies to consider in identifying valid real property needs:

- Is all of the property essential for program requirements?

- Are buffer zones kept to a minimum?

- Can the land be disposed of and program requirements satisfied through reserving rights and interests in the property?

- Is the land being retained merely because it is landlocked?

- Is the land being retained merely because it is considered undesirable due to topographical features or believed to be not disposable?

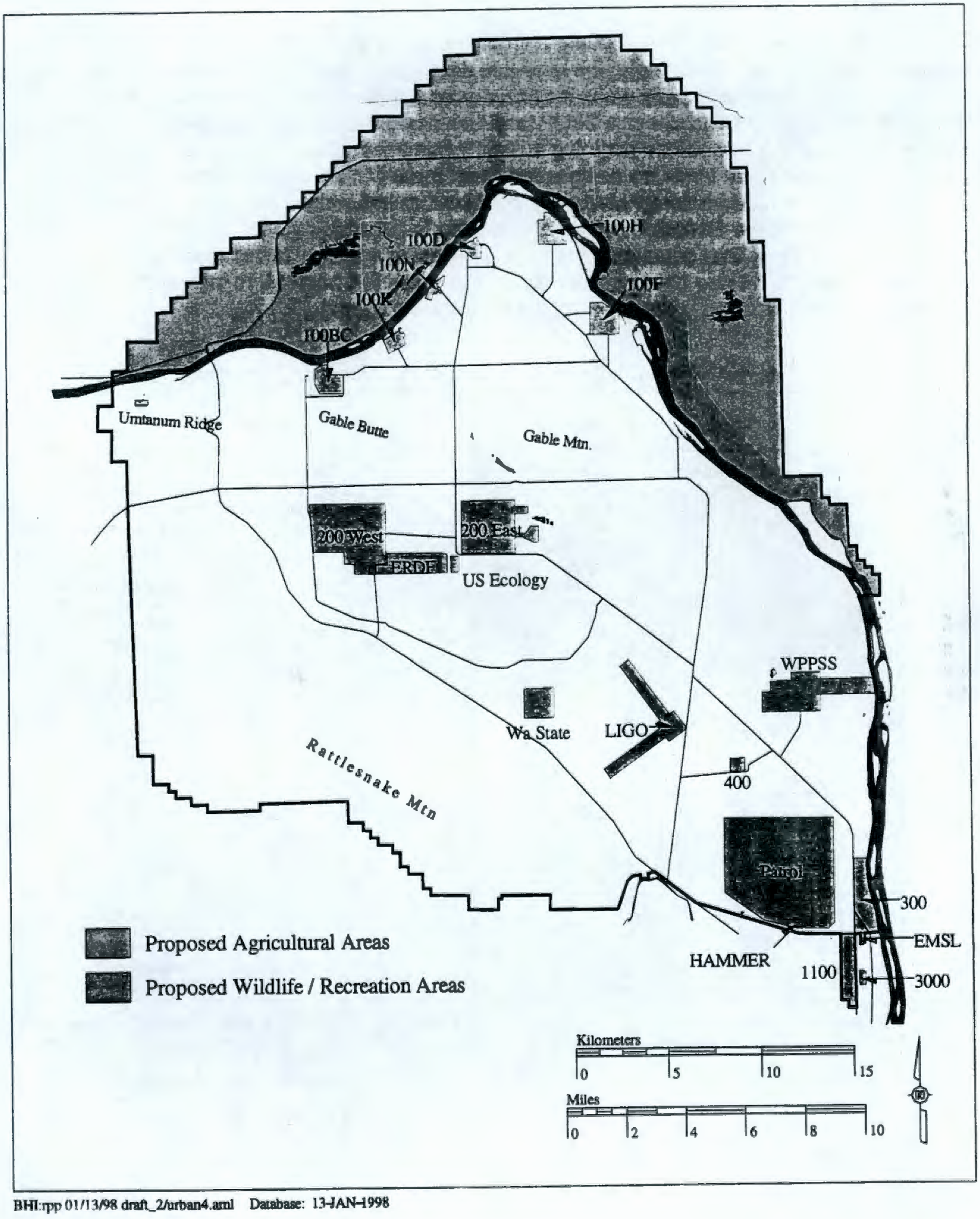
- Is any portion of the property being retained primarily because the present boundaries are marked by existing fences, roads, and utility systems?

These questions are specifically applicable to purchased land. However, in the absence of other guidance, it is reasonable to apply these same factors when assessing the need for land withdrawn from the Public Domain. Departmental policy requires field activities to identify long-term mission needs and rationally plan for future site development. More specifically, policy requires that comprehensive land-use plans be developed based on mission needs, site and regional conditions, strategic goals, and other technical information such as the need for buffer zones. Also, disposals are to be made through the Department's certified realty specialists at field sites in accordance with statutory and regulatory requirements (DOE 1997c).

Within the context of Hanford, the CLUP's authority is limited to as long as DOE retains legal control of some portion of the land estate. For example, in the Columbia River Corridor, DOE might decide to retain control of the subsurface or groundwater and release only the first 5 m (15 ft) of the surface. Because of the cooperating agencies' involvement, however, the CLUP can provide reasonable assurance as to what the future land use would be if the land is transferred to the control of one of the cooperating agencies. Further, the creation of a land-use plan through the NEPA process can assist the transfer of land under DOE's NEPA regulations (e.g., 10 CFR 1021, CX A.7, CX B1.24, and CX B1.25) where there is no change in land use, and there is little expressed public interest.

With the input from the cooperating agencies, the usefulness of this EIS goes beyond the control of DOE. This EIS is not about land transfer; rather, it is about the integrated use and management of land and resources independent of who owns the land. This EIS does not contain any new mechanisms or preferences regarding the transfer of land. In fact, the EIS

Figure 1-5. Wahluke 2000 Plan Map



BHI:rpp 01/13/98 draft_2/urban4.aml Database: 13-JAN-1998 and the implementing CLUP are ownership neutral. Land transfer is a complicated and separate process from the CLUP. For more information about regulations pertaining to land transfer or facility leasing, see Table 1-4. For more information about the process for transferring property, refer to the guidebook, *Cross-Cut Guidance on Environmental Requirements for DOE Real Property Transfers* (DOE 1997), or the Department of Ecology's guidebook, *Hanford Land Transfer* (Ecology 1993).

Chapter 6 details how the cooperating agencies would approach land-use planning should a land-use transfer occur. Generally, the land-use designation in the CLUP for a specific piece of property goes with that property when it's transferred to a cooperating agency. In other words, should a piece of land under a CLUP land-use designation get transferred, and if the agency that acquires the land-use planning authority has adopted the same land-use designation as the current land-use designation, then there is no change in the land-use designation (i.e., if DOE has designated a piece of land as Industrial and it is transferred to the Port of Benton, and if the Benton County's designation is Industrial, then the zoning remains Industrial). The agency that acquires the land-use planning authority is encouraged, but not required, to use the land-use change procedures discussed in Chapter 6 to implement any changes to DOE's preferred land use once it leaves DOE's control.

Table 1-4. Regulations Affecting Land Transfer. (3 pages)

Year	Law	Name	Mechanism	Term	Approvals	Major Elements
1954	PL 83-703, Sec. 161(g)	*Atomic Energy Act* (AEA)	- Lease Real Property - Lease Personal Property - Sell Real Property - Sell Personal Property	Not specified	Sec. of Energy approval delegated to field offices	- General authority to sell, lease, grant, and dispose of real and personal property. (There must be a direct correlation between the purpose of the lease and the mission of DOE derived from the AEA.) - Limited to R&D efforts or efforts to support atomic energy, or efforts to support international agreements
1955	PL 221-Chapter 543: 69 STAT 471, as amended 1964 (PL 88-394); (US Code 42 USC 2349)	*Atomic Energy Community Act*	- Lease Land - Lease Equipment - Sell Equipment	Not specified	Sec. of Energy approval Congressional Review	- Applies to Hanford Site only - Must obtain fair market value - Congress has 45 day review - Must reduce adverse economic impact in local area
1977	PL 95-91, 91 STAT 565, as amended, 42 USC 701 et. seq., August 4, 1977	*Energy Organization Act*	Lease Real Property	5 years	Local DOE field office authority for approval established under DOE Order 4300.1C	- Not currently needed, but not yet excessed - Does not require fair market value, but implementing DOE order 4300.1C does require fair market value

Table 1-4. Regulations Affecting Land Transfer. (3 pages)

Year	Law	Name	Mechanism	Term	Approvals	Major Elements
1954	Chapter 1255- Public Law 771 43 USC 931c	*Public Lands Authorization for Certain Uses*	Lease Land	30 years	Secretary or designee	- DOE must have authority over land - Fair market value must be received - Can only lease to states, counties, cities, towns, townships, municipal corporations, or other public agencies for the purpose of construction and maintaining on such lands, public buildings or other public works
1980	PL 96-480	*Stephen-Wydler Technology Innovation Act*	- Technology Transfer - Cooperative Research Agreements - Licensing	N/A	Local DOE field office authority	-Established technology transfer as a mission of the federal government
1949	Chapter 288, 63 STAT 377 40 USC 471 et. seq.	*Federal Property and Administrative Services Act of 1949*, as amended				
1994	PL 103-251, 15 USCA 3710a	*Cooperative Research & Development Agreements* (CRADA)	- Land Use - Facility Use - Equipment Transfer	5 years	Local DOE field office authority	-Must be joint effort between one or more government laboratories and one or more non-Federal parties - Work scope must be research and development - Special consideration to small businesses - Both Parties can provide people, services, facilities, equipment, intellectual property, and other resources, except government cannot provide cash

Table 1-4. Regulations Affecting Land Transfer. (3 pages)

Year	Law	Name	Mechanism	Term	Approvals	Major Elements
1994	PL 103-160, Sec 3154, 3155	*Defense Authorization Act* (Hall Amendment)	Section 3154: - Lease Real Property and related personal property	Sec 3154: 10 years - option for additional term (unspecified)	Section 3154: - Requires Secretary approval or designee plus administrator of EPA for NPL Site or appropriate state official. State official has 60 days to reject request for concurrence	Section 3154: - Located at DOE facility to be closed or reconfigured - Not needed by DOE - Under DOE's control - Must be acquired land, not Public Domain land - Can be leased for less than fair market value - Lease revenues can be used at the Site generating the revenues.
			Section 3155: - Transfer Personal Property		Section 3155: - Secretary or designee approval required	Section 3155: - Can be used if transfer mitigates adverse economic consequences that might otherwise arise from the closure of the facility - Equipment must be located at the facility to be closed - Must be excess to DOE needs - Must cost more than 110% of new cost to relocate if needed elsewhere in DOE - Consideration received may be less than fair market value - Additional terms may be required that Secretary deems necessary to protect U.S. interests

Table of Contents

2.0 Purpose and Need 2-1

This page intentionally left blank.

2.0 Purpose and Need

The U.S. Department of Energy (DOE) has several missions to fulfill at the Hanford Site that have competing natural resource consumption needs and management values. Governments and stakeholders within the region have an interest in Hanford resources and in management of those resources over the long term. DOE needs to conduct a process to assess the relative qualities of Hanford's resources, compare the priorities and needs of Hanford's missions, and reach decisions concerning the most efficient way to manage and use those resources in fulfillment of Hanford's missions. Moreover, such a process has now been mandated by DOE Order 430.1 and by Public Law 104-201. The purpose of the *Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land-Use Plan* (HRA-EIS) (DOE/EIS-0222D) is to provide a mechanism to conduct this analysis and make decisions.

DOE needs to determine (1) If DOE wants to plan with the cooperating agencies, and (2) what the land-use plan should look like. The decision to cooperatively plan involves the adoption of plans and procedures as outlined in Chapter 6. The default would be no cooperative planning as referenced in the no-action alternative.

The role of the HRA-EIS is to document, in the public forum, the process of determining the best combination of potential land uses required to meet DOE mission needs over the next 50 years. Through this EIS, the DOE is responding to these needs as follows:

- Meet the mandate set forth in Public Law 104-201, Section 3153, requiring the development of a final future-use plan

- Support the U.S. Environmental Protection Agency (EPA) remediation decision-making processes

- Develop a comprehensive land-use plan for the Hanford Site in accordance with DOE Order 430.1 (DOE 1995c).

This page intentionally left blank.

Table of Contents

3.0 Description of the Proposed Action and Alternatives 3-1

3.1 Proposed Action 3-1

3.2 Development of the Alternatives 3-1
3.2.1 Involvement of the Cooperating Agencies 3-1
3.2.2 Development of the Nine Hanford Site Land-Use Designations 3-2
3.2.3 Identification of Land-Use Suitability 3-2
3.2.4 Developing the Environmental Impact Statement Alternatives 3-5
3.2.5 Incorporation of the Future Site Uses Working Group's Geographic Study Areas into the Alternatives 3-5
3.2.6 Screening for Reasonable Alternatives 3-6

3.3 Description of the Alternatives 3-8
3.3.1 No-Action Alternative 3-9
3.3.1.1 Planning Goals, Objectives, and Values (Vision) 3-11
3.3.1.2 Assumptions Regarding Future Use 3-13
3.3.1.3 Application of the Land-Use Designations. 3-13
3.3.1.3.1 The Wahluke Slope 3-13
3.3.1.3.2 The Columbia River Corridor 3-13
3.3.1.3.3 The Central Plateau 3-14
3.3.1.3.4 The All Other Areas 3-14
3.3.1.3.5 The Arid Lands Ecology Reserve (ALE Reserve) 3-15
3.3.2 The Agency's Preferred Alternative 3-17
3.3.2.1 Planning Goals, Objectives, and Values (Vision) 3-17
3.3.2.2 Assumptions Regarding Future Use 3-17
3.3.2.3 Application of the Land-Use Designations 3-19
3.3.2.3.1 The Wahluke Slope 3-19
3.3.2.3.2 The Columbia River Corridor 3-20
3.3.2.3.3 The Central Plateau 3-21
3.3.2.3.4 The All Other Areas 3-21
3.3.2.3.5 The Arid Lands Ecology Reserve (ALE Reserve) 3-22
3.3.3 Alternative One 3-23
3.3.3.1 Planning Goals, Objectives, and Values (Vision) 3-23
3.3.3.2 Assumptions Regarding Future Use 3-25
3.3.3.3 Application of the Land-Use Designations 3-26
3.3.3.3.1 The Wahluke Slope. 3-26
3.3.3.3.2 The Columbia River Corridor. 3-26
3.3.3.3.3 The Central Plateau 3-27
3.3.3.3.4 The All Other Areas 3-27
3.3.3.3.5 The Arid Lands Ecology Reserve (ALE Reserve) 3-28
3.3.4 Alternative Two 3-29
3.3.4.1 Planning Goals, Objectives, and Values (Vision) 3-29
3.3.4.2 Assumptions Regarding Future Use 3-29
3.3.4.3 Application of the Land-Use Designations 3-31
3.3.4.3.1 The Wahluke Slope 3-31
3.3.4.3.2 The Columbia River Corridor 3-32
3.3.4.3.3 The Central Plateau 3-32
3.3.4.3.4 The All Other Areas 3-32
3.3.4.4 The Arid Lands Ecology Reserve (ALE Reserve) 3-33

3.3.5 Alternative Three 3-35
3.3.5.1 Planning Goals, Objectives, and Values (Vision). 3-35
3.3.5.2 Assumptions Regarding Future Uses 3-35
3.3.5.3 Application of the Land-Use Designations 3-36
3.3.5.3.1 The Wahluke Slope 3-38
3.3.5.3.2 The Columbia River Corridor 3-39
3.3.5.3.3 The Central Plateau 3-39
3.3.5.3.4 The All Other Areas 3-39
3.3.5.3.5 The Arid Lands Ecology Reserve (ALE Reserve) 3-40
3.3.6 Alternative Four 3-41
3.3.6.1 Planning Goals, Objectives, and Values (Vision). 3-41
3.3.6.2 Assumptions Regarding Future Use 3-41
3.3.6.3 Application of the Land-Use Designations 3-45
3.3.6.3.1 The Wahluke Slope 3-45
3.3.6.3.2 The Columbia River Corridor 3-45
3.3.6.3.3 The Central Plateau 3-46
3.3.6.3.4 The All Other Areas 3-46
3.3.6.3.5 The Arid Lands Ecology Reserve (ALE Reserve) 3-49

3.4 Summary of Potential Environmental Impacts 3-51
3.4.1 Comparison of Affected Areas by Alternative 3-51
3.4.2 Comparison of Affected Resources 3-52

Figures

3-1. Geographic Study Areas on the Hanford Site 3-7
3-2. No-Action Alternative 3-10
3-3. The Preferred Alternative 3-18
3-4. Alternative One 3-24
3-5. Alternative Two 3-30
3-6. Alternative Three 3-37
3-7. Alternative Four 3-42

Tables

3-1. Hanford Site Land-Use Designations 3-3
3-2. Comparisons of Affected Areas by Alternative 3-51
3-3. Summary of Potential Impacts to Hanford Site Resources 3-53

3.0 Description of the Proposed Action and Alternatives

This chapter describes the proposed action and the alternative methods by which the proposed action could be accomplished. Also included is a discussion of the No-Action Alternative. A No-Action Alternative is required by the *National Environmental Policy Act of 1969* (NEPA) and provides a baseline against which the impacts of the other alternatives can be compared.

3.1 Proposed Action

The proposed action for the *Hanford Remedial Action Environmental Impact Statement and Comprehensive Land-Use Plan* (HRA-EIS) is to develop a comprehensive future land-use plan for the Hanford Site. As mandated by Public Law 104-201, Section 3153, the land-use plan must address a 50-year planning period. Once established, this land-use plan would provide a framework for making land-use and facility-use decisions.

3.2 Development of the Alternatives

Alternatives for potential future use of the Hanford Site lands were developed through a cooperative effort with the U.S. Department of Energy (DOE); the Confederated Tribes of the Umatilla Indian Reservation (CTUIR); the Nez Perce Tribe Department of Environmental Restoration and Waste Management (Nez Perce ER/WM Department); the U.S. Department of Interior (DOI); the Washington Department of Fish and Wildlife (WDFW); the City of Richland; and Benton, Franklin, and Grant counties. Following development of the alternatives, an analysis of potential environmental impacts resulting from proposed future land uses associated with each alternative was conducted. The results of these impact analyses are presented in Chapter 5.

3.2.1 Involvement of the Cooperating Agencies

During the public comment period on the August 1996 Draft HRA-EIS, several entities formally requested cooperating agency status in developing the Final HRA-EIS. These agencies included the DOI, the City of Richland, and Benton and Franklin counties (with whom the State of Washington has placed land-use planning authority under the *Washington Growth Management Act of 1990* [GMA]). Each of these agencies has a legal interest in land-use planning at the Hanford Site because each has some responsibility or interest in managing Hanford lands or dependent resources. From a management perspective, it is also important to understand who orchestrates Columbia River activities (see text box, *"The Managed River"*).

Discussions with the interested agencies were initiated in January 1997 to provide a forum to participate in Hanford Site land-use planning and alternatives development. On March 4, 1997, DOE issued letters formally requesting the participation of these agencies, as well as Grant County and affected Tribal governments, in the development of a Revised Draft HRA-EIS. Later, upon request, a letter was also issued to the U.S. Department of Fish and Wildlife (USFWS) (see Appendix B).

The HRA-EIS land-use planning sessions resulted in development of the nine land-use designations, six alternatives (including the No-Action Alternative), planning goals and policies, the environmental impacts analysis, and the contents of the Revised Draft HRA-EIS. The

HRA-EIS cooperating agency sessions are expected to continue through publication of the Record of Decision (ROD) and implementation of the Comprehensive Land Use Plan (CLUP) (see Chapter 6).

3.2.2 *Development of the Nine Hanford Site Land-Use Designations*

The following land-use designations and their definitions were developed by the cooperating agencies so alternative land-use plans could be commonly developed and compared. These land-use designations determined to be suitable for the Hanford Site lands include the following designations:

- Industrial-Exclusive
- Industrial
- Agricultural
- Research and Development
- High-Intensity Recreation
- Low-Intensity Recreation
- Conservation (Mining and Grazing)
- Conservation (Mining)
- Preservation.

These Hanford Site land-use designations and their definitions are presented in Table 3-1. In developing these definitions, the cooperating agencies drew from the Final Report of the Future Site Uses Working Group (FSUWG), the August 1996 Draft HRA-EIS, Benton County's GMA planning effort, and the City of Richland's GMA planning effort.

> ***The Managed River***
>
> Because ownership is integral to land-use planning, it is important to understand who owns the Columbia River. Within the Hanford Comprehensive Land-Use Plan, the DOE, Bureau of Land Management (BLM), Bureau of Reclamation (BoR), U.S. Army Corps of Engineers (USACE), and Washington State Department of Natural Resources all own portions of the Columbia River's islands, riverbed, shoreline, water, or adjoining riverbanks. The Columbia River is central to both commerce and environmental quality for the Northwest.
>
> In addition to ownership, it also helps to know what activities are regulated and who the managers are in the Columbia River Corridor. The Columbia River is a very managed river. At the top of the Federal responsibilities are Congressional Treaties. There are treaties with Tribal Nations concerning fishing rights, international treaties concerning migratory birds, and specific treaties with Canada that concern river flows, hydropower marketing, and migratory fish stocks. Next is the authority of the Federal agencies. Section 404 of the *Clean Water Act* involves two lead agencies — the U.S. Environmental Protection Agency (EPA), whose regulations implement the Dredged and Fill Material Discharge Permit Program of Section 404, and the USACE, whose regulations also implement the permit program and who control river flows via their dams.
>
> The DOI has several agencies with regulatory authority on the river, including the USFWS for the migratory and listed *Endangered Species Act* plants or animals, the National Park Service while the river is being considered for Wild and Scenic Recreational status, and the BoR which controls river flows via their dams. The U.S. Department of Commerce's National Oceanic and Atmospheric Administration, National Marine Fisheries Service (or "NOAA Fisheries") administers NOAA's programs that support the migratory salmon and steelhead stocks. The DOE operates the Hanford Site through its agency, the Bonneville Power Administration, marketing the hydroelectric power generated at a series of dams on the Columbia River and its tributaries. At the local level, Benton, Franklin, and Grant counties have some dams that regulate river flow and have planning authority for the shoreline through the shoreline master program.

3.2.3 *Identification of Land-Use Suitability*

Developing alternatives was preceded by a land-use suitability analysis for a given area of the Hanford Site. A roundtable opportunity-and-constraint discussion on existing Site conditions was shared by the cooperating agencies. During these discussions, the land-use designations in Table 3-1 were developed. While land-use decisions are fundamentally value-driven decisions, they also should be informed decisions by identifying opportunities and

Table 3-1. Hanford Site Land-Use Designations.

Land-Use Designation	Definition
Industrial-Exclusive	An area suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes. Includes related activities consistent with Industrial-Exclusive uses.
Industrial	An area suitable and desirable for activities, such as reactor operations, rail, barge transport facilities, mining, manufacturing, food processing, assembly, warehouse, and distribution operations. Includes related activities consistent with Industrial uses.
Agricultural	An area designated for the tilling of soil, raising of crops and livestock, and horticulture for commercial purposes along with all those activities normally and routinely involved in horticulture and the production of crops and livestock. Includes related activities consistent with Agricultural uses.
Research and Development	An area designated for conducting basic or applied research that requires the use of a large-scale or isolated facility. Includes scientific, engineering, technology development, technology transfer, and technology deployment activities to meet regional and national needs. Includes related activities consistent with Research and Development.
High-Intensity Recreation	An area allocated for high-intensity, visitor-serving activities and facilities (commercial and governmental), such as golf courses, recreational vehicle parks, boat launching facilities, Tribal fishing facilities, destination resorts, cultural centers, and museums. Includes related activities consistent with High-Intensity Recreation.
Low-Intensity Recreation	An area allocated for low-intensity, visitor-serving facilities, such as improved recreational trails, primitive boat launching facilities, and permitted campgrounds. Includes related activities consistent with Low-Intensity Recreation.
Conservation (Mining and Grazing)	An area reserved for the management and protection of archeological, cultural, ecological, and natural resources. Limited and managed mining and grazing could occur as a special use (e.g., a permit would be required) within appropriate areas. Limited public access would be consistent with resource conservation. Includes activities related to Conservation (Mining and Grazing), consistent with the protection of archeological, cultural, ecological, and natural resources.
Conservation (Mining)	An area reserved for the management and protection of archeological, cultural, ecological, and natural resources. Limited and managed mining could occur as a special use (e.g., a permit would be required) within appropriate areas. Limited public access would be consistent with resource conservation. Includes activities related to Conservation (Mining), consistent with the protection of archeological, cultural, ecological, and natural resources.
Preservation	An area managed for the preservation of archeological, cultural, ecological, and natural resources. No new consumptive uses (e.g., mining) would be allowed within this area. Public access controls would be consistent with resource preservation requirements. Includes activities related to Preservation uses.

constraints (see text box, *"What is an Opportunity or Constraint?")* Existing Site conditions and resources analyzed in the Revised Draft HRA-EIS include the following:

- Biology
- Surface water
- Groundwater
- Waste sites including vadose zone
- Geological
- Cultural
- Economic (e.g., infrastructure).

These definitions, while based on land-use suitability, also provide insight into a myriad of potential land-use opportunities and reflect the many and varied interests of the cooperating agencies. Examples of potential implementation for the definitions in Table 3-1 follow.

Industrial-Exclusive -- Would use existing waste management areas, such as the 200 Area. This land-use designation would preserve DOE control of the continuing remediation activities and use the existing compatible infrastructure required to support these activities. This land-use designation supports the Environmental Protection Agency (EPA) Brownfields Initiative for contaminated areas (EPA 1997).

Industrial -- Would allow the opportunity for expanded economic growth as a result of an increased and diversified regional marketplace. This land-use designation would use existing compatible infrastructure, including transportation corridors, utilities and availability of energy, and suitable buildings or building space. This land-use designation supports the EPA Brownfields Initiative for contaminated areas (EPA 1997).

Agriculture -- Would use the economic potential of the Columbia River Basin in eastern Washington (see text box, "*Hanford's Agricultural Opportunity Cost*").

What Is an Opportunity or Constraint?

In land-use planning, existing conditions offer a mix of "opportunities and constraints." Not all opportunities are equally viable at a specific point in time. And, few constraints are insurmountable given today's engineering and construction capabilities.

For example, shorelines of navigable water bodies typically have *constraints* to development because of potential flooding, geologic instability, bank erosion, wildlife habitat, and cultural resources. However, shorelines also offer excellent *opportunities* for enhancing recreation, cultural resources, fishery habitat, and water quality. These shorelines also are unique in that siting of needed water "dependent" and water "related" developments cannot be an opportunity (physically located) in upland landscapes.

Landscapes with few or no constraints present the greatest challenges because they represent boundless opportunities with no hint as to their inherent suitability for one land use or another. Consequently, unless a site's suitability for a particular land use is narrowly prescribed by law (e.g., wetlands are protected for biological and water quality needs), the land-use decision is fundamentally value driven. Therefore, when the opportunities and constraints of a particular landscape are analyzed together, the "suitability" for different land uses can be compared and contrasted for an informed and value-driven decision.

Research and Development -- Would allow economic growth potential from research activities associated with Hanford Site remediation, as well as non-site-related research activities. This land-use designation would take advantage of existing compatible infrastructure, including transportation corridors, utilities, and availability of energy, suitable buildings or building space, and security (i.e., controlled access), and the isolation of the Hanford Site from large population centers.

High-Intensity Recreation -- Would use the economic potential of planned multi-activity recreational uses, including destination resorts, golf courses, recreational vehicle service areas, and off-road vehicle parks.

Low-Intensity Recreation -- Would allow use of the Hanford Site's natural features and the opportunity for human recreational activities (e.g., fishing, hiking, and biking), which would result in minimal disturbance and require minimal development. Low-Intensity Recreation would require active management practices to preserve the existing resources, and to minimize or eliminate undesirable or non-native species.

Conservation (Mining and Grazing) -- Would use the economic potential of the open space and the availability of valuable near-surface geologic resources on the Hanford Site. This land-use designation would allow permitted (i.e., conditional) livestock grazing and mining activities in specific, limited areas. Should DOE determine that some or all of the withdrawn lands are surplus to DOE's needs and releases the Public Domain lands back to the DOE, the DOE could then determine if the Tribal treaty language "the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land" is applicable. Conservation (Mining and Grazing) would afford protection of natural resources;

however, other compatible uses, such as recreation, would also be allowed. Conservation would require active management practices to preserve the existing resources, and to minimize or eliminate undesirable or non-native species.

Conservation (Mining) -- Would allow the same permitted uses as Conservation (Mining and Grazing), except grazing would be prohibited. This land-use designation reflects the anticipated need for onsite geologic resources to construct surface barriers as required by Hanford Site remediation activities. Conservation would require active management practices to preserve the existing resources, and to minimize or eliminate undesirable or non-native species.

Preservation -- Would protect the unique Hanford Site natural resources and would enhance the benefits resulting from the protection of these resources. Preservation would require active management practices to preserve the existing resources, and to minimize or eliminate undesirable or non-native species. Commercial grazing of domesticated livestock would not be allowed. An approved wild fire management plan also would be required. Preservation would not preclude all access, but would allow only uses consistent with the purposes of the preservation of the natural resources.

A discussion of the affected environment and the existing constraints due to legacy waste contamination and other features is presented in Chapter 4. Chapter 4 also contains Hanford Site maps that illustrate the relevant site characteristics of the natural environment and individual constraints.

Hanford's Agricultural Opportunity Cost

In a May 18, 1995, letter response to the Benton County Assessor, the Washington State University Area Extension Horticulturist, John W. Watson, estimated the present value of crops that could be grown on the Benton County portion of the Hanford Site. His report estimated the farm gate income from arable Hanford acreage (79,737 ha [197,035 ac], or 73 percent of the area) under three assumption scenarios:

- **Assumption 1.** Benton County has 26 major crops currently being grown on irrigated land. Growing those crops on the site, Hanford agricultural income would equal $121,491,340.
- **Assumption 2.** If the crops that are expanding the fastest in the county are the only crops used to estimate potential income, the lost farm gate income in 1994 would be as follows:
  - 50% apples would be 98,517 acres at $5,000/acre for $492,800,000
  - 25% cherries would be 49,258 acres at $7,000/acre for $344,806,000
  - 25% grapes would be 49,258 acres at $4,000/acre for $197,032,000

  (resulting in a total of $1,034,638,000).
- **Assumption 3.** If the total acreage was planted to high-income-producing apple varieties (e.g., Gala, Fuji, and Braeburn), then Hanford lands could produce an income of $2,955,525,000 (assuming 197,035 ac at $15,000/ac).

3.2.4 Developing the Environmental Impact Statement Alternatives

Following identification of the opportunities and constraints on the Hanford Site (see Chapter 4), and development of the nine land-use designations, individual alternatives were developed. Based on visions, goals, and objectives of the cooperating agencies, the land-use designations were applied to specific tracts of land on the Hanford Site. This process resulted in the development of the five (six, including the No-Action) alternatives that are presented and analyzed in this Revised Draft HRA-EIS.

3.2.5 Incorporation of the Future Site Uses Working Group's Geographic Study Areas into the Alternatives

On December 22, 1992, the FSUWG submitted its report into the official scoping record for the HRA-EIS, which provided one of the first coordinated outside looks into the future of the Hanford Site. One of the important contributions of the FSUWG was the establishment of six geographic study areas for the Hanford Site for planning purposes (see Figure 3-1). These geographic areas were North of the River, the Columbia River, Reactors on the River, the Central Plateau, All Other Areas, and the Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve). These original geographic areas are used in this EIS with the following slight modifications:

- The North of the River geographic area has adopted the local name, the Wahluke Slope.

- Two geographic areas -- the Reactors on the River and the Columbia River -- have been combined into a single geographic area, the Columbia River Corridor, consistent with Hanford Advisory Board (HAB) advice.

- The buffer area associated with the Central Plateau geographic area is not shown; instead, the Central Plateau geographic area represents only the central waste management area and defers the point of compliance for groundwater to the Tri-Party Agreement's processes.

- The All Other Areas was divided into the South 600 Area to reflect the clusters of infrastructure located there, and the Central Core which surrounds the Central Plateau but contains less developed infrastructure.

3.2.6 Screening for Reasonable Alternatives

As discussed in the "Memorandum to Agencies: Forty Most Asked Questions Concerning the Council on Environmental Quality's (CEQ) *National Environmental Policy Act* Regulations" (40 FR 18026), reasonable alternatives include the alternatives that are feasible from a common sense, technical, and economic standpoint. Further, the CEQ guidance states that the number of reasonable alternatives considered in detail should represent the full spectrum of alternatives for meeting the purpose and need of the agency, but should not discuss every unique alternative when an unmanageably large number of alternatives would be involved.

An infinite number of land-use alternatives could be developed for the Hanford Site. Consequently, DOE and the cooperating agencies developed a process for generating a series of alternatives representative of the many stakeholder desires for the future of the Hanford Site lands. This involved considering the relevant factors that influence land use at the Hanford Site. These factors include the following:

- Consider public values from scoping and comments on the August 1996 Draft HRA-EIS

- Consider site characteristics

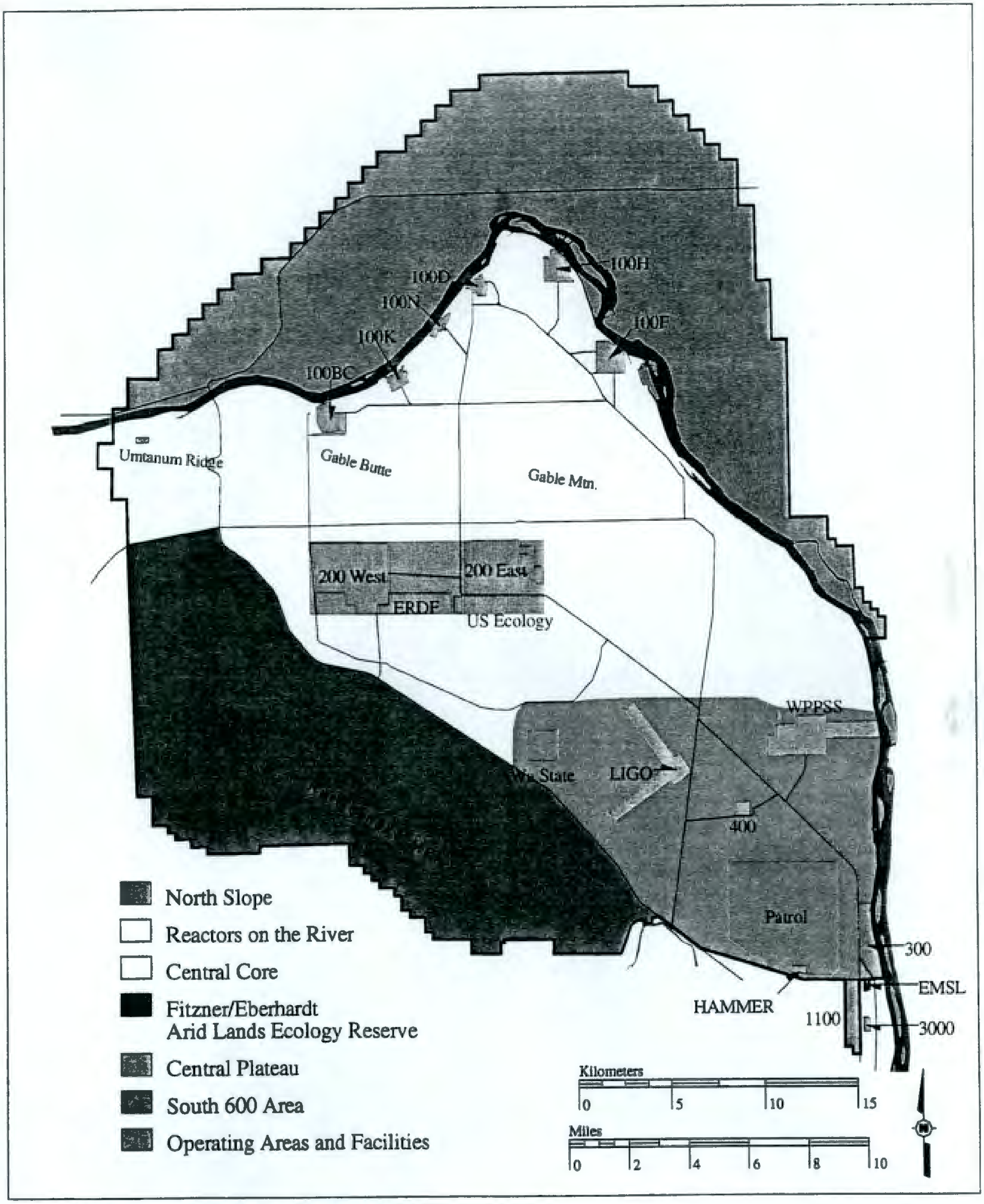
- Consider regional development and ecosystem characteristics

- Consider the FSUWG plausible future-use options and HAB advice

- Consider existing land uses, permits, easements, and current ownerships (i.e., the Bureau of Land Management (BLM), Bureau of Reclamation (BoR), DOE, State of Washington, and Big Bend Alberta Mining Company) in developing proposed land uses

- Consider projected changes to the natural and built environment over the next 50 years

Figure 3-1. Geographic Study Areas on the Hanford Site.



BHI:rpp 04/23/96 clup/geogareac1.aml Database: 23-APR-1998

THIS PAGE INTENTIONALLY
LEFT BLANK

- Consider projected future land uses at 50 years (in the year 2046)

- Evaluate projected future land uses against the values, goals, and objectives of the expressed public interests and the cooperating agencies

- Consider contamination institutional controls

- Honor treaties.

3.3 Description of the Alternatives

The individual land-use alternatives developed for this Revised Draft HRA-EIS, as well as the No-Action Alternative, are discussed in the following sections. Each discussion begins with the values that were used to develop the alternative. These values were applied to the nine land-use designations listed in Table 3-1 to generate six alternatives, each of which reflects a particular future land-use objective.

3.3.1 No-Action Alternative

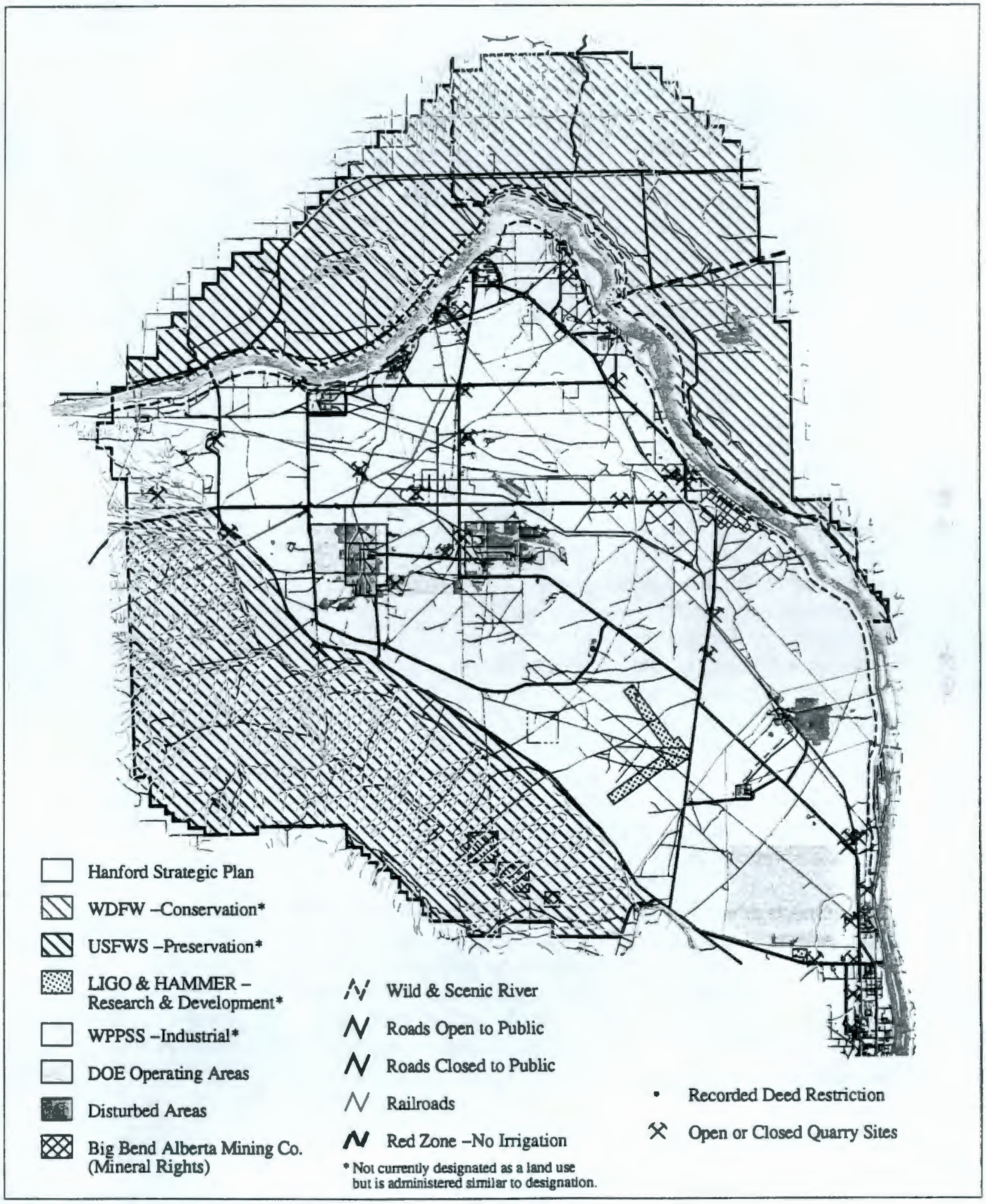
As required by CEQ regulations for implementing NEPA (40 CFR 1502.14[d]), the No-Action Alternative has been included. Question 3 of CEQ's guidance, "Council of Environmental Quality Regulations for Implementing the Procedural Provisions of the *National Environmental Policy Act*" (40 CFR 1500-1508), 46 FR 18026-18038 explains how the DOE is to develop the No-Action Alternative:

> *There are two distinct interpretations of "no action" that must be considered, depending on the nature of the proposal being evaluated. The first situation might involve an action such as updating a land management plan where ongoing programs initiated under existing legislation and regulations will continue, even as new plans are developed. In these cases "no action" is "no change" from current management direction or level of management intensity. To construct an alternative that is based on no management at all would be a useless academic exercise. Therefore, the "no action" alternative may be thought of in terms of continuing with the present course of action until the action is changed. Consequently, projected impacts of alternative management schemes would be compared in the EIS to those impacts projected for the existing plan. In this case, alternatives would include management plans of both greater and lesser intensity, especially greater and lesser levels of resource development.*

Therefore, in keeping with CEQ guidance, the No-Action Alternative is presented as "no change" from current management direction or level of management intensity.

The No-Action Alternative serves two purposes. First, it serves as a true baseline that presents the current status of land use and land management on the Hanford Site. For this purpose, a baseline no-action map was developed that contained available information defining existing buildings and infrastructure at the Hanford Site. Second, the No-Action Alternative provides a basis for comparing the alternatives against a baseline. To analyze the impacts associated with implementing the No-Action Alternative, assumptions regarding future land-management options were applied. In the No-Action Alternative, specific land-use decisions and designations would be made through the NEPA process on a project-by-project basis as needed. Consequently, potential future uses for the Hanford Site lands under the No-Action Alternative were mapped using the information presented in *Hanford Strategic Plan* (DOE-RL 1996b) (Figure 3-2). Impacts associated with these potential future uses were analyzed and are presented in Chapter 5.

Figure 3-2. No-Action Alternative.



BHI:rpp 04/23/98 clup/noactionalt.aml Database: 23-APR-1998

3.3.1.1 Planning Goals, Objectives, and Values (Vision). No publicly reviewed future land-management plan has been developed for the Hanford Site since 1975 (ERDA 1975) (see text box, *"Permanent Commitments"*). In the *Waste Management Operations, Hanford Reservation, Richland, Washington: Final Environmental Statement* (ERDA 1975), the Section IX.2.3, "Land Use," states:

> *Continuation of the Hanford Waste Management Operations Program will result in 1) occupancy of land by structures containing radionuclides and 2) restricted use of land containing radionuclides. The quantity of land committed will remain essentially constant for about 300 years because of the presence of ^{137}Cs, ^{90}Sr, and transuranium materials in the burial grounds and crib sites unless major recovery and cleanup programs are initiated. After 300 years, the quantity of land required for such purposes will decrease to the lands which contain plutonium or other long-lived transuranics. Recovery of plutonium from stored waste would eliminate the need for long term control and surveillance.*
>
> *A summary description of the committed lands is presented in Table IX-2. The areas in that table include appropriate buffer zones for surveillance and prevention of disturbance of the radionuclides by nearby activities such as irrigation agriculture.*
>
> *Commitment of some of the Hanford lands to waste management makes that land unavailable for other uses. Because there are tens of thousands of acres of similar desert land available throughout the western United States, the dedicated land cannot be considered to have rare characteristics that result in a premium value, such as for residential or industrial use. Ample similar land is available nearby for any such uses foreseen.*

Permanent Commitments

The resources that are considered to be committed in an irretrievable and irreversible manner by the Hanford Waste Management Operations are (1) land and materials containing or used for storing radionuclides with a half-life longer than 10 years; (2) labor expended by construction and operating personnel; and (3) materials, such as fuels and chemicals, that are burned, diluted, or consumed during use.

Most land containing fission product radionuclides with long half-lives can be considered unusable for agricultural purposes for centuries. Although most of these radionuclides probably could be separated from the land, reduction of the concentration to a level which would permit unrestricted use undoubtedly would cost more than the value associated with normally expected uses. This land will require a commitment of both people and surveillance equipment until the radioactivity is essentially removed by processing or decay.

Land containing transuranic materials, particularly plutonium, can be considered unusable for any purpose for hundreds of thousands of years. Until any recovery program for the transuranic materials would be completed, this land will require a commitment of both people and surveillance equipment.

About half a million tons of fossil fuels and 50,000 tons of chemicals are expected to be irreversibly consumed by the Hanford Waste Management Operations. Some components of the concrete structures and equipment, as well as about 6,000 ac of desert land, are essentially irretrievable due to the practical aspects of reclamation and/or radioactive decontamination. Present operating practices will not require additional land usage for cribs (ERDA 1975).

TABLE IX-2
DEDICATED WASTE MANAGEMENT LANDS

General Location	*Content* [a]	*Approximate Area (Acres)*
100 Areas	*Burial Grounds*	*70*
200 Areas	*Burial Grounds, Process Buildings, Tank Farms, Cribs, and Ponds*	*5,100*
300 Area	*Burial Grounds and Process Ponds*	*50*
600 Area	*Burial Grounds*	*10*
Total		*5,230* [b]

(a) Excludes standby facilities.
(b) This is 1.4% of the total Hanford Reservation land area.

In place of any formalized plan, land management at the Hanford Site would be administered using the visions outlined in the *Hanford Strategic Plan* (DOE-RL 1996b), which is not a land-use plan but is instead a DOE mission plan. The *Hanford Strategic Plan* details the current management direction for the Site. As outlined in the Strategic Plan, Hanford's environmental management, or cleanup, mission is to protect the health and safety of the public, workers, and the environment; control hazardous materials; and utilize the assets (people, infrastructure, site) for other missions. Hanford's science and technology mission is to develop and deploy science and technology in the service of the nation, including stewardship of the Hanford Site.

Hanford Site managerial values, which are further explained in the Strategic Plan, are identified below:

- **Safety** -- The safety and health of our workers and the public will not be compromised. We place a high priority on managing and reducing the risks in our workplace as well as risks to the public and the environment.

- **Results** -- We are committed to environmental and scientific excellence. We will meet or exceed the needs and expectations of our customers. Our employees are encouraged to seek creative and innovative solutions and to continuously find ways to improve what we do.

- **Teamwork** -- We work as a team to accomplish our missions. We regard all concerned parties as essential members of the team and value and plan for their participation. "Win-win" solutions are essential elements of the way we do business. We value the diversity of our employees and all other members of the team.

- **Integrity** -- We conduct ourselves with the highest standards of professionalism and ethical behavior. We honor our commitments and comply with applicable laws and regulations. We are proper stewards of the taxpayer's interest.

The *Hanford Strategic Plan* divided the Hanford Site into five distinct geographic study areas, including the Columbia River, Reactors on the River (100 Areas), Central Core, Central Plateau (200 Areas), and the South 600 Area (DOE-RL 1996b). These areas were modified to be consistent with the geographic areas used in this HRA-EIS. Specifically, the Columbia River and Reactors on the River geographic areas were combined to create the Columbia River Corridor geographic area. The Wahluke Slope and ALE Reserve were not included in the *Hanford Strategic Plan* but have been included in this alternative, since these areas would remain under DOE authority.

3.3.1.2 Assumptions Regarding Future Use. Specific land-use decisions under the No-Action Alternative will continue to be made through the NEPA or the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement or TPA) (Ecology et al. 1989) process on a project-by-project, as-needed basis.

3.3.1.3 Application of the Land-Use Designations.

3.3.1.3.1 The Wahluke Slope. The entire Wahluke Slope is managed under permit for DOE. The western portion of the Wahluke Slope is managed by the U.S. Fish and Wildlife Service (USFWS) as the Saddle Mountain National Wildlife Refuge. Current permit conditions require this area to be closed to the public as part of a security zone for the N Reactor (now shut down), and the area would continue to be managed similar to Preservation. This permit also provides protection for the K Basin spent nuclear fuel (SNF) removal project. The USFWS permit provides additional protection to sensitive areas and species of concern. The remainder of this geographic area is managed by the WDFW and is designated the Wahluke Slope Wildlife Recreation Area. Consistent with the permit, the land is managed similar to Conservation (Mining and Grazing). These designations are also consistent with the BoR's Red Zone, in which irrigation is prohibited to minimize slumping of the bluffs into the Columbia River. Under this alternative, limited public access for hunting, fishing, or recreation; permitted mining and grazing activities; and agricultural leases would continue. These existing permits can be revoked by DOE at any time.

3.3.1.3.2 The Columbia River Corridor. The surface water in this geographic area would continue to be managed to allow limited public access and use as a Low-Intensity Recreation area. Access to the Columbia River's islands would remain restricted to provide protection for cultural, aesthetic, biological, and geologic resources. Restrictions that are intended to preserve the unique character of the Hanford Reach portion of the Columbia River (Public Law 100-605) would also remain in effect. Public access to the Reactors on the River area (i.e., the 100 Areas) would remain restricted, which is consistent with current management.

Hazardous and/or dangerous waste has been disposed at the 183-H Solar Evaporation Basins under the terms of the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) regulations. Future use restrictions associated with this parcel of land are to be consistent with the terms of 40 CFR 264.117(c) and *Washington Administrative Code* (WAC) 173-303-610(7)(d). The WAC 173-303-610(7)(d) and 40 CFR 264.117(c) are identical in intent and similar in text and state the following:

> *Post-closure use of property on or in which [hazardous and/or] dangerous wastes remain after partial or final closure must never be allowed to disturb the integrity of the final cover, liner(s), or any other components of any containment system, or the function of the facility's monitoring system, unless the department finds that the disturbance: (i) Is necessary to the proposed use of the property, and will not increase the potential hazard to human health or the environment; or (ii) Is necessary to reduce a threat to human health or the environment.*

A deed restriction has been filed with Benton County for the 183-H Solar Basin *Resource Conservation and Recovery Act of 1976* (RCRA) corrective action (BHI 1997) because of residual contamination. Other deed restrictions or covenants for activities that potentially may extend beyond 4.6 m (15 ft) below ground surface are expected for the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) remediation areas.

3.3.1.3.3 The Central Plateau. Lands within the Central Plateau geographic area would continue to be used for the management of radioactive and hazardous waste materials. These management activities would include collection and disposal of radioactive and/or hazardous waste materials that remain onsite, contaminated groundwater management, current offsite commitments, and other related and compatible uses. Individual project land-use requirements would be irreversibly and irretrievably (I&I) committed through the appropriate NEPA and CERCLA processes. Deed restrictions or covenants also would be applied to this area through the CERCLA and RCRA processes.

3.3.1.3.4 The All Other Areas. These areas would be available for other Federal programs or leased for non-Federal uses, provided that such uses are consistent with the safety requirements and address the cultural and biological resource issues through DOE's NEPA process. Individual project land-use requirements would be I&I committed through the appropriate NEPA and CERCLA processes. A portion of this geographic area (just north of the City of Richland), would be used for industrial purposes. An Industrial use would allow research and development facilities similar to the Environmental and Molecular Sciences Laboratory (EMSL). The lands in and adjacent to the 300 and 400 Areas would remain under Federal ownership, but DOE would be able to lease lands for private and public uses (including withdrawn lands with the owning agency's permission) to support regional industrial and economic development (e.g., Washington Public Power Supply System [WPPSS]). Other Federal uses would be allowed by permit (e.g., Laser Interferometer Gravitational-Wave Observatory [LIGO]). Excess land within the 1100 Area has been targeted for transition to non-Federal ownership. This geographic area would remain under Federal ownership consistent with DOE Order, DOE 0 151.1, *Comprehensive Emergency Management System*, with safety analysis exclusion zone boundaries and waste management operations in the 200 Areas (DOE 1996f). This area includes a section south of the 200 Areas that was sold to the State of Washington for a dangerous waste, non-nuclear disposal site but remains undeveloped. If the state were to develop that property per its Quit Claim Deed (State of Washington 1980), the state would have to obtain appropriate county, state, and Federal permits.

The Horn Rapids Landfill (HRL), operated by the U.S. Department of Energy Richland Operations Office (RL), encompasses approximately 20 ha (50 ac) of the 600 Area. Originally, the landfill was a quarry for sand and gravel. Subsequently, the HRL was used as a landfill for office and construction waste, asbestos, sewage sludge, fly ash, and reportedly numerous drums of unidentified organic liquids. Consistent with EPA recommendations for operators of landfills that handle asbestos, fencing and warning signs have been erected around the perimeter of the HRL to control public access. The HRL has been remediated under the terms of the 1100 Area CERCLA ROD. Future-use restrictions associated with this parcel of land are to be consistent with the terms of 40 CFR 61.151 as an asbestos-containing landfill. In general, for the purposes of restrictions on land uses, 40 CFR 61.151 indicates that a notation must be made on the deed or covenant notifying a potential purchaser that the land has been used for asbestos-containing waste material. A deed restriction has been filed with Benton County for the Horn Rapids Asbestos Landfill. Other deed restrictions or covenants would likely be applied to this area through the CERCLA and RCRA processes.

3.3.1.3.5 The Arid Lands Ecology Reserve (ALE Reserve). The ALE Reserve geographic area would continue to be managed similar to Preservation in accordance with the Rattlesnake Mountain National Research Area designation and the USFWS permit. Big Bend Alberta Mining Company holds mineral rights on about two square miles under the southern portion of the ALE Reserve. The USFWS is developing an Area Management Plan for the ALE Reserve with additional opportunity for public involvement (see Chapter 6).

Currently, persons wishing to visit the ALE Reserve must first contact an appropriate staff member or the ALE Reserve facility manager. The group or individual hosting visitors must provide information to the ALE Reserve facility manager, including names of visitors, purpose of the visit, destinations on the ALE Reserve, and the date of the visit. The ALE Reserve facility manager can authorize the visit, provide specific instructions or guidance to the host, and initiate badging for the visitor(s).

This page intentionally left blank.

3.3.2 The Agency's Preferred Alternative

The CEQ requires an agency to ". . .identify the agency's Preferred Alternative if one or more exists, in the draft statement, and identify such alternative in the final statement. . . (40 CFR 1502.14[e])." The DOE believes the Preferred Alternative would fulfill the statutory mission and responsibilities of the agency and give adequate consideration to economic, environmental, technical, and other factors.

3.3.2.1 Planning Goals, Objectives, and Values (Vision). Much like the No-Action Alternative, the DOE Preferred Alternative was developed based on planning goals, objectives, and values that are consistent with the *Hanford Strategic Plan* (DOE-RL 1996b). However, unlike the No-Action Alternative, the Preferred Alternative places Hanford's land-use planning decisions in a regional context and acknowledges Hanford's many unique regional resources and problems.

The DOE has identified the alternative presented in Figure 3-3 as the Agency Preferred Alternative. The Preferred Alternative represents land management values, goals, and objectives of DOE for the next 50 years. It also represents a multiple-use theme of Industrial-Exclusive, Industrial, Research and Development, High-Intensity Recreation, Low-Intensity Recreation, Conservation (Mining and Grazing), Conservation (Mining), and Preservation land uses that have been identified by the public and cooperating agencies as being important to the region.

3.3.2.2 Assumptions Regarding Future Use. The assumptions used to develop the Agency Preferred Alternative are as follows:

- DOE, as a Federal agency, has a trust responsibility to protect Tribal interests.

- DOE has a responsibility to consult with and recognize the interests of the cooperating agencies. As land is remediated and deemed excess to DOE's needs, the BLM and BoR will request a review of the land withdrawal orders and ask for the return of their lands.

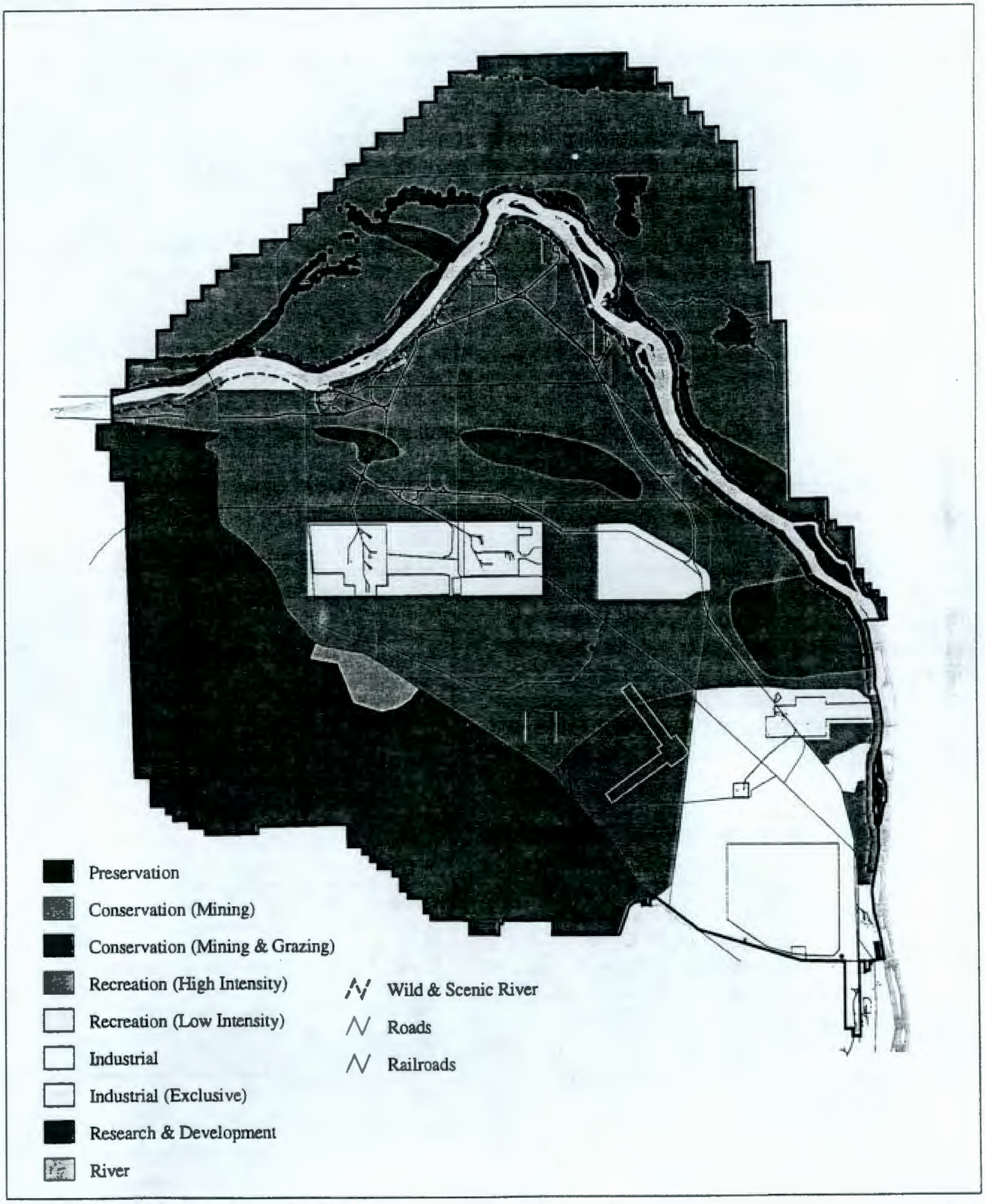
- DOE will support economic transition and potential industrial development by the City of Richland or the Port of Benton by encouraging the use of existing utility infrastructure on the Hanford Site.

- Other entities will ask for Hanford's resources and lands.

- The public will continue to support protection of cultural and natural resources on the Site, especially on the Wahluke Slope, the Columbia River Corridor, and the ALE Reserve.

- Mining of onsite geologic materials will be needed to construct surface barriers as required by Hanford Site remediation activities.

Figure 3-3. The Preferred Alternative.



BHI:rpp 04/23/98 clup/prefalt.aml Database: 23-APR-1998

- Remediation of the Site will continue and, where necessary, the institutional controls currently in place will continue to be required at some level for the next 50 years. Institutional controls are transferrable and can be shared with other governmental agencies.

- Plutonium production reactor blocks will remain in the 100 Areas throughout the planning period and will be considered a pre-existing, non-conforming use.

- Vadose zone contamination will persist in the All Other Areas, Central Plateau, and 100 Area. Contaminated groundwater will remain unremediated in the All Other Areas, Central Plateau, and 100 Area.

- The public will support preservation of the Manhattan Project's historical legacy and development of a High-Intensity Recreation area, consistent with the B Reactor museum proposal.

- The public will support access to the Columbia River for recreational activities and public restrictions consistent with the protection of cultural and biological resources.

- Areas will be set aside specifically for Research and Development projects.

- An adequate land base and utility infrastructure will be maintained to support possible industrial development associated with future DOE missions.

3.3.2.3 Application of the Land-Use Designations. Land-use designations identified for the DOE Preferred Alternative are Industrial-Exclusive, Industrial, Research and Development, High-Intensity Recreation, Low-Intensity Recreation, Conservation (Mining and Grazing), Conservation (Mining), and Preservation (see text box, "*Planning for Possible Future Missions,*" and Figure 3-3).

> ***Planning for Possible Future Missions***
>
> The Preferred Alternative identifies lands required to support DOE's current Environmental Management and Science and Technology missions at the Hanford Site, as well as lands for future industrial development by the City of Richland and the Port of Benton. DOE is proposing that additional lands be maintained under the Industrial land-use designation in areas where existing infrastructure is available and other compatible uses exist. DOE believes it is prudent to retain land under the Industrial land-use designation to support possible future missions, rather than convert the land to the Conservation or Preservation land-use designation at this time. This would avoid possible conflicts with future missions. DOE anticipates that the need for land under the Industrial land-use designation will continue to be evaluated during future planning efforts, which may result in conversion of some lands to the Conservation, Preservation, or other land-use designations.

3.3.2.3.1 The Wahluke Slope. The majority of the Wahluke Slope would be designated as Conservation, consistent with current management practices. The Saddle Mountain National Wildlife Refuge as currently managed by the USFWS does not allow grazing, although grazing would be consistent with the Conservation (Mining and Grazing) land-use designation. Approximately one-eighth of the land would be designated for Preservation, much of which is located along the BoR's Columbia Basin Project's irrigation waste ways. The major reason for designating these areas as Preservation would be to provide protection for sensitive areas or species of concern (e.g., wetlands, sand dunes, steep slopes, or the White Bluffs) from impacts associated with intensive land-disturbing activities. A Preservation designation is also compatible with the ROD for the Hanford Reach EIS (NPS 1996). Low-Intensity Recreation activities include development of a primitive campground north of Highway 24.

3.3.2.3.2 The Columbia River Corridor. The Columbia River Corridor has historically contained reactors and associated buildings to support Hanford's former defense production and energy research missions. Nevertheless, remediation planning documents, public statements of advisory groups, and such planning documents as the *Environmental Impact Statement: The Decommissioning of Eight Surplus Reactors* (DOE 1992) have determined that remediation and restoration of the Columbia River Corridor will return the corridor to a nondeveloped, natural condition. Restrictions on certain activities may continue to be necessary to prevent the mobilization of contaminants, the most likely example of such restrictions being on activities that discharge water to the soil. Although the Surplus Reactor NEPA ROD calls for the reactor buildings to be demolished and the reactor blocks to be moved to the Central Plateau, this action will not take place until 2067 or until a new Tri-Party Agreement milestone is negotiated. As a result, the reactor buildings will remain in the Columbia River Corridor throughout the 50-year planning period addressed by the HRA-EIS.

The Columbia River Corridor would include High-Intensity Recreation, Low-Intensity Recreation, Conservation (Mining and Grazing), and Preservation land-use designations. The river islands would be designated as Preservation.

- Four sites would be designated High-Intensity Recreation to support visitor-serving activities and facilities development. The B Reactor would be converted into a museum and the surrounding area would be available for museum-support facilities. The High-Intensity Recreation area near Vernita Bridge (where the current Washington State rest stop is located) would be expanded across State Highway 240 and to the south to include a boat ramp and other visitor-serving facilities. Two areas on the Wahluke Slope would be designated as High-Intensity Recreation for potential exclusive Tribal fishing villages.

- Two areas would be designated for Low-Intensity Recreation within the 100 Areas. The area west of the B Reactor would be used as a corridor between the High-Intensity Recreation areas associated with the B Reactor and the Vernita Bridge rest stop and boat ramp. The third area, the White Bluffs boat launch, is located between the H and F Reactors and would be used for boat launch facilities. A fourth area, near the old Hanford High School, would accommodate visitor facilities and access to the former town site and provide visitor services for hiking and biking trails that could be developed along the Hanford Reach. A fifth site, just north of the WPPSS, would also provide visitor services for hiking and biking trails along the Hanford Reach. A Low-Intensity Recreation designation for the water surface of the Columbia River would be consistent with current management practices and the wishes of many stakeholders in the region.

- The remainder of land within the Columbia River Corridor would be designated for Conservation (Mining and Grazing). This designation would allow for permitted mining and/or grazing activities. Grazing would be permitted by DOE for fire and weed management only, and mining would be permitted only in support of the cleanup mission. Should DOE determine that some or all of the withdrawn lands are surplus to DOE's needs and releases the Public Domain lands back to the DOI, the DOI could then determine if the Tribal treaty language "the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land" is applicable. A Conservation (Mining and Grazing) designation would allow DOE to provide protection to sensitive cultural and biological resource areas. This designation is consistent with the ROD for the Hanford Reach EIS (NPS 1996).

- A Preservation land-use designation for the Columbia River islands would be consistent with the ROD for the Hanford Reach EIS (NPS 1996) and would provide additional protection to sensitive cultural areas, wetlands, flood plains, Upper Columbia Steelhead, or bald eagles from impacts associated with intensive land-disturbing activities. Remediation activities would continue in the 100 Areas (i.e., 100-BC, 100-KE, 100-KW, 100-N, 100-D, 100-DR, 100-H, and 100-F), and would be considered a pre-existing, non-conforming use in the Preservation land-use designation.

3.3.2.3.3 The Central Plateau. The Central Plateau (200 Areas) geographic area would be designated for Industrial-Exclusive use. An Industrial-Exclusive land-use designation would allow for continued waste management operations within the Central Plateau geographic area. This designation would also allow expansion of existing facilities or development of new waste management facilities. Designating the Central Plateau as Industrial-Exclusive would be consistent with FSUWG recommendations, current DOE management practice, other government's recommendations, and many public stakeholder values throughout the region.

To keep the 1975 I&I commitments (see text box in Section 3.3.1.1) and help maintain the current waste management mission, there have been several Notices of Deed Restriction placed with the Benton County Assessor's Office and the Benton County Planning Office. The No-Action Alternative shows where these Notice of Deed Restrictions have been placed across the Hanford Site. They are currently being used mainly for asbestos left in landfills (e.g., the HRL and the Central Waste Complex Landfill) and concrete structures that were surface contaminated (e.g., the 183-H Solar Basins) (BHI 1997). As remediation continues, DOE expects to file more restrictions that will institutionalize the 5-m (15-ft) depth restriction for excavation in the 100 Areas CERCLA RODs, the Industrial land-use restriction CERCLA ROD in the 300 Area, and the Central Plateau expected Industrial land use RODs and point-of-compliance boundaries for groundwater remediation.

3.3.2.3.4 The All Other Areas. Within the All Other Areas geographic area, the Preferred Alternative would include Industrial, Research and Development, High-Intensity Recreation, Low-Intensity Recreation, Conservation, and Preservation land-use designations.

Several areas that would be designated as Conservation (Mining and Grazing) would be unable to fulfill the designated land use. A Notice of Deed Restriction would be placed in those areas where vadose zone contamination remained in-place, according to the CERCLA ROD or RCRA Closure Permit (e.g., the HRL, Central Waste Complex, 183-H Solar Basins, etc.), foreclosing the mining option.

- The section of Washington State Land that is deed restricted to waste management would be designated as Conservation (Mining and Grazing) and, therefore, could not fulfill any waste management purpose.

- Two distinct areas, one located east of the 200 Areas (i.e., May Junction) and the other located north of Richland, would be designated for Industrial use. This designation would provide additional industrial development and/or expansion area for current facilities.

- An area west of State Highway 10 and east of State Highway 240 would be designated for Research and Development. This area would allow for the development of research and development facilities, such as LIGO, which could require substantial buffer zones for operation. In addition, research and development facilities not requiring large areas for operation would also be located within this area.

- Gable Mountain, Gable Butte, the area from Umtanum Ridge to the ALE Reserve, and the active sand dunes areas would be designated for Preservation, which would provide additional protection of these sensitive areas.

3.3.2.3.5 The Arid Lands Ecology Reserve (ALE Reserve). Almost all of the ALE Reserve geographic area would be designated as Preservation. This designation would be consistent with current management practices of the Rattlesnake Hills Research Natural Area and the U.S. Fish and Wildlife Service permit. A portion of the ALE Reserve would be managed as Conservation (Mining) during the remediation of the Hanford Site as a trade-off developed during the cooperating agencies discussions for preservation of a wildlife corridor through the McGee Ranch. The wildlife corridor through the McGee Ranch/Umtanum Ridge area had been identified by the DOE as the preferred quarry site for basalt rock and silty soil materials that could be required for large waste management area covers (RCRA caps or the Hanford Barrier) in the Central Plateau. In addition to the wildlife corridor function, the mature shrub-steppe vegetation structure in the McGee Ranch area has greater wildlife value (i.e., BRMaP Levels 3 and 4) than the cheat grass (BRMaP Level 1) in the ALE Reserve quarry site. The BRMaP (DOE-RL 1996c) levels of concern run from Level 1 through Level 4, increasing in biological importance as the numbers increase, with Level 1 being the level of least importance.

3.3.3 Alternative One

3.3.3.1 Planning Goals, Objectives, and Values (Vision). Alternative One represents a stewardship role for managing valuable national resources on the Hanford Site. This alternative addresses these national resources (i.e., ecological, historic, cultural, and economic resources) in a regional context.

Alternative One was developed using the seven land-use planning goals listed below:

- Integrate mission, economic, ecological, social, and cultural factors as stated in the Secretary of Energy's Land- and Facility-Use Policy (DOE 1994), which includes sustaining the valuable biological resources of the Hanford Site and supporting sustainable economic development.

- Support the Rattlesnake Hills Research Natural Area, established in 1971.

- Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development by encouraging siting of high-density development areas.

- Achieve ecosystem planning based on a regional perspective.

- Preserve the lands, sites, and structures of historical, cultural, or archaeological significance on the Hanford Site.

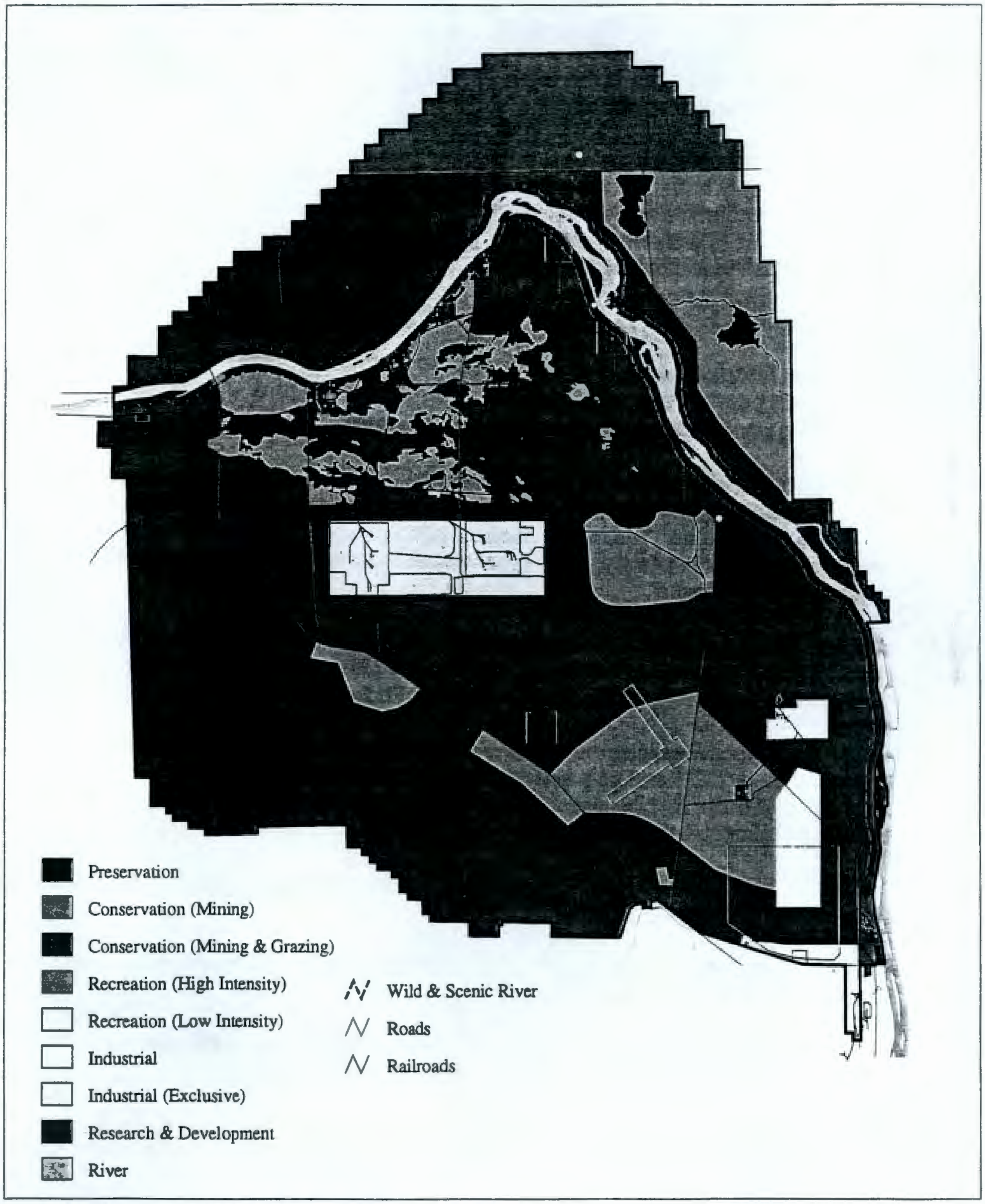
- Consider the resource needs of the Hanford cleanup program.

- Encourage the retention of open space.

The land-use designations included in Alternative One are presented in Figure 3-4. The land-use designations in Alternative One incorporate the commonly identified goals of the FSUWG, TWRS Task Force, and HAB, as well as DOE's adoption of these stakeholder values (see text box, "*Commonly Identified Goals of Alternative One*").

The objectives of Alternative One are to promote protection and recovery of state and federally listed species, a wide range of fish and wildlife recreational opportunities, aquatic and terrestrial habitats and associated fish and wildlife populations, and the utilization of the existing infrastructure, especially in the southeast portion of the site and the Central Plateau for development. The vision of Alternative One is to conserve the Hanford Site shrub-steppe ecosystem, which provides a sanctuary for dependent species, and to maintain a habitat link between the Hanford Site and the Yakima Training Center, which is Washington State's second largest shrub-steppe ecosystem. This will ensure conservation of the region's shrub-steppe heritage for future generations to enjoy.

Figure 3-4. Alternative One.



BHI:rpp 04/23/98 clup/alternative1.aml Database: 23-APR-1998

3.3.3.2 Assumptions Regarding Future Use.

The assumptions used to develop Alternative One are as follows:

Commonly Identified Goals of Alternative One
• Encourage economic development and diversification
• Protect the Columbia River
• Use the Central Plateau wisely for waste management
• Do no harm during cleanup
• Recognize the importance of ecological diversity and recreational opportunities and that the equality of those resources should be maintained or improved as a result of cleanup and waste management decisions
• Protect the integrity of all biological resources, with specific attention given to rare, threatened, and endangered species and their habitats

- Existing hazardous waste and on-going remedial actions will require DOE to maintain control of portions of the Site for the proposed planning period.

- DOE control of the Site will be required to provide a safety buffer for the public from unforeseeable accidents that pose health risks to workers and the public, such as the Plutonium Reclamation Facility explosion, during the cleanup mission.

- Plutonium production reactor blocks will remain in the 100 Areas throughout the planning period and will be considered a pre-existing, non-conforming use.

- DOE will continue to practice as low as reasonably achievable (ALARA), only approving staff and projects on the Site necessary for management of radioactive and hazardous wastes. The intent of the ALARA program is to avoid unnecessary exposure and potential risks to workers and/or the public. These risks could include unexpected air releases.

- DOE will find new missions for buildings in the 300 and 400 areas for exploring new technologies related to the treatment and handling of hazardous waste. These new missions may be conducted by Federal and non-Federal entities.

- Expansion for future development during the planning period will not exceed historical used acreage by DOE and its predecessors. This projected future development expansion will occur as high-density development to conserve the other natural resources present on the Site.

- Stewardship will be based on the principles of ecosystem management and sustainable development.

- Existing permits and Memorandums of Agreement made by DOE with other entities for land management purposes will continue.

- Research and development necessary for cleanup will occur in a manner that creates additional private-sector economic development opportunities.

- Quarry sites will support DOE's remediation needs and the Washington State Department of Transportation's infrastructure needs. No commercial exploitation will occur during this planning period.

3.3.3.3 Application of the Land-Use Designations. Alternative One land-use designations include Industrial-Exclusive, Industrial, Research and Development, High-Intensity Recreation, Low-Intensity Recreation, Conservation (Mining and Grazing), Conservation (Mining), and Preservation. The location, shape, and size of the land-use designations were based on analysis of the existing natural and man-made resources (e.g., infrastructure, topography, and biology, etc.) found in Chapter 4 and land-use projects for economic development, also found in Chapter 4.

3.3.3.3.1 The Wahluke Slope. Land-use designations for the Wahluke Slope would include Low-Intensity Recreation, Conservation (Mining and Grazing), Conservation (Mining), and Preservation. The Wahluke Slope is currently administered for wildlife and recreation as the Saddle Mountain National Wildlife Refuge and the Wahluke Slope Wildlife Area, respectively, under a permit granted by DOE to the USFWS and the WDFW.

The Saddle Mountain National Wildlife Refuge would be designated Preservation, which is consistent with the current administered land use. Preservation would provide a protective safety buffer zone for remedial activities in the 100 Areas which are expected to continue for the planning period, and would continue to provide a sanctuary for shrub-steppe dependent species that inhabit the area. Preservation would also prevent activities within the BoR's Red Zone that could jeopardize stability of the White Bluffs.

The Wahluke Slope Wildlife Area would be designated as Low-Intensity Recreation, Conservation (Mining and Grazing), Conservation (Mining), and Preservation, which would be consistent with the current administered land use. The Low-Intensity Recreation area would be used for primitive overnight camping. Conservation (Mining and Grazing) is consistent with the current grazing permit administered by the WDFW. Conservation (Mining) is consistent with the usage pattern of quarry sites in the area. Preservation is reserved for the wetlands associated with the BoR's Columbia Basin Project's irrigation waste ways.

These land uses have been implemented by the WDFW since 1971 and continue to provide recreational opportunities. WDFW management of the Wahluke Slope Wildlife Area management would implement road and trail system closures (i.e., seasonal and permanent) to protect sensitive plants and animals, use grazing as a management tool, and regulate primitive overnight camping.

3.3.3.3.2 The Columbia River Corridor. The Columbia River Corridor land-use designations would include High-Intensity Recreation, Low-Intensity Recreation, Conservation (Mining), and Preservation.

The Columbia River islands within the Hanford Site boundary would be designated for Preservation to maintain important areas for wildlife. Wildlife species using these islands include mule deer, American white pelicans, sandhill cranes, waterfowl, and ring-necked pheasant. A significant area of the upriver bright fall chinook salmon spawning habitat is located near these islands, as well as potential juvenile rearing habitat for the Federally listed Upper Columbia River Run steelhead.

The Columbia River Corridor includes Low-Intensity Recreation, High-Intensity Recreation, Conservation (Mining), and Preservation land-use designations. The Low-Intensity Recreation areas would include an existing trail/road system, an existing unimproved boat ramp facility on the Franklin County side for public river access, and an unimproved boat ramp on the Benton County side at the White Bluffs which would be restricted to emergency responses to protect suitable bald eagle nesting habitat. Restrictions would be consistent with the *Hanford Site Bald Eagle Management Plan* (DOE-RL 1994b). The High-Intensity Recreation area currently includes an existing highway rest area, leased from DOE by the Washington Department of Transportation, on the west side of State Highway 240 at Vernita Bridge. A boat ramp facility has been proposed east of the highway across from the rest area on the Benton County side. The Preservation designation would provide protection for ecologically and culturally sensitive areas being considered for protection under the Wild and Scenic Recreational River designation (NPS 1996).

The 100 Areas would include High-Intensity Recreation, Conservation (Mining), and Preservation land-use designations. The B Reactor would be designated High-Intensity Recreation to allow tourism of the federally registered landmark and would be consistent with the B Reactor museum proposal. Radioactive contamination would remain below 4.6 m (15 ft) in the 100 Areas vadose zone. During this 50-year planning period, the spent fuel will be removed from the K Basins. Associated environmental risks were evaluated in the K Basin EIS (DOE 1996c).

3.3.3.3.3 The Central Plateau. The Central Plateau would include Industrial-Exclusive and Preservation land-use designations. The Central Plateau includes undeveloped and uncontaminated land, the majority of which has been designated priority shrub-steppe habitat by the WDFW. Potential future Hanford Site projects include a full-scale, low-level vitrification plant and a burial ground for eight reactor cores (DOE 1992). The remaining undeveloped areas would be considered sufficient for the preferred regional alternative of the DOE's Programmatic Waste Management EIS (DOE 1997). Under the Programmatic EIS preferred regional alternative, the Central Plateau would be committed to waste management from other DOE sites. Although this land-use designation does not include research and development, research and development projects specific to DOE waste management activities would be allowed. Mitigations for impacts from all the previously mentioned, and any unforeseeable projects, would be consistent with the Draft *Hanford Site Biological Resources Management Plan* (BRMaP) (DOE-RL 1996c).

Land west of the currently developed 200 West Area within the Central Plateau geographic area would be Preservation. This area contains high-quality mature sagebrush, which provides essential habitat for shrub-steppe dependent species. This designation would prevent additional sprawl to the west and encourage siting of new projects between the 200 East and 200 West Areas.

3.3.3.3.4 The All Other Areas. The All Other Areas geographic area would include Industrial, Research and Development, Low-Intensity Recreation, Conservation (Mining), and Preservation land-use designations. All development (i.e., Industrial, and Research and Development) would occur south of the WPPSS, inclusive. This development would include transition of existing facilities in the 1100, 300, 400, and WPPSS to potential uses such as high technology incubators, manufacturing, and medical isotope production. The majority of non-federal uses would occur offsite or within the area identified by the City of Richland's proposed expanded Urban Growth Area (UGA) boundary in the southeast portion of the Site. This UGA would include Industrial, and Research and Development. DOE's industrial needs could also be met within the UGA or the approximately 4 mi^2 of land identified for industrial use between WPPSS and the UGA boundary. This 4 mi^2 area contains low quality habitat. Wildlife corridors would be located around this industrial development to allow wildlife movements to and from the Columbia River Corridor which is being considered for protection under the *Wild and Scenic Rivers Act of 1968* as a Recreational River. Just west of the

Industrial designation is an extensive tract of seral shrub-steppe habitat which has been designated Conservation (Mining). As the canopy cover increases, this seral shrub-steppe habitat will become more important for shrub-steppe dependent species as additional shrub-steppe habitat is destroyed offsite.

Within a proposed wildlife corridor north of the Yakima River, a small area would be designated Conservation (Mining) to allow potential extraction of geologic materials for use in the 200 Areas remedial efforts. Considering this as a quarry site for basalt and soil provides DOE with the option to designate, as Preservation, Gable Mountain, Gable Butte, and West Haven as sites which have significant cultural value; and to designate as Preservation the McGee Ranch site (which is DOE land north and west of Highway 24 and south of the Columbia River) as part of an important wildlife corridor between the Hanford Site and the Yakima Training Center.

3.3.3.3.5 The Arid Lands Ecology Reserve (ALE Reserve). The ALE Reserve geographic area would be designated for Preservation and Conservation (Mining). A vast extent of the ALE Reserve would be Preservation to protect the rare and high quality shrub-steppe plant communities, and unique and rare fauna that reside on this portion of the Site. Many of these plant communities and fauna are found nowhere else in the state or the Columbia Basin eco-region.

Two areas of the ALE Reserve along State Highway 240 would be designated Conservation (Mining). These areas contain mostly Management Concern Level 1 resources as identified in the BRMaP (DOE-RL 1996c). The area furthest to the northwest coincides with a potential subsurface basalt site identified in the document titled *Site Evaluation Report for Candidate Basalt Quarry* (BHI 1995). The soil of this area would meet DOE needs for capping waste sites on the Central Plateau. The DOE would reclaim the site after removing materials. The *Site Evaluation Report for Candidate Basalt Quarry* also suspended evaluation of Gable Butte, Gable Mountain, and West Haven as basalt quarry sites because of their cultural significance to American Indian Tribes. Considering the ALE Reserve as a quarry site for basalt and soil allows DOE to designate as Preservation Gable Mountain, Gable Butte, and West Haven because of their significant cultural value, and to designate the McGee Ranch site (DOE land north and west of State Highway 240 and south of the Columbia River) as an important wildlife corridor between the Hanford Site and the Yakima Training Center.

The second area designated Conservation (Mining) would be along State Highway 240 southeast of the area described above. This area does not contain basalt but contains BRMaP Management Concern Level 1 habitat (i.e., low-habitat value). The soils found in this area meet the criteria in the basalt report (BHI 1995) for capping waste sites on the Central Plateau.

3.3.4 Alternative Two

3.3.4.1 Planning Goals, Objectives, and Values (Vision). Alternative Two presents the vision of the Nez Perce Tribe Department for Environmental Restoration and Waste Management at the Hanford Site. This vision calls for preservation of the natural and cultural resources at Hanford (Figure 3-5). Traditional Tribal use is consistent with the Preservation land-use designation. Protection of cultural resources at the Hanford Site is the top priority of Alternative Two. Sharing with everyone the Nez Perce Tribe's knowledge and point of view about sacred sites and nature is vitally important. Cultural resources remain important to the Nez Perce Tribe's way of life and are part of the Tribe's tradition.

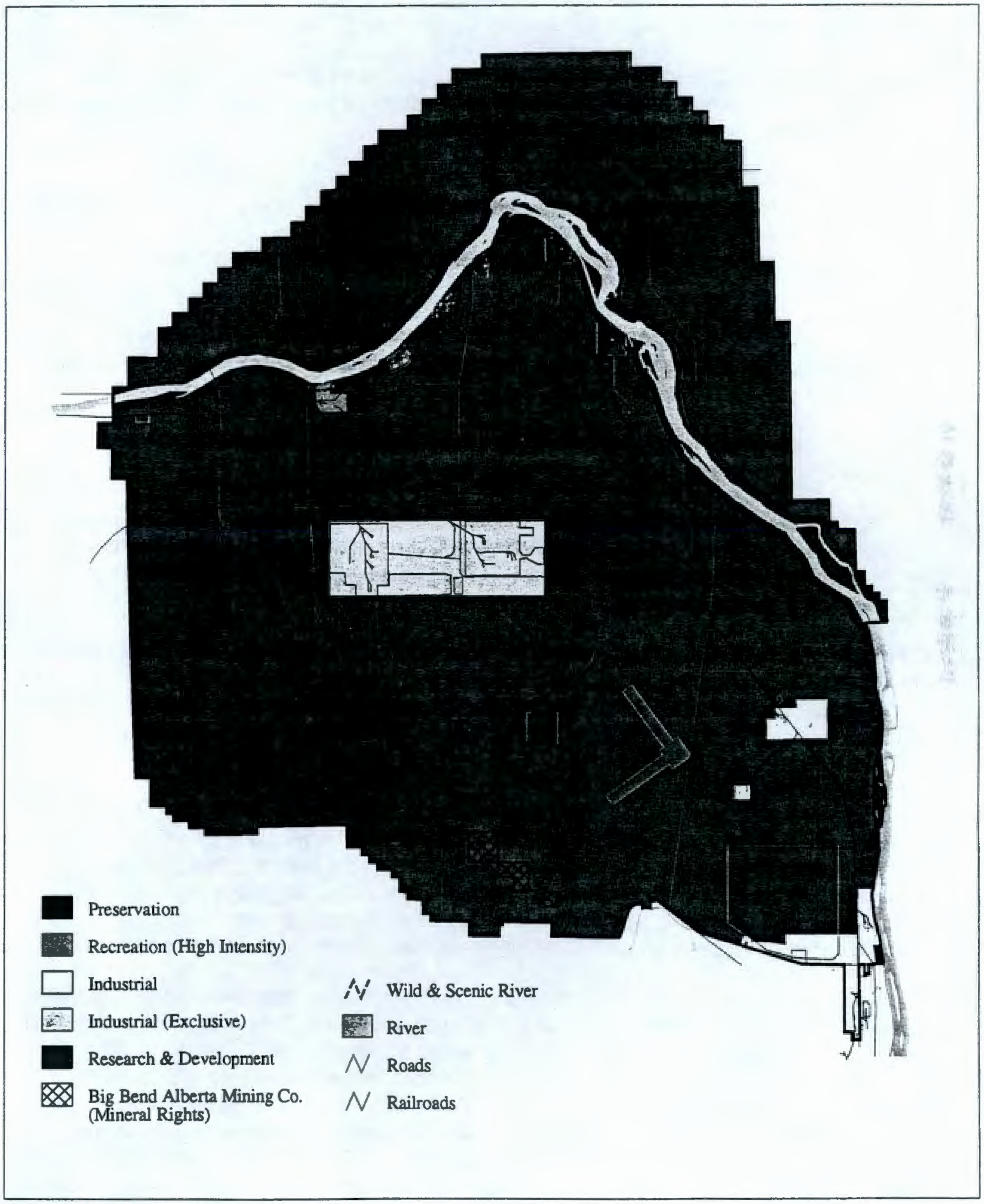
The Hanford Site, including the Columbia River, has a history of serving as a gathering place for Indian Nations to hunt, fish, trade, and feast. The Nez Perce have shared and participated in these known ancient and traditional activities with other Tribes where there were no fences, boundary lines, or treaties. The Hanford Site is one of the largest areas of land in the Pacific Northwest region that has not been developed, with agriculture being the principal development on surrounding lands. The Hanford Site contains the last non-tidal, unimpounded section of the Columbia River in the United States, and the Hanford Reach is the only remaining area on the Columbia River where Chinook salmon still spawn naturally. The ALE Reserve geographic area contains one of the few resident elk herds in the world that inhabit a semi-arid area, and the ALE Reserve is one of the largest remnants of relatively undisturbed shrub-steppe ecosystem in the State of Washington. Approximately 50 species of animals that are classified as "sensitive species" currently reside at the Hanford Site. The largest population of sage sparrows in Washington State can also be found at Hanford.

The Nez Perce have always considered that the land and its creatures are essential to everyday life. Humans are considered to be only one small part of a much larger circle of life on the earth. Nez Perce stories exemplify this intimate relationship between humans and the earth, and traditional Nez Perce culture weaves an intimate relationship between humanity and nature. In all phases of their daily lives, the Nez Perce recognize the spirits of the forces and objects around them as supernatural guardian forms which they call in a personal way their *Wyakin*. The Nez Perce identify themselves with all the natural features of the earth. In the Nez Perce's belief, the earth is the ever nourishing mother, as any mother provides for a child. We must continue to be caretakers of the earth, or life will surely soon end. These values are used in developing Alternative Two.

3.3.4.2 Assumptions Regarding Future Use. The assumptions used to develop Alternative Two are as follows:

- Potential industrial and recreational development of the City of Richland and Benton County will primarily occur outside of the Hanford Site's boundary and close to Benton County's population centers.

Figure 3-5. Alternative Two.



BHI:rpp 04/23/98 clup/alternative2.aml Database: 23-APR-1998

- Remediation of the Hanford Site will continue, and the security measures currently in place will continue to be required.
- Plutonium production reactor blocks will remain in the 100 Areas throughout the planning period and will be considered a pre-existing, non-conforming use.
- The last non-tidal, unimpounded section of the Columbia River, and the salmon habitat found therein, as well as cultural resources of the indigenous people who pre-date the Federal government will be protected.
- The retained rights to the area, as recognized and affirmed by the Federal government in treaties with the affected Native American Tribes, will be protected.
- International treaties concerned with protecting salmon and other wildlife will be honored.
- With the DOE mission change from defense production to environmental restoration, the land needs of future DOE missions could be contained in the Central Plateau, 400 Area, and 300 Area.
- Major portions of the Site could not be conveyed to private ownership due to soil contamination left at depth after remediation.
- Existing contaminated groundwater conditions would not preclude development in any given location but would be considered a constraint to groundwater use and prevent transfer to private ownership, as the private sector would be unable and unwilling to accept the environmental liabilities.

3.3.4.3 Application of the Land-Use Designations. Alternative Two land-use designations include Industrial-Exclusive, Industrial, Research and Development, High-Intensity Recreation, and Preservation. The location, shape, and size of the land-use designations were influenced by a thorough analysis of the existing cultural resources, the hazards and resources created by humans, and geology.

3.3.4.3.1 The Wahluke Slope. Alternative Two would designate the entire Wahluke Slope Preservation. Preservation would prohibit irrigation of the Wahluke Slope because irrigation is accelerating sloughing of the White Bluffs along the Hanford Reach of the Columbia River. Sloughing of the bluffs, or other activities that change the course of the Columbia River, such as dredging or mining, could release chemical and radioactive contaminants that have been entombed within the fine sediments of the Hanford Reach.

Preservation would protect the last non-tidal, unimpounded section of Columbia River and the salmon habitat found within, as well as the cultural resources of the indigenous people who pre-date the Federal government. Preservation would honor retained Tribal rights as recognized and affirmed by the United States of America in the *Treaties of 1855* with the affected Tribes, as well as complying with international fishing treaties. Preservation would prevent an additional appropriation of water from the Columbia River in order to support development of lands on the Wahluke Slope. The Wahluke Slope is not in acreage that has been appropriated water from the Columbia Basin Project (BoR 1997). Finally, a Preservation designation would be appropriate because a large portion of the Wahluke Slope is too steep to develop (see Section 4.2).

3.3.4.3.2 The Columbia River Corridor. The Columbia River Corridor would include High-Intensity Recreation, Low-Intensity Recreation, Research and Development, and Preservation land-use designations. The Columbia River (surface water only) would be designated for Low-Intensity Recreation. The river islands would be designated as Preservation, which would be consistent with current management practices and would provide additional protection to sensitive cultural areas, wetlands, and sensitive species. The B Reactor and surrounding area, which is located within the Columbia River Corridor, would be designated for High-Intensity Recreation and would allow conversion of the reactor into a museum with museum-related facilities. The B Reactor was the first full-scale nuclear reactor in the world and was critical in the development of the first nuclear weapons. The K Reactor area would be designated for Research and Development. The K Reactor area could be used by the Tribes and others for fish farming or for aqua-culture and aquatic research.

The remainder of land within the 100 Areas would be designated Preservation. Preservation would protect retained rights of American Indian Tribes to the area and would protect sensitive cultural and biological resource areas. Prohibiting further irrigation and other land uses that increase infiltration on both sides of the Hanford Reach would aid in the stabilization of the Columbia River shoreline. Prohibiting irrigation would protect public health and the environment by preventing remobilization of contaminants entombed within the river's sediment and the shoreline's soil column, and would prevent siltation and destruction of salmon spawning beds. Preservation prohibiting irrigation near the reactor areas would mobilize contaminants left behind at depth long after cleanup efforts have ceased (see Section 4.11). Because the cleanup efforts in the 100 Area's soil column are limited to a depth of about 6.1 m (20 ft) below ground surface, the contaminants remaining in the soil column below 6.1 m (20 ft) will not be remediated.

3.3.4.3.3 The Central Plateau. The majority of land within the Central Plateau geographic area would be designated Industrial-Exclusive allowing for continued management of radioactive and hazardous waste. These management activities include collection and disposal of radioactive and hazardous waste materials that remain onsite, contaminated soil and groundwater containment and cleanup, and other related and compatible uses. Deed restrictions or covenants could be applied to this area through the CERCLA and RCRA processes. This designation would allow for expansion of existing facilities or the development of new facilities for waste management or other DOE missions.

Land west of the currently developed 200 West Area within the Central Plateau geographic area would be Preservation. This area contains high-quality mature sagebrush, which provides this essential habitat for shrub-steppe dependent species. This designation would prevent additional sprawl to the west and encourage siting of new projects between the 200 East and 200 West Areas.

3.3.4.3.4 The All Other Areas. The All Other Areas geographic area would include Industrial, Research and Development, and Preservation. Alternative Two designates, for future economic development, the City of Richland Urban Growth Area (UGA), the 400 Area (including the FFTF), and WPPSS as Industrial. An Industrial designation would accommodate economic development for the next 50 years of the area identified by the City of Richland's UGA boundary at the southeast portion of the Site. An Industrial designation would also reserve the 400 Area for DOE missions, and the WPPSS area for use by WPPSS. The area around the LIGO within the All Other Areas geographic area would be designated Research and Development, consistent with current management practices.

The remainder of the All Other Areas would be designated Preservation. Major constraints identified in the *Draft HRA-EIS* (August 1996) demonstrated that the majority of the Hanford Site is unsuitable for economic development and that the best future land use would be Preservation. Designating the majority of the All Other Areas as Preservation is appropriate because, while portions of the All Others Areas geographic area have a well-developed transportation network, these areas are remote from population centers thus limiting their economic potential. A sand dune complex and vegetation stabilized sand dunes, which extend from the Columbia River westward across the site to State Highway 240 (see Section 4-5), should not be developed because vegetation-disturbing activity might reactivate stabilized dune fields. Soil and groundwater contamination remaining at depth after remediation prevents these lands from being exploited for economic reasons due to the difficulties involved in transferring public lands with environmental liabilities to private ownership. For example, the widespread environmental contamination from the 200-BC Cribs is approximately 32.1 km^2 (12 mi^2). A Preservation designation also precludes extensive economic development of the All Other Areas geographic area because of the large exclusive use zones (safety buffers) around the Hanford Site's existing nuclear facilities (see Section 4.5). Additionally, the nature of the research conducted at LIGO requires a substantial seismic buffer zone for operation.

The promontories of Gable Mountain, Gable Butte, Umtanum Ridge, and a large portion of their viewsheds would be designated Preservation, consistent with traditional Tribal use. The *Old Indians* went to high mountains seeking vision sites and to fast for a few days to seek a vision or a *Wyakin* (which is the Nez Perce word for your personal vision spirit that will protect you for the rest of your life). The *Wyakin* could be a bird, four-legged animal, plant, or root, and it will be your personal medicine. During a vision quest, one looks at the big picture or the view as far as the eye can see. This view encompasses the big river, creeks, springs, the various grasses, shrubs, animals, birds, and even insects such as ants. These things and objects all have their place and souls on the mother earth; one prays to the Creator to bless you and ask him to take care of all these things.

To preserve these cultural resources (including wildlife), the large contiguous tract of shrub-steppe habitat in the All Other Areas surrounding the Central Plateau, is designated Preservation. The resident elk herd, one of the largest remnants of relatively undisturbed shrub-steppe ecosystem, and viewsheds for American Indian vision sites (e.g., Gable Butte and Gable Mountain) would be protected by a Preservation land-use designation. The Preservation land-use designation would also ensure that wildlife corridors are maintained.

3.3.4.4 The Arid Lands Ecology Reserve (ALE Reserve). The ALE Reserve geographic area would be designated Preservation in accordance with its management as the Rattlesnake Hills Research Natural Area. Currently, the USFWS manages the ALE Reserve for the DOE. Privately owned mineral rights exist on the ALE Reserve that were not conveyed to the Federal government when the Hanford Site was formed. The ALE Reserve contains one of the few resident elk herds in the world that inhabit a semi-arid area, and the ALE Reserve is one of the largest remnants of relatively undisturbed shrub-steppe ecosystem in Washington State.

This page intentionally left blank.

3.3.5 *Alternative Three*

3.3.5.1 Planning Goals, Objectives, and Values (Vision). Benton, Franklin, Grant, and Adams counties and the City of Richland contain portions of the Hanford Site. Alternative Three represents the individual planning efforts of these local governments. The procedures used by these governments to develop Alternative Three vary by each planning jurisdiction. The designations in Grant County reflect the Wahluke 2000 Plan prepared by farming interests in 1992 and supported by Grant County (NPS 1996). The designations in Franklin County result from a land-use analysis conducted by the Franklin County Planning Department, and designations within Benton County were developed per the procedure outlined below:

- Existing site resources were inventoried, mapped, and characterized.
- Biological resources were identified per the WDFW priority habitat and species data base.
- Natural and biological resources were then translated into five "critical resources" consistent with the GMA, including wetlands, fish and wildlife conservation areas, frequently flooded areas, geologically hazardous areas, and critical aquifer recharge areas.
- An opportunities and constraints analysis was performed using the assembled site information.
- Critical resources were placed in a single contiguous designation (i.e., the Conservation land-use designation).
- Areas remaining outside of the Conservation designation were identified as suitable for development and analyzed to determine the appropriate "intensity" of use within the designated area.
- Once appropriate intensities were identified for each area suitable for development, land uses were designated consistent with "opportunities and constraints" (e.g., availability of infrastructure, nearness of urban areas, soils capabilities, and current use patterns/future options).

The land-use designations included in Alternative Three are presented in Figure 3-6. The county and city governments believe that the land-use designations for the Hanford Site address identified goals and values of DOE, the City of Richland, Benton County, and the HAB. The goals and values include economic diversification, increased public use for recreation and private enterprise, private-sector utilization of infrastructure, and the protection of biological and cultural resources (see text box, "*Goals and Objectives*").

3.3.5.2 Assumptions Regarding Future Uses. The assumptions used to develop Alternative Three are as follows:

- The Hanford Site will eventually be remediated as recommended by the FSUWG.
- Major portions of the Site will be used for multiple private and Federal uses after remediation.

- Existing contaminated groundwater conditions will not preclude development in any given location, but will be considered a constraint to groundwater use.

- Plutonium production reactor blocks will remain in the 100 Areas throughout the planning period and will be considered a pre-existing, non-conforming use.

3.3.5.3 Application of the Land-Use Designations. Alternative Three land-use designations include Industrial-Exclusive, Industrial, Agriculture, Research and Development, High-Intensity Recreation, Low-Intensity Recreation, Conservation (Mining), Conservation (Mining and Grazing), and Preservation. For Site lands within Benton County, the location, shape, and size of the land-use designations were determined by analyzing the existing natural and man-made resources (e.g., infrastructure, topography, and biology) described in Chapter 4 (see text box, "*Allowable and Permitted Uses Within the Land-Use Designations of Alternative Three*"). For lands within the Grant County portion of the Site, land-use designations were influenced by the input and analysis resulting from the Benton, Franklin, and Grant County Hanford Reach Citizens Advisory Panel, the Wahluke 2000 Plan, and the Wahluke Slope Element of the Grant County Comprehensive Plan. The lands within the Franklin County portion of the Site went through an analysis similar to that described above. The designations of Preservation, Conservation, Low-Intensity Recreation, and Agriculture on this portion of the Site were developed from onsite analysis with input from the Benton, Franklin, and Grant County Hanford Reach Advisory Panel and the Wahluke 2000 Plan. In addition, the WDFW, the BoR, and the South Columbia Basin Irrigation District provided information.

Goals and Objectives

County and City Objectives (GMA Mandates*)
- Designate city urban growth areas in cooperation with cities.*
- Designate and conserve, by regulation, natural resource lands (i.e., agricultural lands and mineral resources).*
- Designate and conserve, by regulation, critical resources.*
- Protect the environmental, cultural, historical, and economic resources.*
- Maintain functional infrastructure and utilities currently on the Site.
- Provide for Low-Intensity Recreation.

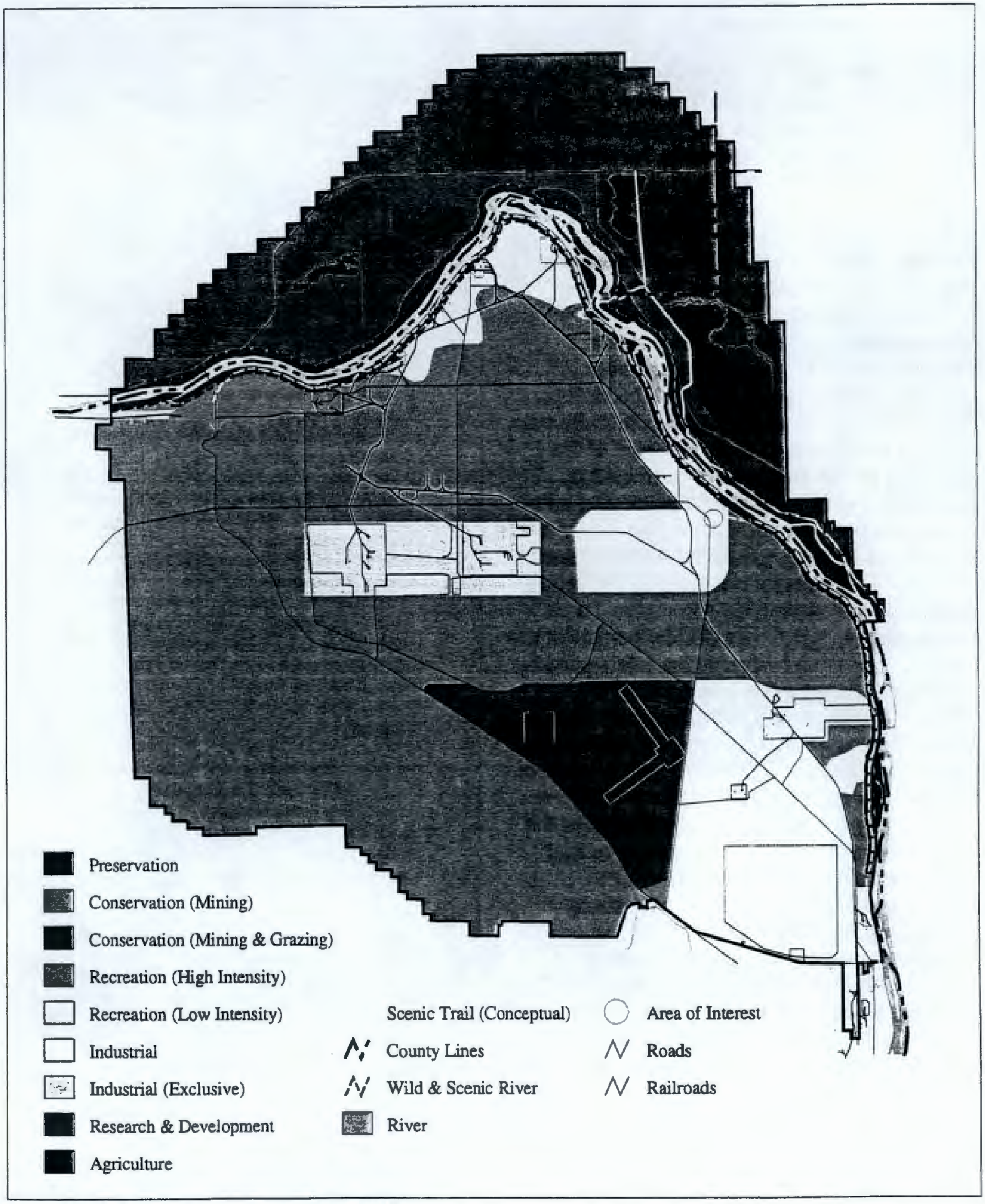
Hanford Advisory Board
- Historic and cultural resources have value. They should not be degraded or destroyed. Appropriate access to those resources is a part of their value.
- The importance of ecological diversity and recreational opportunities should be recognized; these resources should be enhanced as a result of cleanup and waste management decisions.
- Cleanup and waste management decisions should be coordinated with the efforts of the affected communities to shift toward more private business activity and away from dependence on Federal projects that have adverse environmental or economic impact.
- Cleanup activities should protect to the maximum degree possible the integrity of all biological resources, with specific attention to rare, threatened, and endangered species and their habitats.
- Use the Central Plateau wisely for waste management.

Hanford Future Site Uses Working Group (1992)
- Deal realistically and forcefully with groundwater contamination.
- Use the Central Plateau wisely for waste management.
- Do no harm with clean up or new development.

Commonly Identified Goals
- Economic development and diversification
- Protect the Columbia River
- Clean up areas for future use.

Alternative Three would accommodate both future Federal missions and private activities, such as business-related industry and research and development enterprises, in the southeastern portion of the Site (north of the City of Richland). This area would be adjacent to essential services and large-capacity infrastructure. Accommodations for the expansion of public and commercial recreational activities would be focused on the northern portion of the Site (i.e., primarily in the vicinity of the Vernita Bridge).

1 ***Figure 3-6. Alternative Three.***



BHI:rpp 04/23/98 clup/alternative3.aml Database: 23-APR-1998

> ***Allowable and Permitted Uses Within the Land-Use Designations of Alternative Three***
>
> Allowable and permitted uses within any land-use designation would correspond to those listed in Table 3-1, except that within the Industrial, Research and Development, and High-Intensity Recreation land-use designations, dryland agricultural and grazing would be considered an allowable use (typically interim). Irrigated agriculture would be considered an interim conditionally permitted use, which would be subject to existing deed restrictions or covenants standards that prohibit activities that impact contaminated soil and groundwater. Basalt outcrops and other culturally significant landscape features would not be available for mining.

The largest land-use designation would be Conservation (Mining), which would represent a single continuous area that would extend over all geographic areas except the southern portion of the Site. Generally, the shape and extent of this designation would include sensitive biological, physical, and cultural features on the landscape (e.g., rare, threatened or endangered flora/fauna and their habitats, unique geologic hazards and features, and wetland and riverine environments), and would be intended to protect these resources over the long term.

In the southern portion of the Site, located north and northwest of Richland, is a large area designated for Industrial, and Research and Development land uses. Within these land-use designations, a large area of seral-stage, shrub-steppe habitat exists. Given the existence of other planning considerations identified in the All Other Areas geographic area, this area was not included with the Conservation (Mining) land-use designation, and would be considered suitable for future development. However, the importance of this habitat would be recognized and impacts to shrub-steppe habitat would require mitigation.

3.3.5.3.1 The Wahluke Slope. The soil, climate, and topography of the Wahluke Slope make it potentially one of the most productive agricultural areas in the Pacific Northwest. Prior to its inclusion in the Hanford control zone, the BoR had purchased over 10,927 ha (27,000 ac) of the Wahluke Slope for agricultural development. Development of land within the Site that is appropriate for agriculture will result in the completion of the vision for agricultural economy benefitting the citizens of the area. The land-use proposal for the Wahluke Slope seeks to provide balanced and compatible economic development, conservation of critical resource lands, and the protection of the Columbia River Corridor. The Wahluke Slope contains expansive critical resource lands not suitable for farming, but these lands are ideally suitable for wildlife habitat and low-intensity recreation. Such areas constitute an ideal buffer providing protection between agricultural land and the Columbia River Corridor.

The largest land-use designation would be approximately 24,371 ha (60,222 ac), designated as Agriculture. Development of land for agriculture would be based upon an opportunities and constraints analysis. Land designated as Agriculture within the "Red Zone" consists of approximately 10,813 ha (26,720 ac) that would be conserved under a "no-action" scenario pending initiation and completion of geotechnical studies analyzing the impacts of irrigation of the White Bluffs and the Columbia River. Approximately 6,232 ha (15,400 ac) are designated Conservation (Mining and Grazing), including land providing for wildlife refuge and low-intensity recreational activities. Approximately 4,636 ha (11,456 ac) would be designated as Preservation. Generally, the share and extent of this designation would include sensitive biological, physical, and cultural features on the landscape (e.g., rare, threatened or endangered flora/fauna and their habitats, unique geologic hazards and features, and wetland and riverine environments), and would be intended to protect these resources over the long term. Agriculture designated within the Franklin County portion of the Site is outside of the BoR (just outside of the BoR Red Zone).

3.3.5.3.2 The Columbia River Corridor. Land-use designations included in the Columbia River Corridor under Alternative Three would support conservation of the Columbia River, and would maintain and support high-quality aquatic and riparian habitats. These land-use designations within the Columbia River Corridor geographic area are described below.

The Preservation land-use designation would extend upland 400 m (1320 ft) from the average high-water line of the river, except in Franklin and Grant counties, where the boundary would extend further inland to include specific sensitive features, such as the White Bluffs and several upland wetlands. Permitted uses would be similar to those within the Conservation land-use designation, except Mining would be prohibited by the permitting process. Although Preservation is not a land-use term used under county-wide planning ordinances, Conservation is a recognized land-use term. The Conservation (Mining) land-use designation would include those areas that extend upland of the Preservation land-use designation. Within the Conservation (Mining) land-use designation, Mining would be allowed as a conditionally permitted use. Agriculture uses would be prohibited. The primary purpose would be to protect and manage fish and wildlife.

Areas surrounding the K, N, D, and H reactor sites would be designated as Low-Intensity Recreation. This area has minimal biological sensitivity and contains unique natural features potentially suitable for public enjoyment. The Low-Intensity Recreation designation would begin 400 m (1320 ft) upland from the average high-water line of the river except in small isolated areas such as the former White Bluffs town site, and the existing recreational access corridors to the Columbia River. Environmental restoration activities would continue in the 100 Areas (i.e., 100-BC, 100-KE, 100-KW, 100-N, 100-D, 100-DR, 100-H, and 100-F). These uses would be considered a pre-existing, non-conforming use in the Low-Intensity Recreation land-use designation.

A hiking and biking recreational trail along the entire river corridor would be proposed from North Richland to Vernita, which would allow public access along the river corridor and connect important historic and natural resources, such as the former Hanford and White Bluffs townsites, the Bruggerman Warehouse, and the B Reactor museum, and would connect the rest stop and boat launch area located at the Vernita Bridge. This trail would be sited to avoid impact to, or contact with sensitive biological, cultural, hazardous, and/or natural resource sensitive areas. This trail would connect to the river shore trails in Richland at the southern boundary.

3.3.5.3.3 The Central Plateau. DOE would be expected to continue all waste management and disposal activities in the Central Plateau. As a result, the Central Plateau geographic area would be designated for Industrial-Exclusive Use.

3.3.5.3.4 The All Other Areas. The majority of the All Other Areas would be designated Conservation (Mining). Within the Conservation land-use designation, mining would be allowed as a conditionally permitted use. Agricultural uses would be prohibited. A small area along the southern boundary of the Site near the Yakima River would be designated High-Intensity Recreation. This area, adjacent to the Benton County Horn Rapids Park, is currently "master planned" as a regional park. A High-Intensity Recreation land-use designation would provide commercial use support for the expected increase in recreational and visitor use in the park area (a central feature of the Tapteal Greenway), which would extend along the lower Yakima River from Benton City to Columbia Point. The area adjacent to the Vernita Rest Stop, east of State Highway 240 (which includes the B Reactor site), would also be designated as High-Intensity Recreation. The Vernita Rest Stop, the proposed B Reactor museum, and the proposed boat launch are all expected to increase demand for recreational and visitor use of the Vernita area. The strip designated for the west 135 ha (333 ac) of the Vernita Terrace would be designated Low-Intensity Recreation, primarily for limited activities such as biking, hiking, fishing, hunting, boat launching facilities, primitive day camping, and nature viewing, while maintaining the natural resource values upon which those uses are based.

Areas north of the City of Richland would be designated as Industrial, and Research and Development. This area would be accessible using the State Highway 240 corridor, State Highway 10, and existing railroad infrastructure. Existing municipal water and sewer is located nearby within the City of Richland Urban Growth Boundary. Industrial use also would be proposed for the area east of the 200 Area (i.e., May Junction), which contains low-quality biological resources and existing rail and road infrastructure.

3.3.5.3.5 The Arid Lands Ecology Reserve (ALE Reserve). This area would be designated as Conservation (Mining) due to the existing unique and sensitive biological, ecological, and cultural resources.

3.3.6 Alternative Four

3.3.6.1 Planning Goals, Objectives, and Values (Vision). Alternative Four represents the vision of the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) for the management of the Hanford Site over the next 50 years (Figure 3-7). It is based on a detailed knowledge of site resources and upon experience gained from many years participating in a host of Hanford Site planning forums.

In the view of the CTUIR, the greatest value provided to the region and the nation by the Hanford Site is its role as a natural and cultural resource reserve. The CTUIR recognizes, nevertheless, that there are other services provided by the Hanford Site that are not compatible with this primary value, and that a rational land-use plan for Hanford must take into account these other services. In the CTUIR's review of the Hanford site's resources, and of the current and potential services provided or potentially provided by the Site, we have striven to find the most rationally justifiable balance between these interests.

The result is a land-use plan that protects a significantly greater amount of Hanford resources than is protected under DOE's Preferred Alternative. Nevertheless, Alternative Four provides opportunities for waste management, commercial industry, and recreation that by the CTUIR's estimates will meet or exceed actual demand. In the view of the CTUIR (and consistent with the *Final Report of the Hanford Future Site Uses Working Group* [FSUWG 1992]), all permanent waste disposal sites at Hanford should be located in the Central Plateau waste management area. While Alternative Four provides opportunity for research and development activities, the CTUIR has intentionally provided an area for these activities that may not accommodate all proposals received over the next 50 years. The CTUIR has limited the size of this area because, in its view, the value provided by these activities does not justify the consumption of a large amount of Hanford resources. The CTUIR wants to ensure that Hanford lands would only be available to support the most valuable research and development activities, and that any future research and development activities on the Site would make efficient use of Hanford resources. Finally, Alternative Four provides no opportunity for agriculture on the Hanford Site. In the view of the CTUIR, agricultural development at Hanford is not justified. Any value that would be added to the region by allowing agricultural development at Hanford is grossly outweighed by the value presently provided by the natural and cultural services of the Site.

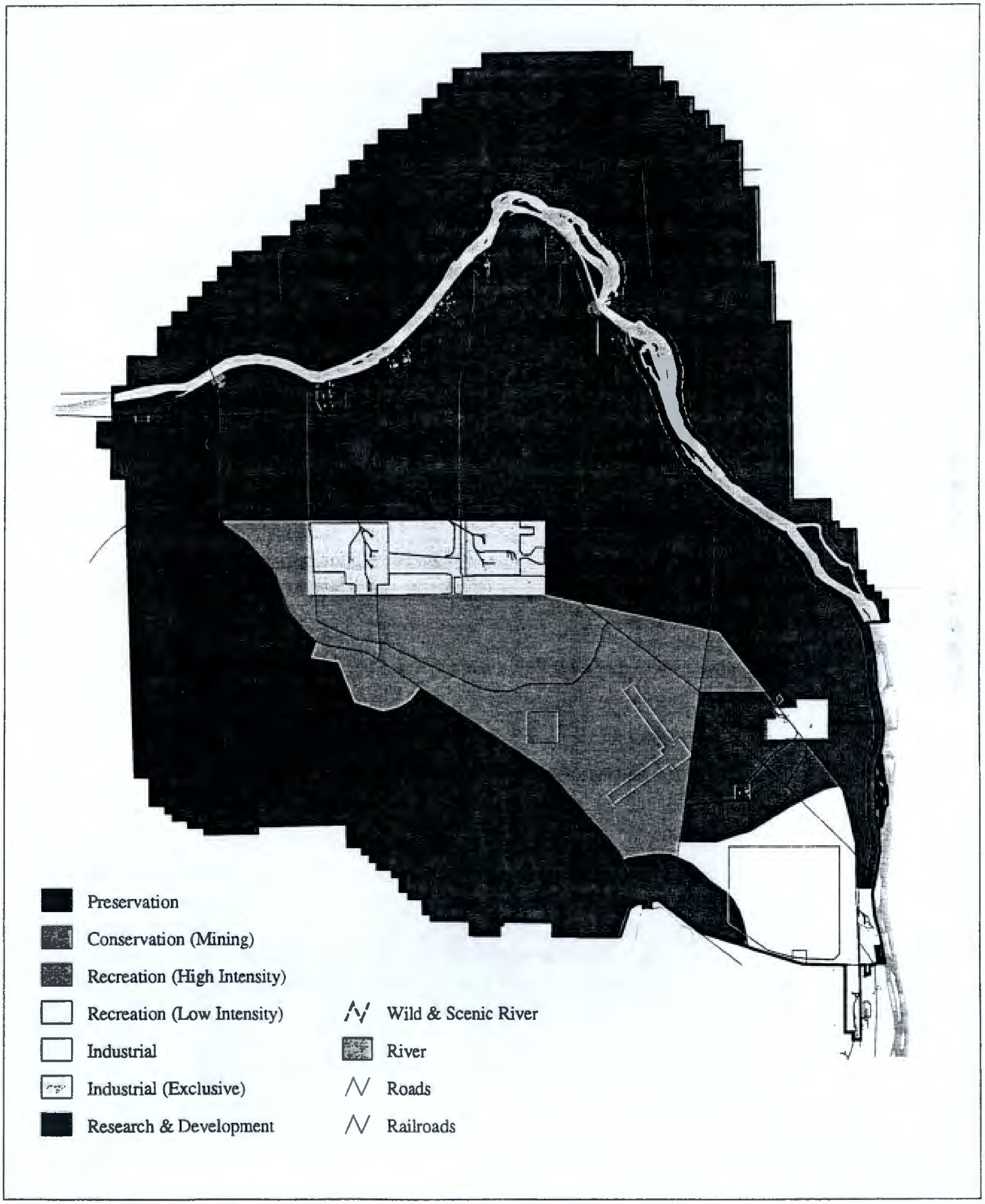
3.3.6.2 Assumptions Regarding Future Use

<u>Remediation and Waste Management</u>:

1. Remediation activities on the Site will continue as planned.

2. The remediation process will generally impose no long-term restrictions on future land use, with the exception of (a) activities which disturb capped permanent waste sites, (b) activities which disturb contaminants which remain in place 4.6 m (15 ft) or more below the ground surface in some areas, and (c) activities which would affect groundwater contaminant plumes.

1 *Figure 3-7. Alternative Four.*



BHI:rpp 04/23/98 clup/alternative4.aml Database: 23-APR-1998

3. Plutonium production reactor blocks will remain in the 100 Areas throughout the planning period and will be considered a pre-existing, non-conforming use.

4. All permanent waste disposal activities (e.g., all capped permanent waste sites) will be located in the Central Plateau.

5. Geologic material will need to be mined on site for the construction of caps over disposal sites.

Local Economic Transition:

1. The Tri-Cities area will need to develop a stable economic base that is independent of DOE activities and budgets. Economic considerations will cause most of that new development to take place within the City of Richland's Urban Growth Area. Available projections indicate that, at the most, only 809 ha (2000 ac) to 1619 ha (4,000 ac) of the Hanford Site will be needed for private commercial development over the next 50 years.

2. Much development in the Tri-Cities area has made inefficient use of available lands, resulting in sprawl. Future land-use regulation should ensure more efficient use of available lands.

Research and Development Activities:

For practical reasons, DOE will locate the research and development activities needed to assist in Hanford remediation, restoration, and waste management in the following manner by one of these actions:

1. In sophisticated laboratory facilities within the City of Richland (e.g., EMSL)

2. In the 300 Area

3. Within the Central Plateau waste management area, or

4. As field studies with little environmental impact.

From time to time proposals are advanced for research and development activities at Hanford that are unrelated to remediation, waste management, or the restoration of the Site. Some of these proposals are rejected as making poor use of Hanford resources, but others are developed on site. This trend is likely to continue. The land-use planning process should ensure that only proposals that provide a clear value and make efficient use of available Hanford resources are accepted.

Natural and Cultural Resource Values, Management, and Use:

1. The Hanford Site and the U.S. Department of the Army's Yakima Training Center constitute the only large, relatively undisturbed areas of natural shrub-steppe habitat remaining in Central Washington.

2. The Hanford Reach will be designated as a Recreational River under the *Wild and Scenic Rivers Act* or other analogous legislation. Demand for (and the need to manage) recreational activity on the Reach and associated Hanford lands will steadily increase.

3. A public desire for low-impact recreation (including hunting) on the uplands of the Hanford Site already exists and will increase over time.

4. The gathering, processing, distribution, and use of natural resources, and the cultural and religious laws governing these activities, are at the core of the traditional culture of the CTUIR and other Hanford-affected Tribes. The survival of the CTUIR's culture depends upon the availability of, access to, and traditional use of native natural resources. As a result, protection of native ecosystems and of Tribal member access to such resources is a priority for the CTUIR and other Tribal governments. As areas of the Hanford Site are determined to be clean, and as administrative mechanisms are put in place, members of the CTUIR and other Hanford-affected Tribes will make increasing use of the Hanford Site for the gathering of natural resources. Such activities will include subsistence plant gathering and hunting, as well as subsistence and commercial fishing.

The Hanford Site contains numerous places of religious important to members of the CTUIR who practice traditional Indian religions. These places include the major basalt outcrops, the active dunes area, and other sites. These sites have been used by members of the CTUIR and other Hanford-affected Tribes from time immemorial for a wide variety of religious activities. In addition, the Prophet Smohalla, a founder of the Washat, or Seven Drums, religion, received his principal visions and teachings at places now located within the boundaries of the Hanford Site. Many members of the CTUIR are members of the Washat religion. Protection of these sites, and of Tribal members' access to these sites, is of great important to the CTUIR and its members (as well as to other Hanford-affected Tribes) and will continue to be an issue of great importance.

The area currently occupied by the Hanford Site has been used by American Indian Tribes for at least the past 13,000 years, and likely much longer than that. Cultural resources such as cemeteries, village sites, and archaeologic resources are abundant on the Hanford Site because of the area's abundance of natural resources, its central location on transportation routes, and its climate. The locations of many of these sites are presently unknown. Federal law mandates the protection of these resources. Moreover, the protection of these resources is very important to members of the CTUIR and other Hanford-affected Tribes. Respect for and non-disturbance of these resources is a fundamental religious value of members of the CTUIR who practice traditional religion. These management principles will continue to be defended by the CTUIR and other Hanford-affected Tribes.

3.3.6.3 Application of the Land-Use Designations

Alternative Four land-use designations include Industrial-Exclusive, Industrial, Research and Development, High-Intensity Recreation, Low-Intensity Recreation, Conservation (Mining),and Preservation. Low-Intensity Recreation, while generally not appearing as a separate land use in Alternative Four, would occur in all land-use designations, as long as protected resources are not placed at risk, and so long as incompatible development has not already occurred. Specific planning for support of Low-Intensity Recreation will take place as part of the implementation (see Chapter 6).

3.3.6.3.1 The Wahluke Slope. Alternative Four would manage the entire Wahluke Slope area as Preservation due to the outstanding value of its natural and cultural resources, which would be destroyed by more consumptive land uses. These resources include wetlands, uplands, and the White Bluffs. The White Bluffs are a unique geologic, paleologic, and cultural feature. The Bluffs, in particular, are highly susceptible to collapse due to activities that increase groundwater flow. Such collapses have occurred in recent years and their impacts continue. Aside from causing the loss of this irreplaceable resource, such collapses bury salmon habitat under tons of silt and alter the course of the Columbia River. The alteration of the river's course causes new erosion which, in turn, destroys cultural resources on the islands and shore of the River, and potentially mobilizes contaminants that are currently stabilized. Managed, Low-Intensity Recreation (including hunting) and other activities would take place on Preservation lands.

Preservation is the land-use designation which bears the strongest resemblance to the land-use alternative chosen by the *Hanford Reach of the Columbia River, Comprehensive River Conservation Study and Environmental Impact Statement, Record of Decision* (NPS 1996). That Department of the Interior NEPA ROD determined that the best use of the Wahluke Slope is as a national wildlife refuge. The DOE concurred that the Wahluke Slope should be a national wildlife refuge. The CTUIR supported that decision, as did other Tribes, governments, and stakeholder groups.

Moreover, as the No-Action Alternative indicates, the Saddle Mountain Wildlife Refuge, which is managed by the U.S. Fish and Wildlife Service, is currently managed in a manner that is most analogous to Preservation. Likewise, the Wahluke Slope Wildlife Recreation Area is managed in the same manner. In both of these areas, as well as under the Hanford Reach ROD (NPS 1996), grazing is only allowed as a tool to improve wildlife habitat. Grazing solely for commercial production is not allowed anywhere on the Site.

In practice, none of the Saddle Mountain Wildlife Refuge has been grazed for many years. Likewise, the portion of the Wahluke Slope Wildlife Recreation Area south of State Highway 24 is not grazed. Only the portion of the Wahluke Slope Wildlife Recreation Area north of State Highway 24 is being grazed in order to control cheatgrass. Under the Preservation designation, grazing would be barred entirely. This would result in no changes to the current management of 26,000 ha (64,247 ac) or 73 percent of the Wahluke Slope. In the area north of State Highway 24, alternative methods for controlling cheatgrass would be adopted.

3.3.6.3.2 The Columbia River Corridor. Alternative Four would designate almost the entire Columbia River Corridor as Preservation due to its outstanding natural and cultural resources. The Columbia River Corridor contains a wealth of aquatic and terrestrial natural resources, including salmon, sturgeon, mule deer, bald eagles, and many others. The

Columbia River Corridor is also an area where cultural resources such as cemeteries and archaeologic resources are highly concentrated.

The Corridor has historically contained reactors and associated buildings to support Hanford's former defense production and energy research missions. Nevertheless, remediation planning documents, public statements of advisory groups, and such planning documents as the *Environmental Impact Statement: The Decommissioning of Eight Surplus Reactors* (DOE 1992) have determined that remediation and restoration of the Columbia River Corridor will return the corridor to a non-developed, natural condition. Restrictions on certain activities may continue to be necessary to prevent the mobilization of contaminants, the most likely example of such restrictions being on activities that discharge water to the soil. Although the Surplus Reactor NEPA ROD calls for the reactor buildings to be demolished and the reactor blocks to be moved to the Central Plateau, this action will not take place until 2067. As a result, the reactor buildings will remain in the Columbia River Corridor throughout the 50-year planning period addressed by the HRA-EIS.

The Preservation designation would allow managed recreation within the Corridor. This activity would include the continued operation of the White Bluffs boat launch, managed as Low-Intensity Recreation, on the east side of the river. Other infrastructure to support Low-Intensity Recreation would be identified during implementation of the CLUP.

Alternative Four provides for a High-Intensity Recreation public boat launch located near the Vernita bridge on the south side of the river. Alternative Four provides another High-Intensity Recreation boat launch, located at the White Bluffs boat launch on the west side of the river. The White Bluffs boat launch would support Tribal treaty-reserved fishing activity throughout the Reach, and would contain appropriate support facilities for that purpose.

Alternative Four does not provide for the creation of a High-Intensity Recreation tourist facility at the B Reactor. The CTUIR prefers to remove all vestiges of the cold war legacy from the Reach.

3.3.6.3.3 The Central Plateau. Consistent with the findings of the *Final Report of the Future Site Uses Working Group* (FSUWG 1992), subsequent planning documents, and the general consensus of governments and stakeholders, the Central Plateau would be used for waste management activities, designated in this EIS as Industrial-Exclusive. All permanent waste disposal at the Hanford site would take place within the Central Plateau. Likewise, research and development activities associated with waste management would take place within this geographic area. Land use within this area would have to be carefully planned during implementation of the CLUP so as to ensure that DOE would not run short of area for waste management activities. Since the Central Plateau currently contains natural resources of high value, developments that impact these resources would be mitigated using the BRMaP.

3.3.6.3.4 The All Other Areas. The All Other Areas geographic area contains a variety of natural and cultural environments, including large stands of mature sagebrush-steppe, basalt outcrops, an active dune complex, stabilized dunes, a wide variety of archaeologic resources, American Indian cemeteries, former agricultural lands, the remains of former DOE facilities, and the remains of two former small towns. Because of the diversity of the All Other Areas, Alternative Four applies a variety of land-use designations to this area. While Low-Intensity Recreation generally does not appear as a separate land use in this geographic area, it is anticipated that during the implementation of the CLUP (Chapter 6), opportunities for compatible Low-Intensity Recreation would be established throughout much of the All Other Areas geographic region.

Alternative Four recognizes that the area within 3.2 km (2 mi) of the Columbia River (an area much larger than the 400 m (1320 ft) area protected by proposed legislation for the Reach, or considered to be part of the Columbia River Corridor) contains a disproportionate share of the archaeologic resources and cemeteries on the Hanford Site. This area also has high natural resource value as a wildlife corridor. In recognition of these facts and the importance of protecting these resources, Alternative Four designates this expanded corridor area as Preservation.

Alternative Four also recognizes that the area north of Gable Butte and Gable Mountain (but outside of the expanded corridor area), contains large blocks of mature, relatively undisturbed sagebrush-steppe habitat. Alternative Four places these areas under the Preservation designation because of the increasing rarity of such resources in Central Washington, the need to avoid fragmentation, and the value of these areas as wildlife corridors. Alternative Four differs from Alternative One by including areas of lower quality habitat within this Preservation area. Alternative Four does this in the interest of avoiding fragmentation. Under Alternative Four, these lower quality areas would be prime sites for the location of restoration projects initiated under BRMaP as mitigation for development in other parts of the Hanford Site. Likewise, such areas would be appropriate for natural resource restoration initiated under the natural resource damage restoration provisions of CERCLA. The area north of the ALE Reserve and south of Umtanum Ridge, (also known as McGee Ranch) would be designated Preservation because of its value as a wildlife corridor and in the interest of avoiding fragmentation. This area would also be a suitable location for habitat impact mitigation activities.

Alternative Four recognizes that the basalt outcrops beginning with Gable Mountain in the east and moving west through Gable Butte and Umtanum Ridge have been of great religious and cultural importance to members of the CTUIR, members of other Hanford-affected Tribes, and their ancestors for many millennia. These sites continue to be of great religious importance to many members of the CTUIR and other Hanford-affected Tribes. In addition to religious importance, these sites are of great cultural and archaeologic value to members of the CTUIR in general. These outcrops also have distinct habitat value, such as providing raptor perching area and talus slope habitat. In recognition of the irreplaceable cultural value of these resources and their biological importance, Alternative Four designates these areas as Preservation.

An important part of cultural and religious use of a basalt outcrop such as Gable Mountain is the view such areas provide of the surrounding landscape. When this landscape is damaged by development -- especially when that development occurs relatively near the viewpoint -- the cultural use of the site is seriously injured. CTUIR members' use of Gable Mountain and Gable Butte has already been significantly injured by the development of the Central Plateau. In order to prevent further injuries to the central basalt outcrops' viewshed, Alternative Four designates the area north of the Central Plateau and south of the outcrops, as well as the area east of the Central Plateau (also known as May Junction) as Preservation. Designation of the May Junction area as Preservation is especially critical, due to its close proximity to Gable Mountain (see Chapter 4, Figure 4-31). The designation as Preservation of other portions of the All Other Areas geographic region, mentioned above, also supports the protection of the central basalt outcrops' viewsheds.

Existing structures on Gable Mountain itself also injure CTUIR members' cultural and religious use of the mountain. Under Alternative Four, structures not currently in use would be removed. During implementation (Chapter 6), further steps would be taken to facilitate the relocation of pre-existing, non-conforming structures to more appropriate locations.

Alternative Four recognizes that the area of active dunes, located north of WPPSS, is similar to the basalt outcrops in being an area of great religious and cultural significance as well as being an area of distinct habitat value. Alternative Four would treat these dunes in a similar manner to the basalt outcrops, designating them as Preservation.

Alternative Four anticipates that work in the Central Plateau Industrial-Exclusive waste management area may require the consumption of large quantities of sand, gravel, and basalt for capping material. Economic considerations would likely require that these materials come from areas near the Central Plateau. While making it clear that the basalt outcrops and the active dunes area are fundamentally inappropriate for such consumptive uses, Alternative Four does anticipate the need to make such materials available. As a result, Alternative Four designates a large area near the Central Plateau and between the Plateau and the southeastern border of the Hanford Site as Conservation (Mining). This area contains a variety of soil and rock types allowing DOE several options for locating quarries which would meet anticipated waste management specifications and quantities.

While the Conservation (Mining) designation provides DOE with the means to satisfy its need for geologic materials, the designation also reflects the high quality of the habitat in this area. Portions of this area contain some of the largest and highest quality mature sagebrush communities on the Hanford Site. Were it not for the need to supply DOE with geologic material, much of this area would most appropriately be designated Preservation. As a result, DOE would need to make prudent choices regarding the removal of needed material, so as to minimize impacts to this generally high-quality habitat. Such decisions would be made during implementation of the CLUP (Chapter 6). Likewise, the provisions of BRMaP would provide incentive for DOE to minimize these impacts, while also providing the assurance that such impacts would be appropriately mitigated. If these geologic materials are not needed to support the waste management and cleanup mission, the land-use designation for this area should revert to Preservation.

The southern portion of the area which Alternative Four designates Conservation (Mining) contains the existing LIGO facility. Alternative Four treats LIGO as a pre-existing, nonconforming use. LIGO would continue to operate throughout its life span, but its use could not be altered to increase its nonconformity, and similar research and development facilities could not be located in this area. This area also contains the square mile of land owned by the State of Washington, but not currently developed. The State of Washington's reason for purchasing this land was to build a hazardous waste treatment, storage and disposal facility on this site (State of Washington 1980). In the view of the CTUIR, such a facility would be a poorly reasoned use of the land. Because this square mile of land is not owned by DOE, this EIS apparently cannot determine the land use on this land. It appears that such a determination can only be made by Benton County. The CTUIR urges Benton County and the State of Washington to agree to a land-use designation for this square mile which is consistent with the designation for the surrounding land adopted in the ROD for this EIS.

Alternative Four designates the portion of the All Other Areas geographic area that is south and east of the Wye Barricade (between State Highway 10 and the Hanford Site rail line) as Research and Development and Industrial in roughly equal amounts. Alternative Four provides 4,388 ha (10,843 ac) for Research and Development. The primary purpose of this land would be to meet any future DOE need for additional research facilities to support the remediation, waste management, and restoration mission. Nevertheless, Alternative Four recognizes that from time to time, proposals will be made for the development of research and development facilities on the Hanford Site that are unrelated to the cleanup mission. Alternative Four provides adequate land for the development of facilities that make efficient use of available resources, while screening out facilities that are highly consumptive of Hanford resources. Such facilities could also be located on available land within the Industrial designation.

While current studies (e.g., the *City of Richland's Comprehensive Plan* [City of Richland 1997] and the Draft *Benton County Comprehensive Plan* [Benton County 1997]) indicate there will be little or no demand for industrial sites in this area in the next 20 years, Alternative Four recognizes that when private commercial industrial development begins on site it will most likely occur in the area immediately north of the City of Richland. Length of commute, distance required for the extension of utilities, and similar factors would encourage private commercial development to take place in this area. While the demand for such land is at this point highly speculative, Alternative Four recognizes that the CLUP adopts a 50-year planning horizon, and that such development may occur within that time frame. As a result, Alternative Four provides 6,881 ha (17,003 ac) for Industrial development. Planning concerning the provision of infrastructure to support industrial development in this area, planning determining the sequence of development in this area, and planning aimed at discouraging sprawl would all occur during implementation of the CLUP (see Chapter 6).

Finally, Alternative Four designates a 3.2 km (2 mi) corridor along the Yakima River as Preservation for the same reasons a similar corridor along the Columbia River was designated Preservation (i.e., the density of archaeologic sites combined with the area's value as a wildlife corridor).

3.3.6.3.5 The Arid Lands Ecology Reserve (ALE Reserve). The same cultural and religious values that pertain to the central basalt outcrops apply with equal force to Rattlesnake Ridge, the dominant feature of the ALE Reserve. The ALE Reserve is currently managed by the U.S. Fish and Wildlife Service. In recognition of the ALE Reserve's outstanding natural and cultural resource value, the ALE Reserve geographic area has been managed for the past 30 years in a manner that is consistent with the Preservation designation. Alternative Four would continue that mode of management, designating this area Preservation. The sole exception is an area of the ALE Reserve bordering State Highway 240 near the 200 West Area that would be designated Conservation (Mining). This area contains large near-surface basalt and soil sources which would provide an adequate and economic source for Central Plateau waste management needs. Since no siting decision has been made, it is not certain that this area would be used as a quarry site. If the site is not used as a source for waste site capping material, the land-use designation should revert to Preservation. This analysis would occur during implementation of this EIS (see Chapter 6).

The ALE Reserve geographic area contains buildings and structures that are currently not in use. Structures that are non-conforming and which are not in use at the time the CLUP is finalized cannot be used in a non-conforming manner after the adoption of the CLUP in the ROD for this EIS (see Chapter 6). Under Alternative Four, structures not currently in use would be removed. During implementation, further steps would be taken to facilitate the relocation of pre-existing, non-conforming structures to more appropriate locations.

This page intentionally left blank.

3.4 Summary of Potential Environmental Impacts

The CEQ NEPA implementing procedures (40 CFR 1500) require a comparative summary of potential environmental impacts and mitigation measures be presented in the alternatives chapter. Table 3-2 is a summary of land-use designation areas by alternative. For ease in understanding, the table is repeated in hectares, acres, square miles, and percentages. Table 3.3 is a summary of cumulative impacts from the future land-use alternatives by impacted resource. Detailed analyses of potential environmental impacts for each of the future land-use alternatives are given in Chapter 5 of this document.

3.4.1 Comparison of Affected Areas by Alternative

Table 3-2 compares each alternative by its respective land-use designation acreages. In addition to the land surface areas, this EIS affects 3642.3 ha (14.1 mi^2) of surface water, almost all of which is the Columbia River.

Table 3-2. Comparisons of Affected Areas by Alternative. (2 pages)

	No-Action	Preferred	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Areas in Hectares						
Agriculture	0	0	0	0	24,371	0
Conservation (Mining and Grazing)	74,115	71,813	9,738	0	6,232	0
Conservation (Mining)	0	1,005	24,992	0	73,544	19,336
Industrial	22,535	16,669	3,661	2,090	17,860	6,881
Industrial-Exclusive	5,064	5,064	4,593	4,593	5,064	5,064
Preservation	46,366	47,961	103,001	140,507	7,967	112,320
High-Intensity Recreation	0	64	64	191	1,768	77
Low-Intensity Recreation	1	593	37	1	3,098	15
Research and Development	0	4,912	1,995	699	8,177	4,388
TOTAL	**148,081**	**148,081**	**148,081**	**148,081**	**148,081**	**148,081**
	No-Action	**Preferred**	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Areas in Acres						
Agriculture	0	0	0	0	60,222	0
Conservation (Mining and Grazing)	183,142	177,454	24,063	0	15,400	0
Conservation (Mining)	0	2,483	61,757	0	181,731	47,780
Industrial	55,685	41,190	9,047	5,165	44,133	17,003
Industrial-Exclusive	12,513	12,513	11,350	11,350	12,513	12,513
Preservation	114,573	118,514	254,521	347,200	19,687	277,549
High-Intensity Recreation	0	158	158	472	4,369	190
Low-intensity Recreation	2	1,465	91	2	7,655	36
Research and Development	0	12,138	4,930	1,727	20,206	10,843
TOTAL	**365,915**	**365,915**	**365,915**	**365,915**	**365,915**	**365,915**
	No-Action	**Preferred**	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Areas in Square Miles						
Agriculture	0	0	0	0	94	0
Conservation (Mining and Grazing)	286	277	38	0	24	0
Conservation (Mining)	0	4	96	0	284	75
Industrial	87	64	14	8	69	27
Industrial-Exclusive	20	20	18	18	20	20
Preservation	179	185	398	542	31	434
High-Intensity Recreation	0	0	0	1	7	0
Low-Intensity Recreation	0	2	0	0	12	0
Research and Development	0	19	8	3	32	17
TOTAL	**572**	**572**	**572**	**572**	**572**	**572**

Table 3-2. Comparisons of Affected Areas by Alternative. (2 pages)

	No-Action	Preferred	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Percentage of Area						
Agriculture	0.00%	0.00%	0.00%	0.00%	16.46%	0.00%
Conservation (Mining and Grazing)	50.05%	48.50%	6.58%	0.00%	4.21%	0.00%
Conservation (Mining)	0.00%	0.68%	16.88%	0.00%	49.66%	13.06%
Industrial	15.22%	11.26%	2.47%	1.41%	12.06%	4.65%
Industrial-Exclusive	3.42%	3.42%	3.10%	3.10%	3.42%	3.42%
Preservation	31.31%	32.39%	69.56%	94.89%	5.38%	75.85%
High-Intensity Recreation	0.00%	0.04%	0.04%	0.13%	1.19%	0.05%
Low-Intensity Recreation	0.00%	0.40%	0.02%	0.00%	2.09%	0.01%
Research and Development	0.00%	3.32%	1.35%	0.47%	5.52%	2.96%
TOTAL	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

3.4.2 Comparison of Affected Resources

The primary resources affected by the future land-use alternatives are (1) geologic resources, (2) water resources, (3) biological resources, (4) cultural resources, (5) aesthetic resources, (6) socioeconomic impacts, (7) environmental justice, and (8) human health impacts. Many of the potentially significant adverse impacts would occur as a result of disturbances of natural areas on the Hanford Site. Natural plant and wildlife communities have flourished, sensitive species have been preserved, and archaeological and cultural resources have been protected because large areas of the Hanford Site have been relatively undisturbed in the past. Many of these natural and cultural features could be impacted directly by land-use designation. For example, if onsite geologic materials were mined in order to construct surface barriers as required by Hanford Site remediation activities, the land-use designation would confine where the impacts might occur.

The DOE intends to prepare a Mitigation Action Plan after the ROD for this EIS is issued which will address mitigation commitments made in the ROD. In general, these mitigation commitments can be expected to include updating the existing resource management plans such as the CRMP, BRMaP, and Bald Eagle Management Plan; and committing to a schedule to develop additional resource management plans (e.g., Minerals Resources Management Plan) under the procedures outlined in Chapter 6. Chapter 5 of this Revised Draft EIS does include, however, potential mitigation measures for each future land-use alternative.

Table 3-3. Summary of Potential Impacts to Hanford Site Resources. (8 pages)

Resource	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four	No-Action Alternative
GEOLOGIC RESOURCES						
Features	Unique geologic features such as Gable Mountain, Gable Butte, the White Bluffs; and active sand dunes would be protected.	Same as the Preferred Alternative.	Same as the Preferred Alternative. Stabilized sand dunes would also be protected.	Unique geologic features could be developed to obtain materials for remediation and economic development.	Same as the Preferred Alternative except stabilized sand dunes would also be protected.	Unique geologic features could be developed.
Missoula Flood	Missoula Flood features could be impacted by sand and gravel operations.	Missoula Flood features would be protected.	Missoula Flood features would be protected.	Same as Preferred Alternative.	Missoula Flood features would be protected.	Same as Preferred Alternative.
Geologic Materials	Viable sources of geologic materials for remediation and regional use could be developed.	Geologic materials could be developed only from existing quarries and to support remediation.	Geologic resources to support remediation would need to be obtained from offsite sources.	Same as Preferred Alternative.	Geologic materials could be developed only to support remediation.	Commercial development of geologic resources would not be restricted.
Natural Gas	Existing natural gas claims on the ALE Reserve could be developed, but the Preservation designation surrounding those claims would preclude construction of an access road.	Same as Preferred Alternative.	Same as Preferred Alternative.	Existing natural gas claims could be developed and an access road could be construction under the Conservation (Mining) designation.	Same as Preferred Alternative.	Existing natural gas claims could be developed and an access road could be constructed.
Soil Compaction	Soil compaction and erosion could occur around quarry sites. Grazing could result in soil compaction around water sources and increased erosion by reducing vegetative cover.	Soil compaction and erosion could occur around quarry sites. Grazing on the northern portion of the Wahluke Slope could increase soil erosion in this area.	The potential for soil erosion and compaction would be minimized by maintaining existing vegetative cover and precluding development.	Soil compaction and erosion could occur around quarry sites. Cultivated agriculture would increase soil erosion through removal of existing cover and tillage.	The potential for soil erosion and compaction would be minimized. Some soil erosion and compaction could occur as a result of mining in support of remediation.	Mining, grazing, and cultivated agriculture could increase soil compaction or erosion.

Table 3-3. Summary of Potential Impacts to Hanford Site Resources. (8 pages)

Resource	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four	No-Action Alternative
WATER RESOURCES						
Surface Water	Runoff from mining operations located close to the Columbia River could lead to water quality degradation.	Mining restricted to upland areas would have little impact on water quality.	Mining, grazing, and agriculture would not be allowed; therefore, there would be no impacts to surface water.	Mining prohibited within 1/4 mile of the Columbia River, reducing the potential for water quality degradation.	Same as Alternative One.	Same as the Preferred Alternative.
	Grazing along the Columbia River could increase sediment loading in the river.	Grazing limited to an area north that does not contain significant surface water.	Experimental aquaculture could increase the nutrient load in the Columbia River.	Grazing permitted in irrigation flow returns, potentially leading to increased siltation.	Grazing would not be allowed, so no impacts would result from this activity.	Same as the Preferred Alternative.
	Increased recreational access to the Columbia River could increase shoreline erosion and could generate additional pollution, such as oil, gas, and engine exhaust.	Similar to the Preferred Alternative, but fewer access points would be provided and use of the river might not increase as much.	Recreational access to the Columbia River would not be increased.	Similar to the Preferred Alternative.	Same as the Preferred Alternative.	Same as the Preferred Alternative.
Groundwater	Mining operations could require groundwater withdrawal for material washing and dust control. Surface water could also collect in quarry sites increasing groundwater recharge locally.	Similar to the Preferred Alternative.	Mining operations would not be allowed.	Same as the Preferred Alternative.	Same as the Preferred Alternative.	Same as the Preferred Alternative.
	Groundwater withdrawal for industrial uses could alter flow patterns. Discharges to the soil column could mobilize contaminants in the vadose zone and accidental releases could contaminate	Similar to the Preferred Alternative, but less likely because less area would be available for development.	New impacts to groundwater from industrial development would be minimal.	Same as the Preferred Alternative. Agricultural chemicals could contaminate groundwater and recharge from irrigation could alter flow patterns and lead to slumping in	Same as the Preferred Alternative.	Same potential impacts as the Preferred Alternative, but new impacts could be distributed across the Hanford Site. Potential impacts from Agricultural similar to Alternative Three.

Table 3-3. Summary of Potential Impacts to Hanford Site Resources. (8 pages)

Resource	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four	No-Action Alternative
BIOLOGICAL RESOURCES						
Vegetation Disturbance	Surface clearing would eliminate vegetation and wildlife habitat in areas under development.	Same as the Preferred Alternative, but restricted to areas of low-quality habitat.	Much lower than the Preferred Alternative.	Greater impacts than the Preferred Alternative. Clearing of vegetation for cultivated agriculture.	Less than the Preferred Alternative.	Greater than the Preferred Alternative.
Habitat Fragmentation	Utility corridors and access roads could fragment habitat within areas designated for industrial development.	Lower than under the Preferred Alternative.	Potential impacts restricted to Urban Growth Area.	Same as the Preferred Alternative, but larger areas designated for development, so potential greater need for new infrastructure.	Less than the Preferred Alternative.	Greater than Preferred Alternative.
Grazing	Livestock grazing could affect sensitive habitats by altering plant communities.	Grazing impacts restricted to the Wahluke Slope north of State Highway 24.	Grazing would not be allowed under this alternative.	Less than the Preferred Alternative because less land available for grazing.	Grazing is not allowed under this alternative.	Same as the Preferred Alternative.
Aquatic Resources	Increased recreational access to the Columbia River could adversely affect salmonid spawning areas, aquatic plant communities, and other resources associated with the river.	Lower than the Preferred Alternative.	No increase in recreational access under this alternative, so no new impacts.	Same as the Preferred Alternative.	Similar, but potentially lower, impacts than the Preferred Alternative.	Less than the Preferred Alternative because no new boat ramps.
Wildlife Migration Corridor	The integrity of the wildlife migration corridor associated with McGee Ranch would be maintained.	Same as the Preferred Alternative.	Same as the Preferred Alternative.	McGee Ranch available for development.	Same as the Preferred Alternative.	McGee Ranch available for development.
Preservation of BRMaP Level III and Level IV Resources	Preservation designation would protect 37% of BRMaP Level III, and 82% of BRMaP Level IV resources.	Preservation designation would protect 78% of BRMaP Level III and 96% of BRMaP Level IV resources.	Preservation designation would protect 96% of BRMaP Level III and 100% of BRMaP Level IV resources.	Preservation designation would protect 5% of BRMaP Level III and 13% BRMaP Level IV resources.	Preservation designation would protect 89% of BRMaP Level III and 100% of BRMaP Level IV resources.	The No-Action Alternative does not specifically designate land for Preservation.

Table 3-3. Summary of Potential Impacts to Hanford Site Resources. (8 pages)

Resource	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four	No-Action Alternative
CULTURAL RESOURCES						
Religious Sites	Cultural resources and religious sites associated with basalt outcrops such as Gable Butte and Gable Mountain would be protected.	Same as the Preferred Alternative.	Same as the Preferred Alternative.	Basalt outcrops would be available for mining, which would cause damage to religious sites and cultural resources.	Same as the Preferred Alternative.	Same as Alternative Three; greater than the Preferred Alternative.
Viewsheds	Mining and industrial development could occur within viewsheds from high promontories.	Area that could be developed within viewsheds is smaller than for the Preferred Alternative.	Viewsheds would be protected. Impacts would be less than for the Preferred Alternative.	Development could occur within viewsheds to a greater extent than for the Preferred Alternative.	Same as Alternative Two. Less than the Preferred Alternative.	Development not precluded at any location. Greater than for the Preferred Alternative.
Natural Resource Gathering Areas	Damage to natural resource gathering areas from development, increased recreational use of the Columbia River, and grazing.	Less than the Preferred Alternative.	Impacts to natural resource gathering areas would be minimal.	Same as the Preferred Alternative.	Less than the Preferred Alternative.	Greater than the Preferred Alternative.
Cultural Sites	Damage to cultural sites from livestock grazing and development. Increased access to the Columbia River could result in damage from artifact collection, vandalism, and erosion.	Less than the Preferred Alternative.	Grazing would not be allowed and impacts to cultural sites from development would be minimal. Access to the Columbia River would not be increased.	Same as the Preferred Alternative, except areas designated for Agriculture would be greater than the Preferred Alternative and could lead to loss of resources on the White Bluffs.	Less than the Preferred Alternative.	Greater than the Preferred Alternative.
Salmonid Spawning Sites	Increased sediment loading could damage salmonid spawning sites.	Less than the Preferred Alternative.	No impact to salmonid spawning sites.	Less than the Preferred Alternative.	Same as Alternative Two; less than the Preferred Alternative.	Same as the Preferred Alternative.

Table 3-3. Summary of Potential Impacts to Hanford Site Resources. (8 pages)

Resource	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four	No-Action Alternative
AESTHETIC RESOURCES						
Viewsheds	Viewing locations associated with Gable Butte and Gable Mountain would be protected. Locations associated with the Columbia River would be disrupted. Viewsheds could be disrupted.	Same as the Preferred Alternative.	Minimal impacts; less than the Preferred Alternative.	Viewing locations associated with basalt outcrops could be adversely impacted, but locations along the river would be protected. Viewsheds could be disrupted.	Viewing locations would be protected. Minimal impacts to viewsheds. Less than the Preferred Alternative.	Viewing locations and viewsheds could be adversely impacted. Greater than the Preferred Alternative.
Ambient Visibility	Visibility could be impacted by releases of fugitive dust from construction sites and pollutants from new industrial sources.	Similar to, but less than, the Preferred Alternative.	Minimal impacts; less than the Preferred Alternative.	Greater than the Preferred Alternative.	Less than the Preferred Alternative.	Greater than the Preferred Alternative.
Ambient Noise	Blasting, industrial sites, and increased use of motorized water craft could increase noise levels, disrupt wildlife, and detract from recreational experiences.	Less than the Preferred Alternative.	Minimal impacts; less than the Preferred Alternative.	Greater than the Preferred Alternative.	Less than the Preferred Alternative.	Same as the Preferred Alternative.
SOCIOECONOMICS AND INDUSTRIAL DEVELOPMENT	15,400 ha available for industrial development, which would meet the need forecasted by the Benton County Planning Department and provide ample area to support possible future DOE missions. This amount of land would support employment of 1,000 or more.	3,235 ha available for industrial development, which would meet the forecasted need and provide 1,615 ha for possible future DOE missions. This land could support employment of 100 to 1,000.	2,089 ha available for industrial development, but much of the land is already developed. Would not provide sufficient vacant land to meet estimated future needs or provide for possible future DOE missions. Employment limited to less than 100.	Greater than the Preferred Alternative.	6,906 ha available for industrial development, meeting the estimated future need and providing land for future DOE missions. This land could support employment of 100 to 1,000.	Facility planning and siting conducted on a project-by-project basis. Ample land available to support future development and future DOE missions.

Table 3-3. Summary of Potential Impacts to Hanford Site Resources. (8 pages)

Resource	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four	No-Action Alternative
RESEARCH AND DEVELOPMENT	4,911 ha designated for Research and Development could support up to 300 employees.	Research and Development limited to previously developed areas.	Research and Development limited to existing uses at LIGO and the K Reactor Basins.	Greater than the Preferred Alternative.	Same as the Preferred Alternative.	Facility siting conducted on a project-by-project basis. Ample land available.
GRAZING AND AGRICULTURE	Up to 73,079 ha available for grazing, which could support 12,400 AUM with a value of approximately $149,000. Cultivated agriculture would not be allowed.	Lands designated for grazing could support 1,655 AUM with a value of $19,900. Cultivated agriculture would not be allowed.	No lands designated for grazing. Cultivated agriculture would not be allowed.	1,059 AUM with a value of $12,700. Cultivated agriculture could generate from $16 to $88 million in additional revenue depending on the scenario.	No lands designated for grazing or cultivated agriculture.	Lack of a plan may discourage multiple use of Hanford lands and grazing and agriculture would be considered under individual proposals.
MINERAL RESOURCES	Existing natural gas claims could be developed, but the Preservation designation in the surrounding are would preclude construction of an access road.	Same as the Preferred Alternative.	Same as the Preferred Alternative.	Existing claims could be developed and access roads could be constructed. Additional development of natural gas could be encouraged.	Same as the Preferred Alternative.	Existing natural gas claims could be developed and access road could be constructed.
RECREATION	Increased recreation could increase revenues generated by tourism.	Less than the Preferred Alternative.	Less than the Preferred Alternative.	A destination resort/conference center could generate up to $2 to $4 million in payroll.	Less than the Preferred Alternative.	New revenue generating recreational opportunities would be unlikely.

Table 3-3. Summary of Potential Impacts to Hanford Site Resources. (8 pages)

Resource	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four	No-Action Alternative
ENVIRONMENTAL JUSTICE	Increased access to the Columbia River would potentially increase exposure and health risk. Minority or low-income populations may be more prone to adopt a subsistence lifestyle, but a particular population would not necessarily be affected.	Same as the Preferred Alternative.	Access to the Columbia River would be limited. No disproportionately high impacts would occur.	Same as Alternative One.	Same as the Preferred Alternative.	Same as the Preferred Alternative.
	Areas of cultural value to American Indians would be protected, but development would be allowed within the viewscape of some of those areas.	Same as the Preferred Alternative.	Same as the Preferred Alternative, but viewscapes would also be protected.	Areas of cultural value to American Indian tribes could be developed and development could occur within culturally significant viewscapes.	Same as Alternative Two.	Same as Alternative Three.
	Economic development of Hanford Site lands would be neutral in low-income and minority communities within the assessment area.	Limitation on development could adversely impact low-income populations. However, local low-income populations are not greatly influenced by Hanford Site spending.	Same as Alternative One.	Same as Preferred Alternative.	Same as Preferred Alternative.	Same as Preferred Alternative.
	Prohibiting agriculture on the Wahluke Slope would reduce the potential for new jobs available to low-income and minority populations north of the Hanford Site, but these lands are not presently available for agriculture.	Same as the Preferred Alternative.	Same as the Preferred Alternative.	Agriculture would be allowed on the Wahluke Slope, potentially benefiting low-income and minority populations located north of the Hanford Site.	Same as the Preferred Alternative.	Same as the Preferred Alternative.

Table 3-3. Summary of Potential Impacts to Hanford Site Resources. (8 pages)

Resource	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four	No-Action Alternative
HUMAN HEALTH	Increased access to Hanford Site lands would increase the potential for health risks.	Less than the Preferred Alternative.	Access to Hanford would be limited and the potential for health risks would be minimized.	Greater than the Preferred Alternative.	Less than the Preferred Alternative.	Access would be restricted and risks would be less than for the Preferred Alternative.
	New developments on the Hanford Site could lead to an increase in occupational injuries and fatalities associated with mining and industrial activities.	Less than the Preferred Alternative.	Much less than the Preferred Alternative.	Greater than the Preferred Alternative and would have the additional risk of occupational injuries from agriculture.	Less than the Preferred Alternative.	Potentially greater risk than for the Preferred Alternative.
	Increased recreational activities could increase the risk of injury from recreational accidents.	Less than the Preferred Alternative.	No increase in recreational use and the risk of recreational accidents would be minimized.	Greater than the Preferred Alternative.	Less than the Preferred Alternative.	Minimal increase in recreational use. Risk of recreational accidents would not increase.

This page intentionally left blank.

Table of Contents

4.0 Affected Environment 4-1

4.1 Land Uses 4-1
4.1.1 Existing Land Uses in the Vicinity of the Hanford Site 4-3
4.1.2 Existing Hanford Site Land Uses 4-3
4.1.2.1 Wahluke Slope 4-3
4.1.2.2 Columbia River Corridor 4-5
4.1.2.3 Central Plateau 4-6
4.1.2.4 All Other Areas 4-6
4.1.2.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) . . . 4-7
4.1.3 Hanford Site Land Ownership 4-8

4.2 Geological Resources 4-8
4.2.1 Landscape 4-10
4.2.2 Stratigraphy 4-10
4.2.2.1 Columbia River Basalt Group 4-13
4.2.2.2 Ellensburg Formation 4-13
4.2.2.3 Suprabasalt Sediments 4-13
4.2.3 Structure 4-15
4.2.3.1 Mineral Development 4-15
4.2.4 Geologic Hazards 4-17
4.2.5 Soils 4-21

4.3 Water Resources 4-21
4.3.1 Surface Water 4-25
4.3.1.1 Flooding 4-28
4.3.1.2 Surface Water Quality 4-32
4.3.2 Groundwater 4-33
4.3.2.1 Groundwater Hydrology 4-33
4.3.2.2 Groundwater Recharge 4-34
4.3.2.3 Groundwater Quality 4-36
4.3.3 Water Use 4-37
4.3.3.1 Water Rights 4-37

4.4 Air Resources 4-38
4.4.1 Climate and Meteorology 4-38
4.4.1.1 Wind 4-39
4.4.1.2 Temperature and Humidity 4-39
4.4.1.3 Precipitation 4-40
4.4.1.4 Severe Weather 4-40
4.4.1.5 Atmospheric Stability 4-40
4.4.2 Air Quality 4-41
4.4.2.1 Regional Air Quality 4-41
4.4.2.2 Hanford Site Nonradiological Air Quality 4-42

4.5 Biological Resources 4-43
4.5.1 Administrative Designations for Natural Resource Protection 4-46
4.5.2 Terrestrial Vegetation and Habitats 4-49
4.5.2.1 Fire 4-51
4.5.2.2 Weeds 4-51

4.5.3 Wildlife . . . 4-55
4.5.3.1 Mammals . . . 4-55
4.5.3.2 Birds . . . 4-56
4.5.3.3 Reptiles and Amphibians . . . 4-57
4.5.3.4 Insects . . . 4-57
4.5.4 Terrestrial Wildlife and Habitat . . . 4-57
4.5.5 Species of Concern on the Hanford Site . . . 4-58
4.5.6 Aquatic Species and Habitat . . . 4-64
4.5.7 Wetland Habitat . . . 4-68
4.5.8 Biological Resources Management . . . 4-68
4.5.9 Biodiversity . . . 4-70

4.6 Cultural Resources . . . 4-71
4.6.1 Pre-Contact Archaeological Resources . . . 4-73
4.6.2 American Indian Cultural Resources . . . 4-73
4.6.3 Post-Contact Archaeological and Architectural Resources . . . 4-74

4.7 Socioeconomic Environment . . . 4-78
4.7.1 Demographics . . . 4-80
4.7.1.1 Demographics of Minority Populations . . . 4-81
4.7.2 Economics . . . 4-82
4.7.2.1 Employment in the Tri-Cities . . . 4-82
4.7.2.2 Income Sources . . . 4-84
4.7.2.3 Hanford Site Employment . . . 4-85
4.7.3 Emergency Services . . . 4-86
4.7.4 Health Care . . . 4-87
4.7.5 Housing . . . 4-88
4.7.6 Human Services . . . 4-88
4.7.7 Educational Services . . . 4-88
4.7.8 Transportation . . . 4-89
4.7.9 Utilities . . . 4-92
4.7.10 Site Infrastructure . . . 4-93
4.7.10.1 Facilities . . . 4-93
4.7.10.2 Road and Rail Systems . . . 4-93
4.7.10.3 Utilities . . . 4-95

4.8 Visual and Aesthetic Resources . . . 4-97

4.9 Noise . . . 4-99
4.9.1 Public Health Implications . . . 4-99
4.9.2 Hanford Site Sound Levels . . . 4-99

4.10 Environmental Monitoring Programs . . . 4-100

4.11 Contamination . . . 4-101
4.11.1 Columbia River Contamination . . . 4-103
4.11.2 Soil Contamination . . . 4-108
4.11.3 Hanford Site Protective Safety Buffer Zones . . . 4-109

Figures

4-1. Hanford Site and the Vicinity 4-2
4-2. Existing Land Uses at the Hanford Site 4-4
4-3. Hanford Site Land Ownership 4-9
4-4. Topography of the Hanford Site 4-11
4-5. A Generalized Stratigraphic Column of the Major Geologic Units of the Hanford Site 4-12
4-6. Map of the Hanford Site Region Showing Known Faults 4-16
4-7. Geologic Hazards 4-18
4-8. Soil Map of the Hanford Site 4-22
4-9. Surface Water on the Hanford Site 4-27
4-10. Probable Maximum Flood of the Columbia River and Cold Creek, and the Actual 1948 Flood of the Columbia River 4-29
4-11. Geologic Cross-Section of the Hanford Site 4-31
4-12. Estimated Recharge from Infiltration of Precipitation and Irrigation on the Hanford Site 4-35
4-13. Current Distribution and Extent of Land Cover Classes Within a Portion of the Columbia Basin Ecoregion 4-47
4-14. Administrative-Designated Areas for Biological Resource Values 4-48
4-15. Distribution of Vegetation Types and Cover Classes on the Hanford Site 4-52
4-16. Distribution of Weeds on the Hanford Site 4-54
4-17. Plant Communities of Concern on the Hanford Site 4-59
4-18. Raptor Perch and Nest Sites 4-65
4-19. Key Fall Chinook Salmon Spawning Areas 4-67
4-20. Wetlands on the Hanford Site 4-69
4-21. Areas of Washington and Oregon Where Socioeconomic Resources Might Be Affected 4-79
4-22. Transportation Routes in the Vicinity of the Hanford Site 4-90
4-23. Transportation Network on the Hanford Site 4-91
4-24. Export Water System for the Hanford Site 4-94
4-25. Electrical System for the Hanford Site 4-96
4-26. Viewshed from Gable Mountain 4-98
4-27. Hanford Surface Waste Sites 4-102
4-28. Distribution of Hazardous Chemicals in Groundwater Within the Hanford Site ... 4-104
4-29. Distribution of Radionuclides of Concern in Groundwater Within the Hanford Site 4-105
4-30. Protective Safety Buffer Zones 4-111

Tables

4-1. Soil Types on the Hanford Site 4-24
4-2. Annual (1995) Average Concentrations of Radionuclides in Columbia River 4-33
4-3. Maximum Allowable Increases for Prevention of Significant Deterioration of Air Quality 4-43
4-4. National and Washington State Ambient Air Quality Standards 4-44
4-5. Nonradioactive Constituents Discharged to the Atmosphere, 1995 4-45
4-6. Plant Species of Concern Occurring on the Hanford Site 4-62
4-7. Wildlife Species of Concern Occurring on the Hanford Site 4-63
4-8. Nonagricultural Workers in Benton and Franklin Counties, 1995 to 1996 4-80
4-9. Government Retirement Payments in Benton and Franklin Counties in 1994 4-84
4-10. Hanford Employee Residences by County 4-86
4-11. Police Personnel in the Tri-Cities for 1996 4-86
4-12. Fire Protection in the Tri-Cities for 1996 4-87
4-13. Total Units and Occupancy Rates, 1996 Estimates 4-88
4-14. Detected Concentrations Greater Than Drinking Water Standards: 1995 Groundwater Sampling Rounds 4-106
4-15. Protective Safety Buffer Zones (Exclusive Use Zones and Emergency Planning Zones) 4-112

4.0 Affected Environment

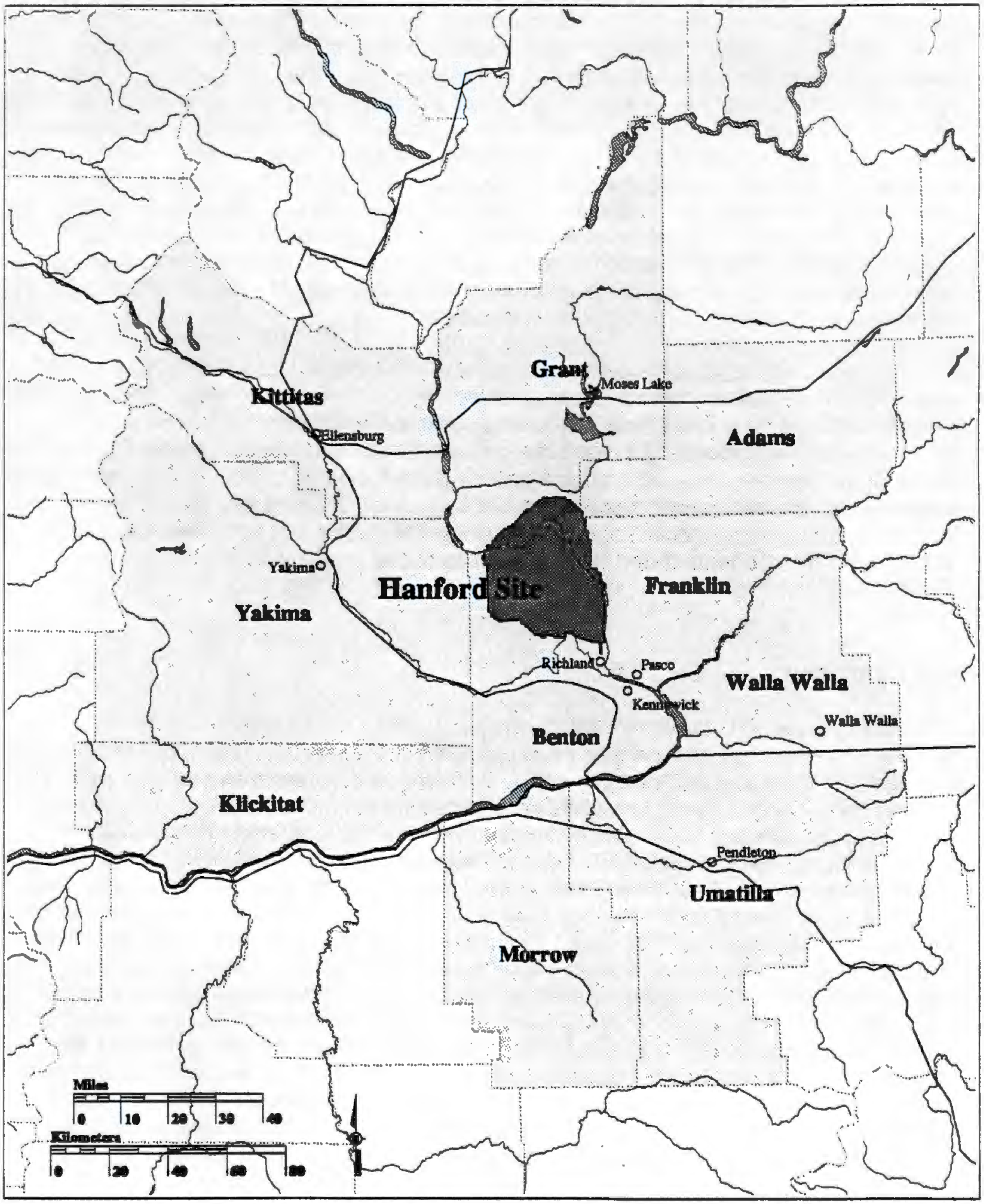
The Hanford Site lies within the semi-arid Pasco Basin of the Columbia Plateau in southeastern Washington State. The Hanford Site occupies an area of approximately 1,517 square kilometers (km^2) (586 square miles [mi^2]) north of the confluence of the Yakima River with the Columbia River. The Hanford Site is about 50 km (30 mi) north to south and 40 km (24 mi) east to west. The Columbia River flows through the northern part of the Hanford Site and, turning south, forms part of the Hanford Site's eastern boundary. The Yakima River runs near the southern boundary and joins the Columbia River below the City of Richland, which bounds the Hanford Site on the southeast. Rattlesnake Mountain, Yakima Ridge, and Umtanum Ridge form the southwestern and western boundaries, and the Saddle Mountains form the Hanford Site's northern boundary. Two small east-west ridges, Gable Butte and Gable Mountain, rise above the plateau of the central part of the Hanford Site. Adjoining lands to the west, north, and east are principally agricultural and range land. The cities of Richland, Kennewick, and Pasco (also referred to as the Tri-Cities) constitute the nearest population center and are located immediately southeast of the Hanford Site. Figure 4-1 depicts the Hanford Site and the surrounding area.

The production of defense nuclear materials at the Hanford Site since the 1940s has necessitated the exclusion of public access and most non-government-related development on the Hanford Site. As a result of its defense-related mission, the Hanford Site has also provided *de facto* protection of the natural environment and cultural resources (NPS 1994); however, the defense nuclear production mission has left the Hanford Site with an extensive waste legacy. Nuclear weapons material production and associated activities at the Hanford Site during the past five decades have generated a variety of radioactive, hazardous, and other wastes that have been disposed of or discharged to the air, soil, and water at the Hanford Site.

4.1 Land Uses

For many years, the area along the Columbia River was used extensively by Tribal members for fishing, hunting, and gathering. Pasturing of livestock became important in pre-contact times. The Cayuse, Umatilla, and Walla Walla people became very skillful at breeding horses (in the 1700s). When Lewis and Clark first came down the Columbia River, there were great herds of horses grazing the rich hills of southeastern Washington and northeastern Oregon. Although the horse meant greater mobility, these people maintained traditional migratory patterns. The Columbia River supplied an endless cycle of vegetable crops. Most bands gathered at winter sites on or near the Columbia River. These sites had been used by the same people for thousands of years. The routes of migration followed ancient patterns with the band stopping at the same spot it camped the year before. In the early spring, family bands would leave the main encampment on the river and travel to the upper lands to dig roots. They returned in time for the main salmon run in the spring and fall. When they had enough, they would return to the mountains to gather berries and hunt for game until the snows would push them back to the lowlands near or on the Columbia where they would gather together in the large wintering sites and spend the colder months. Mission, Oregon; Walla Walla, Washington; Pasco, Washington; and Umatilla, Oregon are just a few of the modern-day names of where some of those old winter camping sites used to be.

Figure 4-1. Hanford Site and the Vicinity.



Land uses at the Hanford Site have changed dramatically over the past 100 years. By the turn of the century, settlers had moved into the area, developing irrigated farmland and practicing extensive grazing (see Figure 1-2). In the early 1940s, the Federal government acquired the Hanford Site for production of nuclear materials to be used in the development of the atomic bomb.

4.1.1 Existing Land Uses in the Vicinity of the Hanford Site

Land uses within the vicinity of the Hanford Site include urban and industrial development, wildlife protection areas, recreation, irrigated and dryland farming, and grazing (Figure 4-2). According to the 1992 Census of Agriculture (USDA-NASS 1992), Benton, Franklin, and Grant counties had a total of 958,626 hectares (ha) (2,396,564 acres [ac]) of land in farms, of which 667,027 ha (1,667,568 ac) were in crop land. Approximately 46% of crop land was irrigated in 1992, and approximately 40% of crop land in 1992 was used as pastureland. According to the 1992 census, the total market value of agricultural products in the three counties was $935 million, including $758 million for crops and $177 million for livestock. In 1994, wheat represented the largest single crop (in terms of area) planted in Benton and Franklin counties. The total area planted in the two counties was 97,490 ha (240,900 ac) and 12,020 ha (29,700 ac) for winter and spring wheat, respectively. Other major crops such as alfalfa, apples, asparagus, cherries, corn, grapes, and potatoes are also produced in Benton and Franklin counties (PNNL 1996a). In 1994, the Conservation Reserve Program of the U.S. Department of Agriculture (USDA)[1] included 10,279.8 ha (25,382.3 ac) in Benton County, 9,359.3 ha (23,109.3 ac) in Franklin County, and 10,116.8 ha (24,979.8 ac) in Grant County.[2]

In 1992, the Columbia Basin Project, a major irrigation project to the north of the Tri-Cities, produced gross crop returns of $552 million, representing 12.5 percent of all crops grown in Washington State. Also, in that year, the average gross crop value per irrigated acre was $1,042. The largest percentage of irrigated acres produced alfalfa hay (26.1 percent of irrigated acres), wheat (20.2 percent), and feed-grain corn (5.8 percent). Other significant crops are apples, dry beans, potatoes, and sweet corn (PNNL 1996a).

Other land uses in the vicinity of the Hanford Site include a low-level radioactive waste decontamination, super-compaction, plasma incinerator and packaging facility (operated by Allied Technology Group Corporation); and a commercial nuclear fuel fabrication facility (operated by Siemens Power Corporation).

4.1.2 Existing Hanford Site Land Uses

Land-use categories at the Hanford Site include reactor operations, waste operations, administrative support, operations support, sensitive areas, and undeveloped areas (Figure 4-2). Remedial activities are currently focused within or near the disturbed areas. Much of the Hanford Site is undeveloped, providing a safety and security buffer for the smaller areas used for operations. Public access to most facility areas is restricted.

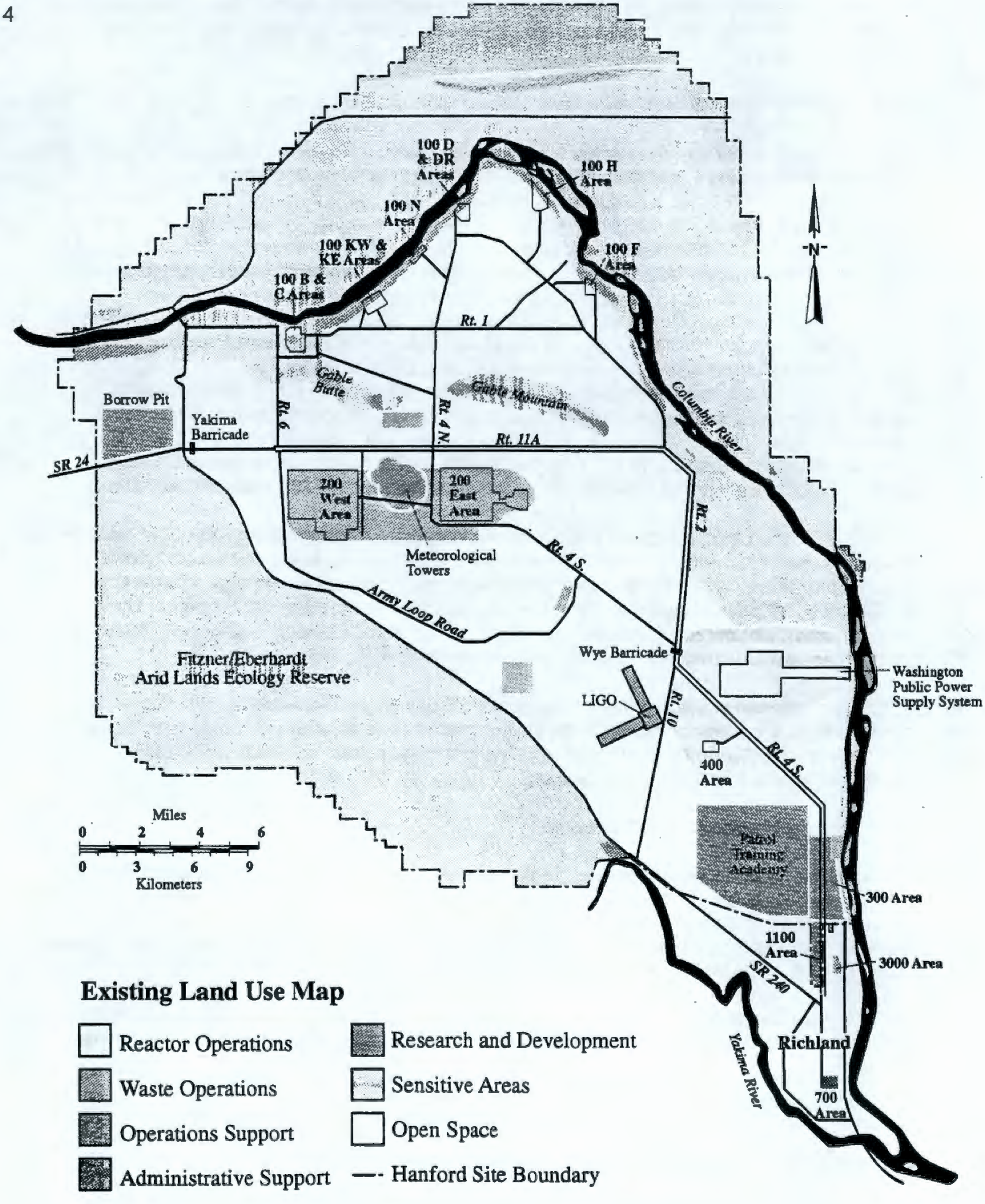
4.1.2.1 Wahluke Slope. The area north of the Columbia River encompasses approximately 357 km^2 (138 mi^2) of relatively undisturbed or returning shrub-steppe habitat. The northwest

---

[1] Agricultural lands at risk for soil erosion set aside to enhance wildlife.

[2] Personal conference with Rod Hamilton, Conservation Program Specialist with the USDA, Farm Service Agency, in Spokane, Washington, October 1997.

Figure 4-2. Existing Land Uses at the Hanford Site.



portion of the area is managed by the U.S. Fish and Wildlife Service (USFWS) under a permit issued in 1971 as the Saddle Mountain National Wildlife Refuge. The permit conditions require that the refuge remain closed to the public as a protective perimeter surrounding Hanford operations. The closure has benefitted migratory birds, particularly ducks and geese.

In the northeast portion of the Wahluke Slope, the Washington State Department of Fish and Wildlife (WDFW) operates the Wahluke Slope Wildlife Recreation Area, which was established in 1971. The WDFW has leased a total of approximately 43 ha (107 ac) of the Wahluke Slope Wildlife Area for sharecropping. The purpose of these agricultural leases is to produce food and cover for wildlife and manage the land for continued multi-purpose recreation. In addition, the WDFW issued a grazing permit for approximately 3,756 ha (9,280 ac), allowing up to 750 animal-unit-months to graze the parcel (Washington Department of Fish and Wildlife Grazing Permit #W5-01; and Washington Department of Fish and Wildlife Agricultural Leases #R-01, #WB-01, and #WB-02).

The Wahluke Slope Wildlife Recreation Area is open to the public for recreational uses during daylight hours. According to data published in the Hanford Reach Final Environmental Impact Statement (EIS) (NPS 1994), the Wahluke Slope State Wildlife Recreation Area has more than 40,000 visits per year by recreationists. Most recreational visits are related to sport fishing in the Columbia River.

The Wahluke Slope once contained small, nonradioactively contaminated sites that the U.S. Department of Energy (DOE) remediated in 1997. The DOE is not planning to alter the current land uses of the Wahluke Slope and is specifically prohibited from causing any adverse impacts on the values for which the area is under consideration for Wild and Scenic River or National Wildlife Refuge status (NPS 1996).

4.1.2.2 Columbia River Corridor. The 111.6 km^2 (43.1 mi^2) Columbia River Corridor, which is adjacent to and runs through the Hanford Site, is used by the public and Tribes for boating, water skiing, fishing, and hunting of upland game birds and migratory waterfowl. While public access is allowed on certain islands, access to other islands and adjacent areas is restricted because of unique habitats and the presence of cultural resources.

The 100 Areas occupy approximately 68 km^2 (26 mi^2) along the southern shoreline of the Columbia River Corridor. The area contains all of the facilities in the 100 Areas, including nine retired plutonium production reactors, associated facilities, and structures. The primary land uses are reactor decommissioning and undeveloped areas. Future use restrictions have been placed in the vicinity of the 100-H Area, which is associated with the 183-H Solar Evaporation Basins. Additional deed restrictions or covenants for activities that potentially extend beyond 4.6 meters (m) (15 feet [ft]) below ground surface are expected for other *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) remediation areas. Additional information is provided in Section 3.3.1.4.2.

The area known as the Hanford Reach includes an average of a 402 m (1,320 ft) strip of public land on either side of the Columbia River. The Hanford Reach is the last unimpounded, nontidal segment of the Columbia River in the United States. In 1988, Congress passed Public Law 100-605, *Comprehensive River Conservation Study*, which required the Secretary of the Interior to prepare a study (in consultation with the Secretary of Energy) to evaluate the outstanding features of the Hanford Reach and its immediate environment.

Alternatives for preserving the outstanding features also were examined, including the designation of the Hanford Reach as part of the National Wild and Scenic Rivers system. The results of the study can be found in the *Hanford Reach of the Columbia River, Comprehensive*

River Conservation Study and Environmental Impact Statement Final - June 1994 (NPS 1994). The Record of Decision (ROD) issued as a result of this EIS recommended that the Hanford Reach be designated a "recreational river" as defined by the *National Wild and Scenic Rivers Act of 1968*. The ROD also recommended that the remainder of the Wahluke Slope be established as a National Fish and Wildlife Refuge. Finally, the ROD recommended that the approximately 728 ha (1,800 ac) of private land located in the Hanford Reach Study Area be included in the recreational river boundary, but not the refuge boundary. The final designation will require Congressional legislation.

There are two proposals currently under consideration in Congress. The primary differences between the proposals include the extent of the geographic scope (whether the Wahluke Slope is addressed in addition to the river corridor), and the designation of the land manager (i.e., local vs. Federal control).

4.1.2.3 Central Plateau. The 200 East and 200 West Areas occupy approximately 51 km^2 (19.5 mi^2) in the Central Plateau of the Hanford Site. Facilities located in the Central Plateau were built to process irradiated fuel from the production reactors. The operation of these facilities resulted in the storage, disposal, and unplanned release of radioactive and nonradioactive waste. The primary land uses are waste operations and operations support. Deed restrictions or covenants for activities that potentially may extend beyond 4.6 m (15 ft) below ground surface are expected for CERCLA remediation areas in the Central Plateau geographic study area.

In 1964, a 410-ha (1,000-ac) tract was leased to the State of Washington to promote nuclear-related development. A commercial low-level radioactive waste disposal facility, run by U.S. Ecology, Inc., currently operates on 41 ha (100 ac) of the leasehold. The rest of the leasehold was not used by the State, and this portion of the leasehold was recently reverted to DOE. The DOE constructed the Environmental Restoration Disposal Facility (ERDF) on this tract.

The ERDF is operated on the Central Plateau to provide disposal capacity for environmental remediation waste generated during remediation of the 100, 200, and 300 Areas of the Hanford Site. The facility is currently about 65 ha (160 ac) and can be expanded up to 414 ha (1.6 mi^2) if additional waste disposal capacity is required.

4.1.2.4 All Other Areas. The All Other Areas geographic area is 689 km^2 (266 mi^2) and contains the 300, 400 and 1100 Areas, Washington Public Power Supply System (WPPSS) facilities, and a section of land currently owned by the State of Washington.

The 300 Area is located just north of the City of Richland and covers 1.5 km^2 (0.6 mi^2). The 300 Area is the site of former reactor fuel fabrication facilities and is also the principal location of nuclear research and development facilities serving the Hanford Site. Kaiser Aluminum and Chemical Corporation is leasing the 313 Building in the 300 Area to use an extrusion press that was formerly owned by the DOE. The Environmental Molecular Sciences Laboratory (EMSL) and associated research programs provide research capability to advance technologies in support of the DOE mission of environmental remediation and waste management.

The 400 Area, located southeast of the 200 East Area, is the site of the Fast Flux Test Facility (FFTF), which was used in the testing of breeder reactor systems and is scheduled to be shut down. Defueling of the FFTF, which was the first major phase of deactivation, was completed in April 1995. The next deactivation phases are under way; however, the DOE is also studying if the FFTF reactor could be used to produce medical isotopes and as an interim backup to produce tritium for defense purposes. The primary land use for the 400 Area is reactor operations and irradiation services with attendant support functions including fuel and target fabrication, processing, and interim storage.

The 1100 Area, located just north of Richland, serves as the central warehousing, vehicle maintenance, and transportation operations center for the Hanford Site. A deed restriction has been filed with Benton County for the Horn Rapids Asbestos Landfill, which restricts future land uses in the vicinity of the landfill. Additional information is provided in Section 3.3.1.4.4.

Additional land uses in the All Other Areas geographic area include the following:

- The Hazardous Materials Management and Emergency Response (HAMMER) Training Center, which is used to train hazardous materials response personnel. The HAMMER Training Center is located north of the 1100 Area and covers about 32 ha (80 ac).

- Land was leased to WPPSS to construct three commercial power reactors in the 1970s. One plant, Washington Nuclear Plant Number 2 (WNP-2), was completed and is currently operating. Activities on the other two plants were terminated and the plants will not be completed.

- In 1980, the Federal government sold a 259-ha (640-ac) section of land south of the 200 East Area, near State Route (SR) 240, to the State of Washington for the purpose of nonradioactive hazardous waste disposal. This parcel is uncontaminated (although the underlying groundwater is contaminated) and undeveloped. The deed requires that if it is used for any purpose other than hazardous waste disposal, ownership would revert to the Federal government.

- The Laser Interferometer Gravitational-Wave Observatory (LIGO), built by the National Science Foundation on the Hanford Site, detects cosmic gravitational waves for scientific research. The facility consists of two underground optical tube arms, each 4 km (2.5 mi) long, arrayed in an "L" shape. The facility is sensitive to vibrations in the vicinity, which can be expected to constrain nearby land uses.

4.1.2.5 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve). The Fitzner/Eberhardt Arid Lands Ecology Reserve (also designated the Rattlesnake Hills Research Natural Area, or the ALE Reserve), encompasses 308.7 km^2 (119.2 mi^2) in the southwestern portion of the Hanford Site and is managed as a habitat and wildlife reserve and environmental research center. A Research Natural Area is a classification used by Federal land management agencies to designate lands on which various natural features are preserved in an undisturbed state solely for research and educational purposes. The ALE Reserve remains the largest Research Natural Area in the State of Washington (PNL 1993a).

The mineral rights to a 518-ha (1,280-ac) area on the ALE Reserve are owned by a private company. The company has been free to enter this area and explore for oil or gas since 1977. Additional information is provided in Section 4.2.3.

Because public access to the ALE Reserve has been restricted since 1943, the shrub-steppe habitat is virtually undisturbed and is part of a much larger Hanford tract of shrub-steppe vegetation. This geographic area contained a number of small contaminated sites that were remediated in 1994 and 1995 and have been revegetated. In 1997, DOE granted a permit to the USFWS for the management of the ALE Reserve. Under this framework, the USFWS is responsible for protection of the environmentally sensitive area and developing an Area Management Plan (see Chapter 6).

4.1.3 Hanford Site Land Ownership

The Hanford Site land holdings consist of three different real property classifications: (1) lands acquired in fee by DOE or its predecessor agencies, (2) BLM-administered Public Domain lands withdrawn from the Public Domain for use as part of the Hanford Site, and (3) lands the Bureau of Reclamation (BoR) has withdrawn from the Public Domain or acquired in fee as part of the Columbia Basin Project (Figure 4-3).

The BoR agreed in a Memorandum of Agreement (MOA) to transfer custody, possession, and use of certain acquired and withdrawn lands situated within the control zone of the Hanford Works to the U.S. Atomic Energy Commission (AEC) on February 27, 1957. These lands consisted of a checkerboard pattern of alternating square-mile sections on the Wahluke Slope. The BoR retained the right to construct, operate, and maintain the Wahluke Canal and related facilities and any necessary waste ways and drainage ways through the Wahluke Slope in connection with irrigation of lands outside of the control zone. These lands were included in the South Columbia Basin Irrigation District and the East Columbia Irrigation District at the time of district formation. In the MOA, the BoR identified a continued interest in development of irrigable lands on the Wahluke Slope as part of the Columbia Basin Project. The AEC acknowledged the interest of the BoR and reaffirmed a policy of keeping DOE land ownership and restrictions of land use on the Wahluke Slope to a minimum.

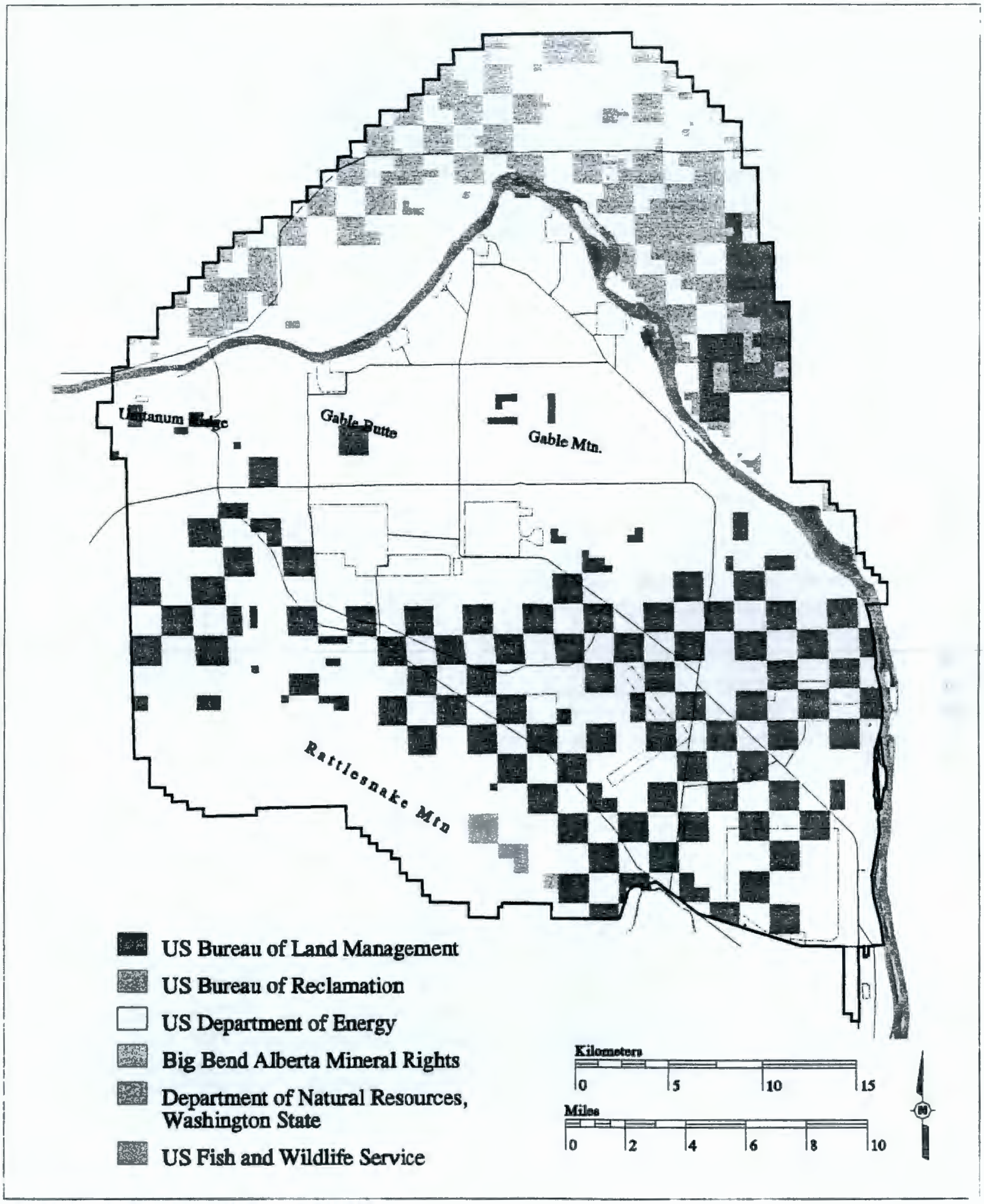
The BoR continues to retain an interest in the ultimate development of the irrigable lands within the Wahluke Slope as part of the Columbia Basin Project. The interest of the BoR pertains not only to irrigation development, but also to other project purposes (e.g., fish and wildlife protection) and to resource management and environmental concerns. The BoR maintains that the agreement with the AEC assures return of the lands when the lands are no longer necessary to support the DOE mission for the Hanford Site. Furthermore, the BoR would not concur with any change in the present use of the lands until technical and environmental studies were completed.

The alternating square-mile sections that would eventually revert to the Bureau of Land Management (BLM) or BoR are an important consideration that complicates land-use planning. Because the lands are owned by another government agency (BLM), the DOE cannot authorize uses of the property beyond the mission needs of the DOE itself. Typically, after getting the land back, the BLM evaluates current use(s) of the land, compatibility of uses, and suitability of the land for different uses (i.e., mining, grazing, recreation, and preservation). (See text box, *"Consolidation of BLM Lands."*)

4.2 Geological Resources

Geologic considerations for the Hanford Site include physiography, stratigraphy, structural geology, seismic and volcanic hazards, and soil characteristics. The *Hanford Site National Environmental Policy Act (NEPA) Characterization* report (PNNL 1996a) provides the basis for the following discussions.

Figure 4-3. Hanford Site Land Ownership.



BHI:rpp 04/22/96 clup/landown1.amlDatabase: 08-SEP-1997

4.2.1 *Landscape*

The landscape of the Hanford Site is dominated by the low-relief plains of the Central Plains and the anticlinal ridges of the Yakima Folds physiographic regions. The surface topography has been modified within the past several million years by several processes: (1) Pleistocene cataclysmic flooding, (2) Holocene eolian activity, and (3) landsliding. Cataclysmic flooding occurred when ice dams in western Montana and northern Idaho were breached and allowed large volumes of water to spill across eastern and central Washington. This flooding formed the channeled scablands and deposited sediments in the Pasco Basin. The last major flood occurred about 13,000 years ago, during the late Pleistocene Epoch. Braiding flood channels, giant current ripples, and giant flood bars are among the landforms created by the floods. The 200 Area waste management facilities are located on one prominent flood bar, the Cold Creek Bar (Figure 4-4).

Since the end of the Pleistocene, winds have locally reworked the flood sediments and have deposited dune sands in the lower elevations and loess (windblown silt) around the margins of the Pasco Basin. Many sand dunes have been stabilized by anchoring vegetation, except where they have been reactivated when the vegetation is disturbed.

> ***Consolidation of BLM Lands***
>
> In addition to the lands acquired by DOE through condemnation during and after World War II (WW II), the Hanford Reservation includes: (1) Bureau of Land Management (BLM) administered lands withdrawn from the Public Domain by DOE during and following WW II; (2) BLM lands withdrawn from the Public Domain by the Bureau of Reclamation (BoR) prior to WW II as part of the Columbia Basin Reclamation Project (CBRP); and (3) lands acquired in fee by the BoR prior to WW II as part of the CBRP. The withdrawn lands and non-withdrawn lands form a checkerboard pattern over large portions of the Hanford Site.
>
> The lands in category (2) (as listed above) were subsequently affected by a second overlapping withdrawal by DOE during and following WW II. When DOE relinquishes its withdrawals on lands that were historically Federal, those lands withdrawn only by DOE will revert to the Public Domain and management by BLM. Those lands withdrawn by the overlapping DOE and BoR withdrawals will remain withdrawn and managed by the BoR.
>
> The BoR's use of the withdrawn Public Domain lands (after the relinquishment of DOE's overlapping withdrawal) must be consistent with the purposes for which they were originally withdrawn by the BoR. If they are not, the BoR could be expected to relinquish their withdrawal and the lands returned to the Public Domain and management by the BLM, or BoR could negotiate anew withdrawal order with the BLM.

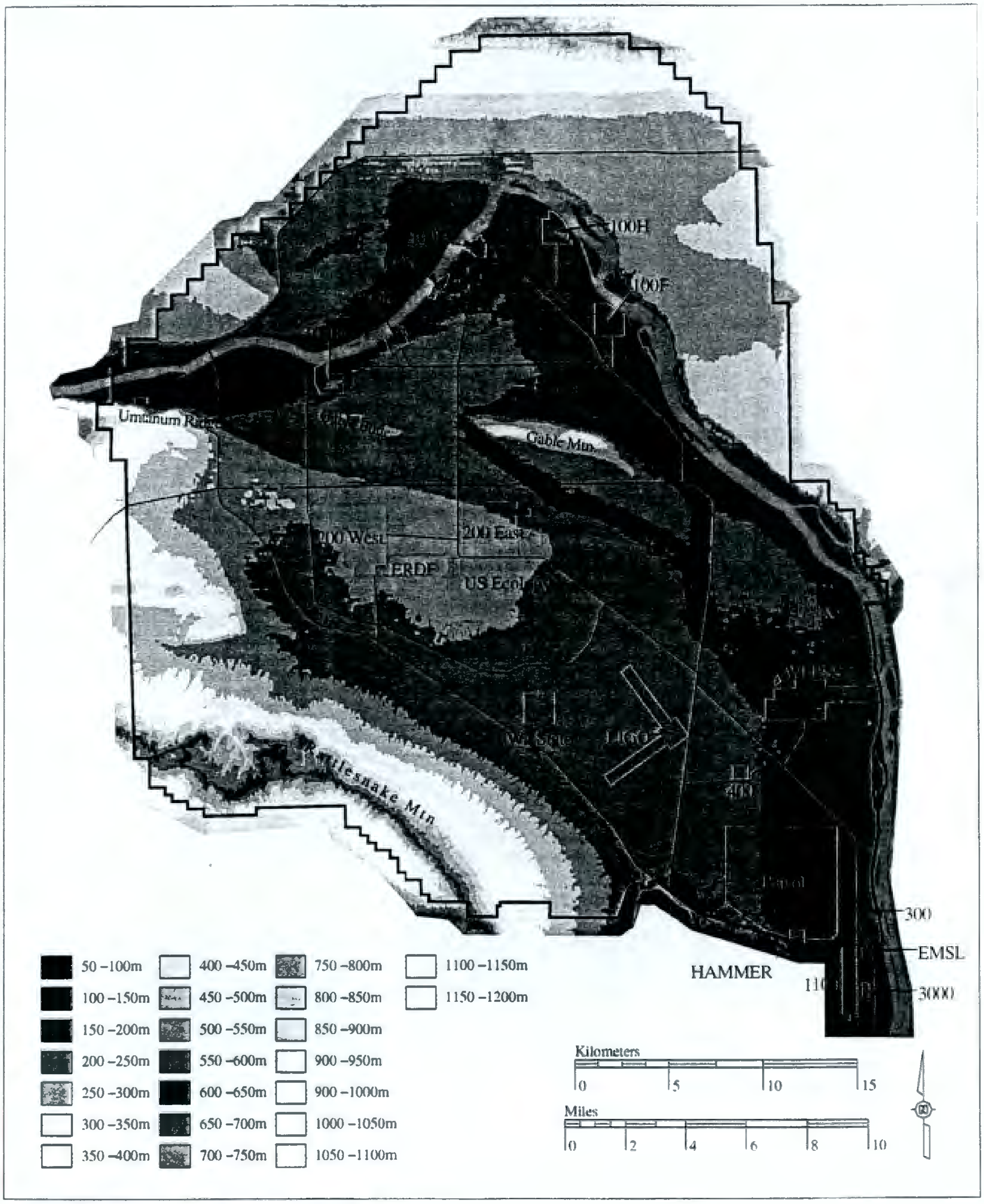
A series of bluffs occurs for a distance of approximately 56 km (35 mi) along the eastern and northern shores of the Columbia River. In the northern portion of the area, these bluffs are known as the White Bluffs.

Landslides occur along the north limbs of some Yakima Folds and along steep river embankments such as White Bluffs. Landslides on the Yakima Folds occur along contacts between basalt flows or sedimentary units between the basalt, whereas active landslides at White Bluffs occur in sediments above the basalt flows. A study of the Hanford Reach by U. S. Geological Survey geologists (Hays and Schuster 1986) concluded that nearby irrigation has accelerated the rate of landslides occurring in the area. The active landslides at White Bluffs are the result of irrigation activity east of the Columbia River.

4.2.2 *Stratigraphy*

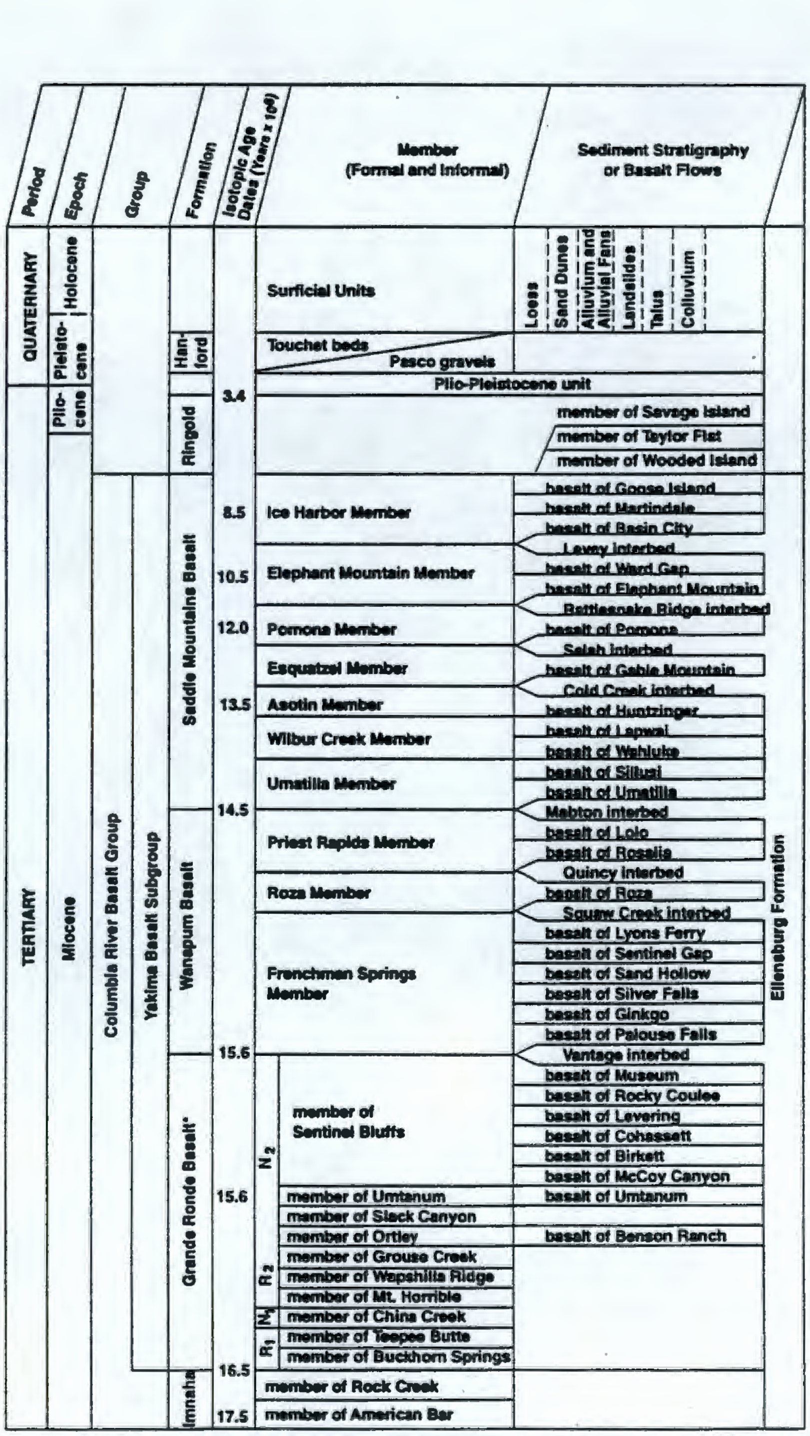
The stratigraphy of the Hanford Site consists of Miocene-age and younger rocks. Older Cenozoic sedimentary and volcaniclastic rock underlie the Miocene and younger rocks but are not exposed at the surface. The Hanford Site stratigraphy is described in the following subsections and is summarized in Figure 4-5.

Figure 4-4. Topography of the Hanford Site (WHC 1991a).



BHI:rpp 04/23/96 clup/topo1.aml Database: 04-FEB-1998

Figure 4-5. A Generalized Stratigraphic Column of the Major Geologic Units of the Hanford Site.



*The Grande Ronde Basalt consists of at least 120 major basalt flows comprising 17 members. N_2, R_2, N_1, and R are magnetostratigraphic units.

4.2.2.1 Columbia River Basalt Group. The Columbia River Basalt Group consists of an assemblage of continental flood basalts of the Miocene age. These basalts cover an area of more than 163,170 km^2 (63,000 mi^2) in Washington, Oregon, and Idaho, and have an estimated volume of about 174,000 km^3 (67,200 mi^3) (PNNL 1996a). Isotopic age determinations suggest flows of the Columbia River Basalt Group were erupted during a period from approximately 17 to 6 million years ago, with more than 98 percent by volume being erupted in a 2.5 million-year period (17 to 14.5 million years ago).

Columbia River basalt flows were erupted from north-northwest-trending fissures (linear vent systems) in north-central and northeastern Oregon, eastern Washington, and western Idaho. The Columbia River Basalt Group is formally divided into five formations (listed in order from the oldest to the youngest): Imnaha Basalt, Picture Gorge Basalt, Grande Ronde Basalt, Wanapum Basalt, and Saddle Mountains Basalt. Of these, only the Grande Ronde, Wanapum, and Saddle Mountains Basalts are present in the Pasco Basin. The Saddle Mountains Basalt forms the uppermost basalt unit in the Pasco Basin, with the exception that some of the bounding ridges where the Wanapum and Grande Ronde Basalt flows are exposed.

4.2.2.2 Ellensburg Formation. The Ellensburg Formation includes sedimentary rocks interbedded with the Columbia River Basalt Group in the central and western part of the Columbia Plateau (PNNL 1996a). The age of the Ellensburg Formation is principally Miocene, although locally it may be equivalent to early Pliocene. The thickest accumulations of the Ellensburg Formation lie along the western margin of the Columbia Plateau where Cascade Range volcanic materials interbed with the Columbia River Basalt Group. The lateral extent and thickness of interbedded sediments generally increase upward in the section.

4.2.2.3 Suprabasalt Sediments. The suprabasalt (above the basalt) sediments within and adjacent to the Hanford Site are dominated by the Ringold and Hanford formations, with other minor deposits (PNNL 1996a).

4.2.2.3.1 Ringold Formation. Late Miocene to Pliocene deposits, younger than the Columbia River Basalt Group, are represented by the Ringold Formation within the Pasco Basin. The Ringold Formation was deposited in east-west trending valleys by the ancestral Columbia River and its tributaries in response to development of the Yakima Fold Belt. Exposures of the Ringold Formation are limited to the White Bluffs within the central Pasco Basin and the Smyrna and Taunton Benches located north of the Pasco Basin. Extensive data on the Ringold Formation are available from boreholes on the Hanford Site.

Flood-related deposits of the Ringold Formation can be broken into different associations based on proximity to the ancestral Columbia and/or Snake River channels. Gravel and associated sand and silt represent a migrating channel deposit of the major river systems and generally are confined to the central portion of the Pasco Basin. Overbank sand, silt, and clay reflect occasional deposition and flooding beyond the influence of the main river channels, and generally are found along the margins of the Pasco Basin. Over time, the main river channels moved back and forth across the basin, causing a shift in location of the various facies. Periodically, the river channels were blocked and caused lakes to develop where mud (with minor amounts of sand) was deposited.

4.2.2.3.2 Plio-Pleistocene Unit. A locally derived unit consisting of an alluvium and/or pedogenic calcrete occurs at the unconformity between the Ringold Formation and the Hanford formation. The sidestream alluvial facies are derived from Cold Creek and its tributaries and are characterized by relatively thick zones of unweathered basalt clasts along with wind-blown materials and soil. The calcrete is relatively thick and impermeable in areas of the western Pasco Basin, often forming an aquitard to downward migration of water in the vadose zone where artificial recharge is occurring.

4.2.2.3.3 Early Palouse Soil. Overlying the Plio-Pleistocene unit in the Cold Creek syncline area is a fine-grained sand to silt. It is believed to consist mainly of eolian (derived from wind deposits) origin, derived from either an older reworked Plio-Pleistocene unit or upper Ringold Formation. The early Palouse soil differs from the overlying slackwater flood deposits by a greater calcium-carbonate content, massive structure in core samples, and a high natural gamma response in geophysical logs.

4.2.2.3.4 Quaternary Deposits. Repositioning of sediments resumed during the Quaternary Period, following the period of late-Pliocene to early-Pleistocene erosion. In the Columbia Plateau, the Quaternary record is dominated by cataclysmic flood deposits with lesser amounts of sediments deposited by water and wind lying below, between, and above flood deposits.

Sand and gravel river sediments, referred to informally as the pre-Missoula gravels, were deposited after incision of the Ringold Formation and before deposition of the cataclysmic flood deposits. The pre-Missoula gravels are similar to the Ringold Formation main-channel gravel facies, consisting of dominantly nonbasaltic clasts. These sediments occur in a swath that runs from the Old Hanford Townsite on the eastern side of the Hanford Site, across the Site toward Horn Rapids on the Yakima River.

Cataclysmic floods inundated the Pasco Basin a number of times during the Pleistocene, beginning as early as one million years ago. The last major flood sequence is dated at about 13,000 years ago by the presence of erupted material from Mount Mazama interbedded with the flood deposits. The number and timing of cataclysmic floods continues to be debated. As many as 10 flood events have been documented during the last ice age. The largest and most frequent floods came from glacial Lake Missoula in northwestern Montana; however, smaller floods may have escaped downvalley from glacial Lakes Clark and Columbia along the northern margin of the Columbia Plateau, or down the Snake River from glacial Lake Bonneville. The flood deposits, informally called the Hanford formation, blanket low-lying areas over most of the central Pasco Basin (DOE 1988).

Cataclysmic floodwaters entering the Pasco Basin quickly became impounded behind Wallula Gap (located about 32 km [20 mi] downstream from the Hanford Site), which was too restrictive for the volume of water involved. Floodwaters formed temporary lakes with a shoreline up to 381 m (1,250 ft) in elevation, which lasted only a few weeks or less (DOE 1988). Two types of flood deposits predominate: (1) a sand-and-gravel, main-channel facies, and (2) a mud-and-sand, slackwater facies. Within the Pasco Basin, these deposits are referred to as the Pasco Gravels and slackwater deposits of the Hanford formation. Sediments with intermediate grain sizes (e.g., sand-dominated facies) also are present in areas throughout the Pasco Basin, particularly on the south, protected half of Cold Creek Bar.

Landslide deposits in the Pasco Basin are of variable age and genesis. Most occur within the basalt outcrops along the ridges (e.g., on the north side of Rattlesnake Mountain) or steep river embankments (e.g., White Bluffs), where the Upper Unit Ringold Formation crops out in the Pasco Basin.

4.2.3 Structure

The Hanford Site is located near the junction of the Yakima Fold Belt and the Palouse structural subprovinces (DOE 1988a). These structural subprovinces are defined on the basis of their structural fabric, unlike the physiographic provinces that are defined on the basis of landforms. The Palouse subprovince is a regional paleoslope that dips gently toward the Columbia Plateau and exhibits only relatively mild structural deformation. The Palouse Slope is underlain by a wedge of Columbia River basalt that thins gradually toward the east and north, and laps onto the adjacent highlands.

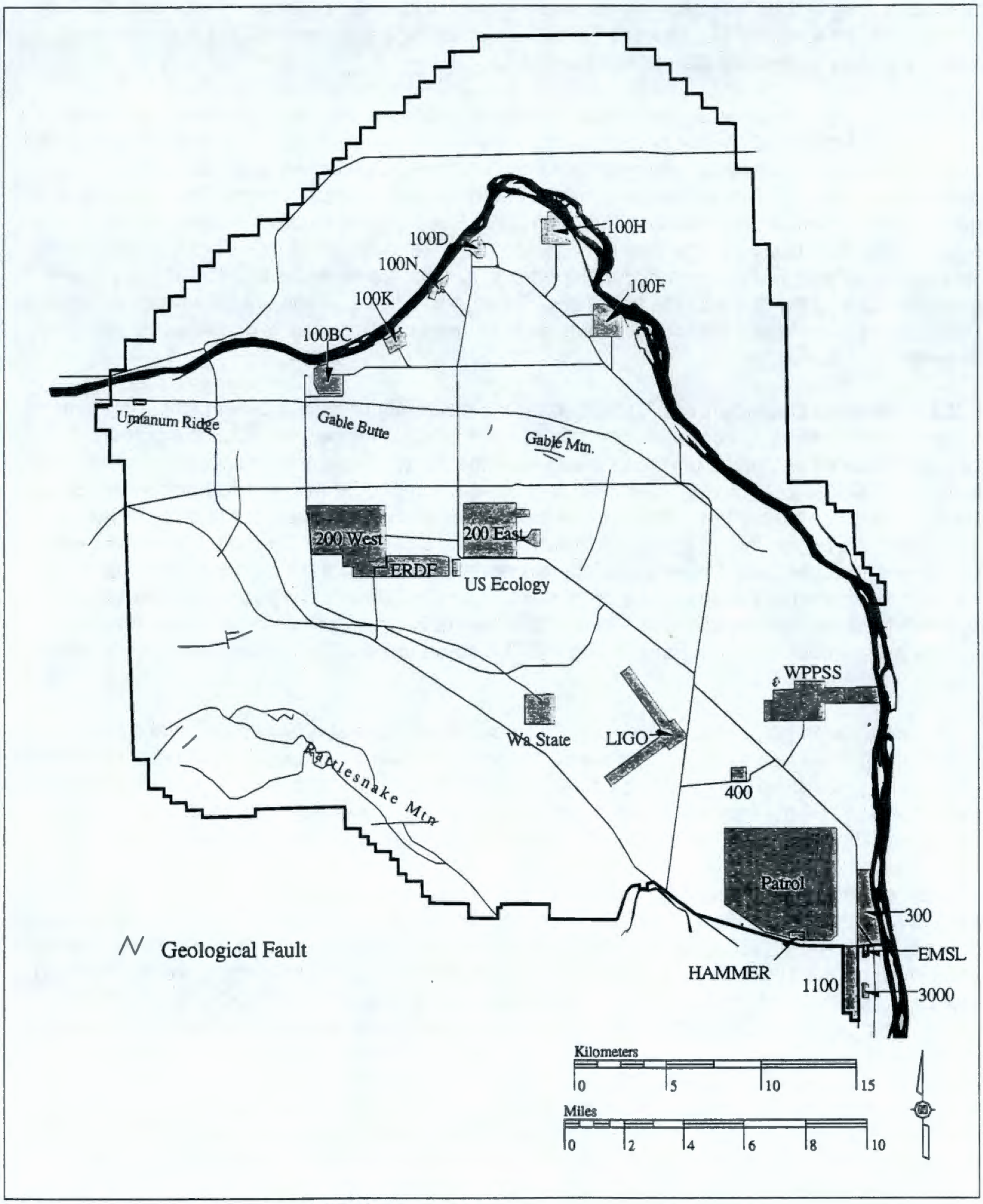
The principal characteristics of the Yakima Fold Belt are a series of segmented, narrow, asymmetric anticlines. These anticlinal ridges are separated by broad synclines or basins that, in many cases, contain thick accumulations of Tertiary- to Quaternary-age sediments. The deformation of the Yakima Folds occurred under north-south compression. The fold belt was growing during the eruption of the Columbia River Basalt Group and continued to grow into the Pleistocene, and likely into the present (Reidel 1984; Reidel et al. 1989). Thrust or high-angle reverse faults with fault planes that strike parallel or subparallel to the axial trends are found principally along the limbs of the anticlines (Figure 4-6) (PNNL 1996a). The amount of vertical stratigraphic offset associated with these faults varies but commonly exceeds hundreds of meters.

4.2.3.1 Mineral Development. Directly after the discovery of gold in British Columbia and Oregon in the 1850s, gold was discovered in eastern Washington. In 1862, the first very successful strike in Washington was made near the mouth of the Methow River. Strikes were also made on the Clearwater River near present-day Orofino, Idaho, in 1860 and in the Boise Basin ("Treasure Valley") in 1862. These discoveries caused prospectors to explore the mid-Columbia region in the 1860s, upstream from the Dalles to the Canadian border. Between Vantage and Alderdale, Washington, at least seven sites along the Columbia River have had past placer mining activity and gold production. The Chinaman's Bar Placer (located on the south side of the river directly upstream of the Vernita Bridge, partially on the Hanford Site) supported a small operation from 1939 to 1941 with an unknown amount of production (NPS 1994).

In addition to gold mining along the Columbia River, natural gas was discovered on Rattlesnake Mountain in 1913. The small, shallow field was developed in 1929 and produced until it was closed in 1941, yielding a total of approximately 0.07 billion m^3 (2.5 billion ft^3) of gas (NPS 1994). Twenty-four wells were drilled, with the main gas field located on the ALE Reserve. Although intensive exploration occurred, deposits proved to be small.

Oil exploration was also conducted in the Rattlesnake Mountain and Rattlesnake Hills area in the 1920s and 1930s, but useful deposits were not found (Gerber 1997). The mineral rights to a 518-ha (1,280-ac) area are still owned by a private company, the Big Bend-Alberta, Ltd. The surface title to this acreage was acquired by the AEC by condemnation in 1952. At that time, the final judgment of the court revested in the owners (at that time, the Big Bend Land Company) the gas and oil rights in the land providing, however, that all rights of ingress and egress over the surface of the land for exploration or exploitation of such rights were prohibited for 25 years from the date of the judgment (January 14, 1952). Presently, Big Bend-Alberta, Ltd., is free to enter on the lands at will to explore for oil or gas. Big Bend-Alberta, Ltd., holds all the oil and mineral rights on one section, the oil and mineral rights on three-quarters of a second section, and the soil and mineral rights on one-quarter of a third section (see Figure 4-3).

Figure 4-6. Map of the Hanford Site Region Showing Known Faults.



BHI:rpp 02/11/98 clup/geology2.aml Database: 11-FEB-1998

4.2.4 Geologic Hazards

The White Bluffs represent a geologic hazard to certain types of land uses, such as irrigated farming and other forms of intensive development (Figure 4-7). The White Bluffs are composed of claystones and siltstones that are relatively strong when dry but lose considerable strength when wet. Visual evidence of recent, suspected human-induced landslide activity has developed over the past two decades. Irrigation water applied to croplands immediately east of the White Bluffs has raised the water table significantly, resulting in local saturation, increased pore pressures, reduced shear strength, and instability of slopes above the river. Leaks in local irrigation canals and irrigation wastewater are believed to be contributing groundwater to the slide area, but a regional aquifer may also be responsible (NPS 1994).

Based on studies in the early 1970s, the BoR determined that irrigation would increase the potential for landslide activity along the White Bluffs. Also, a detailed drainage investigation completed in 1967 found a large portion of "red zone" area infeasible to drain based on economic criteria. As part of its effort to restrict irrigation in this area, the BoR rescinded the plats for two irrigation blocks (Blocks 36 and 55) and acquired private lands on a "willing seller" basis (NPS 1994).

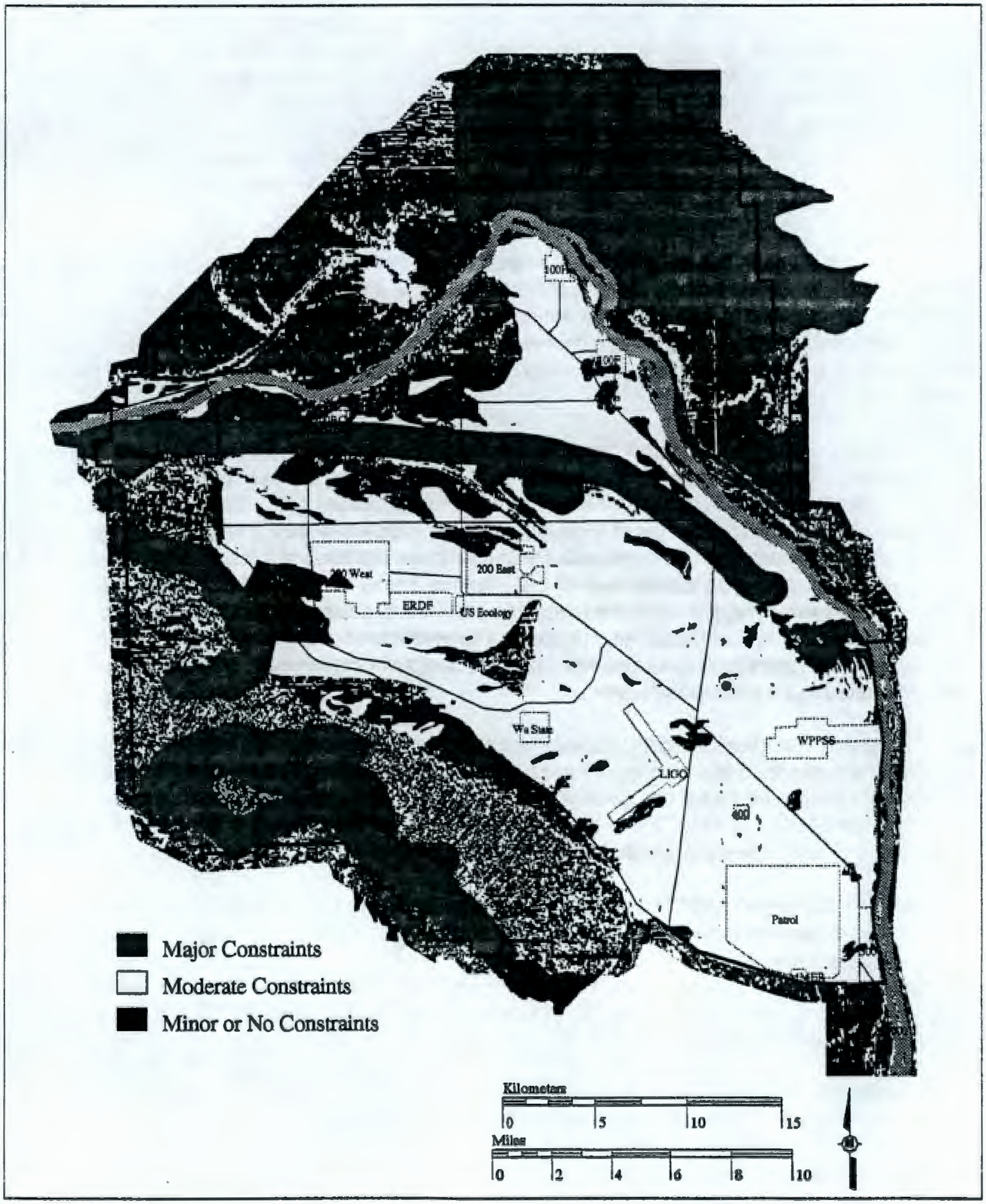
Ringold Formation sediments that make up a large portion of the White Bluffs are largely unconsolidated and uncemented (Lindsey 1996). These sediments were deposited between 6 and 3.5 million years ago. During and following deposition of Ringold sediment, the floor of the Pasco Basin was subsiding while the surrounding highlands were rising (DOE 1988a; Reidel 1984). Consequently, the Ringold sediment layers dip toward the center of the Pasco Basin, which lies in the east-central part of the Hanford Site. The angle of dip of these layers is less than 2 degrees. Ringold sediment layers dip down from the northern and eastern edges of the basin toward the Columbia River. Ringold sediments found in the bluffs consist predominantly of layers of river-deposited sand, ancient soils (paleosols), and sand, silt, and clay deposited in lakes (Lindsey 1996).

Throughout the Hanford Site, a series of catastrophic flood deposits, informally known as the Hanford formation, lies atop the Ringold Formation sediments. The Hanford formation consists of fine-grained sediments know as Touchet Beds and gravel beds known as the Pasco Gravels (DOE 1988a). The sediments of the Hanford formation are unconsolidated, uncemented, and highly transmissive for the flow of water.

Hays and Schuster (1987) concluded that the entire area of the bluffs along the northern and eastern shores of the Columbia River is susceptible to landslides. Recent landslides have occurred in four areas along the bluffs; these areas are the Locke Island, Savage Island, Homestead Island, and Johnson Island slide areas. The length of the slide areas parallel to the river shoreline ranges from more than a mile at Locke Island to about 0.4 km (0.25 mi) of a mile near Homestead Island.

The Hanford powerline area shows evidence of Late Pleistocene landslides, and the area coincides with lack of irrigation adjacent to the bluffs (Hays and Schuster 1987). The landslides, both active and inactive, total about 11.2 km^2 (4.3 mi^2) in area, and the total landslide susceptible area is about 15.1 km^2 (5.8 mi^2) (Hays and Schuster 1987). These slide areas are characterized by major cracks about two-thirds of the way up the bluff face, surface

Figure 4-7. Geologic Hazards.



areas on the slopes below the cracks with an irregular ground surface, and mud flows at the base of the slope. The irregular surface forms as the bluff face slides away and begins to break up. The mud flows occur as a result of a process known as liquefaction, which is water-saturated soil that flows similar to a liquid. Some of the slide areas, such as Savage Island and Locke Island slides, are rimmed by a scarp or cliff. Surface cracks located upland of the bluff face can be found, which indicate the slopes behind the bluffs are very unstable and prone to future landslides.

Examination of slide areas reveals the universal presence of water seeping from the bluffs in springs and marshes. Observation of these springs, saturated cliff faces, and mud flows indicates that water plays a role in producing landslides along the bluffs. The water found in the bluffs reduces the strength, decreases frictional resistance, and adds weight to the unconsolidated Ringold Formation. Because the transmissivity of the Ringold layers varies, water accumulates in certain sediment layers within the bluffs. This wet layer is the plane on which the slide begins. The bluff above a wet layer will slide when the water-laden and lubricated layer fails under the weight of the overburden.

Sources of water on the bluffs are natural precipitation, irrigated farmlands, irrigation and waste water canals, and irrigation waste water ponds located up-slope and east of the bluffs and on the Wahluke Slope. Water from these activities percolates through the soil to the Ringold Formation. Some of the layers within the formation resist the downward flow of water, forcing the water to flow laterally. Ringold Formation layers dip toward the Columbia River and the water that collects above less transmissive Ringold Formation layers moves downslope toward the bluffs. Eventually, this water reaches the bluffs and increases the potential for a landslide.

Hays and Schuster (1987) concluded, "In the present climate, most of these bluffs are very stable under natural conditions, but irrigation of the upland surface to the east, which began in the 1950s and has been greatly expanded, led to increased and more widespread seepage in the bluffs and to a spectacular increase in slope failures since 1970. With continuing irrigation, areas of the bluff wetted by seepage will be subject to landslides wherever slopes exceed about 15 degrees and, on lesser slopes, wherever the surficial material is old landslide debris."

The hazards posed by landslides in bluffs range from minor to catastrophic. Economic loss from landslides in the bluffs has not been large because the area is relatively undeveloped. Road closures have occurred. A concrete flume, part of the Ringold Wasteway, was destroyed by the Homestead Island slide in the late 1960s (Hays and Schuster 1987). Encroachment up-slope by the Savage Island slide destroyed the riverward margins of irrigated fields along the top of the bluffs (Hays and Schuster 1987).

Perhaps the most unlikely occurrence would be an earthquake-triggered, massive slope failure caused by liquefaction of the White Bluffs (Harty 1979), which would temporally block the Columbia River. Hanford facilities on the west side of the river could be endangered as well as citizens and property located downstream of this temporary dam. Also, contaminants left at depth in the soil column would be further mobilized by the subsequent rise in groundwater levels on the Hanford facilities side of the river.

The Locke Island slide caused the loss of cultural artifacts on the island by changing the channel of the river and causing erosion to occur on Locke Island. Since its beginning in the mid 1970s, the Locke Island slide has extended 150 m (492 ft) into the channel of the

Columbia River (Nickens et al. 1997). Since November 1995, Locke Island has an actively eroding cut bank that is 400 m (1,312 ft) in length, with a horizontal loss of 16 m (53 ft) (Nickens et al. 1997). These slides can disturb and destroy salmon spawning beds by siltation, and the increase in sediment load in the Hanford Reach could potentially adversely affect the WPPSS reactor cooling-water intake systems (Hays and Schuster 1987).

The Hanford Dune Field, located north of the WPPSS reactor, also represents a hazard to certain types of land uses. The Hanford Dune Field is one of three great dune fields in the Columbia River Basin. It is an active area of migrating barchan dunes and partially stabilized transverse dunes derived from alluvium, with bare rock-rubbled areas between dunes. In the late 1970s, a study done by the Heritage Conservation and Recreation Service determined this dune field to be of national significance and proposed a 2,560-ha (6,320-ac) protected area for inclusion in the National Natural Landmark system. For security purposes and other reasons, the DOE requested that the site not be designated as such, and the request was honored (NPS 1994).

There is also an extensive dune system that is stabilized with vegetation, located south of the 200 Areas, trending to the northeast toward the Columbia River. This stabilized dune system, which forms hummocky terraces and dune-like ridges, also represents a potential geologic hazard to development. Should the vegetation on the dune system be altered, cleared, or otherwise disturbed, the dunes might remobilize, resulting in dune sand movement and blowing sand during windy weather.

4.2.4.1 Seismic and Volcanic Hazards. The historic record of earthquakes in the Pacific Northwest dates from about 1840. The early part of this record is based on newspaper reports of structural damage and human perception of the shaking, as classified by the Modified Mercalli Intensity (MMI) scale and is probably incomplete because the region was sparsely populated. Seismograph networks did not start providing earthquake locations and magnitudes in the Pacific Northwest until about 1960. A comprehensive network of seismic stations, which provide accurate locating information for most earthquakes larger than a magnitude of 2.5 on a Richter scale, was installed in eastern Washington in 1969.

Seismicity of the Columbia Plateau, as determined by the rate of earthquakes per area and the historical magnitude of these events, is relatively low when compared to other regions of the Pacific Northwest, the Puget Sound area, western Montana, and eastern Idaho. The largest known earthquake had a magnitude of 5.75 and an MMI of VII, and was followed by a number of aftershocks, which indicates a northeast-trending fault plane. Other earthquakes with Richter magnitudes of 5.0 or larger and/or MMIs of VI are located along the boundaries of the Columbia Plateau in a cluster near Lake Chelan extending into the northern Cascade Range, in northern Idaho and Washington, and along the boundary between the western Columbia Plateau and the Cascade Range.

In the central portion of the Columbia Plateau, the largest earthquakes near the Hanford Site occurred in 1918 and 1973. These two earthquakes had Richter scale magnitudes of 4.4 and an MMI of V. Earthquakes often occur in spatial and temporal clusters in the Columbia Plateau and are termed "earthquake swarms." The region north and east of the Hanford Site is concentrated with earthquake swarm activity; however, earthquake swarms also have occurred in several locations within the Hanford Site. Earthquakes in a swarm tend to gradually increase and decay in frequency of events, and usually no outstanding large event is present within the sequence. These earthquake swarms occur at shallow depths, with 75 percent of the events located at depths less than 4 km (2.5 mi). Each earthquake swarm typically lasts several weeks to months, may consist of anywhere from several to more than

100 earthquakes, and is clustered in an area 5 to 10 km (3 to 6 mi) in lateral dimension. Often, the longest dimension of the swarm area is elongated in an east-west direction.

Earthquakes in the Columbia Plateau also occur to depths of approximately 30 km (18 mi). These deeper earthquakes are less clustered and occur more often as single, isolated events. Based on epicenter studies and refraction surveys in the region, the shallow earthquake swarms occur in the Columbia River Basalts and the deeper earthquakes occur in crustal layers below the basalts.

Several major volcanoes are located in the Cascade Range west of the Hanford Site. The nearest volcano, Mount Adams, is about 165 km (102 mi) from the Hanford Site. The most active volcano, Mount St. Helens, is located approximately 220 km (136 mi) west-southwest of the Hanford Site.

Because of their close proximity, the volcanic mountains of the Cascades are the principal volcanic hazard at the Hanford Site. The major concern is that ash fall could affect Hanford Site communications equipment and electronic devices, as well as the movement of truck and automobile traffic in and out of the area.

4.2.5 Soils

The *Soil Survey Hanford Project in Benton County Washington*, BNWL-243 (PNL 1966), describes 15 different soil types on the Hanford Site, varying from sand to silty and sandy loam (Figure 4-8). The soil classifications given in BNWL-243 have not been updated to reflect current reinterpretations of soil classifications (see text box, *"Hanford Site Quick Facts: Soils"*). Until soils on the Hanford Site are resurveyed, the descriptions presented in BNWL-243 will continue to be used (Table 4-1). No soils on the Hanford Site are currently classified as prime farmlands because (1) there are no current soil surveys, and (2) the only prime farmland soils in the region are irrigated (August 1996 Draft HRA-EIS).

Hanford Site Quick Facts: Soils

- Fifteen types of soils identified
- Textures range from sand to silty and sandy loam
- Most common soil type: Quincy Sand

The parent material for predominant soil types at the Hanford Site consists of the Hanford formation and Holocene surficial deposits (Cushing 1992). Soils with well-developed profiles occur only where fine and poorly-drained sediments have been deposited and typically are low in organic matter (PNL 1991a).

Wind and water erosion have been key factors in modifying developed soil profiles on the Hanford Site, and have resulted in the loss of soil down to parent material in some areas and the creation of large active sand dunes in other areas. Currently stabilized dune complexes can potentially be reactivated as a result of surface disturbances.

4.3 Water Resources

This section provides an overview of the Hanford Site hydrologic setting, which includes surface water and groundwater resources, and a discussion of existing water rights.

Figure 4-8. Soil Map of the Hanford Site (adapted from PNNL 1996a).

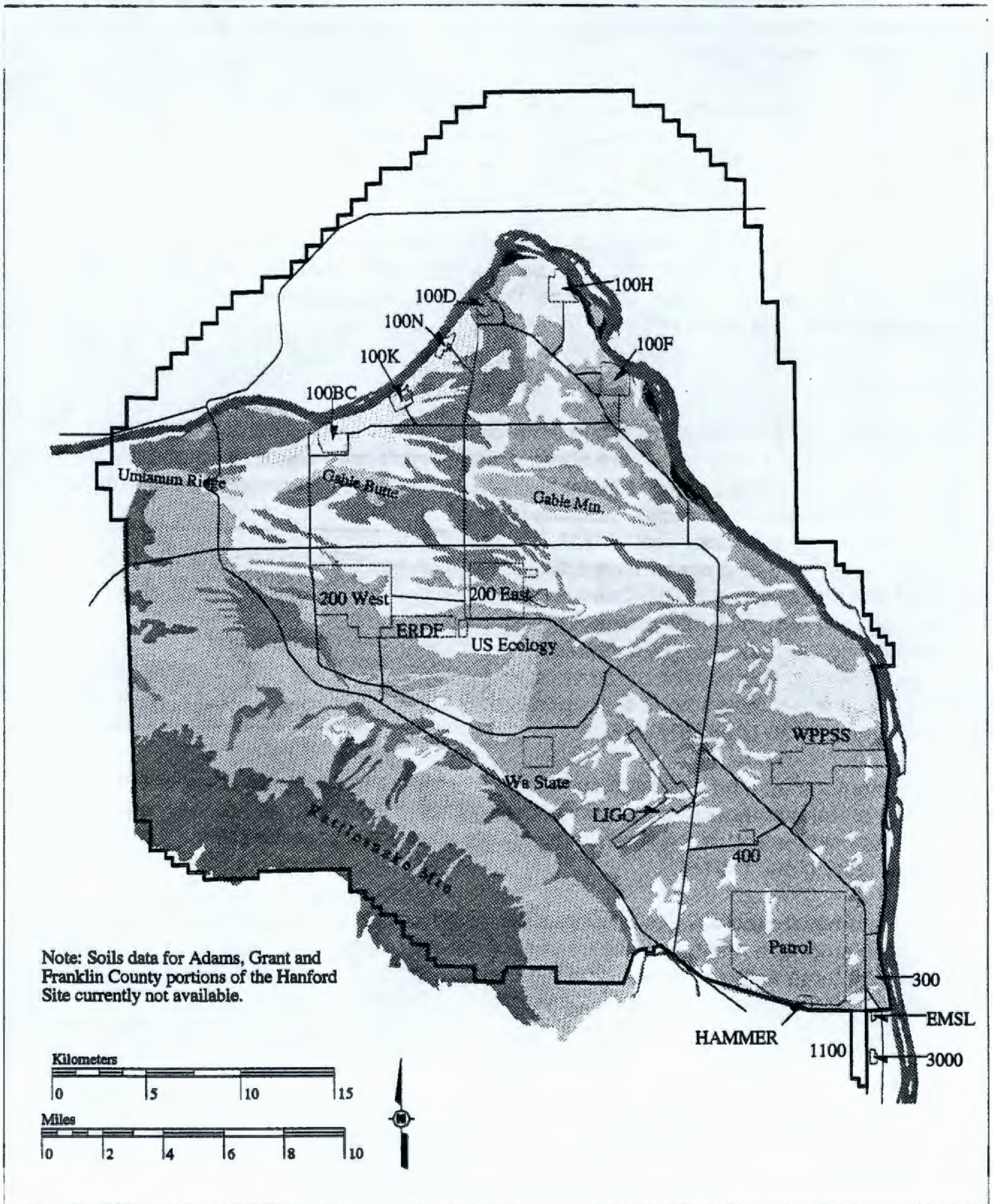


Figure 4-8. Soil Map of the Hanford Site (Legend).

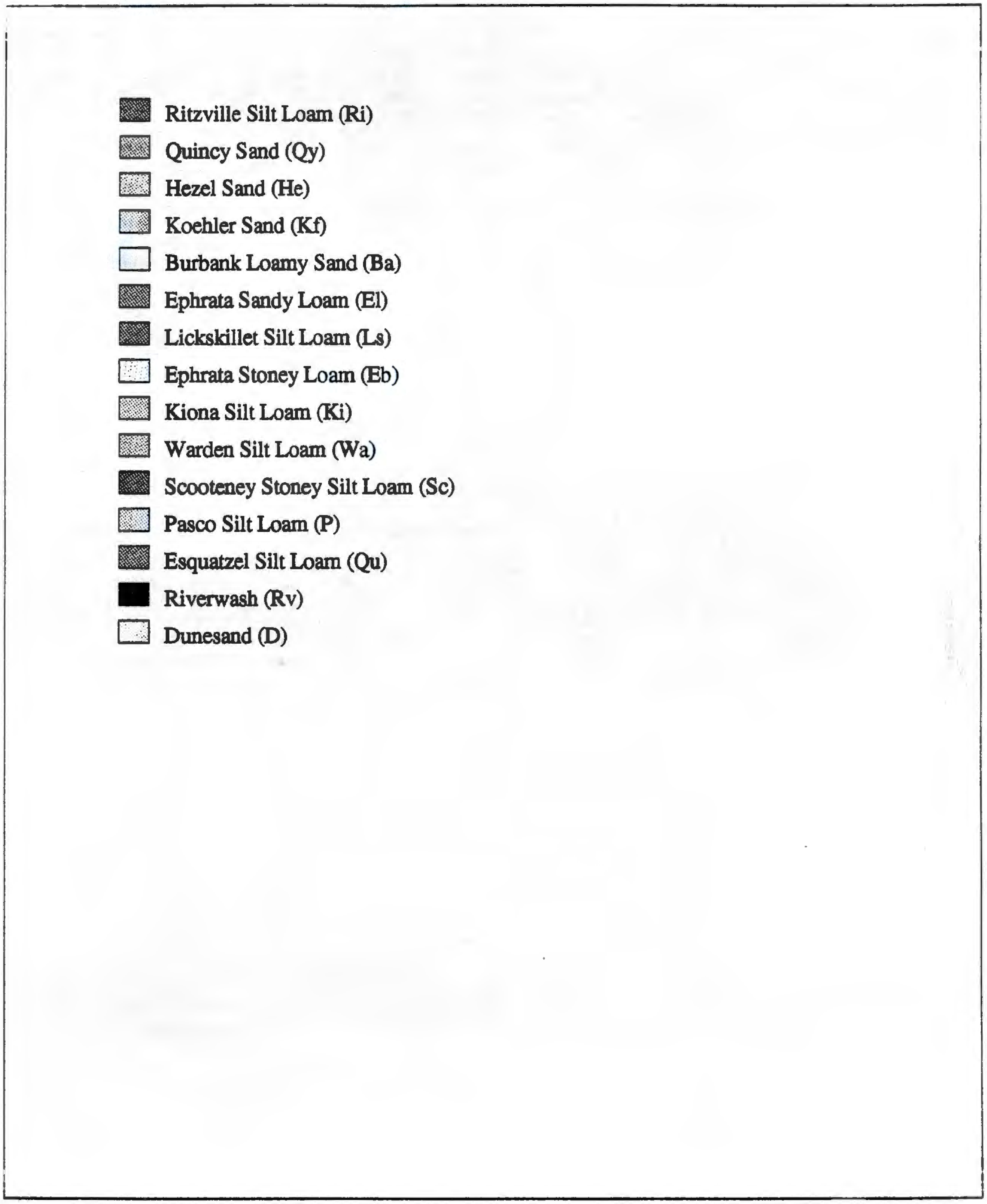


Table 4-1. Soil Types on the Hanford Site (adapted from PNNL 1996a).

Name (symbol)	Description
Ritzville silt loam (Ri)	Dark-colored silt loam soils midway up the slopes of the Rattlesnake Hills. Developed under bunchgrass from silty wind-laid deposits mixed with small amounts of volcanic ash. Characteristically greater than 150 cm (59 in.) deep; bedrock may occur at less than 150 cm (59 in.) but greater than 75 cm (30 in.).
Quincy (Rupert) sand (Rp)	One of the most extensive soils on the Hanford Site. Brown to grayish-brown coarse sand grading to dark grayish-brown at approximately 90 cm (35 in.). Developed under grass, sagebrush, and hopsage in coarse, sandy, alluvial deposits that were mantled by wind-blown sand. Hummocky terraces and dune-like ridges.
Hezel sand (He)	Similar to Rupert sands; however, a laminated grayish-brown strongly calcareous silt loam subsoil usually is encountered within 100 cm (39 in.) of the surface. Surface soil is very dark brown, and was formed in wind-blown sands that mantled lake-laid sediments.
Koehler sand (Kf)	Similar to other sandy soils on the Hanford Site. Developed in a wind-blown sand mantle. Differs from other sands because the sand mantles a lime-silica-cemented layer "hardpan." Very dark grayish-brown surface layer is somewhat darker than Rupert Sand. Calcareous subsoil usually is dark grayish-brown at approximately 45 cm (18 in.).
Burbank loamy sand (Ba)	Dark, coarse-textured soil underlain by gravel. Surface soil usually is 40 cm (16 in.) thick, but can be 75 cm (30 in.) thick. Gravel content of subsoil ranges from 20 to 80 percent.
Kiona silt loam (Ki)	Located on steep slopes and ridges. Surface soil is very dark grayish-brown and approximately 10 cm (4 in.) thick. Dark brown subsoil contains basalt fragments 30 cm (12 in.) and larger in diameter. Many basalt fragments found in surface layer. Basalt rock outcrops present. A shallow stony soil normally occurring in association with Ritzville and Warden soils.
Warden silt loam (Wa)	Dark grayish-brown soil with a surface layer usually 23 cm (9 in.) thick. Silt loam subsoil becomes strongly calcareous at approximately 50 cm (20 in.) and becomes lighter in color. Granitic boulders are found in many areas. Usually greater than 150 cm (59 in.) deep.
Ephrata sandy loam (El)	Surface is dark colored, and subsoil is dark grayish-brown medium-textured soil underlain by gravelly material, which may continue for many meters (feet). Level topography.
Ephrata stony loam (Eb)	Similar to Ephrata sandy loam. Differs in that many large hummocky ridges presently are made up of debris released from melting glaciers. Areas between hummocks contain many boulders several meters (feet) in diameter.
Scooteney stony silt loam (Sc)	Developed along the north slope of Rattlesnake Hills; usually confined to floors of narrow draws or small fan-shaped areas where draws open onto plains. Severely eroded with numerous basaltic boulders and fragments exposed. Surface soil usually is dark grayish-brown, grading to grayish-brown in the subsoil.
Pasco silt loam (P)	Poorly drained, very dark grayish-brown soil formed in recent alluvial material. Subsoil is variable, consisting of stratified layers. Only small areas found on the Hanford Site, located in low areas adjacent to the Columbia River.
Esquatzel silt loam (Qu)	Deep dark-brown soil formed in recent alluvium derived from loess and lake sediments. Subsoil grades to dark grayish-brown in many areas, but color and texture of the subsoil vary because of the stratified nature of the alluvial deposits.
Riverwash (Rv)	Wet, periodically flooded areas of sand, gravel, and boulder deposits that make up overflowed islands in the Columbia River and adjacent land.
Dune sand (D)	Miscellaneous land type that consists of hills or ridges of sand-sized particles drifted and piled up by wind, and are either actively shifted or so recently fixed or stabilized that no soil horizons have developed.
Lickskillet silt loam (Ls)	Located on ridge slopes of Rattlesnake Hills and slopes greater than 765 m (2,509 ft) in elevation. Similar to Kiona series except surface soils are darker. Shallow over basalt bedrock, with numerous basalt fragments throughout the profile.

In 1980, Congress enacted the *Northwest Power Act* (NPA) (16 U.S.C. 839-839h), which "marked an important shift in Federal policy." Continually declining fish runs had revealed the failures of previous legislative efforts requiring that "equal consideration" be given to fish and wildlife affected by resource exploitation. The NPA created "a pluralistic intergovernmental and public review process. At the hub of this process, Congress established the Pacific Northwest Electric Power and Conservation Planning Council (Council), directing it to create "a program to protect, mitigate, and enhance" the Columbia River Basin's fish and wildlife "to the extent affected by the development and operation of the Basin's hydropower system." The Council's authority with respect to fish and wildlife measures is contained; the Council "can guide, but not command, Federal river management."

Columbia River Flow — Who Controls It?

On the Columbia River above the Hanford Site, there are dams such as the Grant County Public Utility District (PUD) Rock Island Dam and Rocky Reach Dam; the Douglas County PUD Wells Dam; the U.S. Army Corps of Engineers Chief Joseph Dam; the BoR Grand Coulee Dam; and the British Columbia Hydro Keenleyside Dam, Revelstoke Dam, and Mica Dam.

The 1964 Columbia River Treaty between the United States and Canada provided for building four storage reservoirs: three in Canada (Mica, Kennleyside, and Duncan) and one in the United States (Libby). The reservoirs that were built and operated under the Treaty represent almost half the water storage on the Columbia River System. The Treaty required over 15.5 million acre-feet of Canadian storage, but reservoirs actually built contained storage capacity of 20.5 million acre-feet. The excess storage capacity, most of which is behind Mica Dam, is referred to as non-Treaty storage. The Non-Treaty Storage Agreements made by DOE's BPA were necessary to govern the rights to this additional storage capacity. Nothing in the Treaty prevented Canada from using all of the non-Treaty storage unilaterally, although the United States argued it had the right to compensation if use of the non-Treaty storage resulted in reduced Columbia River flows in the United States.

The three dams in British Columbia were developed to provide water storage for power generation in the United States. Mica Dam has the highest "head" at 200 m (656.2 ft) and is the only installation of the three to have a powerhouse. In return for building the three dams (Mica, Keenleyside, and Duncan), B.C. Hydro was entitled to half the additional power generated in the United States that resulted from storage operations in Canada. These "downstream benefits" were sold to a group of American utilities for 30 years. This share, known as the "Canadian Entitlement," is owned by B.C. Hydro. In September 1994, British Columbia and the United States signed a Memorandum of Agreement which outlines new arrangements for the return of the Canadian Entitlement, beginning in 1998.

The Vernita Bar Agreement (signed June 16, 1998, by the U.S. Department of Energy, Federal and state agencies, Tribal governments, and public utility districts in Grant, Chelan, and Douglas counties) was entered into by the dam owners to prevent salmon eggs from being left high and dry when river flows fluctuate to meet peak power demands.

The overall water flow in the Columbia River is precisely controlled with cooperation from all dam owners from the U.S. Army Corps of Engineers Operations Center in Portland, Oregon.

In addition, Canada and the United States signed the Pacific Salmon Treaty in 1985. The Pacific Salmon Treaty has provided for improved conservation and management of the resource. The Treaty covers five species of Pacific salmon and steelhead, and applies to fisheries in Southeast Alaska, British Columbia, Washington, and Oregon — two of which (the upper Columbia steelhead and the Redfish Lake sockeye salmon) are now also covered by the *Endangered Species Act of 1973.*

There is no single "law of the river" on the Columbia River. Instead, there is a maze of overlapping treaties, laws, and regulations, which together attempt to balance the varied interests on the river. (See text box, *"Columbia River Flow -- Who Controls It?"*)

4.3.1 Surface Water

The Pasco Basin occupies about 4,900 km^2 (1,900 mi^2) and is located centrally within the Columbia Basin. Elevations within the Pasco Basin generally are lower than other parts of the Columbia Plateau, and surface drainage enters the Pasco Basin from other basins. Within the Pasco Basin, the Columbia River is joined by three major tributaries: the Yakima River, the Snake River, and the Walla Walla River.

The Hanford Site occupies approximately one-third of the land area within the Pasco Basin. Primary surface-water features associated with the Hanford Site are the Columbia and Yakima rivers (see text box, *"Hanford Site Quick Facts: Surface Water"*). Several surface ponds and ditches, which were generally associated with fuel- and waste-processing activities, are present. In addition, several small spring-fed streams occur on the ALE Reserve, which is located on the southwestern side of the Hanford Site (Figure 4-9).

A network of dams and multipurpose water resource projects is located along the course of the Columbia River. Water storage behind Grand Coulee Dam, combined with storage upstream in Canada, totals 3.1 x 10^{10} m^3 (1.1 x 10^{12} ft^3) of usable storage to regulate the Columbia River for power, flood control, and irrigation.

The flow of the Columbia River has been inventoried and described in detail by the U.S. Army Corps of Engineers (USACE) (DOE 1995d). Flow along the Hanford Reach is controlled by the Priest Rapids Dam. Several drains and intakes are present along the Hanford Reach. These include irrigation outfalls from the Columbia Basin Irrigation Project, and Hanford Site and WPPSS intakes for the onsite water export system.

> ***Hanford Site Quick Facts: Surface Water***
>
> - Columbia River average annual flow: 3,400 m^3 (120,100 ft^3) per second
> - Yakima River average annual flow: 104 m^3 (3,673 ft^3) per second

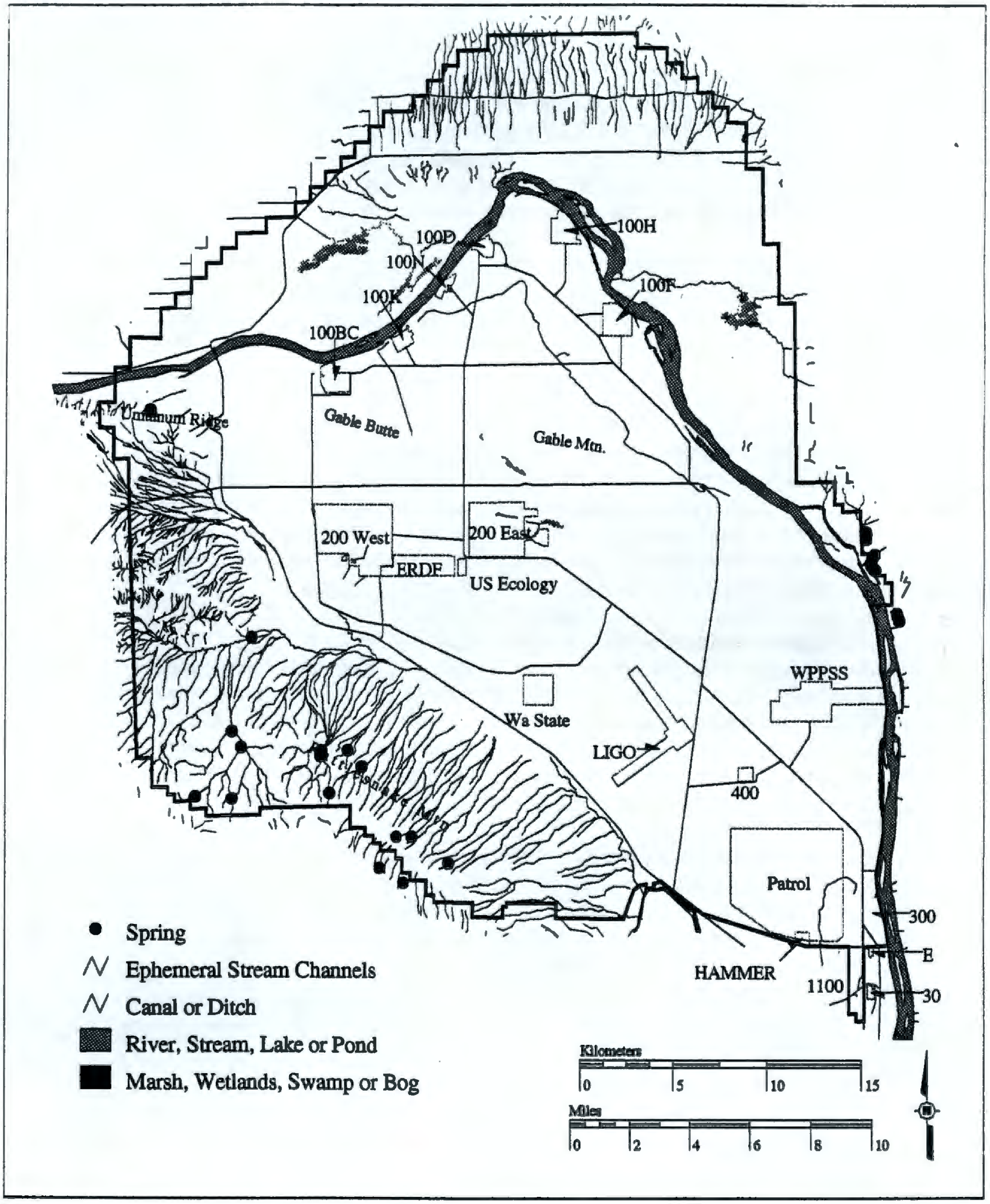
Recorded flow rates in the Hanford Reach have ranged from 4,500 to 18,000 m^3/s (approximately 158,900 to 635,600 ft^3/s) during the runoff in spring and early summer, and from 1,000 to 4,500 m^3/s (35,300 to 158,900 ft^3/s) during the low flow period of late summer and winter. The average annual Columbia River flow in the Hanford Reach, based on records from 65 years, is about 3,400 m^3/s (120,100 ft^3/s). Normal river elevations range from 120 m (394 ft) above mean sea level where the river enters the Hanford Site near Vernita, to 104 m (341 ft) where the river leaves the Hanford Site near the 300 Area. Vertical fluctuations of approximately 1.5 m (greater than 5 vertical ft) are not uncommon along the Hanford Reach (PNNL 1996a). The width of the river varies from approximately 300 to 1,000 m (984 to 3,281 ft) within the Hanford Site.

The Yakima River, bordering the southern portion of the Hanford Site, has a low annual flow compared to the Columbia River. For 57 years of record, the average annual flow of the Yakima River has been about 104 m^3/s (3,673 ft^3/s), with monthly maximum and minimum flows of 490 m^3/s and 4.6 m^3/s (17,305 ft^3/s and 162 ft^3), respectively.

Cold Creek and a tributary, Dry Creek, are ephemeral streams within the Yakima River drainage system that roughly parallel SR 240 through the Hanford Site. Both streams drain areas to the west of Hanford Site. Surface flow, when it occurs, infiltrates and disappears into the surface sediments in the western portion of the Hanford Site. Rattlesnake Springs, located on the western portion of the Hanford Site, forms a small surface stream that flows for approximately 3 km (1.8 m) before disappearing into the ground.

West Lake is located north of the 200 East Area and is recharged from groundwater (PNNL 1996a). West Lake has not received direct effluent discharges from Hanford Site facilities; rather, its existence is caused by the intersection of the elevated water table with the land surface in the topographically low area south of Gable Mountain (and north of the 200 East Area). The artificially elevated water table occurs under much of the Hanford Site and reflects the artificial recharge from past Hanford Site operations. This elevated water table is dropping.

Figure 4-9. Surface Water on the Hanford Site.



The seepage of groundwater into the Columbia River has been known to occur for many years. The riverbank seep discharges were documented along the Hanford Reach long before Hanford Site operations began during World War II (PNNL 1996a). These relatively small seeps flow intermittently, apparently influenced primarily by changes in river level. Hanford-origin contaminants have been documented in these groundwater discharges along the Hanford Reach (PNNL 1996a).

In the 200 West Area, the West Powerhouse Pond, 216-T-1 Ditch, 216-T-4-2 Ditch, and 216-Z-21 Basin are active. In the 200 East Area, only the East Powerhouse Ditch and the 216-B-3C Pond are active. The 216-B-3C Pond originally was excavated in the mid-1950s for disposal of process cooling water and other liquid wastes occasionally containing low levels of radionuclides. The FFTF Pond is located near the 400 Area and was excavated in 1978 for the disposal of cooling and sanitary water from various facilities in the 400 Area (PNNL 1996a).

The ponds are not accessible to the public and do not constitute a direct offsite environmental impact (PNNL 1996a). However, the ponds are accessible to migratory waterfowl, creating a potential pathway for the dispersion of contaminants. Periodic sampling provides an independent check on effluent control and monitoring systems (PNNL 1996a).

Other than rivers and springs, no naturally occurring bodies of surface water are present on the Hanford Site. However, artificial wetlands (caused by irrigation) exist on the Wahluke Slope, which lies north of the Columbia River. Hatcheries and canals associated with the Columbia Basin Irrigation Project constitute the only other artificial surface water expressions in the area. The Ringold Hatchery, located just south of the Hanford Site boundary on the east side of the Columbia River (northeast of the 300 Area), is the only local fish hatchery. In addition to the public hatchery, the Yakama Indian Nation raised several species of fish in settling pools in the 100-K Area as part of an experimental program.

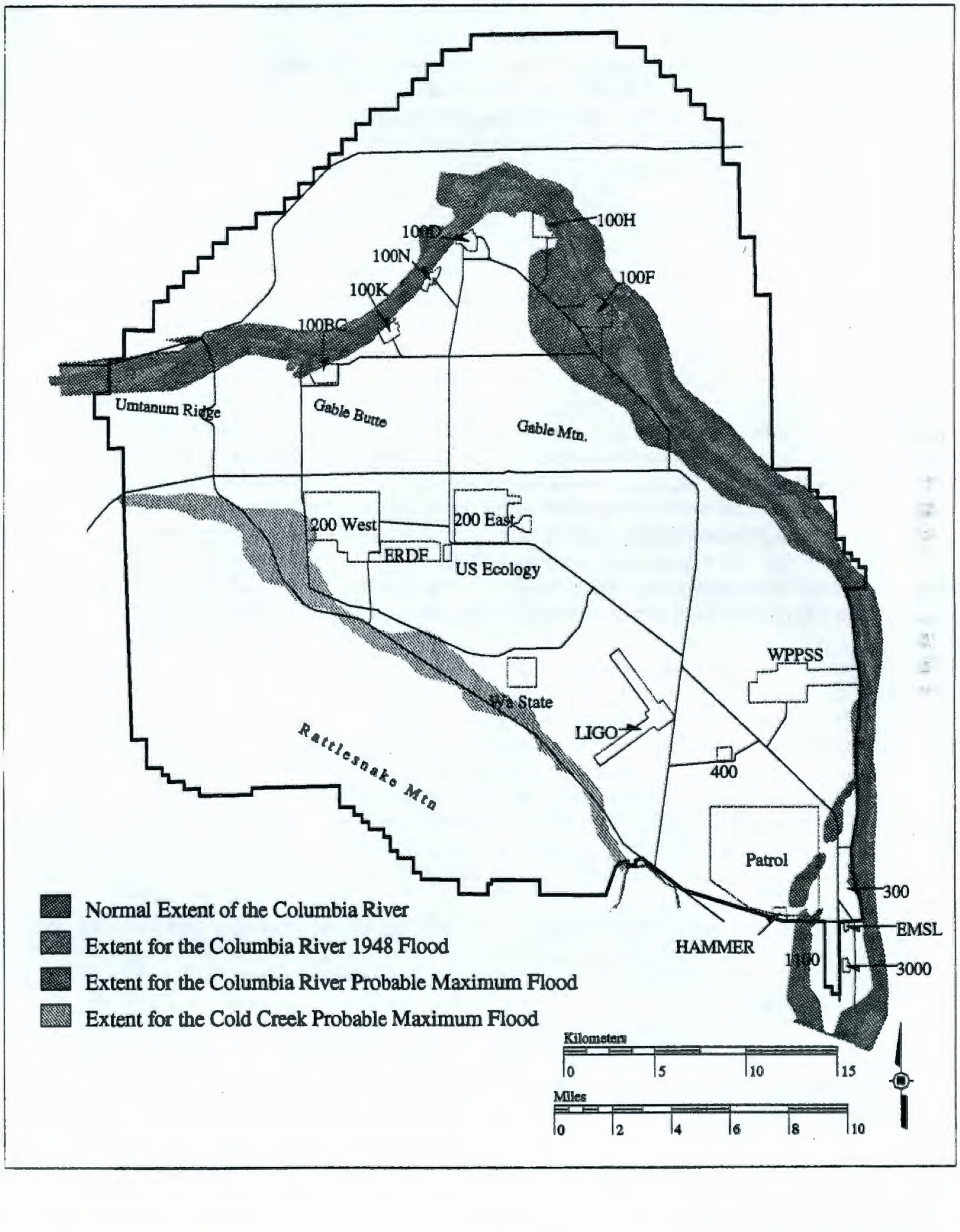
Total estimated precipitation over the Pasco Basin is about 9×10^8 m^3 (1.2×10^9 yd^3) annually, averaging less than 20 cm/yr (approximately 8 in./yr). Mean annual runoff from the Pasco Basin is estimated at less than 3.1×10^7 m^3/yr (4.1×10^7 yd^3/yr), or approximately 3 percent of the total precipitation. The basin-wide runoff coefficient is basically zero. The remaining precipitation is assumed to be lost through evapotranspiration, with less than 1 percent recharging the groundwater system. Precipitation contributes recharge to the groundwater in areas where soils are coarse-textured and bare of vegetation (PNNL 1996a).

4.3.1.1 Flooding. Large Columbia River floods have occurred in the past, but the likelihood of recurrence of large-scale flooding has been reduced by the construction of several flood control and water storage dams upstream of the Hanford Site. Major floods on the Columbia River typically result from rapid melting of the winter snowpack over a wide area, augmented by above-normal precipitation. The maximum historical flood on record occurred June 7, 1894, with a peak discharge at the Hanford Site of 21,000 m^3/s (742,000 ft^3/s). The largest recent flood took place in 1948, with an observed peak discharge of 20,000 m^3/s (706,280 ft^3/s) at the Hanford Site (PNNL 1996a). The floodplain associated with the 1948 flood is shown in Figure 4-10 (see text box, *"Hanford Site Quick Facts: Columbia River Floods"*).

Hanford Site Quick Facts: Columbia River Floods

- Largest flood on record: 1894 at 21,000 m^3/s
- Largest recent flood: 1948 at 20,000 m^3/s

Figure 4-10. Probable Maximum Flood of the Columbia River and Cold Creek, and the Actual 1948 Flood of the Columbia River (adapted from PNNL 1996a).



The Federal Emergency Management Agency has not prepared floodplain maps for the Hanford Reach because they only prepare maps for areas that are being developed (a criterion that specifically excludes the Hanford Reach).

Evaluation of flood potential is conducted, in part, through the concept of the probable maximum flood, which is determined from the upper limit of precipitation falling on a drainage area and other hydrologic factors (e.g., antecedent moisture conditions, snowmelt, and tributary conditions) that could result in maximum runoff. The probable maximum flood for the Columbia River below the Priest Rapids Dam has been calculated at 40,000 m^3/s (1.4 million ft^3/s) (see Figure 4-11) and is greater than the 500-year flood. This flood would inundate some portions of the 100 Area that are located adjacent to the Columbia River; the central portion of the Hanford Site would remain unaffected (PNNL 1996a). Floodplain issues are further discussed in Appendix C.

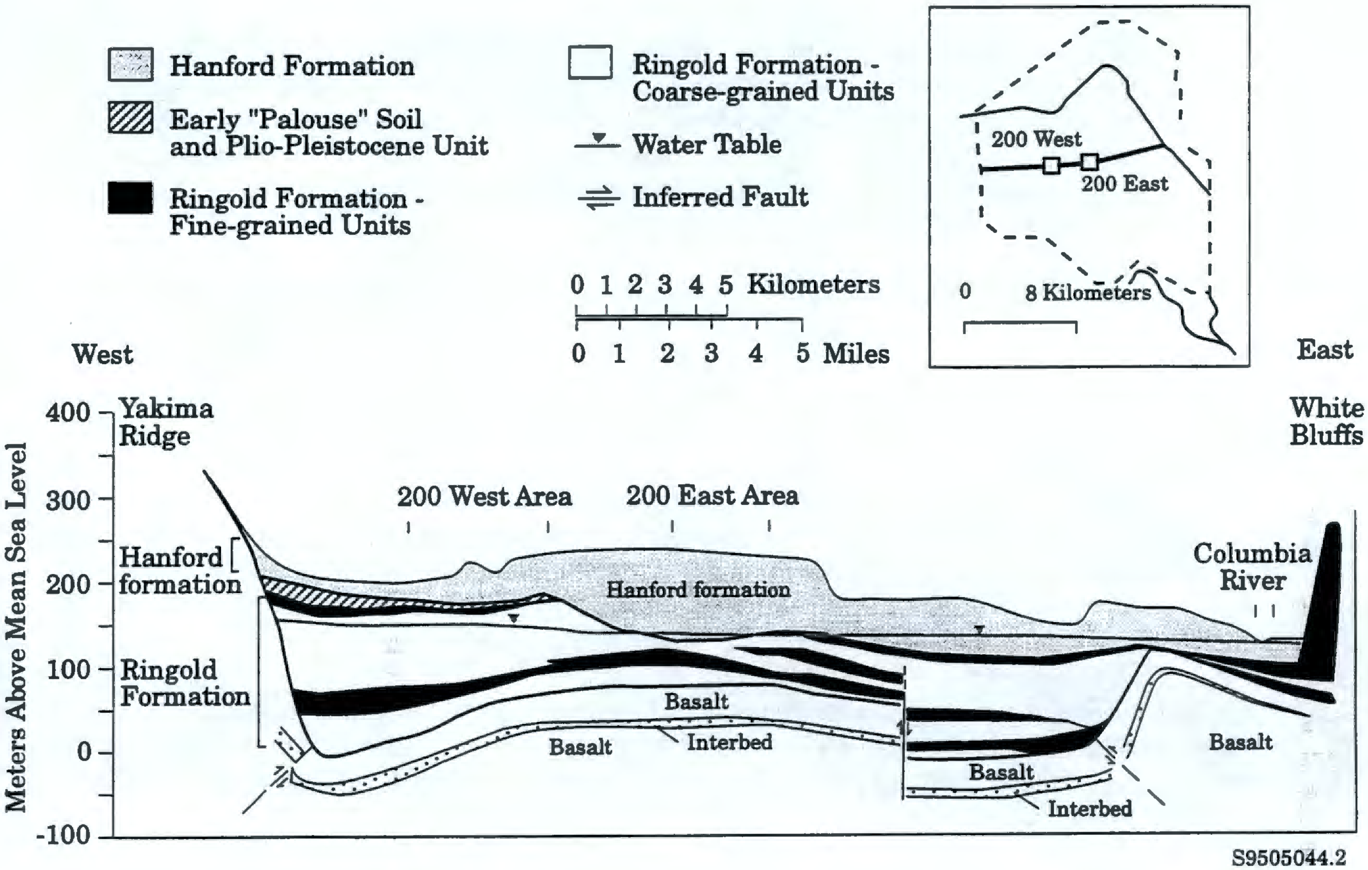
The USACE has derived the Standard Project Flood with both dam-regulated and unregulated peak discharges given for the Columbia River below Priest Rapids Dam (PNNL 1996a). The regulated Standard Project Flood for this part of the river is given as 15,200 m^3/s (540,000 ft^3/s), and the 100-year regulated flood as 12,400 m^3/s (440,000 ft^3/s).

Potential dam failures on the Columbia River have been evaluated (PNNL 1996a). Upstream failures could arise from a number of causes, with the magnitude of the resulting flood depending on the degree of breaching at the dam. The USACE evaluated a number of scenarios for failure of the Grand Coulee Dam, and assumed flow conditions of 11,000 m^3/s (400,000 ft^3/s). For purposes of emergency planning, they hypothesized that 25 and 50 percent breaches (the instantaneous disappearance of 25 or 50 percent of the center section of the dam) would result from the detonation of nuclear explosives in sabotage or war. The discharge or floodwave from such an instantaneous 50 percent breach at the outfall of the Grand Coulee Dam was determined to be 600,000 m^3/s (21 million ft^3/s). In addition to the areas inundated by the probable maximum flood, the remainder of the 100 Areas, the 300 Area, and nearly all of Richland, Washington, would be flooded (PNNL 1996a).

Determinations were not made for (1) failures of dams upstream, (2) associated failures downstream of Grand Coulee, or (3) breaches greater than 50 percent of Grand Coulee, because the 50 percent scenario was believed to represent the largest realistically conceivable flow that could result from a natural or human-induced breach (DOE 1995b); that is, it was not considered credible that a structure as large as the Grand Coulee Dam would be 100 percent destroyed instantaneously. The analysis also assumed that the 50 percent breach would occur only as the result of direct explosive detonation, not because of a natural event (e.g., an earthquake). Even a 50 percent breach under these conditions would indicate an emergency situation where other overriding major concerns might be present.

The possibility of a landslide resulting in river blockage and flooding along the Columbia River also has been examined for an area bordering the east side of the river upstream from the City of Richland (PNNL 1996a). The landslide area considered was the 75-m (250-ft)-high bluff (generally known as White Bluffs). Calculations were made for an 8×10^5 m^3 (1×10^6 yd^3) landslide volume with a concurrent flood flow of 17,000 m^3/s (600,000 ft^3/s) (a 200-year flood) that results in a flood wave crest elevation of 122 m (400 ft) above mean sea level. Areas inundated upstream from such a landslide event would be similar to a 50 percent breach of the Grand Coulee Dam.

Figure 4-11. Geologic Cross-Section of the Hanford Site (PNNL 1996c).



A flood risk analysis of Cold Creek was conducted in 1980 as part of the characterization of a geologic repository for high-level radioactive waste. This design work evaluated the probable maximum flood rather than the worst case and/or 100-year flood scenarios. Therefore, in lieu of 100- and 500-year floodplain studies, a probable maximum flood evaluation was made for a reference repository located directly west of the 200 East Area that encompasses the 200 West Area (PNNL 1996a). Figure 4-10 identifies the extent of this probable maximum flood.

4.3.1.2 Surface Water Quality. The Washington State Department of Ecology (Ecology) classifies the Columbia River, between Grand Coulee Dam and the mouth of the river near Astoria, Oregon, as Class A (excellent) (PNNL 1996a). Class A waters are suitable for essentially all uses, including drinking water, recreation, and wildlife habitat. Federal and State drinking water standards, as well as DOE Order 5400.5 (DOE 1993a), apply to the Columbia River and are currently being met.

The DOE funds PNNL to conduct routine monitoring (for both radiological and nonradiological water quality parameters) of the Columbia River. A yearly summary of these monitoring results has been published since 1973 (PNNL 1996b). Numerous water quality studies have been conducted on the Columbia River during the past 37 years. Three outfalls, located in the 100-K, 100-N, and 300 Areas of the Hanford Site, are covered by a National Pollutant Discharge Elimination System Permit (Permit No. WA-000374-3). These discharge locations are monitored for various measures of water quality, including nonradioactive and radioactive pollutants. The estimated dose from radionuclide releases is presented in environmental reports such as the *Hanford Site Environmental Report for Calendar Year 1995* (PNNL 1996b). In 1994, monitored liquid discharges resulted in a dose of 0.016 mrem to the downstream maximally exposed individual (PNL 1995).

Radiological monitoring of the Columbia River continues to show low levels of radionuclides. Although radionuclides associated with Hanford Site operations continued to be identified in Columbia River water in 1994, concentrations remained well below applicable standards at all monitored locations (PNL 1995).

In 1995, tritium, iodine-129, and uranium concentrations downstream of the Hanford Site were found to be slightly higher than upstream concentrations, but these concentrations were well below guidelines established by the DOE through DOE Order 5400.5 (DOE 1993a) and the U.S. Environmental Protection Agency (EPA) drinking water standards (Table 4-2). In 1995, the average annual strontium-90 and technetium-99 concentrations were essentially the same at Priest Rapids Dam (upstream of the Hanford Site) and at the Richland Pumphouse (PNNL 1996b).

For nonradiological water quality parameters measured in Columbia River water during 1995, concentrations of metals and anions were similar upstream and downstream and were found to be in compliance with applicable primary drinking water standards. Concentrations of volatile organic compounds (VOC) also were below regulatory standards (PNNL 1996b).

Table 4-2. Annual (1995) Average Concentrations of Radionuclides in Columbia River (adapted from PNNL 1996b).

Radionuclides	Water Concentrations (pCi/L)			Downstream Concentration as Percentage of Drinking Water Standard
	Upstream Concentration (Priest Rapids Dam)	Downstream Concentration (Richland Pumphouse)	EPA Drinking Water Standard	
H-3	34	79	20,000	0.40
Sr-90	0.08	0.09	8.0	1.1
U	0.40	0.50	20.0 (ug/L)[a]	2.5
Tc-99	ND	0.06	900	–
I-129	3.6×10^{-6}	5.7×10^{-5}	0.48	0.01

[a] Proposed
ND = Not detected.

4.3.2 Groundwater

The following sections describe the groundwater resources at the Hanford Site. Groundwater under the Hanford Site occurs under unconfined and confined conditions. The unconfined aquifer is contained within the glaciofluvial sands and gravels of the Hanford formation and within the Ringold Formation. This aquifer is dominated by the Ringold Unit E, consisting of sands and gravels with varying amounts of cementation. The bottom of the unconfined aquifer is the basalt surface or, in some areas, the clay zones of the Ringold Lower Mud Unit. A semi-confined aquifer occurs in areas where the coarse-grained Ringold Unit A lies between the basalt and the fine-grained Ringold Lower Mud Unit. The confined aquifers consist of sedimentary interbeds and/or interflow zones that occur between dense basalt flows in the Columbia River Basalt group. The main water-bearing portions of the interflow zones occur within a network of interconnecting vesicles and fractures of the basalt flow tops or flow bottoms. Figure 4-11 presents a generalized subsurface cross-section of the Hanford Site.

4.3.2.1 Groundwater Hydrology. The multi-aquifer system within the Pasco Basin has been conceptualized as consisting of four geohydrologic units: (1) Grande Ronde Basalt, (2) Wanapum Basalt, (3) Saddle Mountain Basalt, and (4) Hanford and Ringold formation sediments lying above the basalt units (see Figure 4-10). Geohydrologic units older than the Grande Ronde Basalt probably are of minor importance to the regional hydrologic dynamics and system. Together, the Grande Ronde, Wanapum, and Saddle Mountain Basalts compose the Columbia River Basalt group.

The Grande Ronde Basalt is the most voluminous and widely spread formation within the Columbia River Basalt group and has a thickness of at least 2,745 m (9,000 ft). The Grande Ronde Basalt is composed of the basalt flows and minor intercalated sediments that are equivalent to or part of the Ellensburg Formation (DOE 1988a). More than 50 flows of Grande Ronde Basalt underlie the Pasco Basin, but little is known of the lower 2,200 to 2,500 m (7,216 to 8,200 ft). Groundwater in these basalts is confined to semi-confined and is recharged along the margins of the Columbia Plateau where the basalt is at, or close to, the land surface and by surface-water and groundwater inflow from lands adjoining the plateau. Vertical movement into and out of this system is known to occur. Groundwater within the Grande Ronde Basalt in the eastern Pasco Basin is believed to originate from groundwater inflow from the east and the northeast.

The Wanapum Basalt consists of basalt flows intercalated with minor and discontinuous sedimentary interbeds of the Ellensburg Formation or equivalent sediments. In the Pasco Basin, the Wanapum Basalt consists of three members, each consisting of multiple flows. The Wanapum Basalt underlies the entire Pasco Basin and has a maximum thickness of 370 m (1,215 ft). Groundwater within the Wanapum Basalt is confined to semi-confined.

The Saddle Mountain Basalt is composed of the youngest formation of the Columbia River Basalt group and several thick sedimentary beds of the Ellensburg Formation or equivalent sediments, which comprise up to 25 percent of the unit. Within the Pasco Basin, the Saddle Mountain Basalt contains seven members, each with one or more flows. This Saddle Mountain Basalt underlies most of the Pasco Basin, attaining a thickness of about 290 m (950 ft), but is absent along the northwest part of the basin and along some anticlinal ridges. Groundwater in the Saddle Mountain Basalt is confined to semi-confined, with recharge and discharge believed to be local (DOE 1988a).

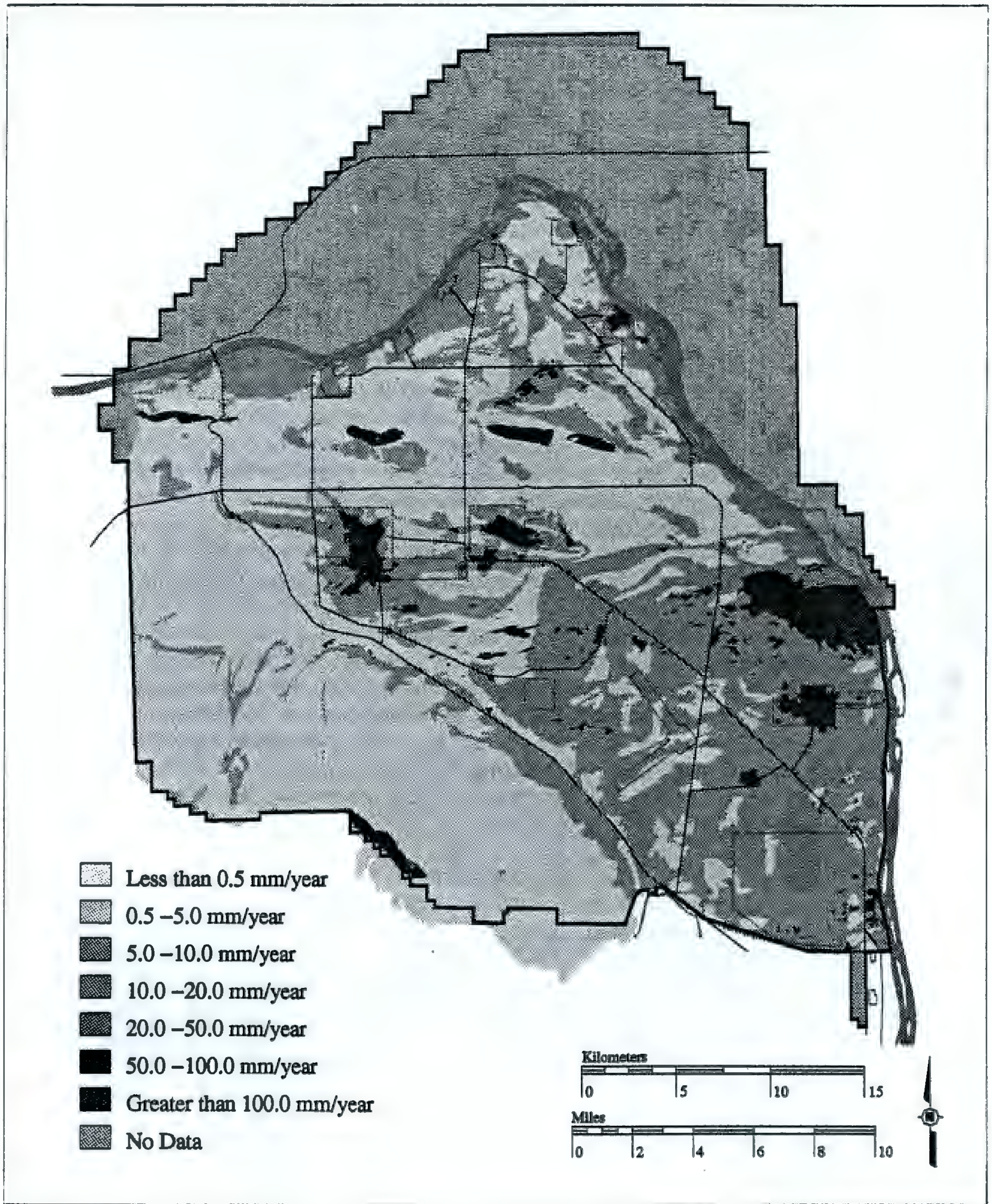
The rock materials that overlie the basalts in the structural and topographic basins within the Columbia Plateau generally consist of Miocene-Pliocene sediments, volcanics, Pleistocene sediments (including those from catastrophic flooding), and Holocene sediments consisting mainly of alluvium and eolian deposits. The suprabasalt sediment (referred to as the Hanford/Ringold unit) consists principally of the Miocene-Pliocene Ringold Formation stream, lake, and alluvial materials, and the Pleistocene catastrophic flood deposits informally called the Hanford formation. Groundwater within the suprabasalt sediment is unconfined, with recharge and discharge usually coincident with topographic highs and lows (DOE 1988a). The Hanford/Ringold unit is restricted to the Pasco Basin; principal recharge occurs (along the periphery of the basin) from precipitation and ephemeral streams.

4.3.2.2 Groundwater Recharge. Little, if any, natural recharge occurs within the Hanford Site, but artificial recharge occurs from liquid waste disposal activities (PNNL 1996b) (Figure 4-12). Recharge from irrigation occurs east and north of the Columbia River and in the synclinal valleys west of the Hanford Site. Within the Pasco Basin, recharge occurs along the anticlinal ridges to the north and west and from groundwater inflow from the east and northeast (DOE 1988a). Sources of natural recharge to the unconfined aquifer are rainfall and runoff from the higher bordering elevations, water infiltrating from small ephemeral streams, and river water along influent reaches of the Yakima and Columbia rivers. To define the movement of water in the unsaturated (vadose) zone, the movement of precipitation through the vadose zone has been studied at several locations on the Hanford Site. Conclusions from these studies vary depending on the location studied.

From the recharge areas to the west, groundwater flows downgradient to the discharge areas, primarily along the Columbia River. This general west-to-east flow pattern is interrupted locally by the groundwater mounds in the 200 East and 200 West Areas. From the 200 East and 200 West Areas, a component of groundwater also flows to the north, between Gable Mountain and Gable Butte. These flow directions represent current conditions; the aquifer is dynamic, and responds to changes in natural and artificial recharge.

Studies indicate that local recharge to the shallow basalts results from infiltration of precipitation and runoff along the margins of the Pasco Basin. Regional recharge of the deep basalts is thought to result from interbasin groundwater movement that originates northeast and northwest of the Pasco Basin in areas where the Wanapum and Grande Ronde Basalt outcrops are extensive (DOE 1995b). Groundwater is discharged from the shallow basalt to the overlying unconfined aquifer and the Columbia River. In some cases, well bores may have allowed water movement between the unconfined aquifer and the confined aquifer.

Figure 4-12. Estimated Recharge from Infiltration of Precipitation and Irrigation on the Hanford Site.



4.3.2.3 Groundwater Quality. The quality of the groundwater at the Hanford Site has been affected by many of the activities related to the production of nuclear materials. Due to the arid climate, natural recharge of the groundwater on the Hanford Site is low. Artificial recharge has occurred in the past from the disposal of liquid waste associated with processing operations in the 100, 200, and 300 Areas, which created mounds of water underlying discharge points. Large areas underlying the Hanford Site have elevated levels of both radiological and nonradiological constituents. The liquid effluents discharged into the ground have carried with them a variety of radionuclides and chemicals that move through the soil column at differing rates, eventually entering the groundwater and forming plumes of contamination (see text box, *"Hanford Site Quick Facts: Principal Groundwater Contaminants"*).

Hanford Site Quick Facts: Principal Groundwater Contaminants

- chromium
- nitrate
- trichloroethylene
- fluoride
- carbon tetrachloride
- chloroform
- arsenic
- cobalt-60
- strontium-90
- tritium
- uranium
- cesium-137
- iodine-129
- plutonium
- technetium-99

4.3.2.3.1 Unconfined Aquifer. As part of the continuing environmental monitoring program at the Hanford Site, groundwater monitoring reports are published in the *Hanford Site Environmental Report* (PNNL 1996b), which is issued each calendar year. The shallow, unconfined aquifer in the Pasco Basin and on the Hanford Site contains waters of a dilute (less than or approximately 350 mg/L total dissolved solids) calcium bicarbonate chemical type. Other principal constituents include sulfate, silica, magnesium, and nitrate. Variability in chemical composition exists within the unconfined aquifer because of natural variation in the composition of the geologic strata, and irrigation and other agricultural practices north, east, and west of the Hanford Site—and on the Hanford Site, because of liquid waste disposal.

Radioactive and nonradioactive liquid effluents were discharged to the environment from facilities in the Central Plateau (DOE 1995b). The U.S. Department of Energy, Richland Operations Office (RL) has committed by October 1997 to implement the best available technology and all known and reasonable methods of prevention, control, and treatment for several of the effluent streams, and to obtain permits for the waste streams under the "State Waste Water Discharge Permit Program," *Washington Administrative Code* (WAC) 173-216. The goal associated with the use of best available technology is to eliminate, minimize, or treat effluents discharged to the ground.

4.3.2.3.2 Confined Aquifer. The uppermost confined aquifer (Rattlesnake Ridge) was sampled to determine what extent of groundwater contamination occurred from interaction between the confined and unconfined aquifers. Groundwater samples from selected confined aquifer wells were analyzed for a variety of radionuclides and hazardous chemicals. In most cases, no indication of contamination was observed. Detection of radionuclides in well 299-E33-12 (the Central Plateau) was attributed to contamination by high-salt waste that migrated by density flow into the borehole when it was open to both the unconfined and the confined aquifer during drilling (PNNL 1996b). The 1995 samples from well 299-E33-12 contained up to 458 pCi/L of tritium, similar to levels detected since 1982. The 1995 samples from this well also contained cobalt-60 at levels up to 31.4 pCi/L, nitrate at levels up to 11 mg/L, technetium-99 at levels up to 1,560 pCi/L, and cyanide at levels up to 20.7 µg/L. Although all of these constituents are indicators of contamination, only nitrate and technetium-99 were detected at levels greater than drinking water standards.

4.3.3 Water Use

Water use in the Pasco Basin is primarily from surface diversion, with groundwater diversions accounting for less than 10 percent of the total use (DOE 1988a). Historically, industrial, agricultural, and municipal usage represented about 32, 50, and 9 percent, respectively. Until recently, the Hanford Site used about 81 percent of the water withdrawn for industrial purposes. However, because of the N Reactor shutdown, and considering other data (DOE 1988a), these percentages now approximate 13 percent for industrial, 75 percent for agricultural, and 12 percent for municipal uses, with the Hanford Site accounting for about 41 percent of the water withdrawn for industrial use (DOE 1995b). The first downstream drinking water intake below the Hanford Site is the City of Richland intake.

The largest categories of wells in the Pasco Basin are those used for domestic purposes (approximately 50 percent). Agricultural wells, used for irrigation and stock supply, constitute the second-largest category of well use (about 24 percent for the Pasco Basin). Industrial users account for only about 3 percent of the wells (DOE 1995b).

Most of the water used by the Hanford Site is withdrawn from the Columbia River. The water distribution systems supplying river water are located at the 100-B, 100-D, 200, and 300 Areas at the WPPSS. In addition, wells supply water to the 400 Area and a variety of low-use facilities at remote locations. The 700 and 1100 Areas are supplied with water by the City of Richland.

Regional effects of water-use activities are apparent in some areas where the local water tables have declined because of withdrawals from wells. In other areas, water levels in the shallow aquifers have risen because of artificial recharge mechanisms, such as excessive application of imported irrigation water or impoundment of streams. Wastewater ponds on the Hanford Site have artificially recharged the unconfined aquifer below the 200 East and 200 West Areas. The increase in water table elevations was most rapid from 1950 to 1960 and slowed down substantially between 1970 and 1980, when only small increases in water table elevations occurred. Wastewater discharges from the 200 West Area were reduced significantly in 1984 (DOE 1988a), with an accompanying decline in water table elevations.

The Vernita Bar Settlement Agreement, executed June 16, 1988, established a minimum Columbia River flow below Priest Rapids Dam to protect salmon spawning habitat. This Agreement was signed by the Washington Public Utility Districts in Chelan, Grant, and Douglas counties; the Bonneville Power Administration (BPA); National Marine Fisheries Service; WDFW; Oregon Department of Fish and Wildlife; Yakama Indian Nation; the Umatilla Confederated Tribes; and the Colville Confederated Tribes. The Agreement was then approved by the Federal Energy Regulatory Commission as a condition of the license for the Priest Rapids Dam. This minimum flow is in effect from about December 15 to May 31 each year to hold flows down during the fall (which will limit the area of fall chinook salmon spawning to the lower elevations of the Vernita Bar), and then to provide sufficient flows during the winter and spring to assure the survival of the eggs and newly hatched fish. The Vernita Bar Agreement limits river flow in the fall to 1,960 m^3/s (70,000 ft^3/s). The post-spawning flows are determined annually, based on field surveys that identify when, where, and to what extent spawning has occurred (NPS 1994).

4.3.3.1 Water Rights. Water rights in the state of Washington are determined by the Washington State Superior Courts and regulated by Ecology. Water sources relevant to the discussion in this document include the Columbia River and underground aquifers on the Hanford Site.

The DOE's past and present water withdrawals at the Hanford Site are based on the "Federal Reserved Water Rights" doctrine. This doctrine, developed as case law from U.S. Supreme Court rulings, holds that the Federal government, when it withdraws public domain lands for the purpose of the creation of a Federal reservation, necessarily withdraws unappropriated water rights sufficient to meet the needs for which the reservation was created. The date of priority of these rights is the date of creation of the reservation. In the case of the Hanford Site, this date is 1943. It is the general rule that Federal reserved water rights cease to exist when the Federal reservation ceases to be used for the purposes for which it was created. The limited exception to the rule is reflected in the *U.S. v. Powers*, 305 U.S. 527 (1939), wherein the Court allowed that a purchaser of agricultural land on an Indian reservation may be entitled to a portion of Federal reserved water rights where the use of the property did not change.

The Federal government has not established its own water rights regulation. Instead, it uses the regulatory procedures outlined in the State water rights laws to document the extent of its rights. There has been no general adjudication in the State of Washington of the water rights in the Columbia River and, therefore, the reserved water right of the Hanford Site has not been documented. The quantity of that right, however, would be equal to the maximum amounts used at Hanford during its operation, up to the amount of unappropriated water in the Columbia River as of 1943.

In a report entitled *Hanford Land Transfer* (Ecology 1993), Ecology indicated that if water rights were attached to privately owned parcels of land acquired in fee by the Federal government for the creation of Hanford in 1943, those water rights may continue to be attached to these parcels of land. Ecology has indicated that it has not taken action to extinguish these rights, although under Washington law appropriative water rights are subject to be extinguished if unused for a period of five years.

Further complications exist regarding non-Federal water rights claims at the Hanford Site. The first is the issue of groundwater contamination at Hanford. The second is that the date for filing a water rights claim in the Hanford sub-basin, for both Columbia River water and groundwater, expired in 1992. No claims for water rights under state law appear to have been filed within the required time period (NPS 1994).

4.4 Air Resources

This section addresses the general air resources at the Hanford Site and the surrounding region. Included in this section are discussions on climate and meteorology, ambient air quality, and atmospheric dispersion.

4.4.1 Climate and Meteorology

The Hanford Site climate is classified as mid-latitude semi-arid or mid-latitude desert, depending on the climatological classification scheme used. Summers are warm and dry, with abundant sunshine. Large diurnal temperature variations result from intense solar heating during the day and radiational cooling at night. Daytime high temperatures in June, July, and August periodically exceed 38°C (100°F). Winters are cool, with occasional precipitation. Outbreaks of cold air associated with modified arctic air masses can reach the area and cause temperatures to drop below -18°C (0°F). Overcast skies and fog occur periodically (DOE 1995b).

Topographic features have a significant impact on the climate of the Hanford Site. All air masses that reach the region undergo some modification during their passage over the complex topography of the Pacific Northwest. The climate of the region is strongly influenced by the Pacific Ocean and the Cascade Range to the west. The relatively low annual average rainfall of 16.1 cm (6.3 in.) at the Hanford Meteorological Station (HMS) is caused largely by the rain shadow created by the Cascade Range. These mountains limit much of the maritime influence of the Pacific Ocean, resulting in a more continental-type climate than would exist if the mountains were not present. Maritime influences are experienced in the region during the passage of frontal systems and as a result of movement through gaps in the Cascade Range (e.g., the Columbia River Gorge).

The Rocky Mountains to the east and the north also influence the climate of the region. These mountains play a key role in protecting the region from the more severe winter storms and the extremely low temperatures associated with the modified arctic air masses that move southward through Canada. Local and regional topographical features, such as the Yakima Ridge and the Rattlesnake Hills, also impact meteorological conditions across the Hanford Site (DOE 1995b). In particular, these features have a significant impact on wind directions, wind speeds, and precipitation levels.

Climatological data are available for the HMS, which is located between the 200 East and 200 West Areas. Data collected at this location since 1945 (PNL 1994b) are representative of the general climatic conditions for the region and describe the specific climate of the Central Plateau. Local variations in the topography of the Hanford Site may cause some aspects of the climate to differ significantly from those of the HMS (see text box, *"Hanford Site Quick Facts: Meteorology"*). For example, winds near the Columbia River are different from those at the HMS. Similarly, precipitation along the slopes of the Rattlesnake Hills differs from that at the HMS.

> ***Hanford Site Quick Facts: Meteorology***
>
> - Average annual precipitation: 16.1 cm (6.3 in.)
> - Prevailing wind direction: Northwest
> - Average monthly temperature: January - 0.9°C (30°F); July - 24.6°C (76°F)

4.4.1.1 Wind. Prevailing wind directions on the Central Plateau are from the northwest during all months of the year; southwesterly winds occur less frequently. Summaries of wind direction indicate that winds from the northwest quadrant occur most often during the winter and summer. During the spring and fall, the frequency of southwesterly winds increases with a corresponding decrease in northwest flow. Winds blowing from other directions (e.g., the northeast) display minimal variation from month to month. Monthly average wind speeds are lowest during the winter months, averaging 10 to 11 km/hr (6 to 7 mi/hr), and highest during the summer, averaging 14 to 16 km/h (8 to 10 mi/hr). Summertime drainage winds generally are northwesterly and can frequently gust to 50 km/hr (30 mi/hr) (PNNL 1996a).

4.4.1.2 Temperature and Humidity. Nine separate temperature measurements are made at the 122-m (400-ft) tower at the HMS. Temperatures also are measured at the 2-m (6.5-ft) level on the twenty-four 9.1-m (30-ft) towers located on and around the Hanford Site. The three 61-m (200-ft) towers have temperature-measuring instrumentation at the 2-, 9.8-, and 61-m (6.5-, 33-, and 200-ft) levels. The temperature data from the 9.1- and 61-m (30- and 200-ft) towers are telemetered to the HMS.

Ranges of daily maximum and minimum temperatures vary from normal maxima of 2°C (35°F) in late December to 35°C (95°F) in late July (PNL 1994b). On the average, 51 days during the summer months have maximum temperatures greater than or equal to 32°C (90°F), and 12 days have maxima greater than or equal to 38°C (100°F). From mid-November through early March, minimum temperatures average less than or equal to 0 °C (32°F), with the minima in late December and early January averaging -6°C (-21°F). During the winter, on average, four days have minimum temperatures less than or equal to -18°C (0°F); however, only about one winter in two experiences such temperatures. The record maximum temperature is 45°C (113°F), and the record minimum temperature is -31°C (-23°F). For the period of 1946 through 1993, the average monthly temperatures ranged from a low of -0.9°C (30°F) in January to a high of 24.6°C (76°F) in July. During the winter, the highest monthly average temperature at the HMS was 6.9°C (44°F), and the record average lowest temperature was -11.1°C (12°F), both occurring during February. During the summer, the record highest monthly average temperature was 27.9°C (82°F) in July, and the record lowest temperature was 17.2°C (63°F) in June.

Relative humidity and dew-point temperature measurements are made at the HMS and at the three 61-m (200-ft) tower locations. The annual average relative humidity at the HMS is 54 percent. It is highest during the winter months, averaging about 75 percent, and lowest during the summer, averaging about 35 percent. Fog reduces the visibility to 9.6 km (6 mi) during an average of 42 days/yr and to less than 0.4 km (0.25 mi) during an average of 25 days/yr (DOE 1995b).

4.4.1.3 Precipitation. The average annual precipitation at the HMS is 16.1 cm (6.3 in.). Winter monthly average snowfall ranges from 0.8 cm (0.3 in.) in March to 14.5 cm (6 in.) in January. The seasonal record snowfall of 142 cm (56 in.) occurred in the winter of 1993. During the months of December, January, and February, snowfall accounts for about 38 percent of all precipitation (PNNL 1996a). Rainfall intensities of at least 1.3 cm/hr (0.5 in./hr), persisting for 1 hour, has only a 10 percent probability of occurring in any given year. A rainfall intensity of at least 2.5 cm/hr (1 in./hr) has only a 0.2 percent probability of occurring in any given year.

4.4.1.4 Severe Weather. Severe weather on the Hanford Site may include a variety of meteorological events, which include severe winds, blowing dust, hail, fog, ash falls, extreme temperatures, temperature inversions, and blowing and drifting snow. The HMS climatological summary and the National Severe Storms Forecast Center database list only 24 separate tornado occurrences within 160 km (100 mi) of the Hanford Site from 1916 to 1995 (PNNL 1996a). Only one of these tornadoes was observed within the boundaries of the Hanford Site (on the extreme western edge), and no damage resulted. The estimated probability of a tornado striking a point at the Hanford Site is 9.6×10^{-6}/yr (PNNL 1996a). Because tornadoes are infrequent and generally small in the Pacific Northwest (and hurricanes do not reach this area), risk from severe winds normally are associated with thunderstorms or the passage of strong cold fronts. The greatest peak wind gust was 130 km/hr (81 mi/hr), recorded at 15 m (50 ft) above ground level at the HMS. Extrapolations based on 35 years of observations indicate a return period of about 200 years for a peak gust in excess of 145 km/hr (90 mi/hr) at 15 m (50 ft) above ground level.

4.4.1.5 Atmospheric Stability. Atmospheric dispersion is a function of wind speed, duration and direction of wind, atmospheric stability, and mixing depth. Dispersion conditions generally are good if winds are moderate to strong, if the atmosphere is of neutral or unstable stratification, and if there is a deep mixing layer. Good dispersion conditions associated with neutral and unstable stratification exist about 57 percent of the time during the summer. Less favorable dispersion conditions might occur when the wind speed is light and the mixing layer is shallow. These conditions are most common during the winter when moderately to extremely stable stratification exists about 66 percent of the time. Less favorable conditions also occur periodically for surface and low-level releases in all seasons from about sunset to about 1 hour after sunrise, as a result of ground-based temperature inversions and shallow mixing layers (PNNL 1996a).

4.4.2 Air Quality

The EPA has set National Ambient Air Quality Standards (NAAQS) that define levels of air quality that are necessary to protect the public health (primary standards) and the public welfare (secondary standards). Regional air quality is generally good, with the occasional exception due to blowing dust.

***4.4.2.1 Regional Air Quality*.** Air quality in the Hanford region is well within the state and Federal standards for criteria pollutants, except that short-term particulate concentrations occasionally exceed the 24-hour "particulate matter nominally 10 microns or less" (PM_{10}) standard. Because the highest concentrations of airborne particulate material are generally a result of natural events, the area has not been designated nonattainment[1] with respect to the PM_{10} standard.

Particulate concentrations can reach relatively high levels in eastern Washington State because of extreme natural events (e.g., dust storms, volcanic eruptions, and large brushfires) that occur in the region. "Rural fugitive dust" from extreme natural events was not considered when estimating the maximum background concentrations of particulates in the area east of the Cascade Mountain crest and when determining Washington State ambient air quality standards. In the past, the EPA has exempted the rural fugitive dust component of background concentrations when considering permit applications and enforcement of air quality standards. However, the EPA is now investigating the prospect of designating parts of Benton, Franklin, and Walla Walla counties as a nonattainment area for PM_{10}. Windblown dust has been identified as a particularly large problem in this area.

Ecology has been working with the EPA and the Benton County Clean Air Authority under a MOA to characterize and document the sources of PM_{10} emissions and develop appropriate control techniques in the absence of formally designating the area nonattainment. At this time, the parties are characterizing the sources of PM_{10} emissions and working through other items in the MOA. A final decision on this issue will be made by the EPA, when the final results of the PM_{10} characterization analysis are received (PNNL 1996a).

Ecology conducted the only offsite monitoring (for PM_{10}) near the Hanford Site in 1993 (PNNL 1996a). PM_{10} was monitored at one location in Benton County—at Columbia Center in Kennewick located approximately 24.1 km (15 mi) southeast of the Hanford Site. During 1993, the 24-hour PM_{10} standard established by the State of Washington, 150 $\mu g/m^3$, was exceeded twice at the Columbia Center monitoring location. The maximum 24-hour concentration at Columbia Center was 1,166 $\mu g/m^3$ (the suspected cause was windblown dust); the other occurrence greater than 150 $\mu g/m^3$ was 155 $\mu g/m^3$. The site did not exceed the annual primary standard, 50 $\mu g/m^3$, during 1993. The arithmetic mean for 1993 was 32 $\mu g/m^3$ at Columbia Center.

During the past 10 years, carbon monoxide, sulfur dioxide, and nitrogen dioxide have been monitored periodically in communities and commercial areas southeast of the Hanford Site. These urban measurements are used to estimate the maximum background pollutant concentrations for the Hanford Site. Because these measurements were made in the vicinity of local sources of pollution, they might overestimate maximum background concentrations for the Hanford Site or at the Hanford Site boundaries. Concentrations of toxic chemicals, as listed in 40 CFR 60.1, are not measured and, therefore, are not available for the Hanford Site.

---

[1]A nonattainment area is an area where measured concentrations of a pollutant are above the primary or secondary NAAQS.

4.4.2.2 Hanford Site Nonradiological Air Quality. The NAAQS, set by EPA, must be met at the Hanford Site boundary or other publicly accessible locations (e.g., highways on the Hanford Site). The standards define levels of air quality that are necessary, with an adequate margin of safety, to protect the public health and welfare. Standards exist for sulfur oxides (measured as sulfur dioxide), nitrogen dioxide, carbon monoxide, total suspended particulates (TSP), PM_{10}, lead, and ozone. The standards specify the maximum pollutant concentrations and frequencies of occurrence that are allowed for specific averaging periods (e.g., the concentration of carbon monoxide when averaged over 1 hour is allowed to exceed 40 mg/m^3 only once a year). The averaging periods vary from 1 hour to 1 year, depending on the pollutant.

In addition to ambient air quality standards, the EPA has established standards for the Prevention of Significant Deterioration (PSD) of air quality. PSD standards provide maximum allowable increases in concentrations of pollutants for areas already in compliance with NAAQS. The PSD standards are expressed as allowable increments in atmospheric concentrations of specific pollutants (nitrogen dioxide, sulfur dioxide, and PM_{10}) (40 CFR 52). Different PSD standards exist for Class I areas (where degradation of ambient air quality is restricted) and Class II areas (where moderate degradation of air quality is allowed).

The closest Class I areas to the Hanford Site are as follows:

- Mount Rainier National Park, approximately 160 km (100 mi) west of the Hanford Site
- Goat Rocks Wilderness Area, approximately 145 km (90 mi) west of the Hanford Site
- Mount Adams Wilderness Area, approximately 150 km (95 mi) southwest of the Hanford Site
- Alpine Lakes Wilderness Area, approximately 175 km (110 mi) northwest of the Hanford Site.

If the Hanford Reach is given Congressional status as a Wild and Scenic River with the Wahluke Slope added as a wildlife refuge, then it would be eligible for Class 1 air shed status.

The PSD standards are presented in Table 4-3. The Hanford Site, which is located in a Class II area, operates under a PSD permit (Permit No. PSD-X80-14) issued by the EPA in 1980. This permit provides specific limits for emissions of nitrogen oxide from the Plutonium-Uranium Extraction (PUREX) and the Uranium-Trioxide plants which are now closed and being decommissioned.

State and local governments have the authority to impose standards for ambient air quality that are more stringent than the national standards. Washington State has established more stringent standards for sulfur dioxide. In addition, Washington has established standards for VOCs, fluoride, TSPs, and other pollutants that are not covered by national standards. The state standards for carbon monoxide, nitrogen dioxide, PM_{10}, and lead are identical to the national standards. Table 4-4 summarizes the relevant air quality standards (Federal and supplemental state standards).

Emission inventories for permitted pollution sources in Benton County are routinely compiled by the Benton County Clean Air Authority. The annual emission rates for Hanford Site sources are reported to Ecology by DOE (Table 4-5).

Table 4-3. Maximum Allowable Increases for Prevention of Significant Deterioration of Air Quality (40 CFR 52).

Pollutant	Averaging Time	Class I	Class II
Particulate matter[a] (PM_{10}) (µg/m^3)	Annual	4	17
	24 hours	8	30
Sulfur dioxide (µg/m^3)	Annual	2	20
	24 hours	5	91
	3 hours	25	512
Nitrogen dioxide (µg/m^3)	Annual	2.5	25

[a] PM_{10} is defined as particulate matter nominally 10 microns or less.

Monitoring of nitrogen oxides was discontinued after 1990, mostly because of the end of operations at the PUREX facility. Monitoring of TSP was discontinued in early 1988 when the Basalt Waste Isolation Project ended (for which those measurements were required).

In 1995, air samples of semi-volatile organic compounds were collected in the 200 and 300 Areas, and at a background location near Rattlesnake Springs. In assessing semi-volatile organic compound concentrations, samples were analyzed for individual polychlorinated biphenyl (PCB) congener, polycyclic aromatic hydrocarbons, phthalate ester plasticizers, and chlorinated pesticides. The 300 Area had higher average concentrations of polycyclic aromatic hydrocarbons and chlorinated pesticides than the other monitoring locations. Air concentrations at the 300 Area are influenced by sources on the Hanford Site and in the neighboring community and agricultural areas. There was little difference between monitoring sites in the average measured concentrations of total PCBs, while the concentrations of phthalate ester plasticizers were below the detection limit (PNNL 1996a).

Ambient air monitoring for radionuclides during 1995 consisted of sampling at 40 onsite and offsite locations. Total concentrations of beta-emitting radionuclides at the Hanford Site perimeter were indistinguishable from those at distant locations that are unaffected by Hanford emissions. Air concentrations of total alpha are slightly elevated at the Hanford Site perimeter; concentrations in nearby communities were within the range of historical values (PNL 1995). Concentrations of two radionuclides (tritium and iodine-129) were elevated relative to background; however, the contribution of these radionuclides to total airborne activity was small.

4.5 Biological Resources

As a Federal land manager, the DOE is responsible for conserving fish, wildlife, and plant populations and their habitats on the Hanford Site. Information about these natural resources is presented below. The Washington Department of Fish and Wildlife identifies priority habitats and priority species within Washington State. Counties and cities may use information prepared by the WDFW to classify and designate locally important habitats and species. While these priorities are those of the Department, they and the data on which they are based may be considered by counties and cities when developing their land-use plans under the GMA (WAC 365-180-080).

Table 4-4. National and Washington State Ambient Air Quality Standards.[a]

Pollutant	National Primary	National Secondary	Washington State
Total suspended particulates			
Annual geometric mean	NS	NS	60 μg/m³
24-hour average	NS	NS	150 μg/m³
PM-10 (fine particulates)			
Annual arithmetic mean	50 μg/m³	50 μg/m³	50 μg/m³
24-hour average	150 μg/m³	150 μg/m³	150 μg/m³
PM-2.5			
Annual arithmetic mean	15 μg/m³	–	–
24-hour average	65 μg/m³	–	–
Sulfur dioxide			
Annual average	0.03 ppm	NS	0.02 ppm
24-hour average	0.14 ppm	NS	0.10 ppm
3-hour average	NS	0.50 ppm	NS
1-hour average	NS	NS	0.40 ppm[b]
Carbon monoxide			
8-hour average	9 ppm	9 ppm	9 ppm
1-hour average	35 ppm	35 ppm	35 ppm
Ozone			
1-hour average	—	0.12 ppm	0.12 ppm
8-hour average	0.08 ppm[c]	—	—
Nitrogen dioxide			
Annual average	0.05 ppm	0.05 ppm	0.05 ppm
Lead			
Quarterly average	1.5 μg/m³	1.5 μg/m³	1.5 μg/m³
Fluoride			
30-day average			0.84 mg/m³
7-day average			1.7 mg/m³
24-hour average			2.9 mg/m³
12-hour average			3.7 mg/m³
VOCs			source-specific standards

[a] Annual standards are never to be exceeded; short-term standards are not to be exceeded more than once per year unless otherwise noted (Ecology 1994).

[b] 0.25 ppm not to be exceeded more than twice in any 7 consecutive days; not to be exceeded more than 1 day per calendar year.

[c] Based on a 3-year average of the annual fourth highest daily maximum 8-hour average.

NS = no standard
ppm = parts per million
μg/m³ = micrograms per cubic meter
VOC = volatile organic compound

Table 4-5. Nonradioactive Constituents Discharged to the Atmosphere, 1995[a] (Dirkes and Hanf 1996).

Constituent	Release (kg)		
	200 East Area	200 West Area	300 Area
Particulate matter	3.40×10^2	8.02×10^1	1.43×10^4
Nitrogen oxides	1.77×10^5	2.82×10^4	4.69×10^4
Sulfur oxides	2.25×10^5	3.53×10^4	2.34×10^5
Carbon monoxide	6.43×10^4	1.01×10^4	4.25×10^3
Lead	1.62×10^2	2.53×10^1	2.52×10^1
Volatile organic compounds[b]	6.43×10^2	1.00×10^2	2.38×10^2
Ammonia[c]	6.18×10^3	1.53×10^3	NM
Arsenic	1.73×10^2	2.70×10^1	1.48×10^1
Beryllium	2.33×10^1	3.64×10^0	5.46×10^1
Cadmium	1.37×10^1	2.18×10^0	2.74×10^1
Carbon tetrachloride[d]	NM	NE	NM
Chromium	5.01×10^2	7.83×10^1	1.67×10^1
Cobalt	NE	NE	1.57×10^1
Copper	3.15×10^2	5.02×10^2	3.62×10^1
Formaldehyde	7.05×10^1	1.25×10^1	5.27×10^1
Manganese	6.93×10^2	1.08×10^2	9.63×10^0
Mercury	5.11×10^0	8.08×10^1	4.16×10^0
Nickel	4.12×10^2	6.43×10^1	3.03×10^2
Polycyclic organic matter	NE	6.00×10^2	7.14×10^3
Selenium	6.26×10^1	9.84×10^0	4.94×10^0
Vanadium	4.31×10^1	7.79×10^0	3.93×10^2

a The estimate of volatile organic compound emissions do not include emissions from certain laboratory operations; NM = not measured; NE = no emissions.

b Produced from burning fossil fuels for steam generation.

c Ammonia releases are from the 200 East Area tank farms, 200 West Area tank farms, and the operation of the 242-A Evaporator.

d Does not include carbon tetrachloride Vapor Extraction Project releases from passively ventilated wells.

The Hanford Site is located within a region known as the Columbia Basin Ecoregion, which occupies an extensive area south of the Columbia River between the Cascade Range and Blue Mountains in Oregon and roughly two-thirds of the area of Eastern Washington. This region has been botanically characterized as a shrub-steppe ecosystem, with various shrub and bunchgrass associations playing dominant roles. The region is often referred to as high desert, northern desert shrub, or desert scrub (Franklin and Dyrness 1973).

Settlement during the late 19th and early 20th century has resulted in significant changes to vegetation patterns through activities such as farming, dam development, and regional settlement. The State of Washington is rapidly losing much of its remaining steppe habitat and losses are projected to be high for the next 50 years. It has been estimated that approximately

60 percent of the original acreage (4.2 million ha [10.4 million ac]) of shrub-steppe vegetation in Washington has been lost, primarily to agriculture (DOE-RL 1996c) (see text box, *"What is Shrub-Steppe?"*).

An illustration of this habitat alteration can be seen through the use of satellite-based remote sensing data, which can provide images of land surfaces and existing vegetation cover. Using these data, the WDFW has developed a land cover classification map of a portion of the Columbia Basin Ecoregion (Figure 4-13). As indicated in Figure 4-13, the Hanford Site and the Department of Defense Yakima Training Center (located to the west of the Hanford Site) contain the largest remaining remnant of shrub-steppe vegetation in the Columbia Basin.

What is Shrub-Steppe?

The shrub-steppe ecosystem is a vegetation zone occupying most of central and southeastern Washington, part of northeastern Oregon, and portions of Idaho, Utah, and Nevada. It is a region whose native, pre-settlement vegetation consisted primarily of shrubs, perennial bunchgrasses, and a variety of forbs. Typical shrubs include several sagebrush species, rabbitbrush, and bitterbrush. Dominant grasses were bluebunch wheatgrass, Idaho fescue, needle-and-thread grass, and Sandberg's bluegrass. Before European settlement, at least 4.2 million hectares (10.4 million acres) of unaltered shrub-steppe habitat covered much of central and southeastern Washington. With the advent of dryland wheat farming, intensive livestock grazing, irrigation, and altered fire regimes, the landscape is changed to such an extent that the amount of natural shrub-steppe remaining is a small faction of the original acreage. The average cover of big sagebrush was about 10% prior to the introduction of livestock into Washington. Because livestock do not eat it, sagebrush often increases in density in grazed areas, replacing most other plants in badly degraded ranges. Hanford is unique in that it contains large expanses of relatively undisturbed shrub-steppe vegetation and has become a refuge for the native species and habitats comprising the shrub-steppe.

The Hanford Site is a relatively large, undisturbed area of shrub-steppe habitat that contains numerous plant and animal species adapted to the semi-arid environment in the region. The Hanford Site consists of mostly undeveloped land, with widely spaced clusters of industrial buildings located along the western shoreline of the Columbia River and at several locations in the interior of the Hanford Site. The industrial buildings are interconnected by roads, railroads, and electrical transmission lines. The major facilities and activities occupy about 6 percent of the total available land area, and their impact on the surrounding ecosystems is minimal from direct discharges or releases attributable to the DOE. Most of the Hanford Site has not experienced tillage or livestock grazing since the early 1940s. The Columbia River flows through the Hanford Site, and although the river flow is not directly impeded by dams within the Hanford Site, the historical daily and seasonal water fluctuations have been changed by dams upstream and downstream of the Hanford Site (DOE 1995b).

The Columbia River and other water bodies on the Hanford Site provide valuable habitat for aquatic organisms. Several large portions of the Site are administered in a manner to protect and preserve biological resources, such as the ALE Reserve and the Wahluke Slope (Figure 4-14).

4.5.1 Administrative Designations for Natural Resource Protection

In 1977, the U.S. Energy Research and Development Agency (a predecessor to the DOE) designated the entire Hanford Site as one of seven National Environmental Research Park sites located in the United States. In addition, two other portions of the Hanford Site are administered under special designations.

Figure 4-13. Current Distribution and Extent of Land Cover Classes Within a Portion of the Columbia Basin Ecoregion (DOE-RL 1996c).

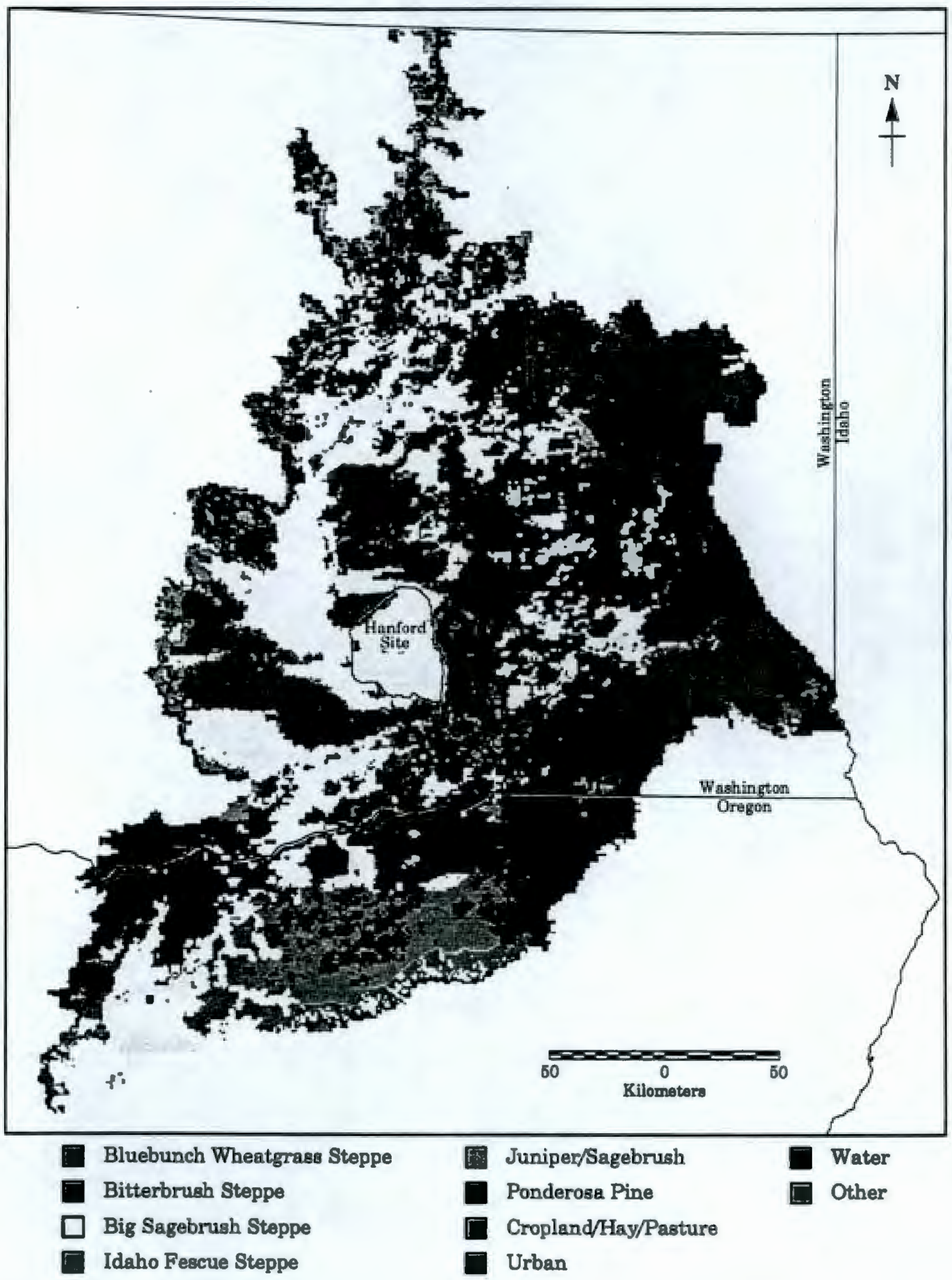
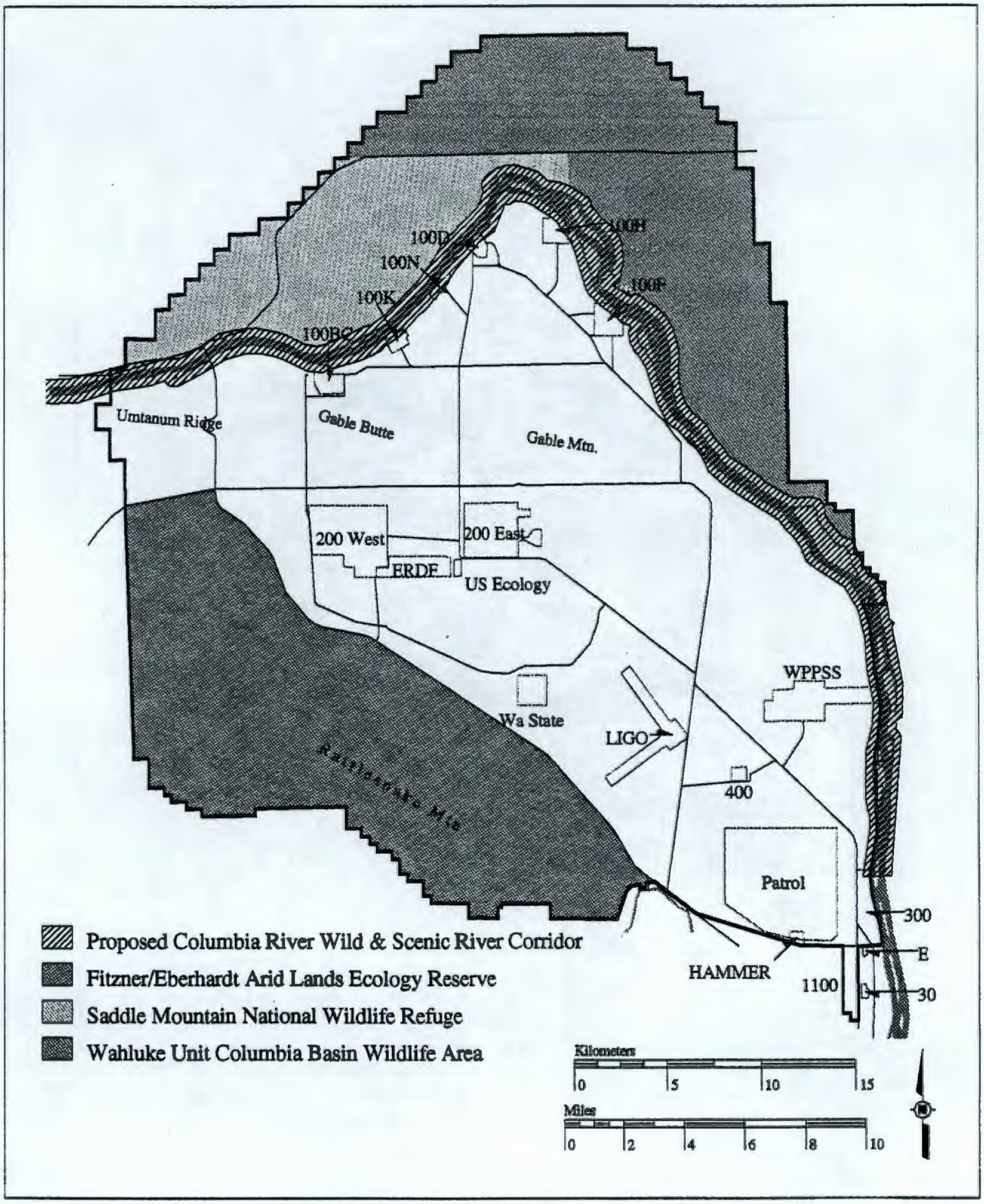


Figure 4-14. Administrative-Designated Areas for Biological Resource Values (DOE-RL 1996c).



The Wahluke Slope encompasses approximately 365 km^2 (140 mi^2) and is administered as two wildlife areas known as the Saddle Mountain National Wildlife Refuge and the Wahluke State Wildlife Recreation Area. The Saddle Mountain National Wildlife Refuge is managed by the USFWS; the Wahluke State Wildlife Recreation Area is managed by the WDFW. These areas are operated under the terms of a permit issued by the AEC on November 30, 1971, to provide for management of Hanford lands north and east of the Columbia River. According to the terms of the permit, the USFWS is required to keep the lands managed as the Saddle Mountain National Wildlife Refuge closed to all public access. The closure ensured a security zone for the N Reactor and encompassed an area within a 8.8-km (5.5-mi) radius of the reactor (NPS 1994). Although N Reactor is being decommissioned and doesn't require an extensive buffer, the K basins still required an exclusion zone until the spent nuclear fuel is removed from the basins.

The ALE Reserve has been used for ecological research dating back to 1952, but it was not until 1967 that the Richland Office of the AEC established the ALE Reserve by administrative order (PNL 1993b). As a result of a Federal interagency cooperative agreement, the ALE Reserve was designated as the Rattlesnake Hills Research Natural Area in 1971. The ALE Reserve currently retains its status as an administratively protected environment and as a valuable ecological study site. Through a MOA with DOE, the USFWS is responsible for management and protection of the ALE Reserve.

4.5.2 Terrestrial Vegetation and Habitats

The Hanford Site has been botanically characterized as a shrub-steppe ecosystem. In the early 1800s, the dominant plant in the area was big sagebrush with an understory of perennial bunchgrasses, especially Sandberg's bluegrass and bluebunch wheatgrass. With the advent of horses in the 1700s and settlement in the 1800s that brought livestock grazing and crop raising, the natural vegetation mosaic was opened to a persistent invasion by non-native annual species, especially cheatgrass. Today, cheatgrass is the dominant plant on fields that were cultivated 50 years ago. Cheatgrass is also well established on rangelands at elevations less than 244 m (800 ft) (DOE 1995b).

The dryland areas of the Hanford Site were treeless in the years before land settlement; however, for several decades before 1943, trees were planted and irrigated on most of the farms to provide windbreaks and shade. Some of the trees died when the farms were abandoned in 1943, but others have persisted, presumably because their roots are deep enough to contact groundwater. Today these trees serve as nesting platforms for several species of birds (e.g., hawks, owls, ravens, magpies, and great blue herons), and as night roosts for wintering bald eagles (DOE 1995b). The vegetation mosaic of the Hanford Site currently consists of a variety of diverse plant communities.

The State of Washington has designated large and small blocks of shrub-steppe as priority habitat because these areas possess unique or significant value to many species. The State identifies priority habitats based on the quality of the habitat with respect to the following attributes: comparatively high fish and wildlife density; comparatively high fish and wildlife species diversity; important fish and wildlife breeding habitat; important fish and wildlife seasonal ranges; important fish and wildlife movement corridors; limited availability; high vulnerability to habitat alteration; and unique or dependent species (WDFW 1995). Although Washington State priority habitat designations have no associated legal requirements for habitat protection, DOE Order 430.1 (DOE 1995c) requires that the DOE consider ecosystem management and preservation values during all phases of Hanford Site operations.

The DOI National Biological Service identifies native shrub and grassland steppe in Washington and Oregon as endangered ecosystem (with an 85 to 98 percent decline) (DOI 1995). (Almost 600 species of plants have been identified on the Hanford Site (PNNL 1996a). The dominant plants are big sagebrush, rabbitbrush, cheatgrass, and Sandberg's bluegrass, with cheatgrass providing half of the total plant cover on much of the Hanford Site. Cheatgrass and Russian thistle, annuals introduced to the United States from Eurasia in the late 1800s, invade areas where the ground surface has been disturbed. Mosses and lichens appear on undisturbed soil surface; lichens commonly grow on the shrub stems and on basalt outcrops. The important desert shrubs, big sagebrush and bitterbrush, are widely spaced and usually provide less than 20 percent canopy cover. The important native understory plants are grasses, especially Sandberg's bluegrass, Indian ricegrass, June grass, and needle-and-thread grass.

As compared to other semi-arid regions in North America, primary productivity is relatively low and the number of vascular plant species also is low. This situation is attributed to the low annual precipitation (16 cm [6 in.]), the low water-holding capacity of the rooting substrate (sand), and the hot, dry summers and occasionally very cold winters.

The 100 Areas are located in the vicinity of the Columbia River and encompass both riparian and upland habitats. Riparian habitats are found along the shoreline, slack water, and slough areas. Riparian vegetarian includes both woody and herbaceous species. Common plant species occurring in the riparian zone include black cottonwood, mulberry, willow, dogbane, and a variety of grasses and forbs (Cushing 1992). Scattered groves of white mulberry, black locust, Siberian elm, apricot, juniper, and willow were noted in an ecological investigation within the 100-BC-5 and 100-HR-3 operable units (WHC 1992). The upland vegetation within the 100 Areas is dominated by the non-native annuals, cheatgrass, and tumble mustard on former agricultural lands that were abandoned in 1943 (DOI 1995).

More than 100 species of plants have been identified on the Central Plateau (Cushing 1992). Common plant species include sagebrush, rabbitbrush, cheatgrass, and Sandberg's bluegrass. The dominant vegetation type consists of big sagebrush with an understory of cheatgrass and Sandberg's bluegrass (PNNL 1996a). Cheatgrass provides approximately 50 percent of total plant cover. Most of the waste disposal and storage sites are covered by non-native vegetation or are kept in a vegetation-free condition.

In recent years, a die-off of big sagebrush has been noted on the Hanford Site. A preliminary investigation of the nature and extent of die-off has been conducted. Although the cause remains unknown, early indications focus on the possibility that the die-off might be the result of disease or weather-related stress. The die-off area is estimated to be 1,776 ha (4,390 ac) (Cushing 1992).

Other vegetation within the Central Plateau includes wetland species associated with man-made ditches and ponds on the Central Plateau and introduced perennial grasses (e.g., Siberian wheatgrass) that were planted to revegetate disturbed areas. Wetland species (e.g., cattail and reeds) and trees (e.g., willow, cottonwood, and Russian olive) are established around some of these ponds (PNNL 1996a). However, several of the ponds have been decommissioned, resulting in the elimination of wetland habitat as the supply of industrial waste water feeding the ponds was terminated.

Sixteen different plant community types have been identified on the Wahluke Slope. Cheatgrass and other nonnative species dominate, most likely because of disturbances caused by military training activities, historical livestock grazing, dry soil, and multiple fires. However, the Wahluke Slope still possesses extensive remnants of the original shrub-steppe ecosystem. For example, the most extensive and highest quality antelope bitterbrush and Indian ricegrass plant community in the State of Washington is found on the Wahluke Slope (TNC and Pabst 1995). In 1994, The Nature Conservancy discovered a new plant species of the genus *Lesquerella*. This discovery, along with high habitat quality, illustrates the potential ecological value of the Wahluke Slope.

The two major vegetation types occurring along the Hanford Reach of the Columbia River are riparian and upland (NPS 1994). Riparian habitats are found along the shoreline, slack water and slough areas, and on islands in the river. Riparian vegetation at these locations includes both woody and herbaceous species maintained by the high water table immediately adjacent to the river. Common plant species occurring in the riparian zone include black cottonwood, mulberry, willow, dogbane, and a variety of grasses and forbs (Cushing 1992). Sensitive habitats within the riparian zone include islands and cobbled shorelines occurring as a narrow band along the Hanford Reach. Plant species occurring in these areas include perennial summer-blooming forbs adapted to seasonal changes in water levels (NPS 1994). Upland habitats along the Hanford Reach are composed of shrub-steppe vegetation similar to that found on the rest of the Hanford Site.

The ALE Reserve supports one of the largest remnants of relatively undisturbed shrub-steppe ecosystem in the State of Washington. Vegetation on the ALE Reserve contains largely undisturbed stands of several plant communities (e.g., sagebrush-bluebunch wheatgrass, blue bunch wheatgrass, sagebrush-Sandberg's bluegrass, sagebrush-bitterbrush-needle-and-thread grass, cheatgrass, and cottonwoods and willows) (DOE 1994a). Extensive wildfires have removed the shrub component from large areas of the ALE Reserve. These areas now support stands of perennial bunchgrasses at the upper elevations and cheatgrass and bunchgrasses at the lower elevations (PNL 1993c).

Special topographic features of the Hanford Site include Gable Butte and Gable Mountain north of the Central Plateau and an extensive series of active sand dunes in the southeast portion of the Site. Vegetation occurring on scree slopes, outcrops, and scarps on Gable Butte and Gable Mountain is limited to scattered individuals or groups of plants. Plant species include squaw currant, bluebunch wheatgrass, rock buckwheat, and thyme buckwheat. Rigid sagebrush occurs at the Hanford Site only on Gable Mountain and Umtanum Ridge (PNL 1993c).

4.5.2.1 Fire. Plant communities within the shrub-steppe have evolved in the presence of natural wildfires. Typically, shrubs are killed by fire, but the perennial bunchgrasses are not killed. The severity of the damage depends upon the intensity and extent of the fire. Hot fires incinerate entire shrubs and damage grass crowns. Less intensive fires leave dead shrub stems standing with prompt recovery of grasses and forbs. The most recent and extensive wildfire on the Hanford Site occurred in the summer of 1984 (Figure 4-15). Previous fires occurred in 1957, 1973, and 1981. The presence of non-native plant species and changing land-use practices have altered the frequency and severity of wildfires. Less frequent and more severe fires have reduced the ability of the native habitat to recover from fire, as well as the development of late successional shrub-steppe habitat.

4.5.2.2 Weeds. Non-native weedy species have invaded many areas on the Hanford Site (Figure 4-16). In particular, weeds have invaded areas that have been disturbed by natural (e.g., fire) and human factors (e.g., pre-Hanford agricultural activities, road and facility

Figure 4-15. Distribution of Vegetation Types and Cover Classes on the Hanford Site (PNNL database).

Figure 4-15. Distribution of Vegetation Types and Cover Classes on the Hanford Site (Legend).

Post-Fire Shrub-Steppe on the Columbia River Plain
Rabbitbrush / Bunchgrasses
Rabbitbrush / Cheatgrass
Big Sagebrush / Bunchgrasses –Cheatgrass
Big Sagebrush –Spiny Hopsage / Bunchgrasses –Cheatgrass
Threetip Sagebrush / Bunchgrasses
Spiny Hopsage / Bunchgrasses
Spiny Hopsage / Cheatgrass
Black Greasewood / Sandberg's Bluegrass
Winterfat / Bunchgrasses
Winterfat / Cheatgrass
Snow Buckwheat / Indian Ricegrass
Bunchgrasses
Cheatgrass –Sandberg's Bluegrass
Planted Non-native Grass
Bitterbrush / Bunchgrasses Sand Dune Complex
Bitterbrush / Cheatgrass
Alkali Saltgrass –Cheatgrass
Riparian
Basalt Outcrops
Agricultural Areas
White Bluffs Cliffs
Buildings / Parking Lots / Gravel Pits / Disturbed Areas
Abandoned Old Fields and Farms
Riverine Wetlands and Associated Deepwater Habitats
Non-Riverine Wetlands and Associated Deepwater Habitats

Figure 4-16. Distribution of Weeds on the Hanford Site.

construction, etc.). The weed species include, but are not limited to, cheatgrass; Russian thistle; Russian, spotted, and diffuse knapweed; yellow star thistle; Rush skeletonweed; and puncture vines. Cheatgrass and Russian thistle, annuals introduced from Eurasia in the late 1800s, invade areas where the ground surface has been disturbed. Old agricultural fields on the Hanford Site that have been left to naturally recolonize for 50 years are still dominated by cheatgrass and other non-native annuals, showing a strong resistance to invasion by native perennial plants (Neitzel et al. 1997).

4.5.3 Wildlife

Major habitat types occurring on the Hanford Site include basalt outcrops, scarps and screes, riparian and riverine areas, shrub-steppe, sand dunes and blowouts, and abandoned fields (PNL 1993c). These habitat types support a variety of wildlife.

4.5.3.1 Mammals. Approximately 40 species of mammals have been identified on the Hanford Site (PNNL 1996a). The largest predator inhabiting the Hanford Site is the coyote, which ranges all across the Hanford Site. Coyotes have been a major cause of destruction for the nests of Canadian geese on Columbia River islands, especially islands upstream from the abandoned Hanford townsite. Bobcats, cougars, and badgers also inhabit the Hanford Site in low numbers.

Black-tailed jackrabbits are common on the Hanford Site, mostly associated with mature stands of sagebrush. Cottontail rabbits also are common but appear to be more closely associated with the buildings, debris piles, and equipment laydown areas associated with the onsite laboratory and industrial facilities.

Townsend's ground squirrels occur in colonies of various sizes scattered across the Hanford Site. The most abundant mammal inhabiting the site is the Great Basin pocket mouse. The mouse occurs all across the Columbia River plain and on the slopes of the surrounding ridges. Other small mammals include the deer mouse, harvest mouse, grasshopper mouse, montane vole, vagrant shrew, and Merriam's shrew.

The Hanford Site has 14 species of bats that are known to be or are potential inhabitants, most of which may be present year-round (PNL 1993d). The pallid bat frequents deserted buildings and is thought to be the most abundant. Other species include the hoary bat, silver-haired bat, California brown bat, little brown bat, Yuma brown bat, and Pacific western big-eared bat.

A herd of Rocky Mountain elk is present on the ALE Reserve. It is believed these animals migrated to the reserve from the Cascade Mountains in the early 1970s. This herd grew from approximately eight animals in 1975 to approximately 420 animals in December 1996 (after the hunting season).[1] Current projections (summer 1997) indicate that the elk herd is composed of approximately 600 animals. Elk frequently move from the ALE Reserve to private lands, the Yakima Training Center, and other parts of the Hanford Site, particularly during late spring, summer, and early fall. Lack of water and the high level of human activity presumably inhibit the elk from using other areas of the Hanford Site. Despite the arid climate, these elk appear to be very healthy; antler and body size for some age classes are among the highest recorded for this species (DOE 1995b). In addition, reproductive output of this species is also among the highest recorded.

---

[1]Personal communication with Brett Tiller, Pacific Northwest National Laboratory, September 22, 1997.

Mule deer are found throughout the Hanford Site, although areas of highest concentrations are on the ALE Reserve and along the Columbia River. Deer populations on the Hanford Site appear to be relatively stable. Islands in the Hanford Reach are used extensively as fawning sites by the deer (DOE 1995b) and, thus, are a very important habitat for this species. Hanford Site deer frequently move offsite and are killed by hunters on adjacent public and private lands (DOE 1995b).

4.5.3.2 Birds. In general, bird species on the Hanford Site include a variety of raptors, songbirds, and other species associated with riparian, riverine, and upland habitats. Approximately 238 species of birds, including migrants and accidental species, have been observed at or near the Hanford Site (WHC 1992b). Of these, 36 are common species and 40 occur as accidental species.

Twenty-six species of raptors have been sighted on the Hanford Site, 11 of which are known to nest on the Hanford Site (PNL 1981). The nesting species include the great horned owl, long-eared owl, short-eared owl, barn owl, burrowing owl, northern harrier, ferruginous hawk, Swainson's hawk, red-tailed hawk, prairie falcon, and American kestrel. In 1994, 41 nests of red-tailed Swainson's and ferruginous hawks were located on the Hanford Site.

Raptors that may occur year-round on the Hanford Site are the northern harrier, red-tailed hawk, golden eagle, prairie falcon, American kestrel, barn owl, great horned owl, long-eared owl, and burrowing owl (Fitzner and Gray 1991). Raptors use a variety of habitats for nesting and foraging at the Hanford Site. Depending on raptor size and species, prey may include small mammals, birds, reptiles (e.g., snakes), and insects.

Passerine species known to occur in the shrub-steppe vegetation on the Hanford Site include the loggerhead shrike, sage sparrow, western meadowlark, grasshopper sparrow, horned lark, and sage thrasher. The western meadowlark, sage sparrow, and horned lark are the most abundant shrub-steppe passerine bird species that breed on the Hanford Site (Rickard and Poole 1989). The western meadowlark and horned lark nest on the ground in the open, while shrub-steppe species (e.g., the sage sparrow, sage thrasher, and loggerhead shrike) require sagebrush or bitterbrush for nesting habitat.

Common upland game bird species include the chukar, California quail, and ring-necked pheasant. Sage grouse and gray partridge are less common and rarely seen. Regional sage grouse populations have declined since the early 1800s because of the conversion of shrub-steppe habitat. Surveys conducted by the WDFW and the PNNL during 1993 did not reveal the presence of sage grouse on the ALE Reserve (PNNL 1996a).

In addition to upland bird species, numerous species associated with wetlands and riparian habitats are found along the Columbia River and at isolated wetlands on the Hanford Site. Ring-billed and California gulls, Forster's terns, and Canada geese all form nesting colonies on islands in the Hanford Reach. Large numbers of swallows depend on the Columbia River riparian areas during the summer months, eating flying aquatic insects such as caddis flies and collecting mud from wetted areas to build their nests. The Hanford Site is located in the Pacific Flyway and, during the spring and fall months, the Hanford Reach serves as a resting area for neotropical migrants, migratory waterfowl, and shorebirds. During the fall and winter months, large numbers of migratory ducks and geese find refuge along the Hanford Reach. Other species observed during winter months include white pelicans, double-crested cormorants, and common loons.

4.5.3.3 Reptiles and Amphibians. Fifteen species of reptiles and amphibians are known to occur on the Hanford Site (PNNL 1996a). The side-blotched lizard is the most abundant reptile and can be found throughout the Hanford Site. Short-horned and sagebrush lizards are also common in selected habitats. The most common snakes are the gopher snake, the yellow-bellied racer, and the Pacific rattlesnake, all of which are found throughout the Hanford Site. Striped whipsnakes and desert night snakes are rarely found, but some sightings have been recorded for the Site. Toads and frogs, such as the Great Basin spadefoot toad, Woodhouse's toad, bullfrog, and the Pacific tree frog, are found near the permanent water bodies and along the Columbia River.

4.5.3.4 Insects. Approximately 600 species of terrestrial and aquatic insects have been found on the Hanford Site (PNNL 1996a). Nineteen species are new to science; more than 71species represent new findings in Washington State. These numbers will increase as more material is identified. An estimate of the number of species occurring on the Hanford Site would be between 10,000 and 15,000 (see text box, *"Hanford Site Quick Facts: Wildlife"*).

Hanford Site Quick Facts: Wildlife

- 44 species of fish
- 40 species of mammals
- Approximately 238 species of birds
- 15 species of reptiles and amphibians
- Approximately 600 species of insects

Grasshoppers and darkling beetles are among the more conspicuous groups and, together with other species, are important components in the food webs of the local ecosystem. Most species of darkling beetles occur throughout the spring to fall period, although some species are evident only during two or three months in the fall (PNL 1977). Grasshoppers are evident during the late spring to fall. Both beetles and grasshoppers are subject to wide annual variations in abundance.

4.5.4 Terrestrial Wildlife and Habitat

Terrestrial wildlife species use both shoreline riparian and shrub-steppe habitats occurring along the Columbia River and on the islands occurring in the Hanford Reach. Wildlife reported to use the Hanford Reach include 184 species of birds, 36 species of mammals, 9 species of reptiles, and 4 species of amphibians (NPS 1994). Canadian geese use the islands along the Hanford Reach extensively for nesting. Studies on the nesting habits of geese that use the Hanford Site have been ongoing since 1953. These studies indicate a general decline over the years in the number of nests on the islands in the Hanford Reach because of heavy predation by coyotes (PNNL 1996a). Mule deer use the islands and other riparian areas for fawning habitat. Wildlife occurring on the shoreline habitat includes 46 species that use willow communities and 49 species that use grass areas (NPS 1994).

Terrestrial wildlife species found in the 100 Areas generally are the same species found across the Hanford Site (Cushing 1992). Coyotes occurring along the Columbia River reportedly feed on carp and small mammals such as the Great Basin pocket mouse, northern pocket gopher, Nuttall's cottontail, and black-tailed jack rabbit (Fitzner and Gray 1991). Mule deer may occur almost anywhere on the Hanford Site but prefer habitats along the Columbia River where riparian areas provide abundant food and cover. Mule deer forage on mulberry, Russian olive, and cottonwood trees, and shrubs such as willow (WHC 1992c).

Wildlife likely to occur in riparian habitat adjacent to the Columbia River includes a variety of birds, mammals, reptiles, and amphibians (Fitzner and Gray 1991). The three known species of amphibians at the Hanford Site use riparian habitat along permanent water bodies and the Columbia River. Medium-size mammals using riparian habitat are the muskrat, raccoon, beaver, weasel, skunk, otter, and porcupine; small mammals include the vagrant shrew and montane meadow mouse. Upland birds likely to occur in habitats in the 100 Areas along the Columbia River are the California quail and ring-necked pheasant (Cushing 1992). Trees along the river, including those found in the 100 Areas, provide habitat for several species of birds. These include the great blue heron, which has colonial nest sites (rookeries) near the White Bluffs ferry landing, and the bald eagle, which uses selected trees for perching and night roosts during the winter (PNNL 1996a).

Terrestrial wildlife species common to the Hanford Site also can be found in the Central Plateau (Cushing 1992). A characterization study of small mammals that occur near the 100-BC cribs (located south of the 200 East Area) resulted in five species being trapped: Great Basin pocket mouse, deer mouse, northern grasshopper mouse, sagebrush vole, and western harvest mouse (PNL 1977). The Great Basin pocket mouse represented more than 90 percent of the mammals caught. Medium and large-size mammals that may occur in the Central Plateau include rabbits, coyotes, badgers, and mule deer (PNL 1977). Mammals potentially using areas associated with ponds and ditches in the 200 East and 200 West Areas include muskrats, porcupines, and raccoons.

Many common bird species, such as the western meadowlark and sage sparrow, are likely to occur on the Central Plateau where suitable habitats exist. Thirty-seven species of terrestrial birds were recorded during surveys conducted in the 200 East and 200 West Areas of the Hanford Site in 1986 (Schuller et al. 1993). Bird studies associated with wastewater ponds in the Central Plateau reveal that a large number of species, particularly waterfowl, use these ponds during migration (PNL 1977).

Unique habitats can be found on Columbia River islands, sand dunes, the cliffs of White Bluffs, and on Gable Butte and Gable Mountain situated north of the Central Plateau (Figure 4-17). The Gable Butte and Gable Mountain unique habitats include basalt outcrops, scarps, and scree slopes. Birds likely to occur in these habitats are the prairie falcon, rock wren, poorwill, and chukar; small mammals include the yellow-bellied marmot and wood rat; reptiles include rattlesnakes, gopher snakes, and horned lizards (PNL 1993c).

4.5.5 Species of Concern on the Hanford Site

Species of concern on the Hanford Site include Federally listed threatened or endangered species, state-listed threatened or endangered species, state candidate species, and state monitor species (see text box, *"Hanford's Federal Threatened and Endangered Species"*). No plants or mammals on the Federal List of Endangered and Threatened Wildlife and Plants (50 CFR 17) are known to occur on the Hanford Site. There are, however, three species of birds and one fish species that are Federally listed, and several species of plants and animals are under consideration for formal listing by the State of Washington.

Hanford's Federal Threatened and Endangered Species

Several Federally threatened or endangered species might be found at the Hanford Site, including the following:

- Steelhead trout (upper Columbia River run)
- Aleutian Canada goose
- Bald eagle
- Peregrine falcon

Figure 4-17. Plant Communities of Concern on the Hanford Site.

Figure 4-17. Plant Communities of Concern on the Hanford Site (Legend).

- Post-Fire Shrub-Steppe on the Columbia River Plain
- Rabbitbrush / Bunchgrasses
- Big Sagebrush / Bunchgrasses –Cheatgrass
- Big Sagebrush –Spiny Hopsage / Bunchgrasses –Cheatgrass
- Threetip Sagebrush / Bunchgrasses
- Spiny Hopsage / Bunchgrasses
- Spiny Hopsage / Cheatgrass
- Black Greasewood / Sandberg's Bluegrass
- Winterfat / Bunchgrasses
- Winterfat / Cheatgrass
- Snow Buckwheat / Indian Ricegrass
- Bunchgrasses
- Planted Non-native Grass
- Bitterbrush / Bunchgrasses Sand Dune Complex
- Bitterbrush / Cheatgrass
- Alkali Saltgrass –Cheatgrass
- Riparian
- Basalt Outcrops
- White Bluffs Cliffs
- Riverine Wetlands and Associated Deepwater Habitats
- Non-Riverine Wetlands and Associated Deepwater Habitats

- Habitats of Low Value
  - Rabbitbrush / Cheatgrass
  - Cheatgrass –Sandberg's Bluegrass
  - Agricultural Areas
  - Abandoned Old Fields and Farms
  - Buildings / Parking Lots / Gravel Pits / Disturbed Areas

Candidate species occurring on the Hanford Site are considered in the preparation of DOE NEPA documentation. Species of concern occurring on the Hanford Site are listed in Tables 4-6 and 4-7; the tables also include definitions of each category of species of concern.

No Federally listed threatened or endangered plant species occur on the Hanford Reach. State-listed endangered plant species occurring along the Hanford Reach include the Columbia yellowcress. Preferred habitat for Columbia yellowcress is shoreline areas with gently sloping, cobbly, or sandy substrate (PNL 1993c). Wetland species of concern that have been found along the shoreline and on islands of the Hanford Reach between the Vernita Bridge and the 300 Area include the southern mudwort, dense sedge, and shining flatsedge (WHC 1992d), all of which are state-sensitive species.

Wildlife species of concern that may occur along the Hanford Reach include several species of birds associated with riparian and aquatic habitat (PNL 1993c) and the Upper Columbia River run of steelhead trout from the confluence of the Yakima River and upstream. Federally listed threatened and endangered birds include the Aleutian Canadian goose, peregrine falcon, and bald eagle. The Aleutian Canadian goose and the peregrine falcon are rare migrants or accidental species on the Hanford Site (PNL 1993c). Other bird species of concern (see Table 4-7) occurring along the Hanford Reach include the black-crowned night heron, black-necked stilt, Caspian tern, Clark's grebe, common loon, Forster's tern, great blue heron, great egret, horned grebe, osprey, red-necked grebe, western grebe, and sandhill crane (PNL 1993c). Bird species of concern occurring along the Hanford Reach that are considered relatively common include the American white pelican, bald eagle, Caspian tern, common loon, Forster's tern, great blue heron, and sandhill crane, while other species discussed are rare migrants or accidental species on the Hanford Site (Fitzner and Gray 1991).

A state-listed endangered plant species, the northern wormwood, may occur in the 100 Areas, although it has not yet been identified. State-sensitive plant species that are known to occur in the 100 Areas are Piper's daisy, southern mudwort, false pimpernel, dense sedge, and shining flatsedge (WHC 1992d). Southern mudwort, false pimpernel, dense sedge, and shining flatsedge occur in wetland areas, while northern wormwood and Piper's daisy are upland species.

The bald eagle, a Federal and Washington State threatened species, is the only Federally listed wildlife species known to regularly use the 100 Areas (Figure 4-18). Bald eagles use groves of trees (e.g., black locust, white poplar, and Siberian elm) near the White Bluffs peninsula along the Hanford Reach for perching and night roosts (PNL 1993c). Daytime perching areas used by bald eagles are trees along the Hanford Reach from the Hanford townsite upstream to Vernita Bridge (PNL 1991a).

Plant species of concern include the Columbia milk-vetch and Hoover's desert-parsley. These species also are listed as state-threatened plants. State-sensitive species include dense sedge, gray cryptantha, Piper's daisy, and dwarf evening-primrose. Dense sedge is known to occur in wetland habitats along the Columbia River, while the other species of concern are found on upland habitats (WHC 1992d).

Wildlife species of concern include the ferruginous hawk and loggerhead shrike (PNL 1993c). Sensitive wildlife species include the long-billed curlew, burrowing owl, sage sparrow, sage thrasher, Swainson's hawk, and golden eagle. All of these species except the golden eagle nest on the Hanford Site (Fitzner and Gray 1991).

Table 4-6. Plant Species of Concern Occurring on the Hanford Site (adapted from PNNL 1996a).

Common Name	Scientific Name	Federal Status	State Status
Columbia milk-vetch	*Astragalus columbianus*		T
Columbia yellowcress	*Rorippa columbiae*		E
Dwarf evening primrose	*Oenothera pygmaea*		T
Hoover's desert parsley	*Lomatium tuberosum*		T
Northern wormwood	*Artemisia campestris borealis* var. *wormskioldii*		E
White eatonella	*Eatonella nivea*		T
Bristly coneseed	*Pectocarya setosa*		S
Suksdorf's monkeyflower	*Mimulus suksdorfii*		S
Kittitas larkspur	*Delphinium multiplex*		M3
Bristly cryptantha	*Cryptantha interrupta*		M2
Columbia River mugwort	*Artemisia lindleyana*		M3
Crouching milkvetch	*Astragalus succumbens*		M3
Dense sedge[a]	*Carex densa*		S
Desert evening primrose	*Oenothera caespitosa*		S
False pimpernel	*Lindernia anagallidea*		S
Fuzzy-beard tongue penstemon	*Penstemon eriantherus*		M3
Gray cryptantha	*Cryptantha leucophaea*		S
Medic milkvetch[a]	*Astragalus speirocarpus*		M3
Geyer's milkvetch	*Astragalus geyeri*		S
Palouse thistle	*Cirsium brevifolium*		M3
Piper's daisy	*Erigeron piperianus*		S
Robinson's onion	*Allium robinsonii*		M3
Rosy balsamroot	*Balsamorhiza rosea*		M3
Shining flatsedge	*Cyperus rivularis*		S
Smooth cliffbrake	*Pellaea glabella*		M3
Southern mudwort	*Limosella acaulis*		S
Squill onion	*Allium scillioides*		M3
Stalked-pod milkvetch	*Astragalus sclerocarpus*		M3
Thompson's sandwort	*Arenaria franklinii* v. *thompsonii*		M2
Desert dodder	*Cuscuta denticulata*		M1

[a] May inhabit the Hanford Site but have not been recently collected, or the known collections are questionable in terms of location and/or identification.

E	=	Endangered; a species native to Washington State that is seriously threatened with extinction throughout all or a significant portion of its range within the state. Endangered species are designated in WAC 232-12-014.
M1	=	Monitor group 1; taxa for which there are insufficient data to support listing as threatened, endangered, or sensitive.
M2	=	Monitor group 2; taxa with unresolved taxonomic questions.
M3	=	Monitor group 3; taxa that are more abundant and/or less threatened than previously assumed.
S	=	Sensitive; taxa vulnerable or declining, and could become endangered or threatened without active management or removal of threats.
T	=	Threatened; a species native to Washington State likely to become endangered within the foreseeable future throughout significant portions of its range within the state without cooperative management or the removal of threats. Threatened species are designated in WAC 232-12-011.

Table 4-7. Wildlife Species of Concern Occurring on the Hanford Site (adapted from Cushing 1995) (2 Pages).

Common Name	Scientific Name	Federal Status	State Status
Molluscs			
Columbia pebble snail	*Fluminicola (= Lithoglyphus) columbiana*		C
Shortfaced lanx	*Fisherola (= Lanx) nuttalli*		C
Fish			
Steelhead Trout (Upper Columbia River run)	*Onchorhychus mykiss*	E	
Birds			
Aleutian Canada goose[b]	*Branta canadensis leucopareia*	T	E
American white pelican	*Pelecanus erythrorhynchos*		E
Bald eagle	*Haliaeetus leucocephalus*	T	T
Ferruginous hawk	*Buteo regalis*		T
Peregrine falcon[b]	*Falco peregrinus*	E	E
Prairie falcon	*Falco mexicanus*		M
Sandhill crane[b]	*Grus canadensis*		E
Black-crowned night-heron	*Nycticorax nycticorax*		M
Black tern[b]	*Chlidonias niger*		M
Burrowing owl	*Athene cunicularia*		C
Caspian tern	*Sterna caspia*		M
Clark's grebe	*Aechmophorus clarkii*		M
Common loon	*Gavia immer*		C
Flammulated owl[b]	*Otus flammeolus*		C
Forster's tern	*Sterna forsteri*		M
Golden eagle	*Aquila chrysaetos*		C
Great blue heron	*Ardea herodias*		M
Green-backed heron	*Butorides striatus*		M
Horned grebe	*Podiceps grisegena*		M
Lewis' woodpecker[b]	*Melanerpes lewis*		C
Loggerhead shrike	*Lanius ludovicianus*		C
Long-billed curlew	*Numenius americanus*		M
Northern goshawk[b]	*Accipiter gentilis*		C
Sage sparrow	*Amphispiza belli*		C
Sage thrasher	*Oreoscoptes montanus*		C
Swainson's hawk	*Buteo swainsoni*		C
Western bluebird[b]	*Sialia mexicana*		C
Western grebe	*Aechmophorus occidentalis*		M
Western sage grouse[b]	*Centrocercus urophasianus*		C
Insects			
Columbia River tiger beetle[b]	*Cicindela columbica*		C
Oregon silverspot butterfly[a]	*Speyeria zerene hippolyta*	T	T
Reptiles			
Striped whipsnake	*Masticophis taeniatus*		C

Table 4-7. Wildlife Species of Concern Occurring on the Hanford Site (adapted from Cushing 1995) (2 Pages).

Common Name	Scientific Name	Federal Status	State Status
Mammals			
Long-legged Myotis	*Myotis volans*		M
Merriam's shrew	*Sorex merriami*		C
Northern grasshopper mouse	*Onychomys leucogaster*		
Pacific western big-eared bat[b]	*Plecotus townsendii*		C
Pallid bat	*Antrozous pallidus*		M
Pygmy rabbit[a]	*Brachylagus idahoensis*		E
Sagebrush vole	*Lagurus curtatus*		M

[a] Likely not occurring on the Hanford Site.
[b] Reported as possibly occurring on the Hanford Site.

C = Candidate; a native species that the state or Federal Departments of Fish and Wildlife has enough substantial information on biological vulnerability to support proposals to list them as endangered or threatened species.

E = Endangered; a species that is seriously threatened with extinction throughout all or a significant portion of its range. Endangered species are designated in WAC 232-12-014 or 50 CFR 17.

M = Monitor; a native species whose population requires monitoring because (1) there is insufficient population data, (2) there are special habitat requirements, (3) the species is an indicator of environmental quality, or (4) the species have significant popular appeal.

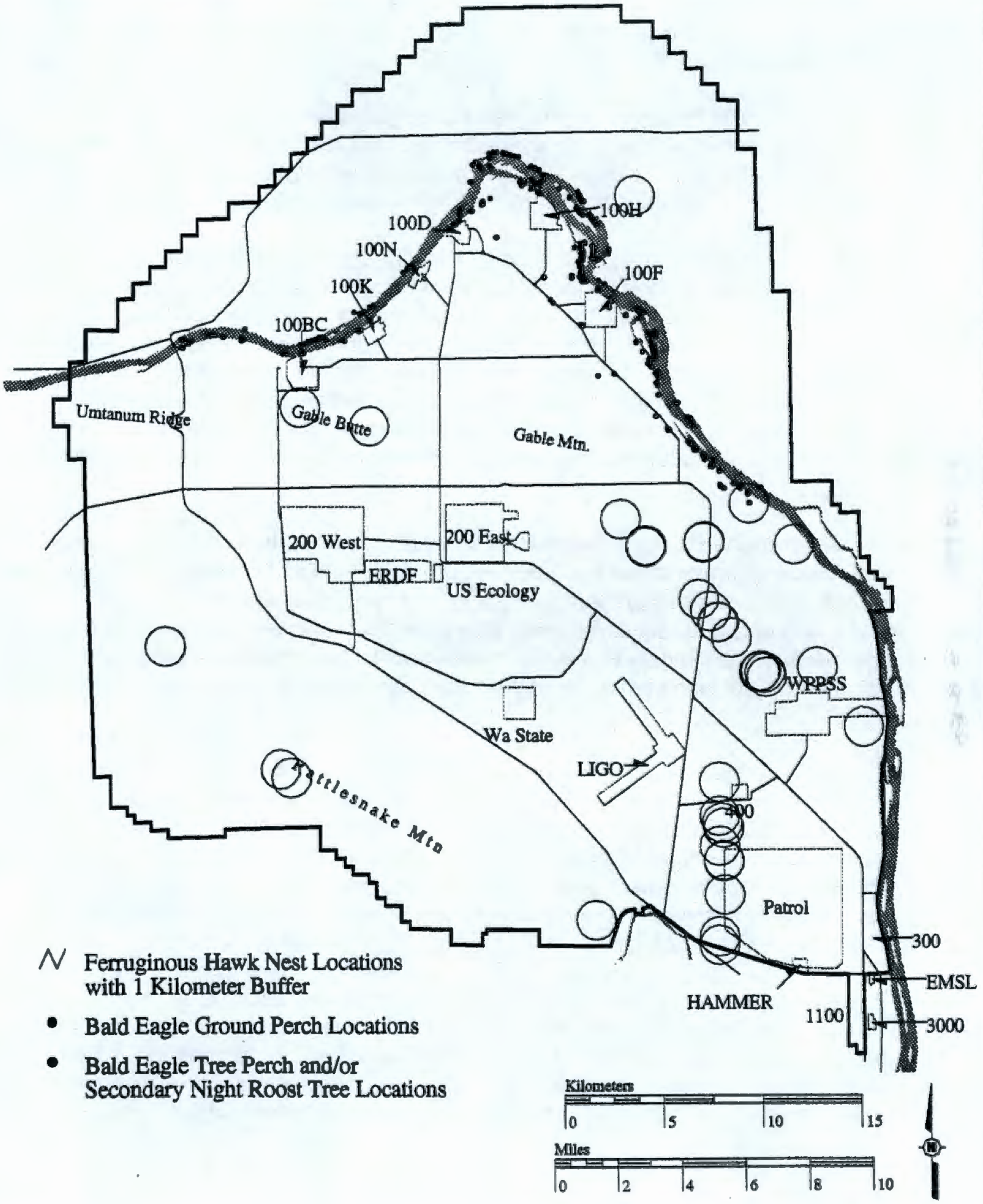
T = Threatened; a species that is likely to become endangered within the foreseeable future throughout significant portions of its range without cooperative management or the removal of threats. Threatened species are designated in WAC 232-12-011 or 50 CFR 17.

4.5.6 Aquatic Species and Habitat

There are two primary types of natural aquatic habitats on the Hanford Site: (1) the Columbia River, which flows along the northern and eastern edges of the Hanford Site, and (2) the small spring-streams and seeps located mainly in the Rattlesnake Hills. Several artificial water bodies, both ponds and ditches, have been formed as a result of wastewater disposal practices associated with the operation of the reactors and separation facilities. These bodies of water are temporary and will vanish with cessation of activities, but while present, the ponds form established aquatic ecosystems (except the West Pond), complete with representative flora and fauna. The West Pond, also known as West Lake, is created by a rise in the water table in the Central Plateau and is not fed by surface flow; thus, the pond is alkaline and has low species diversity.

Forty-four species of fish representing 13 families are known to occur in the Hanford Reach (PNNL 1996a). Of these species, chinook salmon, sockeye salmon, coho salmon, steelhead trout, and pacific lamprey use the Columbia River as a migration route to upstream spawning areas. Other fish of importance to sport fishermen are whitefish, sturgeon, small-mouth bass, catfish, walleye, and perch. Large populations of rough fish also are present, including carp, shiners, suckers, and squawfish (PNNL 1996a).

1
2 *Figure 4-18. Raptor Perch and Nest Sites (PNNL database).*



The Hanford Reach represents the only remaining significant mainstream Columbia River spawning habitat for stocks of upriver bright fall chinook salmon and white sturgeon (PNL 1990a). Since 1948, an annual census of salmon spawning on the Hanford Reach indicates that over 60 percent of fall chinook spawning occurs at Vernita Bar and the Locke Island area near White Bluffs (PNL 1993c). The numbers of fall chinook spawning sites (redds) in the Hanford Reach increased between the late 1940s and the 1980s. In 1988, the Hanford Reach served as the spawning area for 50 to 60 percent of the total fall chinook salmon runs in the Columbia River (PNNL 1996a) (Figure 4-19).

The Upper Columbia River run of steelhead trout has been Federally listed as endangered. These fish spawn in and migrate through the Hanford Reach. Recent population estimates indicate that Upper Columbia River steelhead run has declined to fewer than 1,400 fish, prompting listing by the National Marine Fisheries Service (62 FR 43974).

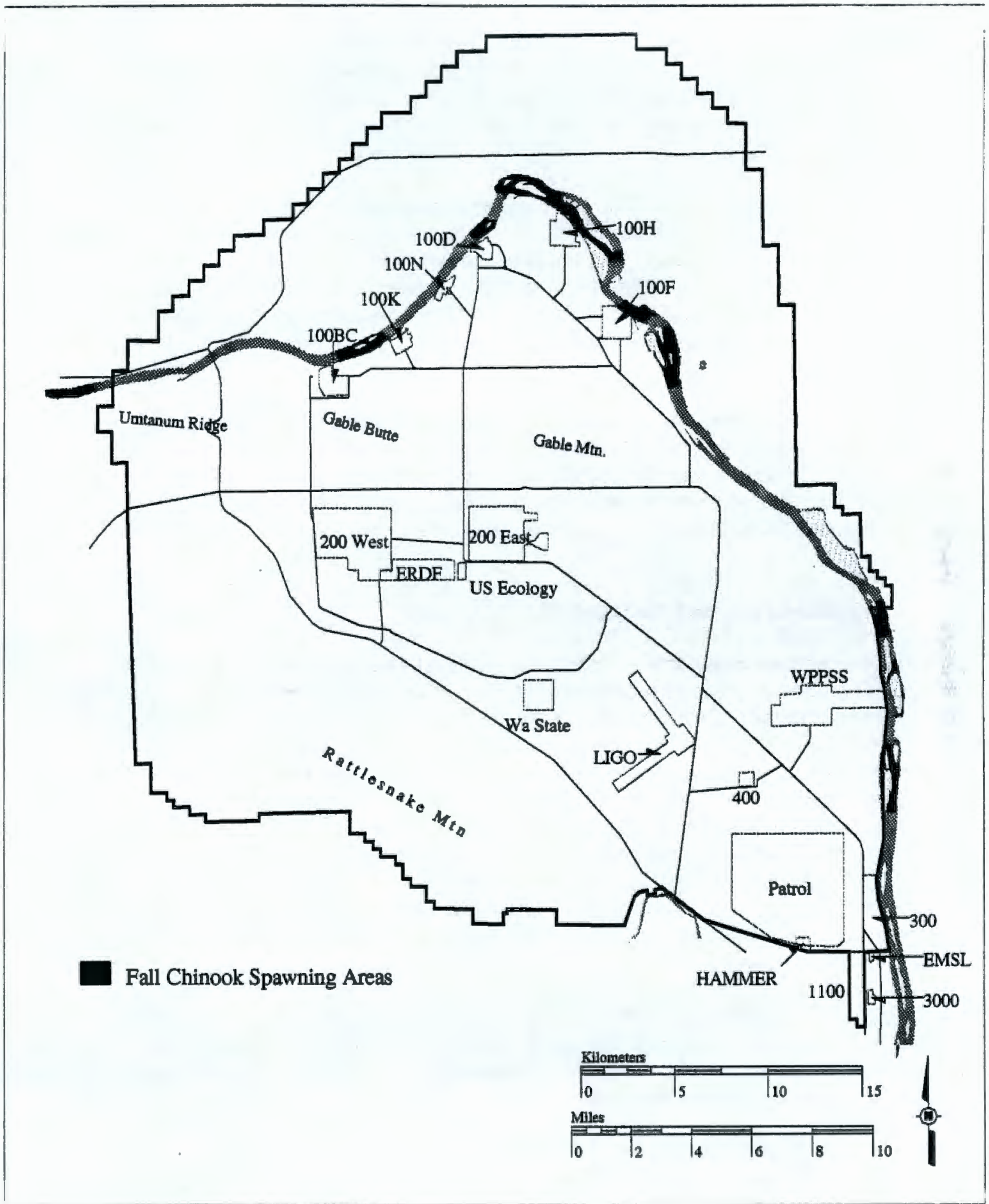
Steelhead trout follow a life cycle similar to salmon, but with a distinct advantage; salmon die after spawning, but steelhead migrate back to the ocean and a small percentage return in subsequent years to spawn again. Little is known about the quality and quantity of steelhead trout spawning, rearing and adult holding habitat in the Hanford Reach. Counts from 1972 and 1988 indicate that about 20,000 steelhead trout passed McNary Dam but did not pass Priest Rapids or Ice Harbor Dam. Some of these fish would enter the Yakima River while others would be caught in the Hanford Reach sport fishery. The remainder represent potential spawners. A substantial number of steelhead do terminate their migration in the Hanford Reach.

Aquatic plants in the Hanford Reach include water milfoil, waterweed, pondweed, Columbia yellowcress, watercress, and duckweed (PNNL 1996a). Aquatic plants generally are more prevalent where currents are less swift (e.g., in slack water areas like sloughs) (WHC 1992c). Aquatic plants are important to resident fish because they provide food, cover, and spawning areas for a variety of species. Water milfoil, an aggressive introduced aquatic plant, is becoming a nuisance in the Columbia River because of its rapid growth and lack of natural control.

Other aquatic species found in the Hanford Reach include a variety of microflora, zooplankton, and benthic invertebrates. Microflora include both sessile types (periphyton) and free-floating types (phytoplankton). Microflora species include diatoms, golden or yellow-brown algae, green algae, blue-green algae, red algae, and dinoflagellates. Dominant zooplankton taxa include *Bosmina*, *Diaptomus*, and *Cyclops*. Benthic invertebrate taxa occurring in the Hanford Reach include insect larvae such as caddisflies, midge flies, and black flies; snails; freshwater sponges; limpets; and crayfish (PNNL 1996a).

The small spring-streams, such as Rattlesnake and Snively springs, contain diverse biotic communities and are extremely productive (DOE 1995b). Dense blooms of watercress occur and are not lost until a major flash flood occurs. The aquatic insect production is fairly high as compared to that in mountain streams (DOE 1995b). The macrobenthic biota varies from site to site and is related to the proximity of colonizing insects and other factors.

Figure 4-19. Key Fall Chinook Salmon Spawning Areas.



4.5.7 Wetland Habitat

Wetlands include transitional lands occurring between terrestrial and aquatic ecosystems (Figure 4-20) where the water table usually is close to the surface or where shallow water covers the surface. The primary jurisdictional wetlands found on the Hanford Site occur along the Hanford Reach and include the riparian and riverine habitats located along the river shoreline. Riparian habitat includes the uplands immediately adjacent to the Hanford Reach or its backwater sloughs and supports vegetation typical of a high water table (NPS 1994). Common riparian species found along the Hanford Reach include a variety of woody and herbaceous plant species.

Other wetland habitats found on the Hanford Site are associated with man-made ponds and ditches occurring on the Hanford Site, including the B Pond Complex located near the 200 East Area and a small cooling and wastewater pond in the 400 Area. The B Pond complex was constructed in 1945 to receive cooling water from facilities in that area. Since that time, effluent flow to the B Pond has halted. One lobe of the pond received cooling water until very recently; the rest of the B Pond complex is slowly reverting to a shrub-steppe ecosystem.

The West Lake, a shallow, highly saline and alkaline pond located southwest of Gable Mountain, fluctuates in size with changes in the water table (PNL 1991b) and is currently less than 2 ha (5 ac) in size. Unlike other ponds on the Hanford Site, West Lake does not receive direct effluent discharges from Hanford Site facilities (PNL 1993a). Wetland vegetation found at West Lake is limited to scattered patches of emergent macrophytes such as cattails and bulrushes.

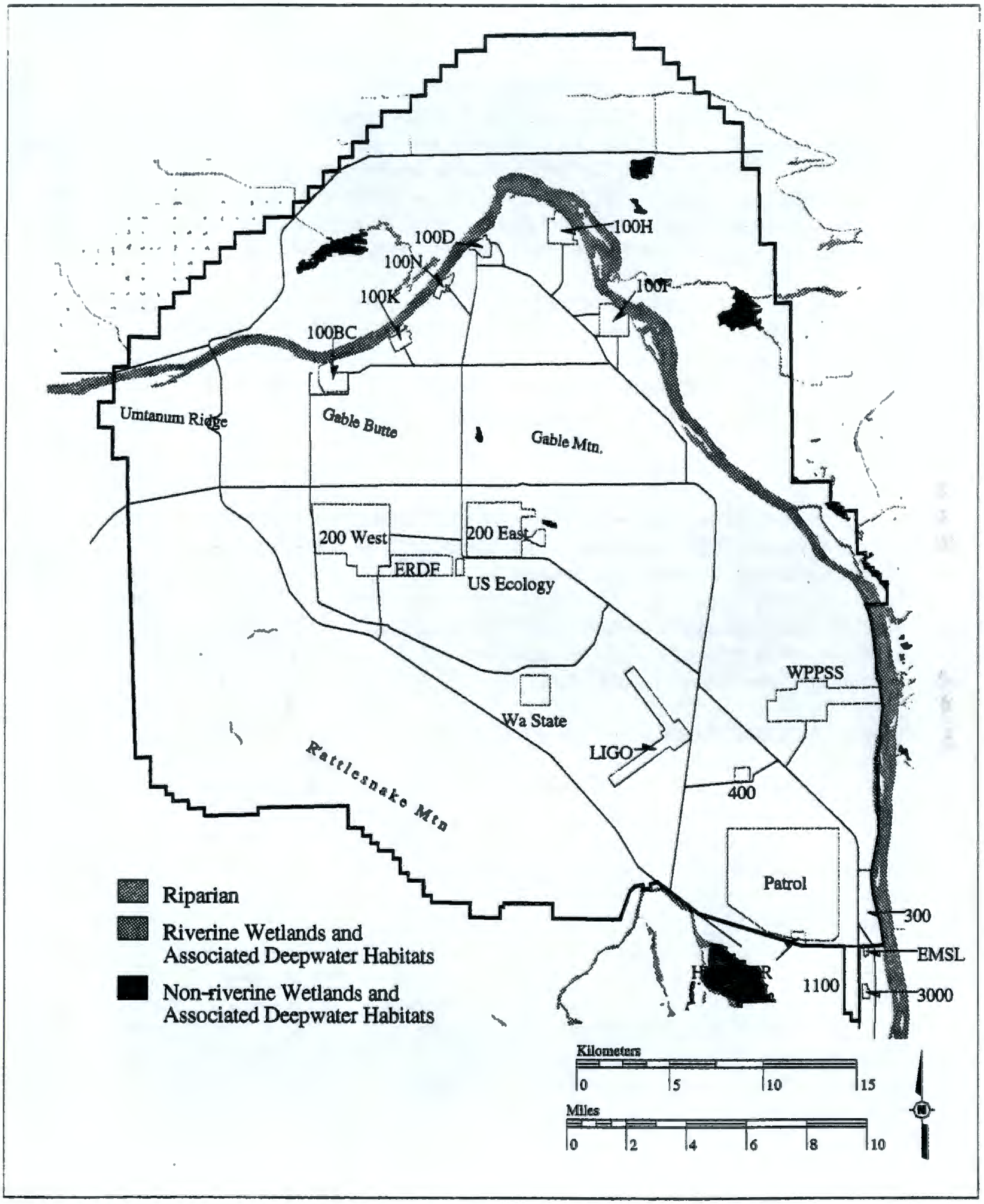
4.5.8 Biological Resources Management

The DOE is currently in the process of developing and implementing an overall management strategy for the conservation of fish, wildlife, and plant populations and their habitats on the Hanford Site. The draft *Hanford Site Biological Resources Management Plan* (BRMaP) (DOE-RL 1996c) was developed to provide the DOE and its contractors with a consistent approach to protect biological resources and to monitor, assess, and mitigate impacts from site development, and environmental cleanup and restoration activities. The primary purposes of the BRMaP are to (1) support DOE Hanford missions; (2) provide a mechanism for ensuring compliance with laws that relate to the management of potential impacts to biological resources; (3) provide a framework for ensuring appropriate biological resource goals, objectives, and tools are in place to make DOE an effective steward of the Hanford Site biological resources; and (4) implement an ecosystem management approach for biological resources on the Site.

The BRMaP provides a broad, but comprehensive, direction that specifies DOE biological resource policies, goals, and objectives and prescribes how they will be met. Two subordinate implementing documents outline specific management actions necessary to meet the policies, goals, and objectives, as described below:

- The *Ecological Compliance Assessment Management Plan* (DOE-RL 1995a) outlines the methods to be used to evaluate and quantify environmental impacts.

1 2 *Figure 4-20. Wetlands on the Hanford Site.*



- The draft *Hanford Site Biological Resources Mitigation Strategy Plan* (BRMiS) (DOE-RL 1996c) is designed to aid DOE in balancing its primary missions of environmental restoration, technology development, and economic diversification with its stewardship responsibilities for the biological resources it administers. The BRMiS will (1) ensure consistent and effective implementation of mitigation recommendations and requirements; (2) ensure that mitigation measures for biological resources meet the responsibilities of DOE under both the *National Environmental Policy Act of 1969* (NEPA) and the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA); (3) enable Hanford Site development and cleanup projects to anticipate and plan for mitigation needs through early identification of mitigation requirements; (4) provide guidance to Hanford personnel in implementing mitigation in a cost-effective and timely manner; and (5) preserve Hanford biological resources while facilitating balanced development and Site restoration activities.

These draft management plans are currently in trial use at Hanford for a one-year period. The plans are presented as guidance, not requirements. The plans have been issued to various resource agencies, organizations, and stakeholders for review and comment, and it is expected that once comments are received and on-the-ground implementation experience is gained, the plans will be revised and issued as Hanford Site requirements.

4.5.9 Biodiversity

The principles of ecosystem management and sustainable development are the foundation upon which DOE manages its lands and facilities. Comprehensive plans guide land- and facility-use decisions by addressing ecological, social, and cultural factors, as well as Site mission and economics. Each comprehensive plan considers the Hanford Site's larger regional context and is developed with stakeholder participation. This DOE policy will result in land and facility uses that support DOE's mission at Hanford, while stimulating the economy and protecting the environment (DOE 1995c).

Biodiversity, a critical component of comprehensive land-use planning, has been defined as the diversity of ecosystems, species, and genes, and the variety and variability of life (CEQ 1993). Major components of biodiversity are plant and animal species, micro-organisms, ecosystems and ecological processes, and the inter-relationships between and among these components. Biodiversity also is a qualitative measure of the richness and abundance of ecosystems and species in a given area (NPS 1994).

Features contributing to biodiversity on the Hanford Site include one of the largest undisturbed tracts of native shrub-steppe habitat left in Washington State and the Hanford Reach, which is the last free-flowing nontidal stretch of the Columbia River in the United States (PNNL 1996a). Other influencing factors include topographic features such as Rattlesnake Mountain, Gable Butte, and Gable Mountain; a variety of soil textures ranging from sand to silty and sandy loam; and most importantly, the lack of human use and development over much of the Hanford Site. Specialized terrestrial habitats contributing to the biodiversity of the Hanford Site include areas of sagebrush-steppe, basalt outcrops, scarps (cliffs), scree slopes, and sand dunes. Aquatic components of biodiversity are mainly associated with the Columbia River and include aquatic habitat, wetland and riparian areas, and riverine habitat along Hanford Reach shoreline and islands in the Columbia River. Ecologically important plant and animal species on the Hanford Site include species of concern; commercial and recreational wildlife species (e.g., anadromous fish, mule deer, and upland game birds); and plant species used as a source of food, medicine, fiber, and dye by native peoples of the Columbia Basin (WHC 1992a).

In 1992, DOE and The Nature Conservancy entered into a Memorandum of Understanding that called for a cooperative and coordinated inventory of plants, animals, and ecologically significant areas at the Hanford Site. In 1994, DOE awarded The Nature Conservancy a grant to conduct a partial inventory of the Hanford Site on the ALE Reserve and the Wahluke Slope. The inventory, which was conducted from March 1994 to March 1995, showed that the Hanford Site supports a rich mosaic of relatively unaltered and increasingly uncommon native habitats, the quality and extent of which are unequaled within the Columbia Basin (TNC and Pabst 1995). Significant numbers of plant, bird, and insect species, many of which are rare or in declined numbers in Washington, were found to be associated with or dependent on these habitats. The Hanford Site serves as a genetic bank for both the common and unusual plants and animals that comprise the shrub-steppe ecosystem. This initial inventory can provide only a rough indication of the quality of biodiversity that is to be found on the main part of the Hanford Site, which is more extensively disturbed than the ALE Reserve or the Wahluke Slope. Additional inventories are being performed of the main part of the Hanford Site and may include studies of small mammals, reptiles and amphibians, and nonvascular plants.

The central portion of the Hanford Site has not been farmed or grazed by livestock for over 50 years, allowing the Hanford Site to serve as a refuge for various plant and animal species (PNNL 1996a). However, the invasion and spread of non-native plant species into previously disturbed areas represents a potential threat to biodiversity through displacement of native species, simplification of plant communities, and fragmentation of habitat. Introduced plant species account for approximately 21 percent of the vascular plants found on the Hanford Site and include species such as cheatgrass, Russian thistle, and most of the tree species found on the Hanford Site (WHC 1992f). Most of the disturbed areas on the Hanford Site, including abandoned farmland and areas burned by wildfire, are dominated by pure stands of cheatgrass where the native shrub component has been modified severely or replaced altogether (Cushing 1992).

Human activities may have profound effects on the biodiversity of an ecosystem or community. Among other factors, these human activities include habitat modification or destruction and habitat fragmentation. Destruction or modification of a habitat can occur when undisturbed areas are harvested or converted to other uses, such as agriculture or industrial facilities. Habitat fragmentation occurs when disturbed areas break up a large community into smaller isolated undisturbed areas. When fragmentation occurs, biodiversity is impacted because the smaller undisturbed areas may not be capable of supporting the same number of species. The edges of the undisturbed area also may be strongly affected by proximity to the disturbed area, further reducing the size of the area that is truly undisturbed. Furthermore, the disturbed areas may serve as migration barriers for some species, effectively blocking recolonization of areas where small localized extinctions have occurred. Areas such as the Hanford Site serve to preserve regional biodiversity by providing refuges for species that have been eliminated by human activities in the surrounding region.

4.6 Cultural Resources

The Hanford Site is known to be rich in cultural resources, with numerous, well-preserved archaeological sites representing the period since American Indian contact with Euro-Americans, and the period prior to that contact. These periods are often referred to as "prehistoric" and "historic," but these terms do not recognize the fact that members of Tribal Nations have maintained an active oral history for a long period of time that predates the contact with Euro-Americans. For this reason, the EIS will use the terms "post-contact" and "pre-contact" to describe these periods when appropriate. Management of the Hanford Site cultural resources follows the *Hanford Cultural Resources Management Plan* (PNL 1989) and is conducted by the Cultural Resources staff of the Environmental Restoration Contractor team, in partnership with the Fluor Daniel Hanford, Inc. staff historian and the Hanford Cultural Resources Laboratory (HCRL) of PNNL (see text box, *"Hanford Site Quick Facts: Cultural Resources"*).

> ***Hanford Site Quick Facts: Cultural Resources***
>
> About 8 percent of the Hanford Site has been surveyed. From those surveys, 964 cultural resource sites and isolated finds have been recorded to date. Each find of one or more features (nonportable, nondiscrete artifacts), or of three or more artifacts within 10 m (32.8 ft) of each other, will be designated as a site and duly recorded in the files of the Washington State Office of Archaeology and Historic Preservation. All other objects are isolated finds (i.e., isolates). Forty-nine properties are listed on the National Register.

The *Hanford Cultural Resources Management Plan* (PNL 1989), which was approved by the State Historic Preservation Office (SHPO) in 1989, was developed to establish guidance for the identification, evaluation, recordation, curation, and management of archaeological, historic, and traditional cultural resources as individual entities or as contributing properties within a district. The plan specifies methods of consultation with affected Tribes, government agencies, and interested parties, and includes strategies for the preservation and/or curation of representative properties, archives, and objects.

Cultural resources are defined as any district, Site, building, structure, or object considered to be important to a culture, subculture, or community for scientific, traditional, religious or other reasons. For the purpose of this EIS, these resources are divided into several categories: pre-contact and post-contact archaeological resources, architectural resources, and traditional (American Indian) cultural resources. Significant cultural resources are those that are eligible or potentially eligible for listing in *The National Register of Historic Places* (National Register) (NPS 1988).

Consultation is required to identify the traditional cultural properties that are important to maintaining the cultural heritage of American Indian Tribes. Under separate treaties signed in 1855, the Confederated Tribes and Bands of the Yakama Indian Nation and the Confederated Tribes of the Umatilla Indian reservation ceded lands to the United States that include the present Hanford Site. Under the treaties, the Tribes reserved the right to fish at usual and accustomed places in common with the citizens of the territory, and retained the privilege of hunting, gathering roots and berries, and pasturing horses and cattle upon open unclaimed land. The Treaty of 1855 with the Nez Perce Tribe includes similar reservations of rights, and the Hanford Reach is identified as the location of usual and accustomed places. The Wanapum People are not signatory to any treaty with the United States and are not a Federally recognized Tribe; however, the Wanapum People were historical residents of the Hanford Site, and their interests in the area have been acknowledged.

The methodology for identifying, evaluating, and mitigating impacts to cultural resources is defined by Federal laws and regulations including the *National Historic Preservation Act of 1966*, the *Archaeological Resources Protection Act of 1979*, the *Native American Graves Protection and Repatriation Act of 1990*, and the *American Indian Religious Freedom Act of 1978*. A project affects a significant resource when it alters the characteristics of the property, including relevant features of its environment or use, that qualify it as significant according to the National Register criteria. These effects may include those listed in 36 CFR 800.9. Impacts to traditional American Indian properties can be determined only through consultation with the affected American Indian groups.

In 1995, 964 cultural resource sites and isolated finds were recorded in the files of the Hanford Cultural Resources Laboratory (HCRL) (PNNL 1996a). Forty-eight archaeological sites and one building are included on the National Register. National Register nominations have been prepared for several archaeological districts and sites considered to be eligible for listing on the National Register. While many significant cultural resources have been identified, only a small portion of the Hanford Site has been surveyed by cultural resource specialists and few of the known sites have been evaluated for their eligibility for listing in the National Register. Many additional cultural resources may remain unidentified. Cultural resource reviews are conducted when projects are proposed in areas that have not been previously surveyed. About 100 to 120 reviews were conducted annually through 1991; this figure rose to more than 360 reviews during 1995 (PNNL 1996a).

4.6.1 Pre-Contact Archaeological Resources

People have inhabited the middle Columbia River region since the end of the glacial period. More than 10,000 years of precontact human activity in this largely arid environment have left extensive archaeological deposits. Certain areas inland from the river show evidence of concentrated human activity, and recent surveys indicate extensive, although dispersed, use of arid lowlands for hunting. Graves are common in various settings, as are spirit quest monuments (Neitzel et al. 1997). Throughout most of the region outside of Hanford, hydroelectric development, agricultural activities, and domestic and industrial construction have destroyed or covered the majority of these deposits. Amateur artifact collectors have had an immeasurable impact on the remainder of the resources. Within the Hanford Site, from which the public is restricted, archaeological resources found in the Hanford Reach and on adjacent plateaus and mountains have been spared some of the disturbances that have befallen other sites. The Hanford Site is, thus, a *de facto* reserve of archaeological information of the kind and quality that has been lost elsewhere in the region.

Currently, 366 pre-contact archaeological sites have been found on the Hanford Site, 23 of which contain post-contact components. Of the 48 sites included on the National Register, two are single sites and the remainder are located in seven archaeological districts. In addition, four other archaeological districts have been nominated or are planned to be nominated to the National Register. Archaeological sites include the remains of numerous pithouse villages, campsites and graves, spirit quest monuments, hunting camps, game drive complexes, quarries, hunting and kill sites, and small temporary camps (Neitzel et al. 1997).

Recorded sites were found during archaeological reconnaissance projects conducted between 1926 and 1968. Systematic archaeological surveys conducted from the middle 1980s through 1995 are responsible for the remainder. The 100 Areas were surveyed in the early 1990s, revealing other archaeological sites (DOE 1995b).

4.6.2 American Indian Cultural Resources

In pre-contact and early contact periods, the Hanford Reach was populated by American Indians of various Tribal affiliations. The Wanapum People and the Chamnapum Band lived along the Columbia River from south of Richland upstream to Vantage (DOE 1995b). Some of their descendants still live nearby at Priest Rapids, and others have been incorporated into the Yakama and Umatilla Reservations. Palus People, who lived on the lower Snake River, joined the Wanapum, Nez Perce, and Chamnapum to fish the Hanford Reach, and some inhabited the east bank of the river (DOE 1995b). Walla Walla and Umatilla People also made periodic visits to fish in the area. These people retain traditional secular and religious ties to the region, and many have knowledge of the ceremonies and lifeways of their culture. The Washani, or Seven Drums religion, which originated among the Wanapum on what is now the Hanford Site, is still practiced by many people on the Yakama, Umatilla, Warm Springs, and Nez Perce Reservations. Native plant and animal foods, many of which are abundant on the

Hanford Site, are used in the ceremonies performed by sect members of this religion, as well as other American Indians who conduct traditional activities (Neitzel et al. 1997).

During public scoping of this EIS, Tribal members emphatically expressed an interest in renewing their use of these resources in accordance with the Treaties of 1855. The DOE is attempting to address Tribal concerns by allowing access for the purposes of religious activities and gathering foods and medicines to the extent that these activities are consistent with DOE missions. From a traditional American Indian viewpoint, nature is intrinsically spiritual, as sacredness is embedded in natural phenomena, landforms, plants, and animals. People are one of the thousands of species in a single interconnected system of species relationships. This system of relationships is considered to be based on a sense of reciprocity, and a threat to the land or environment can be perceived as a threat to the entire culture. Impacts to the natural landscape also might be considered impacts to the self-identity of a Tribal community.

Spirituality is expressly interwoven in the Tribal community's way of life. This attachment to land and water means that sacred sites are not always confined or precisely located and are numerous and diverse in form (DOI 1995).

The Hanford Site possesses traditional cultural significance for many members of Columbia Plateau Tribes. Certain sites demonstrate traditional cultural significance for the following reasons:

- An American Indian group associates the location(s) with traditional beliefs about their origin, their cultural history, or the nature of the world.

- American Indian religious practitioners historically have gone, and continue to go, to the location(s) to perform ceremonial activities in accordance with traditional cultural rules.

- American Indian groups make use of natural resources in the conduct of traditional activities. Use can be as food, medicine, barter and exchange items (currency), and for artistic and religious purposes. The act and method of gathering, processing, and exchange and use can all carry important cultural significance.

4.6.3 Post-Contact Archaeological and Architectural Resources

The first Euro-Americans who came to this region were Lewis and Clark, who traveled along the Columbia and Snake rivers during their 1803 to 1806 exploration of the Louisiana Territory. Lewis and Clark were followed by fur trappers, military units, and miners who also passed through on their way to more productive lands upriver and downstream and across the Columbia Basin. It was not until the 1860s that merchants set up stores, a freight depot, and the White Bluffs Ferry on the Hanford Reach. Chinese miners began to work the gravel bars for gold. Cattle ranches opened in the 1880s and farmers soon followed. Several small, thriving towns, including Hanford, White Bluffs, and Ringold, were established along the riverbanks in the early 20th century. Other ferries were established at Wahluke and Richland. The towns and nearly all other structures were razed after the U.S. government acquired the land for the original Hanford Engineer Works in the early 1940s (DOE 1995b; Neitzel 1997).

A total of 390 post-contact archaeological sites, 89 post-contact isolated finds, and numerous post-contact properties have been recorded by the HCRL on the Hanford Site. Of these sites, one is included in the National Register. Properties from the pre-Hanford Site era include semi-subterranean structures near McGee Ranch; the Hanford Irrigation and Power

Company pumping plant at Coyote Rapids; the Hanford Irrigation Ditch; the old Hanford Townsite, pumping plant, and high school; Wahluke Ferry; the White Bluffs Townsite and bank; the Richland Ferry; Arrowsmith Townsite; a cabin at East White Bluffs ferry landing; the White Bluffs road; the Chicago, Milwaukee, St. Paul, and Pacific Railroad (Priest Rapids-Hanford Line) and associated whistle stops; and the Bruggeman fruit warehouse (Cushing 1995). Historic archaeological sites, including the East White Bluffs townsite and associated ferry landings and an assortment of trash scatters, homesteads, corrals, and dumps, have been recorded by the HCRL since 1987. Minor test excavations have been conducted at some of the historic sites, including the Hanford townsite locality. In addition to the recorded sites, numerous unrecorded areas of gold mine tailings along the river bank and the remains of homesteads, farm fields, ranches, and abandoned U.S. Army installations are scattered over the entire Hanford Site.

More recent historic structures are the defense reactors and associated materials processing facilities that are present on the Hanford Site. The first reactors (B, D, and F) were constructed in 1943 as part of the Manhattan Project. Plutonium for the first atomic explosion and the bomb that destroyed Nagasaki to end World War II was produced at the B Reactor. Additional reactors and processing facilities were constructed after World War II during the Cold War. All reactor containment buildings still stand, although many ancillary structures have been removed. The B Reactor is listed on the National Register and was given the National Historic Landmark Award (Cushing 1995). About 45 other buildings have been evaluated for National Register eligibility by the SHPO.

A Historic Buildings Task Force was established to coordinate future evaluations among DOE and the Hanford Site contractors. This task force established the Hanford Site Historic District, identified all contributing and noncontributing buildings and structures within the District, and prepared an Historic Buildings Programmatic Agreement to direct the documentation of the contributing properties.

After negotiation, the Programmatic Agreement was approved by the Advisory Council on Historic Preservation, the SHPO, and DOE in August 1996. The Programmatic Agreement outlines the methods agreed to by these parties to preserve and protect significant historical resources on the Hanford Site. The Programmatic Agreement stipulates that DOE will document the contributing historic buildings and structures identified in Appendix C of the Programmatic Agreement, which includes about 190 buildings considered to be historically significant. These buildings will require mitigation (i.e., to document the historical character of the building) prior to activities that might adversely affect historic characteristics. The Programmatic Agreement also identifies the form of mitigation required and exemptions to the requirement for mitigation. Evaluation and mitigation will proceed for the identified buildings in accordance with the Programmatic Agreement.

The Programmatic Agreement allows for: the exemption of property types from review and documentation requirements; the exemption of classes of action from review; the designation of an Historic District; the mitigation of all actions on Site, up to and including demolition of properties, through production of a site-wide process/events history. Provisions in the Programmatic Agreement are implemented through the "Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan."

For the purpose of this discussion, the cultural resources present along the Columbia River and in the 100 Areas are considered together. This allows a discussion of sensitive cultural resources, without providing information sufficient to allow the discovery and/or adverse impact of these resources by unauthorized personnel. Much of the following information has been obtained from the *Hanford Site National Environmental Policy Act (NEPA) Characterization* (PNNL 1996a).

Intensive field surveys were completed in the 100 Areas from 1991 to 1993. Much of the surface area within and near the 100 Areas fencelines has been disturbed by the industrial activities that have taken place during the past 50 years. Numerous archaeological sites have been encountered, and many are potentially eligible for the National Register. A complete inventory of 100 Area buildings and structures was completed during fiscal year 1996. The former community of Wahluke, which was at the landing of a ferry of the same name, is situated on the north bank of the river.

The principal post-contact site in the vicinity is the East White Bluffs ferry landing and former townsite, which has been considered for nomination to the National Register. The site was the upriver terminus of shipping during the early and mid-19th century. It was at this point that supplies for trappers, traders, and miners were off-loaded, and commodities from the interior were transferred from pack trains and wagons to river boats. The first store and ferry of the mid-Columbia region were located at this site. A log cabin, thought by some to have been a blacksmith shop in the mid-19th century, still stands. The structure has been recorded according to standards of the Historic American Buildings Survey. The only remaining structure associated with the White Bluffs townsite (near the railroad) is the White Bluffs Bank. A revised historic property inventory form for the bank was completed in 1995. Two Manhattan Project buildings, 105-F and 108-F, remain in the 100-F Area. The 108-F Biology Laboratory, originally a chemical pumphouse, has been determined eligible for the National Register.

In the vicinity of 100-F, post-contact sites were recorded during 1992, 1993, and 1995 and include 20th century farmsteads, household dumps, and military encampments. None of the sites have been evaluated for eligibility to the National Register. Only three buildings associated with the Cold War era remain in this area. These buildings were inventoried and evaluated in 1996.

In the 100-K Area, historic sites containing the remains of farms are found in the nearby area; four historic sites and three isolated finds have been recorded as of 1994. Two important linear features, the Hanford Irrigation Ditch and the former Priest Rapids-Hanford railroad, also are present in the 100-K Area. Remnants of the Allard community and the Allard Pumphouse at Coyote Rapids are located west of the K Reactor compound. The Historic Buildings Task Force has recommended that the 105-KW Reactor and the 1706-KE and 1706-KER water recirculation study facilities be listed in the National Register.

Knowledge about the archaeology of the 100-N Area is based largely on reconnaissance-level archaeological surveys conducted within the last 30 years (PNNL 1996a). These surveys are not complete inventories of the areas covered. Intensive surveys of surrounding areas were conducted during 1991. The Hanford Generating Plant vicinity also has been surveyed intensively for archaeological resources.

The most common evidence of activities now found near the 100-N Area consists of gold mine tailings on riverbanks and archaeological sites where farmsteads once stood. The significance of the 100-N buildings, their role in the Cold War, and their eligibility for listing in the National Register, have been documented through *The Hanford Site N Reactor Buildings Task Identification and Evaluation of Historic Properties* (BHI 1996a), which was conducted during fiscal year 1995. Buildings 105-N, 109-N, 155-N, 185-N, and 1112-N have been determined eligible for the National Register by DOE and the SHPO. Additional determinations for contributing buildings have been submitted to the SHPO, as well as a mitigation plan for the 100-N Reactor complex.

An archaeological survey conducted of all undeveloped portions of the 200 East Area and a 50 percent random sample conducted of undeveloped portions of the 200 West Area have indicated no findings of archaeological sites (PNL 1990b). However, some small sites are known to exist within the boundaries of the 200 East and 200 West Area (DOE 1995b). The only evaluated historic site is the old White Bluffs freight road that crosses diagonally through the 200 West Area. The road, which was originally an American Indian trail, has been in continuous use as a transportation route since pre-contact history and has played a role in Euro-American immigration, regional development, agriculture, and the recent Hanford Site operations. As such, the property has been determined to be eligible for the National Register, although the segment that passes through the 200 West Area is considered to be a noncontributing element. A 100-m (328-ft) restricted zone has been created to protect the road from uncontrolled disturbance. In addition, 49 buildings in the 200 East and 200 West Areas have been evaluated; nine of these buildings have been determined as eligible for the National Register.

Most of the 300 Area has been highly disturbed by industrial activities. Archaeological surveys of the 300 Area have included inspection of a narrow strip along the riverbank, the right-of-way for a planned toll bridge just south of the area boundary, and several DOE project-driven surveys. The majority of the buildings in the 300 Area were constructed in the Manhattan Project and Cold War (1943 through 1989) eras. A total of 158 buildings/structures in the 300 Area have been inventoried on historic property inventory forms. Of that number, 47 buildings/structures have been determined eligible for the National Register as contributing properties within the Historic District recommended for mitigation (Neitzel et al. 1997).

Most of the 400 Area has been subjected to intensive development-related construction activities. Archaeologists surveying the site in 1978 were able to find only 12 ha (30 ac) that were undisturbed. No cultural resources were found within that small area and no sites have been recorded or are known to exist within 2 km (1.2 mi) of the 400 Area (Cushing 1995). The FFTF and its associated structures have been evaluated by the Historic Buildings Task Force. Buildings 405, 4703, and 4710 have been recommended as contributing properties to the Hanford Site Historic District.

The 600 Area contains diverse cultural resource sites and traditional cultural properties. Project-driven surveys have been conducted throughout the area, but much of the 600 Area remains unsurveyed.

Five anti-aircraft artillery sites have been determined eligible for the National Register. Because of the proposed remediation of these sites, mitigation to reduce the adverse effects will be carried out. The Central Shops Complex, in the 600 Area, was determined to be ineligible for the National Register in 1995 (Cushing 1995).

Historic cultural resources have been identified in or near the 1100 Area. These resources include remnants of homesteads and agricultural structures predating the establishment of the Hanford Site. These sites will be evaluated for National Register eligibility before the start of any project that might adversely affect them.

4.7 Socioeconomic Environment

Activity on the Hanford Site plays a dominant role in the socioeconomics of the Tri-Cities and other parts of Benton and Franklin counties. The Tri-Cities serves as a market center for a much broader area of eastern Washington, including Adams, Columbia, Grant, Walla Walla, and Yakima counties. The Tri-Cities also serves parts of northeastern Oregon, including Morrow, Umatilla, and Wallowa counties. Socioeconomic impacts of changes at Hanford are mostly confined to the immediate Tri-Cities community and Benton and Franklin counties (and Yakima County, to a lesser extent) (PNL 1984, PNL 1987). However, because of the significance of the wider agricultural region and surrounding communities in the Tri-Cities economic base, this section briefly discusses the wider region as well (Figure 4-21). Table 4-8 summarizes the regional (Benton and Franklin counties) jobs from 1995 to 1996.

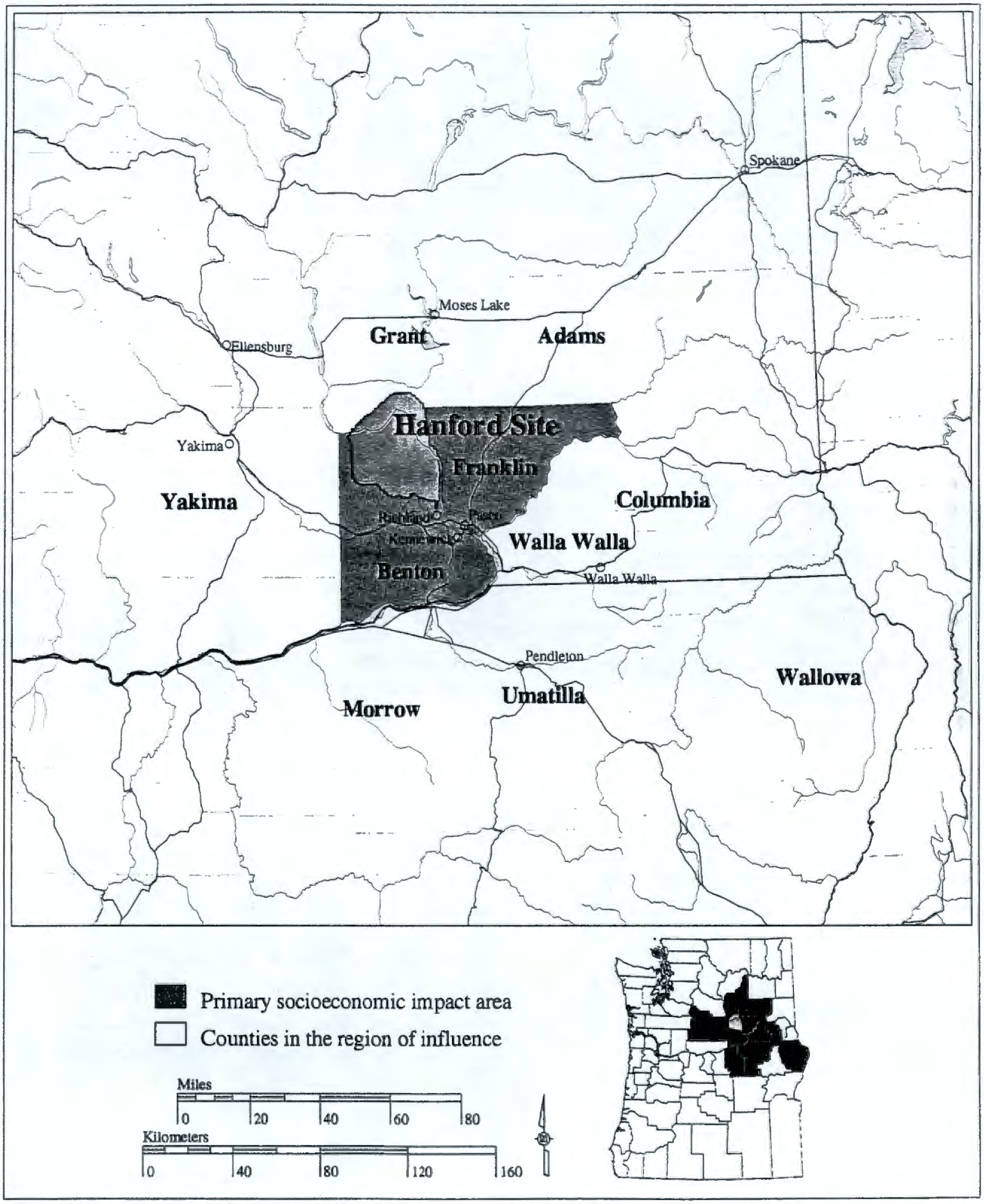
Due to the changing Hanford mission, it has been necessary to develop a facility transition plan. The first step will be conversion, which transitions the process from facilities that were developed to support DOE's nuclear production mission to either new Federal or private development. There have been many obstacles to the successful implementation of a facility reuse plan. The objectives of a successful conversion are as follows:

- Retraining and re-employment of those who have lost jobs, directly or indirectly, as a result of the Federal mission change
- Creation of jobs to replace the revenue lost directly through reductions in payroll taxes and property taxes, as well as through indirect impacts, such as lost sales tax revenue
- Reuse of the facilities on the Hanford Site so the local government might generate revenue to cover the costs involved in its newly acquired responsibilities of maintaining and servicing those facilities, such as the provision of police and fire services and municipal utilities (e.g., water service)
- Using the closure as an opportunity to revitalize the local community
- Mitigating the impacts on the community at large, both from the business and social service perspectives.

There are several steps that a community may have to take to achieve these objectives, including some of those outlined below:

- Improvement of marketing of facilities (i.e., buildings, transportation, and utilities) to new employers
- Training of potential employees
- Negotiation of property transfer and leases
- Negotiation of care and custody agreements
- Supporting environmental remediation to enable the transfer of property

Figure 4-21. Areas of Washington and Oregon Where Socioeconomic Resources Might Be Affected (DOE 1995b).



BHI:rpp 02/11/98 clup/region2.aml Database: 11-FEB-1998

Table 4-8. Nonagricultural Workers in Benton and Franklin Counties, 1995 to 1996 (Neitzel et al. 1997).

Industry	1995 Annual Average	1996 Annual Average	% Change 1995-1996
Nonagricultural wage laborers	72,300	69,600	-3.7
Manufacturing	6,000	5,800	-3.3
Construction	4,300	4,000	-7.0
Public utilities	2,900	2,900	0
Wholesale and retail trade	15,500	15,400	-0.7
Finance, insurance, and real estate	2,300	2,200	-4.4
Services and mining	27,800	25,900	-6.8
Government	13,500	13,400	0.7
Agricultural[a]	5,210	5,500	5.5

[a]Source: TRIDEC Tri-City demographics.

- Acquisition of funding for continued conversion efforts (e.g., planning and implementation)

- Conducting feasibility studies to assist in the successful implementation of specific components of the reuse plan, such as the creation of a historic district or educational programs.

The Hanford Community is working on the Hanford facilities reuse problem through a collation of local cities, port districts, and counties, with assistance from DOE's Office of Worker and Community Transition.

4.7.1 Demographics

Estimates for 1996 placed population totals for Benton and Franklin counties at 131,000 and 43,700, respectively (Neitzel et al. 1997). When compared to the 1990 census data in which Benton County had 112,560 residents and Franklin County population totaled 37,473, the current population totals reflect the continued growth occurring in these two counties.

The 1996 estimates distributed the Tri-Cities population as follows: Richland, 35,990; Pasco, 22,370; and Kennewick, 48,010. The combined populations of Benton City, Prosser, and West Richland totaled 13,665 in 1996 (see text box, *"Hanford Site Quick Facts: Populations [1996 Estimates]"*). The unincorporated population of Benton County was 33,335. In Franklin County, incorporated areas other than Pasco have a total population of 3,263. The unincorporated population of Franklin County was 18,067 (Neitzel et al. 1997).

Hanford Site Quick Facts: Populations (1996 Estimates)

- Kennewick: 48,010
- Richland: 35,990
- Pasco: 22,370

Benton and Franklin counties accounted for 3.2 percent of the population in Washington State (Neitzel et al. 1997). In 1996, the population demographics of Benton and Franklin counties were quite similar to those found within the State of Washington. In 1995, 55 percent of the population of Benton and Franklin counties was under the age of 35, compared to 51 percent for the State of Washington. In general, the population of Benton and Franklin counties is somewhat younger than that of Washington State. The 0- to 14-year old age group accounts for 26.6 percent of the total bi-county population as compared to 22.7 percent for Washington State. In 1996, the 65-year old and older age group constituted 9.7 percent of the population of Benton and Franklin counties compared to 11.5 percent for the State of Washington.

4.7.1.1 Demographics of Minority Populations. Demographic information obtained from the U.S. Bureau of Census was used to identify minority populations and low-income communities within an 80-km (50-mi) radius surrounding the Hanford Site. For the evaluation of environmental justice impacts, the area defined by this 80-km (50-mi) radius is considered the zone of potential impact.

4.7.1.1.1 Definitions. The demographic analysis used the following definitions to develop community characteristics:

- Census Tract — An area defined for the purpose of monitoring census data that is usually comprised of between 2,500 and 8,000 persons, with 4,000 persons being ideal. When first delineated, census tracts are designed to be homogeneous with respect to population characteristics, economic status, and living conditions. Census tracts do not cross county boundaries. Spatial census tract size varies widely depending on the density of settlement. Census tract boundaries are delineated with the intention of being maintained over a long period of time so that statistical comparisons can be made from census to census.

- Census Block Group — An area defined for the purpose of monitoring census data that generally consists of between 250 and 550 housing units.

- Minority Populations — A group of people and/or communities experiencing common conditions of exposures or impact that consists of persons classified by the U.S. Bureau of Census as Negro/Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and other non-White persons, based on self-classification by the people according to the race with which they most closely identify. For the purposes of analysis, minority populations are defined as those census tracts within the zone of impact where the percent minority population exceeds the percentage minority population within the entire zone of impact. Census tracts where the percent minority population exceeds 50 percent are also considered minority populations. In the case of migrant or dispersed populations, a minority population consists of a group that is greater than a 50 percent minority.

- Low-Income Community — An area where the median household income is 80 percent or more below the median household income for the metropolitan statistical area (urban) or county (rural). The 80 percent threshold was used based on definitions used by the U.S. Department of Housing and Urban Development.

- Population Base — Census tracts were included in the analysis if 50 percent of the geographic area of the tract fell within the 80-km (50-mi) radius of the Hanford Site.

4.7.1.1.2 Minority and Low-Income Populations Near Hanford. Demographic maps were prepared using 1990 census data resolved to the census group tract level (USBC 1992).

A total population of approximately 384,000 people reside within an 80-km (50-mi) radius of the Hanford Site. The minority population within the area consists of approximately 95,000 people and represents approximately 25 percent of the population in the assessment area. The ethnic composition of the minority population is primarily Hispanic (approximately 80 percent) and American Indian (8 percent). Census tracts where the percentage of minority persons within the population exceeds 20 percent are located to the southwest and northeast of the Hanford Site and within the City of Pasco, Washington (Neitzel et al. 1997).

The low-income population within the 80-km (50-mi) area of impact represents approximately 42 percent of the households in the area of impact. Census tracts where the percentage of the population consisting of low-income households exceeds 25 percent are principally located to the southwest and north of the Hanford Site and within the City of Pasco, Washington (Neitzel et al. 1997). Considerable overlap between low-income populations and minority populations exists in the vicinity of the Hanford Site.

4.7.1.1.3 Limitations of Demographic Data. Characterization of minority and low-income populations residing within a geographical area is sensitive to the basic definitions and assumptions used to identify those populations. Consequently, the number of individuals identified as minority and/or low-income individuals within the population around a particular site may vary from analysis to analysis. Several different approaches to identification of minority and low-income populations have been used in recent DOE EISs. The approach presented in this EIS is consistent with the approach used in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Neitzel et al. 1997). Other demographic studies may use different assumptions and, consequently, report a different total population, minority population, or low-income population depending on the assumptions used to identify each population.

4.7.2 Economics

This section summarizes pertinent economic activity within the region of interest, including information on the general economy, employment, income, and impact of the Hanford Site. Historically, the primary industries within the region have been related to agriculture—a multitude of crops encompassing many fruits, vegetables, and grains are grown each year.

4.7.2.1 Employment in the Tri-Cities. Three major sectors have been the principal driving forces of the economy in the Tri-Cities since the early 1970s: (1) the DOE and Hanford Site contractors; (2) the WPPSS in its construction and operation of nuclear power plants; and (3) agriculture, including a substantial food-processing industry. With the exception of a minor amount of agricultural commodities sold to local area consumers, the goods and services produced by these sectors are exported from the Tri-Cities. In addition to direct employment and payrolls, these major sectors also support a sizable number of jobs in the local economy through the procurement of equipment, supplies, and business services.

- ***DOE and Hanford Contractors***. An average of 11,400 employees worked for the DOE and its Hanford contractors in 1996. This number is down from over 19,000 in 1994 due to downsizing activities, which has reduced employment at Hanford by 7,700 through FY 1996 (Source: Hanford Site Internet homepage). In addition to downsizing by Hanford contractors in 1996, DOE created a new Project Hanford Team in an effort to produce cleanup results more cost effectively over a shorter time period, and to help diversify and stabilize the Tri-Cities economy. This team is made up of the overall management contractor Fluor Daniel Hanford Company, Fluor's six major subcontractors, and six newly created "enterprise companies." Fluor Daniel is responsible for integrating and directing cleanup tasks. The actual cleanup work is conducted by the six subcontractors. The "enterprise companies" will provide services to the six major subcontractors.

As of December 31, 1996, the official employment count for Hanford was 11,413, which includes Fluor, the six major subcontractors, Pacific Northwest National Laboratory, Bechtel, Hanford Environmental Health Foundation, ICF Kaiser, and local DOE employees. The "enterprise companies," which have a combined employment of just over 2,000, are not included in this count. The Hanford payroll has a widespread impact on the Tri-Cities and state economies, in addition to providing direct employment.

- ***WPPSS***. Although activity related to nuclear power plant construction ceased with the completion of the WNP-2 reactor in 1983, the WPPSS continues to be a major employer in the Tri-Cities area. Headquarters personnel based in Richland oversee the operation of one generating facility and perform a variety of functions related to two mothballed nuclear plants and one generating facility. In 1995 and 1996, downsizing activities at the WPPSS headquarters decreased employment to about 1,164 workers (down from more than 1,900 in 1994). The WPPSS activities generated a payroll of approximately $81 million in the Tri-Cities during 1996. Decommissioning of the two mothballed Washington Nuclear Plants (WNP-1 and WNP-4) is expected to begin in the next few years. This decommissioning is expected to reduce the number of employees necessary to maintain these facilities (PNNL 1996a).

- ***Agriculture***. In 1995, agricultural activities in Benton and Franklin counties were responsible for approximately 9,739 jobs, or 12 percent of the total employment in the area. According to the U.S. Department of Commerce Regional Economic Information System, about 2,173 people were classified as farm proprietors in 1994. Farm proprietors' income, according to this same source, was estimated to be $69 million (Neitzel et al. 1997).

In 1996, the counties of Benton, Franklin, and Walla Walla counties averaged 7,033 seasonal farm workers, ranging from 1,090 workers during the winter pruning season to 16,120 workers at the peak of harvest. An estimated average of 6,150 seasonal workers were classified as local (ranging from 1,653 to 14,388); an average of 375 were classified as intrastate (ranging from 0 to 1,311); and an average of 508 were classified as interstate (ranging from 8 to 1,558). Most intrastate workers resided elsewhere in Benton, Franklin, Walla Walla, and Yakima counties, although the peak harvest season saw an influx of workers from around eastern and central Washington.

Area farms and ranches generate a sizable number of jobs in supporting sectors, such as agricultural services (e.g., application of pesticides and fertilizers or irrigation system development) and sales of farm supplies and equipment. Although formally classified as a manufacturing activity, food processing is a natural extension of the farm sector. More than 20 food processors in Benton and Franklin counties produce items such as potato products, canned fruits and vegetables, wine, and animal feed.

In addition to the three major employment sectors (Hanford-related, power marketing, and agricultural), five other employers in 1996 were readily identified as contributors to the economic base of the Tri-Cities economy: (1) Iowa Beef Processing Inc., which employed 1,500 workers (this company lies outside of Benton and Franklin Counties, but most of the workforce resides in the Tri-Cities); (2) Lamb Weston, which employed 1,340 workers; (3) Siemens Nuclear Power Corporation, which employed 830 workers; (4) Boise

Cascade/Paper Group, which employed 525 workers (like Iowa Beef Processors, Boise Cascade's Wallula mill lies outside both Benton and Franklin Counties, but most of its workforce resides in the area); and (5) Burlington Northern Santa Fe Railroad, which employed 375 workers. Approximately 4,570 workers were employed by these businesses in Benton and Franklin counties in 1996 (Neitzel et al. 1997).

4.7.2.1.1 Tourism. The Tri-Cities Visitors and Convention Bureau reported that approximately 206 conventions were held in the Tri-Cities in 1996, with 63,540 attending visitors spending an estimated $21 million.

Overall tourism expenditures in the Tri-Cities were roughly $184 million in 1995, with travel-generated employment of about 3,220 and an estimated $34 million in payroll in Benton and Franklin counties.

4.7.2.1.2 Retirees. Although Benton and Franklin counties have a relatively young population (approximately 55 percent under the age of 35), 16,958 people over the age of 65 resided in Benton and Franklin counties in 1996. The portion of the total population 65 years and older in Benton and Franklin counties accounts for 9.7 percent of the total population, slightly below that of the State of Washington (11.5 percent). This segment of the population supports the local economy on the basis of income received from government transfer payments and pensions, private pension benefits, and individual savings.

Although information on private pensions and savings is not available, data is available regarding the magnitude of government transfer payments. The U.S. Department of Commerce Regional Economic Information System has estimated transfer payments by various programs at the county level. A summary of estimated major government pension benefits received by the residents of Benton and Franklin counties in 1994 is shown in Table 4-9.

About two-thirds of the social security payments go to retired workers; the remainder of the payments are for disability and other types of payments. The historical importance of government activity in the Tri-Cities area is reflected in the relative magnitude of the government employee pension benefits as compared to total payments (Neitzel et al. 1997).

4.7.2.2 Income Sources. Total personal income is comprised of all forms of income received by the populace, including wages, dividends, and other revenues. Per capita income is roughly equivalent to total personal income divided by the number of people residing in the

Table 4-9. Government Retirement Payments in Benton and Franklin Counties in 1994 ($ million) (Neitzel et al. 1997).

Source	Benton County	Franklin County	Total
Social security (including survivors and disability)	148.0	38.5	186.5
Railroad retirement	3.9	4.0	7.9
Federal civilian retirement	12.7	2.6	15.3
Veterans pension and military retirement	20.5	3.9	24.4
State and local employee retirement	28.9	5.7	34.6
Total	214.0	54.7	268.7

area. Median household income is the point at which half of the households have an income greater than the median and half of the households have less. The source for total personal income and per capita income was the U.S. Department of Commerce Regional Economic Information System, while median income figures for Washington State were provided by the Office of Financial Management (PNNL 1996a).

In 1994, the total personal income for Benton County was $2,851 million, Franklin County was $726 million, and the State of Washington was $120.4 billion. Per capita income in 1994 for Benton County was $22,053, Franklin County was $16,999, and Washington State was $22,526. Median household income in 1994 for Benton County was estimated to be $43,684, Franklin County was estimated $31,121, and the State of Washington was estimated at $38,094 (Neitzel et al. 1997).

4.7.2.3 Hanford Site Employment. An average of 11,415 employees worked for DOE and its Hanford contractors in 1996 (Source: Hanford Site Internet homepage). Future downsizing in Hanford Site employment is anticipated, although the extent of this downsizing is unknown at this time.

In 1996, Hanford employment accounted directly for 20 percent of total nonagricultural employment in Benton and Franklin counties and about 0.7 percent of all statewide nonagricultural jobs. In 1996, the Hanford Site total wage payroll was $521 million and accounted for a significant percentage of the payroll dollars earned in the area (Neitzel et al. 1997) (see text box, *"Hanford Site Quick Facts: Economic Multipliers"*).

Hanford Site Quick Facts: Economic Multipliers

Each Site job supports:

- 1.2 jobs in the local service sector
- 1.5 jobs in the state service sector

Each Site dollar supports:

- 2.1 dollars in total local incomes
- 2.4 dollars in total state incomes

Previous studies have revealed that each Hanford job supports about 1.2 additional jobs in the local service sector of Benton and Franklin counties (about 2.2 total jobs) and about 1.5 additional jobs in the state service sector. Similarly, each dollar of Hanford income supports about 2.1 dollars of total local incomes and about 2.4 dollars of total statewide incomes. Based on these multipliers, Hanford directly or indirectly accounts for more than 40 percent of all jobs in Benton and Franklin counties (Neitzel et al. 1997).

Based on employee residence records as of December 1996, 93 percent of the direct employment of Hanford is comprised of residents of Benton and Franklin counties. Approximately 76 percent of the employment is comprised of residents who reside in one of the Tri-Cities. More than 37 percent of the employment is comprised of Richland residents, 30 percent of Kennewick residents, and 9 percent of Pasco residents. West Richland, Benton City, Prosser, and other areas in Benton and Franklin counties account for 17 percent of total employment. Table 4-10 contains the estimated percent of Hanford employees residing in each of the counties within the region of influence. Available information did not include the residences of DOE employees nor employees of DynCorp Tri-Cities Services, Inc. It was assumed that the distribution of these employees would be similar to the distribution of the other Hanford Site contractor employees.

The DOE and Hanford Site contractors procured nearly $298 million of goods and services (45.6 percent of total procurements of $653 million) from Washington firms in 1993. About 18 percent of Hanford Site orders were filled by Tri-Cities firms.

Table 4-10. Hanford Employee Residences by County (DOE 1995b).

County	Percent of Employees in Residence (%)
Adams	0.18
Benton	84.16
Columbia	0.01
Franklin	9.07
Grant	0.25
Walla Walla	0.21
Yakima	5.08
Morrow	0.01
Umatilla	0.01

The DOE and Hanford Site contractors paid a total of $10.9 million in state taxes on operations and purchases during fiscal year 1988 (the most recent year available). Estimates show that Hanford employees paid $27.0 million in state sales tax, use taxes, and other taxes and fees in fiscal year 1988. In addition, the Hanford Site paid $0.9 million to local governments in Benton, Franklin, and Yakima counties in local taxes and fees (DOE 1995b).

4.7.3 Emergency Services

Police protection in Benton and Franklin counties is provided by county sheriff departments, local municipal police departments, and the Washington State Patrol Division, which is headquartered in Kennewick. Table 4-11 shows the number of commissioned officers and patrol cars in each department in April 1997. The Kennewick, Richland, and Pasco municipal departments maintain the largest staffs of commissioned officers with 78, 45, and 45, respectively.

Table 4-12 indicates the number of firefighting personnel, both paid and unpaid, on the staffs of fire districts in the area.

Table 4-11. Police Personnel in the Tri-Cities for 1996 (PNNL 1996a).

Area	Commissioned Officers	Reserve Officers	Patrol Cars
Kennewick Municipal	74	13	22
Pasco Municipal	44	22	15
Richland Municipal	50	13	13
West Richland Municipal	11	8	9
Benton County Sheriff	43	20	55
Franklin County Sheriff	21	20	21

Table 4-12. Fire Protection in the Tri-Cities for 1996 (Neitzel et al. 1997).

Station	Firefighting Personnel	Volunteers	Total	Service Area
Kennewick	63	0	63	City of Kennewick
Pasco	30	0	30	City of Pasco
Richland	48	0	48	City of Richland
BCRFD 1	6	94	100	Kennewick Area
BCRFD 2	3	26	29	Benton City
BCRFD 4	4	32	36	West Richland

BCRFD = Benton County Rural Fire Department.

The Hanford Fire Department, operated by Hanford Site contractors for the DOE, has 93 firefighters who are trained to dispose of hazardous waste and to fight chemical fires, in addition to their regular firefighting duties. During a 24-hour duty period, the 1100 and 300 Areas have 6 firefighters; the 200 East and 200 West Areas have 8 firefighters; the 100 Areas have 5 firefighters; and the 400 Area, which includes the WPPSS, has 6 firefighters (Neitzel et al. 1997). To perform their responsibilities, each station has access to a hazardous material response vehicle that is equipped with chemical fire-extinguishing equipment, an attack truck that carries foam and Purple-K dry chemical, a mobile air truck that provides air for respirators, and a transport tanker that supplies water to six brushfire trucks. The Hanford Fire Department owns five ambulances and maintains contact with local hospitals. The DOE is currently involved in discussions with the City of Richland regarding the possibility of contracting Hanford Site fire protection services (PNNL 1996a).

4.7.4 Health Care

The Tri-Cities have three major hospitals, all of which offer general medical services and include a 24-hour emergency room, basic surgical services, intensive care, and neonatal care.

Kadlec Medical Center, located in Richland, has 133 beds and functioned at 49.9 percent capacity in 1995. Non-Medicare and Medicaid patients accounted for 61 percent (or 3,620 patients) of their annual admissions in 1995. An average stay of 4.1 days per admission was reported for 1995.

Kennewick General Hospital maintains a 43.9 percent occupancy rate of its 70 beds with 4,822 annual admissions in 1995. Non-Medicare and Medicaid patients in 1995 represented 51 percent of its total admissions. An average stay of 3.0 days per admission was reported in 1995.

Our Lady of Lourdes Health Center, a 132-bed medical facility located in Pasco, provides acute, sub-acute, skilled nursing and rehabilitation, and alcohol and chemical dependency services. Our Lady of Lourdes also operates the Carondolet Psychiatric Care Center, a 32-bed psychiatric hospital located in Richland, which provides a significant amount of outpatient and home health services. For the fiscal year ending June 30, 1994, Our Lady of Lourdes had a total of 4,449 admissions, of which 32.8 percent were non-Medicare and Medicaid admissions. An average acute care length of stay of 3.1 days was reported (PNNL 1996a).

4.7.5 Housing

In 1996, 91 percent of all housing (44,488 total units) in the Tri-Cities was occupied. Single-unit housing, which represents nearly 59 percent of the total units, has a 95 percent occupancy rate throughout the Tri-Cities. Multiple-unit housing, defined as housing with two or more units, has an occupancy rate of 95 percent. Richland has the lowest occupancy rate (84 percent) in all categories of housing, followed by Kennewick with 85 percent, and Pasco with 85 percent. Mobile homes, which represent 11 percent of the housing-unit types, have the lowest occupancy rate at 84 percent. Table 4-13 shows a detailed listing of total units and occupancy rate by type in the Tri-Cities.

Table 4-13. Total Units and Occupancy Rates, 1996 Estimates (Neitzel et al. 1997).

City	All Units	Rate (%)	Single Units	Rate (%)	Multiple Units	Rate (%)	Manufactured Homes	Rate (%)
Richland	15,839	92	10,722	96	4,284	84	853	88
Pasco	8,419	89	4,104	95	2,956	85	1,359	83
Kennewick	20,210	90	10,887	95	6,660	85	2,241	84
Total for Tri-Cities	44,488	91	27,213	95	13,900	85	4,875	84

Recent Hanford Site downsizing has resulted in lower occupancy rates throughout the Tri-Cities. Statistics from February 1996 indicated that the Tri-Cities apartment occupancy rates are significantly lower: Richland apartment occupancy was 80.2 percent, Kennewick apartment occupancy was 85.4 percent, and Pasco apartment occupancy was 83.7 percent (TCH 1996a).

4.7.6 Human Services

The Tri-Cities offers a broad range of social services. State human service offices in the Tri-Cities include the job services office of the Employment Security Department; food stamp offices; the Division of Developmental Disabilities; Financial and Medical Assistance; Child Protective Services; emergency medical service; a senior companion program; and vocational rehabilitation.

The Tri-Cities also are served by a large number of private agencies and voluntary human services organizations. The United Way, which is an umbrella fund-raising organization, incorporates 24 participating agencies offering more than 46 programs. These member agencies had a cumulative budget total of $22.3 million in 1995. In addition, there were 482 organizations that received funds as part of the United Way-Franklin County donor designation program (PNNL 1996a).

4.7.7 Educational Services

Primary and secondary education are served by the Tri-Cities and Kiona-Benton School Districts. The combined 1994/1995 spring enrollment for all districts was approximately 30,940 students, a decrease of 3.2 percent from the 1994 total of 31,970 students. The 1995 total includes 8,686 from the Richland School District, 7,592 students from the Pasco School District, 13,125 students from the Kennewick School District, and 1,535 from Kiona-Benton. In 1995, Richland was operating near capacity; Pasco was at capacity for primary education but had room for more students at the secondary level; Kennewick was at capacity; and Kiona-Benton was operating at capacity.

Post-secondary education in the Tri-Cities area is provided by a junior college, Columbia Basin College (CBC), and the Tri-Cities branch campus of Washington State University (WSU-TC). WSU-TC offers a variety of upper-division, undergraduate, and graduate degree programs. The 1995 fall/winter enrollment was approximately 6,729 at CBC and 1,219 at WSU-TC. Many of the programs offered by these two institutions are geared toward the vocational and technical needs of the area. Currently, 27 associate degree programs are available at CBC, and WSU-TC offers 10 undergraduate and 17 graduate programs, plus access to eight additional graduate programs via satellite (PNNL 1996a).

4.7.8 Transportation

The Tri-Cities serve as a regional transportation and distribution center with major air, land, and river connections (Figure 4-22). The Tri-Cities have direct rail service, provided by Burlington Northern Santa Fe and Union Pacific, which connects the area to more than 35 states. Union Pacific operates the largest fleet of refrigerated rail cars in the United States and is essential to food processors that ship frozen food from this area. Passenger rail service is provided by Amtrak, which has a station in Pasco.

Docking facilities at the Ports of Benton, Kennewick, and Pasco are important aspects of the regional infrastructure. These facilities are located on the 525-km (325.5-mi)-long commercial waterway, which includes the Snake and Columbia rivers and extends from the Ports of Lewiston-Clarkston in Idaho to the deep-water ports of Portland, Oregon, and Vancouver, Washington. The average shipping time from the Tri-Cities to these deep-water ports by barge is 36 hours (PNNL 1996a).

Daily air passenger and freight services connect the area with most major cities through the Tri-Cities Airport, which is located in Pasco. The airport is currently served by one national and two commuter-regional airlines. There are two runways: a main and minor crosswind. The main runway is equipped for precision instrumentation landings and takeoffs. Each runway can accommodate landings and takeoffs by medium-range commercial aircraft, such as the Boeing 727-200 and Douglas DC-9. The Tri-Cities Airport handled approximately 168,200 passengers in 1995. Projections indicate that the terminal can serve nearly 300,000 passengers annually. Two additional airports, located in Richland and Kennewick, are limited to serving private and airfreight aircraft (PNNL 1996a).

The regional transportation network in the Hanford vicinity (Figure 4-23) includes the areas in Benton and Franklin counties from which most of the commuter traffic associated with the Hanford Site originates. Interstate highways that serve the area are I-82, I-182, and I-90. Interstate-82 is 8 km (5 mi) south-southwest of the Hanford Site. Interstate-182, a 24-km (15-mi)-long urban connector route, located 8 km (5 mi) south-southeast of the Hanford Site, provides an east-west corridor linking I-82 to the Tri-Cities area. Interstate-90, located north of the Hanford Site, is the major link to Seattle and Spokane and extends to the east coast; I-82 serves as a primary link between Hanford and I-90. SR 224, south of the Hanford Site, serves as a 16-km (10-mi) link between I-82 and SR 240.

1 ***Figure 4-22. Transportation Routes in the Vicinity of the***
2
3 ***Hanford Site.***

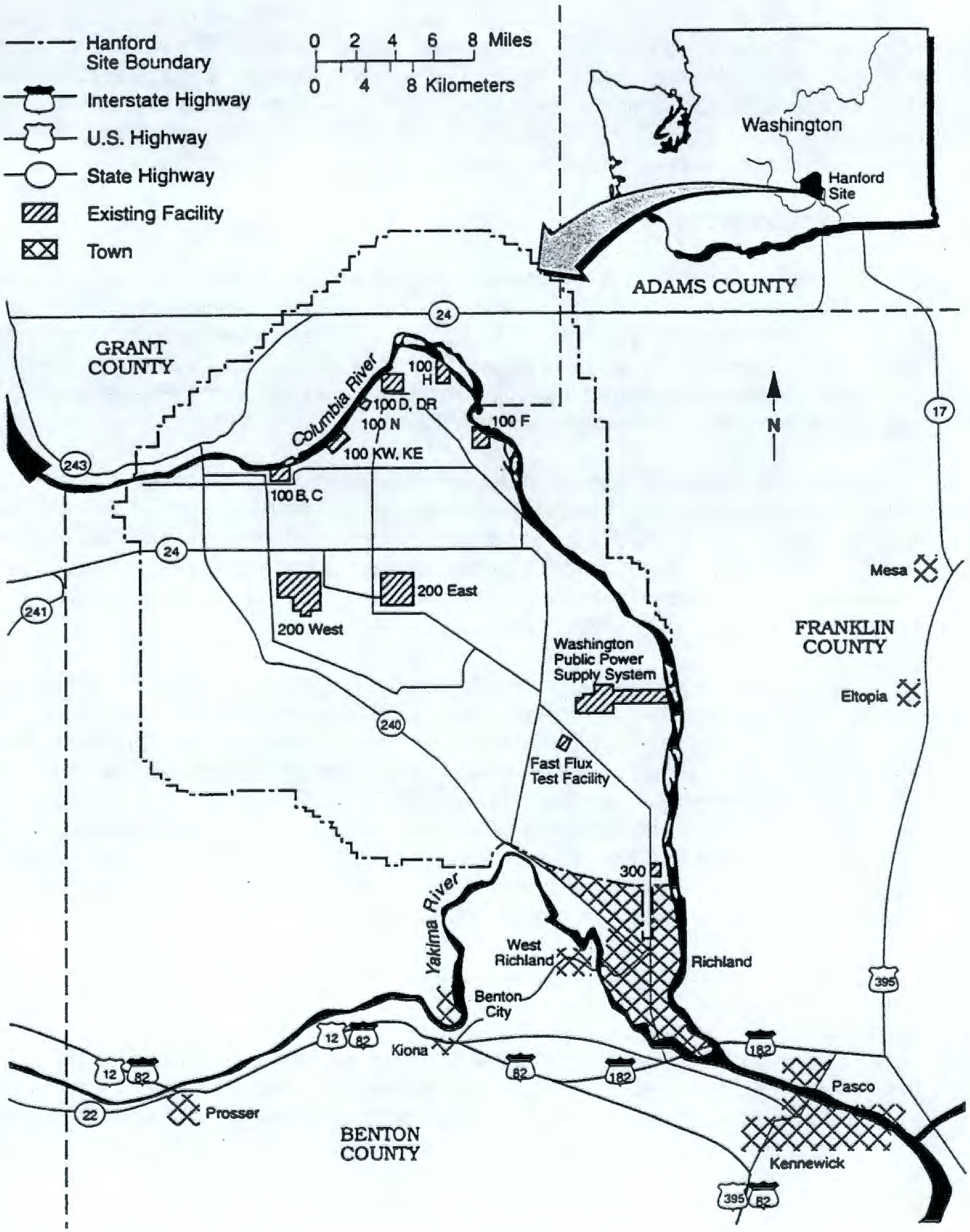
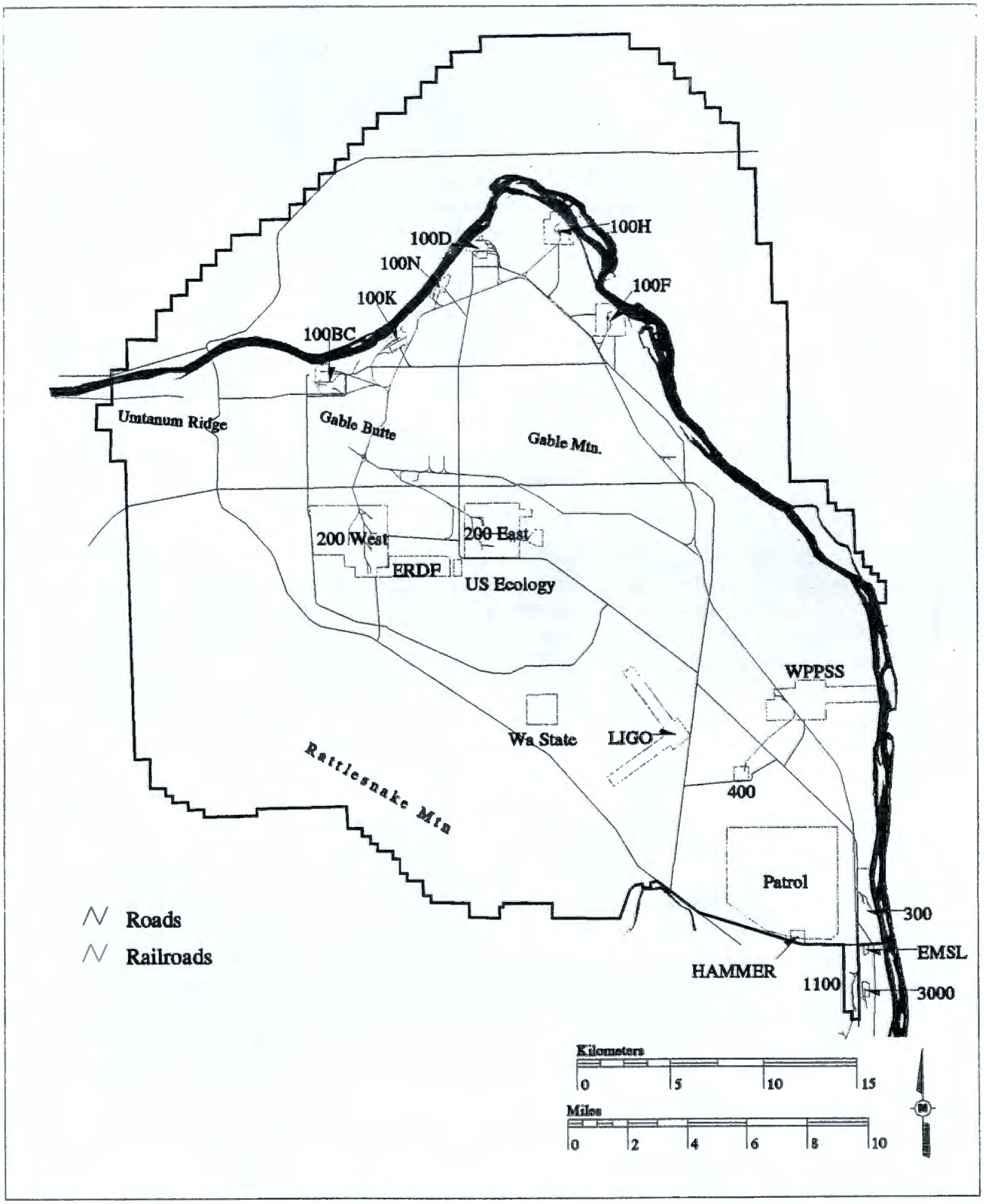


Figure 4-23. Transportation Network on the Hanford Site (DOE-RL 1990a).



SR 24 enters the Hanford Site from the west, continues eastward across the northern-most portion of the Hanford Site, and intersects SR 17 approximately 24 km (15 mi) east of the Hanford Site boundary. SR 17 is a north-south route that links I-90 to the Tri-Cities and joins U.S. Route 395, which continues south through the Tri-Cities. SR 14 connects with I-90 at Vantage, Washington, and provides ready access to I-84 at several locations along the Oregon and Washington border. SRs 240 and 24 traverse the Hanford Site and are maintained by Washington State. Other roads within the Hanford Site are maintained by the DOE (PNNL 1996a).

4.7.9 Utilities

The principal source of water in the Tri-Cities and the Hanford Site is the Columbia River. The potable water systems of Richland, Pasco, and Kennewick drew a large portion of the 50.6 billion L (13.43 billion gal) used in 1995 from the Columbia River. Each city operates its own supply and treatment system. The Richland water supply system derives about two-thirds of the water used from the Columbia River, while the remainder is split between a well field in North Richland and other groundwater wells. Total usage by the City of Richland in 1995 was 28 billion L (7.4 billion gal). This usage represents approximately 65 percent of the maximum supply capacity. The City of Pasco system also draws water from the Columbia River. In 1995, Pasco consumed 8.9 billion L (2.35 billion gal). The Kennewick system uses two wells and the Columbia River as a water supply. These wells serve as the sole source of water between November and March and can provide approximately 62 percent of the total maximum supply of 27.6 billion L (7.3 billion gal). Total 1995 usage in Kennewick was 13.9 billion L (3.68 billion gal).

The major incorporated areas of Benton and Franklin counties are served by municipal wastewater treatment systems, whereas the unincorporated areas are served by onsite septic systems. The Richland wastewater treatment system is designed to treat a total capacity of 113.5 million L/day (30 million gal/day) and processed an average flow of 76.4 million L/day (20.2 million gal/day) in 1995. The Kennewick system similarly has significant excess capacity; with a treatment capability 83.2 million L/day (22 million gal/day) and 1994 usage of 40 million L/day (10.56 million gal/day). The Pasco waste treatment system processed an average 29.5 million L/day (7.8 million gal/day), while the system is capable of treating 94.6 million L/day (25 million gal/day).

Natural gas, provided by the Cascade Natural Gas Corporation, serves a small portion of Tri-Cities residents, with 6,000 residential customers in December 1995.

In the Tri-Cities, electricity is provided by the Benton County Public Utility District, Benton Rural Electrical Association, Franklin County Public Utility District, and City of Richland Energy Services Department. All of the power provided by these utilities in the local area is purchased from the BPA, a Federal power marketing agency. The average rate for residential customers served by the three local utilities is approximately $0.050/kWh. Electrical power for the Hanford Site is purchased wholesale from the BPA. Energy requirements for the Hanford Site during fiscal year 1995 exceeded 336 million kWh, for a total cost of nearly $9.2 million.

In the Pacific Northwest, hydropower (and to a lesser extent, coal and nuclear power), constitute the regional electrical generation system. The system is capable of delivering approximately 20,300 average megawatts of guaranteed energy; of that amount, approximately 62 percent is derived from hydropower, 16 percent from coal, and less than

7 percent from nuclear plants. One commercial nuclear power plant (WNP-2) remains in service in the Pacific Northwest, with an average generating capability of 833 megawatts. The Trojan Nuclear Power Plant in Oregon was permanently shut down on January 4, 1993, and is being buried at Hanford's commercial low-level waste facility.

The regional electrical power system, more than any other system in the nation, is dominated by hydropower. In a given peak-demand hour, the hydropower system is capable of providing nearly 30,000 megawatts of capacity. Variable precipitation and limited storage capabilities alter system output from 12,300 average megawatts under critical water conditions to 20,000 average megawatts in record high-water years. The reliance on hydroelectric power in the Pacific Northwest means that the system is more constrained by seasonal variations in peak demand than in meeting momentary peak demand.

Additional constraints on hydroelectric production are measures designed to protect and enhance the production of salmon, as many salmon runs have dwindled to the point of being threatened or endangered. These measures, outlined by the Northwest Power Planning Council (NPPC) Columbia River Basin Fish and Wildlife Program, include minimum flow levels and a "water budget," which refers to water in the Columbia and Snake rivers that is released to speed the migration of young fish to the sea. Generation capacity of the hydroelectric system is decreased with these measures, as less water is available to pass through the turbines.

Throughout the 1980s, the Pacific Northwest had a surplus of electric power. This surplus has been exhausted, however, and the system only supplies enough power to meet regional electricity needs. In the 1991 Northwest Power Plan, the NPPC set a goal of purchasing more than 1,500 megawatts of energy savings by the year 2000 to help the existing system meet the rising electricity demand. The NPPC estimates that the Pacific Northwest will need an additional 2,000 megawatts over 1991 consumption by the turn of the century (PNNL 1996a).

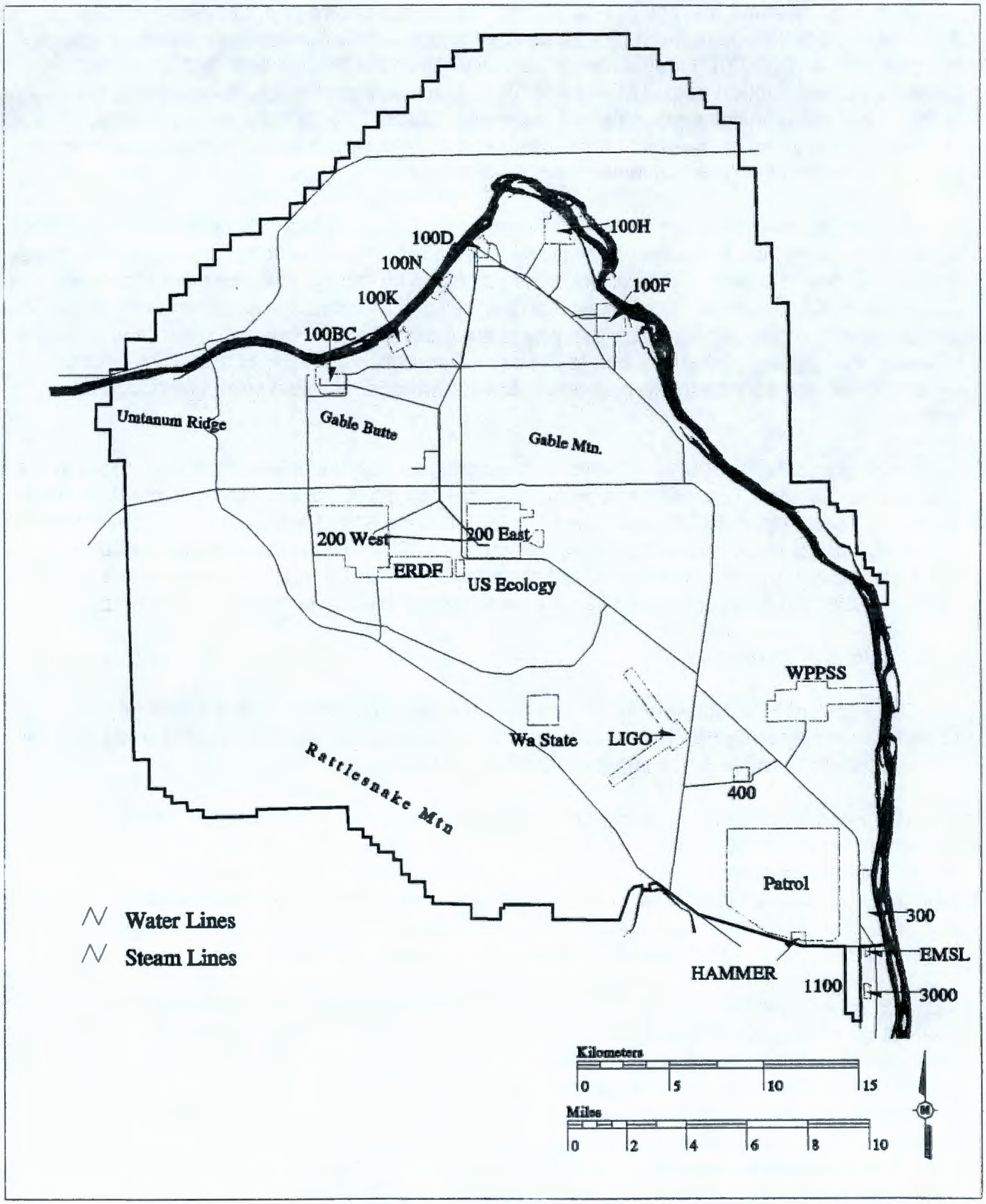
4.7.10 Site Infrastructure

The Hanford Site infrastructure is a significant resource for furthering industrial development of the region. Key elements of this infrastructure include facilities, road and rail systems, utilities, and support services (DOE-RL 1994a).

4.7.10.1 Facilities. Onsite programmatic (60 percent) and general purpose facilities (40 percent) provide 600,000 m^2 (6.5 million ft^2) of space. General purpose facilities include offices, laboratories, shops, warehouses, and other facilities. The programmatic space supports an evaporator, filter, waste recovery, waste treatment, waste storage, and research and development laboratories. Many of these facilities are over 30 years old; however, upgrades and expansion of some facilities could occur as remediation progresses.

4.7.10.2 Road and Rail Systems. The transportation network is well developed on the Hanford Site with approximately 460 km (approximately 288 mi) of roads onsite (Figure 4-24). SR 24 crosses the Hanford Site primarily on the Wahluke Slope. SR 240 crosses the Hanford Site on the southwest and serves as the boundary between the ALE Reserve and the rest of the Site. A Site access road from SR 240 to the 200 West Area was completed in December 1994. Upgrades are planned for road capacities north of the Wye Barricade in support of remediation activities. Road maintenance will continue on all active roads. The 1100 Area roads were recently upgraded to improve traffic circulation and access.

Figure 4-24. Export Water System for the Hanford Site (DOE-RL 1990a).



There are approximately 204 km (127 mi) of rail line on the Hanford Site (see Figure 4-24). The rail system begins at the Richland Junction (Columbia Center), where it joins the Union Pacific commercial tracks and runs to the abandoned Chicago, Milwaukee, St. Paul, and Pacific right-of-way near the Vernita Bridge, located on the north boundary of the Hanford Site. Approximately 35 km (22 mi) of track are in "out-of-service" condition. The in-service track accommodates 4,000 movements of 1,500 rail cars annually. A railroad spurline from the 1100 Area to the City of Richland's Horn Rapids Industrial Park is planned to serve new industrial development in the Park.

4.7.10.3 Utilities. The Hanford Site water system includes numerous buildings, pumps, valve houses, reservoirs, wells, and a distribution piping system that delivers water from the Columbia River to all areas of the Hanford Site. The export water system, which is the largest, delivers water to the 100, 200, and parts of the 600 Areas from the Columbia River (Figure 4-24). The 300 Area and the WPPSS also draw water directly from the Columbia River. Water is purchased from the City of Richland for the 700, 1100, and intermittently provided to the 300 Area, while the 400 Area and part of the 600 Area draw some water from groundwater wells.

The BPA, a Federal power marketing agency, sells electricity to the Hanford Site and the agencies that serve the Tri-Cities. The BPA provides electrical power to three distinct systems on the Hanford Site (Figure 4-25). The systems are located in the 100, 200, 300, and 400 Areas. Power for the 700 and 1100 Areas is provided by the City of Richland. Major upgrades or replacements of these systems to accommodate Hanford Site remediation are being implemented or planned.

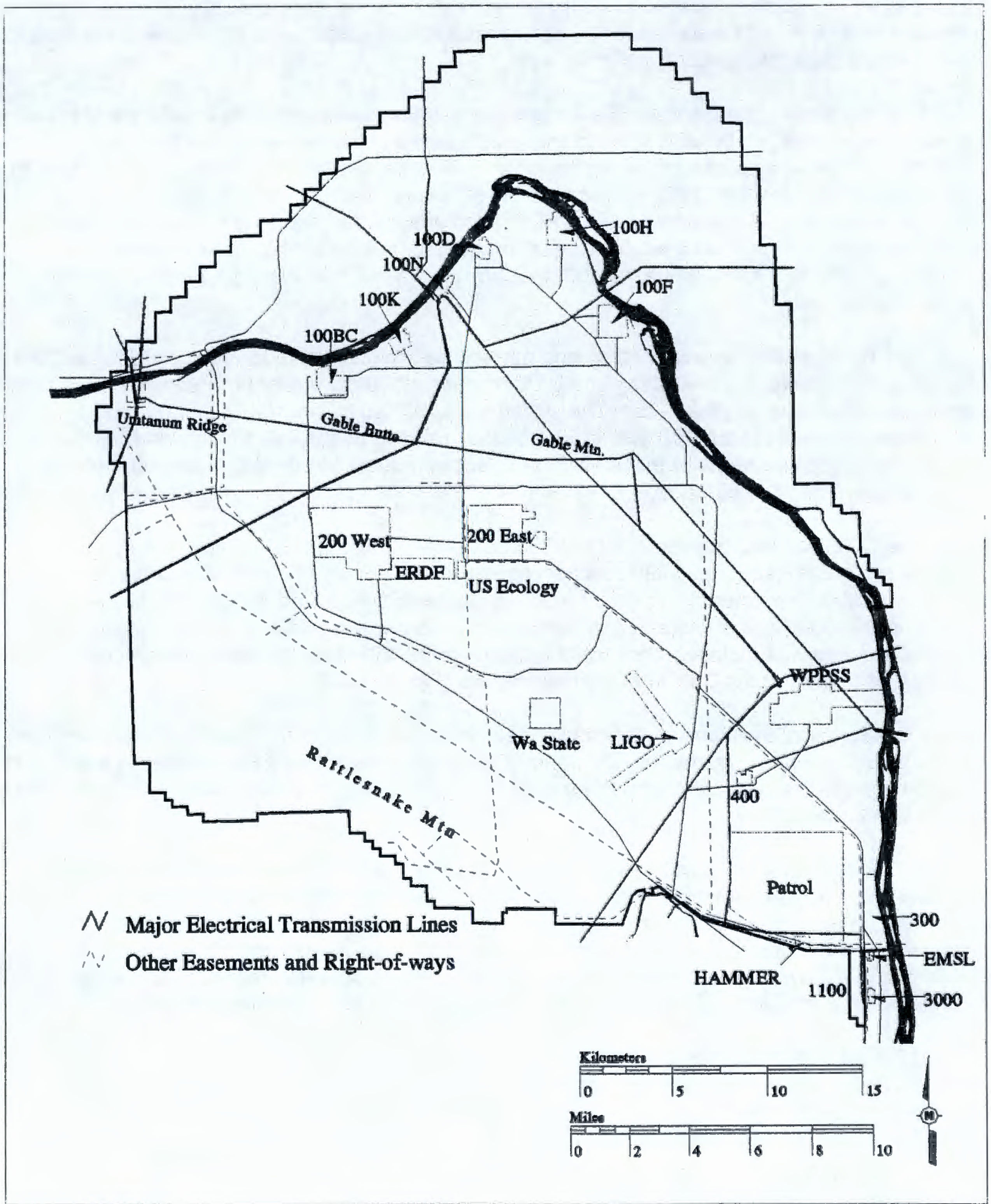
The DOE has recently replaced the 200 East Area, 200 West Area, and 300 Area centralized steam plants by individual package boilers at specific facilities to supply heat and process steam. The steam in the 200 Areas is produced by oil-fired package boilers, while steam in the 300 Area is produced by natural gas-fired package boilers. A new underground natural gas line was installed from south Richland to the 300 Area to supply natural gas in support of operating the 300 Area package boilers (Figure 4-25).

4.7.10.4 Support Services. Other support services on the Hanford Site include sewers, fire stations, telecommunications, landfills, and safeguards and security. Businesses in the City of Richland provide a number of important services such as laundry of radioactively contaminated protective clothing.

4.7.10.4.1 Sewer. Sanitary wastes in the 200 East and 200 West Areas are currently disposed of through septic tanks and drain fields. A central collection and treatment evaporation plant is being constructed in the 200 East and 200 West Areas to handle the sanitary sewer system. The sewer system in the 300 Area was recently connected to the City of Richland's sewer system. The 400 Area septic tank and drain field were recently closed and sanitary sewer effluent liquid was rerouted to the WPPSS sanitary sewer system.

4.7.10.4.2 Fire Stations. Fire stations are located in the 100, 200, and 300 Areas. Water supply, alarm, and sprinkler system upgrades are planned for the 300 Area laboratory and general support buildings. New and upgraded fire protection systems are planned for the 100-K Area facilities currently in use for interim fuel storage.

Figure 4-25. Electrical System for the Hanford Site (DOE-RL 1990b).



***4.7.10.4.3 Telecommunications*.** A new fiber optic communications network was recently installed on the Hanford Site. This system provides a fully connected internal network of shared computing resources and capabilities to support future voice and data communication requirements.

***4.7.10.4.5 Environmental Restoration Disposal Facility*.** A 65-ha (160-ac) landfill operates directly south of the 200 East and 200 West Areas to address the disposal of radioactive, hazardous, asbestos, PCB, and mixed wastes resulting from the remediation of operable units on the Hanford Site. The facility can be expanded as needed, to a maximum of 414 ha (1.6 mi^2).

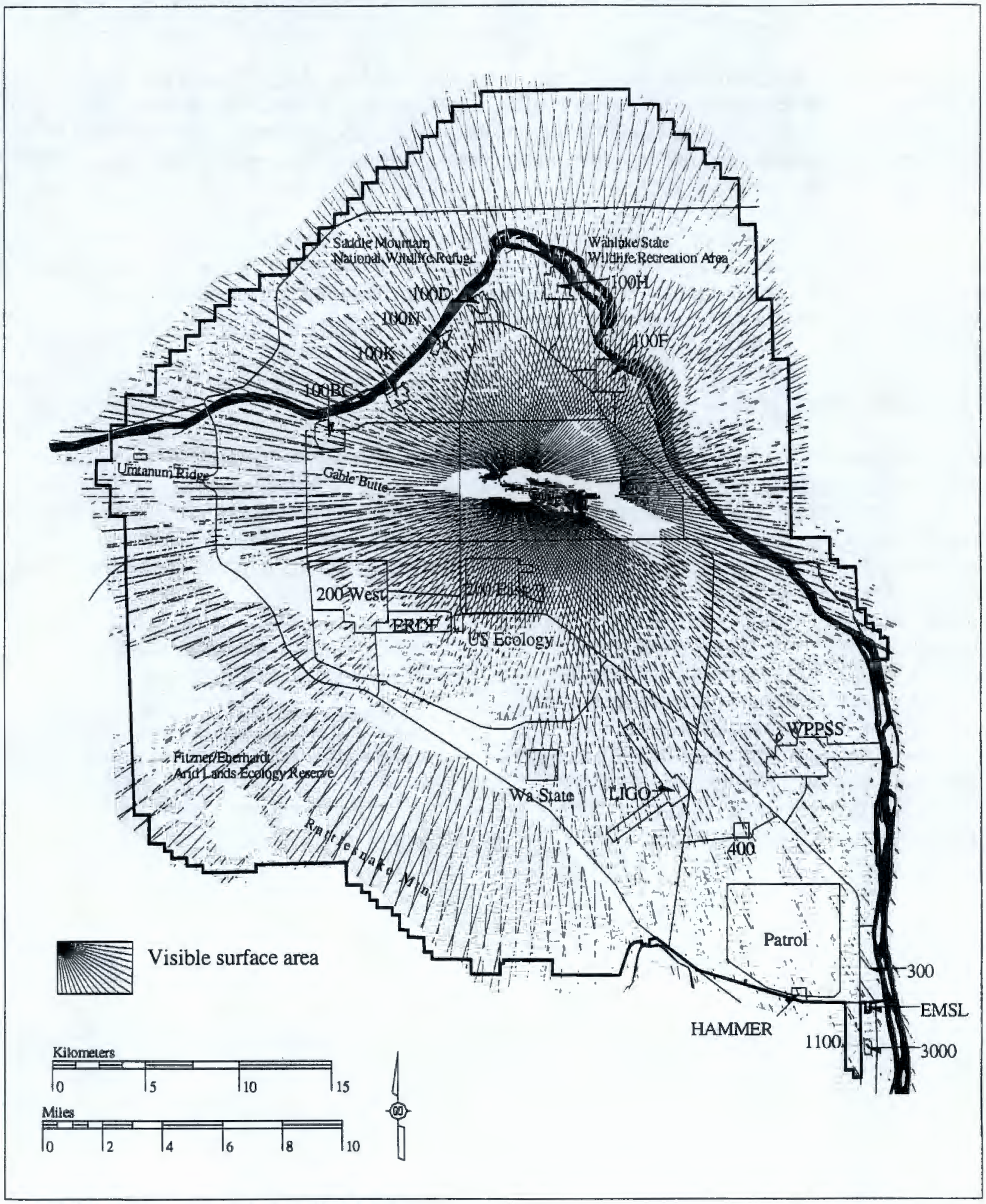
***4.7.10.4.6 Safeguards and Security*.** A security force is employed onsite and a number of systems are in place to control site access, and protect classified and business-sensitive information, property and personnel. The Benton County Sheriff's Office provides traffic enforcement, criminal enforcement, and investigations onsite.

4.8 Visual and Aesthetic Resources

The land in the vicinity of the Hanford Site is generally flat with little relief. Rattlesnake Mountain, rising to 1,060 m (3,477 ft) above mean sea level, forms the southeastern boundary of the Hanford Site. Gable Mountain and Gable Butte are the highest land forms within the Hanford Site (Figure 4-26). The view toward Rattlesnake Mountain is visually pleasing, especially in the springtime when wildflowers are in bloom. Large rolling hills are located to the west and north. The Columbia River, flowing across the northern part of the Site and forming the eastern boundary, is generally considered scenic, with its contrasting blue against a background of dark basaltic rocks and desert sagebrush. The White Bluffs, steep whitish-brown bluffs adjacent to the Columbia River, are a striking natural feature of the landscape (see text box, *"Hanford Site Quick Facts: Visual and Aesthetic Resources"*).

> ***Hanford Site Quick Facts:***
> ***Visual and Aesthetic Resources***
>
> Prominent natural features include the Columbia River, Saddle Mountains, Gable Butte, Rattlesnake Mountain, White Bluffs, and Gable Mountain.

Figure 4-26. Viewshed from Gable Mountain.



BHI:rpp 03/03/98 clup/viewshed1.aml Database: 09-MAR-1998

SR 24 provides public access through the northern portion of the Hanford Site, primarily on the north side of the Columbia River. Viewsheds along this highway include limited views of the Columbia River when the road drops down into the river valley, crosses the river over the Vernita Bridge, and climbs up out of the valley to a level plateau north of the river. A turnout on the north side of the river offers views of the river and the B and C Reactors, with an interpretive sign located nearby. A rest stop along the road just to the south of the river provides views of the Umtanum Ridge to the west, the Saddle Mountains to the north, and the Columbia River valley to the east and west.

4.9 Noise

This EIS defines noise as "any undesirable or unwanted sound or audible disturbance that interferes with normal activity." Typically, intrusive noise events are those that disrupt normal human activity, especially verbal communication. Under certain circumstances, people are willing to endure noise as a tradeoff for accomplishing some meaningful activity or because certain noises represent tangible evidence of progress. In the context of transportation systems, a certain amount of noise also is usually considered tolerable.

4.9.1 Public Health Implications

Noise impacts on public health usually are analyzed in terms of a dose-response relationship because noise effects are cumulative. Prolonged exposure to loud noises can impair hearing. The impairment can be temporary or permanent, depending on intensity and duration of the noise. Normally, hearing degeneration does not occur if the duration of the event is brief. Off-property noise impacts are the sound-exposure levels that interfere with normal speech, disrupt sleep, or produce secondary effects such as increased levels of stress among community members.

4.9.2 Hanford Site Sound Levels

Most industrial facilities on the Hanford Site are located far enough away from the Site boundary that noise levels at the boundary are not measurable or are barely distinguishable from background noise levels. Modeling of environmental noises has been performed for commercial reactors and traffic on SR 240 through the Hanford Site. These data are not concerned with background levels of noise and are not reviewed here.

Two studies of environmental noise were performed at the Hanford Site. One study reported environmental noise measurements taken in 1981 during site characterization of the Skagit/Hanford Nuclear Power Plant Site (DOE 1995b). The second consisted of a series of site characterization studies performed in 1987 that included measurement of background environmental noise levels at five locations on the Hanford Site. Noise can be disruptive to wildlife and studies have been performed to compile noise data in remote areas.

Recently, the potential impact of traffic noise resulting from Hanford Site activities has been evaluated for a draft environmental impact statement (EIS) addressing the siting of a proposed New Production Reactor (Cushing 1995). While the draft EIS did not include any new baseline measurements, it did address the traffic component of noise and provides modeled "baseline" measurements of traffic noise for the Hanford Site and adjacent communities. Baseline noise estimates were determined for two locations: SR 24, leading from the Hanford Site west to Yakima; and State Highway 240, south of the Site and west of Richland where maximum traffic volume exists. Traffic volumes were predicted based on the presence of both operational and construction work forces. Noise levels were expressed in Leq for one-hour periods in dBA at a receptor located 15 m (49 ft) from the road. Adverse community responses would not be expected at increases of 5 dBA over background noise levels.

To provide noise data for the Hanford WPPSS plants, measurements of environmental noise were taken in June 1981 before the construction of the WPPSS plants on the Hanford Site (DOE 1995b). Monitoring was conducted at 15 sites, showing point noise levels reading ranging from 30 to 60.5 dBA. The corresponding values for more isolated areas ranged from 30 to 38.8 dBA. Measurements taken in the vicinity of the sites where the WPPSS was constructing nuclear power plants ranged from 50.6 to 64 dBA, reflecting operation of construction equipment. Measurements taken along the Columbia River near the intake structures for WNP-2 were 47.7 and 52.1 dBA, compared to more remote river noise levels of 45.9 dBA (measured about 4.8 km [3 mi] upstream of the intake structures). Community noise levels from point measurements in North Richland (at Horn Rapids Road and Stevens Road [Route 240]) were 60.5 dBA, which was largely attributed to traffic.

To support the Basalt Waste Isolation Project, background noise levels were determined at five sites located within the Hanford Site. Noise levels are expressed as equivalent sound levels for 24 hours (Leq-24). The average noise level for these five sites was 38.8 dBA on the dates tested. The wind was identified as the primary contributor to background noise levels, with winds exceeding 19 km/hr (12 mi/hr) significantly affecting noise levels. This study concluded that background noise levels in undeveloped areas at the Hanford Site are generally in the range of 24 to 36 dBA (Cushing 1992). Periods of high wind, which normally occur in the spring, would elevate background noise levels.

In addition to the project-driven studies described above, the Hanford Environmental Health Foundation has monitored noise levels resulting from several routine operations performed in the field at the Hanford Site. These included well drilling, pile driving, compressor operations, and water-wagon operation. Occupational sources of noise propagated in the field from outdoor activities ranged from 74.8 to 125 dBA (PNNL 1996a).

4.10 Environmental Monitoring Programs

Environmental surveillance at the Hanford Site consists of monitoring for potential radiological and nonradiological constituents and includes monitoring of external radiation, air, surface water, groundwater, soil, vegetation, wildlife, and regional food and farm products. Monitoring is performed to ensure protection of human health and safety and is conducted in compliance with DOE Order 5400.1, *General Environmental Protection Program* (DOE 1990a), and DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1993a). A detailed discussion of the Hanford Site environmental monitoring program is found in the *Hanford Site Environmental Monitoring Plan* (DOE-RL 1991a), and monitoring data are presented in annual reports, such as the *Hanford Site Environmental Report for Calendar Year 1995* (PNNL 1996b).

The Hanford Environmental Health Foundation (HEHF) provides occupational health services to Hanford personnel through health risk management and occupational health monitoring. The HEHF's Health Risk Management program is used to identify and analyze the hazards that Hanford personnel face in the work environment and bring an awareness to worker health and safety issues at Hanford. HEHF's occupational health services provide occupational medicine and nursing, medical monitoring and surveillance, ergonomics assessment, exercise physiology, case management, psychology and counseling, fitness for duty evaluations, health education, infection control, immediate health care, industrial hygiene, and health, safety, and risk assessments.

4.11 Contamination

Three operating areas of the Hanford Site (the 100, 200, and 300 Areas) are still included on the EPA's National Priorities List (NPL), while the 1100 Area has been fully remediated and removed from the EPA's NPL. Radioactive and hazardous materials have been disposed to the ground throughout the period of active Hanford Site operations, resulting in extensive contamination of the vadose zone and groundwater.

Under the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989), the more than 1,000 inactive waste disposal and unplanned release sites were grouped into groundwater and source operable units, based on geographic proximity or similarity of waste disposal history. In addition, a number of *Resource Conservation and Recovery Act of 1976* (RCRA) treatment, storage, and/or disposal (TSD) units are included in the Tri-Party Agreement, which will be closed or permitted to operate in accordance with the State of Washington's "Dangerous Waste Regulations" (WAC 173-303). Some of these waste sites and TSD units are sources of environmental contamination.

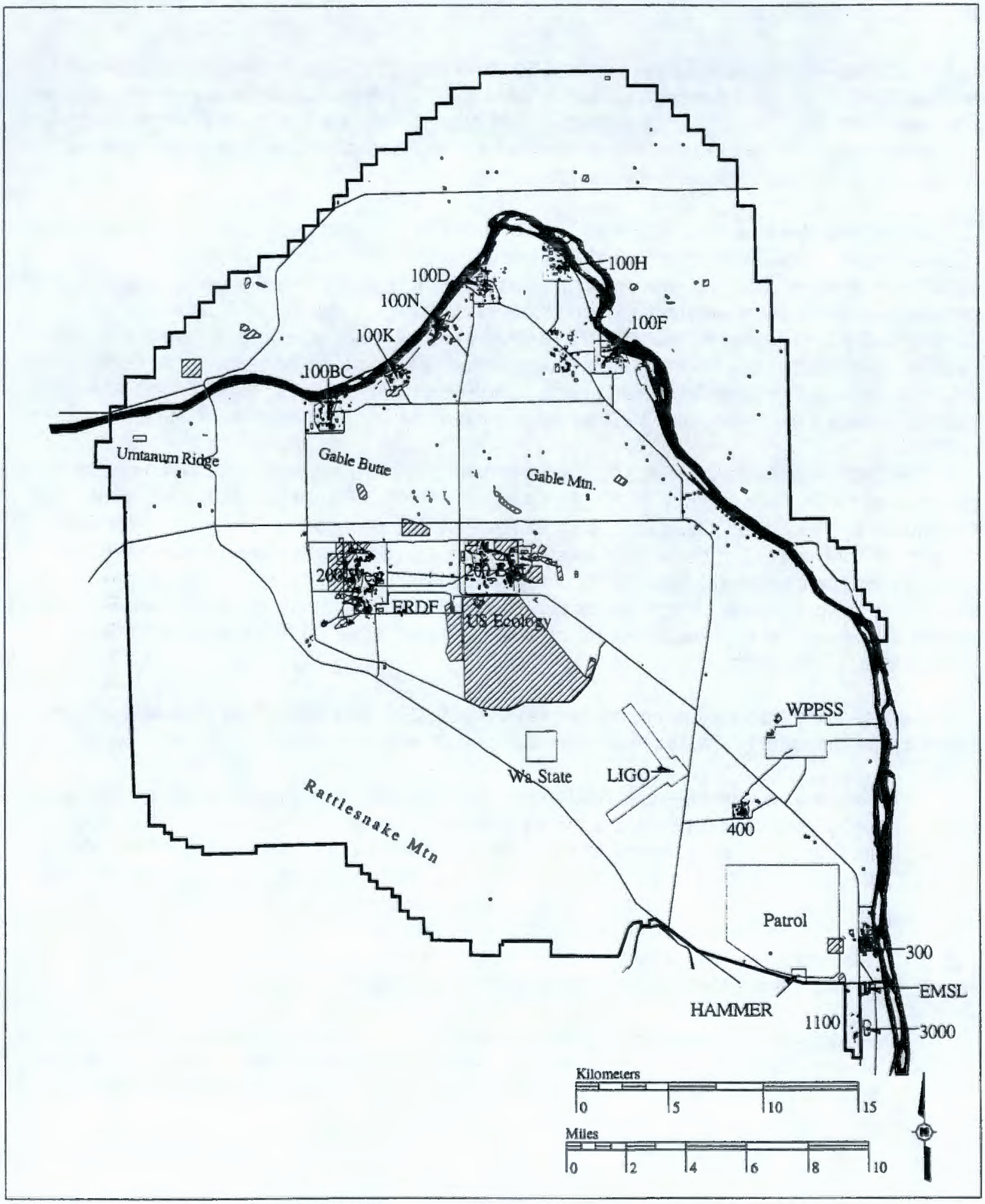
The DOE holds interim status for the operation of hazardous waste management facilities by virtue of having submitted a RCRA Part A application to EPA on November 18, 1980. On November 6, 1985, the DOE submitted a RCRA Part B application to Ecology and the EPA Region 10 for the TSD of hazardous wastes at Hanford. Supplemental and revised RCRA applications have been submitted to Ecology in accordance with the schedule established in the Tri-Party Agreement. A final status permit covering several units at the Hanford Site was issued in August 1994. This permit will be amended over a period of years to add additional interim status TSD units.

Vadose zone contamination, primarily in the 100, 200, and 300 Areas (Figure 4-27), is a result of the disposal of wastes to surface disposal structures such as:

- **Tanks and Vaults**—used to store radioactive liquid wastes generated by uranium and plutonium processing activities in the 200 Areas. Tanks include catch tanks, settling tanks, and storage tanks. The catch tanks are generally associated with diversion boxes and other transfer units and were designed to accept overflow and spills; wastes collected in catch tanks were transferred to storage tanks. Settling tanks were used to settle particulates in liquid wastes prior to transfer to cribs. Storage tanks were used to collect and store large quantities of liquid wastes. Storage tanks include single-shell tanks and double-shell tanks.

- **Vaults**—typically are deep underground concrete structures that contain tanks as well as associated pumps, valves, and agitators. Vaults do not hold wastes but instead provide containment for other types of storage features and associated plumbing.

Figure 4-27. Hanford Surface Waste Sites (HGIS and Waste Information Data System database).



BHI:rpp 04/30/98 clup/wastesite1.aml Database: 30-APR-1998

- **Cribs and drains**—were designed to percolate low-level radioactive process waste into the ground without exposing the waste to the open air. Cribs and drain fields are shallow excavations that were either backfilled with permeable material or held open by wooden structures, both of which are covered with an impermeable layer. Water flows directly into the backfilled material or covered open space and percolates into the soil. French drains generally deliver wastewater at a greater depth (up to 12.2 m [40 ft]) and are constructed of steel or concrete pipes that are either left open or filled with gravel.

- **Ponds, ditches, and trenches**—were designed to percolate high volumes of low-level liquid wastes into the soil. Ditches are long, unlined excavations used to convey wastes to the ponds. Trenches are generally open, unlined, shallow excavations used for disposal of low-liquid discharges, such as sludge, which has a high salt content. Trenches were used for short periods and were deactivated when the discharge rate exceeded the soil infiltration rate.

- **Burial grounds**—were used for disposal of solid wastes. Burial grounds received a variety of contaminated debris and solid wastes packed in barrels and boxes.

There are a variety of contaminants present in the groundwater of the Hanford Site (Figures 4-28 and 4-29 and Table 4-14). Tritium, iodine-129, and nitrate plumes originating in the Central Plateau are quite widespread, reaching the Columbia River to the east. Other contaminants are not as widespread but exist in the groundwater at many different locations. Examples of these contaminants include strontium-90, uranium, technetium-99, and chromium. Contaminant plume migration is affected in part by the degree to which individual contaminants are mobile in groundwater and in part on hydrogeologic conditions. Natural groundwater flow at the Hanford Site has been altered in some areas due to past Hanford Site operations; this alteration is due in large part to groundwater mounds that were created by extensive artificial recharge at some wastewater disposal facilities. Although these groundwater mounds are dissipating, groundwater flow patterns are still affected by past wastewater discharges on the Hanford Site.

4.11.1 Columbia River Contamination

The Columbia River has received radiological and chemical contamination as a result of past operations at the Hanford Site. Columbia River water that was used to cool the Hanford Site nuclear production reactors subsequently was contaminated with chemical and radiological constituents. The contaminated water entered the Columbia River primarily through direct effluent discharge. In addition to direct discharges of contaminated cooling water, the Columbia River received and continues to receive contaminants indirectly through soil column waste disposal units, leaks from pipelines, and possibly leaks from tanks that are carried by the groundwater and discharged through springs and seeps along the shoreline (DOE 1993a).

Sediments in the Columbia River contain low levels of Hanford radionuclides (cobalt-60, uranium-238, and europium-154) and metals; and radionuclides from nuclear weapons testing fallout, which collect in slack water habitats. Analyses of sediments showed detectable, though low, levels of metals in Columbia River sediments. Chromium concentrations in sediment along the Hanford Reach appeared to be slightly elevated when compared to upstream samples (PNNL 1996c).

Figure 4-28. Distribution of Hazardous Chemicals in Groundwater Within the Hanford Site (PNL 1995 and BHI data).

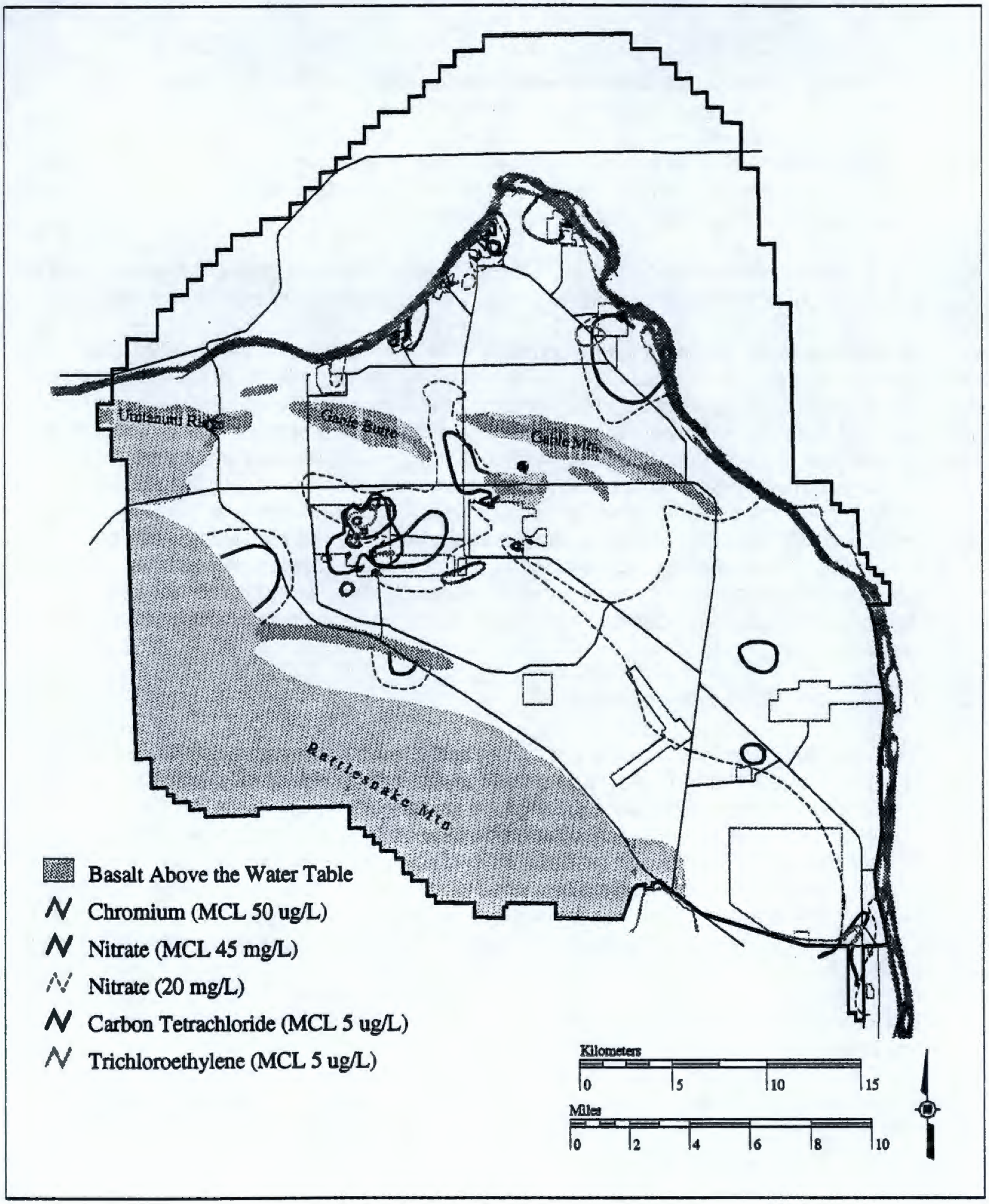


Figure 4-29. Distribution of Radionuclides of Concern in Groundwater Within the Hanford Site (PNL 1995 and BHI data).

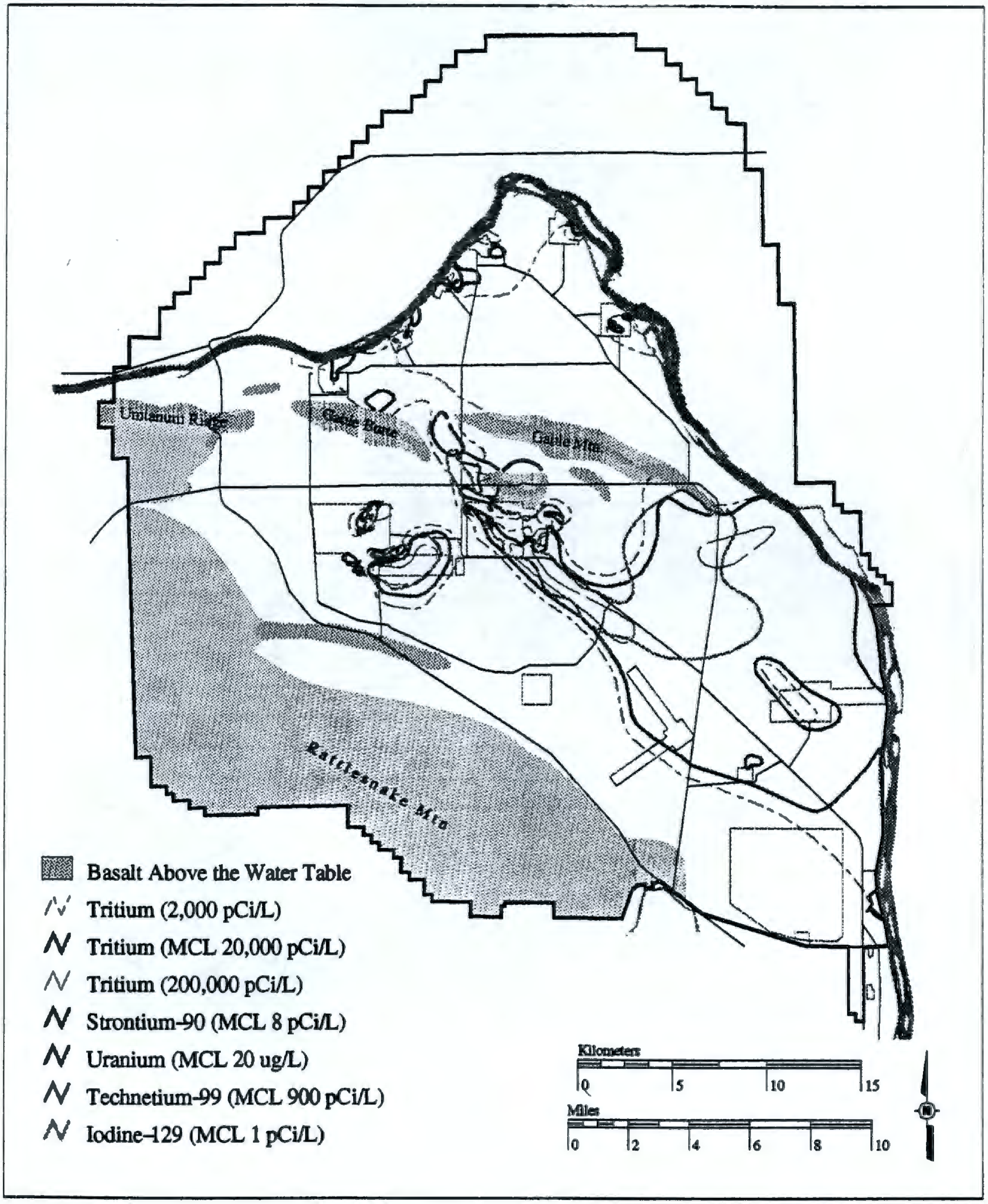


Table 4-14. Detected Concentrations Greater Than Drinking Water Standards: 1995 Groundwater Sampling Rounds (adapted from PNL 1995) (2 Pages).

Area Name	Plume Constituent	Units	Maximum Plume Concentration	EPA DWS	Washington Water Quality Standard
100-B/C	Chromium	ug/L	>50.0	100	50
	Strontium-90	pCi/L	56.7	8	8
	Tritium	pCi/L	28,000	20,000	20,000
100-D/DR	Chromium	ug/L	1,360	100	50
	Nitrate	mg/L	205	45	45
	Strontium-90	pCi/L	44.0	8	8
	Tritium	pCi/L	69,000	20,000	20,000
100-F	Chromium	ug/L	82.4	100	50
	Nitrate	mg/L	110.0	45	45
	Uranium	ug/L	133.0	20	20
	Strontium-90	pCi/L	20.5	8	8
	Tritium	pCi/L	98,300	20,000	20,000
	Trichloroethylene	ug/L	27.0	5	N/A
100-H	Chromium	ug/L	300.0	100	50
	Nitrate	mg/L	730.0	45	45
	Strontium-90	pCi/L	28.0	8	8
100-KE/KW	Chromium	ug/L	210.0	100	50
	Nitrate	mg/L	110.0	45	45
	Strontium-90	pCi/L	803.0	8	8
	Tritium	pCi/L	1,040,000	20,000	20,000
	Trichloroethylene	ug/L	20.0	5	N/A
100-N	Chromium	ug/L	200.0	100	50
	Cobalt-60	pCi/L	732.0	100	N/A
	Nitrate	mg/L	65	45	45
	Strontium-90	pCi/L	4,030	8	8
	Tritium	pCi/L	74,200	20,000	20,000

Table 4-14. Detected Concentrations Greater Than Drinking Water Standards: 1995 Groundwater Sampling Rounds (adapted from PNL 1995) (2 Pages).

Area Name	Plume Constituent	Units	Maximum Plume Concentration	EPA DWS	Washington Water Quality Standard
200 East	Chromium	ug/L	73.0	100	50
	Nitrate	mg/L	120.0	45	45
	Cyanide	ug/L	39.5	200	200
	Strontium-90	pCi/L	9,740	8	8
	Cesium-137	pCi/L	2,310	10	10
	Tritium	pCi/L	3,370,000	20,000	20,000
	Cobalt-60	pCi/L	40.1	100	N/A
	Iodine-129	pCi/L	11.8	1	1
	Plutonium-239/240	pCi/L	2,670	1	N/A
	Technetium-99	pCi/L	3,700	900	900
	Uranium	ug/L	64.3	20	20
200 West	Cesium-137	pCi/L	21.8	10	10
	Cobalt-60	pCi/L	13.2	100	N/A
	Cyanide	ug/L	20.0	200	200
	Chromium	ug/L	500.0	100	50
	Nitrate	mg/L	1,700	45	45
	Fluoride	mg/L	5.1	4	4
	Tritium	pCi/L	2,400,000	20,000	20,000
	Iodine-129	pCi/L	86.1	1	1
	Technetium-99	pCi/l	23,700	900	900
	Uranium	ug/L	2,720	20	20
	Carbon Tetrachloride	ug/L	5,200	5	0.3
	Chloroform	ug/L	107.0	100	7
	Strontium-90	pCi/L	14.5	8	8
	Trichloroethylene	ug/L	44	5	N/A
300 Area	Chromium	ug/L	<100.0	100	50
	Uranium	ug/L	150	20	20
	Trichloroethylene	ug/L	6.1	5	N/A
600 Area (All Other Areas)	Cyanide	ug/L	110.0	200	200
	Chromium	ug/L	>100.0	100	50
	Nitrate	mg/L	100	45	45
	Strontium-90	pCi/L	994.0	8	8
	Technetium-99	pCi/L	4,310	900	900
	Tritium	pCi/L	257,000	20,000	20,000
	Trichloroethylene	ug/L	25	5	N/A

DWS = drinking water standard
EPA = U.S. Environmental Protection Agency
ug/L = 1 part per billion (ppb) or microgram per liter
mg/L = 1 part per million (ppm) or milligram per liter
pCi/L = picocurie per liter
N/A = not applicable.

Contaminated areas within the Columbia River are generally located in slack water areas, such as sloughs and portions of the islands. These contaminated areas have been identified by aerial gamma-ray surveys (EG&G 1990). Riverbed sediments and floodplain soils of the Hanford Reach constitute a sink for many of the pollutants released to the environment by past Hanford operations. Shoreline activities that affect the flow of the Columbia River could remobilize contaminants entombed within river sediments.

River water used for cooling flowed through the Hanford reactor to the Columbia River, carrying nuclear fission products and neutron-activated stellites (i.e., cobalt-60 particles). The extent and amount of discrete cobalt-60 particles in the river have never been thoroughly investigated and the actual amount of neutron-activated material transported to the Columbia River is not known. Based on Stokes Law and the physical properties of sand and stellite (Sula 1980; Cooper and Woodruff 1993), cobalt-60 particles (stellite) entrained into the river bedload have preferentially settled in areas dominated by sand-size grains. The sandy areas of the Hanford Reach have never been thoroughly examined for the presence of radionuclides. For example, the sandy portion of D Island has not received a detailed survey for discrete radioactive particles (DOE 1997b). Randomly placed surveys have been conducted, but the deposition of cobalt-60 particles by the Columbia River may not be a random process, and use of a random sampling pattern may actually underestimate the concentration of cobalt-60 particles in the Columbia River shoreline.

Due to shielding by soil, water, vegetation, and air (as well as the motion of the detector), aerial gamma-ray surveys lack the sensitivity and resolution required to aid in the determination of concentration of cobalt-60 particles. The non-random distribution of the cobalt-60 particles into discrete areas and the presence of water within the detector's "field of view" (Sula 1980) further reduces the utility of aerial gamma-ray surveys in determining the potential for cobalt-60 particles.

4.11.2 Soil Contamination

The 100 Areas include nine retired plutonium production reactors, effluent lines from each reactor complex, 33 surplus facilities, more than 200 Waste Information Data System past-practice waste sites, and 6 TSD units. Extensive contamination exists in some areas of surface soils, subsurface soils, and groundwater (EPA 1995a). Strontium-90, tritium, nitrate, and chromium are detected at many of the 100 Area operable units.

The Central Plateau has been used for fuel reprocessing, waste management, and disposal activities and is the most extensively contaminated area at the Hanford Site. More than 400 Waste Information Data System past-practice waste sites, 13 TSD units, and numerous groundwater contaminant plumes occur in the 200 Areas. This area is the site of the Hanford Central Waste Complex and the Tank Waste Remediation System facilities, which support present and future Hanford waste management activities (EPA 1995a). Contaminants include extensive groundwater plumes of technetium-99, iodine-129, nitrate, tritium, uranium-238, and chlorinated hydrocarbons (e.g., carbon tetrachloride, chloroform, and trichloroethylene). Carbon tetrachloride in particular poses a complex remediation problem; it is estimated that about 580 to 920 metric tons (640 to 1,014 tons) of carbon tetrachloride have been disposed to the vadose zone where it exists in a vapor phase above the water table, a liquid phase above and below the water table, and as a solute within the water.

The 600 Area presents a diverse range of existing contamination. Parts of the 600 Area vadose zone are essentially uncontaminated, while nearby operating areas, such as the 300 Area, present significant environmental remediation challenges. Several small, isolated surface waste sites have been remediated as expedited response actions under the

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Extensive groundwater contamination (i.e., nitrate, tritium, technetium-99, and iodine-129) occurs in the 600 Area.

Although some information on soil contamination is available, DOE recognizes that a comprehensive and integrated vadose zone characterization effort is needed at the Hanford Site to adequately assess risk during waste retrieval and treatment activities, and eventual closure of the 200 Area tank farms. Therefore, in April 1996, DOE brought together Hanford's Vadose Zone Expert Panel, comprised on representatives from state government, national laboratories, and the private sector. The Panel was convened primarily to assess how cesium-137 reached depths of 39 m (130 ft) in the vadose zone under the SX Tank Farm. An integrated vadose zone program plan for the entire Hanford Site is under development (DOE 1997).

4.11.3 Hanford Site Protective Safety Buffer Zones

Existing and planned waste disposal sites, waste processing facilities, and hazardous or radiological materials storage facilities are found throughout the Hanford Site. To protect the public from routine or accidental releases of radiological contaminants and/or hazardous materials, the use of protective buffer zones surrounding the waste remediation, processing, and disposal areas is required by DOE O 151.1, *"Comprehensive Emergency Management System* (DOE 1996c). These buffer zones limit public exposure to radiological and hazardous chemicals from routine operations and accidents. A methodology was developed to determine the location, size, shape, and characteristics of the buffer zones needed for the Hanford Site, using existing safety analysis reports, hazard assessments, and emergency planning zone studies. This methodology allows decision makers to restrict potential land uses in areas where hazardous or radioactive material handling could pose an unacceptable risk to human health.

Buffer zones necessary to protect human health and safety in potential accidents are divided into two main components — an inner exclusion zone or an exclusive use zone (EUZ) and an emergency planning zone (EPZ).

- The EUZ is an area designated for activities associated with the waste site or facility at the center of the buffer zone. The land-use designation for the EUZ is "reserved for waste management operations," with severely restricted public access. This zone extends from the facility fence line to a distance at which threat to the public from routine and accidental releases diminish to the point where public access can be routinely allowed. The size and shape of the EUZ is determined by the most restrictive safety analysis report or hazard assessment boundary and is based on the inventory of contaminants, potential release mechanisms, and atmospheric transport parameters.

- The EPZ is an area surrounding a facility for which planning and preparedness efforts are carried out to ensure that prompt and effective actions can be taken to minimize the impact to onsite personnel, public health and safety, and the environment in the event of an operational emergency. The EPZ begins at the boundary of the facility and ends at a distance for which special planning and preparedness efforts are no longer required. Access restrictions are not required within an EPZ; however, the DOE would be responsible for ensuring adequate planning and preparedness efforts for every person within the zone.

The protective buffer zones for the Hanford Site (Figure 4-30) were established using boundaries calculated for individual limiting facilities (i.e., facilities with accidents of maximum potential public health impact). Information about the limiting facilities, controlling contaminants, and credible accidents is presented in Table 4-15. The boundaries provide a conservative buffer zone that is expected to be sufficient to address protective zone needs for the multiple facilities present in each area on the Hanford Site.

In an effort to consider non-Hanford protective buffer zone requirements that could be affected by Hanford Site public access and land-use decisions, the emergency preparedness needs of the WPPSS were considered. Under U.S. Nuclear Regulatory Commission procedures, the WPPSS WNP-2 Reactor requires a 16-km (10-mi) EPZ and a 1.9-km (1.2-mi) EUZ.

Within portions of the EUZ, certain types of public access would be restricted, while other types of public access within that same area might be acceptable. Criteria are needed to evaluate, on a case-by-case basis, the types of public access possible within an EUZ. Six different types of public access have been defined for the EUZ. These types of access are presented below in decreasing order of restrictions:

- ***Very Limited Access***. Very limited access, such as passing through on transportation corridors. Special arrangements would be required to leave the designated access point. The evacuation time for this type of access would be no more than 30 minutes. The maximum amount of time the maximally exposed individual (MEI)[1] would spend in this area is estimated to be about 100 hr/yr.

- ***Restricted Routine Access.*** This type of access area would include activities such as industrial and commercial usage of a specifically designated area. It could also include short special interest uses, such as short nature trails. All users of the area must have ready access to transportation to facilitate a rapid evacuation. Evacuation time for this type of access would be no more than 1 hour. The maximum amount of time the MEI would spend in this area is estimated to be about 3,000 hr/yr.

- ***Restricted Short-Term Access.*** This type of access may include locations adjacent to transportation corridors. Public access might involve short stops to view sights or engage in short duration activities. Access to areas more than 0.4 km (0.25 mi) from a designated access point would be prohibited. The evacuation time for this type of access would be no more than 1.5 hours. The maximum amount of time the MEI would spend in this area is estimated to be about 200 hr/yr.

- ***Moderately Restricted Periodic Access.*** This type of access would allow for periodic activities, such as limited agricultural activities. Public access to this area would tend to be more periodic and seasonal. No permanent residences, schools, or hospitals would be allowed. The evacuation time for this type of access would be no more than 2 hours. The maximum amount of time the MEI would spend in this area is estimated to be about 3,000 hr/yr.

---

[1]The maximally exposed individual (MEI) is defined as a hypothetical person who lives near the Hanford Site, who, by virtue of location and living habits, could receive the highest possible dose.

Figure 4-30. Protective Safety Buffer Zones.

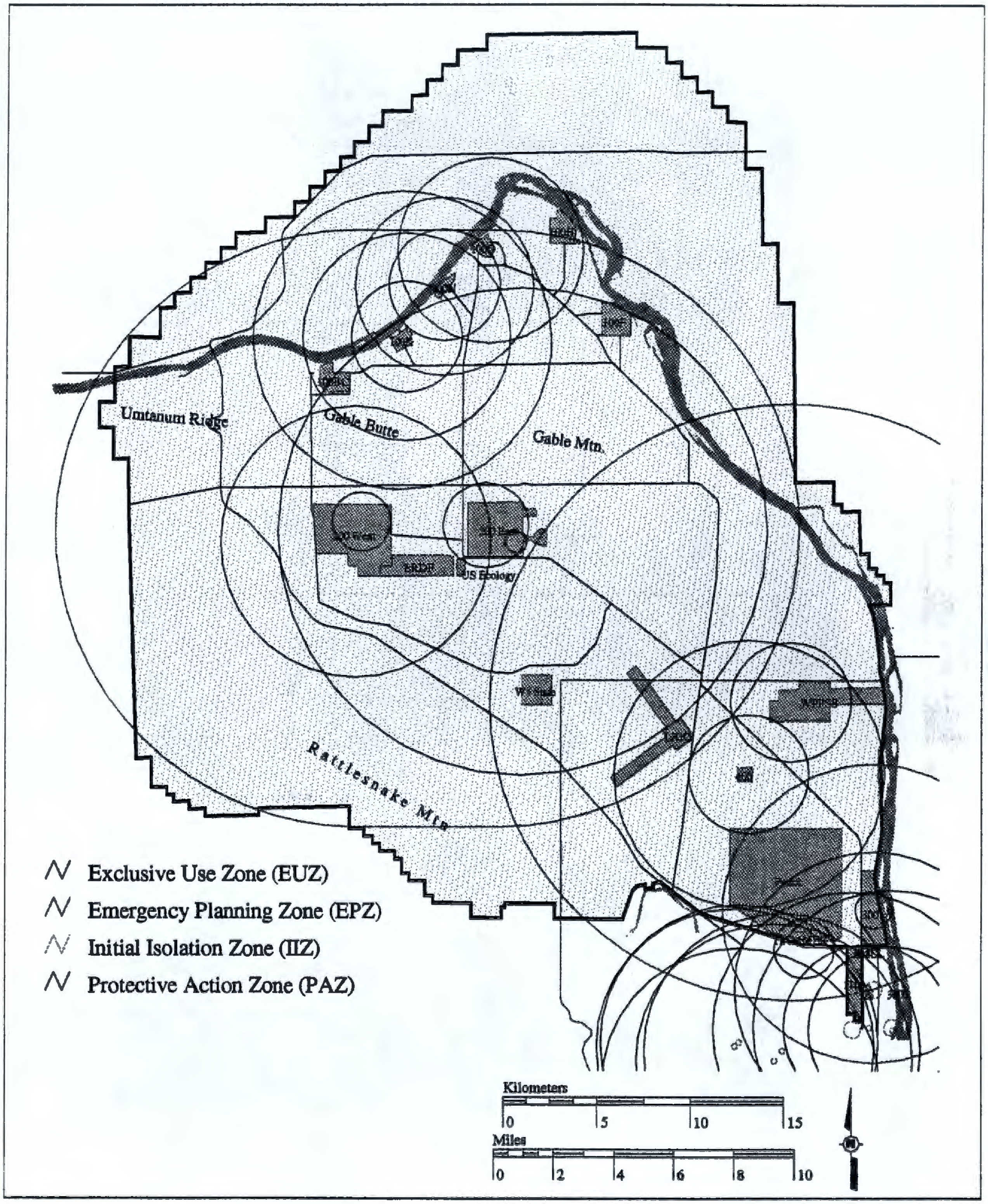


Table 4-15. Protective Safety Buffer Zones (Exclusive Use Zones and Emergency Planning Zones). (2 pages)

Limiting Facility	Coordinates WASP-X	Coordinates WASP-Y	EUZ Boundary (m)	Credible Accident	Controlling Contaminant	EPZ Boundary (m)	Limiting Accident	Controlling Contaminant
100-K Area								
K-Basin	569184.3	146717	3,000	Chlorine cylinder valve failure	Cl	8,100	Sabotage	Cl, Pu, Cs-137
			5,600[a]	Fuel processing for dry storage	Cs-137			Sr-90, Am-241
100-N Area								
N-Reactor Complex	571215.9	149516.3	3,000	Chlorine cylinder valve failure	Cl	5,000	150 lbs. chlorine incident	Cl
200 West Area								
PFP	566474.3	135652.7	7,300	Seismic event with ventilation	Pu	16,100	Waste tank sabotage and PFP seismic accident	Pu, Am-241
Tank Farms	566777	136734.1	1,600	Single-shell tank hydrogen deflagration	Cs-137	16,100	Waste tank sabotage and PFP seismic accident	Pu, Am-241
200 East Area								
B Plant / WESF	573504.9	136548.1	2,300	Cross-contamination from K-3 to K-1 filter banks	Sr-90, Cs-137	16,100	Waste tank sabotage	Pu, Am-241
Tank Farms	575422.2	136203.9	13,150	Double-shell tank filter blowout	Cs-137	16,100	Waste tank sabotage	Pu, Am-241
Limiting Proposed Facility - Tank Waste Vitrification Plant	575118.1	135636.9	600	Earthquake	Am-241	16,100	Waste tank sabotage	Pu, Am-241

Table 4-15. Protective Safety Buffer Zones (Exclusive Use Zones and Emergency Planning Zones). (2 pages)

Limiting Facility	Coordinates WASP-X	Coordinates WASP-Y	EUZ Boundary (m)	Credible Accident	Controlling Contaminant	EPZ Boundary (m)	Limiting Accident	Controlling Contaminant
300 Area								
324 Bldg. B-Cell	594247.4	115784.7	1,000	Earthquake 324 Bldg. w/o B-Cell upset	Sr-90		(315 Bldg. accident dominates)	
315 Bldg.	594480.3	115761.7		(324 Bldg. accident dominates)		8,100	1,920 lbs. chlorine incident in the 315 Bldg.	Cl
400 Area								
FFTF	587604.9	123117.5	3,200	Sodium Storage Safety Class 2	Sodium hydroxide	7,300	Sodium sabotage	Sodium hydroxide

[a] If K-Basin fuel is not stable enough to move to the 200 Area before processing for dry storage, this larger EUZ may be needed.
[b] the 324 B-Cell accident dominated the credible (>10^{-6} probability) accident calculations for the 300 Area EUZ; the 315 Building chlorine accident dominated the incredible (<10^{-6} probability) accident calculations for the 300 Area EPZ.

EPZ = emergency planning zone
EUZ = exclusive use zone
FFTF = Fast Flux Test Facility
PFP = Plutonium Finishing Plan
WESF = Waste Encapsulation and Storage Facility

- ***Moderately Restricted Occasional Access.*** This type of access area would allow for more diverse activities for a longer, but controlled, periods of time than those defined for the Moderately Restricted Periodic Access areas. For example, overnight stays for short periods would be allowed. The evacuation time for this type of access would be no more than 2.5 hours. The maximum amount of time the MEI would spend in this area is estimated to be about 1,000 hr/yr.

- ***Moderately Restricted Access.*** This type of access requires only minimal access restrictions to ensure timely evacuation. This type of access would consider limited residential-type usage of the area and could accommodate small schools and commercial businesses. The evacuation time for this type of access would be 2.5 hours. The maximum amount of time the MEI would spend in this area is estimated to be about 8,700 hr/yr.

Table of Contents

5.0 Environmental Consequences 5-1

5.1 Analysis Approach 5-1
5.1.1 Geographic Information System Analysis 5-2
5.1.2 Identification of Key Resources, Unique Features, and Species and Habitats of Concern 5-3
5.1.3 Description of Impacting Activities 5-4
5.1.4 Consideration of CLUP Implementing Procedures 5-5
5.1.5 Identification of Impacted Resources 5-5
5.1.6 Methods and Assumptions for Estimating Socioeconomic Impacts 5-5
5.1.6.1 Industrial 5-5
5.1.6.2 Industrial-Exclusive 5-6
5.1.6.3 Agricultural 5-6
5.1.6.4 Research and Development 5-7
5.1.6.7 Conservation (Mining and Grazing) and Conservation (Mining) . . 5-9
5.1.6.8 Preservation 5-9
5.1.7 Methodology for Evaluating Environmental Justice Impacts 5-9
5.1.7.1 Definitions 5-9
5.1.7.2 Demographic Data 5-10

5.2 Resource Impacts 5-10
5.2.1 Geologic Resources 5-10
5.2.1.1 No-Action Alternative 5-11
5.2.1.2 Preferred Alternative 5-11
5.2.1.3 Alternative One 5-13
5.2.1.4 Alternative Two 5-13
5.2.1.5 Alternative Three 5-14
5.2.1.6 Alternative Four 5-14
5.2.1.7 Mitigation Measures 5-14
5.2.2 Water Resources 5-15
5.2.2.1 No-Action Alternative 5-16
5.2.2.2 Preferred Alternative 5-18
5.2.2.3 Alternative One 5-19
5.2.2.4 Alternative Two 5-20
5.2.2.5 Alternative Three 5-20
5.2.2.6 Alternative Four 5-21
5.2.2.7 Mitigation Measures 5-21
5.2.3 Impacts to Biological Resources 5-22
5.2.3.1 No-Action Alternative 5-28
5.2.3.2 Preferred Alternative 5-29
5.2.3.3 Alternative One 5-29
5.2.3.4 Alternative Two 5-30
5.2.3.5 Alternative Three 5-31
5.2.3.6 Alternative Four 5-32
5.2.3.7 Mitigation Measures 5-32
5.2.4 Cultural Resources 5-33
5.2.4.1 No-Action Alternative 5-34
5.2.4.2 Preferred Alternative 5-34
5.2.4.3 Alternative One 5-35
5.2.4.4 Alternative Two 5-36
5.2.4.5 Alternative Three 5-36

5.2.4.6 Alternative Four ... 5-36
5.2.4.7 Mitigation Measures ... 5-37
5.2.5 Aesthetic Resources ... 5-37
5.2.5.1 No-Action Alternative ... 5-39
5.2.5.2 Preferred Alternative ... 5-39
5.2.5.3 Alternative One ... 5-39
5.2.5.4 Alternative Two ... 5-40
5.2.5.5 Alternative Three ... 5-40
5.2.5.6 Alternative Four ... 5-40
5.2.5.7 Mitigation Measures ... 5-41

5.3 Socioeconomic and Environmental Justice Impacts ... 5-41
5.3.1 Socioeconomic Impacts ... 5-41
5.3.1.1 No-Action Alternative ... 5-41
5.3.1.2 Preferred Alternative ... 5-42
5.3.1.3 Alternative One ... 5-43
5.3.1.4 Alternative Two. ... 5-44
5.3.1.5 Alternative Three. ... 5-45
5.3.1.6 Alternative Four. ... 5-47
5.3.2 Environmental Justice Impacts ... 5-47
5.3.2.1 Demographic Analysis ... 5-48
5.3.2.2 American Indian Populations Near the Hanford Site ... 5-48
5.3.2.3 Human Health Impacts ... 5-48
5.3.2.4 No-Action Alternative ... 5-49
5.3.2.5 Preferred Alternative ... 5-50
5.3.2.6 Alternative One ... 5-50
5.3.2.7 Alternative Two ... 5-51
5.3.2.8 Alternative Three ... 5-51
5.3.2.9 Alternative Four ... 5-52

5.4 Human Health Risk ... 5-53

5.5 Cumulative Impacts ... 5-56
5.5.1 Cumulative Impacts to Land Use ... 5-57
5.5.2 Cumulative Impacts by Resource ... 5-60
5.5.2.1 Geologic Resources ... 5-60
5.5.2.2 Water Resources ... 5-60
5.5.2.3 Biological Resources ... 5-60
5.5.2.4 Cultural Resources ... 5-61
5.5.2.5 Aesthetic Resources ... 5-62
5.5.3 Cumulative Socioeconomic Impacts ... 5-63
5.5.4 Cumulative Human Health Risk ... 5-63

5.6 Other NEPA Considerations ... 5-64
5.6.1 Unavoidable Adverse Impacts ... 5-64
5.6.2 Irreversible and Irretrievable Commitments of Resources ... 5-65
5.6.3 Conflicts with Land-Use Plans of Other Federal, Regional, State, Local, and Tribal Agencies ... 5-67
5.6.4 Relationship Between Near-Term Use and Long-Term Productivity of the Environment ... 5-68

Figure

5-1. Percentage of BRMaP Level II, III, and IV Resources Under the Preservation Land-Use Designation for Each Alternative Designation 5-27

Tables

5-1. Calculation of Ratios for Estimating Employment Under the Research and Development Land-Use Designation 5-8
5-2. Data Used to Estimate Recreational Impacts 5-8
5-3. Potential Adverse Impacts of Land-Use Alternatives on Unique Geologic Features . 5-12
5-4. Opportunities for Geologic Resource Development Under the Alternatives 5-13
5-5. Potential Adverse Impacts of Alternatives on the Vadose Zone and Groundwater .. 5-17
5-6. Potential Adverse Impacts of the Alternatives on Surface Water 5-19
5-7. Potential Adverse Impacts of the Alternatives on Sensitive Biological Resources ... 5-23
5-8. Potential Adverse Impacts to Biological Resources as Defined by BRMaP 5-24
5-9. Distribution of BRMaP Level II, III, and IV Resources Under the Nine Land-Use Designations for the Alternatives 5-25
5-10. Potential Impacts of Land-use Alternatives on Cultural Resources 5-33
5-11. Potential Impacts of Land-Use Alternatives on Aesthetic Resources 5-38
5-12. Potential Economic Impacts of Agricultural Development 5-46
5-13. Future Exposed Populations and Estimated Cancer Incidences for Each Geographic Area, Assuming Loss of Institutional Controls 5-54
5-14. Future Exposed Populations and Estimated Cancer Incidences for Each Geographic Area, Assuming Institutional Controls for the Central Plateau and Associated Groundwater Plumes 5-55
5-15. Future Exposed Populations and Estimated Cancer Incidences for the Columbia River Geographic Area 5-55
5-16. Occupational Fatality Rates for Selected Occupations (1995) 5-56
5-17. Present or Reasonably Foreseeable Future Actions Compatible with Land-Use Designations Under All Alternatives 5-58
5-18. Present or Reasonably Foreseeable Future Actions with Nonconforming Land Uses 5-59
5-19. Comparisons of Affected Areas by Alternative 5-66

This page intentionally left blank.

5.0 Environmental Consequences

This chapter describes the potential environmental consequences associated with the future land-use alternatives (including the No-Action Alternative) discussed in Chapter 3. These analyses focus on the environmental resource categories described in Chapter 4, "Affected Environment."

5.1 Analysis Approach

The future land-use alternatives developed by U.S. Department of Energy (DOE) and the cooperating agencies would allow a range of future land uses for Hanford Site lands. These land uses would have impacts to natural and cultural resources and could affect the socioeconomic environment in the region surrounding the Hanford Site. The environmental impacts of each land use would depend on the nature of the use, its location with respect to the resources, and the amount of land affected by the land use. Because the location and scale of specific future uses (e.g., a sand and gravel quarry or a metal fabrication plant) cannot be readily predicted, the impacts of these uses on specific resources cannot be accurately quantified. As described in Chapter 6, impacts of specific projects would be analyzed under the *National Environmental Policy Act of 1969* (NEPA), NEPA equivalent *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) and *Resource Conservation and Recovery Act of 1976* (RCRA) documentation, and, where applicable, local *State Environmental Policy Act of 1971* (SEPA) processes as part of the implementation of the Hanford Comprehensive Land-Use Plan (CLUP) (see Chapter 6).

Question #18 of the Council on Environmental Quality's (CEQ's) "40 Most Asked Questions" (46 FR 18026) provides guidance regarding the uncertain effects of future actions (see text box, *"CEQ's 40 Most Asked Questions: Uncertainties About Future Actions"*). The analysis in this chapter was based on the CEQ guidance and focuses on identifying and describing the impacts of reasonably foreseeable future uses in light of land-use trends in the Hanford region. For some land uses, information was readily available on possible development plans. For example, the Wahluke 2000 Plan (Wahluke 2000 Committee 1992), provided information on proposed agricultural development of the Wahluke Slope, and DOE's Strategic Plan provided information on proposed DOE development. For other uses, assumptions could be made on the basis of data available for trends in the region (e.g., industrial development in the Tri-Cities).

> ***CEQ's 40 Most Asked Questions: Uncertainties About Future Actions***
>
> **18.Q. How should uncertainties about indirect effects of a proposal be addressed, for example, in case of disposal of Federal lands, when the identity or plans of future landowners is unknown?**
>
> A. The EIS must identify all the indirect effects that are known and make a good faith effort to explain the effects that are not known but are "reasonably foreseeable" Section 1508.8(b). In the example, if there is total uncertainty about the identity of future land owners or the nature of future land uses, then of course, the agency is not required to engage in speculation or contemplation about their future plans. But, in the ordinary course of business, people do make judgments based upon reasonably foreseeable occurrences. It will often be possible to consider the likely purchasers and the development trends in that area or similar areas in recent years; or the likelihood that the land will be used for an energy project, shopping center, subdivision, farm, or factory. The agency has the responsibility to make an informed judgment, and to estimate future impacts on that basis, especially if trends are ascertainable or potential purchasers have made themselves known. The agency cannot ignore these uncertain but probable effects of its decisions.

Although the analysis in this chapter is necessarily more qualitative than quantitative, it has been designed to provide adequate information to support the decisions to be made and to allow for meaningful comparison of the alternatives. The following sections describe the methods used to identify, describe, and compare the impacts of the alternatives.

5.1.1 Geographic Information System Analysis

A geographic information system (GIS) was used to organize the environmental data and identify and quantify the resources potentially affected under each alternative. The following source documents were used to obtain this data.

- Draft *Hanford Site Biological Resources Management Plan* (BRMaP) (DOE-RL 1996) for biological elements including salmonid spawning areas; hawk and eagle nesting, perching, and roosting sites; floodplains; wetlands; and plant communities of concern (BRMaP Levels I, II, III, and IV)

- Waste Inventory Data System (WIDS)

- Hanford Geographic Information System (HGIS)

- Draft *Hanford Site Cultural Resources Management Plan* (Chatters 1989) for cultural resources, including pre-contact and post-contact sites

- *Site Evaluation Report for Candidate Basalt Quarry Sites* (BHI 1995) for geologic resources (analysis of basalt outcrops only)

- *Hanford Site Groundwater Monitoring for Fiscal Year 1997* (PNNL 1997b)

- *Hanford Site Development Plan* (DOE-RL 1993) and other area development plans (DOE-RL 1993a, DOE-RL 1993b, DOE-RL 1990, and DOE-RL 1991) for Site infrastructure, including buildings, roads, and utilities

- *Hanford Site Environmental Report* (PNNL 1997a).

The GIS system includes spatial data on the distribution of resources, habitats, and infrastructure and allows these elements to be mapped and quantified. The GIS system was also used to quantify the land areas under each land-use designation for each alternative. The land areas, in hectares, acres, square miles, and percent of total acreage, are presented in Table 3-2. By combining the data sets for the resource elements listed above and the land areas for each land-use designation, the amount of each resource element that could potentially be affected under a given land-use designation was quantified. The GIS data are tabulated for BRMaP Level II, III, and IV resources in Table 5-9.

The GIS analysis has limitations for determining the impacts to a resource from future land uses. For example, although approximately 274 hectares (ha) (685 acres [ac]) of BRMaP Level IV habitat fall under the Conservation (Mining and Grazing) land-use designation under the Preferred Alternative land-use plan, it cannot be assumed that all of this habitat would be impacted by mining. Future mining operations under this alternative could impact BRMaP Level IV habitat, but the size of the impact area cannot be quantified at this time. What can be determined at this time is (1) those areas designated for Preservation will not be disturbed by mining in the future, and (2) the mineral resources that are there are committed for Preservation.

5.1.2 *Identification of Key Resources, Unique Features, and Species and Habitats of Concern*

The analysis of the alternatives was focused on resource elements that were identified as important to DOE, the cooperating agencies, affected Tribal governments, and members of the public. These elements were identified through public scoping, comments on the August 1996 *Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* (HRA-EIS), and discussions with representatives of cooperating agencies and Tribes. Generally, the resource elements can be categorized as follows:

- Key resources, including surface water (e.g., the Columbia River), groundwater, economically viable geologic resources, and industrial infrastructure

- Unique features, including the White Bluffs, basalt outcrops, active and stabilized sand dunes and bergmounds and ripple marks created by the cataclysmic Pleistocene Missoula Floods, viewing locations, viewsheds, archaeological and historic sites, and areas of cultural and religious importance to American Indian tribes

- Species and habitats of concern, including plant communities of concern, wildlife and wildlife habitat, aquatic species and habitat, wetlands, and biodiversity.

Plant communities of concern were identified using the classifications from BRMaP. These classifications associate different management actions (i.e., monitoring, impact assessment, mitigation, and preservation) with particular sets of biological resources. The BRMaP classifies Hanford Site biological resources into four levels of management concern, which can be summarized as follows:

- **Level I** biological resources are resources that require some level of status monitoring because of the recreational, commercial, or ecological role or previous protection status of the resources. Level I includes Washington State "Monitor 3" species (DOE-RL 1996).

- **Level II** biological resources require consideration of potential adverse impacts from planned or unplanned Hanford Site actions for compliance with procedural and substantive laws such as NEPA, CERCLA, and the *Migratory Bird Treaty Act of 1918*. Mitigation of potential impacts by avoidance and/or minimization is appropriate for this level; however, additional mitigation actions are not required. Level II resources include Washington State Monitor 1 and 2 species and early successional habitats.

- **Level III** biological resources require mitigation because the resource is listed by the State of Washington; is a candidate for Federal or state listing; is a plant, fish, or wildlife species with unique or significant value; has a special administrative designation (e.g., the Fitzner/Eberhardt Arid Lands Reserve [ALE Reserve]); or is environmentally sensitive. When avoidance and minimization are not possible, or application of these measures still results in adverse residual impacts above a specified threshold value, mitigation by rectification and/or compensation is required. Maintenance of Level III resource values may prevent more restrictive and costly management prescriptions in the future. Level III resources include Washington State candidate and sensitive species, threatened and endangered species, Federal candidate species, wetlands and deep-water habitats, and late-successional habitats.

- **Level IV** biological resources justify preservation as the primary management option because these resources are Federally protected or have regional and national significance. The plant communities and habitats that are defined as belonging to this level are of such high quality and/or rarity that damages to these resources cannot be mitigated except through compensatory mitigation by acquiring and protecting in-kind resources. The legally protected species that are included in Level IV cannot be impacted without the concurrence of the U.S. Fish and Wildlife Service so these types of impacts do not jeopardize the continued existence of the species. Level IV resources include Federal threatened and endangered species and those species proposed for listing, rare habitats such as the White Bluffs, active and stabilized sand dunes, and basalt outcrops.

The analysis of impacts to biological resources included an evaluation of effects on BRMaP II, III, and IV plant communities.

5.1.3 Description of Impacting Activities

The nine land-use designations used to develop the alternatives discussed in Chapter 3 are each unique in defining allowable future uses. However, impacts to resources would be similar for several land-use designations. For example, the Industrial, Industrial-Exclusive, Research and Development, and High-Intensity Recreation land-use designations would each involve siting and construction of facilities with surface disturbance, increased traffic, and other similar impacts. Therefore, to simplify the analysis, the possible impacts under the nine land-use designations were organized into five impacting activities, defined as follows:

- **Mining**, including removal of vegetation, surface and subsurface disturbance, changes in groundwater hydrology, and increased dust and noise generation under the Conservation (Mining) and Conservation (Mining and Grazing) land-use designations

- **Livestock grazing**, including changes to vegetation cover and plant species composition under the Conservation (Mining and Grazing) land-use designation

- **Cultivated agriculture**, including removal of vegetation, surface disturbance (e.g., soil tillage), use of agricultural chemicals, increased water usage, changes to groundwater hydrology, and increased dust and noise generation under the Agriculture land-use designation

- **Development**, including removal of vegetation, surface disturbance, construction and operation of facilities, increased traffic, increased dust and noise generation, increased water usage, and changes in groundwater hydrology under the Industrial, Industrial-Exclusive, Research and Development, and High-Intensity Recreation land-use designations

- **Recreation**, including increased traffic and increased fishing, hunting, boating, bicycling, hiking, and picnicking, under the Low-Intensity Recreation land-use designation.

These five impacting activities were used in the analysis to identify and describe, in general terms, the potential impacts to resource elements under each land-use designation.

5.1.4 Consideration of CLUP Implementing Procedures

Impacts to resources from the activities described above would likely be mitigated through the application of the CLUP implementing procedures described in Chapter 6. For example, a Use Request involving a proposed sand and gravel quarry in an area designated for Conservation (Mining) would be subject to review as described in Section 6.4. After completing the review, the Hanford Site Real Estate Officer (REO) may deny the request or issue a conditional use permit with project modifications to avoid protected resources or to mitigate damages to those resources. For the purpose of this analysis, the impacts of the alternatives are compared without consideration of the possible mitigating effects of the CLUP implementing procedures discussed in Chapter 6. This approach allows for clearer comparisons of the alternatives and does not take credit for procedures that are not fully developed or in place. The CLUP implementing procedures are discussed along with other possible mitigation measures under each resource section.

5.1.5 Identification of Impacted Resources

The environmental impacts of proposed land-use designations under each alternative were evaluated by comparing the locations of impacting activities under each plan to the locations of key resources, unique features, and species and habitats of concern on the Hanford Site. This enabled the generation of tables showing which resource elements would be affected by impacting activities under each alternative. Tables 5-3 through 5-8, 5-10, and 5-11 provide an overview of the potential environmental consequences of each alternative and allow for simple comparisons of the alternatives. The identification of the affected resource elements provides a focus for the discussion of impacts under each alternative.

5.1.6 Methods and Assumptions for Estimating Socioeconomic Impacts

The possible socioeconomic impacts of each alternative were analyzed by focusing on the possible opportunities for economic development posed by each alternative. This approach provides for meaningful comparison of the alternatives without attempting to predict specific impacts, such as changes in demand for housing, schools, or other services. These types of impacts are best assessed on a project-by-project basis, through the appropriate local planning processes.

The study area for this analysis was limited to Benton, Franklin, and Grant counties, including the cities of Kennewick, Pasco, and Richland (the Tri-Cities), which are most likely to be affected by land-use changes. The assumptions used for and the general socioeconomic effects of each land-use designation are discussed below.

5.1.6.1 Industrial. The potential socioeconomic impacts of the Industrial land-use designation were evaluated by comparing the amount of land available for industrial use under each alternative to the estimated land needs for future industrial development. The land needs for future private industrial development were estimated by the Benton County Planning Department by correlating industrial land needs with projected population growth (BCPD 1997). For the purpose of this analysis, it was assumed that future industrial land needs would be met using lands on the Hanford Site and not other lands in the study area that are currently zoned for industrial use.

The Benton County Planning Department assumed that annual population growth in the study area would continue at a rate of 2 percent during the 50-year planning period. This growth rate was extrapolated from the Washington State Office of Financial Management "medium series" population projections for Benton County for the period between the years

2010 and 2020 (Washington OFM 1995). This growth rate corresponds to a population increase of approximately 193,000 for Richland, West Richland, Kennewick, and Pasco. Using a factor of 6 ha (15 ac) per 1,000 population, the Benton County Planning Department estimated that approximately 1,200 ha (3,000 ac) would be needed for industrial development to support the population growth. This estimate was increased to 1,620 ha (4,050 ac) to account for interior roads, railroads, and utility corridors needed to support the industries. The amount of land designated for Industrial use under each alternative was compared to the estimated need for 1,620 ha (4,050 ac).

The amount of land under the Industrial land-use designation for each alternative was correlated with potential employment levels using data on Tri-Cities industrial development compiled by the Benton County Planning Department. Possible levels of employment, expressed as ranges, were determined for each alternative using data on the percentage of lands under industrial zoning designations that are currently developed, and scaling factors similar to those described in Section 5.1.5.4 for the Research and Development land-use designation. The ranges of predicted employment levels used were less than 100 employees, 100 to 1,000 employees, and over 1,000 employees.

Because DOE has a continuing mission at the Hanford Site and the Site lands are under Federal ownership, the potential for future Federally sponsored industrial projects must also be considered. These projects may include DOE-sponsored privatization efforts, interagency training facilities such as the Hazardous Materials Management and Emergency Response Facility (HAMMER) Volpentest Training and Education Center, or projects sponsored by other agencies. Because the land needs for future Federal projects are not currently known, the alternatives cannot be evaluated to determine whether they would meet these needs. Therefore, the alternatives are evaluated and compared based on the amount of land available to support the DOE mission or for other Federally sponsored industrial development, over and above the estimated need projected by the Benton County Planning Department for private industrial development.

5.1.6.2 Industrial-Exclusive. The Industrial-Exclusive land-use designation applies to the Central Plateau, where DOE would continue waste management activities. Although all the alternatives being considered would accommodate current waste management activities, the alternatives differ in the amount of acreage available for future waste management activities. The extent to which these differences would affect future development and the resulting economic impacts are discussed.

5.1.6.3 Agricultural. The impacts of the Agricultural land-use designation were evaluated based on the increase in land available for agriculture use, as a percentage of total agricultural land in Benton, Franklin, and Grant counties. The increase in land available was correlated to increased sales of agricultural products. These correlations were made using data from the Census of Agriculture (USDA-NASS 1992) and the Benton County Agricultural Extension Office (Watson et al. 1991).

Three scenarios for agricultural development on the Wahluke Slope were identified, as follows:

- **Scenario 1:** All lands under the Agricultural designation, except those lands in the Bureau of Reclamation's (BoR's) Red Zone, would be used to produce a mix of crops similar to those currently produced in the three-county study area, and lands in the Red Zone would be used for grazing.

- **Scenario 2:** All lands under the Agricultural designation, including those lands in the Red Zone, would be used to produce a mix of crops similar to those currently produced in the three-county study area.

- **Scenario 3:** All lands under the Agricultural designation, except those lands in the Red Zone, would be used to produce specialty crops such as irrigated vegetables and irrigated fruit orchards, and lands in the Red Zone would be used for grazing.

5.1.6.4 Research and Development. The Research and Development land-use designation involves the siting of large-scale facilities in clusters or campus-like developments. In some cases, research and development facilities may require large safety zones or may require separation from other facilities to minimize noise, dust, or vibrational impacts. For these reasons, development on lands under the Research and Development land-use designation is assumed to occur at a lower density than for the Industrial land-use designation. Because research and development facilities often require large capital investments and provide relatively high salaries compared to other industries, the economic impacts could be significant.

The Research and Development land-use designation was evaluated by estimating potential employment levels that could be supported by the research and development land base under each alternative. This method, which was developed by the Benton County Planning Department, involved correlating acreage available for research and development uses with employment levels using data from existing research and development projects associated with the Hanford Site. These data include total acreage for each project, total square footage of facilities, and total number of employees (Table 5-1). The average square footage per employee and the average facility area-to-land area ratio shown in Table 5-1 were used to estimate employment levels that would be associated with the research and development land base under each alternative. Because of the uncertainties associated with predicting levels of future use and the wide ranges represented by the data shown in Table 5-1, predicted employment levels for Research and Development were represented as ranges, rather than as point estimates. The predicted employment levels under each alternative were predicted to fall within one of three ranges: up to 100 research and development employees, 100 to 300 research and development employees, and over 300 research and development employees.

5.1.6.5 High-Intensity Recreation. The High-Intensity Recreation land-use designation would involve intensive development of the Vernita Terrace area, which is located near Vernita Bridge. The Benton County Planning Department assumptions include establishment of the B Reactor Museum, a 27-hole golf course, and a destination resort with a 350-room hotel and conference center and a recreational vehicle/trailer park at Vernita Terrace (BCPD 1997). The High-Intensity land-use designation also includes developed Tribal fishing sites. In the *Columbia River Treaty Access Fishing Sites Final Phase Two Evaluation Report and Finding of No Significant Impact/Environmental Assessment* (USACE 1995), in-lieu fishing sites ranged from 21.6 ha to 0.36 ha (53.4 ac to 0.9 ac) and included paved or gravel parking lots, boat ramps, restrooms, drinking water, fish cleaning stations, net repair areas and fish drying sheds, and storage sheds. The economic impacts of intensive recreational use were estimated using available data for recreational visitor days at Vernita Bridge, regional averages of recreational expenditures per visitor day, and data from golf courses in the study area. These data and their sources are presented in Table 5-2.

Table 5-1. Calculation of Ratios for Estimating Employment Under the Research and Development Land-Use Designation.

Facility	Facility Area m^2 (ft^2)	No. of Employees	Facility Area per Employee m^2 (ft^2)	Total Land Area ha (ac)	Facility Area to Land Area Ratio
Environmental Molecular Sciences Laboratory	17,995 (199,940)	230	78 (870)	8 (20)	1:4
Laser Interferometer Gravitational Wave Observatory	561,519 (6,239,099)	20	28,076 (311,955)	594 (1,486)	1:10
Waste Sampling and Characterization Facility	1,293 (14,375)	65	20 (221)	0.4 (1)	1:3
Fast Flux Test Facility	101,025 (1,122,500)	700	144 (1,604)	3,164 (7,909)	1:307
Superconducting Magnetic Energy Storage Facility[a]	19,602 (217,800)	30	653 (7,260)	19 (207)	1:41
Average			5,794 (64,382)		1:73

[a] The Superconducting Magnetic Energy Storage Facility - Engineering Test Model is no longer being proposed for siting at the Hanford Site.
N/A = not applicable

Table 5-2. Data Used to Estimate Recreational Impacts.

Data Category	Datum	Source
Recreational Use on the Columbia River and Wahluke Slope		
Total, Hanford Reach	50,000 visits per year	NPS 1994
Sport fishing	30,800 visits per year	
Other day use	19,200 visits per year	
Persons per vehicle	2.3	
Recreational User Expenditures (per person)		
Sport fishing	\$39.06 per day	DOE et al. 1994
Overnight (used for RV park guests)	\$35.38 per day	
Day use	\$10.19 per day	
Golf Courses		
Number of golfers	150 per day	Phone survey of Tri-Cities golf courses, May 1997
Season	365 days/yr	
Expenditures per golfer	\$25/day	

5.1.6.6 Low-Intensity Recreation. The Low-Intensity Recreation land-use designation would increase opportunities for recreational activities in the study area. The socioeconomic impacts of this land-use designation were evaluated using the data for sport fishing and day-use activities provided in Table 5-2.

5.1.6.7 Conservation (Mining and Grazing) and Conservation (Mining). Although the two Conservation land-use designations are focused on habitat and resource conservation, limited mining and grazing, if permitted by the Hanford REO, would be allowed. The economic impact of grazing was evaluated by correlating the increased land available to the increase in the number of cattle that could be supported over the current baseline. Conversion factors of 0.17 animal unit months (AUMs) per hectare (0.067 AUM/acre) and $12/AUM (1998 dollars) (NRCS 1998) were used to estimate the economic impacts of grazing.

The economic effects of limited mining under the two Conservation land-use designations were not quantitatively evaluated because of the speculative nature of developing mineral and natural gas deposits and the lack of data on mining in the study area. The amount and location of lands designated for Conservation uses under each alternative could indirectly affect remediation costs by affecting the costs of obtaining geologic materials for constructing barriers over waste sites. These cost impacts are discussed for each alternative.

5.1.6.8 Preservation. The Preservation land-use designation is reasoned to have little direct impact, although indirect impacts may include improvements in the quality of life, new educational and research opportunities, and benefits associated with ecotourism.

5.1.7 Methodology for Evaluating Environmental Justice Impacts

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 32), directs Federal agencies to consider environmental justice during the NEPA process, and to incorporate environmental justice as part of the agency mission. Federal agencies are specifically directed to identify and address disproportionately high and adverse human health or environmental effects of programs, policies, and activities on minority and low-income populations to the greatest extent practicable and permitted by law.

5.1.7.1 Definitions. The following definitions were used to identify potential environmental justice impacts.

- **Census block group:** An area defined for the purpose of monitoring census data that generally consists of between 250 and 550 housing units.

- **Minority population:** A group of people and/or communities experiencing common conditions of exposure or impact that consists of persons classified by the U.S. Bureau of the Census as Negro/Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and other non-White persons, based on self-classification by the people according to the race with which they most closely identify. For purposes of analysis, minority populations are defined as those census tracts within the zone of impact where the percent minority population exceeds the percentage minority population within the entire zone of impact. Census tracts where the percent minority population exceeds 50 percent also are considered minority populations. In the case of migrant or dispersed populations, a minority population consists of a group that is greater than 50 percent minority.

- **Low-income community:** An area where the median household income is 80 percent or more below the median household income for the metropolitan statistical area (urban) or county (rural). The 80 percent threshold was used based on definitions used by the U.S. Department of Housing and Urban Development.

- **Population base:** Census tracts were included in the analysis if 50 percent of the geographic area of the tract fell within the 80-kilometer (km) (50-mile [mi]) radius of the Hanford Site.

- **Disproportionately high and adverse human health effects:** Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal impacts to human health. Disproportionately high and adverse human health effects occur when the risk or rate for a minority population or low-income population from exposure to an environmental hazard significantly exceeds the risk or rate to the general population and, where available, to other appropriate comparison groups.

- **Disproportionately high and adverse environmental impacts:** An adverse environmental impact is an environmental impact determined to be unacceptable or above generally accepted norms. A disproportionately high impact refers to an impact (or risk of an impact) in a low-income or minority community that significantly exceeds the impact on the larger community.

5.1.7.2 Demographic Data. Demographic information obtained from the U.S. Bureau of Census was used to identify minority populations and low-income communities within an 80-km (50-mi) radius surrounding the 200 East Area on the Hanford Site at the census block group level (Neitzel et al. 1997). For the evaluation of environmental justice impacts, the area defined by this 80-km (50-mi) radius was considered the zone of potential impact.

Characterization of minority and low-income populations residing within a geographical area is sensitive to the basic definitions and assumptions used to identify those populations. Federal guidance on environmental justice with regard to the definition of an area that has a minority or low-income population large enough to act as a test for a disproportionate impact has not been developed. Consequently, the number of individuals identified as minority and/or low-income individuals within the population around a particular site may vary from analysis to analysis. Several different approaches to identification of minority and low-income populations have been used in recent DOE environmental impact statements. The approach presented in this EIS is consistent with the approach used in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Neitzel et al. 1997). Other demographic studies may use different assumptions and, consequently, report a different total population, minority population, or low-income population, depending on the assumptions used to identify each population.

5.2 Resource Impacts

5.2.1 Geologic Resources

The Hanford Site includes geologic resources that are unique or have economic value. The unique features include the White Bluffs and basalt outcrops with their talus slopes, such as Gable Mountain and Gable Butte; Missoula Floods features; and active and stabilized sand dunes, which have aesthetic, historic and ecological value or are valuable for scientific study. Many of these features also have cultural resource value, and are discussed in Section 5.2.4.

Soils on the Hanford Site can also be considered to have ecological value. Key geologic resources include soil, sand and gravel, pea gravel, basalt, and natural gas deposits, which are needed to support remedial activities or have economic value for future development. Geologic materials required to support remediation at the Hanford Site are discussed further in Appendix D.

Impacts of the alternatives on unique geologic features on the Hanford Site are described in the following sections and summarized in Table 5-3. Impacts of the alternatives on the availability of key geologic resources are summarized in Table 5-4. The primary impacts to unique geologic features would occur from mining under the Conservation land-use designations. Development under the Industrial, Research and Development, and High-Intensity Recreation land-use designations could also result in destruction of unique features. Grazing is not anticipated to have impacts on these features, although overgrazing could result in increased erosion of some features.

5.2.1.1 No-Action Alternative. Under the No-Action Alternative, unique geologic features could be impacted by mining. Basalt outcrops could be developed as quarry sites for obtaining geologic materials for remediation. According to an engineering assessment (Appendix D), Gable Mountain and Gable Butte represent the most economic and technically feasible basalt sources available for remediation. In the absence of a land-use plan, features such as active and stabilized sand dunes and Missoula Floods features could be impacted by commercial sand and gravel operations. These features could also be impacted by industrial development. Soils on the Hanford Site could be impacted by mining, grazing, and cultivated agriculture, which would increase soil compaction and erosion.

The No-Action Alternative would permit the commercial development of geologic resources on most of the Hanford Site and would not restrict use of geologic resources needed to support remediation activities. The current administrative designations for the Saddle Mountain National Wildlife Refuge and the Wahluke Slope do not preclude mining; in fact, some mining is occurring on those lands. The administrative designation for the ALE Reserve also would not preclude development of existing natural gas claims on the Reserve.

5.2.1.2 Preferred Alternative. Under the Preferred Alternative, unique geologic features, including Gable Mountain and Gable Butte, the White Bluffs, and the active sand dunes would be protected under the Preservation land-use designation. Missoula Flood features could be impacted by sand and gravel operations. Mining could result in soil compaction and increased erosion around quarry sites. Livestock grazing could result in soil compaction near water sources and increase soil erosion by reducing vegetation cover, especially in areas containing stabilized sand dunes.

The Preferred Alternative would permit the commercial development of existing natural gas claims on the ALE Reserve. However, the Preservation land-use designation for the areas of the ALE Reserve surrounding those claims would preclude construction of an access road to the claims, and could make future development costly.

Although basalt quarrying would not be permitted at Gable Mountain or Gable Butte, other viable sources, such as Vernita Quarry and the ALE Reserve (located along State Highway 240), could be developed to provide geologic materials for remediation. However, development of these sources could result in higher remediation costs than quarries at Gable Mountain or Gable Butte (see Appendix D). Geologic resources on approximately 49 percent

Table 5-3. Potential Adverse Impacts of Land-Use Alternatives on Unique Geologic Features.

Alternative	Impacting Activity	Impacts to Unique Geologic Features (✓ = impact)				
		Soils	Basalt Outcrops	White Bluffs	Missoula Flood Features	Sand Dunes
No-Action	Mining	✓	✓		✓	✓
	Livestock grazing	✓				✓
	Cultivated agriculture	✓		✓		
	Development				✓	✓
	Recreation					
Preferred Alternative	Mining	✓			✓	✓
	Livestock grazing	✓		✓		✓
	Cultivated agriculture					
	Development					✓
	Recreation					
Alternative One	Mining	✓				✓
	Livestock grazing	✓				
	Cultivated agriculture					
	Development					✓
	Recreation					
Alternative Two	Mining					
	Livestock grazing					
	Cultivated agriculture					
	Development					
	Recreation					
Alternative Three	Mining	✓	✓		✓	✓
	Livestock grazing	✓				
	Cultivated agriculture	✓		✓		
	Development				✓	✓
	Recreation					
Alternative Four	Mining	✓				✓
	Livestock grazing					
	Cultivated agriculture					
	Development					✓
	Recreation					

Table 5-4. Opportunities for Geologic Resource Development Under the Alternatives.

Alternative	Development of Geologic Resources Allowed (✓ = yes)				
	Soil	Basalt	Pea Gravel	Sand and Gravel	Natural Gas
No-Action	✓	✓	✓	✓	✓[a]
Preferred Alternative	✓	✓	✓	✓	✓[a]
Alternative One	✓[b]	✓[b]		✓[b]	✓[a]
Alternative Two					✓[a]
Alternative Three	✓	✓	✓	✓	✓[a]
Alternative Four	✓[c]	✓[c]		✓[c]	✓[a]

[a] Development of existing natural gas claims held by the Big Bend Alberta Mining Company could not be precluded under any alternative.
[b] Under Alternative One, mining would only be allowed at existing Washington Department of Transportation quarries and to support remediation.
[c] Under this alternative, basalt, sand, and gravel resources could only be quarried to support remediation, and could not be commercially developed.

of Hanford lands would be available for commercial development under the Preferred Alternative; however, those geologic features that have unique characteristics could be excluded from development by the permitting process.

5.2.1.3 Alternative One. Under Alternative One, unique geologic features, including Gable Mountain and Gable Butte, the White Bluffs, Missoula Floods features, the active sand dunes and most of the stabilized sand dunes, would be protected under the Preservation land-use designation. Mining of geologic materials to support remediation could increase soil compaction and erosion around quarry sites. Livestock grazing on the northern portion of the Wahluke Slope could increase soil erosion by reducing vegetation cover.

Alternative One would allow mining on portions of the Wahluke Slope, in areas around the Laser Interferometer Gravitational-Wave Observatory (LIGO) and the Fast Flux Test Facility (FFTF), on portions of the ALE Reserve along State Highway 240, and in other scattered locations in the 100 and 600 Areas. Mining would be allowed in these areas to support Hanford Site remediation activities. Mining would also be allowed in locations where the Washington Department of Transportation has an existing quarry. As with the Preferred Alternative, Alternative One would allow commercial development of the existing natural gas claims on the ALE Reserve, but the Preservation land-use designation would limit access. Alternative One would not allow any other commercial development of geologic resources.

5.2.1.4 Alternative Two. Under Alternative Two, unique geologic features (including Gable Mountain and Gable Butte, White Bluffs, Missoula Flood features, and active and stabilized sand dunes) would be protected under the Preservation land-use designation. This land-use designation would also minimize soil erosion by maintaining the existing vegetation cover.

As with the Preferred Alternative, Alternative Two would allow commercial development of the existing natural gas claims on the ALE Reserve, but the Preservation land-use designation would limit access. This alternative would preclude the development of any other geologic resources on the Hanford Site. Geologic resources required to support remediation activities would have to be obtained from locations off the Hanford Site, which could increase remediation costs (see Appendix D).

5.2.1.5 Alternative Three. Under Alternative Three, unique geologic features could be impacted by mining. Basalt outcrops, including Gable Mountain and Gable Butte, could be developed as quarry sites for obtaining geologic materials for remediation. Missoula Flood features and active and stabilized sand dunes could be impacted by sand and gravel quarrying. These features could also be impacted by industrial development in the southern and eastern portions of the Hanford Site. Mining and grazing under Alternative Three could result in soil compaction and increased soil erosion. Cultivated agriculture under Alternative Three would increase soil erosion through removal of the existing vegetation cover and tillage. Soil productivity could also decline with intensive cropping.

Alternative Three could result in increased landslide activity at White Bluffs by allowing agricultural development on the Wahluke Slope. Previous studies (discussed in the Hanford Reach EIS [NPS 1994]) suggest that irrigation of crops east of the White Bluffs has raised the local water table, saturating the sedimentary materials in the bluffs and increasing the instability of slopes along the Columbia River. Previous landslides at the White Bluffs have resulted in increased sediment loading to the Columbia River. New development of irrigated agriculture on the Wahluke Slope could contribute additional groundwater to the area, increasing slope instability and the potential for additional landslides.

Alternative Three would allow basalt quarrying, mining of sand and gravel and pea gravel resources, and development of natural gas deposits on the ALE Reserve. The Conservation land-use designation on the ALE Reserve would not preclude construction of an access road to existing natural gas claims. Under Alternative Three, geologic resources on approximately 52 percent of Hanford lands would be available for commercial development; however, those geologic features that have unique characteristics could be excluded from development by the permitting process.

5.2.1.6 Alternative Four. Under Alternative Four, unique geologic features (including basalt outcrops, the White Bluffs, Missoula Flood features and active and stabilized sand dunes) would be protected under the Preservation land-use designation. This land-use designation would also minimize soil erosion, although some soil compaction and increased soil erosion could occur as a result of mining geological materials for remediation.

As with the Preferred Alternative, Alternative Four would allow commercial development of the existing natural gas claims on the ALE Reserve, but the Preservation land-use designation would limit access. Alternative Four would not allow any other commercial development of geologic resources. Mining would be limited to basalt and sand and gravel quarries developed to support remediation activities at the Hanford Site. These quarries would be located in the south-central portion of the Site, in the areas designated as Conservation (Mining). Basalt quarrying would not be permitted at Gable Mountain or Gable Butte under this alternative, but the ALE Reserve along State Route 240 could be developed to provide geologic materials for remediation.

5.2.1.7 Mitigation Measures. Future development of and access to Hanford Site geologic resources would require review under the CLUP implementation procedures described in Chapter 6. These procedures, which would be implemented under any of the alternatives being considered except the No-Action Alternative, would require avoidance or minimization of the impacts of mining or quarrying. Proposed mining or quarrying activities would be controlled through the issuance of special-use permits to be consistent with the CLUP policies requiring protection of natural and cultural resources. Other mitigation measures that could reduce impacts to unique geologic features include the following:

- Researchers could be invited to make observations before and during excavation or mining of unique features such as Missoula Flood features so the scientific value of the features would not be lost.

- Efficient irrigation methods could be employed to minimize groundwater recharge in the area of the White Bluffs.

- Rotational grazing methods could be employed to minimize soil erosion.

- Conservation tillage, fallowing and other techniques could be used to reduce soil erosion from croplands.

- Mining operations could be required to.remove, stockpile and replace topsoil.

- Soil stabilization techniques would be used around mining and development sites to contain wind erosion.

5.2.2 Water Resources

Key water resources at the Hanford Site include surface water and groundwater. The primary surface water feature is the Columbia River. Other surface water features include springs and seeps. Groundwater is found throughout the subsurface of the Hanford Site at depths ranging from approximately 250 meters (m) (820 feet [ft]) in the central portion of the Site to approximately 15 m (50 ft) near the Columbia River.

Surface water resources could be impacted by future land uses in several ways. Water quality could be degraded as a result of point source pollution from industrial wastewater discharges and non-point source pollution from runoff. Future industrial development and research and development activities could increase wastewater discharges to the Columbia River. The Columbia River is classified as a "Class A" body of water by the State of Washington, which requires that permitted discharges of wastewater from point sources to the river be as clean as, or cleaner, than the water in the river. Consequently, under normal circumstances, industrial discharges to the river would be unlikely to impact water quality in the river. Nevertheless, the potential for water quality impacts from new industrial activities must be considered because of the potential for inadvertent releases and permit violations. Contamination of groundwater from industrial development could also indirectly affect surface water through groundwater discharges to the Columbia River. Industrial development could also increase water withdrawals from the Columbia River.

Non-point source degradation of surface water could occur as a result of runoff of agricultural chemicals from cultivated fields or a golf course. Surface water could also be degraded through trampling of wetland vegetation by livestock congregating in the vicinity of the water during dry periods. Loss of this vegetation could lead to increased siltation and water quality degradation.

Impacts to groundwater could occur as a result of consumptive use or contamination. Consumptive use could lead to draw down of aquifers and could change local groundwater flow patterns. Groundwater flow could also be altered by infiltration of water used to irrigate crops under the Agriculture land-use designation. Infiltration from irrigation could also mobilize contaminants in the vadose zone and increase contamination of groundwater. Contamination could occur as a result of infiltration of chemicals from spills. Groundwater contamination could also occur as a result of infiltration of agricultural chemicals applied to crops, landscaped areas, or golf courses.

The potential for impacts to groundwater under each alternative is identified in Table 5-5 and the potential for impacts to surface water is identified in Table 5-6.

5.2.2.1 No-Action Alternative. Under the No-Action Alternative, mining operations could be undertaken within the All Other Areas geographic area and could occur in the vicinity of the Columbia River. Runoff from mining operations located close to the Columbia River could lead to water quality degradation because of erosion and release of silt to the river. Also, potential fuel or chemical spills on quarry sites could contaminate groundwater or surface water if the sites are located close to the Columbia River. Mining operations could also require water for material washing and dust control. Water use by mining operations would be minor compared to agricultural or industrial uses, and would be less likely to result in changes to groundwater hydrology. Quarry sites could collect surface water runoff, and provide a favorable infiltration surface thereby increasing recharge and mobilizing contaminants in the vadose zone below the quarry sites.

Grazing under the No-Action Alternative could occur in the vicinity of the Columbia River and could reduce riparian vegetation cover. Reduced cover could destabilize the river banks and increase sediment loading to the river. Grazing use under the No-Action Alternative would also require development of water sources. However, water consumption for grazing would relatively small compared to other uses, such as agriculture or industrial development.

The No-Action Alternative could allow conversion of lands to cultivated agriculture in the All Other Areas geographic area. Agricultural development would most likely occur near the Columbia River, which would provide a clean source of irrigation water. Irrigation water could also be provided by groundwater wells, which would alter groundwater flow patterns through aquifer drawdown. Irrigation of crops could leach agricultural chemicals and residual Hanford Site contaminants from the vadose zone to the groundwater. Runoff from agricultural land could also degrade water quality in the Columbia River through release of agricultural chemicals and increased siltation.

The No-Action Alternative would allow industrial development throughout the All Other Areas geographic area. Future development would most likely occur in the South 600 Area because supporting infrastructure is available in this area. Water to support development could be obtained from on-site groundwater wells, as is the case in the 400 Area, provided by the City of Richland (as it is in the 300 Area), or withdrawn from the Columbia River. Consumptive use of groundwater to support development could lead to changes in groundwater flow patterns as a result of aquifer drawdown. Water quality degradation from generated by new industrial point sources would be minimal because discharges to groundwater are presently not allowed and discharges to the Columbia River must be as clean or cleaner than water in the river. However, water quality could be affected by accidental releases to the soil column or the Columbia River or Yakima River from industrial sites.

The No-Action Alternative would not increase recreational access to the Columbia River over existing conditions and, therefore, is unlikely to result in increased impacts to water quality from recreational activities.

Table 5-5. Potential Adverse Impacts of Alternatives on the Vadose Zone and Groundwater. (2 pages)

Plan Map	Impacting Activity	Impacts to Vadose Zone and Groundwater (✓ = impact) Consumptive Use	Contamination (Spills)	Contamination (Agricultural Chemicals)	Mobilization of Contaminants	Changes to Hydrology
No -Action Alternative	Mining	✓	✓		✓	✓
	Livestock grazing					
	Cultivated agriculture	✓	✓	✓	✓	✓
	Development	✓	✓		✓	✓
	Low-intensity recreation					
Preferred Alternative	Mining	✓	✓		✓	✓
	Livestock grazing	✓				
	Cultivated agriculture					
	Development	✓	✓		✓	✓
	Low-intensity recreation					
Alternative One	Mining	✓	✓		✓	✓
	Livestock grazing	✓				
	Cultivated agriculture					
	Development	✓	✓		✓	✓
	Low-intensity recreation					
Alternative Two	Mining					
	Livestock grazing					
	Cultivated agriculture					
	Development	✓	✓			
	Low-intensity recreation					
Alternative Three	Mining	✓	✓		✓	✓
	Livestock grazing	✓				
	Cultivated Agriculture	✓	✓	✓	✓	✓
	Development	✓	✓	✓	✓	✓
	Low-intensity recreation					

Table 5-5. Potential Adverse Impacts of Alternatives on the Vadose Zone and Groundwater. (2 pages)

Plan Map	Impacting Activity	Impacts to Vadose Zone and Groundwater (✓ = impact)				
		Consumptive Use	Contamination (Spills)	Contamination (Agricultural Chemicals)	Mobilization of Contaminants	Changes to Hydrology
Alternative Four	Mining	✓	✓		✓	✓
	Livestock Grazing					
	Cultivated Agriculture					
	Development	✓	✓		✓	✓
	Low-intensity recreation					

5.2.2.2 Preferred Alternative. Under the Preferred Alternative, mining operations could occur throughout much of the All Other Areas geographic area, on a portion of the ALE Reserve, and on portions of the Wahluke Slope. As under the No-Action Alternative, mining activities could occur in close proximity to the south bank of the Columbia River. Potential impacts to water resources as a result of mining operations would be similar to the potential impacts described for the No-Action Alternative.

The Preferred Alternative would allow grazing in the central portion of the Hanford Site and on the Wahluke Slope. Grazing could be allowed along the south bank of the Columbia River, if permitted by the Hanford REO, and could have impacts to wetlands and riparian vegetation. Reduced vegetation cover along the river could destabilize the river banks and increase sediment loading to the river. Grazing would also require development of water sources, although water consumption would be minor compared to industrial uses under this alternative.

The Preferred Alternative would allow industrial development in the eastern and southern portions of the Hanford Site. As with the No-Action Alternative, industrial development under this alternative could alter groundwater flows through increased withdrawals. Industrial discharges to the soils column could mobilize contaminants in the vadose zone and accidental releases from industrial sites could contaminate the groundwater or the Columbia or Yakima Rivers. The potential for contamination of the Columbia River is limited, however, as the 300 Area is the only Industrial land-use designation adjacent to the river under this alternative.

Recreational access to the Columbia River would be increased under the Preferred Alternative through adding new, and upgrading existing, boat ramps. The Preferred Alternative would add three new access points to the Hanford Reach of the Columbia River and would allow development of tribal fishing villages with supporting facilities. Increased access could increase boating activity on the river, which could increase shoreline erosion from wakes generated by motorized watercraft. Increased boating activity could also generate additional pollutants (e.g., oil, gas, and engine exhaust).

Table 5-6. Potential Adverse Impacts of the Alternatives on Surface Water. (2 pages)

Plan Map	Impacting Activity	Impacts to Surface Water (✓ = impact)			
		Consumptive Use	Degradation by Point Sources	Degradation by Non-Point Sources	Degradation by Sediment Loading
No-Action Alternative	Mining			✓	✓
	Grazing	✓			✓
	Agriculture	✓		✓	✓
	Development	✓	✓	✓	✓
	Low-intensity recreation				
Preferred Alternative	Mining	✓		✓	✓
	Grazing	✓			✓
	Agriculture				
	Development	✓	✓	✓	
	Low-intensity recreation				✓
Alternative One	Mining				
	Grazing				
	Agriculture				
	Development	✓	✓		
	Low-intensity recreation				✓
Alternative Two	Mining				
	Grazing				
	Agriculture				
	Development		✓	✓	
	Low-intensity recreation				
Alternative Three	Mining				
	Grazing	✓			✓
	Agriculture	✓		✓	✓
	Development	✓	✓	✓	
	Low-intensity recreation				✓
Alternative Four	Mining				
	Grazing				
	Agriculture				
	Development	✓	✓	✓	
	Low-intensity recreation				✓

5.2.2.3 Alternative One. Under Alternative One, mining would be limited to upland areas away from the Columbia River, and would have minimal effects on water quality. Grazing under this alternative would be limited to an area north of State Highway 24 on the Wahluke Slope, which does not contain significant surface water features.

Industrial development under Alternative One would be restricted to areas that have already been developed, the City of Richland Urban Growth Area (UGA), and an area between the Washington Public Power Supply System (WPPSS) site and the UGA. Industrial development in these areas could have impacts such as those described for the Preferred Alternative, including changes in groundwater flows through drawdowns and groundwater contamination through accidental releases. However, these impacts are less likely to occur under Alternative One, as less land would be available for industrial development. Contamination of surface water from new point sources would be minimal under this alternative, as most areas designated for Industrial land use are located away from the Columbia and Yakima Rivers.

Alternative One would increase recreational access to the Columbia River by adding one new access point to the river at Vernita Bridge and maintaining an existing unimproved boat ramp at White Bluffs. The increased access could have impacts to water quality such as those described for the Preferred Alternative, although impacts under Alternative One may be less extensive because it would not provide access to as many areas.

5.2.2.4 Alternative Two. Under Alternative Two, mining, grazing, and agriculture would not be allowed, and no impacts to water resources would occur as a result of these activities.

Areas proposed for industrial development under this alternative include the Richland UGA and areas that have already been developed. The potential for new impacts to water resources under this alternative is minimal. However, Alternative Two would allow experimental aquaculture in the K Reactor area, and discharge of wastewater from fish farming activities could add to the nutrient load in the Columbia River.

Alternative Two would not increase recreational access to the Columbia River and is unlikely to result in increased impacts to water quality from recreational uses.

5.2.2.5 Alternative Three. Alternative Three would allow mining activities in the All Other Areas geographic area and on the ALE Reserve, with impacts to groundwater similar to those described for the No-Action Alternative and the Preferred Alternative. Mining would not be permitted within 0.4 km (0.25 mi) of the Columbia River, and would be unlikely to affect river water quality. Mining operations in the ALE Reserve, if permitted by the Hanford REO, could affect water quality and flows in Rattlesnake and Snively Springs, depending on the proximity of the mining operation.

Grazing under Alternative Three would be permitted in some areas on the Wahluke Slope, including wetland areas associated with irrigation water return flows. Grazing could reduce vegetation cover in wetland and increase siltation in flows entering the Columbia River. However, grazing under this alternative would not be allowed directly adjacent to the Benton County bank of the Columbia River, as it would under the Preferred Alternative and, therefore, would have less effect on water quality.

Alternative Three would allow cultivated agriculture on much of the Wahluke Slope but would not allow agriculture within a corridor along the Columbia River. This buffer zone would minimize the potential for non-point source runoff of agricultural chemicals and eroded soils into the Columbia River. However, infiltration of agricultural chemicals could contaminate groundwater underlying cropland, and agriculture on the Wahluke Slope could also alter groundwater flow patterns. Increased groundwater recharge from irrigation would increase slumping along the White Bluffs, reducing their scientific, aesthetic, and cultural value. Increased slumping would add large quantities of sediment to the Columbia River, which could bury salmonid spawning areas and would alter flow patterns in the river and could mobilize contaminants, causing erosion of banks and islands.

Water resource impacts due to industrial development under Alternative Three would be similar to those described for the Preferred Alternative and could include changes in groundwater flow, mobilization of vadose zone contaminants, and possible groundwater and surface water contamination through accidental releases.

Recreational development under this alternative could include a golf course and destination resort on the Vernita Terrace. Runoff from parking lots and runoff or infiltration of agricultural chemicals from the golf course could impact water resources. However, development would not be permitted within 0.4 km (0.25 mi) of the Columbia River, which would minimize the potential effects of runoff on river water quality. The recreational development would involve consumption of large amounts of groundwater for culinary and sanitary uses at the resort and for irrigation of the golf course. Groundwater wells at the destination resort could result in changes in groundwater flows from aquifer drawdown, as well as possible groundwater mounding under sewage treatment facilities.

Alternative Three would increase recreational access to the Columbia River, with potential impacts from increased boating activity such as those described for the Preferred Alternative. However, Alternative Three would concentrate the increased recreational activity on the upper end of the Hanford Reach and at a location near the Yakima River. This could result in water quality impacts with higher intensity in these areas, but lower intensity in the lower portion of the Hanford Reach.

5.2.2.6 Alternative Four. As with Alternative One, Alternative Four would limit mining to upland areas away from the Columbia River and would result in minimal impacts to water quality from mining.

Water resource impacts due to industrial development under Alternative Four would be similar to those described for the Preferred Alternative and could include changes to groundwater flow from drawdown, mobilization of vadose zone contaminants, and possible contamination from accidental releases. However, these impacts may be less likely to occur, as less land would be available for industrial development.

Alternative Four would increase recreational access to the Columbia River by adding two new access points to the river at White Bluffs and Vernita Bridge, which would be associated with tribal fishing villages and support facilities. The increased access could have impacts to water quality such as those described for the Preferred Alternative, although impacts under Alternative Four may be less extensive because it would not provide access to as many areas.

5.2.2.7 Mitigation Measures. The CLUP implementing procedures described in Chapter 6 would be used to screen development proposals for Hanford Site lands. Some activities with the potential to impact water resources would not be permitted by the Hanford REO and others would be required to incorporate mitigation measures to reduce impacts. Mitigation measures that could reduce impacts to water resources include the following activities.

- Minimizing the use of groundwater so that water withdrawal would not alter groundwater flow and influence existing contamination plumes.

- Restricting irrigated agriculture on the Wahluke Slope, requiring hydrogeologic studies, or requiring efficient irrigation methods to minimize the potential for increased slumping of the White Bluffs.

- Designating "no wake" zones along the Columbia River in areas where the riverbank is subject to erosion.

- Employing agricultural practices that minimize the use of pesticides, fertilizers, and herbicides, thereby minimizing the potential for infiltration or runoff of these chemicals to groundwater or surface water.

- Requiring a demonstration of no adverse effect on vadose zone contaminants or contaminated groundwater plumes prior to allowing irrigation or industrial discharges to the soil column.

- Employing agricultural practices that minimize soil erosion.

- Using silt fences around development sites to contain soil erosion around those sites and minimize the potential for release of silt to surface water.

- Using soil stabilizing techniques around mining and development sites to contain wind erosion.

- Implementing water conservation measures wherever possible to minimize water use.

- Implementing spill control and cleanup measures to minimize the risk of contaminating water resources from accidental releases.

- Managing grazing activities to minimize livestock access to wetlands and riverbanks (e.g., development of off-stream water sources).

5.2.3 Impacts to Biological Resources

Sensitive biological resources are present on the Hanford Site in association with the Columbia River, basalt outcrops with their talus slopes such as Gable Butte and Gable Mountain, sand dunes, low elevation deep soils, and other unique features. Biological resources considered for each alternative in this analysis include terrestrial vegetation and habitat, especially habitats identified through consideration of plant communities of concern; wildlife and wildlife habitat; aquatic species and habitat; wetlands; and biodiversity. The potential impacts of activities allowed under the alternatives on these biological resources are identified in Table 5-7.

Biological resources at the Hanford Site are also classified by level of concern under BRMaP (DOE-RL 1996). This analysis is focused on resources classified as BRMaP Levels II, III, and IV, defined as follows:

- Level II resources include Washington State Monitor 1 and 2 species and early successional habitats.

- Level III resources include Washington State candidate, sensitive, threatened, and endangered species, Federal candidate species, wetlands and deep-water habitats, and late-successional habitats.

Table 5-7. Potential Adverse Impacts of the Alternatives on Sensitive Biological Resources. (2 pages)

Alternative	Impacting Activity	Impacts to Biological Resources (✓ = impact)				
		Terrestrial Vegetation and Habitat	Wildlife and Wildlife Habitat	Aquatic Species and Habitat[a]	Wetlands	Biodiversity
No-Action	Mining	✓	✓	✓	✓	✓
	Livestock grazing	✓	✓	✓	✓	✓
	Cultivated agriculture	✓	✓	✓	✓	✓
	Development	✓	✓	✓		✓
	Low-intensity recreation					
Preferred Alternative	Mining	✓	✓	✓	✓	
	Livestock grazing	✓	✓	✓	✓	✓
	Cultivated agriculture					
	Development	✓	✓			✓
	Low-intensity recreation			✓		
Alternative One	Mining	✓	✓			
	Livestock grazing	✓	✓			✓
	Cultivated agriculture					
	Development	✓	✓			
	Low-intensity recreation			✓		
Alternative Two	Mining					
	Livestock grazing					
	Cultivated agriculture					
	Development	✓	✓			
	Low-intensity recreation					
Alternative Three	Mining	✓	✓			✓
	Livestock grazing	✓	✓	✓	✓	✓
	Cultivated agriculture	✓	✓	✓	✓	✓
	Development	✓	✓			✓
	Low-intensity recreation			✓		

Table 5-7. Potential Adverse Impacts of the Alternatives on Sensitive Biological Resources. (2 pages)

Alternative	Impacting Activity	Impacts to Biological Resources (✓ = impact)				
		Terrestrial Vegetation and Habitat	Wildlife and Wildlife Habitat	Aquatic Species and Habitat[a]	Wetlands	Biodiversity
Alternative Four	Mining	✓	✓			
	Livestock grazing					
	Cultivated agriculture					
	Development	✓	✓			✓
	Low-intensity recreation			✓		

[a] Aquatic species and habitats includes creeks, springs, riparian, and riverine (deep water) habitat.

- Level IV resources include Federal threatened and endangered species and those species proposed for listing and rare habitats such as the White Bluffs, active and stabilized sand dunes, and basalt outcrops.

Table 5-8 presents the potential impacts on biological resources that have been defined in BRMaP as Levels II, III, and IV from activities allowed under the alternatives. The amount of acreage of each BRMaP level under each land-use designation is tabulated from GIS spatial data in Table 5-9.

Alternatives One, Two, and Four would least affect the sensitive biological resources classified under BRMaP. Under these alternatives, most of the BRMaP Level III and IV resources would be protected under the Preservation land-use designation. Figure 5-1 graphically depicts the differences in the alternatives in the level of protection provided to BRMaP resources.

Table 5-8. Potential Adverse Impacts to Biological Resources as Defined by BRMaP. (2 pages)

Alternative	Activity	Impact to BRMaP Resource Level of Concern (✓ = impact)		
		II	III	IV
No-Action	Mining	✓	✓	✓
	Livestock grazing	✓	✓	✓
	Cultivated agriculture	✓	✓	✓
	Development	✓	✓	✓
	Low-Intensity Recreation			
Preferred Alternative	Mining	✓	✓	✓
	Livestock grazing	✓	✓	✓
	Cultivated agriculture			
	Development	✓	✓	
	Low-Intensity Recreation		✓	✓

Table 5-8. Potential Adverse Impacts to Biological Resources as Defined by BRMaP. (2 pages)

Alternative	Activity	Impact to BRMaP Resource Level of Concern (✓ = impact)		
		II	III	IV
Alternative One	Mining			✓
	Livestock grazing		✓	
	Cultivated agriculture			
	Development	✓	✓	
	Low-intensity recreation			
Alternative Two	Mining			
	Livestock grazing			
	Cultivated agriculture			
	Development	✓	✓	
	Low-intensity recreation			
Alternative Three	Mining	✓	✓	✓
	Livestock grazing	✓	✓	✓
	Cultivated agriculture	✓	✓	✓
	Development	✓	✓	
	Low-intensity recreation	✓	✓	✓
Alternative Four	Mining	✓	✓	✓
	Livestock grazing			
	Cultivated agriculture			
	Development	✓	✓	
	Low-intensity recreation		✓	✓

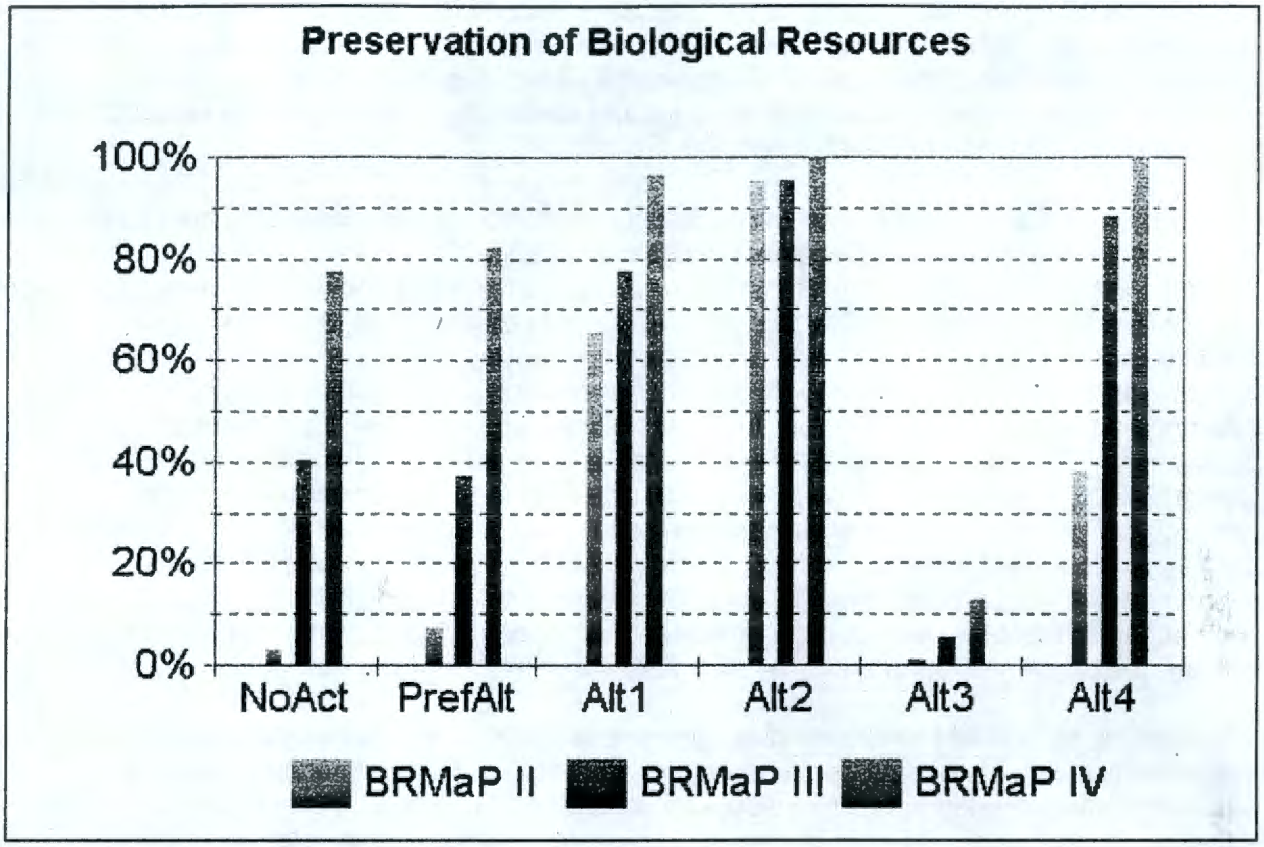
Table 5-9. Distribution of BRMaP Level II, III, and IV Resources Under the Nine Land-Use Designations for the Alternatives. (2 pages)

Land-Use Designation	No-Action Alternative	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four
BRMaP II	ha					
Preservation	1,113	2,614	23,602	34,217	381	13,667
Conservation (Mining)	0	12	10,954	0	14,309	13,462
Conservation (Mining and Grazing)	15,807	16,258	<1	0	93	0
Industrial	18,840	11,983	1,202	954	12,495	4,610
Industrial-Exclusive	146	146	134	134	146	146
Research and Development	0	4,885	10	599	7,885	4,022
Low-Intensity Recreation	3	10	3	3	105	0
High-Intensity Recreation	0	2	2	0	355	1

Table 5-9. Distribution of BRMaP Level II, III, and IV Resources Under the Nine Land-Use Designations for the Alternatives. (2 pages)

Land-Use Designation	No-Action Alternative	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four
BRMaP II	ha					
Agriculture	0	0	0	0	139	0
BRMaP III	ha					
Preservation	26,857	24,689	49,639	63,769	3,548	59,109
Conservation (Mining)	0	126	6,456	0	37,096	4,166
Conservation (Mining and Grazing)	33,396	36,095	5,412	0	3,578	0
Industrial	1,108	400	76	296	706	310
Industrial-Exclusive	3,115	3,115	2,672	2,672	3,115	3,115
Research and Development	0	<1	194	4	13	<1
Low-Intensity Recreation	2,268	2,317	2,293	0	2,379	6
High-Intensity Recreation	0	<1	<1	1	56	37
Agriculture	0	0	0	0	16,251	0
BRMaP IV	ha					
Preservation	7,180	7,631	7,576	9,258	1,178	9,258
Conservation (Mining)	0	0	328	0	6,450	0
Conservation (Mining and Grazing)	721	274	0	0	65	0
Industrial	4	0	0	0	0	0
Industrial-Exclusive	0	0	0	0	0	0
Research and Development	0	0	0	0	0	0
Low-Intensity Recreation	1,355	1,355	1,355	0	1,355	0
High-Intensity Recreation	0	0	0	0	<1	0
Agriculture	0	0	0	0	211	0

Figure 5-1. Percentage of BRMaP Level II, III, and IV Resources Under the Preservation Land-Use Designation for Each Alternative.



5.2.3.1 No-Action Alternative. The No-Action Alternative would allow continued development of the All Other Areas geographic area on a project-by-project basis. Without a land-use plan in place, it is less likely that facility siting would be coordinated to share utility corridors and conserve space. Biological resources would be damaged in localized areas where future development occurred. Construction of new facilities would require surface clearing and grading, which would eliminate vegetation and wildlife habitat present on the construction site and allow weed species to become established. New utility corridors could fragment habitats. Scattered development under the No-Action Alternative could also increase the risk of wildfire, which could result in large-scale losses of habitat. Future industrial development under the No-Action Alternative could affect biological resources associated with BRMaP levels II, III, and IV, as shown in Table 5-9.

The No-Action Alternative would not preclude development of quarries on basalt outcrops such as the Umtanum Ridge, Gable Mountain, and Gable Butte, which could damage sensitive habitats in these locations. This alternative would also allow sand and gravel quarrying in most of the All Other Areas geographic area, and could affect BRMaP II, III, and IV resources. Because basalt and sand and gravel quarries are typically limited in size, it is unlikely that habitat losses would be large enough to affect biodiversity. Conversely, mining of topsoil for covering and reclaiming remediation sites could disturb large areas and could affect biodiversity. Under the No-Action Alternative, the McGee Ranch could be developed as a quarry site for remediation. Large-scale soil mining at McGee Ranch could affect the connection between the large tracts of shrub-steppe habitat on the Hanford Site and those on the Yakima Training Center to the west. Mining at McGee Ranch could eliminate the wildlife movement corridor between these areas and increase habitat fragmentation. Isolating these two habitat remnants could reduce the genetic diversity of plant and animal species associated with shrub-steppe habitat and reduce regional biodiversity in the long term.

Although the No-Action Alternative does not designate lands for cultivated agriculture, this alternative would not preclude future agricultural development of Hanford Site lands. Assuming that cultivated agriculture would be established near the Columbia River to facilitate irrigation, the conversion to cropland could displace rare plants, riparian plant communities, and other BRMaP III and IV resources associated with the free flowing Hanford Reach. Cultivated agriculture adjacent to the Columbia River would increase sediment loading to the river, potentially affecting salmonid spawning areas. Agricultural chemicals in runoff from croplands could damage sensitive wetland and aquatic habitats.

Although the No-Action Alternative would not preclude cultivated agriculture, mining or industrial development adjacent to the Columbia River, such developments would have to be reviewed by the National Park Service for compatibility with the proposed Wild and Scenic River designation for the Columbia River. This review may prevent the siting of impacting activities near the river, and effectively provide protection of biological resources in the Columbia River corridor under any of the alternatives being considered.

Grazing of livestock on the Wahluke Slope under the No-Action Alternative could alter terrestrial vegetation communities by eliminating or reducing the cover of some species, encouraging the growth of grazing-tolerant species, and providing opportunities for weed species to become established. These changes could adversely affect associated wildlife species. Cessation of grazing could increase the fire danger by providing flash and step fuel biomass. Wetland and riparian plant communities could be damaged where livestock congregate near water sources.

Although the No-Action Alternative would continue to allow recreational use of the Hanford Reach, no new boat ramps or other recreational development would be planned. The No-Action Alternative is not likely to result in increased recreational impacts to biological resources associated with the Columbia River.

5.2.3.2 Preferred Alternative. Industrial development under the Preferred Alternative could disturb previously undisturbed land areas, including areas containing BRMaP Level II and III resources in the southern portion of the All Other Areas geographic area. Construction of new facilities would require surface clearing and grading, which would eliminate vegetation and wildlife habitat present on the construction site and provide opportunities for weed species to become established. The Preferred Alternative would encourage clustering of future developments and sharing of utility corridors to conserve space and minimize disturbance. Industrial development under the Preferred Alternative would be less likely to fragment habitats or affect biodiversity than under the No-Action Alternative.

The Preferred Alternative would designate much of the All Other Areas geographic area and the Wahluke Slope for Conservation (Mining and Grazing). In addition, a small portion of the ALE Reserve, which has been identified as an alternative basalt source, would be designated for Conservation (Mining). Biological resources located at quarry sites would be damaged or destroyed. The area in the ALE Reserve where mining would be permitted contains BRMaP Level I and II resources. The Preferred Alternative would not preclude mining near the south bank of the Columbia River, if permitted by the Hanford REO, which could impact sensitive habitats associated with the river, including BRMaP Level II, III, and IV resources. Increased sediment loading from mining near the river could adversely affect salmonid spawning areas.

The Preferred Alternative would allow livestock grazing, which would alter plant communities and wildlife habitat, as described under the No-Action Alternative. This alternative would not preclude livestock grazing along the south bank of the Columbia River, which could affect sensitive habitats, including BRMaP Level II, III, and IV resources and increase sediment loading to the river. Depending on the extent of grazing permitted by the Hanford REO under the Preferred Alternative, the changes in plant communities could be widespread, and could reduce regional biodiversity.

The Preferred Alternative would increase recreational access to the Columbia River by allowing additional boat launch facilities to be constructed. Increased boating activity on the river could adversely affect salmonid spawning areas, aquatic plant communities and other BRMaP III and IV resources. Development of biking and hiking trails and other recreational facilities could also damage plant communities of concern, and disturb bald eagle roosts and great blue heron rookeries along the Hanford Reach. With increased access, there would also be an increase in the probability of a wildfire occurring.

The Preferred Alternative would assign the Preservation land-use designation to approximately 32 percent of the Hanford Site, including most of the ALE Reserve, the basalt outcrops, the McGee Ranch area, the north shoreline of the Columbia River, river islands and the active sand dunes. The Preservation land-use designation would protect approximately 37 percent of BRMaP Level III and 82 percent of BRMaP Level IV resources on the Hanford Site.

5.2.3.3 Alternative One. Industrial development under Alternative One would be allowed in areas where development has already impacted sensitive habitats and in an area south of the WPPSS site where cheatgrass dominates the vegetation cover. These areas consist mainly of BRMaP Level I and II resources. Industrial development under Alternative One would result in destruction of habitat, but the impacts would be less extensive and to lower quality habitat than under the Preferred Alternative or the No-Action Alternative because of the limited areas available for development.

Alternative One would minimize the area designated for Industrial-Exclusive use to preserve the maximum amount of high-quality, late-successional shrub-steppe habitat located west of the 200 West Area. An additional 443 ha (1,108 ac) of BRMaP Level III resources would be protected under the Preservation land-use designation in this area, as compared to the Preferred Alternative and the No-Action Alternative.

Under Alternative One, the Conservation (Mining) land-use designation would be assigned to the southeastern portion of the Wahluke Slope, areas around LIGO and FFTF, on portions of the ALE Reserve, and in other scattered locations in the 100 and 600 Areas. Biological resources at many of these locations have been previously impacted and are classified as BRMaP Level I and II. Other areas contain BRMaP III and IV resources that could be damaged by basalt and sand and gravel quarrying. Impacts to these resources are less likely than under the Preferred Alternative or No-Action Alternative, however, because mining under Alternative One would be limited to supporting remediation activities and maintaining existing Washington Department of Transportation quarry sites.

Alternative One would allow livestock grazing in the northern portion of the Wahluke Slope to control cheat grass and reduce the threat of wildfire, which could affect BRMaP Level III resources. Grazing could alter plant communities and affect associated wildlife by eliminating or reducing the cover of some species, encouraging the growth of grazing-tolerant species, and providing opportunities for weed species to become established. These changes could reduce biodiversity on the Wahluke Slope.

Alternative One would increase recreational access to the Columbia River by allowing an additional boat launch facility to be constructed. Increased boating activity on the river could adversely affect biological resources associated with the Hanford Reach. Impacts would be less extensive than under the Preferred Alternative because access would not be provided to as many locations.

Alternative One would assign the Preservation land-use designation to approximately 69 percent of Hanford Site lands, including most of the ALE Reserve, the basalt outcrops, the McGee Ranch area, the Saddle Mountain National Wildlife Refuge, the entire Columbia River corridor, and the active and most stabilized sand dunes. The Preservation land-use designation would protect approximately 78 percent of BRMaP Level III and 96 percent of BRMaP Level IV resources.

5.2.3.4 Alternative Two. Under Alternative Two, lands designated for Industrial development are mostly occupied by existing facilities, although some BRMaP Level II and Level III resources are included under the Industrial and Research and Development designations. Industrial development under Alternative Two could result in destruction of habitat, but the impacts would be less extensive than under any of the other alternatives being considered because of the limited areas available for development.

Alternative Two, like Alternative One, would minimize the area designated for Industrial-Exclusive use in order to preserve the maximum amount of high-quality, late-successional shrub-steppe habitat located west of the 200 West area. An additional 443 ha (1,108 ac) of BRMaP Level III resources would be protected under the Preservation land-use designation in this area, as compared to the Preferred Alternative and the No-Action Alternative.

Alternative Two would not increase recreational access to the Columbia River, and would be unlikely to result in increased impacts to biological resources associated with the river.

Alternative Two would assign the Preservation land-use designation to approximately 95 percent of Hanford Site lands, including the ALE Reserve, Wahluke Slope, Columbia River Corridor, and much of the All Other Areas geographic area. The Preservation land-use designation would protect approximately 96 percent of the BRMaP Level III and 100 percent of the BRMaP Level IV resources.

5.2.3.5 Alternative Three. Under Alternative Three, the Industrial and Research and Development land-use designations would be larger than under any of the other alternatives, but mainly consist of BRMaP Level I and II resources. Impacts to biological resources from industrial development under Alternative Three would be similar to those described for the Preferred Alternative.

Alternative Three would designate the ALE Reserve and much of the All Other Areas geographic area as Conservation (Mining). Basalt and sand and gravel quarries developed in these areas could impact rare plants and sensitive plant communities, depending on their location. Alternative Three would not preclude development of quarries on basalt outcrops such as the Umtanum Ridge, Gable Mountain, and Gable Butte, if permitted by the Hanford REO, which could damage sensitive habitats in these locations. Basalt and sand and gravel quarrying could affect BRMaP II, III, and IV resources. Because basalt and sand and gravel quarries are typically limited in size, it is unlikely that habitat losses would be large enough to affect biodiversity. However, Alternative Three would not preclude the large-scale soil mining on the McGee Ranch, if permitted by the Hanford REO, which could have impacts to biodiversity, as described under the No-Action Alternative.

Under Alternative Three, lands in the Wahluke Slope could be converted to agriculture, which would involve conversion of native plant communities to cropland, pasture land, and orchards. Habitats of concern, including BRMaP Level II, III, and IV resources, would be damaged or destroyed. Conversion of native plant communities to cropland would reduce biodiversity by replacing complex plant communities with monocultures and allowing invasion of non-native species. Biodiversity could also be affected on portions of the Wahluke Slope designated for Conservation (Mining and Grazing), where livestock grazing could alter native plant communities.

Alternative Three would allow high-intensity recreational development of the Vernita Terrace, and low-intensity recreational use of a large portion of the 100 Areas adjacent to the Columbia River. Development of a destination resort at Vernita Terrace would impact mostly BRMaP Level I resources, as this area consists of cheatgrass and abandoned fields. Construction of low-intensity recreational facilities, such as the proposed recreational trail along the river, would result in habitat losses, including BRMaP II, III, and IV resources. Increased recreational access to the Columbia River under this alternative would increase boating activity and could result in impacts to salmonid spawning areas, bald eagle roosts, great blue heron rookeries, and aquatic plant communities. Increased access could also result in the increased probability of wildfire.

Alternative Three would assign the Preservation land-use designation to approximately 5 percent of Hanford Site lands, primarily along the Columbia River corridor. The Preservation land-use designation would protect approximately 5 percent of BRMaP Level III and 13 percent of BRMaP Level IV resources on the Hanford Site. As with the other alternatives being considered, Alternative Three would also protect sensitive biological resources through the Conservation (Mining) land-use designation with mining only by the Hanford REO's special-use permit, as described in Chapter 6. Under Alternative Three, the Conservation (Mining) land-use designation includes 56 percent of BRMaP Level III and 70 percent of BRMaP Level IV resources on the Hanford Site.

5.2.3.6 *Alternative Four.* Alternative Four would allow industrial development in the Richland UGA, in previously developed sites, such as the WPPSS, FFTF, 300 Area, and undisturbed areas north of the UGA, which contain mainly BRMaP I and II resources. Construction of new industrial or research and development facilities would require surface clearing and grading, which would eliminate vegetation and wildlife habitat present on the construction site and provide opportunities for weed species to become established. Industrial development under Alternative Four would be less likely to fragment habitats and affect biodiversity than the Preferred Alternative or Alternative Three, because the areas available for development would be smaller, of lesser quality, and closer to existing infrastructure.

Under Alternative Four, a portion of the All Other Areas geographic area and a small portion of the ALE Reserve would be managed under the Conservation (Mining) land-use designation. Lands within the ALE Reserve under this land-use designation are classified as BRMaP Levels I and II. The portion of the All Other Areas geographic area available for mining includes BRMaP Levels II and III resources. Basalt and sand and gravel quarries developed in these areas could impact rare plants and sensitive plant communities, depending on their location. Because basalt and sand and gravel quarries are typically limited in size and would be permitted by the Hanford REO, it is unlikely that habitat losses would be large enough to affect biodiversity.

Alternative Four would increase recreational access to the Columbia River by adding two new access points to the river at White Bluffs and Vernita Bridge, which would be associated with tribal fishing villages and support facilities. The increased access could have impacts to biological resources such as those described for the Preferred Alternative, although impacts under Alternative Four may be less extensive because it would not provide access to as many areas.

Alternative Four would assign the Preservation land-use designation to approximately 75 percent of Hanford Site lands, including the Wahluke Slope, the Columbia River corridor, most of the ALE Reserve, the basalt outcrops and active sand dunes and other portions of the All Other Areas geographic area. The Preservation land-use designation would protect approximately 89 percent of BRMaP Level III and 100 percent of BRMaP Level IV resources on the Hanford Site.

5.2.3.7 Mitigation Measures. The CLUP implementation procedures described in Chapter 6 would be used to screen development proposals for Hanford Site lands. All proposals potentially affecting sensitive biological resources would be required to comply with applicable statutes, such as the *Endangered Species Act of 1973*, the *Bald and Golden Eagle Protection Act of 1972*, the *Migratory Bird Treaty Act of 1918*, and other statutes, Executive Orders, and policies discussed in Chapter 7. Some activities with the potential to impact habitats of concern would not be permitted by the Hanford REO and others would be modified or required by the Hanford REO to incorporate mitigation measures to reduce impacts. Mitigation measures that could reduce impacts to biological resources include the following:

- Minimize disturbance of wetlands and replace disturbed wetlands through purchase, construction or restoration of wetlands.

- Perform compensatory mitigation for adverse impacts to BRMaP Level II, III, and IV resources to a degree that reflects the value of the resource and the severity of impacts by improving habitat in other areas designated for Preservation first, or Conservation within the Hanford Site.

- Revegetate disturbed areas using native vegetation.

- Schedule activities to avoid critical nesting, roosting, leking, breeding, and fawning times.

5.2.4 Cultural Resources

Impacts to cultural resources may include damage or destruction of archaeological and historic sites and artifacts, as well as disruption of religious and traditional uses of the Hanford Site by American Indians. Impacts of the alternatives on Hanford Site cultural resources are summarized in Table 5-10.

Table 5-10. Potential Impacts of Land-use Alternatives on Cultural Resources. (2 pages)

Alternative	Impacting Activity	Impacts to Key Cultural Resource Areas (✓ = impact)				
		Religious Sites	Viewsheds	Natural Resource Gathering Areas	Archaeological and Burial Sites	Historic Sites
No-Action	Mining	✓	✓	✓	✓	✓
	Livestock grazing			✓	✓	
	Cultivated agriculture		✓	✓	✓	✓
	Development		✓	✓	✓	✓
	Low-Intensity Recreation				✓	
Preferred Alternative	Mining		✓	✓	✓	✓
	Livestock grazing			✓	✓	
	Cultivated agriculture					
	Development		✓	✓	✓	✓
	Low-Intensity Recreation			✓	✓	✓
Alternative One	Mining		✓	✓	✓	✓
	Livestock grazing			✓	✓	✓
	Cultivated agriculture					
	Development				✓	✓
	Low-intensity recreation			✓	✓	✓

Table 5-10. Potential Impacts of Land-use Alternatives on Cultural Resources. (2 pages)

Alternative	Impacting Activity	Impacts to Key Cultural Resource Areas (✓ = impact)				
		Religious Sites	Viewsheds	Natural Resource Gathering Areas	Archaeological and Burial Sites	Historic Sites
Alternative Two	Mining					
	Livestock grazing					
	Cultivated agriculture					
	Development				✓	✓
	Low-Intensity Recreation					
Alternative Three	Mining	✓	✓	✓	✓	✓
	Livestock grazing			✓	✓	
	Cultivated agriculture		✓	✓	✓	✓
	Development		✓	✓	✓	✓
	Low-Intensity Recreation			✓	✓	✓
Alternative Four	Mining		✓	✓	✓	✓
	Livestock grazing					
	Cultivated agriculture					
	Development			✓	✓	✓
	Low-Intensity Recreation				✓	✓

5.2.4.1 No-Action Alternative. The No-Action Alternative would allow quarrying from basalt outcrops that have traditional, cultural, and religious importance to American Indians. The No-Action Alternative also would allow sand and gravel mining and industrial development in most of the All Other Areas geographic area, which would alter the viewsheds associated with religious sites. These activities and cultivated agriculture (which could be allowed under the No-Action Alternative) could also displace natural resources traditionally gathered by American Indians and disturb archaeological and historic sites. Ground-disturbing activities adjacent to the Columbia River could also increase sediment loading to the Columbia River, which could damage salmonid spawning areas and potentially affect American Indian fishing as a cultural activity. Although the No-Action Alternative would not increase recreational access to the Columbia River, archaeological sites would remain at risk to unauthorized artifact collection and riverbank erosion from boat wakes.

5.2.4.2 Preferred Alternative. Although the Preferred Alternative would preclude quarrying of basalt outcrops such as Gable Mountain and Gable Butte, mining of other areas could damage or destroy archaeological and historic sites and displace natural resources traditionally gathered by American Indians. Mining and industrial development could also affect viewsheds associated with American Indian religious sites. Under the Preferred Alternative, mining could occur, if permitted by the Hanford REO, along the southern portion of the Columbia River Corridor, where cultural resources are concentrated and more likely to be affected. Mining along the Columbia River could also increase sediment loading to the river, which could damage salmonid spawning areas and potentially affect American Indian fishery and fishing by other users.

The Preferred Alternative would allow industrial development in the Central Plateau and in the southeastern portion of the Hanford Site. Although these areas already include developed sites (e.g., 200 Areas, WPPSS, FFTF, and 300 Area), large land areas remain that have not been disturbed. Development of these areas could result in damage to or destruction of archaeological and historic sites and displacement of natural resources traditionally gathered by American Indians.

The Preferred Alternative would also allow grazing, if permitted by the Hanford REO, over much of the All Other Areas and Wahluke Slope geographic areas. Grazing could alter native plant communities of importance to American Indians and directly compete with animals that are important to the American Indian culture. In addition, archaeological and burial sites could be impacted where livestock congregate, such as at water sources and in shaded areas.

The Preferred Alternative would increase recreational access to the Columbia River by allowing additional boat launch facilities to be constructed. The Low-Intensity Recreation land-use designation would also allow increased recreational use of the Vernita Terrace. Increased recreational uses along the Columbia River could result in damage to natural resources traditionally gathered by American Indians and impacts to archaeological and historic sites from unauthorized artifact collection, vandalism, and erosion of riverbanks from boat wakes.

5.2.4.3 Alternative One. Under Alternative One, mining to support remediation would be allowed in portions of the Wahluke Slope, on portions of the ALE Reserve, and in other scattered locations in the All Other Areas. Although archaeological sites in these areas were previously disturbed by pre-Hanford farming or by construction of Hanford Site facilities, cultural artifacts may remain that could be impacted by mining. Mining in these areas and grazing on the northern portion of the Wahluke Slope could affect native plant communities and animals of importance to American Indians. However, this impact is less likely to occur under Alternative One than under the Preferred Alternative, because less land would be available for mining and grazing and much of it has been previously disturbed.

Alternative One would limit the Industrial and Research and Development land-use designations to the Central Plateau, WPPSS site, 300 Area, and areas adjacent to the City of Richland, where some archaeological and historic sites have already been identified and mitigated. The Industrial land-use designation also includes an area located south of the WPPSS site where cheatgrass dominates the vegetation cover. Future industrial development in this area could disturb archaeological or historic sites. Archaeological sites could also be disturbed by future development under the Industrial-Exclusive land-use designation on the Central Plateau, although Alternative One would protect more of these resources in the Central Plateau than the Preferred Alternative.

Alternative One would increase recreational access to the Columbia River by allowing an additional boat launch facility to be constructed. Increased recreational uses along the Columbia River could result in damage to natural resources traditionally gathered by American Indians and impacts to archaeological and historic sites from unauthorized artifact collection, vandalism and riverbank erosion from boat wakes. These impacts would be less extensive under Alternative One than under the Preferred Alternative, which would allow higher levels of recreational use.

5.2.4.4 *Alternative Two.* Industrial development under Alternative Two would be limited to the Central Plateau, WPPSS site, 300 Area, and areas adjacent to the City of Richland. Archaeological and historic resources in most of these areas have already been identified and mitigated. New development in areas of the Central Plateau could disturb additional sites, although Alternative Two would protect more of these resources in the Central Plateau than the Preferred Alternative. Alternative Two would designate most of the Hanford Site for Preservation, which would minimize future impacts to cultural resources.

5.2.4.5 *Alternative Three.* Under Alternative Three, basalt outcrops that have religious, traditional and cultural value to American Indians, could be mined, if permitted by the Hanford REO, for geologic materials for remediation or as commercial basalt quarries. Other areas with known cultural resources, including the ALE Reserve, could also be affected by mining. However, this alternative would not allow mining or other development within 0.4 km (0.25 mi) of the Columbia River corridor, where cultural resources are concentrated. Mining, cultivated agriculture and industrial development under this alternative could alter viewsheds associated with religious sites used by American Indians.

Alternative Three would allow industrial and research and development in the Central Plateau and in the eastern and southern portions of the Hanford Site. Although these areas already include developed sites, such as the 200 Areas, WPPSS site, FFTF, and 300 Area, there remain large land areas that have not been disturbed. Development of these areas could result in damage to or destruction of archaeological and historic sites and displacement of natural resources traditionally gathered by American Indians.

Alternative Three would allow conversion of much of the Wahluke Slope to cropland under the Agricultural land-use designation. Conversion to cropland would involve removal of native vegetation important to American Indians. Tillage of croplands would damage or destroy archaeological and historic sites. Irrigated agriculture would increase slumping of the White Bluffs, which have cultural significance to American Indians. Increased slumping could also impact American Indian cultural fishing and other fishing and could alter the river channel, causing losses of cultural resources to riverbank and island erosion.

Agricultural development and grazing on the Wahluke Slope would also alter native plant communities and displace animals of importance to American Indians. Archaeological and burial sites could be damaged where livestock gather, such as at water sources.

Alternative Three would increase recreational access to the Columbia River by designating a large portion of the 100 Areas for Low-Intensity Recreation, as well as designating the Vernita Terrace and the B Reactor area for High-Intensity Recreation. Development of recreational facilities could damage archaeological and historic sites in these areas. Increased recreational uses along the Columbia River could also result in damage to natural resources traditionally gathered by American Indians and impacts to archaeological and historic sites from unauthorized artifact collection, vandalism, and riverbank erosion from boat wakes. An area designated for High-Intensity Recreation near Horn Rapids on the Yakima River could have similar impacts to cultural resources and the culturally important viewshed.

5.2.4.6 *Alternative Four.* Alternative Four would allow mining to support remediation in the southern portion of the All Other Areas geographic area, which could damage or destroy archaeological and historic sites and displace natural resources traditionally gathered by American Indians. Mining in this area could also alter viewsheds associated with religious sites used by American Indians.

Alternative Four would designate southeastern portions of the Hanford Site for Industrial and Research and Development uses. Although these areas already include developed sites (e.g., WPPSS, FFTF, and the 300 Area), other areas under these designations have not previously been disturbed. Development of these areas could result in damage to or destruction of archaeological and historic sites and displacement of natural resources traditionally gathered by American Indians. These impacts would be less extensive under this alternative than under the Preferred Alternative or Alternative Three because less land would be available for development.

Alternative Four would increase recreational access to the Columbia River by allowing additional boat launch facilities to be constructed. Increased recreational uses along the Columbia River could result in impacts to archaeological and historic sites from unauthorized artifact collection, vandalism and riverbank erosion from boat wakes. These impacts may be less extensive under Alternative Four than under the Preferred Alternative because this alternative would not provide access to as many areas.

5.2.4.7 Mitigation Measures. The CLUP implementation procedures described in Chapter 6 would be used by the Hanford REO to screen development proposals for Hanford Site lands. Proposed projects would be evaluated by the U.S. Department of Energy, Richland Operations Office (RL) NEPA Compliance Officer to determine their impacts on American Indian treaty rights and known archaeological and historic sites. Some projects may not be permitted and others may be required to incorporate mitigation measures to reduce the impacts. Mitigation measures that could reduce impacts to cultural resources include the following:

- Restrict irrigated agriculture on the Wahluke Slope, requiring hydrogeologic studies, or requiring efficient irrigation methods to minimize the potential for increased slumping of the White Bluffs.

- Continue to conduct cultural resource surveys of proposed project locations in accordance with Neitzel et al. 1997.

- Continue to schedule activities to avoid conflicts with American Indian traditional and religious uses.

- Continue to conduct consultations with the RL Cultural Resources Program Manager, the State Historic Preservation Office, affected Tribal governments, and Wanapum Band representatives to identify additional mitigation measures or project alternatives.

5.2.5 Aesthetic Resources

In this document, key aesthetic resources include viewing locations, viewsheds, visibility (ambient air quality), odors, and ambient noise levels. Adoption of any particular alternative would not directly impact aesthetic resources; however, activities allowed under the various alternatives could have different effects on these resources.

Impacts of the alternatives on aesthetic resources are described in the following sections and are summarized in Table 5-11. The primary impacts to aesthetic resources would occur as a result of altering viewsheds through mining or development, visibility or odor impacts from release of atmospheric pollutants from industrial activities, visibility impacts from releases of fugitive dust from construction sites and seasonally from agricultural activities, and new noise impacts as a result of development, mining, or recreation in areas that are typically quiet.

Table 5-11. Potential Impacts of Land-Use Alternatives on Aesthetic Resources.

Plan Map	Impacting activity	Impacts to Aesthetic Resources (✓ = impact)		
		Viewsheds	Ambient Visibility	Ambient Noise Levels
No-Action Alternative	Mining	✓	✓	✓
	Livestock grazing			
	Cultivated agriculture	✓	✓	✓
	Development	✓	✓	✓
	Low-intensity recreation			✓
Preferred Alternative	Mining	✓	✓	✓
	Livestock grazing			
	Cultivated agriculture			
	Development	✓	✓	✓
	Low-intensity recreation			✓
Alternative One	Mining	✓	✓	✓
	Livestock grazing			
	Cultivated agriculture			
	Development		✓	✓
	Low-intensity recreation			✓
Alternative Two	Mining			
	Livestock grazing			
	Cultivated agriculture			
	Development		✓	
	Low-intensity recreation			
Alternative Three	Mining	✓	✓	✓
	Livestock grazing			
	Cultivated agriculture	✓	✓	✓
	Development	✓	✓	✓
	Low-intensity recreation	✓		✓
Alternative Four	Mining	✓	✓	✓
	Livestock grazing			
	Cultivated agriculture			
	Development	✓	✓	✓
	Low-intensity recreation			✓

Under all alternatives, new development projects of would be subject to a New Source Review in accordance with the requirements of *Washington Administrative Code* (WAC) 173-400. The New Source Review would identify probable air emissions and air emission control technology would be required, if necessary, to comply with Washington State air quality thresholds.

5.2.5.1 No-Action Alternative. Under the No-Action Alternative, a quarry operation could be developed on Gable Mountain or Gable Butte, affecting access to these viewing locations. Mining and industrial development activities under this alternative could alter the viewsheds associated with the basalt outcrops. These activities could be widely dispersed under the No-Action Alternative and would stand out against the relatively undisturbed surrounding terrain.

Potential impacts to visibility under this alternative would occur as a result of temporary releases of fugitive dust from construction sites, seasonal releases of fugitive dust from agricultural fields, releases of fugitive dust during mining or quarrying operations, and from releases of pollutants from developed sites.

Potential noise impacts under the No-Action Alternative would include blasting associated with quarry operations, noise generated seasonally by agricultural machinery, and industrial noise around new industrial sites. Depending on the location of the activities, these noise impacts could detract from the recreation experience of recreationists on the Wahluke Slope and along the Columbia River.

Grazing by domestic animals could destroy wetland vegetation, create mud holes, create obnoxious odors, create noise, and be a source of weed and insect pests. Grazing could detract from the recreation experience of recreationists, including hikers, hunters, fishers, and wildlife watchers using areas designated for Low-Intensity Recreation, Conservation, and Preservation, and could disrupt wildlife.

5.2.5.2 Preferred Alternative. Under the Preferred Alternative, viewing locations associated with basalt outcrops and the ALE Reserve would not be disturbed. Viewing locations associated with the Columbia River could be disrupted through development of a mining operation in close proximity to the river. Mining operations would also be permitted within the viewsheds of basalt outcrops. An area designated for Industrial use is within the viewshed of Gable Mountain. Impacts to visibility could include releases of fugitive dust from construction sites and pollutants from new industrial sites.

Noise impacts under the Preferred Alternative could include blasting during quarry operation, increased noise in the vicinity of new industrial sites, and noise from increased motorized watercraft use on the Columbia River. The increased noise levels from these activities could detract from the recreation experience of recreationists, including hikers, hunters, fishers, and wildlife watchers using areas designated for Low-Intensity Recreation, Conservation, and Preservation, and could disrupt wildlife.

Grazing by domestic animals could destroy wetland vegetation, create mud holes, create obnoxious odors, create noise, and be a source of weed and insect pests. Grazing could detract from the recreation experience of recreationists, including hikers, hunters, fishers, and wildlife watchers using areas designated for Low-Intensity Recreation, Conservation, and Preservation, and could disrupt wildlife.

5.2.5.3 Alternative One. Under Alternative One, viewing locations associated with basalt outcrops, the Columbia River, and the ALE Reserve would be protected. Mining operations would be permitted within the viewshed of Gable Mountain, but, with the exception of the 200 Areas, only limited industrial development would be permitted within the viewshed. Visibility impacts could include emissions of fugitive dust from mining operations and construction sites, along with potential emissions of pollutants from industrial activities.

Noise impacts under the Alternative One could include blasting during quarry operation, increased noise in the vicinity of new industrial sites, and noise from increased motorized watercraft use on the Columbia River. Because areas designated for development are in close proximity to previously developed areas, new noise sources are not likely to affect previously quiet areas. Noise from blasting and from recreational activities along the Columbia River could affect some areas that are presently quiet, detracting from the recreation experience of recreationists and potentially disrupting wildlife.

Grazing by domestic animals could destroy wetland vegetation, create mud holes, create obnoxious odors, create noise, and be a source of weed and insect pests. Grazing could detract from the recreation experience of recreationists, including hikers, hunters, fishers, and wildlife watchers using areas designated for Low-Intensity Recreation, Conservation, and Preservation, and could disrupt wildlife.

5.2.5.4 Alternative Two. Alternative Two would allow minimal new development on the Hanford Site, protecting existing viewing locations and viewsheds. New industrial development could occur in the Richland UGA, but would have minimal visibility and noise impacts to recreationists.

5.2.5.5 Alternative Three. Alternative Three would allow quarrying operations on basalt outcrops and mining on the ALE Reserve, which could affect access to viewing locations. Viewing locations associated with the Columbia River would remain unaffected. The viewshed from the basalt outcrops and from points along the Columbia River could be altered by development of agriculture on the Wahluke Slope and mining and industrial development on other portions of the Hanford Site. Agricultural development of the Wahluke Slope would replace natural vegetation mosaics with ordered rectangular, linear, and circular patterns associated with irrigated cropland and orchards.

Visibility impacts could include fugitive dust from mining and quarrying operations, seasonal releases of particulates from farming activities, releases of fugitive dust from construction sites, and releases of pollutants from new industrial sites.

Noise impacts associated with this alternative could include blasting in support of quarry operations, noise from agricultural machinery, industrial noise in developed areas and increased noise associated with motorized watercraft on the Columbia River. The new noise sources could affect some areas that are presently quiet, detracting from the recreation experience of recreationists and potentially disrupting wildlife.

Grazing by domestic animals could destroy wetland vegetation, create mud holes, create obnoxious odors, create noise, and be a source of weed and insect pests. Grazing could detract from the recreation experience of recreationists, including hikers, hunters, fishers, and wildlife watchers using areas designated for Low-Intensity Recreation, Conservation, and Preservation; and could disrupt wildlife.

5.2.5.6 Alternative Four. Alternative Four would protect viewing locations at basalt outcrops, on the ALE Reserve, and along the Columbia River. Mining activities in the south-central portion of the Hanford Site could alter viewsheds associated with basalt outcrops. Impacts to visibility could include releases of fugitive dust from construction sites and pollutants from new industrial sites.

Noise impacts under the Preferred Alternative could include blasting during quarry operation, increased noise in the vicinity of new industrial sites, and noise from increased motorized watercraft use on the Columbia River. The increased noise levels from these activities could detract from the recreation experience of recreationists and could disrupt wildlife.

5.2.5.7 Mitigation Measures. The CLUP implementation procedures described in Chapter 6 would be used to screen development proposals for Hanford Site lands. Proposed projects would be planned to be consistent with the CLUP policies requiring protection of natural and cultural resources. This planning effort would include consideration of aesthetic resources. Potential mitigation measures for aesthetic resources include:

- Implementing dust control measures, such as spraying water or other dust suppressants, on construction, excavation, and quarry sites to reduce emissions of fugitive dust.
- Covering loads when hauling materials away from construction or excavation sites.
- Siting development or mining activities in areas with the least impact on the viewshed from basalt outcrops with their talus slopes, such as Gable Butte and Gable Mountain.
- Minimizing noise impacts to wildlife by restricting activities that generate noise to seasons when sensitive wildlife would be disrupted the least.
- Limiting grazing timing, grazing rotation, and grazing areas to protect aesthetic resources.

5.3 Socioeconomic and Environmental Justice Impacts

5.3.1 Socioeconomic Impacts

The study area used for the purpose of socioeconomics analysis includes Benton, Franklin, and Grant counties.

5.3.1.1 No-Action Alternative. Under the No-Action Alternative, a land-use plan would not be implemented, and facility planning and siting would continue on a project-by-project basis. Because a land-use plan would not guide development, the potential socioeconomic impacts of the No-Action Alternative cannot be readily predicted. The lack of a land-use plan that provides a framework for the DOE and local governments to work cooperatively may discourage multiple use and transfer of Hanford lands. In the absence of a land-use plan, it is also unlikely that new recreational opportunities would be developed that would generate economic benefits. However, it can be assumed that this alternative would allow industrial development and research and development activities to occur. Industrial development under the No-Action Alternative is likely to generate more employment than Alternatives One or Two, but probably less employment than the Preferred Alternative or Alternative Three.

Under the No-Action Alternative, it is less likely facility siting would be coordinated to share utility corridors and conserve space. The lack of a land-use plan could result in inefficient use of existing infrastructure, with new infrastructure added on a project-by-project basis. In the absence of a comprehensive plan, prioritization of infrastructure maintenance and improvements would be more difficult, and could result in higher costs to DOE and local governmental entities responsible for infrastructure.

5.3.1.2 Preferred Alternative. Implementation of the Preferred Alternative would allow industrial development, research and development initiatives, limited grazing and mining, and increased recreational uses on Hanford Site lands. A total of 16,669 ha (41,190 ac) would become available for industrial development, which would meet the estimated need forecasted by the Benton County Planning Department (1,639 ha [4,050 ac]) and provide an additional 15,030 ha (37,140 ac) to support possible future DOE missions. This amount of land would allow the siting of several manufacturing facilities, with a total employment of 1,000 or more. Lands under the Research and Development land-use designation would total approximately 4,912 ha (12,138 ac), which could support at least 527,482 m^2 (5.9 million ft^2) of facility space (including buildings, parking lots, and support facilities) and total employment of up to 100 employees.

Future industrial development on Hanford Site lands would require additional infrastructure, such as roads and utilities, to support it. The City of Richland, in its Comprehensive Plan (COR 1997), anticipates industrial development in its UGA [1], which includes Hanford's 300 Area, and a portion of the Hanford Site north of the city limits. The Comprehensive Plan was prepared with the assumption that all industrial development within the 20-year planning period would be accommodated by land already available within the UGA. The Comprehensive Plan describes the city's plans for addressing additional infrastructure needs anticipated in the UGA during the planning period.

The City of Richland's Comprehensive Plan (pp. 3-17, and 3-19 through 3-22) (COR 1997) indicates that growth exceeding the City's projections could result in reduced levels of service in the city's infrastructure, including the transportation system, wastewater facilities, water supply, solid waste management, and electrical power supply. If industrial development under the Preferred Alternative expanded beyond the UGA, the development could exceed the City's capacity to provide supporting infrastructure. Existing Hanford Site infrastructure could meet at least some of the increased demand. Improvements to the existing infrastructure may have to be financed through other governmental or public entities, such as Benton County or the Port of Benton, to encourage industrial development on Hanford Site lands.

The Preferred Alternative would make much of the Hanford Site available for grazing and mining under the Conservation land-use designation. Up to 71,813 ha (177,454 ac) could be used for grazing livestock in Benton, Franklin, and Grant counties, increasing the total dryland range base in the three counties by 28 percent. This acreage could support approximately 12,400 AUM with a value of approximately $149,000.

The Preferred Alternative would allow the development of the existing natural gas claim held by the Big Bend Alberta Mining Company and the filing of new claims for sand and gravel and natural gas development. However, the Preservation land-use designation for the areas of the ALE Reserve surrounding those claims would preclude construction of an access road to the claims, and could make future development economically unfeasible. Mineral development on other areas of the Hanford Site would depend on the release of Hanford Site lands withdrawn from the public domain by DOE, the Bureau of Land Management (BLM), and

[1] An urban growth area (UGA) is defined as an area designated by the county or city for the expansion of urban development and municipal jurisdiction.

the BoR. The BoR held lands on the Wahluke Slope are not subject to mineral claims without the specific agreement of the BOR. The BOR does not anticipate giving permission for extraction of building materials such as sand and gravel from its lands on the Wahluke Slope. Because the restrictions placed on mineral development at the Hanford Site are likely to discourage investment in mining claims, future mineral development is unlikely to have impacts to the regional economy.

The Preferred Alternative would preclude basalt quarrying from basalt outcrops and soil mining from the McGee Ranch. These locations have been identified as the most cost-effective and technically feasible sources of geologic materials for remediation (see Appendix D). The Conservation (Mining) land-use designation under the Preferred Alternative designates an area in the ALE Reserve as an alternative basalt source. Alternative soil mining sites are also available under the Conservation (Mining and Grazing) land-use designation. Increased haul distances from quarries to remediation sites would increase remediation costs under the Preferred Alternative, as compared to the No-Action Alternative and Alternative Three.

Low-Intensity Recreation associated with the Vernita Terrace and High-Intensity Recreation use associated with boat launches and the B Reactor museum, along with limited recreational opportunities under the Conservation and Preservation land-use designations, could have impacts on the economy in the study area. Because current access to the Columbia River corridor is effectively limited to the Wahluke Slope Wildlife Recreation Area, increased access under the Preferred Alternative could greatly increase use for sport fishing, recreational boating, and other day uses. Assuming that increased access to the Columbia River corridor would double the amount of day use over levels at the Wahluke Slope Wildlife Recreation Area, an additional $1.4 million per year could be generated. Increased recreational use could increase employment in retail sporting goods, boat dealers, recreational vehicle (RV)dealers, and hotels and motels in the study area. These service industry jobs typically benefit the economically disadvantaged worker by providing more job opportunities.

5.3.1.3 Alternative One. Implementation of Alternative One would allow continued industrial development and limited recreational uses on Hanford Site lands. A total of 3,661 ha (9,047 ac) would become available for industrial development, which would meet the estimated need forecasted by the Benton County Planning Department (1,639 ha [4,050 ac]) and would provide an additional 2,022 ha (4,997 ac) to support possible future DOE missions. This amount of land would allow the siting of several manufacturing facilities, with a total employment of 100 to 1,000. Research and Development land uses would be limited to the 300 Area and 400 Area, which are already developed. The economic impact of Research and Development land use under Alternative One would depend on possible future uses for the 300 and 400 Areas facilities.

Alternative One would allow efficient use of existing infrastructure located in the 300 Area and in the Richland UGA, but could require new infrastructure to develop the rectangular area designated for Industrial use located south of the WPPSS site. This area is an "island" surrounded by lands designated Preservation, which could make extension of utilities to the area difficult. Construction of utility corridors through Preservation lands would require more project reviews and justification, resulting in increased costs and extended schedules. Because Alternative One would convert other areas containing existing infrastructure to the Preservation land-use designation, the existing infrastructure would not be maintained and would lose its remaining economic value.

Alternative One would reduce the amount of land designated Industrial-Exclusive as compared to the No-Action Alternative, the Preferred Alternative, and Alternatives Three and Four. This could limit future development of lands under this designation for future DOE missions, and could have impacts on the future economic contribution of DOE activities. However, GIS data indicates that only 38 percent of lands under this designation are currently developed. Also, none of the reasonably foreseeable actions identified for the 200 Areas would require lands that would not be available under Alternative One. This would indicate that sufficient lands would remain available under the Industrial-Exclusive land-use designation to support future development without adverse socioeconomic impacts.

Alternative One would allow the development of the existing natural gas claim held by the Big Bend Alberta Mining Company but would not allow the filing of new claims for sand and gravel and natural gas development. As with the Preferred Alternative, Alternative One would limit access to the existing natural gas claim on the ALE Reserve. Mining elsewhere on the Hanford Site would be limited to obtaining geologic materials to support remediation and maintaining existing Washington DOT sand and gravel quarries. These mining activities are unlikely to have economic impacts in the study area.

Implementation of Alternative One would allow up to 9,738 ha (24,063 ac) to be used for grazing livestock on the Wahluke Slope, increasing the total pasture land base in the three counties by 4 percent. This acreage could support approximately 1,655 AUM, with a value of $19,900.

Alternative One would allow high-intensity recreational uses at the B Reactor and Vernita Bridge, where a new boat ramp would be constructed. Another unimproved boat ramp and other low-intensity recreational uses would also be allowed. Recreation under this alternative is likely to have economic impacts such as increased revenues and employment, but these impacts would probably be less than those described for the Preferred Alternative.

5.3.1.4 Alternative Two. Implementation of Alternative Two would allow limited industrial development and limited recreational uses on Hanford Site lands. This alternative would have the least economic potential of the alternatives being considered. A total of 2,090 ha (5,165 ac) would become available for industrial development, which is 451 ha (1,114 ac) more than the estimated need forecasted by the Benton County Planning Department (1,639 ha [4,050 ac]). However, much of this land, which includes the WPPSS, FFTF, and lands adjacent to the city of Richland, is already developed. According to the GIS database, 673 ha (1,662 ac) or 32 percent of the Industrial land-use designation under Alternative Two is already developed. Therefore, this alternative would not have sufficient vacant land to meet the estimated future need or provide for possible future DOE missions.

Industrial development under Alternative Two would place minimal demands on existing infrastructure, but would result in losses of capital investments as areas containing existing infrastructure are converted to the Preservation land-use designation. The existing infrastructure in these areas would not be maintained and would lose its remaining economic value. These capital losses would be higher under Alternative Two than under any other alternative being considered.

The relatively small amount of vacant land designated for Industrial development under this alternative would probably limit new industrial employment to less than 100. Research and Development land uses under this alternative would be limited to existing uses at LIGO (theoretical physics research) and the K Reactor Basins (aquaculture). The number of employees that could be supported would depend on possible future uses of these facilities. As was described under Alternative One, Alternative Two would reduce the area available for development under the Industrial-Exclusive land-use designation but is unlikely to have adverse socioeconomic impacts.

As with the Preferred Alternative, Alternative Two would allow commercial development of the existing the natural gas claim on the ALE Reserve, but the Preservation land-use designation would limit access. This alternative would preclude the development of any other geologic resources on the Hanford Site. Geologic resources required to support remediation activities would have to be obtained from locations off the Hanford Site, which could increase remediation costs (see Appendix D).

Alternative Two would allow high-intensity recreation associated with the B Reactor museum, but would not increase recreational access to the river. Day use of the B Reactor area would generate some economic benefits, but they would be substantially less than those estimated for the recreational uses under the other alternatives.

An additional economic benefit may be realized from the Preservation land-use designation, which could increase interest in the Hanford Site in the ecotourism market. Interest in ecotourism, which focuses on pristine habitats and rare species, is increasing. The preserved habitats and associated species at the Hanford Site could draw additional visitors to the Site, and generate additional revenues. However, these revenues are likely to be lower than those estimated for recreational uses under the other alternatives.

5.3.1.5 Alternative Three. Under Alternative Three, a total of 17,860 ha (44,133 ac) would become available for industrial development, which would meet the estimated need forecasted by the Benton County Planning Department (1,639 ha [4,050 ac]) and provide an additional 16,221 ha (40,083 ac) to support possible future DOE missions. This amount of land would allow the siting of several manufacturing facilities, with a total employment of 1,000 or more. Industrial development on the Hanford Site could increase infrastructure demand, as described under the Preferred Alternative.

Lands under the Research and Development land-use designation would total approximately 8,177 ha (20,206 ac), of which approximately 20 percent would be occupied by infrastructure, such as roads and utility corridors. The remaining land base would support at least 878,000 m^2 (9.7 million ft^2) of facility space and total employment of 100 to 300 employees.

As with the Preferred Alternative, Alternative Three would allow the efficient use of existing infrastructure on the Hanford Site, but could generate increased demand that could exceed the capacity of the City of Richland. Improvements to the existing infrastructure may have to be financed through other governmental or public entities, such as Benton County or the Port of Benton, to encourage industrial development on Hanford Site lands.

Alternative Three would allow the development of the existing natural gas claim held by the Big Bend Alberta Mining Company and the filing of new claims for sand and gravel and natural gas development. The Conservation (mining) land-use designation on the ALE Reserve would allow access to develop the existing natural gas claim, pending review and issuance of a special-use permit, as described in Chapter 6. Alternative Three is more likely to result in development of the existing natural gas claim than the other alternatives being considered, and could encourage further development of natural gas resources on and near the Hanford Site. Mineral development on other areas of the Hanford Site would depend on the release of Hanford Site lands withdrawn from the public domain, as described under the Preferred Alternative.

Alternative Three would not preclude basalt quarrying, if permitted by the Hanford REO, from basalt outcrops such as Gable Mountain and Gable Butte and soil mining from the McGee Ranch. These locations have been identified as the most cost-effective and technically feasible sources of geologic materials for remediation (see Appendix D).

Alternative Three could reduce remediation costs compared to the Preferred Alternative and Alternatives One, Two, and Four.

Alternative Three would allow cultivated Agriculture, Industrial Development, Research and Development initiatives, limited grazing and mining, and High-Intensity Recreational uses within designated areas of the Hanford Site. This alternative would have the highest potential for economic development of the alternatives being considered. Under this alternative, lands on the Wahluke Slope could be developed for growing irrigated crops, including small grains, potatoes, hay, fruits, and vegetables, as well as livestock production. The economic impact of agricultural development on former Hanford Site lands would depend on how much land is converted to farmland, how much is irrigated, and what crops are grown. Table 5-12 summarizes the potential economic impacts of agricultural development under several scenarios. Under these scenarios, the total market value of agricultural products in the three counties could increase from 1.7 to 9.4 percent, corresponding to a range of $16 million to $88 million (using 1992 prices) in additional revenues. This potential increase does not take into account the effect of increasing production on the market for agricultural commodities.

Table 5-12. Potential Economic Impacts of Agricultural Development.

Agricultural Economic Indicators for the Three-County Study Area	Scenario 1: Crop Mix with Grazing in Red Zone	Scenario 2: Crop Mix Without Red Zone	Scenario 3: Specialty Crop Production with Grazing in Red Zone
	Percent Increase over Existing Conditions		
Agricultural land	2.5%	2.5%	2.5%
Cropland	2.1%	3.7%	2.1%
Irrigated land	4.5%	8.0%	4.5%
Land in vegetable crops	4.5%	8.0%	24%
Land in fruit orchards	4.5%	8.0%	24%
Pasture land	4.1%	0%	4.1%
Total market value of agricultural products	1.7%	3.0%	9.4%
Total market value of crops	2.1%	3.7%	12%
Total market value of livestock	4.1%	0%	4.1%
Total market value of specialty crops	4.5%	8.0%	24%

Alternative Three would allow livestock grazing on 6,232 ha (15,580 ac) of the Wahluke Slope, increasing the total pasture land base in the three counties by 2 percent. This acreage could support approximately 1,059 AUM, with a value of approximately $12,700.

High-Intensity Recreational development of the Vernita Terrace under Alternative Three may include a destination resort with golf course, a boat launch, Tribal fishing facilities, interpretive exhibits, and the B Reactor museum. A destination resort and conference center featuring a 350-unit hotel, RV parking, and a golf course could employ 200 to 400 persons. By comparison, hotels and motels in the study area employed approximately 900 persons with a total payroll of approximately $9.4 million in 1995. A large destination resort located at Vernita Terrace could generate an additional $2 million to $4 million in payroll, in addition to other revenues. However, these possible benefits could have negative impacts on other hotels, motels and resorts in the area. In addition, a destination resort development at Vernita Terrace could also required additional investment in infrastructure in the northwestern portion of the Hanford Site.

If future recreational developments under Alternative Three do not include a destination resort, other developments could contribute to the economy. An RV park containing 100 spaces and operating at 80 percent capacity for 200 days per year could generate approximately $1.3 million annually. A golf course serving 150 golfers per day and operating year-round could generate approximately $1.4 million annually. Increased access to the Columbia River corridor under this alternative could also generate revenues from sport fishing and other day uses that would be similar to those estimated for the Preferred Alternative.

5.3.1.6 Alternative Four. Implementation of Alternative Four would allow continued industrial development, research and development initiatives, limited mining, and recreational uses on former Hanford Site lands. Alternative Four would increase the land base available for industrial and Research and Development land uses in Benton County. A total of 6,881 ha (17,003 ac) would become available for industrial development, which would meet the estimated need forecasted by the Benton County Planning Department (1,639 ha [4,050 ac]) and provide an additional 5,242 ha (12,953 ac) to support possible future DOE missions. This amount of land would allow the siting of several manufacturing facilities, with a total employment of 100 to 1,000. Lands under the Research and Development land-use designation would total 4,388 ha (10,843 ac), which could support at least 522,000 m^2 (5.8 million ft^2) of facility space and total employment of up to 100 employees.

As with the Preferred Alternative, Alternative Four would allow the efficient use of existing infrastructure on the Hanford Site, but could generate increased demand that could exceed the capacity of the City of Richland. Improvements to the existing infrastructure may have to be financed through other governmental or public entities, such as Benton County or the Port of Benton, to encourage industrial development on Hanford Site lands.

Alternative Four would allow the development of the existing natural gas claim held by the Big Bend Alberta Mining Company but would not allow the filing of new claims for sand and gravel and natural gas development. As with the Preferred Alternative, Alternative Four would limit access to the existing natural gas claim on the ALE Reserve. Mining elsewhere on the Hanford Site would be limited to obtaining geologic materials to support remediation. These mining activities are unlikely to have economic impacts in the study area.

Alternative Four would provide increased boating access to the Columbia River by adding two new access points to the river at White Bluffs and Vernita Bridge. Recreation under this alternative is likely to have economic impacts such as increased revenues and employment, but these impacts would probably be less than those described for the Preferred Alternative.

5.3.2 Environmental Justice Impacts

The following discussion addresses environmental justice as related to the land-use alternatives being considered for the Hanford Site. Minority and low-income populations in the vicinity of the Hanford Site are identified, followed by a discussion of the impacts that the alternatives might have on these populations. Analysis of environmental justice concerns was based on a qualitative assessment of the impacts reported in other sections of Chapter 5. The analysis was performed to identify any disproportionately high and adverse human health or environmental impacts on minority or low-income populations within the zone of potential impact and for American Indian Tribes that are beyond the 80-km (50-mi) radius from the 200 East Area but have reserved treaty rights on the Hanford Site. The evaluation considered potential impacts arising under each of the major impact categories evaluated in this EIS, including socioeconomics, water resources, air resources, ecology, health and safety, and cultural resources.

5.3.2.1 Demographic Analysis. Demographic information obtained from the U.S. Bureau of Census was used to identify minority populations and low-income communities within an 80-km (50-mi) radius surrounding the 200 East Area on the Hanford Site at the census block group level (Neitzel et al. 1997). For the evaluation of environmental justice impacts, the area defined by this 80-km (50-mi) radius was considered the zone of potential impact.

A total population of approximately 384,000 people reside within an 80-km (50-mi) radius of the Hanford Site. The minority population within the area of impact consists of approximately 95,000 people and represents approximately 25 percent of the population in the assessment area. The ethnic composition of the minority population is primarily Hispanic (approximately 80 percent) and American Indian (8 percent). Census block groups where the percentage of minority persons within the population exceeds 25 percent are primarily located to the southwest and northeast of the Hanford Site and within the City of Pasco, Washington (Neitzel et al. 1997). However, several large census block groups (i.e., areas with low population density) with populations consisting of between 25 and 50 percent minority persons border the Hanford Site on the west, north, and east.

The low-income population within the 80-km (50-mi) area of impact represents approximately 42 percent of households in the area of impact. Census block groups where the percentage of the population below the poverty level exceeds 20 percent are principally located to the southwest and north of the Hanford Site and within the City of Pasco, Washington (Neitzel et al. 1997).

5.3.2.2 American Indian Populations Near the Hanford Site. Substantial American Indian populations are located within the 80-km (50-mi) assessment area. Census block groups within the assessment area and composed primarily of American Indian populations are primarily located on the Yakama Indian Reservation in Yakima County, Washington. However, other American Indian populations located outside of the assessment area also have an interest in the Hanford Site based on treaty rights (see Appendix A). Treaty reserved Tribal fishing rights have been recognized as effective within the Hanford Reach. The Tribes also have an interest in renewing traditional uses, such as gathering of foods and medicines, hunting and pasturing horses and cattle on Hanford Site lands.

Future opportunities of the Tribes to exercise reserved treaty rights are dependent upon the health of the ecosystems. The Tribes assert that a treaty right to hunt, fish, or gather plants is diminished (if not voided) if the fish, wildlife, or plants have vanished or are contaminated to the extent that they threaten human health. These resources, particularly the resources with cultural and religious connotations, do not have equivalent value for the general population. Consequently, impacts to these resources can be considered an environmental justice impact to American Indian populations.

5.3.2.3 Human Health Impacts. Although adoption of a land-use plan for the Hanford Site would not have any direct impacts on human health, each of the alternatives could indirectly affect human health, depending on the land uses that are implemented. Land-use designations such as Preservation, Conservation, and Low-Intensity Recreation, are unlikely to contribute to increased health risk. However, increased human health risk could be associated with Agriculture, Industrial, and Research and Development processes, and High-Intensity Recreation uses.

The *Screening Assessment and Requirements for a Comprehensive Assessment, Columbia River Comprehensive Impact Assessment* (CRCIA) (DOE 1998) evaluated both chemical and radiological health risk potential for a variety of site use scenarios. This assessment focused on the Columbia River and riparian zone and included several Native American subsistence scenarios (e.g., subsistence resident, upland hunter, river-focused hunter and fisher, gatherer of plant materials, and Columbia River island users). These Native American scenarios were developed by a Native American representative on the CRCIA team specifically for the CRCIA effort. The scenarios are not the same as scenarios commonly used for determining health impacts at Hanford. Environmental measurements used for the CRCIA analysis were based on data collected from 1990 through 1996 and, as a consequence, would not necessarily reflect the future condition of the site.

In these Native American scenarios, people were assumed to live along the Columbia River, to eat substantial quantities of food grown in the riparian zone, to eat fish and wildlife from the river, and to drink seep water. These people would have a much larger potential exposure and, thus, estimated health risk. Lifetime health risks greater than 1×10^{-4} [1 in 10,000] were found for many sections of the river for chromium, copper, strontium-90, uranium-238, lead, and tritium. However, the source of these metals (particularly chromium, copper, and lead) may be operations upstream of Hanford, such as mining on the Clearwater River drainage. According to these analyses, potentially increased health risk is possible if people were to move onto the Hanford Site and derive a large percentage of their daily food intake from crops and animals grown or taken in the river's riparian zone. In most cases, this higher risk is limited in extent to a few regions of highest contamination. Although many cultural differences exist in the relative percentages of food types between the general population and Native American populations, the common pathways of food and water consumption could affect both groups.

5.3.2.4 No-Action Alternative. Access restrictions would remain in effect under the No-Action Alternative and the potential for health risks would be comparable to existing risk. Use of the Columbia River for recreation would continue at levels comparable to current use. Minority or low-income individuals may be more prone to use this resource for subsistence than members of the general population. Current uses of the Columbia River are not known to cause disproportionately high and adverse human health impacts in any population and no such impacts would be expected to occur as a result of the No-Action Alternative.

Development of Hanford Site lands would not be restricted by land-use designations under the No-Action Alternative. Cultural resources of importance to American Indians located on the Hanford Site, including Gable Butte and Gable Mountain could be developed under this alternative. The availability of these resources for development represents a potential environmental justice impact to American Indians.

Prohibiting development of agriculture on the Wahluke Slope would also potentially impact low-income and minority populations located to the north of the Hanford Site by limiting the potential for new jobs in those areas. In general, lands on the Wahluke Slope are not presently available for agricultural development and many jobs associated with agricultural practices are not high wage opportunities. Consequently, the current management of the Wahluke Slope would be unlikely to result in disproportionately high and adverse impacts to low-income or minority populations.

5.3.2.5 Preferred Alternative. The Preferred Alternative would allow for increased access to Hanford Site lands and to the Columbia River for Tribal members by establishing two High-Intensity Recreation Tribal fishing camps on the Wahluke Slope. As described in CRCIA, increased use and access to the Hanford Site would potentially increase exposure, and therefore health risk. This access would provide increased opportunity for subsistence consumption of fish taken from the Columbia River, which would also increase the potential for adverse health effects. Minority or low-income individuals may be more prone to adopt a subsistence lifestyle than members of the general population, but the potential for increased exposure would not necessarily affect a minority or low-income population. Avid sportsmen among the general population could also have an increased risk of health effects from increased exposure. Increased access to and use of the Hanford Site is not anticipated to result in disproportionately high and adverse health effects in minority or low income populations.

The Preferred Alternative would designate Gable Mountain, Gable Butte, and other areas of cultural value to American Indians for preservation. This designation would eliminate the potential for disproportionately high and adverse impacts due to development of culturally significant areas. The Preferred Alternative would allow development within the viewscape of these high promontories. Alteration of these viewscapes would represent a potential environmental justice impact to American Indians.

The Preferred Alternative would allow economic development of Hanford Site lands. Low-income populations in the vicinity of the Hanford Site would benefit from increased economic activity and growth in community services that could occur as a result of development. However, economic development could increase the demand for housing and tend to decrease the availability of low-income housing. In spite of these conflicting impacts, low-income populations in communities that are influenced by development at the Hanford Site would probably benefit from the development. Low-income communities located to the north and west of the Hanford Site historically have not been strongly influenced by Hanford Site activities and the effects of future development would probably be neutral in these communities.

Prohibiting development of agriculture on the Wahluke Slope would also potentially impact low-income and minority populations located to the north of the Hanford Site by limiting the potential for new jobs in those areas. In general, lands on the Wahluke Slope are not presently available for agricultural development and many jobs associated with agricultural practices are not high wage opportunities. The Preferred Alternative would be unlikely to result in disproportionately high and adverse socioeconomic impacts to low-income or minority populations.

5.3.2.6 Alternative One. Alternative One would allow for increased access to Hanford Site Lands and to the Columbia River. As described in CRCIA, increased use and access to the Hanford Site would potentially increase exposure, and therefore health risk. This access would provide increased opportunity for subsistence consumption of fish taken from the Columbia River, which would also increase the potential for adverse health effects. Minority or low-income individuals may be more prone to adopt a subsistence lifestyle than members of the general population, but the potential for increased exposure would not necessarily affect a minority or low-income population. Avid sportsmen among the general population could also have an increased risk of health effects from increased exposure. Increased access to and use of the Hanford Site in not anticipated to result in disproportionately high and adverse health effects in minority or low income populations.

Alternative One would limit development primarily to previously disturbed areas and to areas of low habitat quality (BRMaP Levels I and II). This limitation to development could constrain economic development in the vicinity of the site, which would potentially affect low income individuals and communities to a greater degree than the general population. These impacts could include declining community services or increased taxes which could place an greater burden on low-income households and communities than on the population in general. This burden represents a potential disproportionately high socioeconomic impact; however, most low income communities within the analysis area are not greatly influenced by development activities at the Site.

Prohibiting development of agriculture on the Wahluke Slope would also potentially impact low-income and minority populations located to the north of the Hanford Site by limiting the potential for new jobs in those areas. In general, lands on the Wahluke Slope are not presently available for agricultural development and many jobs associated with agricultural practices are not high wage opportunities. Consequently, Alternative One would be unlikely to result in disproportionately high and adverse impacts to low-income or minority populations.

5.3.2.7 Alternative Two. Alternative Two would designate the majority of the Hanford Site for Preservation and would allow development in previously developed areas and in an area immediately north of the city of Richland. Mining and utilization of geologic resources on the Hanford Site would not be allowed under this alternative. Economic development of Hanford Site land and resources would be held to a minimum under this alternative. Alternative Two would allow access to the Columbia River and the potential for reliance on fishing for subsistence.

Alternative Two would also minimize access to the Hanford Site through the Preservation designation. This limited access would minimize the potential for environmental justice impacts to American Indians that could occur as a result of potential damage to cultural and biological resources under other alternatives.

Limitations to economic development under this alternative would potentially impact low-income populations in the vicinity of the Hanford Site. These impacts could include declining community services or increased taxes which could place an greater burden on low-income households and communities than on the population in general. This burden represents a potential disproportionately high socioeconomic impact; however, most low income communities within the analysis area are not greatly influenced by development activities at the Site.

Prohibiting development of agriculture on the Wahluke Slope would also potentially impact low-income and minority populations located to the north of the Hanford Site by limiting the potential for new jobs in those areas. In general, lands on the Wahluke Slope are not presently available for agricultural development and many jobs associated with agricultural practices are not high wage opportunities. Consequently, the preservation designation for the Wahluke Slope would be unlikely to result in disproportionately high and adverse impacts to low-income or minority populations.

5.3.2.8 Alternative Three. Alternative Three would allow for increased access to Hanford Site Lands and to the Columbia River. As described in CRCIA, increased use and access to the Hanford Site would potentially increase exposure, and therefore health risk. This access would provide increased opportunity for subsistence consumption of fish taken from the Columbia River, which would also increase the potential for adverse health effects. Minority or low-income individuals may be more prone to adopt a subsistence lifestyle than members of the general population, but the potential for increased exposure would not necessarily affect a minority or low-income population. Avid sportsmen among the general population could also have an increased risk of health effects from increased exposure. Increased access to and use of the Hanford Site in not anticipated to result in disproportionately high and adverse health effects in minority or low income populations.

Activities associated with Alternative Three, such as agriculture, could result in damage to cultural and biological resources of value to American Indian tribes. Furthermore, if permitted by the Hanford REO, Gable Butte and Gable Mountain could be available for development of quarries and mining activities could be undertaken within the viewsheds of these high promontories. Disturbance of the promontories or their viewsheds would be a disproportionately high and adverse environmental impact to American Indians.

Alternative Three would allow for the maximum potential for economic development of Hanford Site lands. Low-income populations in the vicinity of the Hanford Site would benefit from increased economic activity and growth in community services that could occur as a result of development. However, economic development could increase the demand for housing and tend to decrease the availability of low-income housing. In spite of these conflicting impacts, low-income populations in communities that are influenced by development at the Hanford Site would probably benefit from the development.

Allowing agriculture on the Wahluke Slope would potentially provide a benefit low-income and minority populations located to the north of the Hanford Site by providing the potential for new jobs in those areas. Many jobs associated with current agricultural practices are not high wage opportunities, but increases in economic opportunities could be expected to benefit local communities, including low-income and minority populations. Disproportionately high and adverse socioeconomic impacts to low-income or minority populations would be unlikely under Alternative Three.

5.3.2.9 Alternative Four. Alternative Four would allow for increased access to Hanford Site lands and to the Columbia River for Tribal members by establishing a High-Intensity Recreation Tribal fishing camp at the White Bluffs boat launch. As described in CRCIA, increased use and access to the Hanford Site would potentially increase exposure, and therefore health risk. This access would provide increased opportunity for subsistence consumption of fish taken from the Columbia River, which would also increase the potential for adverse health effects. Minority or low-income individuals may be more prone to adopt a subsistence lifestyle than members of the general population, but the potential for increased exposure would not necessarily affect a minority or low-income population. Avid sportsmen among the general population could also have an increased risk of health effects from increased exposure. Increased access to and use of the Hanford Site in not anticipated to result in disproportionately high and adverse health effects in minority or low-income populations.

Alternative Four would designate most of the Hanford Site for Preservation, and this designation would serve to protect cultural and biological resources of importance to American Indian tribes. Alternative Four would also designate presently undisturbed lands to the North within the viewshed of Gable Butte and Gable Mountain for Preservation, leaving only the center portion of the site with potential to cause disproportionate adverse impacts to American Indians.

Alternative Four would designate most of the Hanford Site for Preservation but would allow for Mining, Research and Development, and Industrial uses. Sufficient area is available to accommodate anticipated future development. Low-income populations in the vicinity of the Hanford Site would benefit from increased economic activity and growth in community services that could occur as a result of development. However, economic development could increase the demand for housing and tend to decrease the availability of low-income housing. In spite of these conflicting impacts, low-income populations in communities that are influenced by development at the Hanford Site would probably benefit from the development. Low-income communities located to the north and west of the Hanford Site historically have not been strongly influenced by Hanford Site activities and the effects of future development would probably be neutral in these communities.

Designating the Wahluke Slope for Preservation would potentially impact low-income and minority populations located to the north of the Hanford Site by limiting the potential for new jobs in those areas. In general, lands on the Wahluke Slope are not presently available for agricultural development and many jobs associated with agricultural practices are not high wage opportunities. Consequently, the preservation designation for the Wahluke Slope would be unlikely to result in disproportionately high and adverse impacts to low-income or minority populations.

5.4 Human Health Risk

The alternatives being considered in this EIS were developed with the assumption that human health risk associated with contamination at the Hanford Site will continue to be addressed through the RCRA and CERCLA processes. These processes are expected to reduce human health risk to acceptable levels through remedial actions and administrative controls, such as deed restrictions, which are imposed by CERCLA Records of Decision (RODs). The DOE has also assumed that future land uses would not be allowed until remediation has reduced human health risk to levels acceptable for the intended land use.

Even though ongoing remedial actions at the Hanford Site are expected to reduce human health risks to acceptable levels, health risk from residual contamination could affect future land users at the Hanford Site. In fact, continued migration of contaminant plumes in groundwater could increase future risk levels in downgradient areas that had previously been remediated to acceptable risk levels. The August 1996 Draft HRA-EIS addressed human health risk to future populations by evaluating four exposure scenarios: residential, agricultural, industrial, and recreational. The risk assessment evaluated the No-Action Alternative, the unrestricted-use alternative, which involved cleanup to risk levels less than 10^{-6}, two restricted-use alternatives, and the exclusive-use alternative, which involved reducing risk levels to less than 10^{-4}.

Tables 5-13 and 5-14 summarize the estimated cancer incidences among future populations under the residential, agricultural, and industrial exposure scenarios. Table 5-13 presents potential cancer incidences with the loss of institutional controls at the 200 Areas. Table 5-14 presents potential cancer incidences with institutional controls remaining in place in the 200 Areas and controls remaining in place to prevent migration of contaminants through groundwater to other locations on the Hanford Site. A separate risk analysis was performed for the recreational exposure scenario on the Columbia River geographic area. The results of this risk analysis are summarized in Table 5-15. The assumptions, methodology, and uncertainties associated with these risk analyses are discussed further in the August 1996 Draft HRA-EIS.

Table 5-13. Future Exposed Populations and Estimated Cancer Incidences for Each Geographic Area, Assuming Loss of Institutional Controls (adapted from DOE 1996).

Geographic Area / Future Land-Use Alternative	Residential Exposure Scenario		Agricultural Exposure Scenario		Industrial Exposure Scenario[a]	
	140 to 1,000 yrs	1,000 to 10,000 yrs	140 to 1,000 yrs	1,000 to 10,000 yrs	140 to 1,000 yrs	1,000 to 10,000 yrs
Reactors on the River						
Total Exposed Population	125,358	1,311,414	4,154	46,831	48,739	510,000
No-Action	63	3,124	0	104	487	5,100
Unrestricted Future Land Use	3	2,658	0	88	0	5,100
Restricted Future Land Use (R1)	7	2,659	0	88	5	5,100
Restricted Future Land Use (R2)	63	3,124	0	104	487	5,100
Central Plateau						
Total Exposed Population	212,003	2,217,833	7,024	73,484	48,739	510,000
No-Action	632	2,532	19	141	487	5,100
Exclusive Future Land Use	632	2,532	19	141	487	5,100
All Other Areas						
Total Exposed Population	1,150,344	12,034,12	38,115	398,732	48,739	510,000
No-Action	114	2,984	6	92	49	5,100
Restricted Future Land Use (R1)	89	2,984	5	92	49	5,100
Restricted Future Land Use (R2)	114	2,984	6	92	49	5,100

[a]An industrial complex of 1,700 workers was assumed to be located above the portion of the geographic area with the highest risk.

Other human health risks not related to environmental contamination could be associated with future uses. For example, agricultural development of Hanford Site lands could result in increased injuries or deaths from farm accidents. Increased recreational use along the Columbia River could result in increases in boating and hunting accidents. However, these health risks are dependent on a number of factors unrelated to land use (e.g., future population growth, technological developments, and economic conditions, making predictions of future risks impossible).

Table 5-14. Future Exposed Populations and Estimated Cancer Incidences for Each Geographic Area, Assuming Institutional Controls for the Central Plateau and Associated Groundwater Plumes (adapted from DOE 1996).

Geographic Area	Residential Exposure Scenario		Agricultural Exposure Scenario		Industrial Exposure Scenario[a]	
Future Land-Use Alternative	140 to 1,000 yrs	1,000 to 10,000 yrs	140 to 1,000 yrs	1,000 to 10,000 yrs	140 to 1,000 yrs	1,000 to 10,000 yrs
Reactors on the River						
Total Exposed Population	125,358	1,311,414	4,154	46,831	48,739	510,000
Unrestricted Future Land Use	0	1	0	<1	0	<1
Restricted Future Land Use (R1)	63	18	0	1	5[c]	51[c]
Restricted Future Land Use (R2)	63	360	2	13	487[c]	5,100[c]
Central Plateau						
Total Exposed Population	N/A	N/A	N/A	N/A	48,739	510,000
Exclusive Future Land Use	N/A	N/A	N/A	N/A	<5[b]	<51[b]
All Other Areas						
Total Exposed Population	1,150,344	12,034,12	38,115	398,732	48,739	510,000
Restricted Future Land Use (R1)	<11	92	0	3	<5[d]	<5
Restricted Future Land Use (r2)	27	92	1	3	49[d]	<5

[a] An industrial complex of 1,700 workers was assumed to be located above the portion of the geographic area with the highest risk.
[b] Institutional controls would maintain risk at 1E-04 or lower.
[c] Institutional facility situated with in the 100-N Area remediated to 1E-04 for R1, and assumed to be equivalent to the No-Action Alternative for R2; no institutional controls outside of Central Plateau.
[d] Industrial facility located within the 300 Area or 400 Area zones of elevated risk.

Table 5-15. Future Exposed Populations and Estimated Cancer Incidences for the Columbia River Geographic Area.

Geographic Area	Recreational Exposure Scenario	
Future Land-Use Alternative	140 to 1,000 yrs	1,000 yrs to 10,000 yrs
Columbia River		
Total Exposed Population	163,800	1,714,128
No- Action Estimated Cancers	15	145
Unrestricted Estimated Cancers	1	<2[a]

[a] Assumes that 100-N Area is remediated and 200 Areas groundwater plumes are remediated or controlled.

Some comparisons can be made regarding occupational health risks among the land-use designations using statistics from the U.S. Bureau of Labor Statistics (Table 5-16). The data in Table 5-16 indicate that mining machine operators would have the highest risk of fatalities based on fatalities per 100,000 employed, although only a small percentage of fatalities are associated with this occupation. Farm workers have somewhat less risk per 100,000 employed, but make up a larger percentage of occupational fatalities. Truck drivers have a similar risk, and make up the largest percentage of fatalities. According to these statistics, future land uses involving truck drivers, such as Industrial, Industrial-Exclusive, and Agricultural are most likely to result in occupational fatalities.

Table 5-16. Occupational Fatality Rates for Selected Occupations (1995).

Occupation	Percent of Total Fatalities	Fatalities per 100,000 Employed
Farm workers, including supervisors	4.2	30
Mining machine operators	0.5	78
Machine operators, assemblers, and inspectors	3.8	3
Truck drivers	12.1	26
Industrial truck and tractor equipment operators	0.5	7
Executive, administrative, and managerial	7.5	3

Source: U.S. Department of Labor, Bureau of Labor Statistics, *Census of Fatal Occupational Injuries*, 1995.

Increased recreational opportunities associated with the Preferred Alternative and Alternatives One, Three, and Four could increase risks associated with outdoor recreation activities. These would include risks from boating and swimming accidents, hunting and target shooting accidents, and bicycling accidents.

5.5 Cumulative Impacts

This section summarizes cumulative impacts associated with Hanford Site land-use designations for each alternative identified in Chapter 3. Cumulative impacts result

> *. . . from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).*

Reasonably foreseeable actions are identified and the relationship between these actions and the proposed land-use designations is discussed. The description of potential cumulative impacts couples impacts of each alternative with impacts from past and existing operations at the Hanford Site and impacts that may be associated with anticipated future actions. Section 5.5.1 discusses cumulative impacts to land use associated with present and reasonably foreseeable actions; Section 5.5.2 discusses cumulative impacts to the resources identified in Section 5.2; and Sections 5.5.3 and 5.5.4 discuss cumulative socioeconomic impacts and cumulative human health risk, respectively.

5.5.1 Cumulative Impacts to Land Use

The alternatives analyzed in this document would establish acceptable uses for Hanford Site lands for the next 50 years. The alternative identified and selected for implementation in the ROD will allocate lands for use under the defined land-use designations. Other present and reasonably foreseeable actions at the Hanford Site that involve siting new facilities or using Site resources also would, in effect, allocate lands for certain uses. Those present and reasonably foreseeable actions that involve land uses that are compatible with the proposed land-use designations under all the alternatives would not have cumulative impacts for land use; these actions are listed in Table 5-17 and described further in Appendix E. However, those present and reasonably foreseeable actions that do not conform with the proposed land-use designations would change the land-use allocations and, in this sense, could be considered to have cumulative impacts. Those present and reasonably foreseeable actions involving nonconforming uses are listed in Table 5-18.

The six actions listed in Table 5-18 would involve land uses that conflict with land-use designations under some alternatives. The USFWS is initiating an Area Management Plan for the ALE Reserve. Assuming that this management plan would call for maintaining the ALE Reserve in its present, preservation-like management status, the management plan would conflict with the proposed Conservation (Mining) land-use designation for the ALE Reserve under the Preferred Alternative and Alternatives One, Three, and Four.

A similar situation exists with the alternative selected in the ROD for the Hanford Reach (NPS 1996), which calls for designating the Wahluke Slope as a wildlife refuge and designating the Columbia River Corridor on the Hanford Site (i.e., the Hanford Reach) as a Wild and Scenic River. These designations, which require Congressional action to take effect, would result in the management of the Wahluke Slope and the Columbia River Corridor for Preservation. The management of the Wahluke Slope as a wildlife refuge would conflict with the Conservation (Mining and Grazing) land-use designations proposed for portions of the Wahluke Slope under the Preferred Alternative, Alternative One, and Alternative Three, as well as the Agriculture land-use designation under Alternative Three. The management of the Columbia River Corridor as a Wild and Scenic River would conflict with the Conservation (Mining and Grazing) designation proposed for the south side of the river under the Preferred Alternative. If Congressional action results in either the refuge designation for the Wahluke Slope or the Wild and Scenic River designation for the Columbia River, or both, then the result would be a re-allocation of lands to the Preservation land-use designation and the CLUP would need updating.

The remaining nonconforming uses listed in Table 5-17 involve present or upcoming actions that would conflict with the land-use designations under Alternatives One, Two, or Four. The operation of LIGO would be considered a pre-existing, nonconforming use under Alternative One and Alternative Four, which could require that the LIGO site be restored to the designated use (Conservation) at the end of the facility's life. The Inert/Demolition Waste Landfill proposed for Pit 9 involves using an existing gravel pit located north of the 300 Area for disposal of inert and demolition wastes from the 300 Area. This would be classified as an Industrial land use, and would be considered a pre-existing, nonconforming use under Alternative One, Alternative Two, and Alternative Four. The proposed salvage and demolition of the 300 Area Steam Plant calls for obtaining fill from Pit 9 for filling voids and constructing the final cover. The use of Pit 9 for quarrying materials would be a pre-existing, nonconforming use under Alternative One, Alternative Two, and Alternative Four.

Table 5-17. Present or Reasonably Foreseeable Future Actions Compatible with Land-Use Designations Under All Alternatives. (2 pages)

Present or Reasonably Foreseeable Future Action	Location	Land Use
Decommissioning of Eight Surplus Production Reactors	200 Areas (disposal)	Industrial-Exclusive
Deactivation of the N Reactor	200 Areas (disposal)	Industrial-Exclusive
Safe Interim Storage of Hanford Tank Wastes	200 Areas	Industrial-Exclusive
Tank Waste Remediation System	200 Areas	Industrial-Exclusive
Plutonium Finishing Plant Stabilization	200 Areas	Industrial-Exclusive
Decommissioning of Building 232-Z and Building 233-S	200 Areas	Industrial-Exclusive
Environmental Restoration Disposal Facility Expansion	200 Areas	Industrial-Exclusive
Spent Nuclear Fuel Management	200 Areas	Industrial-Exclusive
200 Area Effluent Treatment Facility	200 Areas	Industrial-Exclusive
Operation of 200 Areas LLW Burial Grounds	200 Areas	Industrial-Exclusive
Operation of U.S. Ecology Commercial LLW Burial Ground	200 Areas	Industrial-Exclusive
Solid Waste Retrieval Complex, Enhanced Radioactive and Mixed Waste Storage Facility, and Central Waste Support Complex	200 Areas	Industrial-Exclusive
Tank 241-C-106 Sluicing and Waste Removal	200 Areas	Industrial-Exclusive
Special Case Waste Storage Facility	200 Areas	Industrial-Exclusive
Disposal of Decommissioned Naval Reactor Plants	200 Areas	Industrial-Exclusive
Environmental Molecular Sciences Laboratory	300 Area	Research and Development
Disposition of Sodium Test Loops	200 Areas, 300 Area	Industrial-Exclusive, Industrial
Fast Flux Test Facility Re-Start	400 Area	Industrial
Disposal of S3G and D1G Prototype Reactor Plants	200 Areas	Industrial-Exclusive
Hanford Solid Waste EIS	200 Areas	Industrial-Exclusive
Surplus Plutonium Disposition	400 Area	Industrial
Offsite Thermal Treatment of Low-Level Mixed Waste	200 Areas, City of Richland	Industrial-Exclusive, Industrial
200 Area Emergency Facilities Campus	200 Areas	Industrial-Exclusive
300 Area Steam Replacement	300 Area	Industrial
Lead Test Assembly Irradiation and Analysis	200 Areas, 300 Area	Industrial-Exclusive, Industrial
Management of Hanford Site Non-Defense Production Reactor Spent Nuclear Fuel	200 Areas	Industrial-Exclusive
Relocation and Storage of Sealed Isotopic Heat Sources	200 Areas	Industrial-Exclusive

Table 5-17. Present or Reasonably Foreseeable Future Actions Compatible with Land-Use Designations Under All Alternatives. (2 pages)

Present or Reasonably Foreseeable Future Action	Location	Land Use
Trench 33 Widening in 218-W-5 LLW Burial Ground	200 Areas	Industrial-Exclusive
1171 Building Annex Lease	1100 Area	Industrial
City of Richland Comprehensive Land-Use Plan	300 Area, 600 Area	Industrial

Table 5-18. Present or Reasonably Foreseeable Future Actions with Nonconforming Land Uses.

Present or Reasonably Foreseeable Future Action	Nonconforming Land-Use Designations ✓ = nonconforming					
	No-Action	Preferred Alternative	Alternative One	Alternative Two	Alternative Three	Alternative Four
Development of ALE Reserve Management Plan by USFWS **(Preservation)**	N/A	✓ **Conservation (Mining)**	✓ **Conservation (Mining)**		✓ **Conservation (Mining)**	✓ **Conservation (Mining)**
Designation of the Wahluke Slope as a National Wildlife Refuge **(Preservation)**	N/A	✓ **Conservation (Mining and Grazing)**	✓ **Conservation (Mining and Grazing)**		✓ **Agriculture and Conservation (Mining and Grazing)**	
Wild and Scenic River Designation for the Hanford Reach **(Preservation)**	N/A	✓ **Conservation (Mining and Grazing)**				
Operation of the Laser Interferometer Gravitational Wave Observatory **(Research and Development)**	N/A		✓ **Conservation (Mining)**			✓ **Conservation (Mining)**
Inert/Demolition Waste Landfill (Pit 9) **(Industrial)**	N/A		✓ **Preservation**	✓ **Preservation**		✓ **Preservation**
Salvage/Demolition of 200 West, 200 East, and 300 Area Steam Plants **(Conservation - Mining)**	N/A		✓ **Preservation**	✓ **Preservation**		✓ **Preservation**

5.5.2 Cumulative Impacts by Resource

5.5.2.1 Geologic Resources. Geologic resources on the Hanford Site include unique features that have been preserved while similar features in the region have been damaged or destroyed by development. Mining of geologic materials would be allowed under all alternatives being considered, except Alternative Two, and could damage or destroy unique geologic features, such as Missoula Floods features and sand dunes. Mining under the No-Action Alternative and Alternative Three, if permitted by the Hanford REO, could also impact basalt outcrops, such as Umtanum Ridge, Gable Mountain, and Gable Butte. Because these features are rare and susceptible to development elsewhere in the region, damage or destruction of these features on the Hanford Site would increase their aesthetic and ecological value offsite, and decrease their availability for scientific study.

Alternative Three would allow development of cultivated agriculture on the Wahluke Slope. Increasing irrigated lands in the vicinity of the White Bluffs would cumulatively increase groundwater recharge in the area and also could result in additional slumping of the White Bluffs. Additional slumping of the White Bluffs would further reduce their aesthetic, historic, and ecological value; would cumulatively increase sedimentation of the Columbia River; and could accelerate riverbank and island erosion. The No-Action Alternative would also allow the current management practice of growing crops for wildlife management purposes on the Wahluke Slope. This activity is less likely to have cumulative effects on the White Bluffs.

5.5.2.2 Water Resources. Water resources on the Hanford Site, including groundwater and surface water, have been impacted by past waste disposal practices at Hanford. Remediation strategies for cleaning up past contamination are designed for current and predicted future hydrologic conditions. Additional development on the Hanford Site could alter hydrologic conditions and increase impacts to water quality from contamination.

Industrial development would be allowed under all alternatives being considered and would increase groundwater consumption and alter groundwater hydrology. Changes to groundwater hydrology as a result of aquifer drawdown and discharges to the soil column could accelerate the movement of contaminants toward the Columbia River or in any other direction. Groundwater recharge from industrial waste water discharges and collection and infiltration of runoff in quarries could mobilize contaminants in the vadose zone and cumulatively increase contaminant levels in groundwater.

The Preferred Alternative and Alternatives One, Three, and Four would increase recreational use of the Columbia River over existing levels, which would cumulatively increase levels of oil, gas, and engine exhaust discharged to the river; and increase riverbank and island erosion from boat wakes. Unregulated non-point sources associated with industrial development and mining could add to pollutants discharged to the river from upstream sources, resulting in further water quality degradation. Mining and grazing along the Columbia River Corridor, which would be allowed under the No-Action Alternative and the Preferred Alternative, would increase sedimentation in the river, with possible cumulative impacts on spawning areas in the Columbia River.

5.5.2.3 Biological Resources. Because the Hanford Site contains much of remaining undisturbed Columbia Basin shrub-steppe habitat, proposed developments of undisturbed areas would result in cumulative impacts to rare plants and animals, unique plant communities, and terrestrial and aquatic ecosystems. In addition, the Hanford Site contains the last unimpounded, nontidal segment of the Columbia River, and further development along the Reach could result in cumulative losses to species and habitats associated with the Hanford Reach. In some cases (e.g., fall upriver bright chinook salmon), further losses of habitat could endanger remaining populations.

The Industrial, Research and Development, and Industrial-Exclusive land-use designations would allow industrial development to displace native plant communities and wildlife habitats. In addition, ongoing remediation activities, such as the decommissioning of surplus production reactors, would result in further habitat losses. Many of the actions listed in Table 5-17 for the 200 Areas would involve small losses of habitat, but expansion of the Environmental Restoration and Disposal Facility (ERDF) and other future actions in the 200 Areas could involve larger losses, with cumulative impacts to shrub-steppe habitat. Alternatives One and Two would limit cumulative impacts in the 200 Areas by reducing the size of the Industrial-Exclusive land-use designation.

The Conservation land-use designations could result in cumulative impacts by allowing livestock grazing and mining. Cumulative impacts from grazing are most likely under the Preferred Alternative, which would allow grazing over the largest area and could result in further losses of regional biodiversity. Livestock grazing could also increase sedimentation in the Columbia River, which could damage salmonid spawning areas and result in further reductions of fall upriver bright chinook salmon and steelhead populations.

Although basalt and sand and gravel quarries are unlikely to have cumulative impacts because they would disturb relatively small areas, large-scale soil mining to support remediation could result in large habitat losses. If permitted by the Hanford REO, the potential for cumulative effects from mining are greatest under the No-Action Alternative and Alternative Three, which would allow development of quarry sites at the McGee Ranch. Losses of shrub-steppe habitat in this area could eliminate the only remaining wildlife movement corridor connecting the Hanford Site and the Yakima Training Center, which are among the last remaining large tracts of shrub-steppe habitat in the region. Mining in the McGee Ranch area would add to habitat fragmentation that has previously taken place in the region as a result of agricultural, residential, and industrial development; and further reduce regional biodiversity.

Increased recreational use associated with the Wild and Scenic River designation and High- or Low-Intensity Recreation land-use designations under the Preferred Alternative and Alternatives One, Three, and Four could result in cumulative impacts to wildlife and habitats that are not currently accessible by the public under the No-Action Alternative. Recreation designations would increase impacts from boating as well as foot traffic on sensitive plant communities and habitats.

The potential for cumulative impacts to biological resources may best be evaluated by determining the amount of BRMaP Level III and IV resources that could be affected. The BRMaP III and IV designations identify the resources that could most adversely affected by further habitat losses. Alternative Three has the greatest potential to impact Level III and IV resources, primarily because it would allow conversion of native plant communities on the Wahluke Slope to cultivated agriculture. The Preferred Alternative and the No-Action Alternative would have less potential for impacts to BRMaP Level III and IV resources, but are more likely to impact those resources than Alternatives One, Two, or Four. Alternative Two is least likely to have cumulative effects on biological resources, based on the amounts of BRMaP Level III and IV resources that could be impacted by development.

5.5.2.4 Cultural Resources. Regionally, agricultural, industrial, and residential development have damaged or destroyed cultural resources. In addition, construction of dams along the Columbia River has inundated cultural resources and sites of significance to American Indian tribes. Cultural resources on the Hanford Site have been preserved by access restrictions for the past 55 years. Preservation of the Hanford Reach as the last free-flowing stretch of Columbia River would also preserve cultural resources associated with the river. Loss of these sites through development of Hanford Site lands could lead to potentially significant impacts on the remaining cultural resources in the region.

Many of the biological resources on the Hanford Site are also important to American Indian tribes for traditional subsistence uses. In addition, the Hanford Site includes religious sites important to American Indians. American Indian tribes with ties to the Hanford Site have long advocated the protection of these resources in their efforts to maintain their cultures and traditional life ways. Further losses of these resources could impact American Indian cultures associated with the Hanford Site.

Potential cumulative impacts to cultural resources are most likely to occur along the Columbia River, where cultural resources and traditional American Indian uses are concentrated. The No-Action Alternative and the Preferred Alternative have the greatest potential to affect these resources by allowing mining, grazing, or industrial development in the Columbia River Corridor. The Preferred Alternative and Alternatives One, Three, and Four would increase recreational access to the corridor, which could result in impacts to cultural resources from unauthorized artifact collection, vandalism, and losses to riverbank and island erosion from boat wakes.

Industrial development under any of the alternatives has the potential to disturb archaeological and historic sites. Alternatives One and Two are least likely to result in cumulative impacts because these alternatives would minimize the amount of land designated for Industrial, Research and Development, and Industrial-Exclusive land uses. Ongoing remediation activities and some of the proposed projects listed in Table 5-17 could also have cumulative effects on cultural resources.

Other cumulative impacts to American Indian cultures could occur under the No-Action Alternative and Alternative Three which, if permitted by the Hanford REO, would allow quarrying on basalt outcrops that are important religious and cultural sites. Alternative Two would designate most of the Hanford Site for Preservation to protect cultural resources and would be least likely to have cumulative impacts.

5.5.2.5 Aesthetic Resources. The large, undeveloped portions of the Hanford Site and features such as the basalt outcrops, Rattlesnake Mountain, the White Bluffs, and the Columbia River Corridor have aesthetic values that are unique to the region. Industrial development associated with past Hanford operations has altered some viewsheds. Future development of Hanford Site lands could further alter viewsheds and reduce the aesthetic value by increasing airborne particulates, odors, or other pollutants.

The potential for cumulative impacts to viewsheds would be greatest under the No-Action Alternative, which would allow development of Hanford Site lands on a project-by-project basis. This alternative is more likely to result in the siting and construction of industrial developments in previously undisturbed viewsheds. Alternative Three could also have cumulative impacts to viewsheds by allowing, if permitted by the Hanford REO, quarrying on basalt outcrops, the conversion of native plant communities on the Wahluke Slope to cropland and orchards, and development of high-intensity recreational facilities adjacent to the Columbia River Corridor. Future industrial development under the Industrial-Exclusive land-use designation, along with proposed and planned actions listed in Table 5-17, would have cumulative effects on viewsheds that would be similar under the alternatives being considered.

Alternative Three also has the greatest potential for cumulative impacts on visibility associated with air quality. The conversion of much of the Wahluke Slope to agriculture would create a significant new source of fugitive dust from cultivated fields. Industrial development under this alternative as well as all other alternatives being considered could also result in new sources of industrial pollutants, which could further diminish visibility.

Future development could also increase ambient noise levels, which would detract from the recreational experience associated with the Columbia River Corridor and other natural areas on the Hanford Site. Cumulative increases in noise are most likely occur under the No-Action Alternative, which could allow industrial development along the Columbia River. Mining along the river corridor, which could occur under the No-Action and the Preferred Alternative, could also increase noise impacts. Increases in High-Intensity Recreational land use activities such as Alternative Three's proposed destination resort and RV camps, or the Preferred Alternative's and Alternative Four's proposed Tribal fishing camps could also increase the noise along the river and distract from the aesthetic experience.

5.5.3 Cumulative Socioeconomic Impacts

The economy of the area has in the past been strongly influenced by Hanford Site activities. Changes in the Site mission and reductions in Site activities have had negative impacts in the past. Recently, the area economy has become more diversified and less dependent on the Hanford Site. Future development of Hanford Site lands under multiple uses could accelerate the transition to a diversified economy. On the other hand, economic growth associated with future uses of the Hanford Site could cumulatively increase demand for infrastructure and services.

Alternative Three has the greatest potential to have cumulative effects on the socioeconomic conditions because it would provide the most opportunities to develop alternate uses of Hanford Site lands. Alternative Three could also have cumulative effects on the demand for services, including schools, law enforcement, and health and human services, that would be greater than the other alternatives. Alternative Two has the least potential to have cumulative socioeconomic impacts because it would minimize future site development.

As was discussed in Section 5.3.1, future industrial development on Hanford Site lands could place increased demand on infrastructure beyond the City of Richland's capacity. This potentially cumulative impact could occur under the Preferred Alternative and Alternatives Three and Four because they have Industrial land-use designations larger than the Richland UGA. However, the impact would be the most under the No-Action Alternative, because no land-use plan would be available to assist government entities in anticipating and addressing increased demand.

5.5.4 Cumulative Human Health Risk

Risks due to exposure to residual contamination remaining after completion of CERCLA activities would be dependent on the level of access to any particular area where residual contamination remained. Consequently, the cumulative health risk to humans would be expected to be greatest under Alternative Three because it would provide greater access to more areas and would provide more opportunities for development of Hanford Site lands than the other alternatives. Conversely, Alternative Two would have the least potential for cumulative human health risks, because it would provide the least access to Hanford Site lands.

Significant occupational risk to workers could occur under some industrial uses, under both the Industrial-Exclusive and Industrial land-use designations. Agriculture is also traditionally a high risk occupation. Cumulative occupational risk would likely be the greatest under Alternative Three because of the large area designated for Agriculture and the higher level of use associated with the entire Hanford Site. Conversely, occupational risk would be lowest for Alternative Two because industrial risk would be limited to workers in the 200 Areas (similar under all alternatives) and this alternative designates the smallest area for Industrial development.

5.6 Other NEPA Considerations

5.6.1 Unavoidable Adverse Impacts

The potential unavoidable adverse impacts associated with implementation of future land uses on the Hanford Site are described in the following section. Unavoidable adverse impacts are impacts that would occur after implementation of all feasible mitigation measures. Although these impacts would not occur as a result of adoption of any particular land-use plan, unavoidable adverse impacts would occur as a result of development of undisturbed land for other uses. The greatest potential for unavoidable adverse impacts is associated with more intensive land uses and the areal extent of those uses in each alternative. These impacts would be associated with the degree of disturbance of sensitive habitats and loss of cultural resources.

Land-use designations with the greatest potential for unavoidable adverse impacts are Agriculture, Industrial, Industrial-Exclusive, and High-Intensity Recreation. Designations with less potential for unavoidable impacts (but would likely include some unavoidable adverse effects on resources) include Research and Development, Low-Intensity Recreation, Conservation (Mining and Grazing), and Conservation (Mining). Unavoidable adverse impacts would be minimal or nonexistent under the Preservation designation.

The Hanford Site has an abundance of significant cultural resources and conversion of land from the relatively undisturbed condition could result in the loss of significant resources. These resources are considered irreplaceable. The extent of damage to these resources would depend on the extent of the land area converted to intensive uses and the distribution of the resources relative to the location of the disturbance. Some resource locations are more significant than others, and each location must be assessed individually. Mitigation measures, such as data collection, would be implemented but unavoidable adverse impacts associated with destruction of the actual location of resources would occur as a result of some land-use designations.

The Hanford Site also represents on of the last remaining large tracts of the shrub steppe habitat that previously covered extensive areas in eastern Washington State. Intensive use of these lands could result in the loss of significant amounts of this habitat and could potentially lead to listing (as threatened or endangered) species that are dependent upon this habitat. Although lands converted to other uses potentially could revert to the original state, this reversion is unlikely to occur because the land would remain in the developed condition and reversion would require many years.

Physical impacts on terrestrial resources and sensitive habitats (e.g. aquatic habitat, wetlands, shrub-steppe habitat) would be unavoidable under some land-use designations. Permanent loss of habitat for some species of concern could occur and could result in population declines. Habitat loss within the 200 Areas will likely be unavoidable, but these losses are anticipated to be similar under all alternatives. The magnitude of potential physical impacts across other areas on the Hanford Site depends upon the land-use designations associated with particular alternatives.

The Agriculture land-use designation has the greatest potential for unavoidable adverse impacts. Destruction of cultural resource sites, both on the land converted to this use (and, potentially, as a result of increased slumping of the White Bluffs if uncontrolled irrigated agriculture occurs on the Wahluke Slope), would be unavoidable under this designation. Shrub-steppe habitat in areas converted to agricultural use would be lost. Depending on the area of land converted to agriculture, mitigation of habitat loss would not be feasible.

Industrial, Research and Development, and High-Intensity Recreation land-use designations could result in unavoidable adverse impacts to cultural resources and sensitive habitats. The degree of impact would depend on the extent of development. Siting of specific industrial facilities could be modified to minimize impacts. Nevertheless, if large portions of areas designated for Industrial use are ultimately used, cultural and biological resources within the areas would be lost. Similarly, development of High-Intensity Recreational facilities (e.g., golf courses) or Research and Development facilities could involve loss of or damage to resources.

Other potential unavoidable adverse impacts would be associated with grazing of livestock (resulting in damage to habitats that are sensitive to grazing and wetlands), inadvertent or deliberate damage to cultural resources due to increased exposure of resources to humans, and localized damage to resources due to mining activities.

Implementation of Alternative Three would involve the greatest potential for unavoidable adverse impacts. These impacts would be associated with loss of cultural and biological resources due to conversion of extensive areas on the Wahluke Slope to Agriculture and with the area designated for Industrial use, and Research and Development. Alternative Three also includes the greatest extent of land designated for Recreational uses.

The Preferred Alternative also could potentially lead to unavoidable adverse impacts associated with lands designated for Industrial Use, Research and Development, and Conservation (Mining and Grazing). Grazing could adversely impact habitat types that are sensitive to grazing, and wetlands within areas where grazing was permitted. Although impacts associated with other land-use designations could potentially be mitigated, Industrial and Research and Development uses would likely lead to unavoidable adverse impacts to some cultural and biological resources.

Implementation of Alternative Two would have the least potential for unavoidable adverse impacts. This alternative designates virtually the entire Hanford Site for Preservation. Areas designated for other uses occur largely in previously disturbed areas. Unavoidable adverse impacts under this alternative would be minimal and would be associated with Industrial-Exclusive use of the 200 Areas (similar under all alternatives) and with Industrial use in the urban growth area north of the City of Richland, which is smaller than the area designated for Industrial use under all other alternatives.

Alternatives One and Four represent intermediate conditions between Alternative Two and the Preferred Alternative. Potential unavoidable adverse impacts under the No-Action Alternative could involve development of any portion of the Hanford Site in the future, with the exception that this alternative assumes that management on the Wahluke Slope and ALE Reserve would continue to be similar to current management.

5.6.2 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources are related to use of non-renewable resources and the effects that consumption of those resources could have on future generations. Irreversible effects occur as a result of use or destruction of a resource (e.g., energy and minerals) that cannot be replaced within a reasonable time. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored (e.g., extinction of a species or disturbance of a cultural site). Identification of irreversible and irretrievable commitments of resources associated with actions proposed by Federal agencies is required by NEPA.

Table 5-19 summarizes the allocation of Hanford Site lands among the land-use designations under each alternative. Allocation of Hanford Site lands for any particular use would not necessarily lead to irreversible and irretrievable commitments of resources, but the development that could accompany these land-use designations in the near- or long-term could commit resources to development or other use. Commitments of resources for future uses would require review as described in Chapter 6, and project-specific irreversible and irretrievable commitments of resources would require disclosure in NEPA documents prepared for each project.

Table 5-19. Comparisons of Affected Areas by Alternative. (2 pages)

	No-Action	Preferred	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Areas in Hectares						
Agriculture	0	0	0	0	24,371	0
Conservation (Mining and Grazing)	74,115	71,813	9,738	0	6,232	0
Conservation (Mining)	0	1,005	24,992	0	73,544	19,336
Industrial	22,535	16,669	3,661	2,090	17,860	6,881
Industrial-Exclusive	5,064	5,064	4,593	4,593	5,064	5,064
Preservation	46,366	47,961	103,001	140,507	7,967	112,320
High-Intensity Recreation	0	64	64	191	1,768	77
Low-Intensity Recreation	1	593	37	1	3,098	15
Research and Development	0	4,912	1,995	699	8,177	4,388
TOTAL	148,081	148,081	148,081	148,081	148,081	148,081
	No-Action	Preferred	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Areas in Acres						
Agriculture	0	0	0	0	60,222	0
Conservation (Mining and Grazing)	183,142	177,454	24,063	0	15,400	0
Conservation (Mining)	0	2,483	61,757	0	181,731	47,780
Industrial	55,685	41,190	9,047	5,165	44,133	17,003
Industrial-Exclusive	12,513	12,513	11,350	11,350	12,513	12,513
Preservation	114,573	118,514	254,521	347,200	19,687	277,549
High-Intensity Recreation	0	158	158	472	4,369	190
Low-intensity Recreation	2	1,465	91	2	7,655	36
Research and Development	0	12,138	4,930	1,727	20,206	10,843
TOTAL	365,915	365,915	365,915	365,915	365,915	365,915
	No-Action	Preferred	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Areas in Square Miles						
Agriculture	0	0	0	0	94	0
Conservation (Mining and Grazing)	286	277	38	0	24	0
Conservation (Mining)	0	4	96	0	284	75
Industrial	87	64	14	8	69	27
Industrial-Exclusive	20	20	18	18	20	20
Preservation	179	185	398	542	31	434
High-Intensity Recreation	0	0	0	1	7	0
Low-Intensity Recreation	0	2	0	0	12	0
Research and Development	0	19	8	3	32	17
TOTAL	572	572	572	572	572	572

Table 5-19. Comparisons of Affected Areas by Alternative. (2 pages)

	No-Action	Preferred	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Percentage of Area						
Agriculture	0.00%	0.00%	0.00%	0.00%	16.46%	0.00%
Conservation (Mining and Grazing)	50.05%	48.50%	6.58%	0.00%	4.21%	0.00%
Conservation (Mining)	0.00%	0.68%	16.88%	0.00%	49.66%	13.06%
Industrial	15.22%	11.26%	2.47%	1.41%	12.06%	4.65%
Industrial-Exclusive	3.42%	3.42%	3.10%	3.10%	3.42%	3.42%
Preservation	31.31%	32.39%	69.56%	94.89%	5.38%	75.85%
High-Intensity Recreation	0.00%	0.04%	0.04%	0.13%	1.19%	0.05%
Low-Intensity Recreation	0.00%	0.40%	0.02%	0.00%	2.09%	0.01%
Research and Development	0.00%	3.32%	1.35%	0.47%	5.52%	2.96%
TOTAL	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

5.6.3 Conflicts with Land-Use Plans of Other Federal, Regional, State, Local, and Tribal Agencies

The August 1996 Draft HRA-EIS Comprehensive Land-Use Plan (CLUP) identified one vision for the future use of Hanford Site lands. Numerous comments were received by RL from other agencies, Tribal governments, and stakeholders indicating that the a land-use plan for the Hanford Site needed to be developed. These comments indicated that alternative land-use plans needed to be analyzed and compared to plan presented in the CLUP and that DOE needed to identify a Preferred Alternative for future land use at the Hanford Site. As a result of these comments and concerns regarding different visions for the future of Hanford Site lands, DOE initiated a process of coordination and consultation with other Federal, state, and local government agencies, and Tribal governments to develop and analyze potential impacts associated with alternative land-use scenarios for the Hanford Site. DOE has revised the August 1996 Draft HRA-EIS to reflect these concerns and has presented the impact analysis in this Revised Draft HRA-EIS.

Existing plans of other Federal, state, and local agencies, and Tribes have been incorporated as alternatives in the HRA-EIS if those agencies or Tribes elected to provide DOE with a land-use map depicting a vision for the future of Hanford Site lands. DOE cannot speculate with regard to land-use patterns that might be preferred by agencies or Tribes that did not provide a specific vision for the future of land-use at the Hanford Site. Therefore, DOE knows of no existing land-use plans in conflict with the alternatives presented in this Revised Draft HRA-EIS.

The DOE recognizes the interest of the BoR and the BLM in some lands at Hanford Site, and acknowledges the U.S. Atomic Energy Commission's agreement to return lands no longer needed for safeguards and security purposes in the Wahluke Slope to the BoR for development as part of the Columbia Basin Project. DOE also recognizes, as a cooperating agency, the alternative selected in the ROD for the Hanford Reach EIS (NPS 1994). This alternative would, assuming congressional action, designate the land within the Wahluke Slope as a National Wildlife Refuge. DOE and BLM have discussed consolidation of BLM lands within a specific area of the Hanford Site, or the selling of BLM lands to private entities to allow Industrial, Research and Development, or High-Intensity Recreation uses to occur on BLM's scatter tracks if the economic return would find appropriate environmental mitigation elsewhere. These BLM replacement lands would then be subject to BLM management and control (with the exception of lands required to maintain DOE safeguards and security zones around Hanford Site facilities), including waste disposal sites and the 200 Areas.

5.6.4 Relationship Between Near-Term Use and Long-Term Productivity of the Environment

For the purposes of this Revised Draft HRA-EIS, near-term use is defined to encompass the 50-year planning period associated with this EIS. Long-term productivity is defined to encompass the period following this planning window.

DOE anticipates that considerable activity related to ongoing remedial actions will occur at the Hanford Site over the near-term. This activity will likely influence allowable land uses in the near-term. New near-term uses would be consistent with land-use designations adopted in the ROD for this Revised Draft HRA-EIS and remedial activities would be anticipated to support those uses and designations.

Although the land-use alternatives analyzed in this Revised Draft HRA-EIS represent varied viewpoints of the best future use of Hanford Site lands within the near-term, the objective of these plans is establishment of a framework for balancing overlapping long-term needs to meet the requirements of DOE missions, community development, recreational opportunities, and resource preservation. Long-term productivity can be enhanced through this process because conflicting viewpoints regarding the best use of Hanford Site land can be objectively analyzed, and the uses to satisfy the various real and perceived needs can be incorporated into long-term planning. Through this planning process, long-term productivity of Hanford Site lands can be enhanced by establishing areas that would be devoted in the short- and long-term for uses ranging from intensive development to preservation.

Table of Contents

6.0 Implementation of the Comprehensive Land-Use Plan 6-1

6.1 Definitions and Descriptions of Land-Use Map Designations 6-2

6.2 Definitions for Terms Relating to Plan Implementation 6-3

6.3 Hanford CLUP Policies 6-4
6.3.1 Overall Policy 6-5
6.3.2 Protection of Environmental Resources 6-5
6.3.3 Protection of Cultural Resources 6-6
6.3.4 Siting New Development 6-6
6.3.5 Utility and Transportation Corridors 6-7
6.3.6 Economic Development 6-7

6.4 Organizational Structure and Procedure for Review and Approval of Use Requests 6-8
6.4.1 Relationship Between the Site Planning Board and Real Estate Officer . . . 6-8

6.5 Use Requests for Non-Federal Projects 6-8

6.6 Plan Implementation Requirements 6-11
6.6.1 DOE Equivalent to a Municipal or County Planning Approach 6-11
6.6.2 Sitewide Implementation Procedures and CLUP Implementing Controls . . 6-11
6.6.3 Mission-Related Program and Contractor Integration 6-14
6.6.4 Establishment of Site Planning Board 6-15
6.6.5 Amendments to the CLUP 6-15

Figures

6-1. Organizational Structure for CLUP Implementation 6-9
6-2. Review Process for Use Requests 6-10
6-3. Relationships of CLUP, Implementation Procedures, and Controls 6-13

Tables

6-1. Hanford Site Land-Use Designations 6-2
6-2. Similarities Between the Administration of Geographic Areas: RL and Local Jurisdictions 6-12
6-3. A Comparison of RL and Local Cities' and Counties' Existing and Proposed Functional Equivalents 6-12
6-4. CLUP Implementing Controls 6-14

This page intentionally left blank.

6.0 Implementation of the Comprehensive Land-Use Plan

This chapter provides guidance for procedures to implement the Hanford Comprehensive Land-Use Plan (CLUP) for adoption in the Record of Decision (ROD) for the *Hanford Remedial Action Environmental Impact Statement and Comprehensive Land-Use Plan* (HRA-EIS).

Once adopted, the CLUP would provide the framework within which future use of the Hanford Site's lands and resources occurs in order to achieve the visions, goals, and objectives articulated by participants in the land-use planning process. This framework consists of four basic elements:

1. A final ***Hanford CLUP Land-Use Map***, depicting the desired future pattern of land use on the Site (see Chapter 3).

2. ***Hanford CLUP Land-Use Definitions***, describing the purpose, intent, and principal use(s) of each of the land-use designations on the map (see Chapter 3, Table 3-1, and Section 6.1 below).

3. ***Hanford CLUP Policies***, directing future land-use actions. These policies ensure that individual actions of successive administrations shall collectively advance the CLUP's map, goals, and objectives (see policies in Section 6.3 below).

4. ***Hanford CLUP Implementing Procedures***, including:

    - Administrative procedures for reviewing and approving Use Requests for consistency with the CLUP

    - An advisory Site Planning Board (SPB) consisting of representatives from the cooperating agencies and the affected Tribes

    - Actions which, after plan adoption, shall be undertaken to align and coordinate existing and new "area" and "resource" management plans for the Site (e.g., plans for the Fitzner/Eberhardt Arid Lands Ecology Reserve [ALE Reserve]; fire; cultural and historical resources; and species management), with the policies and designations of the CLUP.

For U.S. Department of Energy (DOE) projects, the above procedures and actions shall be integrated with existing DOE land-use review procedures (e.g., biological, cultural, and the *National Environmental Policy Act* [NEPA]). While DOE maintains control of the land, other Federal agencies would be required, as cooperating agencies under NEPA, to follow DOE land use, and DOE's land-use procedures. For private or non-Federal projects, these procedures and actions shall also include an administrative route for referring project review and permitting authority to the local jurisdictions, once a use request is approved (see Section 6.5).

6.1 Definitions and Descriptions of Land-Use Map Designations

The land-use designations of the land-use map depict the categories of land use that can occur within specific geographic locations of the Site. Ideally, the designated use is suitable, based on a broad range of factors including natural and biological resources; existing uses; infrastructure; proximity to other development; economic objectives; and historical, prehistorical, and aesthetic resources and values.

The definitions of the various land-use designations are provided in Table 6-1. These land-use designations and their definitions were developed by the cooperating agencies and are discussed in greater detail in Chapter 3 of this EIS.

Table 6-1. Hanford Site Land-Use Designations.

Land-Use Designation	Definition
Industrial-Exclusive	An area suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes. Includes related activities consistent with Industrial Exclusive uses.
Industrial	An area suitable and desirable for activities, such as reactor operations, rail, barge transport facilities, mining, manufacturing, food processing, assembly, warehouse, and distribution operations. Includes related activities consistent with Industrial uses.
Agricultural	An area designated for the tilling of soil, raising of crops and livestock, and horticulture for commercial purposes along with all those activities normally and routinely involved in horticulture and the production of crops and livestock. Includes related activities consistent with Agricultural uses.
Research and Development	An area designated for conducting basic or applied research that requires the use of a large-scale or isolated facility. Includes scientific, engineering, technology development, technology transfer, and deployment activities to meet regional and national needs. Includes related activities consistent with Research and Development.
High-Intensity Recreation	An area allocated for high-intensity, visitor-serving activities and facilities (commercial and governmental), such as golf courses, recreational vehicle parks, boat launching facilities, Tribal fishing facilities, destination resorts, cultural centers, and museums. Includes related activities consistent with High-Intensity Recreation.
Low-Intensity Recreation	An area allocated for low-intensity, visitor-serving facilities, such as improved recreational trails, primitive boat launching facilities, and permitted campgrounds. Includes related activities consistent with Low-Intensity Recreation.
Conservation (Mining and Grazing)	An area reserved for the management and protection of archeological, cultural, ecological, and natural resources. Limited and managed mining and grazing could occur as a special use (e.g., a permit would be required) within appropriate areas. Limited public access would be consistent with resource conservation. Includes activities related to Conservation (Mining and Grazing), consistent with the protection of archeological, cultural, ecological, and natural resources.
Conservation (Mining)	An area reserved for the management and protection of archeological, cultural, ecological, and natural resources. Limited and managed mining could occur as a special use (e.g., a permit would be required) within appropriate areas. Limited public access would be consistent with resource conservation. Includes activities related to Conservation (Mining), consistent with the protection of archeological, cultural, ecological, and natural resources.
Preservation	An area managed for the preservation of archeological, cultural, ecological, and natural resources. No new consumptive uses (e.g., mining) would be allowed within this area. Public access controls would be consistent with resource preservation requirements. Includes activities related to Preservation uses.

6.2 Definitions for Terms Relating to Plan Implementation

- ***Allowable Use*** -- Any reservation of land for a physical development or land-use activity that is consistent with the land-use designation and policies of the land-use map and CLUP, or a specifically identified part of an approved area management plan (AMP), except for "Amendments" or uses that are identified as "Special Use."

- ***Special Use*** -- The following are special uses:

  1. Any physical development or land-use activity in the Preservation or Conservation designation
  2. AMPs outside of the 200, 300, 400, and 1100 Areas
  3. Any proposed (new) development that is inconsistent with the adopted local counties' or cities' comprehensive plans for the Hanford Site
  4. Mining or extraction activities within areas designated for Conservation
  5. Additions to or enlargements of pre-existing, nonconforming uses
  6. Any proposed new project that establishes an exclusive use zone (EUZ) over lands not currently under an EUZ.

- ***Amendments*** -- Amendments are required for the following:

  1. Any change to the map land-use designation of an area
  2. Any change to CLUP policy
  3. Any change in the use of land or an existing facility to a use that is inconsistent with the map land-use designation.

- ***Area Management Plans (AMPs)*** -- Management plans for specific geographic areas, which may include specific resource management plans, mitigation strategies, and various uses and facilities. An AMP shall be consistent with the CLUP's land-use designations and policies.

- ***Use Request*** — A Use Request is a request to use land or a facility for an activity different from what is currently occurring. This includes soil or vegetation clearing, a lease, or establishing a right-of-way.

- ***Policy*** -- Policies are statements of intent which direct decisions toward the accomplishment of adopted goals and objectives. Policies are applied on a continuous basis and applied consistently over time. Individual actions should neither conflict with, nor be inconsistent with, policies.

- ***Pre-existing, Nonconforming Use*** -- Any lawfully established use that is neither allowed nor conditionally permitted within a land-use designation, but exists therein, having been established prior to the CLUP land-use designation.

- ***Resource Management Plan (RMP)*** -- An RMP contains adopted management standards and strategies for a specific resource. Generally, resources subject to

RMPs are not confined to geographically discrete areas and they are not static (i.e., their characteristics and conditions often vary in time and/or location across the Site). Examples of resources which have RMPs are biological resources (Draft *Biological Resources Management Plan* [BRMaP] [DOE-RL 1996c]), cultural resources (Draft *Cultural Resources Management Plan* [CRMP] [PNL 1989]), and the *Bald Eagle Management Plan* (DOE-RL 1994b). The provisions of each RMP apply wherever its subject resource occurs on the Site, except for areas specifically exempted within the RMP itself.

Several RMPs may apply within an AMP. A single RMP may extend across several AMPs. Where an RMP exists within an AMP, the provisions of both must be integrated toward achieving their common objectives, consistent with land-use designations within which they occur.

- ***RL Manager*** -- The RL Manager is the Manager of the DOE, Richland Operations Office (RL) at the Hanford Site.
- ***RL Site Management Board (SMB)*** — The SMB is made up of Assistant Managers under the RL Manager.
- ***Real Estate Officer (REO)*** — The REO, from the RL Site Infrastructure Division (SID), is the single point of contact for reviewing, processing, and coordinating land-use activities on the Hanford Site.
- ***Shall*** -- For the purpose of Chapter 6 of this EIS, "shall" refers to activities that are mandatory.
- ***Should*** -- For the purpose of Chapter 6 of this EIS, "should" means discretionary.
- ***Site Planning Board (SPB)*** — The SPB is an advisory board to land-use matters on the Hanford Site. The SPB consists of representatives from HRA-EIS cooperating agencies and affected Tribal governments. The SPB reviews Use Requests that are other than "allowable uses" and makes recommendations to the REO.

6.3 Hanford CLUP Policies

The policies connect all other CLUP elements. The policies do the following:

- Establish hierarchies, priorities, and standards relating to land use, resource use, and values
- Integrate competing land and resource goals and objectives
- Provide reference points for addressing unanticipated circumstances and making actual Amendments to the CLUP when necessary
- Identify which RMPs or AMPs shall be developed or undertaken as part of the CLUP implementation.

Land-use and resource-related decisions, actions, and programs should neither conflict with, nor be inconsistent with the adopted CLUP map and policies. If the CLUP is to be implemented, its policies have to be applied on a continuous basis and applied consistently over time. The Hanford CLUP policies are described below. They are a synthesis of stated values and objectives from the DOE, Future Site Uses Working Group, Hanford Advisory Board, August 1996 Draft HRA-EIS public hearing, cooperating agencies, and those associated with municipal and county land-use planning principals.

6.3.1 Overall Policy

The CLUP policy is to accomplish the following for the Hanford Site:

1. Protect the Columbia River and associated natural and cultural resources and water quality.

2. Wherever possible, locate new development, including cleanup and remediation-related projects, in previously disturbed areas.

3. Protect and preserve the natural and cultural resources of the Site for the enjoyment, education, study, and use of future generations.

4. Honor treaties with American Indian Tribes as they relate to land uses and resource uses.

5. Reduce the area of Exclusive Use Zone (EUZ) boundaries, established as exclusion zones under DOE O 151.1, *Comprehensive Emergency Management System*, to protect the public from inherently hazardous operations (DOE 1996f).

6. Allow access for other uses (e.g., recreation) outside of active waste management areas which are consistent with administrative controls.

7. Ensure that a public involvement process is used for implementing the land-use designations and amending the CLUP to respond to changing conditions.

8. As possible, remove pre-existing, nonconforming uses.

9. Facilitate cleanup and waste management.

6.3.2 Protection of Environmental Resources

The CLUP policy is to accomplish the following for the Site:

1. Protect and sustain native species and their habitats on the Site. The Conservation and Preservation land-use designations are the primary land-use controls to accomplish this policy. Within the Conservation and Preservation designations, land uses shall be consistent with the purpose of the designation and all impacts shall be mitigated. Implementation mechanisms such as the Draft *Biological Resources Management Plan and Implementation Strategy* [BRMiS] (DOE-RL 1996d), and habitat management plans augment these designations for development review and approval sitewide. Developments for public access and recreation should be according to adopted AMPs depicting management of use, and siting of support facilities.

2. Within land-use designations other than Conservation and Preservation, mitigate unavoidable (residual) impacts at locations by enhancing habitats within the Conservation or Preservation designations. To accomplish this, undertake the following actions:

   a. Modify the BRMaP (DOE-RL 1996c) and BRMiS (DOE-RL 1996d) to be consistent with this policy, implement this policy, and adopt both documents as implementing procedures.

   b. Review habitat management plans to redirect their actions and strategies, where necessary and possible, to the Conservation and Preservation designations.

   c. Make provisions for the protection of "vulnerable aggregations," as defined by the Washington Department of Fish and Wildlife, for nongame species wherever they occur on the Site.

3. Require that projects be set back from the Preservation and Conservation designation boundaries.

6.3.3 Protection of Cultural Resources

The CLUP policy is to accomplish the following for the Site:

1. Protect and sustain cultural resources on the Site. The Conservation and Preservation land-use designations are the primary land-use controls to accomplish this policy. The CRMP address those actions where land-use controls are not the appropriate mitigation. Within the Conservation and Preservation designations, land uses shall be consistent with the purpose of the designation and all impacts mitigated. Implementation mechanisms such as the CRMP (PNL 1989), and habitat management plans augment these designations for development review and approval sitewide. Developments for public access and recreation should be according to adopted AMPs depicting management of use, and siting of support facilities.

2. Proposed developments within areas of cultural sensitivity (e.g., the Columbia River Corridor or Gable Mountain), should be reviewed and approved in accordance with the BRMaP (DOE-RL 1996c) and the CRMP (PNL 1989) and reflected in the applicable AMP.

6.3.4 Siting New Development

The CLUP policy is to accomplish the following for the Site:

1. Locate and approve new developments in areas consistent with the adopted Hanford CLUP.

2. Locate proposed projects in those areas of the Hanford Site where the adopted CLUP and the local cities' and counties' land-use maps are consistent.

3. Within all land-use designations, previously disturbed areas (as defined by the BRMaP) should be developed first, followed by the acreages with the least sensitive biological and cultural resources. Within the site plan of any proposed new development, the acreages with the most sensitive biological and cultural resources should be worked into natural open space for landscaping, buffers, natural drainage areas, etc.

4. Focus on using existing infrastructure and developed areas for new projects within a land-use designation.

   a. Locate new development in close proximity to existing infrastructure unless a project requires an isolated site away from incompatible uses.

   b. Concentrate development on or adjacent to existing infrastructure. Where extensions of infrastructure are necessary, minimize the extension of infrastructure into undeveloped areas.

   c. Site, plan, and design development to avoid significant impacts on resources. Mitigate unavoidable impacts through design to minimize impacts and mitigation costs associated with biological and cultural resources.

6.3.5 Utility and Transportation Corridors

The CLUP policy is to accomplish the following for the Site:

1. With identified exception(s), existing utility and transportation corridor rights-of-way are the preferred routes for expanded capacity and new infrastructure.

2. Existing utility corridors that are in actual service, clearly delineated, and of defined width, are not considered "nonconforming" uses in any land-use designation.

3. Utility corridors and systems considered to be nonconforming uses shall be identified in the applicable RMP or AMP.

4 Avoid the establishment of new utility corridors within the Conservation and Preservation designations unless the use of an existing corridor(s) is infeasible.

5. Avoid the location of new above-ground utility corridors and systems in the immediate viewshed of an American Indian sacred site. Prioritize for removal existing nonconforming utility corridors and systems in such areas.

6.3.6 Economic Development

It is the CLUP policy to promote the following for the Site:

1. Multiple land uses of both the private and public sector.

2. Protection and maintenance of existing functional infrastructure and utilities for use in economic development and Site transition.

3. Future Federal missions and programs, consistent with the provisions of the CLUP.

4. Protection of natural, historic, and cultural resources as essential elements of a recreation and tourism economy.

5. Reduction or elimination of existing conditions which are impediments to the realization of the land-use designations (e.g., scattered withdrawn Public Domain land, contamination, and nonconforming and abandoned developments).

6.4 Organizational Structure and Procedure for Review and Approval of Use Requests

It is intended that the existing organizational structure within RL be used to implement the Hanford CLUP, augmented with a SPB consisting of representatives from cooperating agencies and affected Tribal governments. The organizational structure for implementation of the Hanford CLUP is shown in Figure 6-1.

Submitted Use Requests, depending on their purposes, locations, and other circumstances, shall be reviewed for consistency with the Hanford CLUP. Depending on the type of Use Request, different tracks of review would occur. The REO shall determine if a Use Request is reviewed as either an "Allowable Use," "Special Use," or "Amendment"; coordinate input between the project manager, SPB, SMB, RL, and contractor support; and forward the Use Request to the NEPA Compliance Officer for processing under NEPA. Figure 6-2 depicts the routing of Use Requests for review.

6.4.1 Relationship Between the Site Planning Board and Real Estate Officer

The SPB is recommended by the cooperating agencies and RL as a function essential to successful implementation of the CLUP. The SPB directly interfaces with the REO to advise DOE on a prescribed range of land-use and resource-management issues. The SPB shall consist of representatives from the cooperating agencies and affected Tribal governments involved in the development of this EIS.

The SPB shall work in concert with the REO to implement the decisions made in the HRA-EIS ROD. The SPB shall also review and provide advice for "area" and "resource" management plans to govern land-use activities, and provide policy advice to RL in areas involving coordination of land and resource management within the boundaries of the Hanford Site.

6.5 Use Requests for Non-Federal Projects

Proponents and entities of non-Federal projects shall follow the approval process for Use Requests onsite (Section 6.4). The county or city will be invited to cooperate early in the Use Request and in the NEPA review process (Figure 6-2). The Use Requests for non-Federal projects, involving new construction, shall be required to comply with local review and permitting requirements.

Figure 6-1. Organizational Structure for CLUP Implementation.

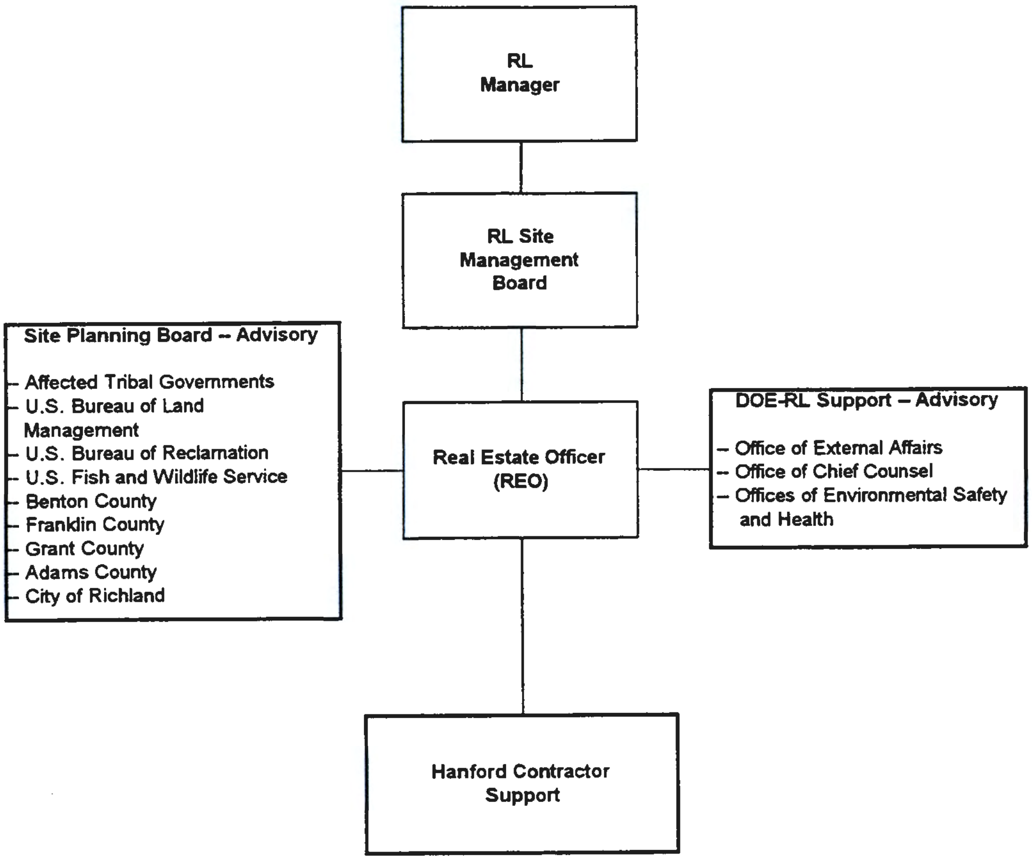
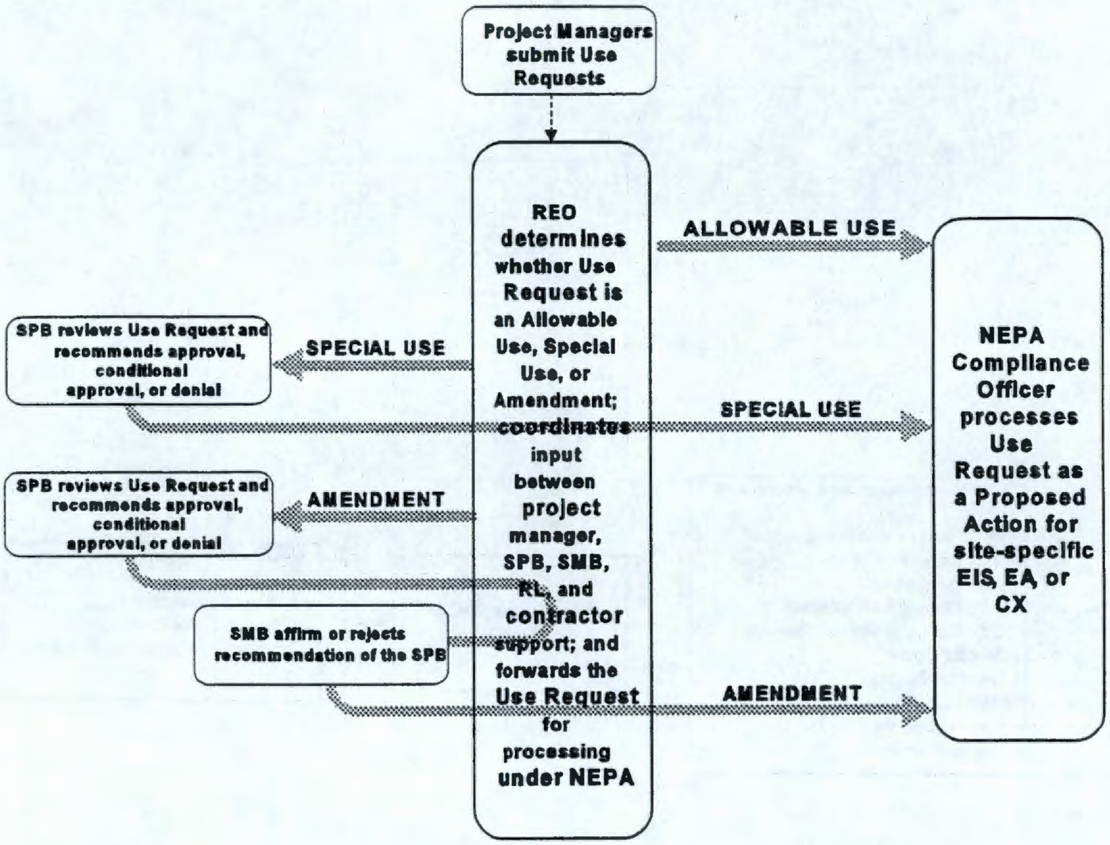


Figure 6-2. Review Process for Use Requests.



6.6 Plan Implementation Requirements

After the HRA-EIS ROD is approved, actions presented in this section are necessary to ensure that the plan is implemented. The objectives of these actions are as follows:

- To streamline and integrate procedures for project review, including ensuring project consistency with the plan, pre-planning for large areas, siting new developments, providing and using infrastructure and utilities, managing resources, notifying the public, and conducting environmental review.

- To make decisions on the use of lands and resources on the Site within the framework of existing DOE legal and administrative procedures, but with an implementation process that parallels, and efficiently coordinates with local land-use regulatory processes, and provides similar accountability and tracking.

- To make adjustments in existing DOE administrative structures as necessary to efficiently implement the CLUP.

Achieving these objectives is essential to accomplishing DOE missions and working with Federal, Tribal, and local cities and counties to jointly accomplish planning goals, economic transition, and multiple uses of the Site.

6.6.1 DOE Equivalent to a Municipal or County Planning Approach

Given the mutual objectives of RL and local governments to coordinate on privatization and transition, the management of uses of real estate at the Hanford Site should be done with procedures that are functionally equivalent to, or compatible with, the administration of land use in the adjacent municipality or county. Currently, there are similarities which are amenable to closer alignment. Table 6-2 shows the similarities between geographic segmentations (e.g., a city in the county is similar to an area on the Hanford Site). Table 6-3 shows the similarities between local land-use regulatory procedures and implementation processes on the Hanford Site which, if aligned and coordinated, would improvement management of resources.

6.6.2 Sitewide Implementation Procedures and CLUP Implementing Controls

Figure 6-3 shows the hierarchical relationships between the CLUP, the sitewide implementation procedures, and the implementation controls. Effective implementation of the CLUP, in coordination with local jurisdictions, requires that these components must be aligned and integrated into a coherent system of sitewide implementation procedures and implementation controls to carry out the CLUP over the long term. The completion of this system should be accomplished within 24 months of the issuance of the HRA-EIS ROD, under the direction of the RL Assistant Manager for Facilities Transition.

Table 6-4 shows the implementing controls (RMPs and AMPs) required for implementation of the CLUP. These controls are tools to ensure that land-use actions are consistent with the CLUP. Prior to the adoption of the controls, each should be reviewed for consistency and alignment with the CLUP, in accordance with the following list of tasks. Tasks 1 through 6 should be performed sequentially, while Task 7 may be completed at any time. Completion of these tasks would integrate the various RMPs, AMPs, and project review activities currently in use on the Site with the sitewide CLUP implementation procedures.

Table 6-2. Similarities Between the Administration of Geographic Areas: RL and Local Jurisdictions.

Municipal and County Land Use	=	DOE Equivalent
Region	=	Region
County	=	Hanford Site
City	=	Area (e.g., 100, 200, and 300)
Neighborhood or Industrial Park	=	Complex (e.g., TWRS)
Site, Lot, and Parcel	=	Site, Lot, and Parcel
Facility, Utility, and Infrastructure	=	Facility, Utility, and Infrastructure

Table 6-3. A Comparison of RL and Local Cities' and Counties' Existing and Proposed Functional Equivalents.

Existing Municipal or County Process	=	DOE Equivalent
Administrator: Planning Department Director • Reviews for consistency with Comprehensive Plan • Coordinates land-use review (e.g., Planning Commission, Board of Adjustment, and Board of County Commissioners) • Administrative/discretionary approval • Administers State Environmental Policy Act (SEPA)	= = = = =	Administrator: REO • Reviews for consistency with CLUP • Coordinates review of Use Requests for real estate (e.g., Site Planning Board, Site Management Board, and Site Manager) • Not applicable NEPA Compliance Officer
Comprehensive Plan • Map • Policies	= = =	CLUP • Map • Policies
Regulatory Review • Protocols for coordination of Department and agency review	= =	Sitewide Implementation Procedures • Protocols for coordination of program and agency review
Official Controls • Zoning ordinances • Subdivision ordinances • Critical Resources Protection Ordinances • Shoreline Management Plan • SEPA • Uniform Building Codes • Approval of building permits • Occupancy permits by Building Department • Other controls	= = = = = = = = =	Implementation Controls • Design standards • Location and development requirements • Resource Management Plans • Area Management Plans • NEPA • Uniform Building Codes • Approval of Use Requests • Occupancy permit by Fire Marshal • Other controls

1. Identify all "functionally equivalent" or related documents, policies, and procedures.

2. Review documents and associated policies and procedures for consistency with the CLUP map and policies.

3. Identify changes necessary to align documents and associated policies and procedures with the provisions of the CLUP.

Figure 6-3. Relationships of CLUP, Implementation Procedures, and Controls.

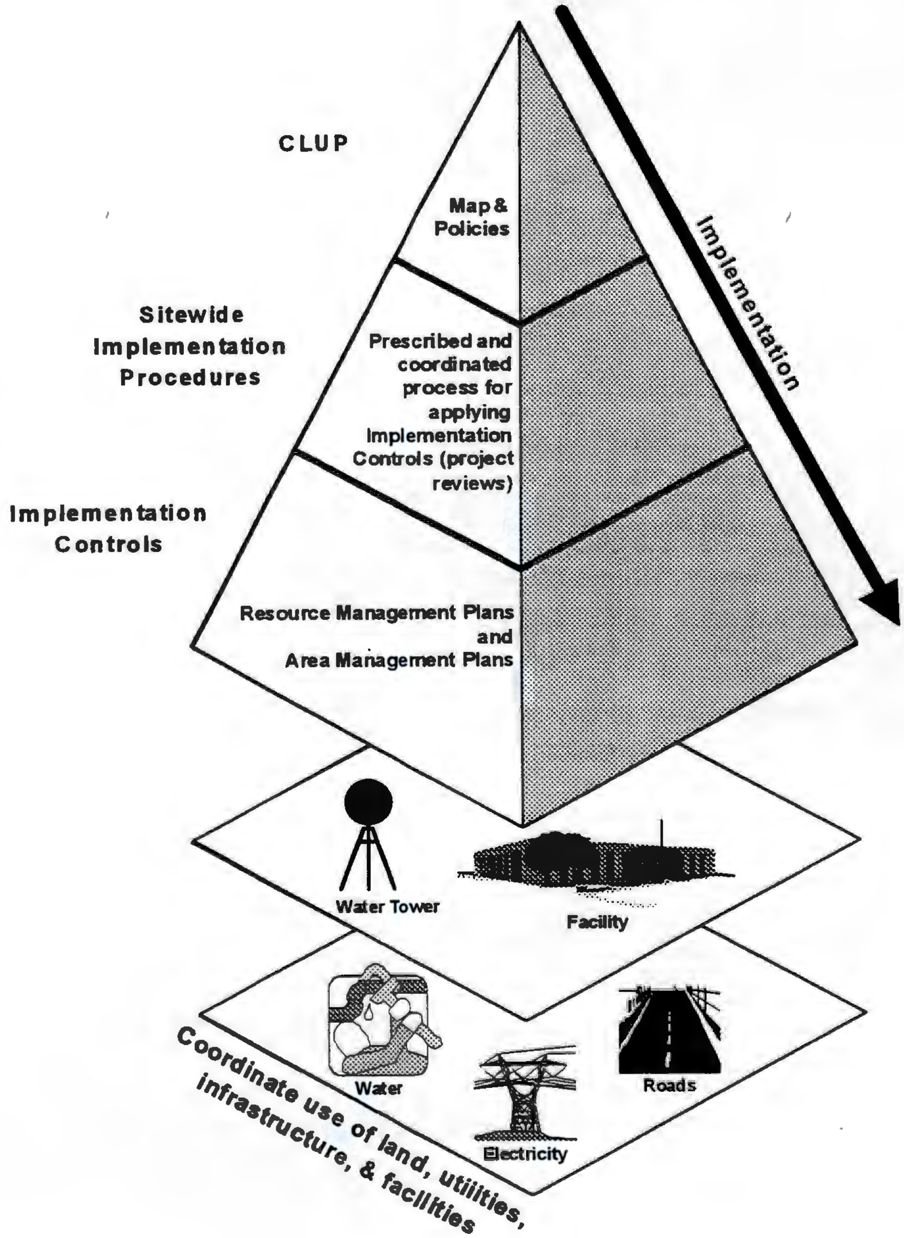


Table 6-4. CLUP Implementing Controls.

Resource Management Plans	To Be Prepared	Current Draft	Current Final
Hanford Cultural Resource Management Plan		✔	
Hanford Biological Resource Management Plan		✔	
Hanford Bald Eagle Management Plan			✔
Fire Management Plan			✔
Hanford Steelhead Management Plan	✔		
Aesthetic and Visual Resource Management Plan	✔		
Facility and Infrastructure Assessment and Strategy	✔		
Mineral Resource Management Plan (i.e., soils, sand, gravel, and basalt)	✔		
Noxious Weed Management Plan			✔
Area Management Plans	**To Be Prepared**	**Current Draft**	**Current Final**
ALE Area Management Plan	✔		
Wahluke Slope Area Management Plan	✔		
Columbia River Corridor Area Management Plan	✔		
South 600 Area Management Plan (includes 300 Area)	✔		

4. Prepare recommendations to amend existing documents and associated policies and procedures so they are consistent with and carry out the CLUP.

5. Prepare new RMPs and AMPs.

6. Submit Amendments and new plans to the REO for review as Special Use Requests so these changes may be integrated with the CLUP implementation procedures as standards for project review (see Figures 6-1 and 6-2).

7. Integrate the provisions of the documents (Table 6-4) into the CLUP sitewide implementation procedure.

6.6.3 Mission-Related Program and Contractor Integration

It is recommended that the CLUP map and policies be integrated with and addressed at the threshold decision points of all authorizations, operational plans, (e.g., Hanford Strategic Plan) and actions. This includes contracts and budget proposals that directly or indirectly affect land use on the Site so they will not create conflicts with the CLUP, or fail to forward its map and policy objectives where the opportunity and ability to do so exists.

6.6.4 Establishment of Site Planning Board

The establishment and seating of the SPB (see Figures 6-1 and 6-2) shall be accomplished within two months from the issuance of the HRA-EIS ROD. Prescribed charter and guidelines will need to be developed by this board.

6.6.5 Amendments to the CLUP

The CLUP is a living document designed to hold a chosen course over an extended period of development and management of resources, yet the plan is flexible enough to accommodate a wide spectrum of both anticipated and unforeseen mission conditions. A fundamentally good plan can do this for a relatively short period of time (5 years), during which monitoring, data gathering, and analysis for the purposes of "fine tuning" and improving the plan by Amendment should be an ongoing program. It is recommended that a reassessment of the CLUP should occur every 5 years, in the form of a NEPA ROD review per 10 CFR 1021, by the RL NEPA Compliance Officer and the SPB.

This page intentionally left blank.

Table of Contents

7.0 Consultations, Laws, and Requirements 7-1

7.1 Federal Laws 7-1
7.1.1 Treaties of the United States with American Indian Tribes of the Hanford Region 7-1
7.1.2 International Treaties of the United States 7-2
7.1.2.1 *Migratory Bird Treaty Act of 1918* 7-2
7.1.2.2 *Pacific Salmon Treaty Act of 1985* 7-2
7.1.3 Federal Natural Resource Management, Pollution Control, and Cultural Resource Laws 7-2
7.1.3.1 *National Environmental Policy Act of 1969* 7-2
7.1.3.2 *Clean Air Act of 1970* 7-2
7.1.3.3 *Safe Drinking Water Act of 1974* 7-3
7.1.3.4 Clean Water Act of 1977 7-3
7.1.3.5 *Resource Conservation and Recovery Act of 1976* 7-3
7.1.3.6 *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* 7-4
7.1.3.7 *Emergency Planning and Community Right-to-Know Act of 1986* 7-4
7.1.3.8 *Toxic Substances Control Act of 1976* 7-4
7.1.3.9 *Pollution Prevention Act of 1990* 7-4
7.1.3.10 *National Historic Preservation Act of 1966* 7-5
7.1.3.11 *Archaeological Resources Protection Act of 1979* 7-5
7.1.3.12 *Native American Graves Protection and Repatriation Act of 1990* 7-5
7.1.3.13 *American Indian Religious Freedom Act of 1978* 7-5
7.1.3.14 *Endangered Species Act of 1973* 7-5
7.1.3.15 *Bald and Golden Eagle Protection Act of 1972* 7-5
7.1.3.16 *Wild and Scenic Rivers Act of 1968* 7-6
7.1.3.17 *Nuclear Waste Policy Act of 1982* 7-6
7.1.3.18 *Atomic Energy Act of 1954* 7-6
7.1.3.19 *Occupational Safety and Health Act of 1970* 7-6
7.1.3.20 *Comprehensive Conservation Study of the Hanford Reach of the Columbia River*, Public Law 100-605 7-6
7.1.3.21 *Mining Law of 1872*, as amended 7-7
7.1.3.22 Archeological and Historic Preservation Act of 1974 7-7
7.1.3.23 *Fish and Wildlife Conservation Act of 1980* 7-7
7.1.3.24 *Fish and Wildlife Coordination Act of 1934.* 7-7
7.1.3.25 *National Wildlife Refuge System Administration Act of 1966.* . . 7-7
7.1.3.26 Noise Control Act of 1972. 7-7
7.1.3.27 *American Antiquities Preservation Act of 1906.* 7-7
7.1.3.28 *Federal Insecticide, Fungicide, and Rodenticide Act of 1972.* . . 7-8
7.1.3.29 *Federal Land Policy and Management Act of 1976* 7-8
7.1.3.30 *Federal Water Pollution Control Act Amendments of 1972.* 7-8
7.1.3.31 *Historic Sites, Buildings, and Antiquities Act of 1965* 7-8
7.1.3.32 *Materials Act of 1947* 7-8
7.1.3.33 *Federal Urban Land-Use Act of 1949* 7-8
7.1.3.34 Public Law 104-201, *National Defense Authorization Act* 7-8

7.2 State Laws 7-8
7.2.1 *State Environmental Policy Act of 1971* 7-8
7.2.2 *Hazardous Waste Management Act of 1976* 7-9
7.2.3 *Model Toxics Control Act of 1989* 7-9
7.2.4 *Water Pollution Control Act of 1945* 7-9
7.2.5 *Growth Management Act of 1989* 7-9
7.2.6 Air Quality Regulations 7-10
7.2.7 *The Shoreline Management Act of 1971* 7-10

7.3 Executive Orders 7-11
7.3.1 Executive Order 11508, *Providing for the Identification of Unneeded Federal Real Property* 7-11
7.3.2 Executive Order 11593, *Protection and Enhancement of the Cultural Environment* 7-11
7.3.3 Executive Order 11724, *Federal Property Council* 7-11
7.3.4 Executive Order 11988, *Floodplain Management* 7-11
7.3.5 Executive Order 11990, *Protection of Wetlands* 7-11
7.3.6 Executive Order 12088, *Federal Compliance with Pollution Control Standards* 7-11
7.3.7 Executive Order 12372, *Intergovernmental Review of Federal Programs* 7-12
7.3.8 Executive Order 12411, *Government Work Space Management Reforms* 7-12
7.3.9 Executive Order 12512, *Federal Real Property Management* 7-12
7.3.10 Executive Order 12580, *Superfund Implementation* 7-12
7.3.11 Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements* 7-12
7.3.12 Executive Order 12866, *Regulatory Planning and Review* 7-13
7.3.13 Executive Order 12875, *Enhancing the Intergovernmental Partnership* 7-13
7.3.14 Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* 7-13
7.3.15 Executive Order 13007, *Indian Sacred Sites* 7-13
7.3.16 Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* 7-14

7.4 Presidential and Executive Branch Policies 7-14

7.5 U.S. Department of Energy Regulations, Orders, and Other Agreements and Requirements 7-14

7.6 Consultations 7-15
7.6.1 Consultation with Other Federal Agencies 7-16
7.6.2 Consultation with Affected Tribal Governments 7-16
7.6.3 Consultation with State and Local Governments 7-17

7.0 Consultations, Laws, and Requirements

This chapter summarizes the major laws, regulations, Executive Orders, and U.S. Department of Energy (DOE) regulations, orders, and agreements that might apply to future Hanford Site land uses. The Federal, Tribal, state, and local agencies that were consulted by the DOE during the preparation of the HRA-EIS are also identified.

7.1 Federal Laws

Relevant laws of the United States that might apply to the implementation of the land-use alternatives at the Hanford Site are discussed in the sections that follow.

7.1.1 Treaties of the United States with American Indian Tribes of the Hanford Region

In May and June of 1855, at Wai-i-lat-pu (near present-day Walla Walla, Washington), leaders of various Columbia Plateau American Indian Tribes and Bands negotiated treaties with representatives of the United States. The negotiations resulted in three treaties, one with the fourteen tribes and bands of what would become the Confederated Tribes and Bands of the Yakama Indian Nation, one with the three tribes that would become the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), and one with the Nez Perce Tribe. The treaties were ratified by the U.S. Senate in 1859. The negotiated treaties are as follows:

- Treaty with the Walla Walla, Cayuse, etc. (June 9, 1855; 12 Stats. 945)
- Treaty with the Yakama (June 9, 1855; 12 Stats. 951)
- Treaty with the Nez Perce (June 11, 1855; 12 Stats. 957).

The terms of all three treaties are essentially the same. Each of the three Tribal organizations agreed to cede large blocks of land to the United States. The Tribes retained certain lands for their exclusive use (the three reservations) and also retained the rights to continue traditional activities outside the reservations. These reserved rights include the right to fish (and erect fish-curing facilities) at usual and accustomed places. These rights also include rights to hunt, gather foods and medicines, and pasture livestock on open and unclaimed lands.

The act of treaty-making between the United States and an Indian Tribe has many legal consequences for both entities. The United States recognizes the existence of the Tribe as a sovereign and initiates a government-to-government relationship with the Tribe. At the same time, the Tribe loses some aspects of its sovereignty, such as the right to negotiate (independently of the United States) with other foreign powers. In return, the United States and the Tribe enter into a trust relationship, whereby the United States assumes the responsibility to preserve the rights and resources of the Tribe from incursions by private entities, states, or the Federal government itself. One aspect of this trust duty is the need to consult with the Tribes concerning decisions made by the Federal government that could affect Tribal rights or resources. In addition to these general legal consequences of treaty-making, the individual treaty itself defines particular new roles and responsibilities of the two governments, within the terms of the new legal relationship created by the treaty.

Every Federal agency that makes decisions potentially affecting the rights or resources of Federally recognized American Indian Tribes shares in the trust responsibility duties of the Federal government. This trust responsibility includes the duty to consult with those Tribes concerning the potential impacts of agency decisions. As a result, DOE regularly consults with the CTUIR, the Confederated Tribes of the Yakama Indian Nation, and the Nez Perce Tribe concerning decisions being made by DOE on the Hanford Site that might affect Tribal rights or resources. Land-use planning decisions are within the realm of such decisions. DOE invited all affected Tribes to participate in the drafting of the HRA-EIS. The U.S. Department of Energy, Richland Operations Office (RL) will continue to consult with these Tribes during the further development and implementation of this environmental impact statement (EIS). Copies of the Treaties are presented in Appendix B.

7.1.2 International Treaties of the United States

7.1.2.1 Migratory Bird Treaty Act of 1918. The *Migratory Bird Treaty Act of 1918*, as amended, is intended to protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia. The law regulates the harvest of migratory birds by specifying factors such as the mode of harvest, hunting seasons, and bag limits. This Act stipulates that, except as permitted by regulations, it is unlawful at any time, by any means, or in any manner to "kill . . . any migratory bird." The DOE is required to consult with the U.S. Fish and Wildlife Service (USFWS) regarding impacts to migratory birds and to evaluate ways to avoid or minimize impacts in accordance with the USFWS migration policy.

7.1.2.2 Pacific Salmon Treaty Act of 1985. The *Pacific Salmon Treaty Act of 1985* ratified a treaty between the United States and Canada concerning Pacific salmon. The law is intended to protect and maintain Pacific salmon fisheries by regulating the fishing season. The law establishes panels with jurisdiction over certain areas. Associated regulations close the panel area to sockeye and pink salmon fishing unless opened by panel regulations or by in season orders of the Secretary of Commerce that give the effect to panel orders.

7.1.3 Federal Natural Resource Management, Pollution Control, and Cultural Resource Laws

7.1.3.1 National Environmental Policy Act of 1969. The *National Environmental Policy Act of 1969* (NEPA), as amended, establishes a national policy that encourages awareness of the environmental consequences of human activities and promotes consideration of those environmental consequences during the planning and implementing stages of a project. Under NEPA, Federal agencies are required to prepare detailed statements to address the environmental effects of proposed major Federal actions that might significantly affect the quality of the human environment. The HRA-EIS has been prepared in accordance with NEPA requirements and policies, and presents reasonable alternatives and the potential environmental consequences of those alternatives.

7.1.3.2 Clean Air Act of 1970. The *Clean Air Act of 1970* (CAA), as amended, is intended to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Section 118 of the CAA requires each Federal agency, with jurisdiction over properties or facilities engaged in any activity that might result in the discharge of air pollutants, to comply with all Federal, state, interstate, and local requirements with regard to the control and abatement of air pollution.

Under Section 109 of the CAA, the U.S. Environmental Protection Agency (EPA) is required to establish national ambient air quality standards (NAAQS) that protect public health from known or anticipated adverse effects of a regulated pollutant. Section 111 of the CAA requires establishment of national performance standards for new or modified stationary sources of atmospheric pollutants. Specific emission increases must be evaluated in order to prevent significant deterioration of air quality. Hazardous air pollutants, including radionuclides, are regulated separately. Emissions of air pollutants are regulated by the EPA in the *Code of Federal Regulations* (CFR),40 CFR 50-99. Radionuclide emissions and hazardous air pollutants are regulated under the National Emissions Standards for Hazardous Air Pollutants Program (40 CFR 61 and 40 CFR 63).

7.1.3.3 Safe Drinking Water Act of 1974. The primary objective of the *Safe Drinking Water Act of 1974* (SDWA), as amended, is to protect the quality of the public water supply and sources of drinking water. In the State of Washington, the EPA has the authority to implement regulations to establish standards applicable to public water systems. These regulations further establish the maximum contaminant levels, including maximum levels of radioactivity, that are allowed in public drinking water systems. The EPA has promulgated the SDWA requirements in 40 CFR 140-149. Current regulations (40 CFR 141) specify that the average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 mrem/yr. Revisions to the limits regulating radionuclides have been proposed by the EPA.

Other programs established by the SDWA include the Sole Source Aquifer Program, the Wellhead Protection Program, and the Underground Injection Control Program.

7.1.3.4 Clean Water Act of 1977. The *Clean Water Act of 1977* (CWA), as amended, was enacted to "restore and maintain the chemical, physical and biological integrity of the Nation's water." The CWA prohibits "discharge of toxic pollutants in toxic amounts" to navigable waters of the United States. Section 313 of the CWA requires all branches of the Federal government with jurisdiction over properties or facilities engaged in any activity that might result in a discharge or runoff of pollutants to surface waters, to comply with Federal, state, interstate, and local requirements.

In addition to setting water quality standards for waterways, the CWA provides guidelines and limitations for effluent discharges from point sources and gives authority for the EPA to implement the National Pollutant Discharge Elimination System (NPDES) Permitting Program. The NPDES Program is administered by the Water Management Division of the EPA (40 CFR 122).

In 1987, the CWA was amended and EPA was required to establish regulations for issuing permits for stormwater discharges associated with industrial activity. Stormwater discharges are permitted through the NPDES Program, and general permit requirements are published in 40 CFR 122.

7.1.3.5 Resource Conservation and Recovery Act of 1976. Treatment, storage, and/or disposal of hazardous and nonhazardous waste is regulated under the *Solid Waste Disposal Act of 1965,* which was amended by the *Resource Conservation and Recovery Act of 1976* (RCRA), and the *Hazardous and Solid Waste Amendments of 1984*. Any state that seeks to administer and enforce a hazardous waste program pursuant to RCRA may apply for EPA authorization of the state program. The Washington State Department of Ecology (Ecology) has been delegated the authority for implementing the Federal RCRA program in the State of Washington. The EPA regulations implementing RCRA define hazardous wastes and specify the transportation, handling, and waste management requirements of these wastes (40 CFR 260-280).

The *Federal Facilities Compliance Act of 1992* (FFCA) amends RCRA and waives sovereign immunity for fines and penalties for RCRA violations at Federal facilities. A provision of the FFCA postpones fines and penalties for three years for mixed waste storage prohibition violations at DOE sites and requires the DOE to prepare plans for developing the required treatment capacity for mixed waste stored or generated at each facility. Each plan must be approved by the host state or the EPA, after consultation with other affected states, and a consent order requiring compliance with the plan must be issued by the regulator. The FFCA also states that the DOE will not be subject to fines and penalties for land disposal restriction storage prohibition violations for mixed waste as long as the DOE is in compliance with an approved plan and consent order and meets all other applicable regulations.

7.1.3.6 Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) provides a statutory framework for the remediation of waste sites containing hazardous substances and, as amended by the *Superfund Amendments and Reauthorization Act of 1986* (SARA), an emergency response program in the event a release (or threat of a release) of a hazardous substance to the environment occurs. Using a hazard ranking system, Federal and private contaminated sites are ranked and may be included on the National Priorities List. CERCLA requires Federal facilities with contaminated sites to undertake investigations, remediation, and natural resource restoration, as necessary.

7.1.3.7 Emergency Planning and Community Right-to-Know Act of 1986. Under Subtitle A of the *Emergency Planning and Community Right-to-Know Act of 1986*, also known as the *Superfund Amendments and Reauthorization Act of 1986* (SARA Title III), Federal facilities are required to provide information regarding the inventories of chemicals used or stored at a site and releases from that site to the State Emergency Response Commission and the Local Emergency Planning Committee. This requirement ensures that emergency plans are sufficient to respond to unplanned releases of hazardous substances. Implementation of provisions in the *Emergency Planning and Community Right-to-Know Act of 1986* began voluntarily in 1987; inventory and emissions reporting began in 1988 based on 1987 activities and information. The requirements of the *Emergency Planning and Community Right-to-Know Act of 1986* are promulgated by the EPA in 40 CFR 350-372. The DOE requires compliance with SARA Title III.

7.1.3.8 Toxic Substances Control Act of 1976. The *Toxic Substances Control Act of 1976* (TSCA) provides the EPA with the authority to require testing of chemical substances (both new and old) entering the environment and, where necessary, to regulate those chemicals. The law complements and expands other toxic substance laws such as Section 112 of the CAA and Section 307 of the CWA. The TSCA was enacted because there were no Federal regulations requiring evaluation of potential environmental or health effects from the thousands of chemicals being developed and released to the public or commerce annually. The TSCA also regulates the treatment, storage, and disposal of certain toxic substances (e.g., polychlorinated biphenyls, chlorofluorocarbons, asbestos, dioxins, certain metal-working fluids, and hexavalent chromium).

7.1.3.9 Pollution Prevention Act of 1990. The *Pollution Prevention Act of 1990* establishes a national policy for waste management and pollution control. This Act focuses first on source reduction, followed sequentially by environmentally safe recycling and treatment and, as a last resort, disposal or other release into the environment. The DOE has committed to participation in Section 313 of SARA, the EPA 33/50 Pollution Prevention Program. The goal for facilities involved in Section 313 compliance is a 33 percent reduction in releases of 17 priority chemicals by 1997 (based on a 1993 baseline). On August 3, 1993, Executive Order 12856 was issued. This Executive Order expands the 33/50 Pollution Prevention Program and requires the DOE to reduce total releases of all toxic chemicals by 50 percent by December 31, 1999. Each DOE site is, therefore, establishing site-specific goals to reduce generation of all waste types.

7.1.3.10 *National Historic Preservation Act of 1966*. The *National Historic Preservation Act of 1966*, as amended, requires nomination for placement of sites with significant national historic value on the National Register of Historic Places (NPS 1988). Permits and certifications are not required under this Act; however, consultation with the Advisory Council on Historic Preservation is required if a Federal undertaking might impact a historic property resource. This consultation generally results in a Memorandum of Agreement (MOA) that includes stipulations to minimize adverse impacts to the historic resource. Coordination with the State Historic Preservation Office is undertaken to ensure that potentially significant sites are properly identified and appropriate mitigation measures are implemented.

7.1.3.11 *Archaeological Resources Protection Act of 1979*. The *Archaeological Resources Protection Act of 1979*, as amended, requires a permit for any excavation or removal of archaeological resources from Federal or Indian lands. Excavations must be undertaken for the purpose of furthering archaeological knowledge in the public interest, and resources removed are to remain the property of the United States. Consent must be obtained from the Indian Tribe or the Federal agency having authority over the land on which a resource is located before issuance of a permit; the permit must contain terms and conditions requested by the Tribe or Federal agency.

7.1.3.12 *Native American Graves Protection and Repatriation Act of 1990*. The *Native American Graves Protection and Repatriation Act of 1990* directs the Secretary of the Interior to guide Federal agencies in the repatriation of Federal archaeological collections and collections affiliated culturally to American Indian Tribes, which are currently held by museums receiving Federal funding. This Act established statutory provisions for the treatment of inadvertent discoveries of American Indians' remains and cultural objects. Specifically, when discoveries are made during ground disturbing activities, the following must take place: (1) activity in the area of the discovery must cease immediately, (2) reasonable efforts must be made to protect the items discovered, (3) notice of discovery must be given to the agency head (DOE) and the appropriate Tribes, and (4) a period of 30 days must be set aside following notification for negotiations regarding the appropriate disposition of these items.

7.1.3.13 *American Indian Religious Freedom Act of 1978*. The *American Indian Religious Freedom Act of 1978* reaffirms American Indians' religious freedom under the First Amendment and sets United States policy to protect and preserve the inherent and constitutional right of American Indian Tribes to believe, express, and exercise traditional religions. This Act also requires that Federal agencies avoid interfering with access to sacred locations and traditional resources that are integral to the practice of religion.

7.1.3.14 *Endangered Species Act of 1973*. The *Endangered Species Act of 1973*, as amended, is intended to prevent further decline of endangered and threatened species and to restore those species and their habitats. This Act is jointly administered by the Departments of Commerce and Interior. Section 7 of this Act requires agencies to consult with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service. This consultation determines whether endangered and threatened species or critical habitats are known to be in the vicinity of a proposed action, and whether an action will adversely affect listed species or designated critical habitats.

7.1.3.15 *Bald and Golden Eagle Protection Act of 1972*. The *Bald and Golden Eagle Protection Act of 1972*, as amended, makes it unlawful to take, pursue, molest, or disturb bald and golden eagles, their nests, or their eggs anywhere in the United States. A permit must be obtained from the U.S. Department of Interior (DOI) to relocate a nest that interferes with resource development or recovery operations.

7.1.3.16 Wild and Scenic Rivers Act of 1968. The *Wild and Scenic Rivers Act of 1968*, as amended, protects selected national rivers possessing outstanding scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar values. These rivers are to be preserved in a free-flowing condition to protect water quality and for other vital national conservation purposes. This Act also instituted a national wild and scenic rivers system, designated the initial rivers within the system, and developed standards for the addition of new rivers in the future.

7.1.3.17 Nuclear Waste Policy Act of 1982. The *Nuclear Waste Policy Act of 1982*, as amended, authorizes Federal agencies to develop a geologic repository for the permanent disposal of spent nuclear fuel and high-level radioactive waste. This Act specifies the process for selecting a repository site and constructing, operating, closing, and decommissioning the repository, and also establishes programmatic guidance for these activities.

7.1.3.18 Atomic Energy Act of 1954. The *Atomic Energy Act of 1954* (AEA), as amended, authorizes the DOE to establish standards to protect health or minimize dangers to life or property with respect to activities under DOE jurisdiction. The DOE has used a series of departmental orders to establish an extensive system of standards and requirements to ensure safe operation of DOE facilities.

The AEA and related statutes give EPA the responsibility and authority for developing applicable environmental standards for protection of the general environment from radioactive materials. The EPA has promulgated several regulations under this authority.

7.1.3.19 Occupational Safety and Health Act of 1970. The *Occupational Safety and Health Act of 1970*, as amended, establishes standards to enhance safe and healthy working conditions in places of employment throughout the United States. The *Occupational Safety and Health Act of 1970* is administered and enforced by the Occupational Safety and Health Administration (OSHA), a U.S. Department of Labor agency. Although the OSHA and the EPA both have a mandate to limit exposures to toxic substances, the jurisdiction of the OSHA is limited to safety and health conditions in the workplace. In general, each employer is required to furnish a place of employment free of recognized hazards likely to cause death or serious physical harm to all employees. The OSHA regulations establish specific standards telling employers what must be done to achieve a safe and healthy working environment. Employees have a duty to comply with these standards and with all rules, regulations, and orders issued by OSHA.

The DOE places emphasis on compliance with OSHA regulations at DOE facilities. Through DOE orders, DOE prescribes that contractors shall meet OSHA standards applicable to work at government-owned, contractor-operated facilities. The DOE maintains and makes available the various records of minor illnesses, injuries, and work-related deaths, as required by OSHA regulations.

7.1.3.20 Comprehensive Conservation Study of the Hanford Reach of the Columbia River, Public Law 100-605. Public Law 100-605, passed by Congress on November 4, 1988, authorizes a comprehensive study of the Hanford Reach of the Columbia River to identify the outstanding features of the Hanford Reach and its immediate environment (including fish and wildlife, geologic, scenic, recreational, natural, historical, and cultural values) and to examine alternatives for their preservation. The Secretary of the Interior has affirmed the addition of the Hanford Reach to the National Wild and Scenic Rivers System and is waiting for Congressional action to implement the decision.

The Secretary of the Interior is charged with reviewing proposed actions within the study corridor to determine if there will be a direct and adverse effect on the values for which the Hanford Reach is under study, and if so, to provide recommendations for mitigation. In 1996, Public Law 104-333, *Omnibus Parks and Public Lands Management Act of 1996*, was enacted. Section 404 of this Act extended the Secretary's environmental review responsibility indefinitely and permanently prohibited any damming, dredging, or navigation project within the Hanford Reach.

7.1.3.21 Mining Law of 1872, as amended. This law permits prospecting and mining on the unappropriated public domain for hardrock minerals (the Hanford Site is not considered unappropriated public domain). Congress declared that it is the continuing policy of the Federal government to foster and encourage private enterprise in (1) the development of economically sound and stable domestic mining, minerals, metals and mineral reclamation industries; (2) the economic development of domestic mineral resources, reserves, and reclamation of metals and minerals; (3) mining, mineral, and metallurgical research, including the use and recycling of scrap to promote the efficient use of natural and reclaimable resources; and (4) the study and development of methods for the disposal, control, and reclamation of mineral waste products and the reclamation of mined land, to lessen the adverse impact of mineral extraction and processing on the physical environment.

7.1.3.22 Archeological and Historic Preservation Act of 1974. The *Archaeological and Historic Preservation Act of 1974*, as amended, protects sites that have historic and prehistoric importance.

7.1.3.23 Fish and Wildlife Conservation Act of 1980. The *Fish and Wildlife Conservation Act of 1980*, as amended, encourages all Federal entities (in cooperation with the public) to protect and conserve the nation's fish and wildlife.

7.1.3.24 Fish and Wildlife Coordination Act of 1934. *The Fish and Wildlife Coordination Act of 1934*, as amended, promotes more effectual planning and cooperation between Federal, state, public, and private agencies for the conservation and rehabilitation of the nation's fish and wildlife and authorizes the DOI to provide assistance.

7.1.3.25 National Wildlife Refuge System Administration Act of 1966. The *National Wildlife Refuge System Administration Act of 1966*, as amended, provides guidelines and directives for the administration and management of all lands within the system, including "wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas." The Secretary of Interior is authorized to permit by regulations the use of any area within the system provided "such uses are compatible with the major purposes for which such areas were established."

7.1.3.26 Noise Control Act of 1972. The *Noise Control Act of 1972*, as amended, directs all Federal agencies to carry out, to the fullest extent within agency authority, programs within agency jurisdiction in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare.

7.1.3.27 American Antiquities Preservation Act of 1906. The *American Antiquities Preservation Act of 1906*, as amended, protects historic and prehistoric ruins, monuments, and antiquities, including paleontological resources, on federally controlled lands.

7.1.3.28 Federal Insecticide, Fungicide, and Rodenticide Act of 1972. The *Federal Insecticide, Fungicide, and Rodenticide Act of 1972*, as amended, governs the storage, use, and disposal of pesticides through product labeling, registration, and user certification.

7.1.3.29 Federal Land Policy and Management Act of 1976. The *Federal Land Policy and Management Act of 1976*, as amended, governs the use of Federal lands which may be overseen by several agencies and establishes the procedure for applying to the U.S. Bureau of Land Management (BLM) for land withdrawals and right-of-ways.

7.1.3.30 Federal Water Pollution Control Act Amendments of 1972. The *Federal Water Pollution Control Act Amendments of 1972* is the predecessor Federal statute to the *Clean Water Act of 1977*.

7.1.3.31 Historic Sites, Buildings, and Antiquities Act of 1965. The *Historic Sites, Buildings, and Antiquities Act of 1965* sets national policy to preserve historic sites, buildings, and antiquities for the inspiration and benefit of the people of the United States.

7.1.3.32 Materials Act of 1947. The *Materials Act of 1947* provides for the management of minerals, timber, and other construction resource materials on public lands.

7.1.3.33 Federal Urban Land-Use Act of 1949. The *Federal Urban Land-Use Act of 1949* was enacted to promote harmonious intergovernmental relations. The Act also encourages sound planning, zoning, and land use practices by prescribing uniform policies and procedures in order that land transactions entered into for the General Services Administration or on behalf of other Federal agencies be consistent with zoning and land-use practices and be made in accordance with planning and development objectives of local governments and local planning agencies concerned.

7.1.3.34 Public Law 104-201, National Defense Authorization Act. Section 3153 of the National Defense Authorization Act requires DOE to develop a future use plan for defense nuclear facilities, including the Hanford Site. The future use plans required under this section must address a planning period of at least 50 years. Final future use plans are to be developed by March 15, 1998.

7.2 State Laws

State and local statutes also apply to activities at the Hanford Site because (1) Federal law delegates enforcement or implementation authority to state or local agencies, or (2) the state requirement is more stringent than the Federal requirement.

7.2.1 State Environmental Policy Act of 1971

The Washington State legislature enacted the *State Environmental Policy Act of 1971* (SEPA). The statute was amended in 1983, and new implementing regulations (the SEPA rules) were adopted and codified by Ecology in 1984 as *Washington Administrative Code* (WAC) 197-11. The purpose and policy sections of the statute are extremely broad, including recognition by the legislature that "each person has a fundamental and inalienable right to a healthful environment. . . ." SEPA contains a substantive mandate that "policies, regulations, and laws of the State of Washington shall be interpreted and administered in accordance with the policies set forth in [SEPA]."

SEPA applies to all branches of state government, including state agencies, municipal and public corporations, and counties. It requires each agency to develop procedures implementing and supplementing SEPA requirements and rules. Although the SEPA does not apply directly to Federal actions, the term "government action" with respect to state agencies is defined to include the issuance of licenses, permits, and approvals. Thus, as in NEPA, proposals (Federal, state, or private) are evaluated, and may be conditioned or denied through the permit process, based on environmental considerations. SEPA does not create an independent permit requirement, but overlays all existing agency permitting activities.

7.2.2 Hazardous Waste Management Act of 1976

The Federal RCRA program allows state enforcement if the state program is consistent with the Federal program and is at least as stringent. Through the *Hazardous Waste Management Act of 1976*, Ecology has enacted hazardous waste regulations that are consistent with and as stringent as (or more stringent than) the Federal program. Washington has been delegated authority to implement RCRA and *Hazardous and Solid Waste Amendments of 1984* programs. Regulated parties must comply with the requirements of both the Federal program, pursuant to regulations in 40 CFR 260-280, and the state program, pursuant to the requirements of the *Hazardous Waste Management Act of 1976* and WAC 173-303, "Dangerous Waste Regulations."

7.2.3 Model Toxics Control Act of 1989

The State of Washington has adopted a statutory "Superfund" scheme for identifying and responding to releases of hazardous substances. Known as the *Model Toxics Control Act of 1989*, the State of Washington law supplements CERCLA. Under this Act, Ecology must investigate and prioritize hazardous waste release sites, provide technical assistance to "potentially liable parties" desiring to perform cleanups, set cleanup standards for hazardous substances, undertake cleanups where appropriate, require and assist in or perform cleanups, provide opportunities for public involvement, establish a scientific advisory board, and regularly report to the legislature. The statute empowers Ecology to gain access to property, enter into settlements (either through administrative orders or consent decrees), file actions or issue orders to compel cleanups, and impose civil penalties and seek recovery of state cleanup costs.

7.2.4 Water Pollution Control Act of 1945

The *Water Pollution Control of 1945*, as amended, establishes a permit system to license and control the discharge of pollutants into waters of the state. Under the permit system, dischargers must reduce releases to a level determined to be technologically and economically achievable, regardless of the condition of the receiving water. Dischargers also must maintain or improve the condition of the receiving water. The state has a general policy prohibiting degradation of existing water quality, and a variety of approaches are used to address the problem of toxic pollutants. Permits are required for both point-source and nonpoint-source discharges.

7.2.5 Growth Management Act of 1989

Most planning by local governments falls under the *State of Washington Growth Management Act* (GMA), which established a statewide planning framework and created roles and responsibilities for planning at the local, regional, and state levels. The GMA required the largest and fastest growing counties (counties with more than 50,000 people or with a population growth of more than 20 percent in the past 10 years) and cities within those counties to develop new comprehensive plans. Counties not required to plan may elect to do so. Benton, Franklin, and Grant counties, along with the City of Richland, have elected to plan under the GMA requirements. Jurisdictions under GMA must prepare comprehensive plans that project growth for a minimum of 20 years.

7.2.6 Air Quality Regulations

Most of the provisions of the *Washington Clean Air Act of 1991* (WCAA) mirror the requirements of the *Federal Clean Air Act Amendments of 1990* (Federal CAAA). The Federal CAAA establishes a minimum or "floor" for Washington air quality programs. The WCAA authorizes Ecology and local air pollution control authorities to implement programs consistent with the Federal CAAA. For example, the WCAA authorizes an operating permit program, enhanced civil penalties, new administrative enforcement provisions, motor vehicle inspections, and provisions addressing ozone and acid rain.

Washington State also has an extensive set of regulations governing toxic air pollutants (TAP) (WAC 173-460). These regulations are similar to the programs for regulating hazardous air pollutants (HAP) required by the Federal CAAA. In contrast to the Federal CAAA HAPs program, which applies to new and existing emission sources, the TAP rules apply only to new sources of TAPs, including any modification of an existing source where the modification will increase TAP emissions. Furthermore, Ecology refers to a list of more than 450 individual chemicals that are deemed to be TAPs. The list overlaps with the Federal CAAA list of HAPs, but is considerably longer. The TAP rules are implemented under the New Source Review Program, and the regulatory standard for TAPs is "best available control technology."

The Washington State Department of Health regulations, "Radiation Protection—Air Emissions," (WAC 246-247) contain standards and permit requirements for the emission of radionuclides to the atmosphere from DOE facilities based on Ecology standards, "Ambient Air Quality Standards and Emission Limits for Radionuclides" (WAC 173-480).

The local air authority, Benton County Clean Air Authority, enforces regulations pertaining to detrimental effects, fugitive dust, incineration products, odor, opacity, asbestos, and sulfur oxide emissions. The Benton County Clean Air Authority also has been delegated authority to enforce the EPA asbestos regulations.

7.2.7 The Shoreline Management Act of 1971

The *Shoreline Management Act of 1971* (RCW 90.58) uses authority passed to the state by the Federal *Rivers and Harbors Act of 1899* (33 U.S.C. 401-413; Sec. 407, referred to as the *Refuse Act*). Section 10 of the *Rivers and Harbors Act of 1899* prohibits the unauthorized obstruction or alteration of any navigable waters of the United States. Examples of activities requiring a U.S. Army Corps of Engineers permit (33 CFR 322) include constructing a structure in or over any waters of the United States, excavation or deposit of material in such waters, and various types of work performed in such waters, including fill and stream channelization. The state is considered the owner of all navigatible waterways within its boundaries.

The state has passed regulatory responsibility for the *Shoreline Management Act of 1971* to the affected county. Counties in Washington State regulate the shoreline (i.e., from the high-water mark to the low-water mark) through each county's Shoreline Management Master Plan and a shoreline permit system consistent with Ecology guidelines (WAC 173-16).

7.3 Executive Orders

This section identifies Presidential Executive Orders that clarify issues of national policy and provide guidelines relevant to Hanford Site land-use planning.

7.3.1 Executive Order 11508, Providing for the Identification of Unneeded Federal Real Property

Executive Order 11508 establishes a uniform policy for the Executive Branch concerning the identification of excess real property holdings and establishes uniform procedures to ensure the prompt identification and release by executive agencies of real property holdings that are no longer essential to their activities and responsibilities.

7.3.2 Executive Order 11593, Protection and Enhancement of the Cultural Environment

Executive Order 11593 requires Federal agencies to direct their policies, plans, and programs in a way that preserves, restores, and maintains federally owned sites, structures, and objects of historical or archaeological significance.

7.3.3 Executive Order 11724, Federal Property Council

Executive Order 11724 directs the Administrator of General Services to conduct surveys of real property holdings of executive agencies on a continuing basis to identify properties which are not utilized, are under-utilized, or are not being put to their optimum use. The Administrator of General Services shall also make reports as to which of these properties (not utilized, under-utilized, not being put to optimum use) should be reported as excess property.

7.3.4 Executive Order 11988, Floodplain Management

Executive Order 11988 directs Federal agencies to establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered for actions undertaken in a floodplain. The Order further directs that floodplain impacts are to be avoided to the extent practicable.

7.3.5 Executive Order 11990, Protection of Wetlands

Governmental agencies are directed by Executive Order 11990 to avoid, to the extent practicable, any short- and long-term adverse impacts on wetlands wherever there is a practicable alternative. The DOE has issued regulations for compliance with this Order and Executive Order 11988 (10 CFR 1022).

7.3.6 Executive Order 12088, Federal Compliance with Pollution Control Standards

Executive Order 12088 was issued on October 13, 1978. This Order directs Federal agencies to comply with applicable administrative and procedural pollution control standards established by, but not limited to, the CWA, the CAA, the SDWA, TSCA, and RCRA. This Order was amended by Executive Order 12580, issued on January 23, 1987.

7.3.7 Executive Order 12372, Intergovernmental Review of Federal Programs

Executive Order 12372 applies to state review of NEPA documents and to the coordination of state and Federal NEPA processes. The goal of this Executive Order is to foster an intergovernmental partnership and a strengthened coordination and consultation process.

7.3.8 Executive Order 12411, Government Work Space Management Reforms

Executive Order 12411 requires the heads of all Federal executive agencies to establish programs to reduce the amount of work space, used or held, to that amount which is essential for known agency missions; to produce and maintain a total inventory of work space and related furnishings and declare excess to the Administrator of General Services all such holdings that are not necessary to satisfy existing or known and verified planned programs; and ensure that the amount of office spaced used by each employee of the agency, or others using agency-controlled space, is held to the minimum necessary to accomplish the task that must be performed.

7.3.9 Executive Order 12512, Federal Real Property Management

Executive Order 12512 authorizes the Administrator of General Services to provide government-wide policy oversight and guidance for Federal real property management. This Executive Order requires all executive departments and agencies to establish internal policies and systems of accountability that ensure effective use of real property in support of mission-related activities, consistent with Federal policies regarding the acquisition, management, and disposal of such assets. All such agencies shall also develop annual real property management improvement plans that include clear and concise goals and objectives related to all aspects of real property management, and identify sales, work space management, productivity, and excess property targets.

7.3.10 Executive Order 12580, Superfund Implementation

Executive Order 12580 delegates to the heads of executive departments and agencies the responsibility (1) for undertaking remedial actions for releases, or threatened releases, that are not on the National Priorities List; and (2) for removal actions where the release is from a facility under the jurisdiction or control of executive departments and agencies.

7.3.11 Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements

Executive Order 12856 directs Federal agencies to reduce and report toxic chemicals entering any waste stream; improve emergency planning, response, and accident notification; and encourage clean technologies and testing of innovative prevention technologies. The Executive Order also provides that Federal agencies are persons for purposes of the *Emergency Planning and Community Right-to-Know Act of 1986* (SARA Title III), which obliges agencies to meet the requirements of that Act.

7.3.12 Executive Order 12866, Regulatory Planning and Review

Executive Order 12866 requires Federal agencies to promulgate only regulations that are required by law, necessary to interpret the law, or necessary by compelling public need. Agencies are further required to assess costs and benefits associated with available regulatory alternatives in deciding how, and whether, to regulate. This Executive Order also outlines principles that agencies are to follow in the regulatory process, including avoidance of regulations that are inconsistent, incompatible, or duplicative with other regulations and tailoring regulations to impose the least burden on society. The Order also addresses the regulatory planning and review process, including coordination of regulations and maximizing consultation and resolution of conflicts at an early stage in the process. Agencies are also directed to review existing regulations to determine if those regulations should be modified of eliminated. Procedures for centralized review of regulations and resolution of conflicts are also identified in this Executive Order. This Order revokes Executive Orders 12291 and 12498.

7.3.13 Executive Order 12875, Enhancing the Intergovernmental Partnership

Executive Order 12875 addresses the imposition of unfunded mandates upon State, local and Tribal governments by Federal agencies. The Order directs agencies to avoid promulgating regulations that create an unfunded mandate that is not required by statute unless funding is available to pay costs incurred by State, local, or Tribal governments, and to develop an effective process for representatives of these governments to provide meaningful and timely input into the development of regulatory proposals that contain significant unfunded mandates. The Order further directs agencies to increase flexibility for State and local waivers. Executive Order 12875 supplements, but does not supercede, Executive Order 12866.

7.3.14 Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898 directs all Federal agencies, to the greatest extent practicable and permitted by law, to achieve environmental justice by identifying and addressing disproportionately high and adverse human health or environmental effects of agency programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. The Executive Order creates an Interagency Working Group on Environmental Justice and directs each Federal agency, to the extent permitted by existing law, to develop strategies to identify and address environmental justice concerns. The Order further directs each Federal agency, to the extent permitted by existing law, to collect, maintain, analyze, and make available information on the race, national origin, income level, and other readily accessible and appropriate information for areas surrounding facilities or sites expected to have a substantial environmental, human health, or economic effect on the surrounding populations. This action is required when these facilities or sites become the subject of a substantial Federal environmental administrative or judicial action.

7.3.15 Executive Order 13007, Indian Sacred Sites

Executive Order 13007 directs Federal agencies to take measures to protect and preserve American Indian Tribes' religious practices. Federal agencies shall, to the extent practicable and permitted by law, and when consistent with essential agency functions, accommodate access to and ceremonial uses of sacred sites by American Indian Tribes' religious practitioners. Further, the Executive Order states that Federal agencies will comply with presidential direction to maintain government-to-government relations with Tribal Governments.

7.3.16 *Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks*

Because a growing body of scientific knowledge demonstrates that children may suffer disproportionately from environmental health and safety risks, Executive Order 13045 directs each Federal agency to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. Each Federal agency will, to the extent permitted by law and appropriate, and consistent with the agency mission, ensure that its policies, programs, activities, and standards address potential disproportionate risks to children.

7.4 *Presidential and Executive Branch Policies*

President Clinton issued a memorandum to the heads of executive departments and agencies regarding government to government relations with Tribal Governments on April 29, 1994. This memorandum directed executive departments and agencies to implement activities that affect Tribal rights in a "knowledgeable, sensitive manner respectful of tribal sovereignty." The memorandum outlined principles for executive departments and agencies to follow in their interactions with tribal governments and clarify the responsibility of the Federal government to operate within a government-to-government relationship with federally recognized American Indian Tribes.

The U.S. Department of Justice recently reaffirmed a long-standing policy regarding the relationship between the Federal government and American Indian Tribes (61 FR 29424). The policy states that the United States recognizes the sovereign status of Indian tribes as "domestic dependent nations" from its earliest days. The Constitution recognizes Indian sovereignty by classifying Indian treaties among the "supreme Law of the Land," and establishes Indian affairs as a unique area of Federal concern.

The DOE American Indian policy commits DOE to working with Tribal governments on a government-to-government basis, recognizes the Federal trust relationship with Tribes and Tribal treaty rights, and commits the department to consultation with Tribes regarding agency activities that could potentially affect the Tribes.

7.5 *U.S. Department of Energy Regulations, Orders, and Other Agreements and Requirements*

This section identifies DOE regulations implementing statutory environmental, health, and safety protection responsibilities and requirements that must be met by operating contractors.

The DOE is responsible for establishing a comprehensive health, safety, and environmental program for its facilities, as authorized by the AEA. The regulatory mechanisms used by the DOE to manage its facilities are the promulgation of regulations and issuance of DOE orders.

DOE regulations are found in Title 10 of the CFR. These regulations address such areas as energy conservation, administrative requirements and procedures, nuclear safety, and classified information. For purposes of this EIS, relevant regulations include the following:

- 10 CFR 820, "Procedural Rules for U.S. Department of Energy Nuclear Activities"

- 10 CFR 830.120, "Quality Assurance Requirements"

- 10 CFR 834, "Radiation Protection of the Public and the Environment"

- 10 CFR 835, "Occupational Radiation Protection"

- 10 CFR 1021, "*National Environmental Policy Act* Implementing Procedures"

- 10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements."

DOE orders generally set forth policies and identify the need for programs and internal procedures to implement those policies.

The DOE, represented by the Bonneville Power Administration, entered into the *Vernita Bar Settlement Agreement* with several Public Utility Districts, the National Marine Fisheries Service, the States of Washington and Oregon, the Confederated Tribes of the Yakama Indian Nation, the CTUIR, and the Confederated Tribes of the Colville Indian Reservation in June 1988. The Agreement established the obligation of the parties to protect fall Chinook salmon at Vernita Bar by requiring maintenance of a sufficient amount of water flowing over Vernita Bar (protection-level flow) to provide protection to salmon redds. The Agreement was approved by the Federal Energy Regulatory Commission as a condition of license for the Priest Rapids Dam. Flows are to be maintained through the spawning period, pre-hatch period, post-hatch period, and emergence period, from approximately December 15 through May 31 each year. The Agreement limits river flow in the fall to 1,960 cubic meters per second (70,000 cubic feet per second), with post-spawning flows determined annually based on field surveys that identify when, where, and to what extent spawning has occurred (NPS 1994). Parties to the agreement may request reopening of the agreement and the imposition by the Federal Energy Regulatory Commission of different, additional, or modified fall Chinook salmon protection measures at Vernita Bar.

The Office of Management and Budget Circular A-95 provides guidance to Federal agencies for cooperation with state and local in the evaluation, review, and coordination of Federal and federally assisted programs and projects.

7.6 Consultations

The NEPA and the Council on Environmental Quality (CEQ) regulations require consultation with Federal, Tribal, state, and local agencies with jurisdiction or special expertise regarding any environmental impact. Agencies involved include those with authority to issue applicable permits, licenses, and other regulatory approvals, as well as those agencies responsible for protecting significant resources (e.g., endangered species, critical habitats, or historic resources). Federal and state agencies and Tribal Governments have been, and will continue to be, consulted during the development of the HRA-EIS. Representatives of Federal, Tribal, state, and local agencies were involved in scoping for the HRA-EIS through involvement in the Working Group and in the preparation of the Final HRA-EIS. Copies of letters from DOE inviting the participation of cooperating and consulting agencies are presented in Appendix B. Copies of response letters received by the DOE are also included.

7.6.1 Consultation with Other Federal Agencies

In accordance with CEQ guidance encouraging lead agencies to consult with other agencies during the NEPA process, DOE invited other Federal agencies to participate in scoping and development of the HRA-EIS. The DOI (USFWS and the National Park Service [NPS]) and the EPA were represented on the Hanford Future Site Uses Working Group (FSUWG) and assisted in developing the FSUWG's report, which was adopted as a scoping comment for the HRA-EIS. The emphasis of the HRA-EIS on future land use led to the development of a comprehensive land use plan for the Hanford Site, which was issued as Appendix M to the August 1996 Draft HRA-EIS. Other Federal agencies were invited to participate in a series of meetings geared to identify values associated with Hanford Site resources. The DOI (USFWS, BLM, and the Bureau of Indian Affairs [BIA]), EPA, and Department of Commerce (National Marine Fisheries Service) were invited to participate in these meetings. Subsequent to identification of values, the DOE developed a future land use plan that incorporated values identified by the participants in the meetings.

The DOE received numerous comments on the August 1996 Draft HRA-EIS that emphasized the need for more extensive agency participation in land use planning at the Hanford Site and the need to consider alternatives to the single plan presented in the Comprehensive Land-Use Plan. The DOI, in particular, requested formal involvement in the land-use planning process for the Hanford Site. As a result of these comments, DOE refocused the HRA-EIS to emphasize future land use at the Hanford Site and formally invited other Federal agencies to cooperate in preparation of the refocused Revised Draft HRA-EIS.

The DOE also initiated a series of meetings through which alternative land use plans were developed and analyzed. Representatives of the DOI (USFWS, BLM, and Bureau of Reclamation) have participated in these meetings and have assisted in the development of the refocused Revised Draft HRA-EIS.

In addition to consultation on the land use planning process, the DOE has formally requested updated lists of endangered species from the USFWS and the National Marine Fisheries Service. The DOE has also requested that the Bureau of Reclamation provide information regarding the availability of water for potential development of irrigated agriculture on the Wahluke Slope.

7.6.2 Consultation with Affected Tribal Governments

The policy of the Federal government for relations with Tribal Governments is clearly stated. The Department of Justice recently reaffirmed a long-standing policy regarding the relationship between the Federal government and Indian Tribes (61 FR 29424). The policy emphasizes the Federal trust responsibility in government-to-government relations with Indian Tribes. Furthermore, the policy of the present Presidential Administration recognizes the sovereignty of Tribal governments, supports the Tribal Governments' rights of self-government and self-determination, and to commit to government-to-government relationships with Tribal governments. The official policy also emphasizes the responsibility of Federal agencies to remove impediments to working directly with Tribal governments on activities that effect the trust property and/or governmental rights of the Tribes. The DOE American Indian policy commits the DOE to working with American Indian Tribal governments on a government-to-government basis, recognizes that some Tribes have treaty-protected interests in resources outside reservation boundaries, recognizes the Federal trust relationship to American Indian Tribes imposes duties on the DOE, commits to consult with American Indian Tribal governments concerning DOE activities that potentially affect Tribes, and commits to remove impediments to working directly and effectively with Tribal governments in accordance with the

Presidential policy. Consultations with Tribal governments have been, and will continue to be, carried out in accordance with these policies.

The DOE invited Tribal Governments to participate in the scoping of the August 1996 Draft HRA-EIS through the FSUWG, in development of the Comprehensive Land-Use Plan through the meeting held by DOE to identify values associated with Hanford Site resources, and in development of the Revised Draft HRA-EIS as cooperating agencies. Representatives of the CTUIR, Yakama Indian Nation, and Nez Perce Tribe were participants on the Working Group. The Wanapum Band, CTUIR, Yakama Indian Nation, and Nez Perce Tribe all participated in meetings on comprehensive land-use planning prior to issuance of the August 1996 Draft HRA-EIS. Nevertheless, Tribal governments expressed concern that the August 1996 Draft HRA-EIS presented only one alternative for future land use at the Hanford Site and indicated a desire to have a greater role in the planning process. As a result these concerns, and concerns of other entities, regarding land use planning at the Hanford Site, DOE invited the affected Tribes to participate in the land use planning process. Representatives of the CTUIR, Nez Perce Tribe, and Yakama Indian Nation have been participants in the process. The CTUIR and Nez Perce Tribe representatives have provided alternatives for analysis in the Revised Draft HRA-EIS.

7.6.3 Consultation with State and Local Governments

The DOE has invited state and local government agencies to participate in all phases of the HRA-EIS. State and local governments were invited, through their participation in the FSUWG, to participate in the scoping of the August 1996 Draft HRA-EIS. They participated in the development of the Comprehensive Land-Use Plan through a meeting held by DOE to identify values associated with Hanford Site resources, and, as cooperating agencies, they helped develop the Revised Draft HRA-EIS. Representatives from the states of Washington and Oregon; Benton, Franklin, and Grant counties; and the Port of Benton participated on the FSUWG. Representatives from Ecology and the Washington Department of Fish and Wildlife; Benton, Adams, Franklin, and Grant County Commissioners' offices; Benton County and City of Richland Planning Departments; and the Port of Benton were invited to participate in meetings on comprehensive land-use planning prior to development of the August 1996 Draft HRA-EIS. Upon issuance of the August 1996 Draft HRA-EIS, these government entities expressed concern that the Comprehensive Land-Use Plan presented only one alternative for future land use at the Hanford Site. Several local agencies expressed an interest in working with DOE in the planning process. As a result of these concerns, and concerns of other entities regarding land-use planning at the Hanford Site, DOE invited state and local governments to cooperate in development of this Revised Draft HRA-EIS. Representatives of these entities have either participated in the planning process or been consulted during the process of developing this Revised Draft HRA-EIS.

This page intentionally left blank.

Table of Contents

8.0 List of Preparers ... 8-1

8.1 Environmental Impact Statement Preparers ... 8-1
U.S. Department of Energy, Richland Operations Office ... 8-1
Jason Associates Corporation ... 8-1
Bechtel Hanford, Inc. ... 8-2
DynCorp Tri-Cities Services, Inc. ... 8-2

8.2 Cooperating Agencies ... 8-2
Bureau of Land Management ... 8-2
Bureau of Reclamation ... 8-2
City of Richland ... 8-2
Benton County ... 8-2
Franklin County ... 8-3
Grant County ... 8-3
U.S. Fish and Wildlife Service ... 8-3

8.3 Consulting Agencies ... 8-3
Confederated Tribes of the Umatilla Indian Reservation ... 8-3
Nez Perce Department of Environmental Restoration and Waste Management ... 8-3

This page intentionally left blank.

8.0 List of Preparers

8.1 Environmental Impact Statement Preparers

U.S. Department of Energy, Richland Operations Office

Thomas W. Ferns, Project Manager
U.S. Department of Energy, Richland Operations Office
M.S., 1985, Land Rehabilitation, Montana State University
B.S., 1980, Interdisciplinary Science, Southern Oregon State College
B.S., 1980, Biology, Southern Oregon State College
Years of Experience: 15

Jason Associates Corporation

William J. Berry, Senior Scientist
Jason Associates Corporation
Ph.D., 1988, Entomology, Iowa State University
M.S., 1983, Biology, University of Notre Dame
B.S., 1981, Biology, University of Notre Dame
Years of Experience: 12

Elizabeth Bush-Williams, Public Involvement
Jason Associates Corporation
B.S., 1979, Home Economics/Journalism Option, University of Idaho
Years of Experience: 9

Christine Chamberlain-Dow, Technical Writer
Jason Associates Corporation
B.A., 1974, History of Art, Skidmore College
Years of Experience: 18

Donald Thomas England, Scientific Specialist
Jason Associates Corporation
B.S., 1985, Biology/Chemistry, Radford University
Years of Experience: 11

Michelle R. Peterson, Technical Editor
Jason Associates Corporation
B.A., 1994, Psychology/Communication, Washington State University
A.A., 1992, Communications, Columbia Basin Community College
Years of Experience: 7

Michael J. Spry, Senior Environmental Specialist
Portage Environmental, Inc.
M.S., 1986, Land Rehabilitation, Montana State University
B.S., 1983, Environmental Studies
Years of Experience: 12

Regan S. Weeks, Senior Scientist
Pacific Northwest National Laboratory
B.S. 1986, Environmental Studies, Huxley College, Western Washington University
Years of Experience: 9

Bechtel Hanford, Inc.

Rudy Prosser, Hanford Geographic Information System Database Administrator
Bechtel Hanford, Inc.
M.A., 1994, Geography, San Diego State University
B.A., 1982, Philosophy, University of California, San Diego
Years of Experience: 12

DynCorp Tri-Cities Services, Inc.

H. Boyd Hathaway, Senior Land Use Planner
DynCorp Tri-Cities Services, Inc.
B.A., 1979, Urban and Regional Planning, Eastern Washington University
Years of Experience: 16

8.2 Cooperating Agencies

Bureau of Land Management

Joel "Jake" Jakabosky, Environmental Specialist
Bureau of Land Management, Division of Sciences
B.S., 1970, Range Management, Oregon State University
B.S., 1969, Wildlife Science, Oregon State University
Years of Experience: 27

Bureau of Reclamation

Jim Blanchard, Special Projects Officer
Bureau of Reclamation, Ephrata District
B.S., 1973, Natural History, Evergreen State College
Years of Experience: 23

City of Richland

Dennis Rhodes, Comprehensive Planning Manager
City of Richland, Comprehensive Planning Division
B.S., 1986, Environmental Planning, Humboldt State University
Years of Experience: 10

Benton County

Darin K. Arrasmith, Associate Planner
Benton County Planning Department
B.A., 1991, Urban and Regional Planning, Eastern Washington University
Years of Experience: 6

Phil Mees, Senior Long Range Planner
Benton County Planning Department
Years of Experience: 22??

Franklin County

Richard German, Director of Planning and Development
Franklin County Planning Department
B.A., 1966, Geography, Eastern Washington State College
Years of Experience: 30

Grant County

Larry Angel, Planning Director
Grant County Planning Department
B.A., 1972, History, Washington State University
Years of Experience: 17

U.S. Fish and Wildlife Service

Dave Goeke, Project Leader
U.S. Fish and Wildlife Service, Columbia National Wildlife Refuge Complex
B.S., 1964, Wildlife Management, Western Illinois University
Years of Experience: 30

8.3 Consulting Agencies

Confederated Tribes of the Umatilla Indian Reservation

Christopher L. Burford, Policy Analyst
CTUIR Special Sciences and Resources Program
J.D., 1992, University of Oregon School of Law
B.A., 1986, History, Western Kentucky University
Years of Experience: 5

Nez Perce Department of Environmental Restoration and Waste Management

Stan Sobcyzk, Environmental Specialist
Nez Perce Department of Environmental Restoration
and Waste Management
Ph.D., 1994, Geology, Washington State University
M.S., 1977, Geophysics, University of Utah
B.S., 1975, Geology/Mathematics, University of Southern California

This page intentionally left blank.

Table of Contents

9.0 References 9-1

This page intentionally left blank.

9.0 References

10 CFR 820, 1993, "Procedural Rules for U.S. Department of Energy Nuclear Activities," *Code of Federal Regulations*, as amended.

10 CFR 830.120, 1994, "Quality Assurance Requirements," *Code of Federal Regulations*, as amended.

10 CFR 834, 1993, "Radiation Protection of the Public and the Environment," *Code of Federal Regulations*, as amended.

10 CFR 835, 1993, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

10 CFR 1021, 1992, "*National Environmental Policy Act* Implementing Procedures," *Code of Federal Regulations*, as amended.

10 CFR 1022, 1979, "Compliance with Floodplain/Wetlands Environmental Review Requirements," *Code of Federal Regulations*, as amended.

29 CFR 1910, 1974, "Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.

36 CFR 800.9, 1986, "Criteria of Effect and Adverse Effect," *Code of Federal Regulations*, as amended.

40 CFR 50-99, 1970, "National Primary and Secondary Ambient Air Quality Standards," *Code of Federal Regulations*, as amended.

40 CFR 50.9, 1979, "National Primary and Secondary Ambient Air Quality Standards," *Code of Federal Regulations*, as amended.

40 CFR 52.21, 1972, "Prevention of Significant Deterioration of Air Quality," *Code of Federal Regulations*, as amended.

40 CFR 60, 1971, "Standards of Performance for New Stationary Sources: Applicability," *Code of Federal Regulations*, as amended.

40 CFR 61, 1973, "National Emissions Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, as amended.

40 CFR 63, 1994, "National Emissions Standards for Hazardous Air Pollutants for Source Categories," *Code of Federal Regulations,* as amended.

40 CFR 122, 1990, "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System," *Code of Federal Regulations,* as amended.

40 CFR 140-149, 1975, "Chapter 1 - Environmental Protection Agency Subchapter D - Water Programs," *Code of Federal Regulations,* as amended.

40 CFR 260-280, 1978, "Federal Regulations for Implementing the *Resource Conservation and Recovery Act*," *Code of Federal Regulations*, as amended.

40 CFR 350-372, 1991, "Federal Regulations for Implementing the Emergency Planning and Community Right-to-Know Act," *Code of Federal Regulations*, as amended.

40 CFR 1500-1508, 1978, "Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act," *Code of Federal Regulations*, as amended.

50 CFR 17, 1975, "Endangered and Threatened Wildlife and Plants," *Code of Federal Regulations*, as amended.

40 FR 18026, 1981, "Memorandum to Agencies: Forty Most Asked Questions Concerning the Council on Environmental Quality's National Environmental Policy Act Regulation," *Federal Register*, Vol. 46, p. 18026 (March 23).

57 FR 37959, 1992, "Intent to Prepare the Hanford Remedial Action Environmental Impact Statement, Richland, Washington," *Federal Register*, Vol. 57, p. 37959 (August 21).

58 FR 48509, 1993, "Record of Decision: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington, Environmental Impact Statement," *Federal Register*, Vol. 58, p. 48509 (September 16).

59 FR 32, 1994, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," *Federal Register*, Vol. 59, p. 32 (February 11).

60 FR 28680, 1995, "Record of Decision: Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs," *Federal Register,* Vol. 60, p. 28680 (June 1).

60 FR 61687, 1995, "Record of Decision: Safe Interim Storage of Hanford Tank Wastes, Hanford Site, Richland, WA," *Federal Register,* Vol. 60, p. 61687 (December 1).

60 FR 63878, 1995, "Record of Decision: Tritium Supply and Recycling Programmatic Environmental Impact Statement," *Federal Register,* Vol. 60, p. 63878 (December 5).

61 FR 9441, 1996, "Amendment to the Record of Decision for the Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs," *Federal Register,* Vol. 61, p. 9441 (March 8).

61 FR 10736, 1996, "Record of Decision: Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington," *Federal Register,* Vol. 61, p. 10736 (March 15).

61 FR 29424-29426, 1996, "Department of Justice Policy on Indian Sovereignty and Government-to-Government Relations with Indian Tribes," *Federal Register*, Vol. 61, pp. 29424-29426 (June 10).

61 FR 29719, 1996, "National Ambient Air Quality Standards for Ozone and Particulate Matter," *Federal Register*, Vol. 61, pp. 29719 (June).

61 FR 36352, 1996, "Record of Decision: Plutonium Finishing Plant Stabilization Final Environmental Impact Statement," *Federal Register*, Vol. 61, p. 36352 (July 10).

61 FR 41596, 1996, "National Environmental Policy Act Record of Decision for the Disposal of Decommissioned, Defueled Cruiser, Ohio Class, and Los Angeles Class Naval Reactor Plants," *Federal Register*, Vol. 61, p. 41596 (August 9).

61 FR 45949, 199, "Final Environmental Impact Statement: Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland, Washington," *Federal Register*, Vol. 61, p. 45949 (August 30).

62 FR 3014, 1997, "Record of Decision: Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Impact Statement," *Federal Register*, Vol. 62, p. 3014 (January 21).

62 FR 8693, 1997, "Record of Decision: Final Environmental Impact Statement: Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland, WA," *Federal Register*, Vol. 62, p. 8693 (February 26) .

62 FR 10830, 1997, "Notice of Availability of Record of Decision: Columbia River System Operation Review on Selecting an Operating Strategy for the Federal Columbia River Power System," *Federal Register*, Vol. 62, p. 10830 (March 10).

62 FR 32076, 1997, "*Interior Columbia Basin Ecosystem Management Project, Notice of Availability of Draft Environmental Impact Statements*)," *Federal Register*, Vol. 62, p. 32076 (June 12).

American Antiquities Preservation Act of 1906, 16 U.S.C. 431, et seq.

American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996, et seq.

Anadromous Fish Conservation Act of 1965, Public Law 89-304, as amended.

Archeological and Historic Preservation Act of 1974, 16 U.S.C. 469, et seq.

Archaeological Resources Protection Act of 1979, 16 U.S.C. 470aa-47011, et seq.

Atomic Energy Act of 1954, 42 U.S.C. 2011, et seq.

Bald and Golden Eagle Protection Act of 1972, 16 U.S.C. 668-668d, et seq.

BCPD, 1997, *Draft Benton County Comprehensive Plan, Environmental Impact Statement Addendum*, Board of County Commissioners Hearing Draft, Benton County Planning Department, Prosser, Washington.

BHI, 1995, *Site Evaluation Report for Candidate Basalt Quarry (DOE/RL-93-83)*, BHI-00005, Rev. 00, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1996a, *The Hanford Site N Reactor Buildings Task Identification and Evaluation of Historic Properties*, BHI-00627, Rev. 0, Bechtel Hanford, Inc., Richland, Washington (January).

BHI, 1997, *Class 1 Permit Modification Request for 183-H Solar Evaporation Basins*, Chron # 054377, letter from G. C. Henckel, III, Bechtel Hanford, Inc., to K. M. Thompson, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

BLM, 1992, *Proposed Spokane Resource Management Plan Amendment and Final Environmental Impact Statement*, Spokane District of the Bureau of Land Management, Spokane, Washington.

COR, 1997, *City of Richland Comprehensive Plan*, September 1997, City of Richland, Richland, Washington.

CEQ, 1993, *Incorporating Biodiversity Considerations into Environmental Impact Analysis Under the National Environmental Policy Act*, Council on Environmental Quality, Washington, D.C. (January).

Clean Air Act of 1970, 42 U.S.C. 7401, et seq.

Clean Water Act of 1977, 33 U.S.C. 1251, et seq.

Comprehensive Conservation Study of the Hanford Reach of the Columbia River, Public Law100-605, et seq.

Comprehensive River Conservation Study, 1988, Public Law 100-605 (November 5).

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, et seq.

Cushing, C. E., 1992, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Rev. 5, Pacific Northwest Laboratory, Richland, Washington.

Cushing, C. E., 1995, *Hanford Site National Environmental Policy Act* (NEPA) *Characterization*, PNL-6415, Rev. 7, Pacific Northwest Laboratory, Richland, Washington.

Dirkes, R. L., and R. W. Hanf, 1995, *Hanford Site Environmental Report for Calendar Year 1994*, PNL-10574, Pacific Northwest Laboratory, Richland, Washington.

Dirkes, R. L., and R. W. Hanf, 1996, *Hanford Site Environmental Report for Calendar Year 1995*, PNL-11139, Pacific Northwest National Laboratory, Richland, Washington.

DOE, 1987, *Final Environmental Impact Statement: Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland, Washington*, DOE/EIS-0113, U.S. Department of Energy, Washington, D.C. (December).

DOE, 1988, *Radioactive Waste Management*, DOE Order 5820.2A, U.S. Department of Energy, Washington, D.C.

DOE, 1988a, *Consultation Draft Site Characterization Plan, Volumes 1-9*, DOE/RW-0164, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, Washington, D.C.

DOE, 1989, *Draft Environmental Impact Statement: Decommissioning of Eight Surplus Reactors at the Hanford Site, Richland, Washington*, DOE/EIS-0119D, U.S. Department of Energy, Washington, D.C. (March).

DOE, 1990a, *General Environmental Protection Program*, DOE Order 5400.1, U.S. Department of Energy, Washington, D.C. (June).

DOE, 1990b, *Environmental Assessment for the Environmental and Molecular Sciences Laboratory at the Hanford Site, Richland, Washington*, DOE/EA-0429, U.S. Department of Energy, Washington, D.C. (September).

DOE, 1992a, *Addendum (Final Environmental Impact Statement): Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington*, DOE/EIS-0119F, U.S. Department of Energy, Washington, D.C. (December).

DOE, 1992b, *Environmental Assessment: Hanford Environmental Compliance Project, Hanford Site, Richland, Washington*, DOE/EA-0383, U.S. Department of Energy, Washington, D.C. (March).

DOE, 1993a, *Radiation Protection of the Public and the Environment*, DOE Order 5400.5, U.S. Department of Energy, Washington, D.C. (January).

DOE, 1993b, *Environmental Protection, Safety and Health Protection Standards*, DOE Order 5480.4, U.S. Department of Energy, Washington, D.C. (January).

DOE, 1994, *Land and Facility Use Policy*, Stewards of a National Resource, U.S. Department of Energy, Washington, D.C.

DOE, 1994a, *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Draft Environmental Impact Statement*, DOE/EIS-0203-D, U.S. Department of Energy, Idaho Operations Office (June).

DOE, 1994b, *Tank 241-C-106 Past-Practice Sluicing Waste Retrieval, Hanford Site, Richland, Washington,* DOE/EA-0933, U.S. Department of Energy, Washington, D.C. (February).

DOE, 1994c, *Environmental Assessment for the Resiting, Construction and Operation of the Environmental and Molecular Sciences Laboratory at the Hanford Site, Richland, Washington*, DOE/EA-0959, U.S. Department of Energy, Washington, D.C.

DOE, 1995a, *U.S. Department of Energy Environmental Justice Strategy, Executive Order 12898*, U.S. Department of Energy, Washington, D.C. (April).

DOE, 1995b, *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*, DOE/EIS-0203-F, U.S. Department of Energy, Idaho Operations Office (April).

DOE, 1995c, *Life-Cycle Asset Management,* DOE Order 430.1, U.S. Department of Energy, Washington, D.C. (August).

DOE, 1995d, *Draft/Final Environmental Impact Statement: Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington*, DOE/EIS-0245D, U.S. Department of Energy, Richland, Washington (October).

DOE, 1995e, *Environmental Assessment for the Deactivation of the N Reactor Facilities*, DOE/EA-0984, U.S. Department of Energy, Richland, Washington (May).

DOE, 1995f, *222-S Radioactive Liquid Waste Line Replacement and 219-S Secondary Containment Upgrade, Hanford Site, Richland, Washington*, DOE/EA-0944, U.S. Department of Energy, Richland, Washington (January).

DOE, 1995g, *Environmental Assessment: Inert/Demolition Waste Landfill (Pit 9) Hanford Site, Richland, Washington*, DOE/EA-0983, U.S. Department of Energy, Washington, D.C. (May).

DOE, 1995h, *Environmental Assessment: Disposition of Alkali Metal Test Loops, Hanford Site, Richland, Washington*, DOE/EA-0987, U.S. Department of Energy, Washington, D.C. (May).

DOE, 1995i, *Environmental Assessment: 300 Area Process Sewer Piping Upgrade and 300 Area Treated Effluent Disposal Facility Discharge to the City of Richland Sewer System, Hanford Site, Richland, Washington*, DOE/EA-0980, U.S. Department of Energy, Washington, D.C. (May).

DOE, 1995j, *Environmental Assessment: Shutdown of the Fast Flux Test Facility, 400 Area, Hanford Site, Richland, Washington*, DOE/EA-0993, U.S. Department of Energy, Washington, D.C. (May).

DOE, 1995k, *Environmental Assessment: Relocation and Storage of TRIGA Reactor Irradiated Fuel, Hanford Site, Richland, Washington*, DOE/EA-0985, U.S. Department of Energy, Washington, D.C. (August).

DOE, 1995l, *Environmental Assessment: Transfer of Plutonium-Uranium Extraction Plant and N Reactor Irradiated Fuel for Storage at the 105-KE and 105-KW Fuel Storage Basins, Hanford Site, Richland, Washington,* DOE/EA-0988, U.S. Department of Energy, Washington, D.C. (July).

DOE, 1996, *Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land-Use Plan*, DOE/EIS-02221, U.S. Department of Energy, Washington, D.C. (June).

DOE, 1996a, *Storage and Disposition of Weapons-Usable Fissile Materials Draft Programmatic Environmental Impact Statement*, DOE/EIS-0229D, U.S. Department of Energy, Office of Fissile Materials Disposition, Washington, D.C. (February).

DOE, 1996b, *Addendum (Final Environmental Impact Statement): Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington*, DOE/EIS-0245F, U.S. Department of Energy, Richland, Washington (January).

DOE, 1996c, *Baseline Environmental Management Report*, DOE/EM-0290, U.S. Department of Energy, Washington, D.C. (May).

DOE, 1996d, *Biodiversity Inventory and Analysis of the Hanford Site: 1995 Annual Report*, Grant #DE-FG06-94RL12858, prepared by The Nature Conservancy of Washington for the U.S. Department of Energy, Washington, D.C.

DOE, 1996e, *Comprehensive Land-Use Planning Process Guide*, GPG-FM-033, U.S. Department of Energy, Washington, D.C. (March).

DOE, 1996f, *Comprehensive Emergency Management System*, DOE O 151.1, U.S. Department of Energy, Washington, D.C. (August).

DOE, 1997a, *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*, DOE/EIS-0200-D, U.S. Department of Energy, Washington, D.C. (May).

DOE, 1997c, *Report on "Audit of the U.S. Department of Energy's Identification and Disposal of Nonessential Land,"* Internal Memorandum from Office of Inspector General to the Secretary, U.S. Department of Energy, Washington, D.C. (January 1997).

DOE, DOA, and DOI, 1995, *Columbia River System Operation Review Final Environmental Impact Statement*, DOE/EIS-0170, U.S. Department of Energy, U.S. Department of the Army, and the U.S. Department of the Interior, Portland, Oregon (November).

DOE and Ecology, 1996, *Final Environmental Impact Statement for the Tank Waste Remediation System*, DOE/EIS-0189, U.S. Department of Energy and Washington State Department of Ecology, Richland, Washington (August).

DOE-RL, 1990a, *Hanford Site Development Plan*, DOE/RL-89-15, U.S. Department of Energy, Richland Operations Office, Richland, Washington (January).

DOE-RL, 1990b, *Hanford Site Infrastructure Plan*, DOE/RL-89-31, U.S. Department of Energy, Richland Operations Office, Richland, Washington (January).

DOE-RL, 1991a, *Hanford Site Environmental Monitoring Plan*, DOE/RL-91-50, U.S. Department of Energy, Richland Field Office, Richland, Washington (November).

DOE-RL, 1994a, *Hanford Site Development Plan*, DOE/RL-94-13, U.S. Department of Energy, Richland Operations Office, Richland, Washington (May).

DOE-RL, 1994b, *Bald Eagle Site Management Plan for the Hanford Site, South-Central Washington,* DOE/RL-94-150, U.S. Department of Energy, Richland Operations Office, Richland, Washington (May).

DOE-RL, 1994c, *Fiscal Year 1995 Hanford Mission Plan, Volume 1, Site Guidance*, DOE/RL-93-102, U.S. Department of Energy, Richland Operations Office, Richland, Washington (September).

DOE-RL, 1995a, *Ecological Compliance Assessment Management Plan*, DOE/RL-95-11, Rev. 1, U. S. Department of Energy, Richland Operations Office, Richland, Washington (April).

DOE-RL, 1995b, *Solid Waste Retrieval Complex, Enhanced Radioactive and Mixed Waste Storage Facility, Infrastructure Upgrades, and Central Waste Support Complex, Hanford Site, Richland, Washington*, DOE/EA-0981, U.S. Department of Energy, Richland Operations Office, Richland, Washington (June).

DOE-RL, 1996, *Hanford Site Biological Resources Mitigation Strategy Plan* (BRMiS), DOE/RL-96-88, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1996a, *Plutonium Finishing Plant Stabilization Final Environmental Impact Statement, Hanford Site, Richland, Washington*, DOE/EIS-0244-F, U.S. Department of Energy, Richland Operations Office, Richland, Washington (May).

DOE-RL, 1996b, *Hanford Strategic Plan*, RL-D-96-92 U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1996c, *Hanford Biological Resources Management Plan* (BRMaP), DOE/RL-96-14, U.S. Department of Energy, Richland Operations Office, Richland, Washington (March).

DOI, 1995, *Endangered Ecosystems of the United States: A Preliminary Assessment of Loss and Degradation*, U.S. Department of the Interior, National Biological Service, Washington, D.C. (February).

DOI, 1995, *Treaties, Spirituality, and Ecosystems: American Indian Interests in the Northern Intermontane Region of Western North America*, U.S. Department of the Interior, Bureau of Land Management, Eugene, Oregon (August).

DOI, 1996, *United States Department of the Interior Record of Decision — Hanford Reach of the Columbia River: Final Environmental Impact Statement for Comprehensive River Conservation Studies*, dated July 16, 1996, U.S. Department of the Interior, Washington, D.C.

Ecology, 1993, *Hanford Land Transfer, A Report Prepared by the Washington State Department of Ecology*, Washington State Department of Ecology, Olympia, Washington (March).

Ecology, 1994, *Air Quality Program Annual Report 1994*, #95-200, Washington State Department of Ecology, Olympia, Washington.

Ecology and DOE-RL, 1995, *Final Environmental Impact Statement: Safe Interim Storage of Hanford Tank Wastes*, DOE/EIS-0212, Washington State Department of Ecology and U.S. Department of Energy, Richland Operations Office, Richland, Washington (October).

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, Document No. 89-10, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy.

Emergency Planning and Community Right-to-Know Act of 1986, 42 U.S.C. 11001, et seq.

Endangered Species Act of 1973, 16 U.S.C. 1531, et seq.

EPA, 1995a, *Declaration of the Record of Decision: USDOE Hanford 100 Area, 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington*, #023681, U.S. Environmental Protection Agency, Washington, D.C. (September).

EPA, 1995b, *Declaration of the Record of Decision: USDOE Hanford Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington, D.C. (January).

EPA, 1997, *Brownfields Economic Development Initiative*, EPA 500-F-97-158, U.S. Environmental Protection Agency, Washington, D.C. (September).

ERDA, 1975, *Waste Management Operations, Hanford Reservation, Richland Washington: Final Environmental Impact Statement*, ERDA-1538, Vol. 1, U.S. Energy Research & Development Administration, Washington, D.C.

Executive Order 11988, *Floodplain Management*, issued May 24, 1977.

Executive Order 11990, *Protection of Wetlands*, issued May 24, 1977.

Executive Order 12088, *Federal Compliance with Pollution Control Standards*, issued October 13, 1978.

Executive Order 12372, *Intergovernmental Review of Federal Programs*, issued July 14, 1982.

Executive Order 12580, *Superfund Implementation*, issued January 23, 1987.

Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*, issued August 3, 1993.

Executive Order 12866, *Regulatory Planning and Review*, issued September 30, 1993.

Executive Order 12875, *Enhancing the Intergovernmental Partnership*, issued October 26, 1993.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued February 11, 1994.

Executive Order 13007, *Indian Sacred Sites*, issued May 24, 1996.

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks,* issued April 21, 1997.

Farmland Protection Policy Act of 1981, 7 U.S.C. 4201-4209, et seq.

Federal Clean Air Act Amendments of 1990, 42 U.S.C. PRAC. 7512, 75129(a), et seq.

Federal Facilities Compliance Act of 1992, 42 U.S.C. 6901, et seq.

Federal Insecticide, Fungicide, and Rodenticide Act of 1972, 7 U.S.C. 136, et seq.

Federal Land Policy and Management Act of 1976, 43 U.S.C. 1701, 11761–1771, et seq.

Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1251-1376, et seq.

Fish and Wildlife Coordination Act of 1934, 16 U.S.C. 661, et seq.

Fish and Wildlife Conservation Act of 1980, 16 U.S.C. 2901, et seq.

Fitzner, R. E., and R. H. Gray, 1991, "The Status, Distribution, and Ecology of Wildlife on the U.S. DOE Hanford Site: A Historical Overview of Research Activities," *Environmental Monitoring and Assessment*, 18 (3): 173-202.

Franklin, J. F., and C. T. Dymess, 1973, *Natural Vegetation of Oregon and Washington*, Pacific Northwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, Portland, Oregon.

FSUWG, 1992, *The Future for Hanford: Uses And Cleanup, The Final Report of the Hanford Future Site Uses Working Group*, Hanford Future Site Uses Working Group, Westinghouse Hanford Company, Richland, Washington.

Gerber, M. S., 1992, *Legend and Legacy: Fifty Years of Defense Production at the Hanford Site*, WHC-MR-0293, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Gerber, M. S., 1997, *Gerber's History Homepage*, http://www.hanford.gov/history/index.htm. U. S. Department of Energy, Richland, Washington.

Growth Management Act of 1990, RCW 36.70A, et seq.

Hanford Reach, 1996, "Trimming the Workforce," *Hanford Reach*, U.S. Department of Energy, Richland Operations Office, Richland, Washington, p. 12 (April 8).

Hanford Waste Tank Force, 1993, *Hanford Tank Waste Task Force: Final Report to Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy*, The Hanford Waste Task Force, Richland, Washington.

Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. 6901, et seq.

Hazardous Waste Management Act of 1976, RCW 70.105, et seq.

Historic Sites, Buildings, and Antiquities Act of 1965, 16 U.S.C. 1461, et seq.

Jason Associates, 1996, (Personal communication with E. Brincken, Natural Resources Conservation Service, U.S. Department of Agriculture, Pasco, Washington, March 19), Jason Associates, Richland, Washington.

Jones, V. C., 1985, *United States Army in World War II, Special Studies — Manhattan: The Army and the Atomic Bomb*, Center of Military History, United States Army, Washington, D.C.

Materials Act of 1947, 30 U.S.C. 601-603, et seq.

Migratory Bird Treaty Act of 1918, 16 U.S.C. 703, et seq.

Mining Law of 1872, 30 U.S.C. 22, May 10, et seq.

Model Toxics Control Act of 1989, RCW 70.105D, et seq.

National Defense Authorization Act of 1994, 107, STAT 1547, et seq.

National Environmental Policy Act of 1969, 42 U.S.C. 4321, et seq.

National Historic Preservation Act of 1966, 16 U.S.C. 470, et seq.

National Wildlife Refuge System Administration Act of 1966, 42 U.S.C. 668dd-ee, et seq.

Native American Graves Protection and Repatriation Act of 1990, 25 U.S.C. 3001, et seq.

Navy, 1996, *Final Environmental Impact Statement on the Disposal of Decommissioned, Defueled Cruiser, Ohio Class, and Los Angeles Class Naval Reactor Plants,* DOE/EIS-0259, U.S. Department of the Navy, Washington, D.C. (April).

Neitzel, D. A., C. J. Formire, D. W. Harvey, D. J. Hoitink, P. D. Thorne, B. N. Bjornstad, R. A. Fowler, P. L. Hendrickson, D. J. Hostick, T. M. Poston, and M. K. Wright, 1997, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNNL-6415, Rev. 9 (UC-600), Pacific Northwest National Laboratory, Richland, Washington.

Noise Control Act of 1972, 42 U.S.C. 4901 to 4918, et seq.

Noise Pollution and Abatement Act of 1970, 42 U.S.C. 1858, et seq.

Northwest Power Act, 16 U.S.C. 839-839h, et seq.

NPS, 1988, *National Register of Historic Places,* National Park Service, U.S. Department of the Interior, Washington, D.C.

NPS, 1994, *Hanford Reach of the Columbia River, Comprehensive River Conservation Study and Environmental Impact Statement, Final - June 1994*, National Park Service, Pacific Northwest Regional Office, Seattle, Washington (June).

NPS, 1996, *Hanford Reach of the Columbia River Final Environmental Impact Statement for Comprehensive River Study*, National Park Service, U.S. Department of the Interior, Washington, D.C.

NSF, 1993, *Environmental Assessment for Construction and Operation of a Laser Interferometer Gravitational-Wave Observatory on the Hanford Site*, National Science Foundation, Richland, Washington (October).

Nuclear Waste Policy Act of 1982, 42 U.S.C. 10101-10270, et seq.

Occupational Safety and Health Act of 1970, 29 U.S.C. 651, et seq.

Omnibus Parks and Public Lands Management Act of 1996, Public Law 104-333, November 12, 1996.

Pacific Salmon Treaty Act of 1985, 16 U.S.C. 3631, et seq.

Parker, P. L., and T. F. King, 1990, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*, National Register Bulletin No. 38, U.S. Department of Interior, National Park Service, Interagency Resources Division, Washington, D.C.

PNL, 1966, *Soil Survey Hanford Project in Benton County Washington*, BNWL-243, Pacific Northwest Laboratory, Richland, Washington (April).

PNL, 1977, *Ecology of the 200 Area Plateau Waste Management Environs: A Status Report*, PNL-2253, Pacific Northwest Laboratory, Richland, Washington (October).

PNL, 1981, *Raptors of the Hanford Site and Nearby Areas of Southcentral Washington*, PNL-3212, Pacific Northwest Laboratory, Richland, Washington (May).

PNL, 1984, *Environmental Characterization of Two Potential Locations at Hanford for a New Production Reactor*, PNL-5275, Pacific Northwest Laboratory, Richland, Washington (September).

PNL, 1987, *The Economic and Community Impacts of Closing Hanford's N Reactor and Nuclear Materials Production Facilities*, PNL-6295, Pacific Northwest Laboratory, Richland, Washington (August).

PNL, 1989, *Hanford Cultural Resources Management Plan*, PNL-6942, Pacific Northwest Laboratory, Richland, Washington (June).

PNL, 1990a, *Spawning and Abundance of Fall Chinook Salmon (Oncorhynchus tshawytscha) in the Hanford Reach of the Columbia River, 1948-1988*, PNL-7289, Pacific Northwest Laboratory, Richland, Washington (March).

PNL, 1990b, *Archaeological Survey of the 200 East and 200 West Areas, Hanford Site, Washington*, PNL-7264, Pacific Northwest Laboratory, Richland, Washington (March).

PNL, 1991a, *A Study Plan for Determining Recharge Rates at the Hanford Site Using Environmental Tracers*, PNL-7626, Pacific Northwest Laboratory, Richland, Washington (February).

PNL, 1991b, *An Evaluation of the Chemical, Radiological, and Ecological Conditions of West Lake on the Hanford Site*, PNL-7662, Pacific Northwest Laboratory, Richland, Washington (March).

PNL, 1993a, *Hanford Site Environmental Report for Calendar Year 1992*, PNL-8682, Pacific Northwest Laboratory, Richland, Washington (June).

PNL, 1993b, *Arid Lands Ecology Facility Management Plan*, PNL-8506, Pacific Northwest Laboratory, Richland, Washington (February).

PNL, 1993c, *Habitat Types on the Hanford Site: Wildlife and Plant Species of Concern*, PNL-8942, Pacific Northwest Laboratory, Richland, Washington (December).

PNL, 1993d, *A Preliminary Survey of Selected Structures on the Hanford Site for Townsend's Big-Eared Bat (Plecotus townsendii)*, PNL-8916, Pacific Northwest Laboratory, Richland, Washington (October).

PNL, 1994a, *Public Values Related to Decisions in the Tank Waste Remediation System Program*, PNL-10107, Pacific Northwest Laboratory, Richland, Washington (August).

PNL, 1994b, *Climatological Data Summary 1993 with Historical Data*, PNL-9809, Pacific Northwest Laboratory, Richland, Washington (June).

PNL, 1995, *Hanford Site Environmental Report for Calendar Year 1994*, PNNL-10574, Pacific Northwest National Laboratory, Richland, Washington.

PNNL, 1996a, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, PNL-6415, Rev. 8, Pacific Northwest National Laboratory, Richland, Washington (August).

PNNL, 1996b, *Hanford Site Environmental Report for Calendar Year 1995*, PNNL-11339, Pacific Northwest National Laboratory, Richland, Washington (June).

PNNL, 1996c, *Hanford Site Ground-Water Monitoring for 1995*, PNNL-11141, Pacific Northwest National Laboratory, Richland, Washington (August).

PNNL, 1997a, *Hanford Site Environmental Report*, Pacific Northwest National Laboratory, Richland, Washington.

PNNL, 1997b, *Hanford Site Groundwater Monitoring for Fiscal Year 1997*, Pacific Northwest National Laboratory, Richland, Washington.

Pollution Prevention Act of 1990, 42 U.S.C. 13101, et seq.

Relander, C., 1956, *Drummers and Dreamers*, Caxton Printers, Caldwell, Idaho.

Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.

Rickard, W. H., and L. D. Poole, 1989, "Terrestrial Wildlife of the Hanford Site: Past and Future," *Northwest Science*, 63 (4): 183-193.

Rivers and Harbors Act of 1899, 33 U.S.C. 401-415, et seq.

Safe Drinking Water Act of 1974, 42 U.S.C. 300(f), et seq.

Schuller, C. A., W. H. Rickard, and G. A. Sargeant, 1993, "Conservation of Habitats for Shrub-Steppe Birds," *Environmental Conservation*, 20 (1): 57-64.

Shoreline Management Act of 1971, Revised Code of Washington 90.58, as amended.

Solid Waste Disposal Act of 1965, 42 U.S.C. 3251 to 3259, et seq.

State Environmental Policy Act of 1971, RCW 43.21C, et seq.

State of Washington, 1979, *Easement Deed for Section 1, Township 11 North, Range 26 East, Willamette Meridian, Benton County, Washington*, Vol. 396, Page 957, No. 822547, State of Washington, County of Benton, Washington, dated October 4, 1979.

State of Washington, 1980, *Quit Claim Deed for Section 1, Township 11 North, Range 26 East, Willamette Meridian, Benton County, Washington*, Vol. 395, Page 956, No. 822546, State of Washington, King County, Washington, dated June 30, 1980.

Superfund Amendments and Reauthorization Act of 1986, 42 U.S.C. 9671, et seq.

TCH, 1996a, "Apartment Vacancy Rates Rising in Tri-Cities," page C1, (Carrie Schafer, Herald Staff Writer), *Tri-City Herald*, Kennewick, Washington (March 7).

TCH, 1996b, "State Seeks Increase in Radioactive Waste Limit," page A12, (John Stang, Herald Staff Writer), *Tri-City Herald*, Kennewick, Washington (May 30).

TNC and R. J. Pabst, 1995, *Biodiversity Inventory and Analysis of the Hanford Site, 1994 Annual Report*, prepared by The Nature Conservancy for the U.S. Department of Energy, Richland Operations Office, Richland, Washington (May).

Toxic Substances Control Act of 1976, 15 U.S.C. 2601-2671, et seq.

Treaty with the Nez Perce, June 11, 1855, 12 Stats 957.

Treaty with the Walla Walla, Cayuse, etc., June 9, 1855, 12 Stats 945.

Treaty with the Yakama, June 9, 1855, 12 Stats. 951.

USBC, 1992, *1990 Census of Population and Housing*, Summary Tape File 3 on CD-ROM, U.S. Department of Commerce, U.S. Bureau of Census, Washington, D.C.

USDA-NASS, 1992, *Census of Agriculture*, U.S. Department of Agriculture, Washington, D.C.

WAC 173-216, 1995, "State Waste Water Discharge Permit Program," *Washington Administrative Code*, as amended.

WAC 173-303, 1995, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WAC 173-460, 1991, "Controls for New Sources of Toxic Air Pollutants," *Washington Administrative Code*, as amended.

WAC 173-480, 1986, "Ambient Air Quality Standards and Emission Limits for Radionuclides," *Washington Administrative Code*, as amended.

WAC 197-11, 1984, "State Environmental Policy Act," *Washington Administrative Code*, as amended.

WAC 232-12-011, 1993, "Wildlife classified as protected shall not be hunted or fished," *Washington Administrative Code*, as amended.

WAC 232-12-014, 1993, "Wildlife classified as endangered species," *Washington Administrative Code*, as amended.

WAC 246-247, 1994, "Radiation Protection--Air Emissions," *Washington Administrative Code*, as amended.

WAC 365-190-080, 1991, "Critical Areas," *Washington Administrative Code*, as amended.

Washington Clean Air Act of 1991, RCW 70.94, et seq.

Washington Department of Fish and Wildlife Agricultural Lease #R-01.

Washington Department of Fish and Wildlife Agricultural Lease #WB-01.

Washington Department of Fish and Wildlife Agricultural Lease #WB-02.

Washington Department of Fish and Wildlife Grazing Permit #W5-01.

Water Pollution Control Act of 1945, as amended, RCW 90.48, et seq.

Water Resources Planning Act of 1965, 42 U.S.C. 1962, et seq.

Watson, Jack, 1991, Benton County Agricultural Extension Office, Prosser, Washington.

WDFW, 1996, *Status of Washington's Shrub-Steppe Ecosystem: Extent, Ownership, and Wildlife/Vegetation Relationships*, Washington Department of Fish and Wildlife, Wildlife Management Program, Olympia, Washington (August).

WHC, 1991a, *Geologic Setting of the 200-West Area: An Update*, WHC-SD-EN-TI-008, Rev. 0, Westinghouse Hanford Company, Richland, Washington (January).

WHC, 1992, *Hanford Groundwater Cleanup and Restoration Conceptual Study*, WHC-EP-0458, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992a, *Fiscal Year 1991 100 Areas CERCLA Ecological Investigations*, WHC-EP-0448, Westinghouse Hanford Company, Richland, Washington (April).

WHC, 1992b, *Status of Birds at the Hanford Site in Southeastern Washington*, WHC-EP-0402, Rev. 1, Westinghouse Hanford Company, Richland, Washington (June).

WHC, 1992c, *A Synthesis of Ecological Data from the 100 Areas of the Hanford Site*, WHC-EP-0601, Westinghouse Hanford Company, Richland, Washington (October).

WHC, 1992d, *Biological Assessment for Rare and Endangered Plant Species, Related to CERCLA Characterization Activities*, WHC-EP-0526, Westinghouse Hanford Company, Richland, Washington (April).

WHC, 1992e, *Biological Assessment for State Candidate and Monitor Wildlife Species Related to CERCLA*, WHC-SD-EN-EE-009, Rev. 0, Westinghouse Hanford Company, Richland, Washington (August).

WHC, 1992f, *Vascular Plants of the Hanford Site*, WHC-EP-0554, Westinghouse Hanford Company, Richland, Washington (July).

WHC, 1994, *Vegetation Communities Associated with the 100-Area and 200-Area Facilities on the Hanford Site*, WHC-SD-EN-TI-216, Rev. 0, Westinghouse Hanford Company, Richland, Washington (January).

Wild and Scenic Rivers Act of 1968, 16 U.S.C. 1271, et seq.

This page intentionally left blank.

Glossary

100-year flood. A flood event of a magnitude that occurs, on average, once every 100 years, and equates to a 1-percent probability of occurring in any given year.

Adequate public facilities. Facilities which have the capacity to serve development without decreasing levels of service below locally established minimums.

Affected environment. In an environmental impact statement, a description of the existing environment covering information that directly relates to the scope of the proposed action and alternatives that are analyzed in the impact analysis. The affected environment provides a baseline and must include sufficient detail to support the impact analysis, including cumulative impacts. Environmentally sensitive resources, such as floodplains and wetlands, threatened and endangered species, prime and unique agricultural lands, and historic and cultural resources, must be identified.

Agriculture. Improvements or activities associated with the growing, cultivating, and/or harvesting of crops and livestock, including those activities necessary to prepare the agricultural commodity for shipment.

Agricultural land-use designation. As presented in this environmental impact statement, an area designated for the tilling of soil, raising of crops and livestock, and horticulture for commercial purposes along with all those activities normally and routinely involved in horticulture, and the production of crops and livestock. Includes related activities that support the above uses.

Atmospheric stability. A measure of the amount of mixing and turbulence in the atmosphere.

Attainment area. Any area that is designated, pursuant to 42 U.S.C. 7407(d) of the *Clean Air Act of 1970*, as having ambient conditions equal to or less than national primary or secondary ambient air quality standards for a particular air pollutant or a group of air pollutants.

Animal unit month (AUM). An AUM is defined as the amount of forage required by an animal-unit (a mature cow weighing 453.6 kg (1,000 lbs) with unweaned calf) for one month assuming average daily consumption to be 11.8 kg (26 lbs) of dry matter. Therefore, by convention, an AUM equals 353.8kg (780 lbs) of dry forage. The amount of area that is required for each AUM determines the stocking rate or the actual number of animals on a specific area at a specific time. The area of land allowed per animal unit for the entire grazing period of the year is expressed as animal units/unit area (AU/Ha) or unit area/AUM (Ha/AUM).

Background radiation. Radiation from cosmic sources; naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material); consumer products containing nominal amounts of radioactive material or producing nominal amounts of radiation; and global fallout that exists in the environment (e.g., from the testing of nuclear explosive devices).

Barrier. Manmade components of a waste management system designed to prevent or impede the release of radionuclides or other contaminants to the biosphere. Barriers can include the waste form, waste container, and materials placed over, under, or around these containers or wastes. For example, an engineered cap constructed over a waste site is a barrier.

Basalt. A dark grey to black, fine grained igneous rock composed primarily of calcium feldspar and pyroxene, with or without olivine. This material underlies the Hanford Site, and may be quarried for use as riprap in the construction of caps to prevent the migration of contaminants in surface soils and burial grounds by preventing infiltration of precipitation.

Benthic. Living on or at the bottom of a body of water.

Biodiversity. The diversity of ecosystems, species, and genes, and the variety and variability of life. Biodiversity also is a qualitative measure of the richness and abundance of ecosystems and species in a given area.

Bounding. Represents the maximum reasonably foreseeable event or impact. All other reasonably foreseeable events or impacts would have fewer and/or less severe environmental impacts.

Buffer zone. An area designated to separate and/or protect human health and safety. In the context of this environmental impact statement, buffer zones in which access is restricted would be maintained around disposal sites and active facilities to protect public health and safety.

Candidate species. A plant or animal species that is under consideration by the U.S. Fish and Wildlife Service or Washington Department of Fish and Wildlife for listing as either threatened or endangered.

Cap. Construction of an engineered barrier over the top of a waste site in order to prevent or impede the release of radionuclides or other waste material into the environment.

Carcinogen. Any substance or agent that is capable of producing cancer.

Chronic exposure. The absorption or intake of hazardous material over a long period of time (e.g., over a lifetime).

Class I area. Under the *Clean Air Act of 1970*, the designation applies to pristine areas, such as national parks and wilderness areas, where substantial growth is effectively precluded in order to avoid degradation of air quality. Goat Rocks Wilderness Area is the closest Class I area to the Hanford Site, located approximately 90 miles northwest.

Class II area. A designation for areas under the *Clean Air Act of 1970* where moderate degradation of air quality is permissible. The Hanford Site and its immediate vicinity are in a Class II Area.

Cold War. Intense economic, political, military, and ideological rivalry between nations just short of military conflict. Major expansions in the production of nuclear materials for military applications were undertaken at the Hanford Site so that the Nation could maintain an overwhelming arsenal of nuclear weapons. In the context of this environmental impact statement, the Cold War refers to the period from the end of World War II to 1989 (when the Berlin Wall was dismantled).

Confined aquifer. An aquifer bounded above and below by less permeable layers. Groundwater in the confined aquifer is under a pressure greater than atmospheric pressure.

Conservation. Areas of ecological, geological, archaeological, and cultural significance and sensitivity that are to be protected and managed so as to maintain the essential qualities derived from the landscape, but contain supplemental values of scientific, education, historical, scenic, and mineral importance that may be suited to human uses insofar as the essential qualities remain intact over the landscape.

Conservation land-use designation. As presented in this environmental impact statement, an area reserved for the management and protection of archeological, cultural, ecological, and natural resources. Limited and managed mining and grazing could occur as a conditional use within appropriate areas. Limited public access would be consistent with resource conservation. Includes related activities that support the above uses.

Controlled area. An area to which access is controlled to protect individuals from exposure to radiation or radioactive and/or hazardous materials.

Contamination. The presence of unwanted radioactive and/or hazardous materials above background concentrations in environmental media (e.g., air, soil, water) or on the surfaces of structures, objects, or personnel.

Criteria pollutants. Substances for which national ambient air quality standards have been established by the U.S. Environmental Protection Agency.

Critical areas. Critical areas are required by Chapter 36.70A of the *State of Washington's Growth Management Act*. Guidelines for defining critical areas are given in WAC 365-190-080. Items to be considered by the local planning agency are as follows: (1) wetlands, (2) aquifer recharge areas, (3) frequently flooded areas, (4) geologically hazardous areas, and (5) fish and wildlife habitat conservation areas. Counties and cities may use information prepared by the Washington department of wildlife to classify and designate locally important habitats and species. Priority habitats and priority species are being identified by the Department of Wildlife for all lands in Washington State. While these priorities are those of the department, they and the data on which they are based may be considered by counties and cities.

Critical habitat. Any air, land, or water area determined (through a regulatory action under the *Endangered Species Act of 1973*) to be essential to the survival of a population of an endangered or threatened species or habitat deemed to be necessary for the recovery of a threatened or endangered species. Critical habitat has not been designated on the Hanford Site.

Cumulative impact. The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable, future actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.

Cultural resources. Areas or objects that are of cultural significance to human history at the national, state, or local level. Generally includes paleontological, pre-contact, and post-contact resources, as well as resources of traditional use or religious value to Native Americans.

Decommissioning. The process of removing a facility from operation, followed by decontamination, entombment, dismantlement, or conversion to another use.

Decontamination. The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, (e.g., removing radioactive contamination from facilities, soil, or equipment by washing, chemical action, mechanical cleaning, or other techniques).

Development. Any change in use, or extension of the use of the land, including, but not limited to, the construction, reconstruction, conversion, structural alteration, relocation, or enlargement of any improvements.

DOE orders. Requirements internal to the U.S. Department of Energy that establish agency policy and procedures, including procedures for compliance with applicable laws.

Derived concentration guides. Concentrations of radionuclides in air and water that an individual could continuously consume, inhale, or be immersed in at average annual rates without receiving an effective dose equivalent greater than 100 mrem/yr.

Dose (or radiation dose). A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent. Relates to a chemical to which an organism is exposed; generally denotes the quality of radiation or energy that is absorbed by the organism.

Dose conversion factor. Any factor used to change an environmental measurement to dose in units of concern.

Ecosystem. The interacting system of a biological community and its physical environment, considered as a unit in nature.

Emission standards. Legally enforceable limits on the quantities and/or kinds of air pollutants that can be emitted into the atmosphere.

Endangered species. Animals, birds, fish, plants, or other living organisms threatened with extinction by man-made or natural changes in their environment. Requirements for declaring a species endangered are contained in the *Endangered Species Act of 1973*.

Environmental justice. The fair treatment of people of all races, cultures, and income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Executive Order 12898 required Federal agencies to identify and address any potentially disproportionately high and adverse human health and environmental effects of agency policies, programs, and activities on minority and low-income populations.

Evapotranspiration. The combined processes by which water is transferred from the surface of the Earth to the atmosphere, including evaporation of liquid or solid water, and transpiration from plants.

Exclusive Use Zone (EUZ). The EUZ is an area designated for activities associated with waste sites and facilities that severely restrict public access. This zone extends from the facility fence line to a distance at which threat to the public from routine and accidental releases diminish to the point where public access can be routinely allowed. It is inside the Emergency Planning Zone (EPZ) and is the same as the exclusion zone boundary required by DOE's "Comprehensive Emergency Management System Order" (DOE O 151.1).

Exposure scenario. A set of facts, assumptions, and inferences about how exposure takes place that aids the exposure assessor in evaluating, estimating, or quantifying exposures.

Facility area. An area within the Hanford Site Boundary immediately surrounding a facility or group of facilities that functions under process safety management and a common emergency response plan.

Floodplain. The portion of a river valley that becomes covered with water when the river overflows its banks at flood stage.

Food chain. The pathways by which any material entering the environment passes from the first absorbing organism through plants and animals, including humans.

Fugitive dust. The particulate matter that is stirred up and released into the atmosphere during excavation or construction activities.

Grazing. To feed on growing herbage, attached algae, or phytoplankton

Groundwater. The supply of water below the land surface in the zone of saturation.

Groundwater mounds. A hydrologic condition, often caused by artificial recharge of an aquifer, in which "mounds" of groundwater are created. These mounds have been known to alter the natural hydraulic gradients and drainage patterns of an aquifer. The pressure and weight of the groundwater mounds can increase the hydrostatic head so all nearby groundwater, and any associated contaminant plume, could move more rapidly toward a receptor.

Grouting. The process of immobilizing or fixing solid or liquid forms of waste to enable safe storage or disposal. Generally, grout is a fluid mixture of cementitious materials and waste that sets up as a solid mass.

Half-life. The time in which half the atoms of a particular radioactive substance disintegrate to a different nuclear form. Used as a measure of the persistence of radioactive materials; each radionuclide has a characteristic, constant half-life. Measured half-lives vary from millionths of a second to billions of years.

Hanford Federal Facility Agreement and Consent Order. The *Hanford Federal Facility Agreement and Consent Order* (also referred to as the Tri-Party Agreement, or TPA), is a binding agreement, negotiated pursuant to Section 120 of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980,* and other regulations signed by the U.S. Department of Energy, the U.S. Environmental Protection Agency (Region 10), and the Washington State Department of Ecology, to organize responsibilities for remediation of the Hanford Site and to establish milestones by which the remediation will be accomplished. This agreement commits the three agencies to a long-term cooperative program to remediate the contaminated sites at Hanford. The Tri-Party Agreement contains a blueprint for remediation and uses enforceable milestones to keep the program on schedule.

Hazard classification. A safety classification based on potential onsite consequences. Criteria for this classification are discussed in DOE Order 5480.23, *Nuclear Safety Analysis Reports*.

Hazardous air pollutant. Any air pollutant subject to a standard promulgated under 42 U.S.C. Section 7412 or other requirements established under 42 U.S.C. Section 7412 of the *Clean Air Act of 1970*, including 42 U.S.C. Section 7412 (g), (j), and (r) to the *Clean Air Act of 1970*. The State of Washington regulates similar pollutants as "toxic air pollutants." However, State regulations apply only to new sources; Federal regulations apply to new and existing sources. The list of chemicals regulated by the state overlaps with the Federal list, but is considerably longer.

Hazardous material. A substance or material, including a hazardous substance, that has been determined by the U.S. Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce.

Hazardous substance. Any substance that, when released to the environment in an uncontrolled or unpermitted fashion, becomes subject to the reporting and possible response provisions of the *Clean Water Act of 1977* and the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*.

Hazardous waste. Those wastes that are identified as hazardous pursuant to 40 CFR 261.

High-efficiency particulate air (HEPA) filter. A filter with an efficiency of at least 99.95% that is used to separate particles from exhaust streams prior to release into the atmosphere.

High-Intensity Recreation land-use designation. As presented in this environmental impact statement, an area allocated for high-intensity visitor serving activities and facilities (commercial and governmental) such as golf courses, recreational vehicle parks, boat launching facilities, Tribal fishing facilities, destination resorts, cultural centers, and museums. Includes related activities that support the above uses.

High-level waste. The highly radioactive waste material that results from processing or reprocessing spent nuclear fuel, including liquid waste produced directly from reprocessing and any solid waste derived from the liquid that contains a combination of transuranic and fission product nuclides in quantities that require permanent isolation. High-level waste may include other highly radioactive material that the U.S. Nuclear Regulatory Commission, consistent with existing law, determines by rule to require permanent isolation.

Historic resources. The sites, districts, structures, and objects that are considered limited and nonrenewable because of an association with historic events, persons, or social or historic movements.

Horticulture. The science and art of growing fruits, vegetables, flowers, or ornamental plants.

Hydraulic conductivity. The capacity of a porous medium to transport water. The parameter relating the volumetric flux to the driving force in flow through a porous medium (particularly water through soil); a function of both the porous medium and the properties of the fluid.

Hydraulic gradient. The slope of the water table.

Impact. The effect, influence, alteration, or imprint of an action. Impacts may be beneficial or detrimental.

Industrial land-use designation. As presented in this environmental impact statement, an area suitable and desirable for activities such as: reactor operations, rail, barge transport facilities, mining, manufacturing, food processing, assembly, warehouse, and distribution operations. Includes related activities that support the above uses.

Industrial-Exclusive land-use designation. As presented in this environmental impact statement, an area suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and non-radioactive wastes. Includes related activities that support the above uses.

Infrastructure. The basic services, facilities, and equipment needed for the operation and growth of an area.

Institutional control. Control of waste management facilities through human institutions. Institutional controls include such measures as access restrictions, deed restrictions, or restrictions on activities or site uses.

Interim action (NEPA). An action that may be undertaken while work on a required program environmental impact statement is in progress, and the action is not covered by an existing program statement. An interim action may not be undertaken unless such action: (1) is justified independently of the program; (2) is itself accompanied by an adequate environmental impact statement or has undergone other *National Environmental Policy Act of 1969* review; and (3) will not prejudice the ultimate decision on the program (i.e., interim action prejudices the ultimate decision on the program when the action tends to determine subsequent development or limits alternatives).

Ion exchange. The reversible interchange of ions of like charge within a medium.

Land use. A term used to indicate the utilization of any piece of land. The way in which land is being used is the land use.

Land-use planning. A decision-making process to determine the future or end use of a parcel of land, considering such factors as current land use, public expectations, cultural considerations, local ecological factors, legal rights and obligations, technical capabilities, and cost.

Life-cycle costs. All costs, except the cost of personnel occupying a facility, from the time that the space requirement is defined until the facility passes out of government hands.

Low-Intensity Recreation land-use designation. As presented in this environmental impact statement, an area allocated for low-intensity visitor serving activities and facilities such as: biking, fishing, hiking, hunting, boat launching facilities, and primitive day camping. Includes related activities that support the above uses.

Low-level waste. Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel. Test specimens of fissionable material irradiated for research and development, and not for the production of power or plutonium, may be classified as low-level waste if the concentration of transuranic elements is less than 100 nanocuries per gram of waste. The U.S. Department of Energy, U.S. Environmental Protection Agency, and U.S. Nuclear Regulatory Commission share the responsibility for managing low-level waste.

Manhattan Project. The code name for the large-scale national project that developed the first atomic bomb.

Maximally exposed individual (MEI). An hypothetical person who lives near the Hanford Site who, by virtue of location and living habits, could receive the highest possible radiation dose.

Maximum contaminant level (MCL). Under the *Safe Drinking Water Act of 1974*, the maximum permissible concentrations of specific constituents in drinking water that is delivered to any user of a public water system that serves 15 or more connections and 25 or more people. The standards take into account the feasibility and cost of attaining the standard. In this environmental impact statement, MCLs are referred to as *Drinking Water Standards*.

Milestone. An important or critical event that must occur in order to achieve the objectives of the Tri-Party Agreement.

millirem (mrem). One thousandth (10^{-3}) of a rem (see also, rem).

Mitigation. Those actions that avoid impacts altogether, minimize impacts, rectify impacts, reduce or eliminate impacts, or compensate for impacts.

Mitigation bank. Wetland enhancement, restoration, or creation undertaken to provide mitigation (compensation) for wetlands losses from future development activities undertaken in advance of development as part of a credit program.

Mixed waste. Waste containing both radioactive and hazardous components as defined by the *Atomic Energy Act of 1954* and the *Resource Conservation and Recovery Act of 1976*, respectively.

Modified Mercalli intensity (MMI). The MMI scale (designated by Roman numerals I through XII) is used to measure the intensity of an earthquake in a particular area. It differs from the Richter Scale (which measures the energy released by an earthquake). Briefly, the scale is: I -- Barely Felt; II -- Just Felt; III -- Noticeable; IV -- Rattling; V -- Felt Strong; VI -- Frightening; VII -- Disturbing; VIII -- Panicking; IX -- Some Damage; X -- Much Damage; and XI -- Complete Destruction.

Multiple use management. Management of the various surface and subsurface resources so that they are utilized in the combination of ways that will best meet the present and future needs of the public, without permanent impairment of the productivity of the land or the quality of the environment.

National Ambient Air Quality Standards (NAAQS). Air quality standards established by the *Clean Air Act of 1970*. Primary NAAQS are intended to protect public health with an adequate margin of safety. Secondary NAAQS are intended to protect the public welfare from any known or anticipated adverse effects of a pollutant.

National Environmental Research Parks. Outdoor laboratories set aside for ecological research to study the environmental impacts of energy developments and for informing the public of environmental and land use options. The parks were established under the U.S. Department of Energy to provide protected land areas for research and education in the environmental sciences and to demonstrate the environmental compatibility of energy technology development and use.

National Priorities List (NPL). A formal listing of the most hazardous waste sites in the nation, as established under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, that have been identified for remediation.

National Register of Historic Places. A list of architectural, historical, archaeological, and cultural sites of local, state, or national significance, established by the *Historic Preservation Act of 1966*, and maintained by the National Park Service. Sites are nominated to the Register by state or Federal agencies.

Nearest public access location. For facility accident analysis, the location of the nearest point where members of the public could be present, such as on an uncontrolled public highway that crosses the Hanford Site.

Nitrogen oxides (NO_x). Gases formed from atmospheric nitrogen and oxygen when combustion takes place under high temperature and high pressure. Nitrogen oxides include nitric oxide (NO) and nitrogen dioxide (NO_2). Nitrogen oxides are considered to be a major air pollutant and are regulated under the *Clean Air Act*. In the presence of sunlight, nitric oxide combines with atmospheric oxygen to form nitrogen dioxide, which can cause lung damage at high concentrations.

Nonattainment area. An area which is shown by monitoring data to exceed any national primary or secondary ambient air quality standard for a pollutant.

NO_x. A generic term used to describe oxides of nitrogen (see nitrogen oxides).

Nuclear fuel. Materials that are fissionable and can be used in nuclear reactors for the production of energy.

Nuclide. A generic term referring to all known isotopes, both stable and unstable, of the chemical elements.

Offsite. Any place located outside of the Hanford Site boundary.

Onsite. A place located within the Hanford Site boundary.

Operable unit. A discrete set of one or more release sites that are considered together for assessment and remedial activities. Criteria for placement of release sites into an operable unit include geographic proximity, similarity of waste characteristics and site types, and the possibilities for economy of scale.

Outfall. The end of a drain or pipe that carries waste water or other effluents into a ditch, pond, or river.

Permeability. The degree of ease with which water can pass through a rock or soil.

Physiographic province. An extensive portion of the landscape, normally encompassing many hundred square miles, which portrays similar qualities of soil, rock, shape, and vegetation of the same geomorphic origin.

Planning criteria. The factors used to guide development of the land use plan, or revision, to ensure that it is tailored to the issues previously identified and to ensure that unnecessary data collection and analyses are avoided.

Plume. The cloud of a pollutant in air, surface water, or groundwater formed after the pollutant is released from a source.

Plutonium-Uranium Extraction Faciilty (PUREX). The PUREX Facility on the Hanford Site used a chemical process to reprocess spent nuclear fuel and irradiated targets.

PM_{10}. All particulate matter in the ambient air with an aerodynamic diameter less than or equal to ten (10) micrometers.

Polychlorinated biphenyls (PCBs). A class of chemical substances formerly manufactured for use as an insulating fluid in electrical equipment. These chemical substances are highly toxic to aquatic life, persist in the environment, and accumulate in animal tissues.

Porosity. The ratio of the volume of pores of a material to the volume of its mass.

Post-contact resources. Sites, districts, structures, and objects considered limited and nonrenewable because of their association with renowned events, persons, or social movements.

Pre-contact resources. All evidences of human activity that predate recorded history and can be used to reconstruct lifeways and culture history of past peoples. These include sites, artifacts, and the contexts in which they occur.

Pre-contact. Of, relating to, or existing in times antedating written history. Pre-contact cultural resources are those that antedate written records of the human cultures that produced them.

Prehistoric resources. All evidence of human activity that pre-dates recorded history and can be used to reconstruct lifestyles and cultural history of past peoples, including artifacts and the contexts in which the artifacts occur.

Preservation. Areas of ecological, geological, archaeological, and cultural significance and sensitivity that are to be protected and managed so as to preserve their natural condition and value.

Preservation land-use designation. As presented in this environmental impact statement, an area managed for the preservation of archeological, cultural, ecological, and natural resources. No new consumptive uses (e.g., mining) would be allowed within this area. Public access limitations would be consistent with resource preservation requirements. Includes related activities that support the above uses.

Probable maximum flood. The largest flood for which there is any reasonable expectancy in a specific area. The probable maximum flood is normally several times larger than the largest flood of record.

Process knowledge. The set of information used by trained and qualified individuals who are cognizant of the origin, use, and location of waste-generating materials and processes in sufficient detail to certify the identity of the waste.

Processing (of irradiated nuclear fuel). Applying a chemical or physical process designed to alter the characteristics of the nuclear fuel matrix or to recover a particular material.

Production reactor. A nuclear reactor that is used to irradiate target material to produce special nuclear material or by-product material.

Public. Anyone outside the U.S. Department of Energy site boundary during normal operations or at the time of an accident.

rad. The unit of absorbed dose of ionizing radiation. One rad is equal to an absorbed dose of 100 ergs/gram.

Radiation (ionizing radiation). Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. In the context of this EIS, radiation does not include non-ionizing radiation such as radiowaves, microwaves, or visible, infrared, or ultraviolet light.

Radioactive waste. Any waste which contains radioactive material in concentrations that exceed those listed in 10 CFR 20.

Radioisotope. An unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation in the process. Approximately 5,000 natural and artificial radioisotopes have been identified. Usually synonymous with *radionuclide*.

Raptor. A bird of prey (e.g., hawk, eagle, etc.).

Red Zone. The Bureau of Reclamation's (BoR's) Red Zone is an administrative area on the Wahluke Slope set aside by the BoR from irrigated agricultural development while the BoR studies the connection between irrigation in this area and mass wasting events at the White Bluffs.

Recharge. Replenishment of water to an aquifer.

Record of Decision (ROD). A public document that records the final decision(s) concerning a proposed action. The ROD is based in whole or in part on information and technical analysis generated either during the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* process, or the *National Environmental Policy Act of 1969* process, both of which consider public comments and community concerns during the decision-making process.

Redd. The spawning ground or nest of various fish species; the term usually refers to salmon nests.

Region of influence. The region in which the direct and indirect principal socioeconomic and environmental justice effects of actions are likely to occur and are expected to be of consequence to local jurisdictions.

rem. The dosage of ionizing radiation that will cause the same biological effect as 1 roentgen of x-ray or gamma ray exposure. Acronym for roentgen-equivalent man.

Remediation. The process of remediating a site where a release of a hazardous substance has occurred.

Reprocessing (of nuclear fuel). Processing of reactor irradiated nuclear material (primarily spent nuclear fuel) to recover fissile and fertile material, in order to recycle the materials, primarily for defense purposes. Historically, reprocessing has involved aqueous chemical separations of desired elements (typically uranium or plutonium) from undesired elements in the fuel.

Research and Development land-use designation. As presented in this environmental impact statement, an area designated for conducting basic or applied research that requires the use of a large-scale or isolated facility. Includes scientific, engineering, technology development, technology transfer, economic diversification, and deployment activities to meet regional and national needs. Includes related activities that support the above uses.

Reverse-well injection. Process in which solutes are injected in an underlying geologic formation through wells. During the early years of Hanford, waste solutions were pumped into reverse wells as a method of waste disposal.

Riparian habitat. A specialized form of wetland restricted to areas along, adjacent to, or contiguous with perennially flooded and intermittently flowing rivers and streams. Also, periodically flooded lake and reservoir shore areas.

Riprap. A loose assemblage of stones that may be used in cap construction. In caps, riprap is used as a capillary break to retard downward migration of water and to limit biointrusion.

Risk. Quantitative expression of possible loss that considers both the probability that a hazard causes harm and the consequences of that event.

Safety analysis report. A report, prepared in accordance with DOE Orders 5481.1B and 5480.23, that summarizes the hazards associated with the operation of a particular facility and defines minimum safety requirements.

Sanitary waste. Liquid or solid wastes that are not considered hazardous or radioactive, generated as a result of routine operations of a facility.

Saturated zone. A subsurface area in which all pores are filled with water under pressure equal to or greater than atmospheric pressure.

Scope. In an environmental impact statement, the range of actions, alternatives, and impacts to be considered.

Scoping process. An early and open public participation process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.

Sedimentary interbeds. Rock layers composed of materials, such as sand or gravel, which are derived from the breakdown of various rocks and are layered between other rock types.

Seismicity. The phenomenon of earth movements; seismic activity. Seismicity is related to the location, size, and rate of occurrence of earthquakes.

Sensitive species. A Washington State category for plant species considered vulnerable or declining, that could become endangered or threatened without active management or removal of threats. Also sometimes used as a generic term for any plant and wildlife species that are threatened or endangered, rare, vulnerable or declining, or monitored by state or Federal agencies.

Shrub-steppe. Typically a treeless area covered by grasses and shrubs and having a semiarid climate. Precipitation is typically very slight, but sufficient to support the growth of sparse grass and other plants adapted to living in conditions where water is scarce. Washington State Department of Fish and Wildlife considers shrub-steppe a priority habitat.

Solid waste. Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including, solid liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities. Solid waste does not include solid and dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows, or industrial discharges which are point sources subject to permits under Section 402 of the *Federal Water Pollution Control Act, as amended*, or source, special nuclear, or by-product material as defined by the *Atomic Energy Act of 1954*, as amended.

SO_x. A generic term used to describe oxides of sulfur. The combination of sulfur oxides with water vapor produces acid rain (see also, sulfur oxides).

Stabilization (of waste sites). Actions taken to reduce the environmental hazards associated with an area used for disposal of hazardous and/or radioactive materials.

Stakeholder. Any person or organization with an interest in or affected by U.S. Department of Energy activities. Stakeholders may include representatives from Tribal governments, Federal agencies, state agencies, Congress, unions, educational groups, industry, environmental groups, other groups, and members of the general public.

Sulfur oxides. Pungent, colorless gases formed primarily by the combustion of fossil fuels. Sulfur oxides are considered to be major air pollutants and may damage the respiratory tract and vegetation (see also, SO_x).

Superfund. The common name used for the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* and its amendments.

Surface water. All waters that are open to the atmosphere and subject to surface runoff (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.

Surplus facility. Any facility or site (including equipment) that has no identified programmatic use and may or may not be contaminated with radioactive or hazardous materials to levels that require controlled access.

Syncline. A fold in the rock structure inclining upward on both sides of a median axis as in a downward fold of rock strata; opposite of anticline.

Threatened species. Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant part of its range.

Transuranic waste. Waste containing more that 100 nanocuries of alpha-emitting transuranic isotopes, which have half-lives greater than 20 years, per gram of waste, except for (1) high-level radioactive waste; (2) waste that the U.S. Department of Energy has determined, with concurrence of the Administrator of the U.S. Environmental Protection Agency, does not need the degree of isolation required by 40 CFR 191; or (3) waste that the U.S. Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61.

Transmissivity. A measure of the capacity of a water-bearing unit to transmit fluid. The product of the thickness and the average hydraulic conductivity of a unit. Also, the rate at which water is transmitted through an aquifer under a specific hydraulic gradient at a prevailing temperature and pressure.

Tritium. A radioactive isotope of the element hydrogen, with two neutrons and one proton (H-3).

Unconfined aquifer. An aquifer that has a water table or surface at atmospheric pressure. At Hanford, the unconfined aquifer is the uppermost aquifer and is the most susceptible to contamination from Hanford Site operations.

Vadose zone. The area between the land surface and the top of the water table. Saturated bodies, such as perched groundwater, may exist in the vadose zone. The vadose zone is also known as the zone of aeration and the unsaturated zone.

Vegetation type. A classification of the plant community on a site based on the dominant plant species in the community.

Volatile organic compound (VOC). Chemical containing mainly carbon, hydrogen, and oxygen that readily evaporates at ambient temperature. Exposure to some organic compounds can produce toxic effects on biological tissues and processes.

Vulnerable aggregations. Vulnerable aggregations are animal species that must aggregate at some specific location and at a specific time to complete some action in their life cycle. These aggregations include sage grouse at a mating lek, a bat colony, great blue heron at a nesting rookery, snakes in a hibernaculum, migrating salmon at a river falls, elk herds during rut, etc. When these animals aggregate, the species becomes vulnerable aggregations that can be severely impacted by predators or disease.

Waste management. The planning, coordination, and direction of functions related to the generation, handling, treatment, storage, transport, and disposal of waste, as well as associated surveillance and maintenance activities.

Waste minimization. An action that economically avoids or reduces the generation of waste by source reduction, reducing the toxicity of hazardous waste, improving energy usage, or recycling. These actions are consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.

Water level (water table). The top elevation of the groundwater.

Wetland. Those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in a saturated soil environment. These areas are frequently transitional between terrestrial and aquatic systems.

Wilderness area. An area formally designated by Act of Congress as part of the National Wilderness Preservation System.

Wild and Scenic River. A portion of a river that has been designated by Congress as part of the *National Wild and Scenic Rivers Act of 1968*.

Worker. Any person whose day-to-day activities are controlled by process safety management programs and a common emergency response plan. When evaluating the potential consequences of an accident, the worker is defined as an individual located 100 m (328 ft) downwind of the facility location where the accident occurs.

Zoning. A police power measure, enacted by general purpose unit of local government, in which the community is divided into districts or zones within which permitted and special uses are established as are regulations governing lot size, building bulk, placement, and other development standards.

This page intentionally left blank.

Appendix A — Treaties

Blackfeet Treaty of Fort Benton, 1855 .... A-1

Nez Perce Treaty of Lapwai, 1863 .... A-7

Third Nez Perce Treaty, 1868 .... A-14

The Nez Perce Treaty, 1855 .... A-16

Yakima Treaty of Camp Stevens, 1855 .... A-21

Walla Walla Treaty of Camp Stevens, 1855 .... A-26

This page intentionally left blank.

swimref@cmc.net

Blackfeet Treaty of Fort Benton, 1855

Articles of agreement and convention made and concluded at the council-ground on the Upper Missouri, near the mouth of the Judith River, in the Territory of Nebraska, this seventeenth day of October, in the year one thousand eight hundred and fifty-five, by and between A. Cumming and Isaac I. Stevens, commissioners duly appointed and authorized, on the part of the United States, and the undersigned chiefs, headmen, and delegates of the following nations and tribes of Indians, who occupy, for the purposes of hunting, the territory on the Upper Missouri and Yellowstone Rivers, and who have permanent homes as follows: East of the Rocky Mountains, the Blackfoot Nation, consisting of the Piegan, Blood, Blackfoot, and Gros Ventres tribes of Indians. West of the Rocky Mountains, the Flathead Nation, consisting of the Flathead, Upper Pend d'Oreille, and Kootenay tribes of Indians, and the Nez Perce tribe of Indians, the said chiefs, headmen and delegates, in behalf of and acting for said nations and tribes, and being duly authorized thereto by them.

ARTICLE 1. Peace, friendship and amity shall hereafter exist between the United States and the aforesaid nations and tribes of Indians, parties to this treaty, and the same shall be perpetual.

ARTICLE 2. The aforesaid nations and tribes of Indians, parties to this treaty, do hereby jointly and severally covenant that peaceful relations shall likewise be maintained among themselves in future; and that they will abstain from all hostilities whatsoever against each other, and cultivate mutual good-will and friendship. And the nations and tribes aforesaid do furthermore jointly and severally convenant, that peaceful relations shall be maintained with and that they will abstain from all hostilities whatsoever, excepting in self-defense, against the following-named nations and tribes of Indians, to wit: the Crows, Assineboins, Crees, Snakes, Blackfeet, Sans Arcs, and Auncepa-pas bands of Sioux, and all other neighboring nations and tribes of Indians.

ARTICLE 3. The Blackfoot Nation consent and agree that all that portion of the country recognized and defined by the treaty of Laramie as Blackfoot territory, lying within lines drawn from the Hell Gate or Medicine Rock Passes in the main range of the Rocky Mountains, in an easterly direction to the nearest source of the Muscle Shell River, thence to the mouth of Twenty-five Yard Creek, thence up the Yellowstone River to its northern source, and thence along the main range of the Rocky Mountains, in a northerly direction, to the point of beginning, shall be a common hunting-ground for ninety-nine years, where all the nations, tribes and bands of Indians, parties to this treaty, may enjoy equal and uninterupted privileges of hunting, fishing and gathering fruit, grazing animals, curing meat and dressing robes. They further agree that they will not establish villages, or in any other way exercise exclusive rights within ten miles of the northern line of the common hunting-ground, and that the parties to this treaty may hunt on said northern boundary line and within ten miles thereof.

Provided, That the western Indians, parties to this treaty, may hunt on the trail leading down the Muscle Shell to the Yellowstone; the Muscle Shell River being the boundary separating the Blackfoot from the Crow territory.

And provided, That no nation, band, or tribe of Indians, parties to this treaty, nor any other Indians, shall be permitted to establish permanent settlements, or in any other way exercise, during the period above mentioned, exclusive rights or privileges within the limits of the above-described hunting-ground.

And provided further, That the rights of the western Indians to a whole or a part of the common hunting-ground, derived from occupancy and possession, shall not be affected by this article, except so far as said rights may be determined by the treaty of Laramie.

ARTICLE 4. The parties to this treaty agree and consent, that the tract of country lying within lines drawn from the Hell Gate or Medicine Rock Passes, in an easterly direction, to the nearest source of the Muscle Shell River, thence down said river to its mouth, thence down the channel of the Missouri River to the mouth of Milk River, thence due north to the forty-ninth parallel, thence due west on said parallel to the main range of the Rocky Mountains, and thence southerly along said range to the place of beginning, shall be the territory of the Blackfoot Nation, over which said nation shall exercise exclusive control, excepting as may be otherwise provided in this treaty. Subject, however, to the provisions of the third article of this treaty, giving the right to hunt, and prohibiting the establishment of permanent villages and the exercise of any exclusive rights within ten miles of the northern line of the common hunting-ground, drawn from the nearest source of the Muscle Shell River to the Medicine Rock Passes, for the period of ninety-nine years.

Provided also, That the Assiniboins shall have the right of hunting, in common with the Blackfeet, in the country lying between the aforesaid eastern boundary line, running from the mouth of Milk River to the forty-ninth parallel, and a line drawn from the left bank of the Missouri River, opposite the Round Butte north, to the forty-ninth parallel.

ARTICLE 5. The parties to this treaty, residing west of the main range of the Rocky Mountains, agree and consent that they will not enter the common hunting ground, nor any part of the Blackfoot territory, or return home, by any pass in the main range of the Rocky Mountains to the north of the Hell Gate or Medicine Rock Passes. And they further agree that they will not hunt or otherwise disturb the game, when visiting the Blackfoot territory for trade or social intercourse.

ARTICLE 6. The aforesaid nations and tribes of Indians, parties to this treaty, agree and consent to remain within their own respective countries, except when going to or from, or whilst hunting upon, the "common hunting ground," or when visiting each other for the purpose of trade or social intercourse.

ARTICLE 7. The aforesaid nations and tribes of Indians agree that citizens of the United States may live in and pass unmolested through the countries respectively occupied and claimed by them. And the United States is hereby bound to protect said Indians against depredations and other unlawful acts which white men residing in or passing through their country may commit.

ARTICLE 8. For the purpose of establishing travelling thoroughfares through their country, and the better to enable the President to execute the provisions of this treaty, the aforesaid nations and tribes do hereby consent and agree, that the United States may, within the countries respectively occupied and claimed by them, construct roads of every description; establish lines of telegraph and military posts; use materials of every description found in the Indian country; build houses for agencies, missions, schools, farms, shops, mills, stations, and for any other purpose for which they may be required, and permanently occupy as much land as may be necessary for the various purposes above enumerated, including the use of wood for fuel and land for grazing, and that the navigation of all lakes and streams shall be forever free to citizens of the United States.

ARTICLE 9. In consideration of the foregoing agreements, stipulations, and cessions, and on condition of their faithful observance, the United States agree to expend, annually, for the Piegan, Blood, Blackfoot, and Gros Ventres tribes of Indians, constituting the Blackfoot Nation, in addition to the goods and provisions distributed at the time of signing the treaty, twenty thousand dollars, annually, for ten years, to be expended in such useful goods and provisions, and other articles, as the President, at his discretion, may from time to time determine; and the superintendent, or other proper officer, shall each year inform the President of the wishes of the Indians in relation thereto: Provided, however, That if, in the judgment of the President and Senate, this amount be deemed insufficient, it may be increased not to exceed the sum of thirty-five thousand dollars per year.

ARTICLE 10. The United States further agree to expend annually, for the benefit of the aforesaid tribes of the Blackfoot Nation, a sum not exceeding fifteen thousand dollars annually, for ten years, in establishing and instructing them in agricultural and mechanical pursuits, and in educating their children, and in any other respect promoting their civilization and Christianization: Provided, however, That to accomplish the objects of this article, the President may, at his discretion, apply any or all the annuities provided for in this treaty: And provided, also, That the President may, at his discretion, determine in what proportions the said annuities shall be divided among the several tribes.

ARTICLE 11. The aforesaid tribes acknowledge their dependence on the Government of the United States, and promise to be friendly with all citizens thereof, and to commit no depredations or other violence upon such citizens. And should any one or more violate this pledge, and the fact be proved to the satisfaction of the President, the property taken shall be returned, or, in default thereof, or if injured or destroyed, compensation may be made by the Government out of the annuities. The aforesaid tribes are hereby bound to deliver such offenders to the proper authorities for trial and punishment, and are held responsible, in their tribal capacity, to make reparation for depredations so committed.

Nor will they make war upon any other tribes, except in self-defense, but will submit all matter of difference, between themselves and other Indians, to the Government of the United States, through its agents, for adjustment, and will abide thereby. And if any of the said Indians, parties to this treaty, commit depredations on any other Indians within the jurisdiction of the United States, the same rule shall prevail as that prescribed in this article in case of depredations against citizens. And the said tribes agree not to shelter or conceal offenders against the laws of the United States, but to deliver them up to the authorities for trial.

ARTICLE 12. It is agreed and understood, by and between the parties to this treaty, that if any nation or tribe of Indians aforesaid, shall violate any of the agreements, obligations, or stipulations, herein contained, the United States may withhold, for such length of time as the President and Congress may determine, any portion or all of the annuities agreed to be paid to said nation or tribe under the ninth and tenth articles of this treaty.

ARTICLE 13. The nations and tribes of Indians, parties to this treaty, desire to exclude from their country the use of ardent spirits or other intoxicating liquor, and to prevent their people from drinking the same. Therefore it is provided, that any Indian belonging to said tribes who is guilty of bringing such liquor into the Indian country, or who drinks liquor, may have his or her proportion of the annuities withheld from him or her, for such time as the President may determine.

ARTICLE 14. The aforesaid nations and tribes of Indians, west of the Rocky Mountains, parties to this treaty, do agree, in consideration of the provisions already made for them in existing treaties, to accept the guarantees of the peaceful occupation of their hunting-grounds, east of the Rocky Mountains, and of remuneration for depredations made by the other tribes, pledged to be secured to them in this treaty out of the annuities of said tribes, in full compensation for the concessions which they, in common with the said tribes, have made in this treaty.

The Indians east of the mountains, parties to this treaty, likewise recognize and accept the guarantees of this treaty, in full compensation for the injuries or depredations which have been, or may be committed by the aforesaid tribes, west of the Rocky Mountains.

ARTICLE 15. The annuities of the aforesaid tribes shall not be taken to pay the debts of individuals.

ARTICLE 16. This treaty shall be obligatory upon the aforesaid nations and tribes of Indians, parties hereto, from the date hereof, and upon the United States as soon as the same shall be ratified by the President and Senate.

In testimony whereof the said A. Cumming and Isaac I. Stevens, commissioners on the part of the United States, and the undersigned chiefs, headmen, and delegates of the aforesaid nations and tribes of Indians, parties to this treaty, have hereunto set their hands and seals at the place and on the day and year hereinbefore written.

A. Cumming. (L.S.)

Isaac I. Stevens. (L.S.)

Piegans:

Nee-ti-nee, or "the only chief," now called the Lame Bull, his x mark. (L.S.)

Mountain Chief, his x mark. (L.S.)

Low Horn, his x mark. (L.S.)

Little Gray Head, his x mark. (L.S.)

Little Dog, his x mark. (L.S.)

Big Snake, his x mark. (L.S.)

The Skunk, his x mark. (L.S.)

The Bad Head, his x mark. (L.S.)

Kitch-eepone-istah, his x mark. (L.S.)

Middle Sitter, his x mark. (L.S.)

Bloods:

Onis-tay-say-nah-que-im, his x mark. (L.S.)

The Father of All Children, his x mark. (L.S.)

The Bull's Back Fat, his x mark. (L.S.)

Heavy Shield, his x mark. (L.S.)

Nah-tose-onistah, his x mark. (L.S.)

The Calf Shirt, his x mark. (L.S.)

Gros Ventres:

Bear's Shirt, his x mark. (L.S.)

Little Soldier, his x mark. (L.S.)

Star Robe, his x mark. (L.S.)

Sitting Squaw, his x mark. (L.S.)

Weasel Horse, his x mark. (L.S.)

The Rider, his x mark. (L.S.)

Eagle Chief, his x mark. (L.S.)

Heap of Bears, his x mark. (L.S.)

Blackfeet:

The Three Bulls, his x mark. (L.S.)

The Old Kootomais, his x mark. (L.S.)

Pow-ah-que, his x mark. (L.S.)

Chief Rabbit Runner, his x mark. (L.S.)

Nez Perces:

Spotted Eagle, his x mark. (L.S.)

Looking Glass, his x mark. (L.S.)

The Three Feathers, his x mark. (L.S.)

Eagle from the Light, his x mark. (L.S.)

The Lone Bird, his x mark. (L.S.)

Ip-shun-nee-wus, his x mark. (L.S.)

Jason, his x mark. (L.S.)

Wat-ti-wat-ti-we-hinck, his x mark. (L.S.)

White Bird, his x mark. (L.S.)

Stabbing Man, his x mark. (L.S.)

Jesse, his x mark. (L.S.)

Plenty Bears, his x mark. (L.S.)

Flathead Nation:

Victor, his x mark. (L.S.)

Alexander, his x mark. (L.S.)

Moses, his x mark. (L.S.)

Big Canoe, his x mark. (L.S.)

Ambrose, his x mark. (L.S.)

Kootle-cha, his x mark. (L.S.)

Michelle, his x mark. (L.S.)

Francis, his x mark. (L.S.)

Vincent, his x mark. (L.S.)

Andrew, his x mark. (L.S.)

Adolphe, his x mark. (L.S.)

Thunder, his x mark. (L.S.)

Piegans:

Running Rabbit, his x mark. (L.S.)

Chief Bear, his x mark. (L.S.)

The Little White Buffalo, his x mark. (L.S.)

The Big Straw, his x mark. (L.S.)

Flathead:

Bear Track, his x mark. (L.S.)

Little Michelle, his x mark. (L.S.)

Palchinah, his x mark. (L.S.)

Bloods:

The Feather, his x mark. (L.S.)

The White Eagle, his x mark. (L.S.)

Executed in presence of - -

James Doty, Secretary.

Alfred J. Vaughan, Jr.

E. Alw. Hatch, agent for Blackfeet

Thomas Adams, special agent Flathead Nation

R. H. Lansdale, Indian agent Flathead Nation

W. H. Tappan, sub-agent for the Nez Perce

James Bird, Blackfoot interpreters

A. Culbertson, Blackfoot interpreters

Benj. Deroche, Blackfoot interpreters

Benj. Kiser, his x mark, Flat Head interpreters

Witness, James Doty, Flat Head interpreters

Gustavus Sohon, Flat Head interpreters

W. Craig, Nez Perce interpreters

Delaware Jim, his x mark, Nez Perce interpreters

Witness, James Doty, Nez Perce interpreters

A Cree Chief (Broken Arm,) his mark

Witness, James Doty

A. J. Hoeekeorsg

James Croke

E. S. Wilson

A. C. Jackson

Charles Shucette, his x mark

Christ. P. Higgins

A. H. Robie

S. S. Ford, Jr.

Ratified Apr. 15, 1856.
Proclaimed Apr. 25, 1856.

Nez Perce Treaty of Lapwai, 1863

Articles of agreement made and concluded at the council-ground, in the valley of the Lapwai, Washington Territory, on the ninth day of June, one thousand eight hundred and sixty-three, between the United States of America, by C. H. Hale, superintendent of Indian affairs, and Charles Hutchins and S. D. Howe, U.S. Indian agents for the Territory of Washington, acting on the part and in behalf of the United States, and the Nez Perce Indians, by the chiefs, head-men, and delegates of said tribe, such articles being supplementary and amendatory to the treaty made between the United States and said tribe on the 11th day of June 1855.

ARTICLE 1. The said Nez Perce tribe agree to relinquish, and do hereby relinquish, to the United States the lands heretofore reserved for the use and occupation of the said tribe, saving and excepting so much thereof as is described in Article II for a new reservation.

ARTICLE 2. The United States agree to reserve for a home, and for the sole use and occupation of said tribe, the tract of land included within the following boundaries, to wit: Commencing at the northeast corner of Lake Wa-ha, and running thence, northerly, to a point on the north bank of the Clearwater River, three miles below the mouth of the Lapwai, thence down the north bank of the Clearwater to the mouth of the Hatwai Creek; thence, due north, to a point seven miles distant; thence, eastwardly, to a point on the north fork of the Clearwater, seven miles distant from its mouth; thence to a point on Oro Fino Creek, five miles above its mouth; thence to a point on the north fork of the south fork of the Clearwater, five miles above its mouth; thence to a point on the south fork of the Clearwater, one mile above the bridge, on the road leading to Elk City, (so as to include all the Indian farms now within the forks;) thence in a straight line, westwardly, to the place of beginning.

All of which tract shall be set apart, and the above-described boundaries shall be surveyed and marked out for the exclusive use and benefit of said tribe as an Indian reservation, nor shall any white man, excepting those in the employment of the Indian Department, be permitted to reside upon the said reservation without permission of the tribe and the superintendent and agent; and the said tribe agrees that so soon after the United States shall make the necessary provision for fulfilling the stipulations of this instrument as they can conveniently arrange their affairs, and not to exceed one year from its ratification, they will vacate the country hereby relinquished, and remove to and settle upon the lands herein reserved for them, (except as may be hereinafter provided.) In the meantime it shall be lawful for them to reside upon any ground now occupied or under cultivation by said Indians at this time, and not included in the reservation above named. And it is provided, that any substantial improvement heretofore made by any Indian, such as fields inclosed and cultivated, or houses erected upon the lands hereby relinquished, and which he may be compelled to abandon in consequence of this treaty, shall be valued under the direction of the President of the United States, and payment therefore shall be made in stock or in improvements of an equal value for said Indian upon the lot which may be assigned to him within the bounds of the reservation, as he may choose, and no Indian will be required to abandon the improvements aforesaid, now occupied by him, until said payment or improvement shall have been made. And it is further provided, that if any Indian living on any of the land hereby relinquished should prefer to sell his improvements to any white man, being a loyal citizen of the United States, prior to the same being valued as aforesaid, he shall be allowed so to do, but the sale or transfer of said improvements shall be made in the presence of, and with the consent and approval of, the agent or superintendent, by whom a certificate of sale shall be issued to the party purchasing, which shall set forth the amount of the consideration in kind. Before the issue of said certificate, the agent or superintendent shall be satisfied that a valuable consideration is paid, and that the party purchasing is of undoubted loyalty to the United States Government. No settlement or claim made upon the improved lands by any Indian will be permitted, except as herein provided, prior to the time specified for their removal. Any sale or transfer thus made shall be in the stead of payment for improvements from the United States.

ARTICLE 3. The President shall, immediately after the ratification of this treaty, cause the boundary-lines to be surveyed, and properly marked and established; after which, so much of the lands hereby reserved as may be suitable for cultivation shall be surveyed into lots of twenty acres each, and every male person of the tribe who shall have attained the age of twenty-one years, or is the head of a family, shall have the privilege of locating upon one lot as a permanent home for such person, and the lands so surveyed shall be allotted under such rules and regulations as the President shall prescribe, having such reference to their settlement as may secure adjoining each other the location of the different families pertaining to each band, so far as the same may be practicable. Such rules and regulations shall be prescribed by the President, or under his direction, as will insure to the family, in case of the death of the head thereof, the possession and enjoyment of such permanent home, and the improvements thereon. When the assignments as above shall have been completed, certificates shall be issued by the Commissioner of Indian Affairs, or under his direction, for the tracts assigned in severalty, specifying the names of the individuals to whom they have been assigned respectively, and that said tracts are set apart for the perpetual and exclusive use and benefit of such assignees and their heirs. Until otherwise provided by law, such tracts shall be exempt from levy, taxation, or sale, and shall be alienable in fee, or leased, or otherwise disposed of, only to the United States, or to persons then being members of the Nez Perce tribe, and of Indian blood, with the permission of the President, and under such regulations as the Secretary of the Interior or the Commissioner of Indian Affairs shall prescribe; and if any such person or family shall at any time neglect or refuse to occupy and till a portion of the land so assigned, and on which they have located, or shall rove from place to place, the President may cancel the assignment, and may also withhold from such person or family their proportion of the annuities or other payments due them until they shall have returned to such permanent home, and resumed the pursuits of industry; and in default of their return, the tract may be declared abandoned, and thereafter assigned to some other person or family of such tribe. The residue of the land hereby reserved shall be held in common for pasturage for the sole use and benefit of the Indians: Provided, however, That from time to time, as members of the tribe may come upon the reservation, or may become of proper age, after the expiration of the time of one year after the ratification of this treaty, as aforesaid, and claim the privileges granted under this article, lots may be assigned from the lands thus held in common, wherever the same may be suitable for cultivation. No State or territorial legislature shall remove the restriction herein provided for, without the consent of Congress, and no State or territorial law to that end shall be deemed valid until the same has been specially submitted to Congress for its approval.

ARTICLE 4. In consideration of the relinquishment herein made the United States agree to pay to the said tribe, in addition to the annuities provided by the treaty of June 11, 1855, and the goods and provisions distributed to them at the time of signing this treaty, the sum of two hundred and sixty-two thousand and five hundred dollars, in manner following, to wit, First. One hundred and fifty thousand dollars, to enable the Indians to remove and locate upon the reservation, to be expended in the ploughing of land, and the fencing of the several lots, which may be assigned to those individual members of the tribe who will accept the same in accordance with the provisions of the preceding article, which said sum shall be divided into four annual instalments, as follows: For the first year after the ratification of this treaty, seventy thousand dollars; for the second year, forty thousand dollars; for the third year, twenty-five thousand dollars; for the fourth year, fifteen thousand dollars.

Second. Fifty thousand dollars to be paid the first year after the ratification of this treaty in agricultural implements, to include wagons or carts, harness, and cattle, sheep, or other stock, as may be deemed most beneficial by the superintendent of Indian affairs, or agent, after ascertaining the wishes of the Indians in relation thereto.

Third. Ten thousand dollars for the erection of a saw and flouring mill, to be located at Kamia, the same to be erected within one year after the ratification hereof.

Fourth. Fifty thousand dollars for the boarding and clothing of the children who shall attend the schools, in accordance with such rules or regulations as the Commissioner of Indian Affairs may prescribe, providing the schools and boarding-houses with necessary furniture, the purchase of necessary wagons, teams, agricultural implements, tools, etc., for their use, and for the fencing of such lands as may be needed for gardening and farming purposes, for the use and benefit of the schools, to be expended as follows: The first year after the ratification of this treaty, six thousand dollars; for the next fourteen years, three thousand dollars each year; and for the succeeding year, being the sixteenth and last instalment, two thousand dollars.

Fifth. A further sum of two thousand five hundred dollars shall be paid within one year after the ratification hereof, to enable the Indians to build two churches, one of which is to be located at some suitable point on the Kamia, and the other on the Lapwai.

ARTICLE 5. The United States further agree, that in addition to a head chief the tribe shall elect two subordinate chiefs, who shall assist him in the performance of his public services, and each subordinate chief shall have the same amount of land ploughed and fenced, with comfortable house and necessary furniture, and to whom the same salary shall be paid as is already provided for the head chief in Article 5 of the treaty of June 11, 1855, the salary to be paid and the houses and land to be occupied during the same period and under like restrictions as therein mentioned.

And for the purpose of enabling the agent to erect said buildings, and to plough and fence the land, as well as to procure the necessary furniture, and to complete and furnish the house, &c., of the head chief, as heretofore provided, there shall be appropriated, to be expended within the first year after the ratification hereof, the sum of two thousand five hundred dollars.

And inasmuch-as several of the provisions of said art. 5th of the treaty of June 11, 1855, pertaining to the erection of school-houses, hospital, shops, necessary buildings for employees and for the agency, as well as providing the same with necessary furniture, tools, etc., have not yet been complied with, it is hereby stipulated that there shall be appropriated, to be expended for the purposes herein specified during the first year after the ratification hereof, the following sums, to wit:

First. Ten thousand dollars for the erection of the two schools, including boarding-houses and the necessary out-buildings; said schools to be conducted on the manual-labor system as far as practicable.

Second. Twelve hundred dollars for the erection of the hospital, and providing the necessary furniture for the same.

Third. Two thousand dollars for the erection of a blacksmith's shop, to be located at Kamia, to aid in the completion of the smith's shop at the agency, and to purchase the necessary tools, iron, steel, etc.; and to keep the same in repair and properly stocked with necessary tools and materials, there shall be appropriated thereafter, for the fifteen years next succeeding, the sum of five hundred dollars each year.

Fourth. Three thousand dollars for erection of houses for employees, repairs of mills, shops, etc., and providing necessary furniture, tools, and materials. For the same purpose, and to procure from year to year the necessary articles - - that is to say, saw-logs, nails, glass, hardware, etc. - - there shall be appropriated thereafter, for the twelve years next succeeding, the sum of two thousand dollars each year; and for the next three years, one thousand dollars each year.

And it is further agreed that the United States shall employ, in addition to those already mentioned in art. 5th of the treaty of June 11, 1855, two matrons to take charge of the boarding-schools, two assistant teachers, one farmer, one carpenter, and two millers.

All the expenditures and expenses contemplated in this treaty, and not otherwise provided for, shall be defrayed by the United States.

ARTICLE 6. In consideration of the past services and faithfulness of the Indian chief, Timothy, it is agreed that the United States shall appropriate the sum of six hundred dollars, to aid him in the erection of a house upon the lot of land which may be assigned to him, in accordance with the provisions of the third article of this treaty.

ARTICLE 7. The United States further agree that the claims of certain members of the Nez Perce tribe against the Government for services rendered and for horses furnished by them to the Oregon mounted volunteers, as appears by certificate issued by W. H. Fauntleroy, A. R. Qr. M. and Com. Oregon volunteers, on the 6th of March, 1856, at Camp Cornelius, and amounting to the sum of four thousand six hundred and sixty-five dollars, shall be paid to them in full, in gold coin.

ARTICLE 8. It is also understood that the aforesaid tribe do hereby renew their acknowledgments of dependence upon the Government of the United States, their promises of friendship, and other pledges, as set forth in the eighth article of the treaty of June 11, 1855; and further, that all the provisions of said treaty which are not abrogated or specifically changed by any article herein contained, shall remain the same to all intents and purposes as formerly, -- the same obligations resting upon the United States, the same privileges continued to the Indians outside of the reservation, and the same rights secured to citizens of the U.S. as to right of way upon the streams and over the roads which may run through said reservation, as are therein set forth.

But it is further provided, that the United States is the only competent authority to declare and establish such necessary roads and highways, and that no other right is intended to be hereby granted to citizens of the United States than the right of way upon or over such roads as may thus be legally established: Provided, however, That the roads now usually travelled shall, in the mean time, be taken and deemed as within the meaning of this article, until otherwise enacted by act of Congress or by the authority of the Indian Department.

And the said tribe hereby consent, that upon the public roads which may run across the reservation there may be established, at such points as shall be necessary for public convenience, hotels, or stage-stands, of the number and necessity of which the agent or superintendent shall be the sole judge, who shall be competent to license the same, with the privilege of using such amount of land for pasturage and other purposes connected with such establishment as the agent or superintendent shall deem necessary, it being understood that such lands for pasturage are to be enclosed, and the boundaries thereof described in the license.

And it is further understood and agreed that all ferries and bridges within the reservation shall be held and managed for the benefit of said tribe.

Such rules and regulations shall be made by the Commissioner of Indian Affairs, with the approval of the Secretary of the Interior, as shall regulate the travel on the highways, the management of the ferries and bridges, the licensing of public houses, and the leasing of lands, as herein provided, so that the rents, profits, and issues thereof shall inure to the benefit of said tribe, and so that the persons thus licensed, or necessarily employed in any of the above relations, shall be subject to the control of the Indian Department, and to the provisions of the act of Congress "to regulate trade and intercourse with the Indian tribes, and to preserve peace on the frontiers."

All timber within the bounds of the reservation is exclusively the property of the tribe, excepting that the U.S. Government shall be permitted to use thereof for any purpose connected with its affairs, either in carrying out any of the provisions of this treaty, or in the maintaining of its necessary forts or garrisons.

The United States also agree to reserve all springs or fountains not adjacent to, or directly connected with, the streams or rivers within the lands hereby relinquished, and to keep back from settlement or entry so much of the surrounding land as may be necessary to prevent the said springs or fountains being enclosed; and, further, to preserve a perpetual right of way to and from the same, as watering places, for the use in common of both whites and Indians.

ARTICLE 9. Inasmuch as the Indians in council have expressed their desire that Robert Newell should have confirmed to him a piece of land lying between Snake and Clearwater Rivers, the same having been given to him on the 9th day of June, 1861, and described in an instrument of writing bearing that date, and signed by several chiefs of the tribe, it is hereby agreed that the said Robert Newell shall receive from the United States a patent for the said tract of land.

ARTICLE 10. This treaty shall be obligatory upon the contracting parties as soon as the same shall be ratified by the President and Senate of the United States.

In testimony whereof the said C. H. Hale, superintendent of Indian affairs, and Charles Hutchins and S. D. Howe, United States Indian agents in the Territory of Washington, and the chiefs, headmen, and delegates of the aforesaid Nez Perce tribe of Indians, have hereunto set their hands and seals at the place and on the day and year hereinbefore written.

Calvin H. Hale, Superintendent Indian Affairs, Wash. T. (SEAL.)

S. D. Howe, United States Indian agent, Wash. t. (SEAL.)

Chas. Hutchins, United States Indian agent, Wash. T. (SEAL.)

Fa-Ind-7-1803 Lawyer
Head Chief Nez Perce Nation. (SEAL.)

Ute-sin-male-e-cum, x (SEAL.)

Ha-harch-tuesta, x (SEAL.)

Tip-ulania-timecca, x (SEAL.)

Es-coatum, x (SEAL.)

Timothy, x (SEAL.)

Levi, x (SEAL.)

Jason, x (SEAL.)

Ip-she-ne-wish-kin, (Capt. John,) x (SEAL.)

Weptas-jump-ki, x (SEAL.)

We-as-cus, x (SEAL.)

Pep-hoom-kan, (Noah,) x (SEAL.)

Shin-ma-sha-ho-soot, x (SEAL.)

Nie-ki-lil-meh-hoom, (Jacob,) x (SEAL.)

Stoop-toop-nin, x (SEAL.)

Su-we-cus, x (SEAL.)

Wal-la-ta-mana, x (SEAL.)

He-kaikt-il-pilp, x (SEAL.)

Whis-tas-ket, x (SEAL.)

Neus-ne-keun, x (SEAL.)

Kul-lou-o-haikt, x (SEAL.)

Wow-en-am-ash-il-pilp, x (SEAL.)

Kan-pow-e-een, x (SEAL.)

Watai-watai-wa-haikt, x (SEAL.)

Kup-kup-pellia, x (SEAL.)

Wap-tas-ta-mana, x (SEAL.)

Peo-peo-ip-se-wat, x (SEAL.)

Louis-in-ha-cush-nim, x (SEAL.)

Lam-lim-si-lilp-nim, x (SEAL.)

Tu-ki-lai-kish, x (SEAL.)

Sah-kan-tai, (Eagle,) x (SEAL.)

We-ah-se-nat, x (SEAL.)

Hin-mia-tun-pin, x (SEAL.)

Ma-hi-a-kim, x (SEAL.)

Shock-lo-turn-wa-haikt, (Jo-nah,) x (SEAL.)

Kunness-tak-mal, x (SEAL.)

Tu-lat-sy-wat-kin, x (SEAL.)

Tuck-e-tu-et-as, x (SEAL.)

Nic-a-las-in, x (SEAL.)

Was-atis-il-pilp, x (SEAL.)

Wow-es-en-at-im, x (SEAL.)

Hiram, x (SEAL.)

Howlish-wampum, x (SEAL.)

Wat-ska-leeks, x (SEAL.)

Wa-lai-tus, x (SEAL.)

Ky-e-wee-pus, x (SEAL.)

Ko-ko-il-pilp, x (SEAL.)

Reuben, Tip-ia-la-na-uy-kala-tsekin, x (SEAL.)

Wish-la-na-ka-nin, x (SEAL.)

Me-tat-ueptas, (Three Feathers,) x (SEAL.)

Ray-kay-mass, x (SEAL.)

Signed and sealed in presence of - -

George F. Whitworth, Secretary

Justus Steinberger, Colonel U.S. Volunteers

R. F. Malloy, Colonel Cavalry, O.V.

J. S. Rinearson, Major First Cavalry Oregon Volunteers

William Kapus, First Lieutenant and Adjutant First W. T. Infantry U.S. Volunteers

Harrison Olmstead

Jno. Owen, (Bitter Root.)

James O'Neil

J. B. Buker, M. D.

George W. Elber.

A. A. Spalding, assistant interpreter

Perrin B. Whitman, interpreter for the council

Ratified Apr. 17, 1867
Proclaimed Apr. 20, 1867

swimref@cmc.net

Third Nez Perce Treaty, 1868

Whereas certain amendments are desired by the Nez Perce tribe of Indians to their treaty concluded at the council ground in the valley of the Lapwai, in the Territory of Washington, on the ninth day of June, in the year of our Lord one thousand eight hundred and sixty-three; and whereas the United States are willing to assent to said amendments; it is therefore agreed by and between Nathaniel G. Taylor, commissioner, on the part of the United States, thereunto duly authorized, and Lawyer, Timothy, and Jason, chiefs of said tribe, also being thereunto duly authorized, in manner and form following, that is to say:

ARTICLE 1. That all lands embraced within the limits of the tract set apart for the exclusive use and benefit of said Indians by the 2d article of said treaty of June 9th, 1863, which are susceptible of cultivation and suitable for Indian farms, which are not now occupied by the United States for military purposes, or which are not required for agency or other buildings and purposes provided for by existing treaty stipulations, shall be surveyed as provided in the 3d article of said treaty of June 9th, 1863, and as soon as the allotments shall be plowed and fenced, and as soon as schools shall be established as provided by existing treaty stipulations, such Indians now residing outside the reservation as may be decided upon by the agent of the tribe and the Indians themselves, shall be removed to and located upon allotments within the reservation.

Provided, however, That in case there should not be a sufficient quantity of suitable land within the boundaries of the reservation to provide allotments for those now there and those residing outside the boundaries of the same, then those residing outside, or as many thereof as allotments cannot be provided for, may remain upon the lands now occupied and improved by them, provided, that the land so occupied does not exceed twenty acres for each and every male person who shall have attained the age of twenty-one years or is the head of a family, and the tenure of those remaining upon lands outside the reservation shall be the same as is provided in said 3d article of said treaty of June 9th, 1863, for those receiving allotments within the reservation; and it is further agreed that those now residing outside of the boundaries of the reservation and who may continue to so reside shall be protected by the military authorities in their rights upon the allotments occupied by them, and also in the privilege of grazing their animals upon surrounding unoccupied lands.

ARTICLE 2. It is further agreed between the parties hereto that the stipulations contained in the 8th article of the treaty of June 9th, 1863, relative to timber, are hereby annulled as far as the same provides that the United States shall be permitted to use thereof in the maintaining of forts or garrisons, and that the said Indians shall have the aid of the military authorities to protect the timber upon their reservation, and that none of the same shall be cut or removed without the consent of the head-chief of the tribe, together with the consent of the agent and superintendent of Indian affairs, first being given in writing, which written consent shall state the part of the reservation upon which the timber is to be cut, and also the quantity, and the price to be paid therefore.

ARTICLE 3. It is further hereby stipulated and agreed that the amount due said tribe for school purposes and for the support of teachers that has not been expended for that purpose since the year 1864, but has been used for other purposes, shall be ascertained and the same shall be reimbursed to said tribe by appropriation by Congress, and shall be set apart and invested in United States bonds and shall be held in trust by the United States, the interest on the same to be paid to said tribe annually for the support of teachers.

In testimony whereof the said Commissioner on the part of the United States and the said chiefs representing said Nez Perce tribe of Indians have hereunto set their hands and seals this 13th day of August, in the year of our Lord one thousand eight hundred and sixty-eight, at the city of Washington, D.C.

N. G. Taylor, (L.S.) Commissioner Indian Affairs. Lawyer, Head Chief Nez Perces. (L.S.)

Timothy, his x mark, Chief. (L.S.)

Jason, his x mark, Chief. (L.S.)

In presence of - -

Charles E. Mix

Robert Newell, United States Agent

W. R. Irwin

Ratified Feb. 16, 1869
Proclaimed Feb. 24, 1869

The Nez Perce Treaty, 1855

Articles of agreement and convention made and concluded at the treaty ground, Camp Stevens, in the Walla-Walla Valley, this eleventh day of June, in the year one thousand eight hundred and fifty-five, by and between Isaac I. Stevens, governor and superintendent of Indian affairs for the Territory of Washington, and Joel Palmer, superintendent of Indian affairs for Oregon Territory, on the part of the United States, and the undersigned chiefs, head-men, and delegates of the Nez Perce tribe of Indians occupying lands lying partly in Oregon and partly in Washington Territories, between the Cascade and Bitter Root Mountains, on behalf of, and acting for said tribe, and being duly authorized thereto by them, it being understood that Superintendent Isaac I. Stevens assumes to treat only with those of the above-named tribe of Indians residing within the Territory of Washington, and Superintendent Palmer with those residing exclusively in Oregon Territory.

ARTICLE 1. The said Nez Perce tribe of Indians hereby cede, relinquish and convey to the United States all their right, title, and interest in and to the country occupied or claimed by them, bounded and described as follows, to wit: Commencing at the source of the Wo-na-ne-she or southern tributary of the Palouse River; thence down that river to the main Palouse; thence in a southerly direction to the Snake River, at the mouth of the Tucanon River; thence up the Tucanon to its source in the Blue Mountains; thence southerly along the ridge of the Blue Mountains; thence to a point on Grand Ronde River, midway between Grand Ronde and the mouth of the Woll-low-how River; thence along the divide between the waters of the Woll-low-how and Powder River; thence to the crossing of Snake River, at the mouth of Powder River; thence to the Salmon River, fifty miles above the place known (as) the "crossing of the Salmon River;" thence due north to the summit of the Bitter Root Mountains; thence along the crest of the Bitter Root Mountains to the place of beginning.

ARTICLE 2. There is, however, reserved from the lands above ceded for the use and occupation of the said tribe, and as a general reservation for other friendly tribes and bands of Indians in Washington Territory, not to exceed the present numbers of the Spokane, Walla-Walla, Cayuse, and Umatilla tribes and bands of Indians, the tract of land included within the following boundaries, to wit: Commencing where the Moh-ha-na-she or southern tributary of the Palouse River flows from the spurs of the Bitter Root Mountains; thence down said tributary to the mouth of the Ti-nat-pan-up Creek; thence southerly to the crossing of the Snake River ten miles below the mouth of the Al-po-wa-wi River; thence to the source of the Al-po-wa-wi River in the Blue Mountains; thence along the crest of the Blue Mountains; thence to the crossing of the Grand Ronde River, midway between the Grand Ronde and the mouth of the Woll-low-how River; thence along the divide between the waters of the Woll-low-how and Powder Rivers; thence to the crossing of the Snake River fifteen miles below the mouth of the Powder River; thence to the Salmon River above the crossing; thence by the spurs of the Bitter Root Mountains to the place of beginning.

All which tract shall be set apart, and, so far as necessary, surveyed and marked out for the exclusive use and benefit of said tribe as an Indian reservation; nor shall any white man, excepting those in the employment of the Indian Department, be permitted to reside upon the said reservation without permission of the tribe and the superintendent and agent; and the said tribe agrees to remove to and settle upon the same within one year after the ratification of this treaty. In the mean time it shall be lawful for them to reside upon any ground not in the actual claim and occupation of citizens of the United States, and upon any ground claimed or occupied, if with the permission of the owner or claimant, guarantying, however, the right to all citizens of the United States to enter upon and occupy as settlers any lands not actually occupied and cultivated by said Indians at this time, and not included in the reservation above named. And provided that any substantial improvement heretofore made by any Indian, such as fields enclosed and cultivated, and houses erected upon the lands hereby ceded, and which he may be compelled to abandon in consequence of this treaty, shall be valued under the direction of the President of the United States, and payment made therefor in money, or improvements of an equal value be made for said Indian upon the reservation, and no Indian will be required to abandon the improvements aforesaid, now occupied by him, until their value in money or improvements of equal value shall be furnished him as aforesaid.

ARTICLE 3. And provided that, if necessary for the public convenience, roads may be run through the said reservation, and, on the other hand, the right of way, with free access from the same to the nearest public highway, is secured to them, as also the right, in common with citizens of the United States, to travel upon all public highways. The use of the Clear Water and other streams flowing through the reservation is also secured to citizens of the United States for rafting purposes, and as public highways.

The exclusive right of taking fish in all the streams where running through or bordering said reservation is further secured to said Indians; as also the right of taking fish at all usual and accustomed places in common with citizens of the Territory; and of erecting temporary buildings for curing, together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land.

ARTICLE 4. In consideration of the above cession, the United States agree to pay to the said tribe in addition to the goods and provisions distributed to them at the time of signing this treaty, the sum of two hundred thousand dollars, in the following manner, that is to say, sixty thousand dollars, to be expended under the direction of the President of the United States, the first year after the ratification of this treaty, in providing for their removal to the reserve, breaking up and fencing farms, building houses, supplying them with provisions and a suitable outfit, and for such other objects as he may deem necessary, and the remainder in annuities, as follows: for the first five years after the ratification of this treaty, ten thousand dollars each year, commencing September 1, 1856; for the next five years, eight thousand dollars each year; for the next five years, six thousand each year, and for the next five years, four thousand dollars each year. All which said sums of money shall be applied to the use and benefit of the said Indians, under the direction of the President of the United States, who may from time to time determine, at his discretion, upon what beneficial objects to expend the same for them. And the superintendent of Indian affairs, or other proper officer, shall each year inform the President of the wishes of the Indians in relation thereto.

ARTICLE 5. The United States further agree to establish, at suitable points within said reservation, within one year after the ratification hereof, two schools, erecting the necessary buildings, keeping the same in repair, and providing them with furniture, books, and stationery, one of which shall be an agricultural and industrial school, to be located at the agency, and to be free to the children of said tribe, and to employ one superintendent of teaching and two teachers; to build two blacksmiths' shops, to one of which shall be attached a tinshop and to the other a gunsmith's shop; one carpenter's shop, one wagon and plough maker's shop, and to keep the same in repair, and furnished with the necessary tools to employ one superintendent of farming and two farmers, two blacksmiths, one tinner, one gunsmith, one carpenter, one wagon and plough maker, for the instruction of the Indians in trades, and to assist them in the same; to erect one saw-mill and one flouring-mill, keeping the same in repair, and furnished with the necessary tools and fixtures, and to employ two millers; to erect a hospital, keeping the same in repair, and provided with the necessary medicines and furniture, and to employ a physician; and to erect, keep in repair, and provide with the necessary furniture the buildings required for the accommodation of the said employees. The said buildings and establishments to be maintained and kept in repair as aforesaid, and the employees to be kept in service for the period of twenty years.

And in view of the fact that the head chief of the tribe is expected, and will be called upon, to perform many services of a public character, occupying much of his time, the United States further agrees to pay to the Nez Perce tribe five hundred dollars per year for the term of twenty years, after the ratification hereof, as a salary for such person as the tribe may select to be its head chief. To build for him, at a suitable point on the reservation, a comfortable house, and properly furnish the same, and to plough and fence for his use ten acres of land. The said salary to be paid to, and the said house to be occupied by, such head chief so long as he may be elected to that position by his tribe, and no longer. And all the expenditures and expenses contemplated in this fifth article of this treaty shall be defrayed by the United States, and shall not be deducted from the annuities agreed to be paid to said tribe, nor shall the cost of transporting the goods for the annuity-payments be a charge upon the annuities, but shall be defrayed by the United States.

ARTICLE 7. The President may from time to time, at his discretion, cause the whole, or such portions of such reservation as he may think proper, to be surveyed into lots, and assign the same to such individuals or families of the said tribe as are willing to avail themselves of the privilege, and will locate on the same as a permanent home, on the same terms and subject to the same regulations as are provided in the sixth article of the treaty with the Omahas in the year 1854, so far as the same may be applicable.

ARTICLE 8. The annuities of the aforesaid tribe shall not be taken to pay the debts of individuals.

ARTICLE 9. The aforesaid tribe acknowledge their dependence upon the Government of the United States, and promise to be friendly with all citizens thereof, and pledge themselves to commit no depredations on the property of such citizens; and should any one or more of them violate this pledge, and the fact be satisfactorily proved before the agent, the property taken shall be returned, or in default thereof, or if injured or destroyed, compensation may be made by the Government out of the annuities. Nor will they make war on any other tribe except in self-defense, but will submit all matters of difference between them and the other Indians to the Government of the United States, or its agent, for decision, and abide thereby; and if any of the said Indians commit any depredations on any other Indians within the Territory of Washington, the same rule shall prevail as that prescribed in this article in cases of depredations against citizens. And the said tribe agrees not to shelter or conceal offenders against the laws of the United States, but to deliver them up to the authorities for trial.

ARTICLE 10. The Nez Perce desire to exclude from their reservation the use of ardent spirits, and to prevent their people from drinking the same; and therefore it is provided that any Indian belonging to said tribe who is guilty of bringing liquor into said reservation, or who drinks liquor, may have his or her proportion of the annuities withheld from him or her for such time as the President may determine.

ARTICLE 11. The Nez Perce Indians having expressed in council a desire that William Craig should continue to live with them, he having uniformly shown himself their friend, it is further agreed that the tract of land now occupied by him, and described in his notice to the register and receiver of the land-office of the Territory of Washington, on the fourth day of June last, shall not be considered a part of the reservation provided for in this treaty, except that it shall be subject in common with the lands of the reservation to the operations of the intercourse act.

ARTICLE 12. This treaty shall be obligatory upon the contracting parties as soon as the same shall be ratified by the President and Senate of the United States.

In testimony whereof, the said Isaac I. Stevens, governor and superintendent of Indian affairs for the Territory of Washington, and Joel Palmer, superintendent of Indian affairs for Oregon Territory, and the chiefs, headmen, and delegates of the aforesaid Nez Perce tribe of Indians, have hereunto set their hands and seals, at the place, and on the day and year hereinbefore written.

Issac I. Stevens, (L.S.), Governor and Superintendent Washington Territory.

Joel Palmer, (L.S.), Superintendent Indian Affairs.

Aleiya, or Lawyer, Head-chief of the Nez Perce, (L.S.)

Appushwa-hite, or Looking-glass, his x mark. (L.S.)

Joseph, his x mark. (L.S.)

James, his x mark. (L.S.)

Red Wolf, his x mark. (L.S.)

Timothy, his x mark. (L.S.)

U-ute-sin-male-cun, his x mark, (L.S.)

Spotted Eage, his x mark. (L.S.)

Stoop-toop-nin, or Cut-hair, his x mark. (L.S.)

Tah-moh-moh-kin, his x mark. (L.S.)

Tippelanecbupooh, his x mark. (L.S.)

Hah-hah-stilpilp, his x mark. (L.S.)

Cool-cool-shua-nin, his x mark. (L.S.)

Silish, his x mark. (L.S.)

Toh-toh-molewit, his x mark. (L.S.)

Tuky-in-lik-it, his x mark. (L.S.)

Te-hole-hole-soot, his x mark. (L.S.)

Ish-coh-tim, his x mark. (L.S.)

Wee-as-cus, his x mark. (L.S.)

Hah-hah-stoore-tee, his x mark. (L.S.)

Eee-maht-sin-pooh, his x mark. (L.S.)

Tow-wish-au-il-pilp, his x mark. (L.S.)

Kay-kay-mass, his x mark. (L.S.)

Speaking Eagle, his x mark. (L.S.)

Wat-ti-wat-ti-wah-hi, his x mark. (L.S.)

Howh-no-tah-kun, his x mark. (L.S.)

Tow-wish-wane, his x mark. (L.S.)

Wahpt-tah-shooshe, his x mark. (L.S.)

Bead Necklace, his x mark. (L.S.)

Koos-koos-tas-kut, his x mark. (L.S.)

Levi, his x mark. (L.S.)

Pee-oo-pe-whi-hi, his x mark. (L.S.)

Pee-oo-pee-iecteim, his x mark. (L.S.)

Pee-poome-kah, his x mark. (L.S.)

Hah-hah-stlil-at-me, his x mark. (L.S.)

Wee-yoke-sin-ate, his x mark. (L.S.)

Wee-ah-ki, his x mark. (L.S.)

Necalahtsin, his x mark. (L.S.)

Suck-on-tie, his x mark. (L.S.)

Ip-nat-tam-moose, his x mark. (L.S.)

Jason, his x mark. (L.S.)

Kole-kole-til-ky, his x mark. (L.S.)

In-mat-tute-kah-ky, his x mark. (L.S.)

Moh-see-chee, his x mark. (L.S.)

George, his x mark. (L.S.)

Nicke-el-it-may-ho, his x mark.
(L.S.)Say-i-ee-ouse, his x mark. (L.S.)

Wis-tasse-cut, his x mark. (L.S.)

Ky-ky-soo-te-lum, his x mark. (L.S.)

Ko-ko-whay-nee, his x mark. (L.S.)

Kwin-to-kow, his x mark. (L.S.)

Pee-wee-au-ap-tah, his x mark. (L.S.)

Wee-at-tenat-il-pilp, his x mark. (L.S.)

Pee-oo-pee-u-il-pilp, his x mark. (L.S.)

Wah-tass-tum-mannee, his x mark. (L.S.)

Tu-wee-si-ce, his x mark. (L.S.)

Lu-ee-sin-kah-koose-sin, his x mark. (L.S.)

Hah-tal-ee-kin, his x mark. (L.S.)

Signed and sealed in presence of us - -

James Doty, secretary of treaties, W.T.

Wm. C. McKay, secretary of treaties, O.T.

W. H. Tappan, sub-Indian agent

William Craig, interpreter

A. D. Pamburn, interpreter

Wm. McBean

Geo. C. Bomford

C. Chirouse, O.M.T.

Mie. Cles. Pandosy

Lawrence Kip

W. H. Pearson

Ratified Mar. 8, 1859
Proclaimed Apr. 29, 1859

swimref@cmc.net

Yakima Treaty of Camp Stevens, 1855

Articles of agreement and convention made and concluded at the treaty-ground, Camp Stevens, Walla-Walla Valley, this ninth day of June, in the year one thousand eight hundred and fifty-five, by and between Isaac I. Stevens, governor and superintendent of Indian affairs for the Territory of Washington, on the part of the United States, and the undersigned head chiefs, chiefs, head-men, and delegates of the Yakama, Palouse, Pisquouse, Wenatshapam, Klikatat, Klinquit, Kow-was-say-ee, Li-ay-was, Skin-pah, Wish-ham, Shyiks, Oche-chotes, Kah-milt-pah, and Se-ap-cat, confederated tribes and bands of Indians, occupying lands hereinafter bounded and described and lying in Washington Territory, who for the purposes of this treaty are to be considered as one nation, under the name of "Yakama," with Kamaiakun as its head chief, on behalf of and acting for said tribes and bands, and being duly authorized thereto by them.

ARTICLE 1. The aforesaid confederated tribes and bands of Indians hereby cede, relinquish, and convey to the United States all their right, title, and interest in and to the lands and country occupied and claimed by them, and bounded and described as follows, to wit: Commencing at Mount Ranier, thence northerly along the main ridge of the Cascade Mountains to the point where the northern tributaries of Lake Che-lan and the southern tributaries of the Methow River have their rise; thence southeasterly on the divide between the waters of Lake Che-lan and the Methow River to the Columbia River; thence, crossing the Columbia on a true east course, to a point whose longitude is one hundred and nineteen degrees and ten minutes, (119 degrees 10',) which two latter lines separate the above confederated tribes and bands from the Oakinakane tribe of Indians; thence in a true south course to the forty-seventh (47 degrees) parallel of latitude; thence east on said parallel to the main Palouse River, which two latter lines of boundary separate the above confederated tribes and bands from the Spokanes; thence down the Palouse River to its junction with the Moh-hah-ne-she, or southern tributary of the same; thence in a southesterly direction, to the Snake River, at the mouth of the Tucannon River, separating the above confederated tribes from the Nez Perce tribe of Indians; thence down the Snake River to its junction with the Columbia River; thence up the Columbia River to the "White Banks" below the Priest's Rapids; thence westerly to a lake called "LaLac"; thence southerly to a point on the Yakama River called Toh-mah-luke; thence, in a southwesterly direction, to the Columbia River, at the western extremity of the "Big Island," between the mouths of the Umatilla River and Butler Creek; all which latter boundaries separate the above confederated tribes and bands from the Walla-Walla, Cayuse, and Umatilla tribes and bands of Indians; thence down the Columbia River to midway between the mouths of White Salmon and Wind Rivers thence along the divide between said rivers to the main ridge of the Cascade Mountains; and thence along said ridge to the place of beginning.

ARTICLE 2. There is, however, reserved, from the lands above ceded for the use and occupation of the aforesaid confederated tribes and bands of Indians, the tract of land included within the following boundaries, to wit: Commencing on the Yakama River, at the mouth of the Attah-nam River; thence westerly along said Attah-nam River to the forks; thence along the southern tributary to the Cascade Mountains; thence southerly along the main ridge of said mountains, passing south and east of Mount Adams, to the spur whence flows the waters of the Klickatat and Pisco Rivers; thence down said spur to the divide between the waters of said rivers; thence along said divide to the divide separating the waters of the Satass River from those flowing into the Columbia River; thence along said divide to the main Yakama, eight miles below the mouth of the Satass River; and thence up the Yakama River to the place of beginning. All which tract shall be set apart and, so far as necessary, surveyed and marked out, for the exclusive use and benefit of said confederated tribes and bands of Indians, as an Indian reservation; nor shall any white man, excepting those in the employment of the Indian Department, be permitted to reside upon the said reservation without permission of the tribe and the superintendent and agent. And the said confederated tribes and bands agree to remove to, and settle upon, the same, within one year after the ratification of this treaty. In the mean time it shall be lawful for them to reside upon any ground not in the actual claim and occupation of citizens of the United States; and upon any ground claimed or occupied, if with the permission of the owner or claimant. Guaranteeing, however, the right to all citizens of the United States to enter upon and occupy as settlers any lands not actually occupied and cultivated by said Indians at this time, and not included in the reservation above named.

And provided, That any substantial improvements heretofore made by any Indian, such as fields enclosed and cultivated, and houses erected upon the lands hereby ceded, and which he may be compelled to abandon in consequence of this treaty, shall be valued, under the direction of the President of the United States, and payment made therefor in money; or improvements of an equal value made for said Indian upon the reservation. And no Indian will be required to abandon the improvements aforesaid, now occupied by him, until their value in money, or improvements of an equal value shall be furnished him as aforesaid.

ARTICLE 3. And provided, That, if necessary for the public convenience, roads may be run through the said reservation; and on the other hand, the right of way, with free access from the same to the nearest public highway, is secured to them; as also the right, in common with citizens of the United States, to travel upon all public highways.

The exclusive right of taking fish in all the streams, where running through or bordering said reservation, is further secured to said confederated tribes and bands of Indians, as also the right of taking fish at all usual and accustomed places, in common with the citizens of the Territory, and of erecting temporary buildings for curing them; together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land.

ARTICLE 4. In consideration of the above cession, the United States agree to pay to the said confederated tribes and bands of Indians, in addition to the goods and provisions distributed to them at the time of signing this treaty, the sum of two hundred thousand dollars, in the following manner, that is to say: Sixty thousand dollars, to be expended under the direction of the President of the United States, the first year after the ratification of this treaty, in providing for their removal to the reservation, breaking up and fencing farms, building houses for them, supplying them with provisions and a suitable outfit, and for such other objects as he may deem necessary, and the remainder in annuities, as follows: For the first five years after the ratification of the treaty, ten thousand dollars each year, commencing September first, 1856; for the next five years, eight thousand dollars each year; for the next five years, six thousand dollars per year; and for the next five years, four thousand dollars per year.

All which sums of money shall be applied to the use and benefit of said Indians, under the direction of the President of the United States, who may from time to time determine, at his discretion, upon what beneficial objects to expend the same for them. And the superintendent of Indian affairs, or other proper officer, shall each year inform the President of the wishes of the Indians in relation thereto.

ARTICLE 5. The United States further agree to establish at suitable points within said reservation, within one year after the ratification hereof, two schools, erecting the necessary buildings, keeping them in repair, and providing them with furniture, books, and stationery, one of which shall be an agricultural and industrial school, to be located at the agency, and to be free to the children of the said confederated tribes and bands of Indians, and to employ one superintendent of teaching and two teachers; to build two blacksmiths' shops, to one of which shall be attached a tin-shop, and to the other a gunsmith's shop; one carpenter's shop, one wagon and plough maker's shop, and to keep the same in repair and furnished with the necessary tools; to employ one superintendent of farming and two farmers, two blacksmiths, one tinner, one gunsmith, one carpenter, one wagon and plough maker, for the instruction of the Indians in trades and to assist them in the same; to erect one saw-mill and one flouring-mill, keeping the same in repair and furnished with the necessary tools and fixtures; to erect a hospital, keeping the same in repair and provided with the necessary medicines and furniture, and to employ a physician; and to erect, keep in repair, and provided with the necessary furniture, the building required for the accommodation of the said employees. The said buildings and establishments to be maintained and kept in repair as aforesaid, and the employees to be kept in service for the period of twenty years.

And in view of the fact that the head chief of the said confederated tribes and bands of Indians is expected, and will be called upon to perform many services of a public character, occupying much of his time, the United States further agree to pay to the said confederated tribes and bands of Indians five hundred dollars per year, for the term of twenty years after the ratification hereof, as a salary for such person as the said confederated tribes and bands of Indians may select to be their head chief, to build for him at a suitable point on the reservation a comfortable house, and properly furnish the same, and to plough and fence ten acres of land. The said salary to be paid to, and the said house to be occupied by, such head chief so long as he may continue to hold that office.

And it is distinctly understood and agreed that at the time of the conclusion of this treaty Kamaiakun is the duly elected and authorized head chief of the confederated tribes and bands aforesaid, styled the Yakama Nation, and is recognized as such by them and by the commissioners on the part of the United States holding this treaty; and all the expenditures and expenses contemplated in this article of this treaty shall be defrayed by the United States, and shall not be deducted from the annuities agreed to be paid to said confederated tribes and band of Indians. Nor shall the cost of transporting the goods for the annuity payments be a charge upon the annuities, but shall be defrayed by the United States.

ARTICLE 6. The President may, from time to time, at his discretion, cause the whole or such portions of such reservation as he may think proper, to be surveyed into lots, and assign the same to such individuals or families of the said confederated tribes and bands of Indians as are willing to avail themselves of the privilege, and will locate on the same as a permanent home, on the same terms and subject to the same regulations as are provided in the sixth article of the treaty with the Omahas, so far as the same may be applicable.

ARTICLE 7. The annuities of the aforesaid confederated tribes and bands of Indians shall not be taken to pay the debts of individuals.

ARTICLE 8. The aforesaid confederated tribes and bands of Indians acknowledge their dependence upon the Government of the United States, and promise to be friendly with all citizens thereof, and pledge themselves to commit no depredations upon the property of such citizens. And should any one or more of them violate this pledge, and the fact be satisfactorily proved before the agent, the property taken shall be returned, or in default thereof, or if injured or destroyed, compensation may be made by the Government out of the annuities. Nor will they make war upon any other tribe, except in self-defense, but will submit all matters of difference between them and other Indians to the Government of the United States or its agent for decision, and abide thereby. And if any of the said Indians commit depredations on any other Indians within the Territory of Washington or Oregon, the same rule shall prevail as that provided in this article in case of depredations against citizens. And the said confederated tribes and bands of Indians agree not to shelter or conceal offenders against the laws of the United States, but to deliver them up to the authorities for trial.

ARTICLE 9. The said confederated tribes and bands of Indians desire to exclude from their reservation the use of ardent spirits, and to prevent their people from drinking the same, and, therefore, it is provided that any Indian belonging to said confederated tribes and bands of Indians, who is guilty of bringing liquor into said reservation, or who drinks liquor, may have his or her annuities withheld from him or her for such time as the President may determine.

ARTICLE 10. And provided, That there is also reserved and set apart from the lands ceded by this treaty, for the use and benefit of the aforesaid confederated tribes and bands, a tract of land not exceeding in quantity one township of six miles square, situated at the forks of the Pisquouse or Wenatshapam River, and known as the "Wenatshapam Fishery," which said reservation shall be surveyed and marked out whenever the President may direct, and be subject to the same provisions and restrictions as other Indian reservations.

ARTICLE 11. This treaty shall be obligatory upon the contracting parties as soon as the same shall be ratified by the President and Senate of the United States. In testimony whereof, the said Isaac I. Stevens, governor and superintendent of Indian affairs for the Territory of Washington, and the undersigned head chief, chiefs, headmen, and delegates of the aforesaid confederated tribes and bands of Indians, have hereunto set their hands and seals, at the place and on the day and year hereinbefore written.

ISAAC I. STEVENS, Governor and Superintendent. (L.S.)

Kamaiakun, his x mark. (L.S.)

Skloom, his x mark. (L.S.)

Owhi, his x mark. (L.S.)

Te-cole-kun, his x mark. (L.S.)

La-hoom, his x mark. (L.S.)

Me-ni-nock, his x mark. (L.S.)

Elit Palmer, his x mark. (L.S.)

Wish-och-kmpits, his x mark. (L.S.)

Koo-lat-toose, his x mark. (L.S.)

Shee-ah-cotte, his x mark. (L.S.)

Tuck-quille, his x mark. (L.S.)

Ka-loo-as, his x mark. (L.S.)

Scha-noo-a, his x mark. (L.S.)

Sla-kish, his x mark. (L.S.)

Signed and sealed in the presence of - -

James Doty, secretary of treaties

Mie. Cles. Pandosy, O. M. T.

Wm. C. McKay

W. H. Tappan, sub Indian agent, W. T.

C. Chirouse, O. M. T.

Patrick McKenzie, interpreter

A. D. Pamburn, interpreter

Joel Palmer, superintendent Indian affairs, O. T.

W. D. Biglow

A. D. Pamburn, interpreter

Ratified Mar. 8, 1859
Proclaimed Apr. 18, 1859

swimref@cmc.net

Walla Walla Treaty of Camp Stevens, 1855

Articles of agreement and convention made and concluded at the treaty ground, Camp Stevens, in the Walla-Walla Valley, this ninth day of June, in the year one thousand eight hundred and fifty-five, by and between Isaac I. Stevens, governor and superintendent of Indian affairs for the Territory of Washington, and Joel Palmer, superintendent of Indian affairs for Oregon Territory, on the part of the United States, and the undersigned chiefs, head-men, and delegates of the Walla-Wallas, Cayuses, and Umatilla tribes, and bands of Indians, occupying lands partly in Washington and partly in Oregon Territories, and who, for the purposes of this treaty, are to be regarded as one nation acting for and in behalf of their respective bands and tribes, they being duly authorized thereto; it being understood that Superintendent I. I. Stevens assumes to treat with that portion of the above-named bands and tribes residing within the Territory of Washington, and Superintendent Palmer with those residing within Oregon.

ARTICLE 1. The above-named confederated bands of Indians cede to the United States all their right, title, and claim to all and every part of the country claimed by them included in the following boundaries, to wit: Commencing at the mouth of the Tocannon River, in Washington Territory, running thence up said river to its source; thence easterly along the summit of the Blue Mountains, and on the southern boundaries of the purchase made of the Nez Perces Indians, and easterly along that boundary to the western limits of the country claimed by the Shoshonees or Snake Indians; thence southerly along that boundary (being the waters of Powder River) to the source of Powder River, thence to the head-waters of Willow Creek, thence down Willow Creek to the Columbia River, thence up the channel of the Columbia River to the lower end of a large island below the mouth of Umatilla River, thence northerly to a point on the Yakama River, called Tomah-luke, thence to Le Lac, thence to the White Banks on the Columbia below Priest's Rapids, thence down the Columbia River to the junction of the Columbia and Snake Rivers, thence up the Snake River to the place of beginning: Provided, however, That so much of the country described above as is contained in the following boundaries shall be set apart as a residence for said Indians, which tract for the purposes contemplated shall be held and regarded as an Indian reservation; to it: Commencing in the middle of the channel of Umatilla River opposite the mouth of Wild Horse Creek, thence up the middle of the channel of said creek to its source, thence southerly to a point in the Blue Mountains, known as Lee's Encampment, thence in a line to the head-waters of Howtome Creek, thence west to the divide between Howtome and Birch Creeks, thence northerly along said divide to a point due west of the southwest corner of William C. McKay's land-claim, thence east along his line to his southeast corner, thence in a line to the place of beginning; all of which tract shall be set apart and, so far as necessary, surveyed and marked out for their exclusive use; nor shall any white person be permitted to reside upon the same without permission of the agent and superintendent. The said tribes and bands agree to remove to and settle upon the same within one year after the ratification of this treaty, without any additional expense to the Government other than is provided by this treaty, and until the expiration of the time specified, the said bands shall be permitted to occupy and reside upon the tracts now possessed by them, guaranteeing to all citizen(s) of the United States, the right to enter upon and occupy as settlers any lands not actually enclosed by said Indians: Provided, also, That the exclusive right of taking fish in the streams running through and bordering said reservation is hereby secured to said Indians, and at all other usual and accustomed stations in common with citizens of the United States, and of erecting suitable buildings for curing the same; the privilege of hunting, gathering roots and berries and pasturing their stock on unclaimed lands in common with citizens, is also secured to them. And provided, also, That if any band or bands of Indians, residing in and claiming any portion or portions of the country described in this article, shall not accede to the terms of this treaty, then the bands becoming parties hereunto agree to reserve such part of the several and other payments herein named, as a consideration for the entire country described as aforesaid, as shall be in the proportion that their aggregate number may have to the whole number of Indians residing in and claiming the entire country aforesaid, as consideration and payment in full for the tracts in said country claimed by them. And provided, also, That when substantial improvements have been made by any member of the bands being parties to this treaty, who are compelled to abandon them in consequence of said treaty, (they) shall be valued under the direction of the President of the United States, and payment made therefor.

ARTICLE 2. In consideration of and payment for the country hereby ceded, the United States agree to pay the bands and tribes of Indians claiming territory and residing in said country, and who remove to and reside upon said reservation, the several sums of money following, to wit: eight thousand dollars per annum for the term of five years, commencing on the first day of September, 1856; six thousand dollars per annum for the term of five years next succeeding the first five; four thousand dollars per annum for the term of five years next succeeding the second five, and two thousand dollars per annum for the term of five years next succeeding the third five; all of which several sums of money shall be expended for the use and benefit of the confederated bands herein named, under the direction of the President of the United States, who may from time to time at his discretion, determine what proportion thereof shall be expended for such objects as in his judgment will promote their well-being, and advance them in civilization, for their moral improvement and education, for buildings, opening and fencing farms, breaking, land, purchasing teams, wagons, agricultural implements and seeds, for clothing, provision and tools, for medical purposes, providing mechanics and farmers, and for arms and ammunition.

ARTICLE 3. In addition to the articles advanced the Indians at the time of signing this treaty, the United States agree to expend the sum of fifty thousand dollars during the first and second years after its ratification, for the erection of buildings on the reservation, fencing and opening farms, for the purchase of teams, farming implements, clothing, and provisions, for medicines and tools, for the payment of employes, and for subsisting the Indians the first year after their removal.

ARTICLE 4. In addition to the consideration above specified, the United States agree to erect, at suitable points on the reservation, one saw-mill, and one flouring-mill, a building suitable for a hospital, two school-houses, one blacksmith shop, one building for wagon and plough maker and one carpenter and joiner shop, one dwelling for each, two millers, one farmer, one superintendent of farming operations, two school-teachers, one blacksmith, one wagon and plough maker, one carpenter and joiner, to each of which the necessary out-buildings. To purchase and keep in repair for the term of twenty years all necessary mill fixtures and mechanical tools, medicines and hospital stores, books and stationery for schools, and furniture for employes. The United States further engage to secure and pay for the services and subsistence, for the term of twenty years, (of) one superintendent of farming operations, one farmer, one blacksmith, one wagon and plough maker, one carpenter and joiner, one physician, and two school-teachers.

ARTICLE 5. The United States further engage to build for the head chiefs of the Walla-Walla, Cayuse, and Umatilla bands each one dwelling-house, and to plough and fence ten acres of land for each, and to pay to each five hundred dollars per annum in cash for the term of twenty years. The first payment to the Walla-Walla chief to commence upon the signing of this treaty. To give to the Walla-Walla chief three yoke of oxen, three yokes and four chains, one wagon, two ploughs, twelve hoes, twelve axes, two shovels, and one saddle and bridle, one set of wagon-harness, and one set of plough-harness, within three months after the signing of this treaty. To build for the son of Pio-pio-mox-mox one dwelling-house, and plough and fence five acres of land, and to give him a salary for twenty years, one hundred dollars in cash per annum, commencing September first, eighteen hundred and fifty-six. The improvement named in this section to be completed as soon after the ratification of this treaty as possible. It is further stipulated that Pio-pio-mox-mox is secured for the term of five years, the right to build and occupy a house at or near the mouth of Yakama River, to be used as a trading-post in the sale of his bands of wild cattle ranging in that district: And provided, also, That in consequence of the immigrant wagon-road from Grand Round to Umatilla, passing through the reservation herein specified, thus leading to turmoils and disputes between Indians and immigrants, and as it is known that a more desirable and practicable route may be had to the south of the present road, that a sum not exceeding ten thousand dollars shall be expended in locating and opening a wagon-road from Powder River or Grand Round, so as to reach the plain at the western base of the Blue Mountain, south of the southern limits of said reservation.

ARTICLE 6. The President may, from time to time at his discretion cause the whole or such portion as he may think proper, of the tract that may now or hereafter be set apart as a permanent home for those Indians, to be surveyed into lots and assigned to such Indians of the confederated bands as may wish to enjoy the privilege, and locate thereon permanently, to a single person over twenty-one years of age, forty acres, to a family of two persons, sixty acres, to a family of three and not exceeding five, eighty acres; to a family of six persons and not exceeding ten, one hundred and twenty acres; and to each family over ten in number, twenty acres to each additional three members; and the President may provide for such rules and regulations as will secure to the family in case of the death of the head thereof, the possession and enjoyment of such permanent home and improvement thereon; and he may at any time, at his discretion, after such person or family has made location on the land assigned as a permanent home, issue a patent to such person or family for such assigned land, conditioned that the tract shall not be aliened or leased for a longer term than two years, and shall be exempt from levy, sale, or forfeiture, which condition shall continue in force until a State constitution, embracing such land within its limits, shall have been formed and the legislature of the State shall remove the restriction: Provided, however, That no State legislature shall remove the restriction herein provided for without the consent of Congress: And provided, also, That if any person or family, shall at any time, neglect or refuse to occupy or till a portion of the land assigned and on which they have located, or shall roam from place to place, indicating a desire to abandon his home, the President may if the patent shall have been issued, cancel the assignment, and may also withhold from such person or family their portion of the annuities or other money due them, until they shall have returned to such permanent home, and resumed the pursuits of industry, and in default of their return the tract may be declared abandoned, and thereafter assigned to some other person or family of Indians residing on said reservatio: And provided, also, That the head chiefs of the three principal bands, to wit, Pio-pio-mox-mox, Weyatenatemany, and Wenap-snoot, shall be secured in a tract of at least one hundred and sixty acres of land.

ARTICLE 7. The annuities of the Indians shall not be taken to pay the debts of individuals.

ARTICLE 8. The confederated bands acknowledge their dependence on the Government of the United States and promise to be friendly with all the citizens thereof, and pledge themselves to commit no depredation on the property of such citizens, and should any one or more of the Indians violate this pledge, and the fact be satisfactorily proven before the agent, the property taken shall be returned, or in default thereof, or if injured or destroyed, compensation may be made by the Government out of their annuities; nor will they make war on any other tribe of Indians except in self-defense, but submit all matter of difference between them and other Indians, to the Government of the United States or its agents for decision, and abide thereby; and if any of the said Indians commit any depredations on other Indians, the same rule shall prevail as that prescribed in the article in case of depredations against citizens. Said Indians further engage to submit to and observe all laws, rules, and regulations which may be prescribed by the United States for the government of said Indians.

ARTICLE 9. In order to prevent the evils of intemperance among said Indians, it is hereby provided that if any one of them shall drink liquor, or procure it for others to drink, (such one) may have his or her proportion of the annuities withheld from him or her for such time as the President may determine.

ARTICLE 10. The said confederated bands agree that, whenever in the opinion of the President of the United States the public interest may require it, that all roads highways and railroads shall have the right of way through the reservation herein designated or which may at any time hereafter be set apart as a reservation for said Indians. ARTICLE 11. This treaty shall be obligatory on the contracting parties as soon as the same shall be ratified by the President and Senate of the United States. In testimony whereof, the said I. I. Stevens and Joel Palmer, on the part of the United States, and the undersigned chiefs, headmen, and delegates of the said confederated bands, have hereunto set their hands and seals, this ninth day of June, eighteen hundred and fifty-five Isaac I. Stevens, (L.S.) Governor and Superintendent Washington Territory.

Joel Palmer, (L.S.) Superintendent Indian Affairs, O.T.
Pio-pio-mox-mox, his x mark, head chief of Walla-Wallas. (L.S.)
Meani-teat or Pierre, his x mark. (L.S.)
Weyatenatemany, his x mark, head chief of Cayuses. (L.S.)
Wenap-snoot, his x mark, head chief of Umatilla. (L.S.)
Kamaspello, his x mark. (L.S.)
Steachus, his x mark. (L.S.)
Howlish-wampo, his x mark. (L.S.)
Five Crows, his x mark. (L.S.)
Stocheania, his x mark. (L.S.)
Mu-howlish, his x mark. (L.S.)
Lin-tin-met-cheania, his x mark. (L.S.)
Petamyo-mox-mox, his x mark. (L.S.)
Watash-te-waty, his x mark. (L.S.)
She-yam-na-kon, his x mark. (L.S.)
Qua-chim, his x mark. (L.S.)
Te-walca-temany, his x mark. (L.S.)
Keantoan, his x mark. (L.S.)
U-wait-quaick, his x mark. (L.S.)
Tilch-a-waix, his x mark. (L.S.)
La-ta-chin, his x mark. (L.S.)
Kacho-rolich, his x mark. (L.S.)
Kanocey, his x mark. (L.S.)
Som-na-howlish, his x mark. (L.S.)

Ta-we-way, his x mark. (L.S.)
Ha-hats-me-cheat-pus, his x mark. (L.S.)
Pe-na-cheanit, his x mark. (L.S.)
Ha-yo-ma-kin, his x mark. (L.S.)
Ya-ca-lox, his x mark. (L.S.)
Na-kas, his x mark. (L.S.)
Stop-cha-yeou, his x mark. (L.S.)
He-yeau-she-keaut, his x mark. (L.S.)
Sha-wa-way, his x mark. (L.S.)
Tam-cha-key, his x mark. (L.S.)
Te-na-we-na-cha, his x mark. (L.S.)
Johnson, his x mark. (L.S.)
Whe-la-chey, his x mark. (L.S.)
Signed in the presence of - - James Doty, secretary treaties.
Wm. C. McKay, secretary treaties.
C. Chirouse, O.M.I.
A. D. Pamburn, interpreter.
John Whitford, his x mark, interpreter
Mathew Dofa, his x mark, interpreter.
William Craig, interpreter.
James Coxey, his x mark, interpreter.
Patrick McKenzie, interpreter
Arch. Gracie, jr., brevet second lieutenant, Fourth Infantry.
R. R. Thompson, Indian agent.
R. B. Metcalfe, Indian sub-agent.
Ratified Mar. 8, 1859. Proclaimed Apr. 11, 1859.

This page intentionally left blank.

This page intentionally left blank.

Appendix B -- Response Letters from Cooperating Agencies

This pages intentionally left blank.

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

MAR 0 4 1997

97-EAP-280

Ms. Donna Powaukee, Manager
Nez Perce Indian Tribe
Environmental Restoration/Waste Mgmt.
P.O. Box 365
Lapwai, Idaho 83540

Dear Ms. Powaukee:

INVITATION TO PARTICIPATE IN DEVELOPMENT OF FINAL HANFORD REMEDIAL ACTION ENVIRONMENTAL IMPACT STATEMENT AND COMPREHENSIVE LAND USE PLAN

Thank you for your comments on the Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA-EIS). This letter serves as notice the Department of Energy, Richland Operations Office (RL) plans to develop the Final HRA-EIS. In order to respond to the comments received from Tribal governments, regulatory agencies and the public, the Department of Energy, Richland Operations Office (RL) is writing the Final HRA-EIS to emphasize land use planning. As we clarified at the December public 1996 meeting the EIS is not intended to make specific cleanup decisions that have already been made or will be made in the future under the Resources Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

RL is inviting you to participate in the development of the Final HRA-EIS, consistent with the Council on Environmental Quality's (CEQ) Regulations For Implementing the Procedural Provisions of NEPA, 40 CFR 1501.6. Consistent with the CEQ guidance, RL will use the environmental analysis and proposals of tribal governments and cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible, consistent with its responsibility as lead agency. RL is requesting that the Nez Perceprovide information and analysis for those portions of the environmental impact statement in which you have special expertise, to support the development of the Final EIS. The addition of your specialized knowledge will be of great value to the land use planning process and your comments will be incorporated into the final EIS. RL looks forward to your cooperation, involvement and assistance in the planning of Hanford's future land uses.

RL is on a strict schedule (Attached), established by Public Law 104-201, Section 3153, to meet a March 15, 1998, deadline for a 50-year future use plan. We are reorganizing material in the draft EIS and are not rescoping the HRA-EIS. RL will focus on revisions to the existing Draft HRA-EIS such that the analyses and terminology in the Comprehensive Land Use Plan are the emphasis in the Final HRA-EIS.

Attachment 1

Key Milestone Dates for Completion of The Final Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan

Initiate Strategy Meetings With Cooperating Agencies	January 31, 1997
Finalize Land Use Alternatives	February 27, 1997
Develop Impact Analysis	May 15, 1997
Initial Draft Final EIS	June 4, 1997
Public Comment Response Document	June 5, 1997
Cooperative Agency Internal Review & Comment Resolution	July 25, 1997
Final EIS to Printer	October 15, 1997
Final EIS to Public	November 24, 1997
Notice of Availability in Federal Register	December 8, 1997
45 Day Waiting Period Closes	February 11, 1998
Final Record of Decision	March 11, 1998
Record of Decision/Future Use Plan	March 15, 1998

* Please note that all letters to the cooperating agencies from the U.S. Department of Energy, Richland Operations Office (RL) included Attachment 1 and a list of carbon copied individuals. However, the attachment to the RL letter and carbon copy page are only shown here with the first RL invitation letter in this Appendix section.

John Wagoner, Manager
May 14, 1997
Page - 2

2. The final EIS and ROD must identify:

   a. the preferred land use map(s);
   b. unresolved issues and impediments to realizing the land use plan; and
   c. implementing mechanisms and actions to be undertaken among cooperating agencies to resolve outstanding issues. Examples of outstanding issues at this time are water availability for non-DOE uses and the underlying ownership of Bureau of Land Management land in a checkerboard fashion across the state.

Grant County (the "County") pledges to support this effort in full faith by providing our expertise for the process as it relates to our land use alternatives to be included in the EIS. We will not commit resources to activities which are unilaterally DOE's responsibility, such as preparing information related to Hanford cleanup activities and federal legal requirements, document printing and distribution, reserving hearing locations, etc.

Thank you for your invitation to participate in the HRA Comprehensive Land Use Plan EIS as a cooperating agency. The County looks forward to a productive and meaningful effort, which can result in a product which meets the needs of DOE and cooperating agencies in the near and long-term, and formally defines our continued working relationship.

The County's "point-of-contact" for this cooperative effort will be Larry N. Angell, Planning Director. Mr. Angell can be contacted at (509) 754-2011, Ext. 493.

Nez Perce
ENVIRONMENTAL RESTORATION & WASTE MANAGEMENT
P.O. BOX 365 · LAPWAI, IDAHO 83540-0365 · (208) 843-7375 / FAX: 843-7378

April 28, 1997

Mr. John Wagoner
U.S. DOE, Mail Stop A7-50
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

RE: Invitation to Participate in Development of Final Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan, March 4, 1997

Dear Mr. Wagoner:

The Nez Perce Tribe Department of Environmental Restoration and Waste Management (ERWM) appreciates being invited to participate in development of Final Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan. Thus far, these meetings have been productive, and we are encouraged by these interactions that contribute to open communication and the free flow of information. Meetings such as these fulfill the partnership embodied in the Cooperative Agreement between the U.S. DOE and Nez Perce Tribe. Tribal consultation, on future Hanford Site land use directly impacts our most important resource, the Columbia River, is of utmost concern to the Nez Perce People. Our rights to the Mid-Columbia were retained in the Treaty of 1855 and were affirmed through a series of federal and state actions.

We look forward to an even greater participation in this process. In fact, we foresee our tribal input greatly surpassing that outlined in your letter dated March 4, 1997. Particularly, we expect to be included in the decision making process as well as writing the land use plan. The first step in this process is development of a revised draft plan, to be submitted for public comment.

Once again, thank you for this invitation, and we look forward a productive and congenial process with all of the involved governments in deciding the best future use of the Hanford Site which will most benefit all of the people. Staff members assigned to this project are Richard Buck, Stan Sobczyk, and Paul Danielson all at (208) 843-7375 or (203) 843-7378 (fax). Please do not hesitate to contact them throughout the development of the plan

Sincerely,

Donna L. Powaukee

Donna L. Powaukee
Nez Perce Tribe ERWM Manager

cc: Tom Ferns, DOE-RL
Paul Krupin, DOE-RL
Lloyd Piper, DOE-RL, Assisitant Site Manager
Kevin Clarke, DOE-RL, Indian Programs Manager
Russell Jim, YIN, ER/WM Manager
J.R. Wilkinson, CTUIR, SSRP Manager

RECEIVED
MAY 0 1 1997
DOE-RL/DIS

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

MAR 04 1997

97-EAP-281

Mr. J. R. Wilkinson
Confederated Tribes of the
Umatilla Indian Reservation
Cultural Resources Protection Program
P.O. Box 638
Pendleton, OR 97801

Dear Mr. Wilkinson:

INVITATION TO PARTICIPATE IN DEVELOPMENT OF THE FINAL HANFORD REMEDIAL ACTION ENVIRONMENTAL IMPACT STATEMENT AND COMPREHENSIVE LAND USE PLAN

Thank you for your comments on the Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA-EIS). This letter serves as notice the Department of Energy, Richland Operations Office (RL) plans to develop the Final HRA-EIS. In order to respond to the comments received from Tribal governments, regulatory agencies and the public, the Department of Energy, Richland Operations Office (RL) is writing the Final HRA-EIS to emphasize land use planning. As we clarified at the December public 1996 meeting the EIS is not intended to make specific cleanup decisions that have already been made or will be made in the future under the Resources Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

RL is inviting you to participate in the development of the Final HRA-EIS, consistent with the Council on Environmental Quality's (CEQ) Regulations For Implementing the Procedural Provisions of NEPA, 40 CFR 1501.6. Consistent with the CEQ guidance, RL will use the environmental analysis and proposals of tribal governments and cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible, consistent with its responsibility as lead agency. RL is requesting that the Confederated Tribes of the Umatilla Indian Reservationprovide information and analysis for those portions of the environmental impact statement in which you have special expertise, to support the development of the Final EIS. The addition of your specialized knowledge will be of great value to the land use planning process and your comments will be incorporated into the final EIS. RL looks forward to your cooperation, involvement and assistance in the planning of Hanford's future land uses.

RL is on a strict schedule (Attached), established by Public Law 104-201, Section 3153, to meet a March 15, 1998, deadline for a 50-year future use plan. We are reorganizing material in the draft EIS and are not rescoping the HRA-EIS. RL will focus on revisions to the existing Draft HRA-EIS such that the analyses and terminology in the Comprehensive Land Use Plan are the emphasis in the Final HRA-EIS.

DEPARTMENT of NATURAL RESOURCES
Administration

CONFEDERATED TRIBES
of the
Umatilla Indian Reservation
P.O. Box 638
PENDLETON, OREGON 97801
Area code 541 Phone 276-3447 FAX 276-3317

April 3, 1997

Mr. John Wagoner, Manager
Richland Operations Office
U.S. Department of Energy
P.O. Box 550, A7-50
Richland, WA 99352

Subject: CTUIR Participation in the Completion of Hanford's Land Use EIS

Dear Mr. Wagoner:

I am writing in response to your letter, dated March 4, 1997, in which you invite the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to become a "cooperating agency" (as defined by regulations of the U.S. Council on Environmental Quality) in the further development of the Hanford Remedial Action Environmental Impact Statement (HRA-EIS). The purpose of this letter is to formally notify you that the CTUIR has accepted your offer.

In the view of the CTUIR, the last four years of the U.S. Department of Energy, Richland Operations Office's (DOE/RL) HRA-EIS effort has been characterized by a failure to clearly define the purpose and goal of the EIS and to structure an appropriate process around achieving that goal. If the CTUIR believed DOE/RL were continuing in that vein, we would not agree to become a cooperating agency.

Since February of this year, however, DOE/RL has repeatedly stated that it is taking a new approach to the HRA-EIS. In meetings with DOE/RL staff in February 1997, CTUIR staff were informed that DOE would be "refocusing" the EIS around the development of the Hanford Comprehensive Land Use Plan. In so doing, DOE would drop those portions of the August DEIS which had attempted to control remediation decisions. These portions include the risk analysis and the analysis of the site in terms of six geographic areas, as well as other large portions of the August DEIS. Instead, DOE would now analyze its proposed land use plan by comparing that plan with alternative land use plans for Hanford. Governments and agencies that had demonstrated an interest in this process were invited to become cooperating agencies, to assist in the completion of the EIS.

The CTUIR views these changes as both logical and necessary. From its earliest beginnings in the Hanford Future Site Uses Working Group process, the obvious reason for the creation of this EIS has always been to enact a land use plan for Hanford. Yet the process DOE/RL adopted which lead to the August 1996 DEIS was singularly inappropriate for achieving this goal. Unlike the "remediation" theme, the need for and purpose of a land use plan is obvious, as is the proper application of the

TREATY JUNE 9, 1855 + CAYUSE, UMATILLA AND WALLA WALLA TRIBES

John Wagoner, Manager
May 14, 1997
Page - 2

2. The final EIS and ROD must identify:

   a. the preferred land use map(s);
   b. unresolved issues and impediments to realizing the land use plan; and
   c. implementing mechanisms and actions to be undertaken among cooperating agencies to resolve outstanding issues. Examples of outstanding issues at this time are water availability for non-DOE uses and the underlying ownership of Bureau of Land Management land in a checkerboard fashion across the state.

Grant County (the "County") pledges to support this effort in full faith by providing our expertise for the process as it relates to our land use alternatives to be included in the EIS. We will not commit resources to activities which are unilaterally DOE's responsibility, such as preparing information related to Hanford cleanup activities and federal legal requirements, document printing and distribution, reserving hearing locations, etc.

Thank you for your invitation to participate in the HRA Comprehensive Land Use Plan EIS as a cooperating agency. The County looks forward to a productive and meaningful effort, which can result in a product which meets the needs of DOE and cooperating agencies in the near and long-term, and formally defines our continued working relationship.

The County's "point-of-contact" for this cooperative effort will be Larry N. Angell, Planning Director. Mr. Angell can be contacted at (509) 754-2011, Ext. 493.

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

97-EAP-278

MAR 04 1997

The Honorable Leroy Allison
Chairman
Board of Grant County Commissioners
P.O. Box 37
Ephrata, Washington 98828

Dear Mr. Allison:

INVITATION TO PARTICIPATE AS A COOPERATING AGENCY IN DEVELOPMENT OF THE FINAL HANFORD REMEDIAL ACTION ENVIRONMENTAL IMPACT STATEMENT AND COMPREHENSIVE LAND USE PLAN

Thank you for your comments on the Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA-EIS). This letter serves as notice the Department of Energy, Richland Operations Office (RL) plans to develop the Final HRA-EIS. In order to respond to the comments received from Tribal governments, regulatory agencies and the public, RL is writing the Final HRA-EIS to emphasize land use planning. As we clarified at the December 1996 meeting, the EIS is not intended to make specific cleanup decisions that have already been made or will be made in the future under the Resources Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). This letter addresses specific agency requests for cooperating agency status to address land use planning and process issues.

RL is inviting you to participate as a "Cooperating Agency" under the National Environmental Policy Act (NEPA) in the development of the Final HRA-EIS, consistent with the Council on Environmental Quality's (CEQ) Regulations For Implementing the Procedural Provisions of NEPA, 40 CFR 1501.6. Consistent with the CEQ guidance, RL will use the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible, consistent with its responsibility as lead agency. RL is requesting that your organization develop information and prepare environmental analyses addressing those portions of the environmental impact statement in which you, as a cooperating agency, have special expertise and make available staff to support the development of the Final EIS. The addition of your specialized knowledge will be of great value to the land use planning process. RL looks forward to your cooperation, involvement and assistance in the planning of Hanford's future land uses.

RL is on a strict schedule (Attachment 1), established by Public Law 104-201, Section 3153, to meet a March 15, 1998, deadline for a 50-year future use plan. We are reorganizing material in the draft EIS and are not rescoping the HRA-EIS. DOE will focus on revisions to the existing Draft HRA-EIS such that the analyses and terminology in the Comprehensive Land Use Plan are the emphasis in the Final HRA-EIS.

05/22/97 13:14:37 1-509-372-2819->5093758196 Page 002

GRANT COUNTY
OFFICE OF
BOARD OF COUNTY COMMISSIONERS
POST OFFICE BOX 37
EPHRATA, WASHINGTON 98823
(509) 754-2011

RL COMMITMENT CONTROL
CONTROL NO. 971743.SE
ASSIGNED TO RP
DISTRIBUTION MGZ
AME
EHP
ESH
AMF
OCC
OEA
SID

May 14, 1997

John Wagoner, Manager
Richland Operations Office
U.S. Department of Energy
P.O. Box 550, A7-50
Richland, WA 99352

Re: Grant County Participants as a Cooperating Agency in development of Hanford Remedial Action Environmental Impact Statement (HRA-EIS) and Comprehensive Land Use Plan

Dear Mr. Wagoner:

The Board of Grant County Commissioners (the "County") accepts DOE-RL's invitation to participate as a "cooperating Agency" in the preparation of the HRA-EIA and comprehensive land use plan. The Board is pleased that DOE-RL has decided to redirect the HRA-EIS and land use plan to more directly support Hanford Comprehensive Land Use Planning and to broaden agency participation and involvement. A cooperative effort among the jurisdictions, sovereignties and agencies with land use interests on Hanford is the appropriate way to proceed.

The Board's objectives for this process are the following:

1. A final Environmental Impact Statement (EIS) and record of decision (ROD) which meets cooperating agencies' NEPA and state SEPA requirements, and provides the public the opportunity to review and comment on this fundamentally changed EIS land use plan. Because of these fundamental changes, we believe it will be necessary to issue an additional draft for public review and comment before the final EIS and ROD. It is important to obtain input from the cooperating agencies, stakeholders, and the Grant County region citizens on this issue.

TIM SNEAD
DISTRICT 1

HELEN FANCHER
DISTRICT 2
PHONE 787-4731

LEROY ALLISON
DISTRICT 3
WARDEN, WA 98857

John Wagoner, Manager
May 14, 1997
Page - 2

2. The final EIS and ROD must identify:

   a. the preferred land use map(s);
   b. unresolved issues and impediments to realizing the land use plan; and
   c. implementing mechanisms and actions to be undertaken among cooperating agencies to resolve outstanding issues. Examples of outstanding issues at this time are water availability for non-DOE uses and the underlying ownership of Bureau of Land Management land in a checkerboard fashion across the state.

Grant County (the "County") pledges to support this effort in full faith by providing our expertise for the process as it relates to our land use alternatives to be included in the EIS. We will not commit resources to activities which are unilaterally DOE's responsibility, such as preparing information related to Hanford cleanup activities and federal legal requirements, document printing and distribution, reserving hearing locations, etc.

Thank you for your invitation to participate in the HRA Comprehensive Land Use Plan EIS as a cooperating agency. The County looks forward to a productive and meaningful effort, which can result in a product which meets the needs of DOE and cooperating agencies in the near and long-term, and formally defines our continued working relationship.

The County's "point-of-contact" for this cooperative effort will be Larry N. Angell, Planning Director. Mr. Angell can be contacted at (509) 754-2011, Ext. 493.

John Wagoner, Manager
May 14, 1997
Page - 3

Thank you for your courtesies.

Very truly yours,

BOARD OF COUNTY COMMISSIONERS
GRANT COUNTY, WASHINGTON

LeRoy C. Allison, Chair

Helen Fancher, Member

Tim Snead, Member

LCA:bp
cc: Larry N. Angell, Planning Director
Benton County
Franklin County
BLM
CTUIR
DOE
USFW
WDFM
Trustees Council

HL [illegible] CONTROL
MAY 19 1997
RICHLAND
OPERATIONS OFFICE

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

MAR 04 1997

97-EAP-262

The Honorable Max Benitz
Chairman
Board of Benton County Commissioners
P.O. 190
Prosser, Washington 99350

Dear Mr. Benitz:

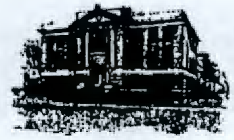
INVITATION TO PARTICIPATE AS A COOPERATING AGENCY IN DEVELOPMENT OF FINAL HANFORD REMEDIAL ACTION ENVIRONMENTAL IMPACT STATEMENT AND COMPREHENSIVE LAND USE PLAN

Thank you for your comments on the Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA-EIS). This letter serves as notice the Department of Energy, Richland Operations Office (RL) plans to develop the Final HRA-EIS. In order to respond to the comments received from Tribal governments, regulatory agencies and the public, RL is writing the Final HRA-EIS to emphasize land use planning. As we clarified at the December 1996 meeting, the EIS is not intended to make specific cleanup decisions that have already been made or will be made in the future under the Resources Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). This letter addresses specific agency requests for cooperating agency status to address land use planning and process issues.

RL is inviting you to participate as a "Cooperating Agency" under the National Environmental Policy Act (NEPA) in the development of the Final HRA-EIS, consistent with the Council on Environmental Quality's (CEQ) Regulations For Implementing the Procedural Provisions of NEPA, 40 CFR 1501.6. Consistent with the CEQ guidance, RL will use the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible, consistent with its responsibility as lead agency. RL is requesting that your organization develop information and prepare environmental analyses addressing those portions of the environmental impact statement in which you, as a cooperating agency, have special expertise and make available staff to support the development of the Final EIS. The addition of your specialized knowledge will be of great value to the land use planning process and will be incorporated into the final EIS. RL looks forward to your cooperation, involvement and assistance in the planning of Hanford's future land uses.

RL is on a strict schedule (Attachment 1), established by Public Law 104-201, Section 3153, to meet a March 15, 1998, deadline for a 50-year future use plan. We are reorganizing material in the draft EIS and are not rescoping the HRA-EIS. DOE will focus on revisions to the existing Draft HRA-EIS such that the analyses and terminology in the Comprehensive Land Use Plan are the emphasis in the Final HRA-EIS.

04/02/97 14:20



Board of County Commissioners
BENTON COUNTY
P.O. Box 190 · Prosser, WA 99350-0190
Phone (509) 786-5600 or (509) 736-3080
Fax (509) 786-5625

Leo Bowman
DISTRICT 1
Max Benitz, Jr.
DISTRICT 2
Claude L. Oliver
DISTRICT 3

RL CORRESPONDENCE CONTROL
CONTROL NO. 9717I5.9F
ASSIGNED TO EAP
DISTRIBUTION MGR
ESH
AME
AMF
OCC
OEA
RP
SID

March 28, 1997

John Wagoner, Manager
U. S. Department of Energy
Richland Operations Office
P O Box 550, A7-50
Richland, WA 99352

RE: Invitation to Participate as Cooperating Agency in Development of Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan

Dear Mr. Wagoner:

The Board of Benton County Commissioners accepts DOE-RL's invitation to participate as a "cooperating agency" in the preparation of the HRA-EIS and comprehensive land use plan. The Board is pleased that DOE-RL has decided to redirect the HRA-EIS and land use plan to more directly support Hanford Comprehensive Land Use Planning, and to broaden agency participation and involvement. A cooperative effort among the jurisdictions, sovereignties and agencies with land use interests on Hanford is the appropriate way to proceed.

The Board's objectives for this process are the following:

(1) A final EIS and record of decision (ROD) which meets cooperating agencies' NEPA and state SEPA requirements, and provides the public opportunity to review and comment on this fundamentally changed EIS land use plan. Because of these fundamental changes, we believe it will be necessary to issue an additional draft for public review and comment before the final EIS and ROD. It is important to obtain input from the cooperating agencies, stakeholders, and the Tri-Cities region citizens on this.

(2) The final EIS and ROD must identify: a) the preferred land use map(s); b) unresolved issues and impediments to realizing the land use plan; c) implementing mechanisms and actions to be undertaken among cooperating agencies to resolve outstanding issues. Examples of outstanding issues at this time are water availability for non-DOE uses and the underlying ownership of Bureau of Land Management land in a checkerboard fashion across the site.

The county pledges to support this effort in full faith by providing our expertise for the process as it relates to our land use alternatives to be included in the EIS. We will not commit resources to activities which are unilaterally DOE's responsibility, such as preparing information related to Hanford cleanup activities and federal legal requirements, document printing and distribution, reserving hearing locations, etc.

Again, thank you for the invitation to participate in the HRA Comprehensive Land Use Plan EIS as a cooperating agency. The County looks forward to a productive and meaningful effort, which can result in a product which meet the needs of DOE and cooperating agencies in the near and long-term, and formally defines our continued working relationship.

The Benton County point-of-contact for this cooperative effort will be Phil Mees, Senior Planner-Long Range. Mr. Mees can be reached at (509) 736-3086.

Sincerely,

MAX E. BENITZ, Jr., Chairman
BOARD OF COUNTY COMMISSIONERS

cc: BLM
USFW
CTUIR
Nez Perce
Yakama
Ecology
WDFW
Trustees Council
City of Richland
Grant County
Franklin County

RL COMMITMENT CONTROL

MAR 31 1997

RICHLAND OPERATIONS OFFICE

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

MAR 04 1997

97-EAP-283

Mr. Carroll Palmer
Yakama Indian Nation
P.O. Box 151
Toppenish, WA 98948

Dear Mr. Palmer:

INVITATION TO PARTICIPATE IN DEVELOPMENT OF THE FINAL HANFORD REMEDIAL ACTION ENVIRONMENTAL IMPACT STATEMENT AND COMPREHENSIVE LAND USE PLAN

Thank you for your comments on the Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA-EIS). This letter serves as notice the Department of Energy, Richland Operations Office (RL) plans to develop the Final HRA-EIS. In order to respond to the comments received from Tribal governments, regulatory agencies and the public, the Department of Energy, Richland Operations Office (RL) is writing the Final HRA-EIS to emphasize land use planning. As we clarified at the December public 1996 meeting the EIS is not intended to make specific cleanup decisions that have already been made or will be made in the future under the Resources Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

RL is inviting you to participate in the development of the Final HRA-EIS, consistent with the Council on Environmental Quality's (CEQ) Regulations For Implementing the Procedural Provisions of NEPA, 40 CFR 1501.6. Consistent with the CEQ guidance, RL will use the environmental analysis and proposals of tribal governments and cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible, consistent with its responsibility as lead agency. RL is requesting that the Yakama Indian Nation provide information and analysis for those portions of the environmental impact statement which you have special expertise, to support the development of the Final EIS. The addition of your specialized knowledge will be of great value to the land use planning process and your comments will be incorporated into the final EIS. RL looks forward to your cooperation, involvement and assistance in the planning of Hanford's future land uses.

RL is on a strict schedule (Attached), established by Public Law 104-201, Section 3153, to meet a March 15, 1998, deadline for a 50-year future use plan. We are reorganizing material in the draft EIS and are not rescoping the HRA-EIS. RL will focus on revisions to the existing Draft HRA-EIS such that the analyses and terminology in the Comprehensive Land Use Plan are the emphasis in the Final HRA-EIS.

Confederated Tribes and Bands
of the Yakama Indian Nation

Established by the
Treaty of June 9, 1855

March 13, 1997

RL COMMITMENT CONTROL
CONTROL NO. 9717[illegible]
ASSIGNED TO: EAP
DISTRIBUTION:
MGR
ESH
AME
AMF
AMW
MET
OCC
OEA
FRG
RF
RPS
SAS
SID
PAD

Mr. John D. Wagoner, Manager
Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

Dear Mr. Wagoner:

This letter is in response to your invitation to the Yakama Nation to participate in the development of the Final Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA EIS). We appreciate your offer to participate as a cooperating agency. We believe that the Yakama Nation has both jurisdiction by law and special expertise that would be of valuable assistance in preparation of a comprehensive land use plan for the Hanford Site. However, we have serious concerns over the direction that DOE has chosen to proceed with the EIS, as well as the timing of this invitation to serve as a cooperating agency.

During the comment period for the Draft EIS, the Yakama Nation submitted written comments identifying what we judged to be significant procedural flaws in the document. Based upon our understanding of the Council on Environmental Quality's (CEQ) Regulations For Implementing the Procedural Provisions of NEPA, deficiencies in scope, alternative analysis and cumulative impacts discussions necessitate the preparation and circulation of a revised Draft EIS. We believe that decisions made regarding the current direction of the EIS process only serve to weaken an already tenuous legal position should this EIS be challenged on procedural grounds. [illegible] urge that DOE reconsider the decision to proceed directly to a Final EIS.

CEQ regulations regarding cooperating agencies, as cited in your letter, require the lead agency to request the participation of each cooperating agency at the earliest time possible in the NEPA process. The lead agency shall allocate assignments among the lead and cooperating agencies during the scoping period. CEQ guidance (Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations) indicates that the majority of cooperating agency participation should occur during the scoping process and the preparation of the Draft EIS. Inviting the Yakama Nation to participate as a cooperating agency at this late stage of the process is clearly not consistent with the intent of CEQ regulations and guidance.

Despite these concerns, we can certainly see the value in developing a comprehensive land use plan which will support DOE's mission at the Hanford Site by guiding land and facility use decisions and protecting the valuable cultural and natural resources at the site. We are willing to participate along with DOE and other stakeholders in the development of such a plan. However, we request that you clarify certain relevant points before we make any commitments in response to your invitation.

(1) *Statement of Underlying Need*

The Draft EIS indicates that DOE is addressing a need to establish "future land-use objectives" which will drive the remediation process. Since this is no longer DOE's direction, we are requesting a clear statement regarding what needs will now be addressed by the HRA EIS and Comprehensive Land Use Plan. Without a clear statement of the underlying need of the proposal, there is not sufficient information to suggest alternatives which meet that need, nor to assess which of a range of alternatives best addresses that need.

(2) *Rationale for Not Preparing a Revised Draft EIS*

As expressed in our December 10, 1996 comments on the Draft EIS, and reiterated above, we believe that significant inadequacies in the Draft EIS must be corrected through preparation and circulation of a revised Draft. We now understand that we will see at least four alternatives in the Final EIS, none of which were analyzed in the Draft. We are requesting a short statement from DOE-RL indicating how the decision to proceed directly to a Final EIS is consistent with the objectives and procedures of NEPA. As you can imagine, we are hesitant to devote more time and resources to a process that we see as so procedurally flawed as to openly invite legal challenge from any party not satisfied with the outcome.

(3) *Role of Cooperating Agencies*

Because cooperating agencies are expected to be involved primarily in the scoping process and in the preparation of the Draft EIS, we are unclear as to what DOE expects of cooperating agencies at this late stage of the process. The CEQ regulations state that the lead agency shall allocate assignments for preparation of the EIS among the lead and cooperating agencies. We are requesting a statement from DOE-RL regarding what our responsibilities would be as a cooperating agency, and how we are expected to coordinate with DOE as well as with other cooperating agencies.

Again, we thank you for this invitation to participate in the development of the HRA EIS. We believe because of our jurisdiction by law and special expertise that it is important for the Yakama Nation to be involved in land use planning efforts at the Hanford Site. We await your response to the information requested above so we may make an informed decision regarding our level of participation in this process. Until that time our staff will continue to be involved in ongoing efforts supporting land use planning at Hanford.

Sincerely,

Carroll Palmer, Deputy Director
Yakama Nation, Division of Natural Resources

Concur: Cecil Sanchey
Cecil Sanchey, Chairman
Radioactive/Hazardous Waste Committee

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

MAR 04 1997

97-EAP-276

The Honorable Frank Brock
Chairman
Board of Franklin County Commissioners
1016 N. 4th
Pasco, Washington 99302

Dear Mr. Brock:

INVITATION TO PARTICIPATE AS A COOPERATING AGENCY IN DEVELOPMENT OF THE FINAL HANFORD REMEDIAL ACTION ENVIRONMENTAL IMPACT STATEMENT AND COMPREHENSIVE LAND USE PLAN

Thank you for your comments on the Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA-EIS). This letter serves as notice the Department of Energy, Richland Operations Office (RL) plans to develop the Final HRA-EIS. In order to respond to the comments received from Tribal governments, regulatory agencies and the public, RL is writing the Final HRA-EIS to emphasize land use planning. As we clarified at the December 1996 meeting, the EIS is not intended to make specific cleanup decisions that have already been made or will be made in the future under the Resources Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). This letter addresses specific agency requests for cooperating agency status to address land use planning and process issues.

RL is inviting you to participate as a "Cooperating Agency" under the National Environmental Policy Act (NEPA) in the development of the Final HRA-EIS, consistent with the Council on Environmental Quality's (CEQ) Regulations For Implementing the Procedural Provisions of NEPA, 40 CFR 1501.6. Consistent with the CEQ guidance, RL will use the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible, consistent with its responsibility as lead agency. RL is requesting that your organization develop information and prepare environmental analyses addressing those portions of the environmental impact statement in which you, as a cooperating agency, have special expertise and make available staff to support the development of the Final EIS. The addition of your specialized knowledge will be of great value to the land use planning process and will be incorporated into the final EIS. RL looks forward to your cooperation, involvement and assistance in the planning of Hanford's future land uses.

RL is on a strict schedule (Attachment 1), established by Public Law 104-201, Section 3153, to meet a March 15, 1998, deadline for a 50-year future use plan. We are reorganizing material in the draft EIS and are not rescoping the HRA-EIS. DOE will focus on revisions to the existing Draft HRA-EIS such that the analyses and terminology in the Comprehensive Land Use Plan are the emphasis in the Final HRA-EIS.

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

MAR 0 4 1997

97-EAP-277

The Honorable Larry Haler
Mayor of the City of Richland
505 Swift Boulvard
Richland, Washington 99352

Dear Mayor Haler:

INVITATION TO PARTICIPATE AS A COOPERATING AGENCY IN DEVELOPMENT OF THE FINAL HANFORD REMEDIAL ACTION ENVIRONMENTAL IMPACT STATEMENT AND COMPREHENSIVE LAND USE PLAN

Thank you for your comments on the Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA-EIS). This letter serves as notice the Department of Energy, Richland Operations Office (RL) plans to develop the Final HRA-EIS. In order to respond to the comments received from Tribal governments, regulatory agencies and the public, RL is writing the Final HRA-EIS to emphasize land use planning. As we clarified at the December 1996 meeting, the EIS is not intended to make specific cleanup decisions that have already been made or will be made in the future under the Resources Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). This letter addresses specific agency requests for cooperating agency status to address land use planning and process issues.

RL is inviting you to participate as a "Cooperating Agency" under the National Environmental Policy Act (NEPA) in the development of the Final HRA-EIS, consistent with the Council on Environmental Quality's (CEQ) Regulations For Implementing the Procedural Provisions of NEPA, 40 CFR 1501.6. Consistent with the CEQ guidance, RL will use the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible, consistent with its responsibility as lead agency. RL is requesting that your organization develop information and prepare environmental analyses addressing those portions of the environmental impact statement in which you, as a cooperating agency, have special expertise and make available staff to support the development of the Final EIS. The addition of your specialized knowledge will be of great value to the land use planning process and will be incorporated into the final EIS. RL looks forward to your cooperation, involvement and assistance in the planning of Hanford's future land uses.

RL is on a strict schedule (Attachment 1), established by Public Law 104-201, Section 3153, to meet a March 15, 1998, deadline for a 50-year future use plan. We are reorganizing material in the draft EIS and are not rescoping the HRA-EIS. DOE will focus on revisions to the existing Draft HRA-EIS such that the analyses and terminology in the Comprehensive Land Use Plan are the emphasis in the Final HRA-EIS.

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352
MAR 0 4 1997

97-EAP-282

Ms. Lenora Seelatsee
Wanapum
Grant County PUD
P.O. Box 878
Ephrata, WA 98823

Dear Ms. Seelatsee:

INVITATION TO PARTICIPATE IN DEVELOPMENT OF THE FINAL HANFORD REMEDIAL ACTION ENVIRONMENTAL IMPACT STATEMENT AND COMPREHENSIVE LAND USE PLAN

Thank you for your comments on the Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA-EIS). This letter serves as notice the Department of Energy, Richland Operations Office (RL) plans to develop the Final HRA-EIS. In order to respond to the comments received from Tribal governments, regulatory agencies and the public, the Department of Energy, Richland Operations Office (RL) is writing the Final HRA-EIS to emphasize land use planning. As we clarified at the December public 1996 meeting the EIS is not intended to make specific cleanup decisions that have already been made or will be made in the future under the Resources Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

RL is inviting you to participate in the development of the Final HRA-EIS, consistent with the Council on Environmental Quality's (CEQ) Regulations For Implementing the Procedural Provisions of NEPA, 40 CFR 1501.6. Consistent with the CEQ guidance, RL will use the environmental analysis and proposals of tribal governments and cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible, consistent with its responsibility as lead agency. RL is requesting that the Wanapum provide information and analysis for those portions of the environmental impact statement in which you have special expertise, to support the development of the Final EIS. The addition of your specialized knowledge will be of great value to the land use planning process and your comments will be incorporated into the final EIS. RL looks forward to your cooperation, involvement and assistance in the planning of Hanford's future land uses.

RL is on a strict schedule (Attached), established by Public Law 104-201, Section 3153, to meet a March 15, 1998, deadline for a 50-year future use plan. We are reorganizing material in the draft EIS and are not rescoping the HRA-EIS. RL will focus on revisions to the existing Draft HRA-EIS such that the analyses and terminology in the Comprehensive Land Use Plan are the emphasis in the Final HRA-EIS.

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352
MAR 0 4 1997

97-EAP-264

Mr. Preston Sleeger
U.S. Department of Interior
Office of Environmental Policy and Guidance
500 NE Multnomah Street, Suite 600
Portland, Oregon 97232-2036

Dear Mr. Sleeger:

INVITATION TO PARTICIPATE AS A COOPERATING AGENCY IN DEVELOPMENT OF FINAL HANFORD REMEDIAL ACTION ENVIRONMENTAL IMPACT STATEMENT AND COMPREHENSIVE LAND USE PLAN

Thank you for your comments on the Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA-EIS). This letter serves as notice the Department of Energy, Richland Operations Office (RL) plans to develop the Final HRA-EIS. In order to respond to the comments received from Tribal governments, regulatory agencies and the public, RL is writing the Final HRA-EIS to emphasize land use planning. As we clarified at the December 1996 meeting, the EIS is not intended to make specific cleanup decisions that have already been made or will be made in the future under the Resources Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). This letter addresses specific agency requests for cooperating agency status to address land use planning and process issues.

RL is inviting you to participate as a "Cooperating Agency" under the National Environmental Policy Act (NEPA) in the development of the Final HRA-EIS, consistent with the Council on Environmental Quality's (CEQ) Regulations For Implementing the Procedural Provisions of NEPA, 40 CFR 1501.6. Consistent with the CEQ guidance, RL will use the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible, consistent with its responsibility as lead agency. RL is requesting that your organization develop information and prepare environmental analyses addressing those portions of the environmental impact statement in which you, as a cooperating agency, have special expertise and make available staff to support the development of the Final EIS. The addition of your specialized knowledge will be of great value to the land use planning process and will be incorporated into the final EIS. RL looks forward to your cooperation, involvement and assistance in the planning of Hanford's future land uses.

RL is on a strict schedule (Attachment 1), established by Public Law 104-201, Section 3153, to meet a March 15, 1998, deadline for a 50-year future use plan. We are reorganizing material in the draft EIS and are not rescoping the HRA-EIS. DOE will focus on revisions to the existing Draft HRA-EIS such that the analyses and terminology in the Comprehensive Land Use Plan are the emphasis in the Final HRA-EIS.

U.S. Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

052597

OCT 27 1997

Mr. Thomas J. Dwyer
Acting Regional Director
U.S. Department of the Interior
Fish and Wildlife Service
911 N.E. 11th Avenue
Portland, Oregon 97232-4181

Dear Mr. Dwyer:

REQUEST FOR STATUS AS A COOPERATING AGENCY IN THE PREPARATION OF THE DRAFT HANFORD REMEDIAL ACTION ENVIRONMENTAL IMPACT STATEMENT AND COMPREHENSIVE LAND USE PLAN (HRA EIS CLUP)

In response to the ARW-RE letter to Mr. John Wagoner from you, same subject as above, dated September 17, 1997, this letter is to confirm the verbal invitation to participate as a Cooperating Agency that has been extended to the U.S. Department of the Interior (DOI), Fish and Wildlife Service (F&WS), representative Mr. Dave Goeke of the Saddle Mountain National Wildlife Refuge.

Other DOI offices have expressed an interest in being Cooperating Agencies on this HRA EIS CLUP. DOI's Spokane District Office of the Bureau of Land Management (BLM) heightened the U.S. Department of Energy's (DOE) awareness in a DOI letter to Mr. John Wagoner from Ms. Ann B. Aldrich, same subject as above, dated February 3, 1997. BLM's request for status as a Cooperating Agency led to DOE inviting DOI to participate as a Cooperating Agency (DOE letter to Mr. Preston Sleeger, DOI Portland, Oregon Office of Environmental Policy and Guidance from Mr. John D. Wagoner "Invitation to Participate as a Cooperating Agency in Development of Final Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan," dated March 4, 1997). In-turn, the Cooperating Agencies advised DOE to start anew with a revised Draft HRA EIS CLUP, on which DOE is currently working.

Although the time isn't available for F&WS to develop it's own alternative for the HRA EIS CLUP, there are six independently developed alternatives to comment on. DOE has taken Mr. William F. Shake's concerns on the potential for mining and grazing on the Fitzner Eberhardt Arid Lands Ecology Reserve (ALE) into account in the development of DOE's preferred alternative (DOE letter to Mr. William F. Shake from Mr. James E. Rasmussen "Potential for Mining and Grazing [Conservation Designation]," dated October 8, 1997). DOE understands the F&WS's desire to participate and believes that F&WS participation in this National Environmental Policy Act (NEPA) process will assist in the F&WS's development of a management plan for the ALE. DOE appreciates DOI's staff-time support and intends to seek the F&WS's advice throughout the HRA EIS CLUP NEPA decision process

Mr. Thomas J. Dwyer -2- 052597 OCT 27 1997

If you want to discuss this matter further or require additional information, please contact me at (509) 372-0649.

Sincerely,

Thomas Ferns

Thomas W. Ferns, NEPA Document Manager
Hanford Remedial Action Environmental
Impact Statement

RAP:TWF

RL COMMITMENT CONTROL
CONTROL NO: 10 971804.9B3
ASSIGNED TO: EAF
DISTRIBUTION: MGK ESH AME OCC OEA RP AMF SID

United States Department of the Interior

FISH AND WILDLIFE SERVICE
911 NE. 11th Avenue
Portland, Oregon 97232-4181

IN REPLY REFER TO: ARW-RE

SEP 17 1997

Mr. John Wagoner, Manager
Department of Energy
Richland Operations Office
P.O. Box 550, StopA7-50
Richland, Washington 99352

Dear Mr. Wagoner:

The U.S. Fish and Wildlife Service (Service) requests status as a Cooperating Agency in preparation of the draft Hanford Site Comprehensive Land Use Plan (CLUP) and Environmental Impact Statement (EIS). The Service does not expect to attend every meeting or comment on all aspects of the document, but would like to focus expertise, text and review on topics that involve the trust resources we are managing, or may be asked to manage in the near future. As a cooperator, the Service would provide the following:

- Preparation of text describing the Service's mission, role and constraints of managing land under the National Wildlife Refuge System.
- Review of land uses proposed for the Arid Land Ecology Reserve (ALE), McGee Ranch, North Slope, and the Columbia River corridor.
- Review of the draft CLUP for compatibility of land uses with typical habitat management actions conducted on the National Wildlife Refuge System on the ALE, McGee Ranch, North Slope, and the Columbia River corridor.

The Department of Energy's (DOE) benefits from Service cooperator status include:

- A CLUP that is coordinated and consistent with the mission of the National Wildlife Refuge System for areas under Service management, or potential future management (ALE, McGee Ranch, North Slope, and the Columbia River corridor).
- Service provision of expertise on refuge matters without requiring the EIS team to research the topic.
- Savings of tax dollars since the Service could tier refuge planning documents from the CLUP EIS and record of decision. Without cooperator status, the Service faces preparation of another EIS for refuge comprehensive management planning that would extensively duplicate the material in this EIS.

Mr. John Wagoner 2

- A CLUP that meets existing public expectation that wildlife habitat on the ALE and North Slope will be protected and/or managed by the Service, and that the Service has contributed to the CLUP for these areas. Public expectations are based on the Hanford Reach EIS and ROD, and the recently announced ALE management agreement.

We look forward to assisting you with the draft CLUP and EIS: Please contact Dave Goeke, Project Leader, at (509) 488-2668 if you need additional information.

Sincerely,

Thomas J. Dwyer
ACTING Regional Director

RL COMMITMENT CONTROL
SEP 22 1997
RICHLAND OPERATIONS OFFICE

This page intentionally left blank.

Appendix C --Floodplain/Wetlands Assessment

C.1 Introduction C-1
C.1.1 Floodplains Potentially Affected C-1
C.1.2 Wetlands Potentially Affected C-2

C.2 Potential Impacts on Floodplains and Wetlands C-4
C.2.1 No-Action Alternative C-8
C.2.2 Preferred Alternative C-8
C.2.3 Alternative One C-9
C.2.4 Alternative Two C-10
C.2.5 Alternative Three C-11
C.2.6 Alternative Four C-12

Figures

C-1. 100-Year Floodplain of the Columbia and Yakima Rivers C-5
C-2. Extent of the Probable Maximum Flood in the Cold Creek Area C-6
C-3. Wetlands and Deep Water Habitats of the Hanford Site C-7

This page intentionally left blank.

Appendix C -- Floodplain/Wetlands Assessment

Floodplains and wetlands on the Hanford Site (including portions of the Columbia River, Yakima River, and Cold Creek floodplains; associated wetlands; and other wetlands and deep water habitats on the Hanford Site) could be affected under each of the land-use alternatives that are identified in this Revised Draft HRA-EIS. The magnitude of these effects depends, in part, on the land-use designations associated with the floodplains and wetlands under each alternative. Floodplains and wetlands are protected from any adverse Federal actions by several laws, regulations, and orders. This Floodplain/Wetlands Assessment identifies the floodplains and wetlands potentially affected by future land-use designations under each alternative. This appendix also provides a brief discussion of floodplain and wetland natural functions and values, as well as the steps to minimize impacts on floodplains and wetlands. The alternatives identified in this assessment are described in detail in Chapter 3.

C.1 Introduction

Under Executive Order 11988, *Floodplain Management*, and Executive Order 11990, *Protection of Wetlands*, Federal agencies are required to consider the impact of proposed actions on wetlands and floodplains. The U.S. Department of Energy (DOE) requirements for compliance with Executive Orders 11988 and 11990 are found in Title 10, *Code of Federal Regulations* (CFR), Part 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements." A Floodplain/Wetlands Assessment consists of a description of the proposed action, a discussion of its effects on the floodplain and wetlands, and consideration of the alternatives. The Executive Orders are intended to be used by Federal agencies to implement floodplain and wetland requirements through existing procedures, such as those established to implement the *National Environmental Policy Act of 1969* (NEPA).

If DOE determines that there is no alternative to implementing a proposed project in a floodplain or wetland, a brief statement of findings must be prepared. This statement of findings would include a description of the proposed action, an explanation indicating why the project must be located in a floodplain or wetland, a list of alternatives considered, measures that will be taken to comply with state and local floodplain protection standards, and a description of the steps to be taken to minimize adverse impacts to the floodplain or wetland.

C.1.1 Floodplains Potentially Affected

A floodplain is defined as ". . . lowlands adjoining inland and coastal waters and relatively flat areas and flood-prone areas of offshore islands including, at a minimum, that area inundated by a 1 percent or greater chance flood in any given year. The base floodplain is defined as the 100-year (1.0 percent) floodplain. The critical floodplain is defined as the 500-year (0.2 percent) floodplain. . ." (10 CFR 1022).

When maintained in a natural state, floodplains provide valuable services by moderating the extent of flooding, thereby (1) reducing the risk of downstream flood loss; (2) minimizing the impacts of floods on human safety, health, and welfare; and (3) providing support to wetlands, fish, and wildlife.

For the purposes of this assessment, the extent of the 100-year floodplains for the Columbia River, Yakima River, and Cold Creek was derived from a number of sources (Neitzel et al. 1997; USACE 1970; Skaggs and Walters 1981; and DOE 1987). The water flow of both the Yakima and Columbia Rivers is regulated by dams located upstream of the Hanford Site.

This flow regulation serves to significantly dampen the 100-year floods. For example, on the Hanford Site, the dam-regulated, 100-year flood for the Columbia River only extends beyond the existing riverbed in certain isolated and shallow zones. A 100-year flood would inundate marshy areas located upstream of the 100-B Reactor and a portion of the low-lying horn of land located downstream of the 100-D Reactor, but is not expected to completely inundate the islands in the Columbia River. Of the 1,142 ha (2,821 ac) of land area associated with these islands, 744 ha (1,838 ac) would be inundated by a 100-year flood.

Although the 100-year floodplain of the ephemeral Cold Creek has not been mapped, it is possible to draw preliminary conclusions from a 1981 Flood Risk Analysis (Skaggs and Walters 1981) to determine the historical extent of the watershed. In this analysis, at least two distinct segments were described: (1) an upper reach extending from the headwaters to just south of the 200 West Area, and (2) a lower reach extending from near the confluence with Dry Creek, which is located on the Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve), to Horn Rapids on the Yakima River. As the upper reach of Cold Creek enters the Hanford Site, gradients diminish significantly. As a result, the channel becomes braided and interconnected. The floodplain essentially follows State Highway 240 through the Hanford Site. Conservative values for precipitation events and magnitudes of infiltration, surface roughness, and topographic parameters were used for the preliminary estimates of probable maximum flooding conditions for the Cold Creek watershed. Based on the estimate and location of the probable maximum flood, it is possible to estimate the potential impact of Hanford Site remedial actions on the much smaller 100-year floodplain of Cold Creek. The 100-year floodplain of Cold Creek probably would not include land within the boundary of the Central Plateau geographic area.

C.1.2 Wetlands Potentially Affected

The *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (EPA et al. 1989) defines wetlands by the presence of hydric soils, hydrophytic vegetation, and wetlands hydrology. Hydric soils are soils with the seasonal high-water table within 2.5 cm (1 in.) of the surface of the ground for at least 1 week of the growing season. As a result, hydric soils typically experience an oxygen depletion. Hydrophytic vegetation may grow in soils at least periodically depleted of oxygen as a result of water saturation. Hydrophytic vegetation might be able to grow only in wetlands (obligate wetlands vegetation) or may be found in upland environments as well (facultative wetlands vegetation). Wetlands hydrology requires permanent or temporary inundation of soils for at least one week during the growing season and the resultant depletion of oxygen. All three conditions must be met for a site to be defined as a wetland.

Wetlands serve a variety of functions within the ecosystem. Consideration of these wetland functions is essential in the evaluation of potential impacts. Wetland functions and values include the following:

- <u>Water Quality Preservation</u>. Wetlands help maintain and improve the water quality of rivers, lakes, and estuaries. Because wetlands are located between uplands and water resources, many wetlands can intercept runoff from the land before it reaches open water. As runoff and surface water pass through, wetlands remove or transform pollutants through physical, chemical, and biological processes.

- **Flood Protection**. Wetlands help protect adjacent and downstream properties from potential flood damage by receiving and temporarily storing water during periods of high runoff or high flows in adjacent streams. Wetlands within and upstream of urban areas are particularly valuable for flood protection because the impervious surface in urban areas greatly increases the rate and volume of runoff, thereby increasing the risk of flood damage.

- **Erosion Control**. By virtue of their place in the landscape, riparian wetlands, salt marshes, and marshes located at the margin of lakes and rivers protect shorelines and streambanks against erosion. Wetland plants hold the soil in place with their roots, absorb wave energy, and reduce the velocity of stream or river currents.

- **Biological Productivity**. Wetlands are among the most productive ecosystems in the world. The unstable nature of many wetlands produces a great diversity of niches that, in turn, support a great diversity of plant and animal species. Numerous species of microbes, plants, insects, amphibians, reptiles, birds, fish, and other wildlife depend in some way on wetlands for at least part of their life cycles. Wetlands with seasonal hydrologic pulsing are the most productive. Wetland plants play an integral role in the ecology of the watershed by providing breeding and nursery sites, resting areas for migratory species, and refuge from predators.

- **Fish and Wildlife Habitat**. Diverse species of plants, insects, amphibians, reptiles, birds, fish, and mammals depend on wetlands for food, habitat, or temporary shelter. Many bird species use wetlands as a source of food, water, nesting material, or shelter. Migratory waterbirds rely on wetlands for staging areas, resting, feeding, breeding, or nesting grounds.

- **Cultural Value**. Wetlands have archaeological, historical, and cultural values. Societies traditionally have formed along bodies of water, and artifacts found in wetlands provide information about these societies.

- **Aesthetic Value**. Historically, painters and writers have used wetlands as their subject matter. Today, such artists are often joined by others with cameras, camcorders, and binoculars.

- **Economic Value**. More than half of all adults in the United States hunt, fish, birdwatch, or photograph wildlife, spending a total of $59.5 billion annually (OTA 1993). Waterfowl hunters alone spend more than $600 million annually to harvest wetland-dependent birds (OTA 1993).

- **Scientific Value**. Scientists value the processes of wetlands individually, particularly the role of wetlands in the global cycles of carbon, nitrogen, and water. Many scientists consider the removal of carbon dioxide from the atmosphere the most valuable function of wetlands (OTA 1993). Carbon sequestration is thought to be an important process in reducing the greenhouse effect and the threat of global warming.

Wetlands regulated under the *Clean Water Act of 1977* generally include swamps, marshes, bogs, and similar areas. The Hanford Site has a number of cribs, trenches, and cooling water ponds, a few of which support diverse wetland communities. Because these features serve waste water treatment or cooling water functions, they are not regulated as wetlands under the *Clean Water Act of 1977* and are not addressed in the scope of this assessment.

Wetlands on the Hanford Site have been identified from several sources, including the *National Wetlands Inventory* maps (USFWS 1976), *Priority Habitats & Species and Natural Heritage Data (Maps)* (WDFW 1993), and *Habitat Types on the Hanford Site: Wildlife and Plant Species of Concern* (Downs et al. 1993). Wetlands on the Hanford Site have not been formally delineated, but most Hanford Site wetlands are found in poorly developed riparian zones along the Columbia River and in association with irrigation runoff in the Wahluke Slope geographic area. Because of strong currents, rocky substrate, and often widely fluctuating water levels, the Columbia River supports a poorly developed riparian vegetation community. Other wetlands present on the Hanford Site include several springs and ephemeral seeps on the ALE Reserve geographic area.

Columbia yellowcress, which is a State of Washington endangered species, occurs in wetlands along the Hanford Reach of the Columbia River. Pacific Northwest National Laboratory biologists recently found 18 separate groups of Columbia yellowcress along the shoreline of the 300 Area (WHC 1993). This species is usually found near the water line and is often submerged during periods of high water.

C.2 Potential Impacts on Floodplains and Wetlands

The following discussion of the proposed action evaluates potential impacts to wetlands and floodplains on the Hanford Site that could be associated with land-use designations under each alternative. The discussion is organized by geographic areas as defined for the Hanford Site in the *Final Report of the Hanford Future Site Uses Working Group* (FSUWG 1992) (except that the Columbia River and Reactors on the River geographic areas defined in the final report have been combined as the Columbia River Corridor geographic area), and is followed by a summary of impacts for each alternative. This organization takes advantage of similarities in land-use designations across alternatives for some geographic areas.

The Columbia River and Yakima River floodplains occur on the Hanford Site (Figure C-1). The floodplain associated with the Columbia River occurs along the entire length of the Hanford Reach and includes many of the islands in the river. A small portion of the Yakima River floodplain intersects the southern edge of the Hanford Site where State Highway 240 crosses onto the Site. A probable maximum floodplain associated with Cold Creek and a tributary, Dry Creek, has also been identified (Figure C-2). These creeks are ephemeral streams within the Yakima River drainage system that drain areas to the west of the Hanford Site and cross the southern portion of the Hanford Site toward the Yakima River. Surface flow, when it occurs in Cold Creek and Dry Creek, infiltrates rapidly and disappears into the surface sediments in the western portion of the Hanford Site. The natural and beneficial functions of the floodplains could be adversely affected by activities that might occur within the floodplains of Cold Creek, the Columbia River, or the Yakima River under certain land-use designations.

Wetlands on the Hanford Site are associated with the Columbia River, irrigation runoff, and irrigation water waste ways from the Wahluke Slope; and riparian zones associated with spring-fed streams on the ALE Reserve (Figure C-3). Many of the beneficial wetland functions could be adversely affected by activities that might occur under certain land-use designations.

Figure C-1. 100-Year Floodplain of the Columbia and Yakima Rivers.

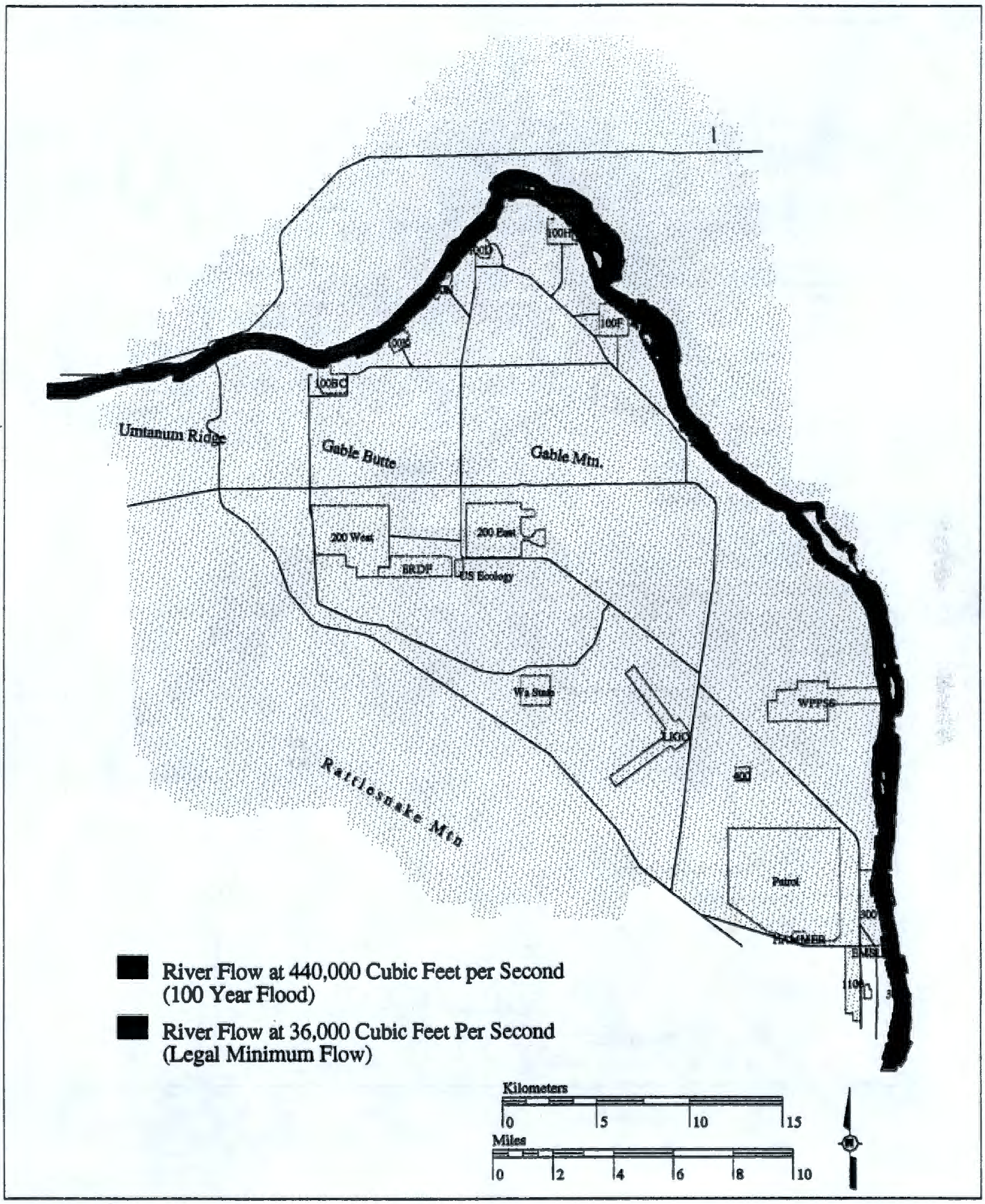


Figure C-2. Extent of the Probable Maximum Flood in the Cold Creek Area.

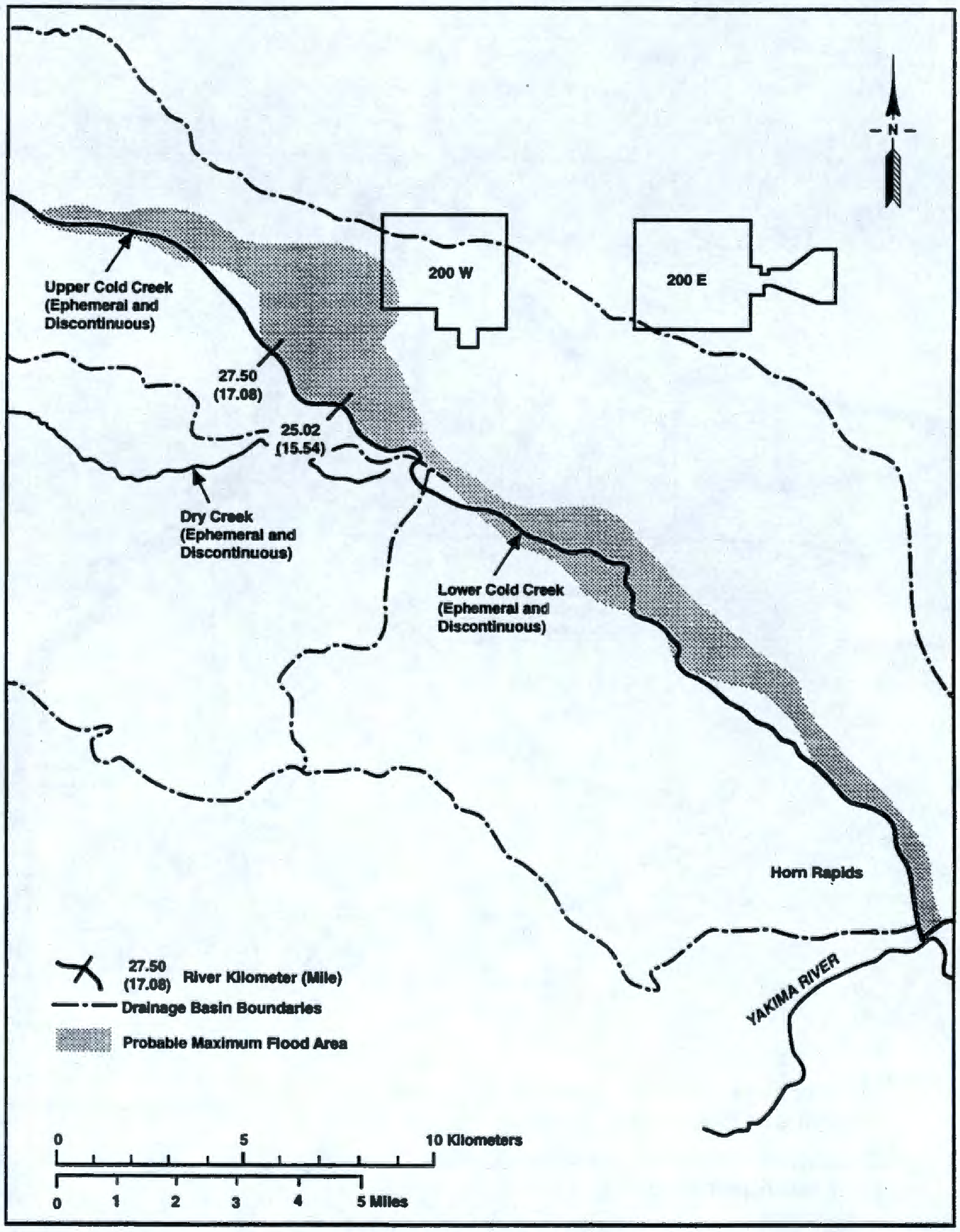
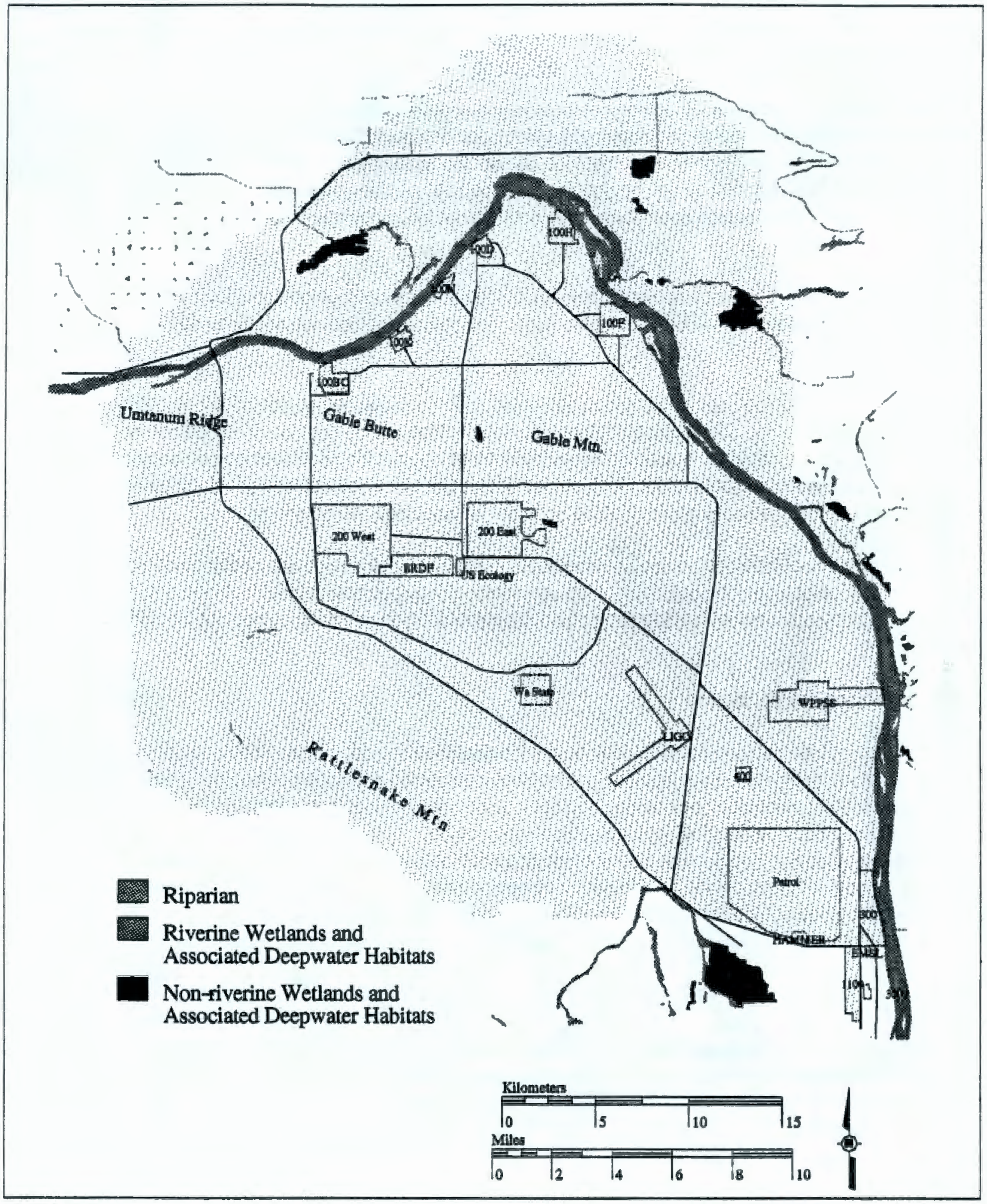


Figure C-3. Wetlands and Deep Water Habitats of the Hanford Site.



C.2.1 No-Action Alternative

Under the No-Action Alternative, impacts to wetlands and floodplains in the ALE Reserve would be minimal. The area is presently managed in a way similar to a Preservation designation. This management is anticipated to continue into the future. However, in the absence of a formal designation, proposals to develop parcels located in the ALE Reserve could be considered.

The Wahluke Slope would continue to be managed as the Saddle Mountain National Wildlife Refuge (similar to Preservation) by the U.S. Fish and Wildlife Service and as the Wahluke State Wildlife Recreation Area (similar to Conservation) by the Washington Department of Fish and Wildlife. Impacts to wetlands and floodplains in the Wahluke Slope geographic area would be minimal as long as these areas continue to be managed in a similar way.

The No-Action Alternative would also maintain the status quo for the Columbia River Corridor. The river could be used for recreation, but access to the islands would not be permitted.

The Central Plateau would continue to be used for waste management (Industrial-Exclusive use) under the No-Action Alternative. Although disturbance of wetlands and development of floodplains would be anticipated to be high with this land-use, wetlands and floodplains are essentially absent in this area. The lack of wetlands and floodplains is a primary consideration in designating the area for Industrial-Exclusive land use.

The No-Action Alternative does not include any particular land-use designations for the remainder. All areas could potentially be developed if appropriate uses were identified in the future. Floodplains and wetlands along the Columbia River could be impacted by future development.

C.2.2 Preferred Alternative

Although the Preferred Alternative would designate an area immediately south of State Highway 240 for Conservation (Mining) to allow for possible development of a quarry within the ALE Reserve, no wetlands are located in this area. No impacts to wetlands or floodplains are anticipated to occur under the Preservation designation. The area designated for Conservation (Mining) is adjacent to or located within the Cold Creek probable maximum floodplain, and infrastructure developed to support a quarry site and transport materials would cross the floodplain. This infrastructure could cause some small impacts to floodplain function because the infrastructure could interfere with movement of water under flood conditions.

The Wahluke Slope is designated for Preservation and Conservation (Mining and Grazing) under the Preferred Alternative. The Preservation designation is applied to all wetland and floodplain areas within this area. Other areas surrounding the wetlands and floodplain are designated for Conservation. Impacts to wetlands on the Wahluke Slope would be minimal. Activities associated with the Conservation (Mining and Grazing) designation could include grazing. Livestock would be expected to use the ponds and irrigation waste ways as a source of water and could damage the existing wetlands to some degree. The Conservation designation also allows considerable human access to the area, which could result in damage to the wetlands regardless of the Preservation designation applied to all wetland areas.

Land-use designations along the Columbia River Corridor would include Preservation, Conservation (Mining and Grazing), Low-Intensity Recreation, and High-Intensity Recreation. The Preservation designation would be applied to the river islands, and the Conservation (Mining and Grazing) designation would encompass lands surrounding the surplus reactors. Low-Intensity Recreation designations apply to places with existing boat launches that are not presently available for public use, to the river itself, and to an area along the Columbia River west of the B Reactor. High-Intensity Recreation is associated with the B Reactor, which may be designated as a National Historic Landmark and open to tourists.

Under the High- and Low-Intensity Recreation land-use designations, impacts to floodplains would be minimal. However, increased use of recreational watercraft could lead to damage to wetlands. High-Intensity Recreation would lead to wetland damage due to intensive use of recreational watercraft, potential off-road vehicle traffic, and foot traffic. Wetlands that would be adversely impacted would be those in the vicinity of the areas designated for High-Intensity Recreation, with impacts diminishing with distance from the high use areas.

Increased activity in the river under the Conservation designation would also potentially lead to damage to wetlands associated with the Columbia River riparian zone. Impacts to wetlands and floodplains associated with the Columbia River are influenced by the land-use designations adjacent to the river, with more aggressive use of the land leading to a greater degree of damage. Impacts to wetlands and floodplains along the Columbia River could occur under the Preferred Alternative as a result of the potential for mining and grazing.

The Preferred Alternative would designate the Central Plateau for Industrial-Exclusive use. No wetlands or floodplains are present within the Central Plateau and no impacts would be anticipated. The lack of wetlands or floodplains in this geographic area is a primary consideration in designating the area for Industrial-Exclusive land use.

The Preferred Alternative would designate portions of the remainder of the Hanford Site for Preservation, Conservation (Mining and Grazing), Industrial use, Low- and High-Intensity Recreation, and Research and Development. Areas within the Cold Creek and Columbia River floodplain would be designated for Conservation (Mining and Grazing) and Research and Development. Areas within the Yakima River floodplain would be designated for Industrial use and Research and Development. These activities are anticipated to have a little impact on the floodplain because development would be minimal and the affected areas are small. Areas along the Columbia River designated for Low- and High-Intensity Recreation could adversely impact wetlands in the vicinity of the land designated for these uses. No wetlands are located within the areas designated for Industrial use.

C.2.3 Alternative One

Although Alternative One would designate an area immediately south of State Highway 240 for Conservation (Mining) to allow for possible development of a quarry within the ALE, no wetlands are located in this area. No impacts to wetlands or floodplains are anticipated to occur under the Preservation designation. The area designated for Conservation (Mining) is adjacent to or located within the Cold Creek probable maximum floodplain, and infrastructure developed to support a quarry site and transport materials would cross the floodplain. This infrastructure could cause some small impacts to floodplain function because the infrastructure could interfere with movement of water under flood conditions.

Alternative One designated portions of the Wahluke Slope for Conservation (Mining and Grazing), Conservation (Mining), Low-Intensity Recreation, and Preservation. The

Preservation designation is applied to all wetland and floodplain areas within this geographic area. Other areas surrounding the wetlands and floodplain are designated for both Conservation (Mining and Grazing), and Conservation (Mining). Impacts to wetlands in the Wahluke Slope geographic area would be minimal. Activities associated with the Conservation (Mining and Grazing) designation could include grazing. Livestock would be expected to use the ponds and irrigation waste ways as a source of water and could damage the existing wetlands to some degree. The Conservation designations would also allow considerable human access to the area, which could result in damage to the wetlands regardless of the Preservation designation applied to all wetland areas.

Alternative One would designate land along the Columbia River Corridor as Preservation, and for Low- and High-Intensity Recreation. The Preservation designation would apply to small upland areas, the river islands, and land adjacent to the river. Low-Intensity Recreation designations apply to places with existing boat launches that are not presently available for public use, to the river itself, and to an area along the Columbia River west of the B Reactor. High-Intensity Recreation is associated with the B Reactor, which may be designated as a National Historic Landmark and open to tourists.

Under the High- and Low-Intensity Recreation land-use designations, impacts to floodplains would be low. High-Intensity Recreation could lead to wetland damage due to intensive use of recreational watercraft, potential off-road vehicle traffic, and foot traffic. Increased activity in the river under the Conservation designation could potentially lead to damage to wetlands associated with the Columbia River riparian zone. Impacts to wetlands and floodplains associated with the Columbia River are influenced by the land-use designations adjacent to the river, with more aggressive use of the land leading to a greater degree of damage. Alternative One designates all land on both sides of the Columbia River for Preservation, with the exception of a small area designated for High-Intensity Recreation in the vicinity of the B Reactor. Impacts to wetlands and floodplains associated with the Columbia River would be minimal under this alternative.

Alternative One would designate the Central Plateau for Industrial-Exclusive use. No wetlands or floodplains are present within the Central Plateau and no impacts would be anticipated. The lack of wetlands or floodplains in this geographic area is a primary consideration in designating the area for Industrial-Exclusive use.

Alternative One includes an area designated for Industrial use in the South 600 Area. No wetlands or floodplains are included in areas designated for this use pattern. Impacts to floodplains and wetlands under this alternative would be minimal or nonexistent.

C.2.4 Alternative Two

Wetland areas on the ALE Reserve and the Wahluke Slope are designated for Preservation under Alternative Two. Under this designation, no adverse impacts to the wetlands or floodplains would be anticipated. The Preservation designation would provide protection for the wetlands and floodplains from disturbance and development. All lands along the Columbia River would also be designated for Preservation under Alternative Two except for the area associated with the B Reactor, which is designated for High-Intensity Recreation. Impacts to wetlands and floodplains associated with the river would be minimal.

Alternative Two would designate the Central Plateau for Industrial-Exclusive use. No wetlands or floodplains are present within the Central Plateau and no impacts would be anticipated. The lack of wetlands or floodplains in this geographic area is a primary consideration in designating the area for Industrial-Exclusive land use.

Alternative Two includes an area designated for Industrial use and Preservation within the All Other Areas geographic area. No areas within wetlands or floodplains are designated for this use pattern. Impacts to floodplains and wetlands under this alternative would be minimal or nonexistent.

C.2.5 Alternative Three

The ALE Reserve would be designated for Conservation (Mining) areas under Alternative Three, including wetland and floodplain areas. Impacts to wetlands and floodplains that could occur under a Conservation (Mining) designation are anticipated to be similar to impacts under the Preservation designation. Mining activities would probably be similar to quarry operations and would involve a quarry site operation. These operations would be localized and would be anticipated to have minimal impact on floodplains.

Alternative Three designates portions of the Wahluke Slope for Agriculture, Conservation (Mining and Grazing), and High-Intensity Recreation. Wetlands within the Wahluke Slope are located in areas designated for Agriculture or Conservation (Mining and Grazing). Up to 261 ha (645 ac) of wetlands and associated deep water habitats could be directly and adversely impacted by Agriculture. Impacts to the remaining 739 ha (1,825 ac) of wetlands in the Wahluke Slope could also include non-point source runoff of agricultural chemicals, and impacts to wetlands due to runoff are anticipated to be minimal. Wetlands in this area exist as a result of irrigation runoff from agricultural areas surrounding the Wahluke Slope. The Agriculture designation also applies to land within the "Red Zone Area" designated for no irrigation. If irrigated agriculture were ultimately developed in this area, increased slumping of the White Bluffs would be expected to occur. This increased slumping would adversely affect existing wetlands and riparian habitat along the Columbia River, and would cover any floodplain in the area of the slump.

The Columbia River would continue to be used as a recreational river with additional development associated with the High-Intensity Recreation designation. The Low-Intensity Recreation designation under Alternative Three applies to a trail enabling access to the river from State Highway 24 to the north of the river and running along the river. Although portions of this trail would be located within the Columbia River floodplain, impacts to the floodplain would be minimal. A small area adjacent to the Columbia River is designated for High-Intensity Recreation and this designation would be anticipated to have a potential for adverse impacts to the 5 ha (12 ac) of riparian habitat in the area designated for High-Intensity Recreation.

Under the High- and Low-Intensity Recreation designations, impacts to floodplains would be minimal. However, increased use of recreational watercraft could lead to damage to wetlands. High-Intensity Recreation could lead to wetland damage due to intensive use of recreational watercraft, potential off-road vehicle traffic, and foot traffic. Wetlands that could be adversely impacted would be those in the vicinity of the areas designated for High-Intensity Recreation, with impacts diminishing with distance from the high use areas.

Alternative Three would designate the Central Plateau for Industrial-Exclusive use. No wetlands or floodplains are present within the Central Plateau and no impacts would be anticipated. The lack of wetlands or floodplains in this geographic area is a primary consideration in designating the area for Industrial-Exclusive use.

Alternative Three would designate areas within the remainder of the Hanford Site for Conservation (Mining), Industrial Use, Research and Development, Low-Intensity Recreation, and High-Intensity Recreation. The Cold Creek floodplain overlaps with areas designated for

Conservation (Mining), Research and Development, and High-Intensity Recreation; the Yakima River floodplain overlaps an area designated for High-Intensity Recreation. These land-use designations, especially High-Intensity Recreation, could adversely impact these floodplains.

C.2.6 Alternative Four

Wetland areas on the ALE Reserve would be designated for Preservation. An area immediately south of State Highway 240 would be designated for Conservation (Mining) to allow for possible development of a quarry. No impacts to wetlands or floodplains are anticipated to occur under the Preservation designation. The area designated for Conservation (Mining) under Alternative Four is adjacent to or located within the Cold Creek probable maximum floodplain, and infrastructure developed to support a quarry site and transport materials would cross the floodplain. This infrastructure could cause some small impacts to floodplain function because the infrastructure could interfere with movement of water under flood conditions. Potential impacts to wetlands and floodplains in the ALE Reserve would be similar to impacts under the Preservation designation. Mining activities would probably be similar to quarry operations and would involve a quarry-site operation that would have minimal impact on the Cold Creek floodplain.

Alternative Four would designate the Wahluke Slope and all lands on both sides of the Columbia River for Preservation, and for High- and Low-Intensity Recreation. Impacts to wetlands and floodplains in the Columbia River Corridor geographic area would be minimal, and no adverse impacts to the wetlands or Columbia River floodplain on the Wahluke Slope geographic area would be anticipated. The Preservation designation would provide protection for the wetlands and floodplains from disturbance and development.

Alternative Four would designate the Central Plateau for Industrial-Exclusive use. No wetlands or floodplains are present within the Central Plateau and no impacts would be anticipated. The lack of wetlands of floodplains in this geographic area is a primary consideration in designating the area for Industrial-Exclusive use.

Alternative Four would designate the majority of the land in the remainder of the Hanford Site for Preservation and for Conservation. Areas would also be designated for Research and Development and for Industrial use. All areas within the boundaries of wetlands and floodplains would be designated for Preservation or Conservation, and impacts to these areas would be negligible.

Appendix D -- Quarry Sites, Haul Roads, Railroads, and Cap Description

D.1 Reference Cap Design D-1

D.2 Quarry Sites D-2
D.2.1 McGee Ranch D-3
D.2.2 Pit 30 . . . . D-3
D.2.3 Potential Basalt Quarry Sites D-4
D.2.3.1 Vernita Quarry D-4
D.2.3.2 McGee Ranch D-5
D.2.3.3 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) Site D-6
D.2.3.4 Horn Rapids Site D-6
D.2.3.5 Gable Mountain Site D-7
D.2.3.6 Gable Butte Site D-8
D.2.3.7 West Haven Site D-8
D.2.3.8 Section 9 Quarry. D-9
D.2.3.9 DeAtley Quarry. D-9
D.2.3.10 Mahaffey Quarry. D-9

This page intentionally left blank.

Appendix D -- Quarry Sites, Haul Roads, Railroads, and Cap Description

The need for mineral resources in support of Hanford Site remediation will likely require development or enlargement of quarries. One possible remediation technology that could be selected to isolate harmful substances from humans and the environment is construction of surface caps over the waste sites. Surface caps generally consist of successive layers of materials such as basalt riprap, sand, gravel, geotextile membranes, and asphalt. Materials required for cap construction could be obtained from sources located on or off the Hanford Site. Appendix D provides a description of a reference cap design (Section D.1) and identifies potential sources of materials required for cap construction (Section D.2). The reference cap provides a conservative estimate of materials that could be required for cap construction. Other cap designs that would require less material would be evaluated during the remediation process for each specific waste site. Quarries located on the Hanford Site would be constructed in areas with a designated land use that accommodates mining activities.

Two prospective quarries have been identified as potential sources of materials for construction of surface caps over waste sites: McGee Ranch and Pit 30. McGee Ranch would serve as a source of fine materials, and Pit 30 would provide coarser aggregates.

In addition to the above quarries, several potential sources of basalt that may be required for barrier construction have been tentatively identified and evaluated in an engineering study (BHI 1995). The basalt quarry would provide material for riprap and possibly for asphalt and asphalt-base layers of the reference barrier. Ten locations on or near the Hanford Site have been evaluated as candidate basalt quarry sites. Evaluations were based on qualifying criteria (i.e., proximity to the 200 Areas on the Hanford Site, basalt availability, suitability of basalt, and threatened and endangered species impacts) and engineering criteria (i.e., haul distance, safety, expansion potential, and land reclamation potential). Other important factors used in determining the suitability of a site for quarry development are the significant cultural, archaeological, and historical resources that might be present.

Cultural resource surveys indicate that the most favorable sites for basalt quarry development from an engineering perspective are the least favorable for development from a cultural resources perspective. The most favorable sites from an engineering perspective exhibit features valued by American Indian tribes for traditional cultural and religious reasons. Sites that are less favorable for quarry development from an engineering perspective typically consist of near-surface basalt sources that do not have the commanding view of the surrounding terrain that is valued by tribal members for traditional cultural and religious uses. Factors other than cultural resources (e.g., excavation requirements, transportation cost, and reclamation potential) make these near-surface basalt sources less desirable from an engineering perspective.

D.1 Reference Cap Design

To estimate the quantity of materials required for cap construction, a conservative reference cap design was used in the analysis. For additional conservatism, capping was assumed to be the selected remedy for most Hanford waste sites. Other cap designs involving less material and, therefore, having lower construction and environmental costs, would be considered in the evaluation of remediation technologies for use at each specific waste site. The reference cap design provides the most conservative estimates of materials that would be required.

The reference cap design, commonly referred to as the Hanford Cap or Hanford Barrier, is a composite cap intended to protect waste sites from human intrusion, burrowing animals, root penetration, and water infiltration. This reference cap was designed specifically for conditions at the Hanford Site (i.e., a desert environment). The Hanford Cap consists of ten layers divided into three zones (from top to bottom): a water retention and evapotranspiration zone, a capillary break and biotic intrusion zone, and a low-permeability moisture barrier.

The water retention and evapotranspiration zone would consist of a 100-cm (39-in.)-thick layer of silt and pea gravel over a 100-cm (39-in.)-thick layer of silt. The top layer of silt and pea gravel would be seeded with various grasses. The silt and pea gravel layer would provide a growing medium for vegetation as well as some resistance to wind and water erosion. Water from precipitation would be held in this 200-cm (78-in.)-thick zone. The plants established on top of this zone would extract water from the soil and, through evapotranspiration, return moisture to the atmosphere.

The capillary break and biotic intrusion zone would be constructed of coarser materials than the water retention zone and would consist of a sand filter, a gravel filter, and a layer of crushed basalt. The capillary break would minimize water infiltration because moisture would not flow into the larger gaps found in the coarser material until water pressure in the overlying zone increased to nearly atmospheric pressure. The upper, fine-textured water retention zone would need to be nearly saturated before moisture would break through into the underlying coarse material. A geotextile filter would be located at the interface between the water retention zone and the capillary break. The geotextile filter would impede downward migration of fine-soil into the underlying sand filter, thereby maintaining the textural contrast that creates the capillary break. The lack of moisture in the basalt layer would discourage root penetration. The larger materials, particularly the crushed basalt, would provide a barrier to burrowing animals, root penetration, and inadvertent human intrusion.

The low permeability moisture barrier would consist of a 30-cm (11.7-in.) crushed rock or gravel drainage layer, a 10-cm (3.9-in.) asphaltic concrete layer, and a base course. This zone would collect moisture that penetrated the upper layers and divert the moisture away from the buried wastes that underlie this last zone. The low permeability moisture barrier would be situated on top of the existing interim soil cover.

D.2 Quarry Sites

The following sites have been identified as preferred sources of cap materials based on engineering studies and other available information (BHI 1995; Lindberg 1994; Skelly 1992). Final selection of quarry sites would depend on the amounts and types of materials required, as determined on a site-specific basis. For example, use of a modified *Resource Conservation and Recovery Act of 1976* (RCRA) C cap would require minimal use of basalt and could make development of a basalt quarry unnecessary. Quarries would be developed only in areas with future land-use designations consistent with mining activities. The following sections discuss potential quarry sites and the land-use designations for those sites under each alternative. Upon approval of the Record of Decision for the *Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* (HRA-EIS), development of a quarry in an area without a land-use designation consistent with mining activities would require changing the land-use designation for that area through the *National Environmental Policy Act of 1969* (NEPA) process.

D.2.1 McGee Ranch

McGee Ranch has been identified as the preferred quarry site for fine-grained soils potentially used in construction of caps for closure of waste sites at the Hanford Site. Fine-grained soils might be used as topsoil for the cap.

McGee Ranch is located near the west boundary of the Hanford Site, north of State Highway 24, west of State Highway 240, and south of the Columbia River. The site encompasses 873 ha (2,182 ac) and has approximately 36.1 million m^3 (47.3 million yd^3) of proven reserves of fine-textured soils (Lindberg 1994; Skelly 1992).

The Hanford Cultural Resources Laboratory conducted an archaeological survey of the McGee Ranch (PNL 1992) and determined that historic and prehistoric cultural resources are associated with this site. Prior to initiating activities at the McGee Ranch, requests for determination of eligibility, findings of effect and adverse effect, and plans for mitigating adverse impacts of the proposed action would be prepared and submitted to the appropriate federal, state, and tribal interests.

A survey for sensitive plant and animal species was conducted at the McGee Ranch site in 1991 (Sonnichsen 1991). No threatened or endangered species were encountered. Subsequent surveys of the site indicated the presence of two Washington State plant species of concern, the crouching milkvetch and scilla onion (BHI 1995). Two Washington State wildlife species of concern, the loggerhead shrike and the sage sparrow, were observed at the McGee Ranch site (BHI 1995). Swainson's hawk potentially could be associated with the McGee Ranch site. Assuming total use of the site, operation of the McGee Ranch quarry would eradicate 652 ha (1,629 ac) of shrub-steppe habitat. This area serves as a wildlife movement corridor between large blocks of shrub-steppe habitat on the Hanford Site and the Yakima Training Center, located northwest of Hanford. Prior to initiating the development of the site, the State of Washington and the U.S. Fish and Wildlife Service (USFWS) would be consulted regarding potential impacts to sensitive species.

McGee Ranch is located in an area designated for Conservation (Mining) under Alternative Three. Development of a quarry site at McGee Ranch would be consistent with the land-use designation under this alternative. The area is designated for Preservation under the Preferred Alternative and Alternatives One, Two, and Four; and this designation would preclude use of McGee Ranch as a source of materials for construction of caps. McGee Ranch could also be developed as a source of materials under the No-Action Alternative.

D.2.2 Pit 30

Pit 30 is an existing quarry site located immediately adjacent to the west side of the 200 East Area. Pit 30 could provide coarse sands and gravels required for cap construction. Pit 30 is a disturbed site associated with pre-Hanford farming activity. Development and expansion of Pit 30 would potentially impact 172 ha (426 ac), including the existing 49-ha (120-ac) pit. A formal calculation of total reserves of coarse aggregate material is not available, but reserves at Pit 30 are estimated to be approximately 15.3 million m^3 (20 million yd^3) of material. Pit 30 would provide aggregate to be used as graded filter material in the reference cap and other graded caps. Expansion of the existing pit would be necessary to provide sufficient quantities of this material. Full use of the site would eradicate approximately 138 ha (345 ac) of shrub-steppe habitat. Cultural resource and sensitive species surveys have not been conducted for Pit 30 and would be required prior to excavation. Preliminary information received from the USFWS and the State of Washington indicate that there are no sensitive species associated with this site. Completion of these surveys and consultation with the State of Washington and the USFWS would be required prior to initiating activity.

Pit 30 is located in an area designated for Industrial-Exclusive use under all alternatives. Obtaining materials for construction of caps over waste sites would be consistent with this land-use designation.

D.2.3 Potential Basalt Quarry Sites

Candidate quarry sites have been evaluated on the basis of qualifying criteria and engineering criteria (BHI 1995). A broad range of possible quarry sites, including seven onsite candidate quarries and three offsite privately operated quarries, were addressed. Candidate quarries included exposed basalt outcrops and basalt sources at or slightly below grade. Sites evaluated as potential basalt quarries were Vernita Quarry, McGee Ranch, the Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) Site, Horn Rapids Site, Gable Mountain Site, Gable Butte Site, West Haven Site, Section 9 Quarry, DeAtley Quarry, and Mahaffey Quarry. (The last three sites are privately owned and operated off the Hanford Site.)

Factors considered in the evaluation were categorized into two groups: (1) environmental, safety, and security factors; and (2) engineering and economic factors. Qualifying criteria included proximity to the 200 Areas on the Hanford Site (Central Plateau), basalt availability, suitability of basalt, and threatened and endangered species impacts. Engineering criteria included haul distance, safety, expansion potential, and land reclamation. Detailed descriptions of these criteria and evaluations are provided in the *Site Evaluation Report for Candidate Basalt Quarry Sites* (BHI 1995).

Historical, archaeological, and cultural resource impacts were not used as qualifying criteria because to date, only a portion of each candidate Hanford quarry has been surveyed and the database is incomplete. These resources would be fully assessed, evaluated, and mitigated, if necessary, prior to beginning any quarry operations. Mitigation would most likely be undertaken in accordance with a Memorandum of Agreement developed in coordination with the U.S. Department of Energy, Richland Operations Office (RL), the State Historic Preservation Office, and Tribal governments.

Development of a surface (or near-surface) basalt site would be comparable to a typical open-pit mine. A site occupying approximately 200 ha (500 ac) would need to be developed to a depth of approximately 25 m (80 ft) to satisfy the potential materials need.

Ecological surveys for threatened or endangered species were conducted at each Hanford Site candidate quarry. No Federal or state threatened or endangered species were observed at these sites, although several Federal and state species of concern were observed. Ecological surveys were not conducted at the three privately operated commercial quarries.

D.2.3.1 Vernita Quarry. Vernita Quarry is located off the east side of State Highway 24 near Vernita Bridge and has been identified as a suitable source to supply riprap required for use in constructing protective surface caps at the Hanford Site. NEPA documentation, including a survey for threatened or endangered species and a cultural resource survey, was prepared to support removing a small quantity of basalt from this quarry, and approximately 10,700 m^3 (14,000 yd^3) of riprap was removed in March 1994. This basalt was used to construct a prototype Reference (Hanford) Cap over the B-57 crib in the 200-BP-1 operable unit. Vernita Quarry could be developed by expanding the existing quarry or by developing a new quarry in the vicinity.

The quarry is located in an extensive basalt outcrop and a considerable volume of basalt exists outside of the area identified for quarry development. Initially, a 45-ha (110-ac) parcel would be developed. This parcel could yield 11.9 million m^3 (15.6 million yd^3) of loose riprap. Additional basalt could be obtained at this quarry by deeper excavation or by extending the quarry deeper into the basalt bench. Additional overburden per unit area might be encountered on parts of this outcrop, if the quarry were to be expanded beyond the identified boundaries. The potential volume of useable basalt makes expansion of this site feasible, and the Vernita Quarry Site could supply a sufficient quantity of basalt for cap construction.

Vernita Quarry is located in an exposed bench that could be reclaimed fairly successfully from a physical and topographic perspective. The bench would be translocated into the original outcrop and, when the quarry operations were complete, an exposed bench would remain. The approach to the new bench could be graded to provide a natural transition from the surrounding terrain. Revegetation would be used to further enhance the transition between undisturbed and disturbed areas.

Two Washington State plant species of concern, the crouching milkvetch and the stalked-pod milkvetch, were observed during a survey at the Vernita Quarry Site. A list of all flora and fauna species observed at this site and other potential sites during the ecological surveys is included as Appendix C in the *Site Evaluation Report for Candidate Basalt Quarry Sites* (BHI 1995).

Vernita Quarry is located in an area designated for Conservation (Mining and Grazing) in the Preferred Alternative, and Conservation (Mining) in Alternative Three. Development of a quarry at this site would be consistent with these land-use designations. Vernita Quarry is located in an area designated for Preservation under Alternatives One, Two, and Four; and development of the quarry would not be consistent with this land-use designation. Vernita Quarry could be expanded under the No-Action Alternative.

D.2.3.2 McGee Ranch. A near-surface basalt source exists on the interior north portion of the McGee Ranch site, northwest of the McGee well. Another portion of McGee Ranch is a potential quarry site for fine-textured soils required for cap construction and the same infrastructure could support both the fine-soil quarry and the basalt quarry. Basalt characteristics for this site are not well known because surfaces or benches are not exposed. The formation exists as a knoll with approximately 15 to 30 m (50 to 100 ft) of vertical relief. The thickness of the overburden is not known. The most likely scenario for developing a quarry at this site would be to begin mining the east end of the ridge. Quarry development would proceed to the west in blocks that span the width of the formation, while maintaining grade above the 274-m (900-ft) contour level. If additional basalt was required, excavation would proceed below this contour level. This potential quarry site consists of a 47-ha (116-ac) parcel. Excavation of the site to the 274-m (900-ft) contour level would yield 15.3 million m^3 (20 million yd^3) of loose riprap.

The basalt knoll at McGee Ranch would be developed similarly to an exposed outcrop. The reclaimed landscape would not blend with the surrounding landscape to the same degree as the Vernita Quarry Site. The knoll has several drainages running lengthwise on either side, which would be eliminated by removal of the basalt formation during quarry operations. A pit would be created if the formation were mined below the grade of the surrounding landscape to provide additional basalt materials. A revegetation program would help the quarry area partially blend with the surrounding landscape and would camouflage the quarry.

Two Washington State plant species of concern (the crouching milkvetch and scilla onion) and two Washington State wildlife species of concern (the loggerhead shrike and the sage sparrow) were observed at the McGee Ranch site.

The McGee Ranch site is located in an area designated for Conservation (Mining) in Alternative Three. Development of a quarry at this site would be consistent with this land-use designation. The proposed quarry site is located in an area designated for Preservation under the Preferred Alternative and Alternatives One, Two, and Four. Development of the quarry would not be consistent with this land-use designation. McGee Ranch could be developed under the No-Action Alternative.

D.2.3.3 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve) Site. The ALE Reserve Site consists of near-surface basalt located approximately 300 m (1,000 ft) south of State Highway 240 near Gate 116. This site would be developed similar to an open-pit surface mine, with adequate buffer zones surrounding the excavation to maintain safe side slopes.

The near-surface portion of the basalt formation covers a fairly limited area compared to the other sites. The quantity of basalt at this site is large and expansion could probably be accommodated through deeper excavation. However, further geologic surveys would need to be conducted to verify the extent of this formation and the depth of overburden and weak flow-top material, and to determine if a sufficient quantity of basalt could be obtained from the ALE Reserve Site.

One Washington State plant species of concern (the stalked-pod milkvetch) and two Washington State bird species of concern (the grasshopper sparrow and sage sparrow) were observed at the ALE Reserve Site.

The ALE Reserve Site is located within an ecology reserve that, for the most part, has remained untouched by large development activities and has been set aside for ecological preservation and research. The proximity of a quarry to the ALE Reserve Site might result in avoidance behavior or other disturbance by sensitive species and animals (e.g., mule deer and elk). A large-scale basalt quarry does not fit historical or current use designations for the ALE Reserve.

The ALE Reserve Site is located in an area designated for Conservation (Mining) in the Preferred Alternative and Alternatives One, Three, and Four. Development of a quarry at this site would be consistent with this land-use designation. The ALE Reserve Site is located in an area designated for Preservation under Alternative Two. Development of the quarry would be consistent with this land-use designation. Development of the quarry would not be consistent with current management practices and would be a nonconforming use under the No-Action Alternative.

D.2.3.4 Horn Rapids Site. A basalt outcrop and potential quarry area exists 900 m (3,000 ft) north of the Horn Rapids Dam. Characteristics of this site are not well known because few basalt benches are exposed. The flow top is relatively flat at the 152-m (500-ft) contour with abundant scattered basalt rocks in places. Some vertical relief exists near the south end and near the center on the west side of the outcrop, and these two locations might provide the most suitable locations to begin quarry operations. Initial quarry development would probably involve an 84-ha (207-ac) parcel.

The Horn Rapids Site could be developed in a manner similar to development of the basalt formation at Vernita. A well-developed and exposed bench is not present at the Horn Rapids Site, but vertical relief at the south end would enable development of a 9- to 12-m (30- to 40-ft) bench.

The near-surface source at the Horn Rapids Site is fairly extensive and could accommodate future expansion. Further geologic surveys would need to be conducted to verify the extent of this formation and to determine if a sufficient quantity of basalt could be obtained from the Horn Rapids Site.

One Washington State wildlife species of concern (two pairs of long-billed curlew) was observed at the Horn Rapids Site.

The Horn Rapids Site is located in an area designated for Research and Development in the Preferred Alternative and Alternative Three. Development of a quarry at this site would not be consistent with this land-use designation. The Horn Rapids Site is located in an area designated for Preservation under Alternatives One, Two, and Four. Development of the quarry would not be consistent with this land-use designation. The site would be available for development under the No-Action Alternative.

D.2.3.5 Gable Mountain Site. Gable Mountain is a prominent geologic feature north of Route 11A and north-to-northeast of the 200 East Area. A small quarry already exists at this site, and observation of exposed basalt indicates that a suitable quality of basalt exists throughout the west end of Gable Mountain. The existing quarry on the west end of Gable Mountain has the capacity to supply all basalt needs at the Hanford Site. The quarry would be expanded by advancing eastward into the mountain. A considerable quantity of naturally occurring talus slope material exists at Gable Mountain and could provide many thousands of cubic meters of riprap. Also, several large piles (thousands of cubic meters) of human-made riprap exist in the old quarry site. Development of a quarry at the Gable Mountain Site would begin at the far west end of the mountain and proceed east.

Gable Mountain contains extensive exposed basalt benches that would be well suited for quarry development. An open-pit mine would not be developed unless restrictions were placed on quarry expansion. Land reclamation at the site would be capable of blending the quarry with the surrounding landscape.

Gable Mountain has considerable cultural resource value as a sacred site for American Indian tribes. Development of a quarry at Gable Mountain would adversely impact a cultural resource valued by American Indians and would represent an irreversible and irretrievable (I&I) commitment of this cultural resource.

One Washington State plant species of concern (the stalked-pod milkvetch) and two state wildlife species of concern (the loggerhead shrike and the prairie falcon) were observed at the Gable Mountain Site.

Gable Mountain is located in an area designated for Preservation in the Preferred Alternative and Alternatives One, Two, and Four. Development of a quarry at this site would not be consistent with this land-use designation. Gable Mountain is located in an area designated for Conservation (Mining) under Alternative Three, and development of the quarry would be consistent with this land-use designation. A quarry could also be developed under the No-Action Alternative.

D.2.3.6 *Gable Butte Site.* Gable Butte is a prominent geologic feature north of Route 11A and north of the 200 West Area. The quarry site would consist of outcrops located west of the railroad grade at Gable Butte, immediately west of Gable Butte proper. A considerable quantity of naturally occurring talus slope material is associated with these outcrops and thousands of cubic meters of riprap could possibly be obtained from this material. Development of a quarry at the Gable Butte Site would begin at the south end of the area of interest. Sufficient space is available for stockpiling material and for parking equipment in the southern portion of this area. The outcrops that would be quarried range in elevation from about 152 m (500 ft) to 182 m (600 ft).

Gable Butte and associated outcrops have the capacity to meet all basalt needs at the Hanford Site. The outcrops immediately west of Gable Butte provide excellent opportunities for quarry expansion. Talus slopes at the base of the outcrops could supply significant quantities of basalt that is already broken into riprap-sized material that may be suitable for cap construction.

Gable Butte has cultural resource value as a sacred site for American Indian tribes. Development of a quarry at Gable Butte would impact a cultural resource valued by American Indians and would represent an I&I commitment of this cultural resource.

Two Washington State plant species of concern (the stalked-pod milkvetch and crouching milkvetch) and one Washington State wildlife species of concern (the loggerhead shrike) were observed at the Gable Butte Site.

Gable Butte is located in an area designated for Preservation in the Preferred Alternative and Alternatives One, Two, and Four. Development of a quarry at this site would not be consistent with this land-use designation. Gable Butte is located in an area designated for Conservation (Mining) under Alternative Three, and development of the quarry would be consistent with this land-use designation. A Gable Butte quarry could also be developed under the No-Action Alternative.

D.2.3.7 *West Haven Site.* The West Haven Site consists of a single large basalt outcrop located immediately east of Route 6 and west of Gable Butte. A considerable quantity of naturally occurring talus slope material exists at this site and could provide many thousands of cubic meters of riprap. The West Haven Site and nearby outcrops have the capacity to supply sufficient quantities of basalt material for cap construction. Development of a quarry at the West Haven Site would begin at the south end of the area of interest. Sufficient space is available for stockpiling material and for parking equipment in the southern portion of this area.

West Haven contains extensive exposed basalt benches that would be well suited for quarry development. An open-pit mine would not be developed unless restrictions were placed on quarry expansion. Land reclamation at the site would be capable of blending the quarry with the surrounding landscape.

Two Washington State plant species of concern (the crouching milkvetch and the stalked-pod milkvetch) were observed at the West Haven Site.

The West Haven Site is located in an area designated for Conservation (Mining and Grazing) in the Preferred Alternative and Conservation (Mining) in Alternative Three. Development of a quarry at this site would be consistent with these land-use designations. The West Haven Site is located in an area designated for Preservation under Alternatives One, Two, and Four; and development of the quarry would not be consistent with this land-use designation. The site could also be developed under the No-Action Alternative.

D.2.3.8 Section 9 Quarry. The Section 9 Quarry is a privately owned quarry located north of Wanapum Dam. This quarry has considerable quantities of basalt in-place that could be blasted and crushed to produce the desired riprap. Quarry development would be the responsibility of the quarry operator. The status of threatened or endangered species and cultural resources at this site is not known.

The Section 9 Quarry and surrounding basalt formation could easily supply the volume estimate of 15.3 million m^3 (20 million yd^3) of riprap used in evaluating sites (BHI 1995). Bank reserve volumes at this quarry site are expected to be sufficient to meet the requirement for basalt materials used in cap construction.

D.2.3.9 DeAtley Quarry. The DeAtley Quarry is a privately owned quarry located on the old Highway 12, about 6.7 km (4.2 mi) east of Benton City, Washington. Development of the quarry would be the responsibility of the quarry operator. The status of threatened or endangered species and cultural resources at this site is not known.

The DeAtley Quarry and surrounding basalt formation could supply an estimated basalt bank volume of 7.6 million m^3 (10 million yd^3) from this 24-ha (60-acre) site (BHI 1995). This translates to approximately 11.6 million m^3 (15.2 million yd^3) of loose riprap. The DeAtley Quarry might not have sufficient reserves to supply the quantity of basalt required for construction of all caps on the Hanford Site.

D.2.3.10 Mahaffey Quarry. The Mahaffey Quarry is privately owned and located on Clodfelter Road about 5.5 km (3.4 mi) from the intersection of Clodfelter Road and Clearwater Avenue in Kennewick, Washington. Quarry development would be the responsibility of the quarry operator. The status of threatened or endangered species and cultural resources at this site is not known.

An area of 5.7 ha (14 ac) of the 16-ha (40-ac) quarry site is currently permitted for operations at the Mahaffey Quarry. Total reserve estimates at this site are not known. Much of the basalt is subsurface, with as much as 2.4 m (8 ft) of topsoil in places. The reserve estimate for this site is assumed to be similar to that of the 24-ha (60-acre) DeAtley Quarry. The Mahaffey Quarry might not have sufficient reserves to supply the quantity of basalt required for construction of all caps on the Hanford Site.

This page intentionally left blank.

Appendix E - Supplementary Information for Cumulative Impacts Analysis

E.1 Present and Reasonably Foreseeable Future Actions at the Hanford Site 1
E.1.1 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve). 1
E.1.2 Wahluke Slope 1
E.1.3 Columbia River 2
E.1.4 200 Areas 4
E.1.5 Other Hanford Areas 10

E.2 Other Potential Hanford Site Actions 12
E.2.1 200 Areas 12
E.2.2 Other Hanford Areas 12

E.3 Present and Reasonably Foreseeable Actions Adjacent to the Hanford Site 13

This page intentionally left blank.

Appendix E

This appendix summarizes cumulative impacts associated with Hanford Site land-use designations for each alternative identified in Chapter 3. Cumulative impacts result

> *. . . from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time . . .* (40 CFR 1508.7).

Reasonably foreseeable actions are identified and the relationship between these actions and the proposed land-use designations is discussed. The description of potential cumulative impacts couples impacts of each alternative with impacts from past and existing operations at the Hanford Site and impacts that may be associated with anticipated future actions.

Cumulative impacts to land use associated with present and reasonably foreseeable actions are discussed in Chapter 5, Section 5.5.1. Section 5.5.2 discusses cumulative impacts to the resources identified in Section 5.2; and Sections 5.5.3 and 5.5.4 discuss cumulative socioeconomic impacts and cumulative human health risk, respectively.

E.1 Present and Reasonably Foreseeable Future Actions at the Hanford Site

This section describes present and reasonably foreseeable actions at the Hanford Site where potential impacts have been identified.

***E.1.1 Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve)*.** No new actions are presently planned for the ALE Reserve. To ensure that the ALE Reserve=s natural resources would be protected, the U.S. Fish and Wildlife Service (USFWS) manages the ALE Reserve for DOE. This management is comparable to a land-use designation of Preservation, as defined in this Revised Draft HRA-EIS.

The ALE Reserve is primarily designated for Preservation under all alternatives, except Alternative Three, which designates the ALE Reserve for Conservation (Mining). The Preferred Alternative and Alternatives One and Four also include areas designated for Conservation (Mining). These areas would accommodate the potential for development of a quarry. Land-use designations for the ALE Reserve are consistent with anticipated future actions. The Conservation (Mining) designation under Alternative Three would accommodate a greater range of uses throughout the ALE Reserve. The impacts associated with this designation would be greater than for the Preservation/Conservation (Mining) designation under the Preferred Alternative and Alternatives One and Four, or for the Preservation designation under Alternative Three.

E.1.2 Wahluke Slope

The current management of lands within the Wahluke Slope is comparable to Preservation and Conservation. No new actions are presently planned for the Wahluke Slope, and DOE anticipates that the present management would continue under the No-Action Alternative.

However, adoption of the alternative selected in the U.S. Department of Interior (DOI) Record of Decision (ROD) for the *Hanford Reach of the Columbia River Final Environmental Impact Statement for Comprehensive River Study* (NPS 1996) would designate the Wahluke Slope as a wildlife refuge. This designation requires congressional action and the wildlife refuge would be managed similarly to the Preservation designation used in this Revised Draft HRA-EIS. There are two proposals currently under consideration in Congress. The primary differences between the proposals include the extent of the geographic scope (i.e., whether the Wahluke Slope is addressed or not), and the designation of the land manager (local versus Federal control).

The Preferred Alternative would designate lands within this area for Conservation (Mining and Grazing) and Preservation. Alternative One would designate lands in the Wahluke Slope for Conservation (Mining and Grazing), Conservation (Mining), and Preservation. Alternatives Two and Four would designate the area for Preservation. Alternative Three would designate a large portion of the area for Agriculture, with the smaller areas designated for Conservation and Preservation. Small areas would also be designated for recreational use (High- and/or Low-Intensity) under all alternatives except Alternative Two. High-Intensity Recreation and Agriculture would not be consistent with the alternative selected in the DOI ROD for the Hanford Reach.

To the extent that DOE retains control of the Wahluke Slope, future actions in the Wahluke Slope would be consistent with the land-use designation adopted through the ROD for this Revised Draft HRA-EIS.

E.1.3 Columbia River

Present and reasonably foreseeable actions with the Columbia River include the following actions:

- ***Hanford Reach of the Columbia River Final Environmental Impact Statement for Comprehensive River Record of Decision* (NPS 1996):** This EIS addressed the need to protect the Hanford Reach as the last free-flowing, nontidal stretch of the Columbia River in the United States. The ROD selected the alternative that combined a Wild and Scenic River designation for the Hanford Reach of the Columbia River and its immediate corridor with a National Wildlife Refuge (NWR) designation for the Wahluke Slope (NPS 1994). Recreational access points would be improved but not expanded, and additional facilities and programs for visitor interpretation and education would be provided. Damming and major dredging would be prohibited. Development of new industrial facilities on the Hanford Site within the immediate river corridor would be curtailed. Other DOE activities would be specifically allowed or be subject to review and approval. The following potential impacts and benefits were identified (NPS 1994):

    - Prohibiting damming and dredging would ensure favorable conditions for salmon to migrate and spawn; preserve biodiversity and sensitive species by preventing disturbance of habitat; maintain the existing high water quality by reducing siltation; minimize water temperature change and the potential contaminant releases associated with dredging; and would prevent inundation and disturbance of cultural resources.

- Ongoing cultural resource inventories and surveys would maintain the quality of historic and archaeological sites, identify new sites, and document existing sites.

- Restricting development would reduce river siltation and prevent disturbance of cultural and paleontological resources.

- Controlling exotic vegetation would prevent this vegetation from crowding out native plants. Controlling nuisance aquatic macrophytes, such as water milfoil, would reduce the impacts of these plants on water quality and aquatic habitats. Revegetating disturbed areas with native plant species would restore the diversity and abundance of native plant and animal communities.

- Prohibiting off-road vehicle use would prevent disturbance of riparian and upland habitats and cultural resource sites.

- Prohibiting grazing would minimize further damage to upland and riparian habitats, but would impact tribal access for the purpose of grazing animals and private citizens currently holding grazing permits.

- Increasing river patrols would reduce the impacts of wildfires, littering, and disturbance of rare plants, wildlife, and cultural resources.

- Conducting a study to examine sloughing of the White Bluffs and identifying possible protective actions could lead to reduced sloughing, which would benefit this important visual and paleontological resource. Measures to reduce the sloughing of the White Bluffs could adversely impact current irrigation practices on adjacent lands if irrigation is shown to contribute to the sloughing.

- The Hanford Reach Study Team intends that the Wild and Scenic River designation would not impose constraints on Hanford Site remediation. New construction would be prohibited within the designated boundaries, with the exception of intakes and outfall structures and required facilities related to remediation of the Hanford Site.

- Habitat protection and restoration efforts would benefit recreational use and access, as would increased river patrols and improvements in public education efforts and recreational facilities.

In mandating the study in 1988, Congress provided interim protection of the Hanford Reach by prohibiting development until November 1996. In 1996, Public Law 104-333 extended this protection indefinitely. Activities such as damming or dredging have been permanently prohibited. Congress must determine the further disposition of the Hanford Reach study area through legislative action (NPS 1994).

- **Decommissioning of eight surplus production reactors:** An EIS was prepared to address the environmental impacts, benefits and costs, and institutional and programmatic needs associated with decommissioning the eight surplus production reactors in this area (DOE 1992a). The ROD for this action was published in 58 FR 48509. The DOE decided on safe storage followed by deferred one-piece removal as the preferred alternative. The DOE intends to complete this decommissioning action consistent with the schedule for remedial action in the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989). Therefore, the safe storage period would be for less than the 75-year time frame outlined in the Decommissioning of Eight Surplus Production Reactors EIS. This action includes continuing surveillance, monitoring, and maintenance, followed by transport of intact reactor blocks from the present locations in the 100 Areas to the 200 West Area for disposal. Contaminated materials associated with the fuel storage basins also would be disposed of in the 200 West Area, along with contaminated equipment and components associated with the reactors. Uncontaminated portions of the fuel storage basins would be removed to provide access for machinery required to move the reactor blocks. Other uncontaminated structures and equipment would be demolished and placed in landfills in the vicinity of the reactor sites.

Occupational radiation doses associated with this action were estimated to be approximately 51 person-rem, and short-term public radiation doses were estimated to be near zero (DOE 1992a). Near-term ecological impacts were considered minimal because of the existing disturbance from other radioactive waste management activities and nuclear facility operations. The maximum number of workers required at any time would be less than 100. Portions of the B Reactor may be preserved for display in recognition of the cultural significance of the reactor.

Approximately 6 ha (15 ac) in the 200 Areas would be disturbed to accommodate disposal of wastes resulting from decommissioning activities. This disturbance would be partially offset by the 5 ha (13 ac) that would be available for revegetation in the 100 Areas after removal or dismantlement of the eight reactors. Additional habitat disturbance would be required for construction of haul roads from the 100 Areas to the 200 Area that are capable of handling the movers required to transport the reactor blocks.

- **Deactivation of the N Reactor:** An environmental assessment (EA) was prepared to address all nonroutine activities associated with the shutdown of the 105-N Reactor (N Reactor) (DOE 1995e); the Finding of No Significant Impact (FONSI) was issued on May 1, 1995. The EA identifies impacts associated with activities required to prepare the reactor for decommissioning. No additional ground disturbance would be anticipated from deactivation of the reactor. The maximum exposed individual (MEI) in the offsite population would receive a dose less than 0.001 mrem/yr and the collective dose to the population would be 0.025 person-rem. Deactivation would require approximately 200 workers for three years, with only three workers required after deactivation was complete.

These actions are consistent with and would enable the land-use designations under all alternatives, with the exception that the alternative selected in the DOI ROD for the Hanford Reach (NPS 1996) would conflict with High-Intensity Recreation and Conservation (Mining and Grazing) designations along the Columbia River.

E.1.4 200 Areas

Present and reasonably foreseeable actions in the 200 Areas include the following:

- **Tank Waste Remediation System (TWRS):** The DOE has issued a ROD for an EIS that analyzed alternatives for remediating the waste currently contained in the 177 single-storage tanks (SSTs) and double-storage tanks (DSTs) in the 200 Areas and in about 60 active and inactive miscellaneous underground storage tanks, and providing for safe storage and disposal of strontium and cesium capsules used in research projects at Hanford Site and offsite locations (DOE and Ecology 1996). The EIS evaluated a range of waste retrieval and removal and in-place remediation options for the SSTs and DSTs. The ROD presented the selected alternative of phased implementation and deferred the decision on disposition of cesium and strontium capsules (DOE 1997). Under phased implementation, tank wastes would continue to be stored until the waste is retrieved in a demonstration phase (Phase I) to verify that treatment processes will function effectively. After Phase I, the full-scale production phase (Phase II) would be implemented. Potential impacts associated with this project include worker exposures to radiological and hazardous constituents during waste disposition and habitat disturbance.

  Worker exposures to hazardous and/or radioactive constituents were evaluated in the EIS. It is estimated that health effects due to radiation exposure would include approximately three latent cancer fatalities in operational workers over the life of the project.

  Approximately 138 ha (340 ac) of shrub-steppe habitat would be disturbed.

- **In 1997, DOE prepared a supplement analysis to determine if additional NEPA review was required for a series of tank farm infrastructure upgrades (DOE-RL 1997a):** These upgrades focus on capital improvements necessary for continued safe operation of DST facilities and selected SST facilities. Most of the activities would involve replacing or upgrading existing systems. In May 1997, DOE determined that the potential impacts of the project were adequately bounded by the analysis in the TWRS-EIS; therefore, an additional *National Environmental Policy Act of 1969* (NEPA) analysis was not required.

- **Plutonium Finishing Plant stabilization:** The DOE has issued a final EIS addressing stabilization of the radioactive materials present in the Plutonium Finishing Plant (PFP) (DOE-RL 1996a). Potential impacts include worker exposure and radiological air emissions. All activities will take place within the facility. There will be no change is land use.
- **Environmental Restoration Disposal Facility (ERDF):** The ERDF was constructed adjacent to the 200 Areas and started operation in August 1996. The facility provides for storage and disposal of waste generated during environmental restoration activities at the Hanford Site (EPA 1995b). The ERDF is the disposal facility for most of the waste excavated during remediation of waste management units at the Hanford Site. Waste generated from remediation of past-practice waste sites and CERCLA remedial activities is placed in the ERDF. The facility accepts only waste that originates on the Hanford Site, which includes dangerous waste, radioactive waste, and mixed waste. The ERDF will be expanded, as needed, ultimately covering as much as 4.1 km^2 (1.6 mi^2) south of the 200 Areas. Initial construction involved 65 ha (165 ac) of this area. In August 1997, DOE, the U.S. Environmental Protection Agency (EPA), and Ecology proposed to expand the existing two operating cells of the ERDF by initiating construction of two additional cells (DOE-RL 1997b). This expansion would require an additional 28 ha (70 ac) within the original ERDF footprint. The original cells were constructed using a double-liner with a

leachate collection and recovery system. The new cells would be constructed using the same design.

Under current climate conditions, contaminants placed in the ERDF are expected to reach groundwater within 10,000 years. After 10,000 years, estimated human health risks are a maximum incremental lifetime cancer rate (ILCR) of 5×10^{-6} and a maximum hazard quotient for noncarcinogens of 0.2 (a hazard quotient of 1 or greater indicates a health concern). Ecological impacts will occur at the ERDF site and at quarries for materials to be used in the liner and cover. The shrub-steppe habitat at the ERDF site is considered priority habitat by the State of Washington and a number of Washington State monitored or candidate species may be affected by the ERDF. The estimated disturbed area ranges from 14 to 54 ha (35 to 133 ac) for the silt quarry (McGee Ranch). The total disturbed area at the actual ERDF site (including the trench, stockpiling areas, roads, and supporting facilities) is estimated to be 260 ha (640 ac), or approximately 2.6 km^2 (1 mi^2). Significant cultural resources have not been identified at the ERDF site. Operation of the ERDF provides up to 167 full-time positions at the Hanford Site. The total estimated capital costs for the ERDF range from $246 million to $663 million. Visual and noise impacts of ERDF construction and operation are considered negligible.

- **Programmatic Spent Nuclear Fuel Management:** The DOE developed the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Draft Environmental Impact Statement* (DOE 1994a) and issued the ROD (60 FR 28680). This decision establishes DOE policies for the environmentally safe transport, storage, and management of spent nuclear fuels. A large portion of the DOE-owned inventory of SNF is already stored at the Hanford Site, and the Hanford Site has been identified as a participant in the management of spent fuel. The selected alternative -- regionalization of SNF storage by fuel type -- requires management of defense production spent fuel at the Hanford Site and transport of other spent fuel currently stored at the Hanford Site to the INEEL.

  An amendment to the ROD (61 FR 9441) was issued to the public on March 8, 1996, to reflect modifications to the original decision resulting from a settlement agreement reached by the DOE, the State of Idaho, and the U.S. Department of the Navy. The amended ROD indicates that only 12 of the originally planned 524 shipments of SNF would be shipped from the Hanford Site to Idaho. These 12 shipments will consist of the sodium-bonded FFTF fuel.

  Land disturbance associated with this action at the Hanford Site is estimated at 7 ha (18 ac) of shrub-steppe habitat west of the 200 East Area. Estimates of employment required for construction activities range from 176 to 1,065 employees during the years from 1997 to 2000. Operations would require 208 to 230 employees through 2004, with levels gradually declining to 50 to 60 workers beyond the year 2004. Many of these employees would be drawn from the existing Hanford Site workforce. Construction of the new facilities is not expected to have any significant impact on cultural resources. Solid waste generation would be a maximum of 330 m^3/yr (11,654 ft^3/yr), or approximately 4 percent of the 21,000 m^3/yr (740,000 ft^3/yr) currently generated at the Hanford Site. The MEI in the general population would receive a dose of 0.007 to 0.02 mrem/yr from waste-processing activities. Resource (e.g., materials, fuels, and public funds) required to implement this action would overlap with the time periods when the same type of resources would be required by remediation activities at the Hanford Site.

- **Hanford Spent Nuclear Fuel Management:** A Hanford Site EIS was prepared to tier from the ROD (60 FR 28680) for the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Draft Environmental Impact Statement* (DOE 1994a). The EIS analyzed the potential environmental impacts of the removal of SNF from the K Basins and subsequent management of the fuel for up to 40 years (DOE 1995d). The ROD for management of K Basin SNF was issued on March 4, 1996 (61 FR 10736).

  The ROD indicates that the Preferred Alternative identified and analyzed in the EIS, with minor modifications, will be implemented. This alternative consists of removing the SNF from the basins, vacuum drying, conditioning, and sealing the SNF in inert gas-filled canisters for dry vault storage in a new facility to be built at Hanford for up to 40 years, pending decisions on ultimate disposition. The K Basins will continue to be operated during the period over which the alternative is implemented. The action also includes transfer of the basin sludge to Hanford DSTs for management, disposal of non-SNF debris in a low-level burial ground at the Hanford Site, disposition of basin water, and deactivation of the basins pending decommissioning. A total of 3.5 ha (8.7 ac) of land and native vegetation would be disturbed or destroyed during land-clearing activities to provide new facilities for this project.

- **200 Area Effluent Treatment Facility:** In 1992, DOE prepared an EA and FONSI (DOE 1992b) that addressed environmental upgrades to liquid waste effluent systems, including the 200 Area Effluent Treatment Facility, located near the 200 East Area. This facility provides effluent treatment and disposal capability required to restart the 242-A Evaporator, which reduces tank waste volume by removing process condensate. The Effluent Treatment Facility provides for effluent collection, a treatment system to reduce the concentration of hazardous and radioactive waste constituents in the effluent streams to acceptable levels, tanks to allow verification of effluent characteristics before discharge, and a state-approved land disposal structure (SALDS) for effluents. The SALDS infiltration gallery consists of a 35- by 61-m (116- by 200-ft) rectangular drain field that is located north of the 200 West Area.

  Environmental impacts associated with this project include habitat destruction associated with the construction of the treatment facility, transfer piping, and the SALDS; and the discharge of small quantities of contaminants to the ground through the SALDS. In particular, the discharge of tritiated streams is of concern, but, because of the relatively short half-life of tritium (12.3 years), the long residence time of the effluent in the groundwater could be expected to be sufficient to attenuate the tritium before it reaches the Columbia River.

- **Operation of Low-Level Burial Grounds:** The low-level burial grounds located in the 200 West and 200 East Areas are an active, permitted RCRA landfill and cover a total area of 225 ha (556 ac). The landfill is divided into eight burial grounds and each burial ground consists of a number of trenches that contain, or will contain, low-level radioactive and mixed waste. Six burial grounds are located in the 200 West Area and two burial grounds are located in the 200 East Area. Impacts associated with operation of the burial grounds include habitat disturbance or loss and the potential for generation of fugitive dust.

  The DOE recently decided to widen one of the trenches in the 218-W-5 Low-Level Burial Ground to accommodate large, packaged low level waste, and to facilitate segregation of low-level waste (DOE-RL 1997c).

- **Operation of the U.S. Ecology, Inc. Commercial Low-Level Radioactive Waste Landfill for offsite commercial waste.** U.S. Ecology, Inc., operates a radioactive waste landfill that accepts commercially generated low-level wastes from states included in the Northwest low-level radioactive waste compact. U.S. Ecology, Inc., accepted 2,191 m^3 (77,418 ft^3) of naturally occurring wastes and 5,801 m^3 (204,981 ft^3) of low-level radioactive wastes in 1995 (TCH 1996b). The U.S. Ecology, Inc., landfill is located directly east of the ERDF landfill. Habitat disturbance is the primary impact associated with the facility. In February 1997, the Washington State Departments of Health and Ecology determined that an EIS must be prepared under SEPA before the state can make several key environmental decisions regarding this site. These decisions include approval of a site closure plan, renewal of the operating license, and an amendment to the regulations limiting the receipt of naturally occurring and accelerator-generated radioactive materials. Public scoping took place through March 27, 1997, and the draft EIS is currently in preparation.

- **Solid Waste Retrieval Complex, Enhanced Radioactive and Mixed Waste Storage Facility, infrastructure upgrades, and Central Waste Support Complex:** The DOE prepared an EA addressing several waste management projects in the 200 Areas (DOE-RL 1995b). A FONSI was issued on September 28, 1995, that addressed the construction of the solid waste retrieval complex, an enhanced radioactive and mixed waste storage facility, infrastructure upgrades, and a Central Waste Support Complex. These projects will be undertaken in the 200 West Area and involve approximately 36 ha (89 ac), or about 5 percent of the 777 ha (1,920 ac) in the 200 West Area. Most activities will occur in previously disturbed areas. The waste storage facility, however, will be constructed on relatively undisturbed land, resulting in an incremental loss of shrub-steppe habitat essential for species such as the loggerhead shrike and sage sparrow.

  Discharges of nonradioactive liquid effluents could incrementally increase discharges of nonradioactive effluents in the 200 Areas by 43,000 m^3 gal (11 million gal), which would comprise approximately 2 percent of the total discharge. This additional volume is not expected to produce any discernable mounding of the groundwater. Changes in the movement of underground contaminant plumes also are not expected.

Implementation of the proposed action would not be expected to produce a cumulative socioeconomic impact, and discernable changes in the radiation dose to offsite receptors would not be expected.

- **Tank 241-C-106 sluicing and waste removal:** This project addresses the need to retrieve the high-heat waste in SST 241-C-106 and transfer the waste to DST 241-AY-102. The DOE has identified a need to take this action to eliminate safety concerns with the storage of high-heat waste in Tank 241-C-106, and to demonstrate a tank waste retrieval technology. The removal of the waste would stabilize this tank and eliminate the need to add cooling water. An EA (DOE 1994b) and FONSI were issued in February 1995.

  Tank 241-C-106, which is located in the 200 East Area, has a 31-cm (10-in) -thick dished bottom, and a useable waste depth of approximately 4.8 m (16 ft) at the sidewall. The waste in Tank 241-C-106 consists of 746,000 L (197,000 gal) of sludge that is stratified into two layers. The top layer consists of 655,000 L (173,000 gal) of sludge, containing a sufficient amount of strontium to be considered high-heat waste, which generates approximately 32 kW of heat. The bottom layer consists of 91,000 L (24,000 gal) of low-heat producing hardened material.

  The high-heat waste will be sluiced from Tank 241-C-106 to a DST through a double-encased (pipe-in-pipe design), bermed line. The system will be a closed loop, continuous sluicing process. The scope of the project is to remove 75 percent, at a minimum, of the high-heat waste. Sluicing of underground storage tanks involves introducing a high-volume, low-pressure stream of liquid to mobilize underground storage tank sludge waste before pumping the tank contents. Impacts associated with this action are potential worker exposure concerns.

- **Disposal of decommissioned, defueled cruiser, Los Angeles Class, and Ohio Class naval reactor plants:** This final EIS, prepared by the U.S. Navy, evaluates the potential impacts of disposing of approximately 100 defueled reactor plants from decommissioned naval vessels (Navy 1996a). The ROD was published in the *Federal Register* on August 9, 1996 (Navy 1996b). The selected alternative is to dismantle the vessels at the Puget Sound Navel Shipyard and transport the reactor plants, by barge, to the low-level burial grounds at the Hanford Site. The DOE was a cooperating agency in the preparation of this EIS.

- **Plutonium-Uranium Extraction Plant (PUREX)/Uranium Trioxide Plant shutdown:** In 1993, the DOE directed Westinghouse Hanford Company to terminate operations at the PUREX Plant and provided guidance to proceed with shutdown planning and terminal clean-out activities. This direction also covered the Uranium Trioxide Plant at completion of the pending shutdown campaign. An EA addressing transfer of the irradiated fuel from PUREX and the N Reactor irradiated fuel for storage at the 105-KE and 105-KW Fuel Storage Basins was prepared (DOE 1995) and a FONSI was approved on July 12, 1995. The FONSI identified that unprocessed irradiated fuel would be transported from the PUREX plant and the 105-N Reactor to the 105-KE and 105-KW fuel storage basins in the 100 K Area; the fuel would be placed in storage at the K Basins and eventually would be dispositioned in the same manner as the other existing irradiated fuel inventory stored in the K Basins. A maximum of three railcar shipments of fuel would be made; two fuel shipments from the PUREX Plant and one from the N Reactor would be shipped to the K basins, unloaded, and stored with the existing fuel. The PUREX fuel removal action has been completed. The 100-N Basin cleanout is ongoing and is estimated to be completed in 1998.

These activities are consistent with the Industrial-Exclusive designation for the 200 Areas under all alternatives.

E.1.5 Other Hanford Areas

Present and reasonably foreseeable actions in other Hanford areas include the following:

- **Construction and operation of a Laser Interferometer Gravitational-Wave Observatory (LIGO) on the Hanford Site:** An EA was prepared by the National Science Foundation for construction and operation of a LIGO (NSF 1993), and a FONSI was issued in December 1993. The LIGO site occupies approximately 6 km^2 (2.3 mi^2), including a support facility at the vertex of two 4-km (2.5-mi) arms, mid- and end-station buildings along the arms, service roads, parking areas and construction laydown areas. Service roads, running the length of the 4-km (2.5-mi) arms, fragment habitat that exists at the site. The facility will accommodate 10 to 20 permanent staff, with an additional 10 visiting scientists. The LIGO is currently operating.

  The LIGO is located in an area designated for Research and Development in the Preferred Alternative and Alternatives Two and Three, and Conservation in Alternatives One and Four. The LIGO represents a use that is consistent with Research and Development and Industrial use designations.

- **Environmental Molecular Sciences Laboratory (EMSL).** A FONSI for the EMSL EA (DOE 1990b) was issued in 1992. The EMSL would consist of an 18,500-m^2 (200,000-ft^2) building originally proposed for siting on a 12-ha (30-ac) site located near the Columbia River, in the southeast portion of the Hanford Site. On the second day of construction, April 12, 1994, construction crews uncovered human remains thought to be those of American Indians. The DOE immediately halted construction and proposed, consistent with the wishes of local American Indian tribes and with the spirit of the *Native American Graves Protection and Repatriation Act of 1990* and the *American Indian Religious Freedom Act of 1978*, to relocate the site of the facility. Another EA was prepared to address re-siting the facility (DOE 1994c) in the south part of the 300 Area; the FONSI was approved in July 1994. Construction of the facility was recently completed at the new site. Approximately 200 to 250 employees are located at the EMSL, including permanent staff and visiting scientists.

  The EMSL is within an area designated for Industrial development under all alternatives. The EMSL represents a use pattern that is consistent with this designation.

- **Inert/Demolition Waste Landfill (Pit 9):** An EA was prepared for the proposal to construct a waste landfill (Pit 9) to accommodate inert and demolition waste for the Hanford Site (DOE 1995g). The DOE identified a need for convenient and economic disposal capacity of these types of waste to support the decommissioning activities planned for the southern areas of the Hanford Site. The current demolition waste landfill, Pit 10, located approximately 25 m (82 ft) west of Route 4S, reached full capacity in 1995. The projected decommissioning activities on the Hanford Site will continue for up to 20 years; therefore, a replacement demolition landfill is required in the near-term. The DOE proposed to use an existing alluvial gravel pit -- Pit 9 -- as a new inert and demolition waste landfill for the Hanford Site. Pit 9 is located approximately 3 km (1.9 mi) north of the 300 Area, in the 600 Area. Based on current disposal projections, Pit 9 will be available for inert waste for 20 years. The FONSI for this action was approved May 15, 1995, and Pit 9 has been open and operational since approximately July 1995. Impacts associated with this action include minor habitat disturbances.

Pit 9 is located within an area that is designated for Conservation under the Preferred Alternative and Alternative Three, and this activity is consistent with this designation. However, Alternatives One, Two, and Four designate the location of Pit 9 for Preservation, which is not consistent with the current use of Pit 9 as an inert/demolition waste landfill.

- **Fast Flux Test Facility Standby:** The DOE has prepared an EA (DOE 1995) addressing shutdown of the FFTF. The action will place the FFTF in a condition suitable for a long-term surveillance and maintenance phase before final decommissioning.

  The FONSI was issued on May 1, 1995. The actions for permanently shutting down the FFTF include the following:

  - Removing the fuel, draining and de-energizing the systems, removing the stored radioactive and hazardous materials, and performing other actions to place the facility in a radiologically and industrially safe shutdown state.

  - Performing appropriate surveillance and maintenance to prevent unacceptable risks to persons or to the environment.

  - Defueling the reactor core to the Interim Decay Storage and the Fuel Storage Facility by use of standard FFTF refueling equipment and operating procedures. The fuel will be replaced with irradiated nonfuel core components: 13 new nonfuel core components, and 3 new simulated core assemblies that otherwise would have been excessed.

  - Appropriately dispositioning two fuel assemblies that experienced a breach in the fuel cladding during irradiation, several fuel assemblies that are known gas leakers, and seven sodium-bonded metal fuel assemblies, as well as sodium-bonded pins that will require slightly different disposition.
  - Maintaining the metallic sodium in a molten state until the fuel assemblies can be removed from their respective storage locations and transferred to appropriate storage.

  - Performing an appropriate excess evaluation of the bulk metallic sodium inventory to determine if alternative sponsors and/or uses are available.

  - Maintaining the residual sodium in the main portion of the FFTF piping and

- equipment in an inert gas atmosphere to prevent chemical reactions during long-term surveillance and maintenance.

- Packaging the solid and liquid effluents from the shutdown activities that contain radioactive and/or hazardous materials, giving primary consideration to transportation of waste to existing Hanford Site treatment, storage, and disposal (TSD) units. Offsite TSD units also will be considered, as appropriate.

Although the FFTF was shut down as scheduled, certain deactivation activities have been put on hold while the DOE evaluates a proposal made by a consortium of private companies to operate the FFTF for the production of medical isotopes, and tritium for use in nuclear weapons.

E.2 Other Potential Hanford Site Actions

A number of other proposed actions at the Hanford Site are likely to be proposed and evaluated in the future. Impacts of these projects cannot be considered in this analysis, because impact analyses are not complete and decisions regarding implementation of a preferred action have not been made. These projects may contribute to cumulative future impacts considered in the HRA-EIS. No additional actions that may affect cumulative impacts associated with the Columbia River are proposed. However, actions in other Hanford areas may have indirect effects on the river.

E.2.1 200 Areas

Actions that may contribute to cumulative impacts in the 200 Areas include the following.

- **Hanford Solid Waste EIS:** The DOE is considering preparation of an EIS to evaluate alternatives for management of radioactive and hazardous wastes generated at the Hanford Site or received at Hanford from offsite generators. The specific waste types to be considered in the analysis include: low-level radioactive waste, mixed low-level radioactive and hazardous waste, transuranic radioactive and mixed waste, hazardous waste, and contaminated equipment and materials for reuse, recycle, or disposal. The EIS would update NEPA analyses addressing ongoing activities, implement associated waste management programmatic RODs, and facilitate site- and program-specific decisions on the future operation of Hanford TSD facilities.

These activities are consistent with the Industrial-Exclusive land-use designation proposed for the 200 Areas under all alternatives.

E.2.2 Other Hanford Areas

Other actions that may contribute to cumulative impacts in other Hanford Site areas, including surplus plutonium disposition, include an EIS DOE is preparing on the disposition of the United States inventory of weapons useable surplus plutonium (62 FR 28009). The EIS will examine reasonable alternatives and potential environmental impacts for the proposed siting, construction, and operation of three types of facilities for plutonium disposition. The first is a facility to disassemble and convert pits (a nuclear weapons component) into plutonium oxide suitable for disposition. The facility would be located at either the Hanford Site, INEEL, Pantex Plant, or Savannah River Site (SRS). The second is a facility to immobilize surplus plutonium in a glass or ceramic form for disposition in a geologic repository pursuant to the Nuclear Waste Policy Act. The second facility will be located at either the Hanford Site or the SRS and will include a collocated capability to convert nonpit plutonium materials into a form suitable for immobilization. The EIS will discuss various technologies for immobilization. The third type of facility would fabricate mixed oxide (MOX) nuclear fuel from plutonium oxide. The MOX fuel fabrication facility would be located at either the Hanford Site, INEEL, Pantex Plant, or SRS. Hanford facilities in the 400 Area are under consideration for each of these three types of facilities.

Additional potential activities that could be undertaken in other Hanford areas include potential Hanford Site missions associated with the *Tritium Supply and Recycling Programmatic Environmental Impact Statement* (60 FR 55021) and potential activities related to disposition of weapons-useable fissile materials (such as mixed oxide fuel fabrication in the 300 Area).

These activities would be consistent with land-use designations in these areas.

E.3 Present and Reasonably Foreseeable Actions Adjacent to the Hanford Site

No major actions have been identified outside the Hanford Site boundary that would significantly contribute to environmental impacts of the proposed action. The Siemens Power Corporation currently operates six wastewater lagoons to dispose of approximately 95,000 kg/day (25,000 gal/day) of effluent containing fluoride, nitrates, and minor amounts of radionuclides. This discharge is not considered during the analysis of cumulative environmental impacts, however, because the facility recently initiated a program to switch to a dry manufacturing system that will eliminate the waste stream. Siemens will complete conversion to the dry manufacturing system by 1998 and will phase out the use of lagoons completely by the year 2004 (TCH 1996b).

In 1996, DOE prepared an EA to address the transport of up to 5,120 m^3 (6,696 yd^3) of contact-handled low-level mixed waste from the Hanford Site to the Allied Technology Group (ATG) private gasification and vitrification building in Richland, WA for treatment (DOE-RL 1996). Treated waste would be returned to the Hanford Site for disposal. The waste would be staged to the ATG facility over a 10-year period. The building is on a 18.2 ha (45 ac) ATG site adjacent to ATG's licensed low-level waste processing facility approximately 0.3 km (0.2 mi) south of the 300 Area. The action by ATG is being undertaken as a private action in anticipation of future work for a variety of contracts, including DOE. The ATG facility is located adjacent to the Hanford Site boundary in an industrial area in the City of Richland. Effects of construction and overall operation have been evaluated in an EIS under the SEPA which was issued on February 23, 1998.

City and county planning officials were consulted to assess other potential actions outside the Hanford Site boundary. The actions identified are primarily road, bridge, and sewer system improvements that are likely to have only minor impacts themselves and are limited compared to the large scale of actions associated with the proposed future land-use objectives. Ongoing economic and residential development in the region could contribute to cumulative socioeconomic impacts. However, as discussed in Chapter 5, there is considerable uncertainty associated with any analysis of such impacts, given available information on the scheduling of potential actions at the Hanford Site.

Land-use planning efforts for areas outside of and surrounding the Hanford Site are currently being undertaken by Benton, Franklin, and Grant counties; and by the City of Richland. These planning efforts will establish land uses that will be permitted by local governments in areas surrounding the Hanford Site. The City of Richland prepared a EIS under SEPA, finalized on August 27, 1997, that identified an urban growth area involving Hanford Site land in the vicinity of the 300 Area. A similar area, of varying size, is identified for Industrial use under all alternatives. The City of Richland's Comprehensive Plan is consistent with current and proposed future land uses at Hanford and DOE missions.

This page intentionally left blank.

THIS PAGE INTENTIONALLY
LEFT BLANK