DOE/RL-2001-22
Rev. 0

Mitigation Action Plan for the 100 and 600 Areas of the Hanford Site

United States
Department of Energy

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P.O. Box 550, Richland, Washington 99352

EXECUTIVE SUMMARY

An Interim Record of Decision (ROD) was issued in 1995 by the U.S. Environmental Protection Agency for remediation of waste sites in the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units in the 100 Areas of the Hanford Site (EPA 1995). An additional 34 waste sites in the 100 Areas were added to the 1995 ROD in a 1997 Amendment (EPA 1997). Three separate interim RODs were later developed to address 209 remaining sites in 13 operable units and an additional 89 sites in the 100-N Area of the Hanford Site (EPA 1999, 2000a, 2000b). These RODs established interim remedial actions for contaminated soil, structures, and debris where remediation is needed to protect human health and the environment. Additional sites may be discovered in the future and will be addressed for remedial action under the current RODs. Activities planned in the RODs were designed to remediate releases of hazardous substances and to minimize impacts to presently undisturbed areas of recovering vegetation. Additionally, the 100-N Area Ancillary Facilities Action Memorandum (Ecology et al. 1999) addresses the decontamination and decommissioning of miscellaneous structures within the 100-N Area. This mitigation action plan (MAP) replaces the *Mitigation Action Plan for Liquid Waste Sites in the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units* (DOE-RL 1996b), previously written to address liquid waste sites in the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units.

As a requirement under the U.S. Department of Energy's "National Environmental Policy Act Implementing Procedures; Mitigation Action Plans" (10 *Code of Federal Regulations* 1021.331), this MAP is designed to address mitigation commitments expressed in the RODs. This MAP explains how the corresponding mitigation measures, designed to mitigate adverse environmental impacts associated with the course of action directed by a ROD, will be planned and implemented. The intent of a mitigation action is to "render the impacts of the proposed action not significant."

This MAP explains how mitigation measures for the remedial activities planned for the 100 and 600 Area operable units will be planned and implemented. The MAP presents a procedure for limiting disturbances and identifies opportunities for revegetating disturbed sites. This MAP was written to be consistent with guidance provided by the Washington State Department of Fish and

Wildlife and the U.S. Army Corps of Engineers (WDFW 1992, USACE 1991), as well as other MAPs and documents written for Hanford Site projects (DOE-RL 1996a, 1996b, 1998, 2000a, 2000b).

Input from the Natural Resource Trustee Council and participating Tribal Nations has been applied in the development of this MAP to help minimize impacts to natural and cultural resources from project activities and to restore the remediated sites to an appropriate level of habitat.

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1.0 PROJECT DESCRIPTION

1.1 PURPOSE AND SCOPE

This mitigation action plan (MAP) addresses a requirement for the remediation of 100 Area and 600 Area waste sites, and explains how mitigation measures for these remediation activities will be planned and implemented. Remediation of waste sites includes the removal, treatment, and disposal of contaminated soil, structure, and debris in the 100 and 600 Areas of the Hanford Site. Remediated sites will undergo the mitigation procedures described in this MAP. Two documents that are integral to the application of this document are the *Hanford Site Biological Resources Management Plan* (BRMaP) (DOE-RL 2000a) and the *Revegetation Manual for the Environmental Restoration Contractor* (McLendon and Redente 1997). "Mitigation" is defined in the Council on Environmental Quality regulations implementing the *National Environmental Policy Act of 1969* process in Part 40, *Code of Federal Regulations* (CFR), Section 1508.20, as including one or more of the following actions:

- *Avoiding* an impact by not taking a certain action or parts of an action
- *Minimizing* an impact by limiting the degree or magnitude of the action and its implementation
- *Rectifying* an impact by repairing, rehabilitating, or restoring the affected environment
- *Reducing or eliminating* an impact over time by preservation and maintenance operations during the life of the action
- *Compensating* for an impact by replacing or providing substitute resources or environments.

This MAP, developed in agreement with the BRMaP (DOE-RL 2000a) and the *Revegetation Manual for the Environmental Restoration Contractor* (McLendon and Redente 1997), presents a procedure for limiting disturbances during the remedial action projects and identifies opportunities for revegetating previously disturbed sites. It also presents a procedure for minimizing impacts to natural and cultural resources from the excavation and use of borrow sites. Expansion of active borrow sites or excavation of new borrow sites will be required to meet all applicable regulations and permit requirements under the *Industrial Mineral Resources Management Plan* (DOE-RL 2001b). The *Industrial Mineral Resources Management Plan* also provides guidance for the revegetation of closed borrow sites.

1.2 SITE DESCRIPTIONS

Waste sites addressed in this document are located in the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, 100-NR-1, and 100-NR-2, Operable Units (Figure 1). The 100 Area is located along the southern shore of the Columbia River on the north end of the Hanford Site. The 600 Area encompasses land between other designated areas such as the 100, 200, and 400 Areas. Site descriptions, including site history, principal contaminants, and projected excavation area or volume, are listed in the appropriate interim ROD for each of the operable units. The referenced interim ROD for each operable unit is listed in Table 1.

The selected remedy for sites to be remediated is to remove, treat as appropriate, and dispose of the waste. The remove, treat, and dispose approach is applied to sites that require remedial action due to unacceptable risk to human health and the environment. The approach includes removal of contaminated soil, structure, and debris; treatment of the waste to meet acceptance criteria of the Environmental Restoration Disposal Facility; disposal of the contaminated material at the Environmental Restoration Disposal Facility; backfill of the excavation; and revegetation of the site.

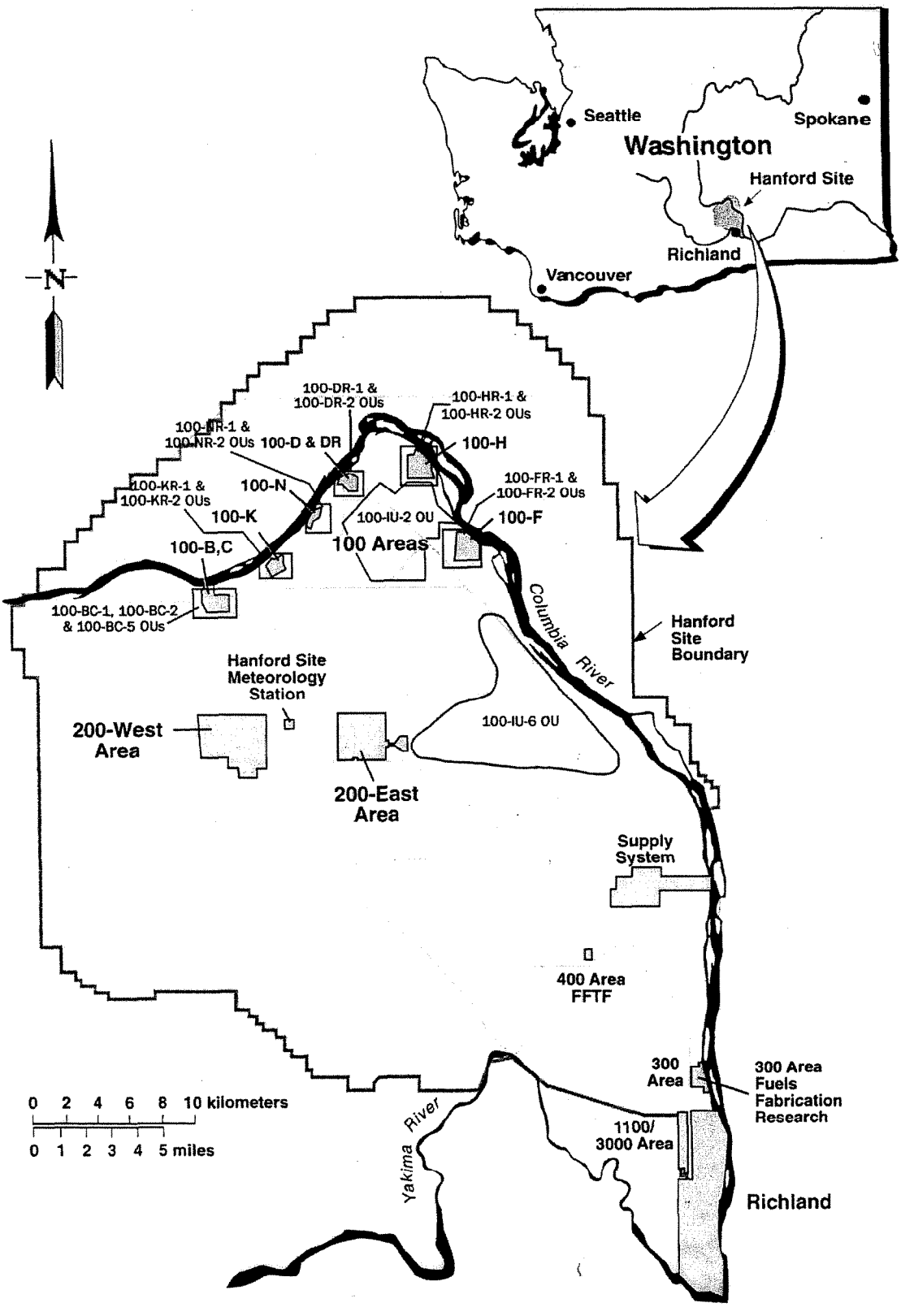
Other sites that may require mitigation at the completion of remedial action activities are the layback, support, and staging areas. Prior to the construction of these support areas, ecological and cultural resource reviews are conducted to determine if the proposed activities in these areas will impact natural or cultural resources. When impacts to ecological resources are unavoidable, the support areas used for office trailers, queues, and layback areas are constructed in areas of least impact. Additional mitigation for impacts to natural resources in these areas is required if a threshold criterion for area of disturbance or habitat value is met. Threshold criteria for mitigation, including area of disturbance and habitat quality, are described in the BRMaP (DOE-RL 2000a). The duration of the impact is also taken into account when selecting the appropriate mitigation.

2.0 CULTURAL AND NATURAL RESOURCES

2.1 CULTURAL RESOURCES

The Columbia River has a long and varied history of use by humans. As a result, archaeological sites, human burials, traditional-use areas, and historic buildings exist in the area. Numerous types of cultural resources on the Hanford Site may be affected by projects. Cultural resources may be identified as prehistoric (before written language) sites, Traditional Cultural Properties, historic sites, or natural resources associated with the cultural landscape. Prehistoric sites may include Native American campsites, pithouses, burial locations, lithic scatters, fishing locations, caches, trails, or rock cairns. Traditional Cultural Properties represent locations significant to a community's beliefs, customs, and practices. There are several Traditional Cultural Properties on the Hanford Site, including Gable and Rattlesnake Mountains.

Figure 1. Hanford Site and Operable Units.



Note: Undesignated areas are part of the 600 Area.

Table 1. Record of Decision References for Operable Unit Waste Site Remediation.

Operable Unit	Appropriate ROD Reference
Radioactive Liquid Waste Sites 100-BC-1, 100-DR-1, 100-HR-1	EPA 1995
Radioactive Liquid Waste Sites 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-KR-1, 100-KR-2	EPA 1997 (amendment to EPA 1995)
Remaining Sites 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6	EPA 1999
Source Waste Sites 100-NR-1 and 100-NR-2 100-NR-1	 EPA 2000a EPA 2000b

Historic sites may include buildings, farmsteads and associated features, ferry locations, railroads lines, irrigation canals, roads, disposal locations, equipment, or towns. Landscapes and their associated natural resources are also culturally significant. In this context, the term landscape refers to a cultural landscape that reflects the physical, biological, and cultural character of the people whose activities or occupancy shaped it. For ease of discussion, natural resources will be discussed separately in this document, taking into account the cultural significance.

Before remedial action work is performed at the sites addressed in this plan, cultural resource reviews will be conducted to determine whether a potential exists for encountering cultural materials, artifacts, or historical properties. Any area within 400 m (0.25 mi) of the Columbia River that has not been extensively disturbed has a high probability of containing significant cultural resources. Protection of these sites is required by federal law. The *National Historic Preservation Act of 1966* (16 U.S.C. 470, et seq.) provides for the preservation of historical and archeological data (including artifacts) that might be irreparably lost or destroyed as the result of a proposed action. The "Native American Graves Protection and Repatriation Act of 1990" (43 CFR 10) requires agencies to consult and notify culturally affiliated tribes when Native American human remains are inadvertently discovered during project activities. If human remains were to be encountered, the procedures documented in the *Hanford Cultural Resource Management Plan* (DOE-RL 2001a) would be followed.

Because of the extensive disturbance resulting from past activity at the waste sites, it is unlikely that archaeological remains possessing archaeological integrity will be found in the footprint of the sites addressed in this document. It is possible, however, that archaeological or human remains disturbed during the original construction are located within the original excavation footprint. It is also possible that old or new construction has impacted or may impact the landscape and need to be mitigated.

Maintenance of landscape continuity and aesthetic integrity is a mission of the Cultural Resources Program at the Hanford Site. Continuing and new uses of the Hanford Site should be

managed in a manner such that the natural landscape is retained to the fullest extent possible to preserve and promote aesthetic, cultural, historic, and visual values. The character-defining visual and spatial relationships of the landscape should be preserved by minimizing the number and intensity of visual and audible intrusions.

2.2 NATURAL RESOURCES

Habitat types and species composition on the Hanford Site are well characterized. Some of the documents describing habitats applicable to this MAP include the following:

- *Fiscal Year 1991 100 Areas CERCLA Ecological Investigation*s (Sackschewsky and Landeen 1992)
- *Biological Assessment for Rare and Endangered Plant Species Related to CERCLA Characterization Activities* (Sackschewsky 1992)
- *Habitat Types on the Hanford Site: Wildlife and Plant Species of Concern* (Downs et al. 1993)
- *Vegetation Communities Associated with the 100 Area and the 200 Area Facilities on the Hanford Site* (Stegen 1993)
- *Threatened and Endangered Wildlife Species of the Hanford Site Related to CERCLA Characterization Activities* (Fitzner et al. 1994).

In addition to the historical characterization data in these reports, ecological surveys are routinely conducted on a site-by-site basis prior to the commencement of all project activities. Ecological surveys identify any current species or habitats of concern that may require mitigation.

Before the 100 Area reactor facilities were constructed, much of the land along the Columbia River was used for agricultural production. Prior to farming, the area is assumed to have been a mixture of shrub-steppe and grasslands, dominated by sagebrush (*Artemisia tridentata*) and Sandberg's bluegrass (*Poa sandbergii*) (Tisdale 1994, Shelford 1974). The current vegetation composition status for most of the waste sites to be remediated and their associated staging areas can be estimated from vegetation maps and other documentation, including annual reports and ecological reviews. The vegetative status of the 100 Area operable units varies from nonvegetated areas such as inside the 100-K Area perimeter fence to gray rabbitbrush (*Chrysothamnus nauseosus*)/Sandberg's bluegrass at the 100-F Area. Many waste sites contain low-quality communities of cheatgrass/Russian thistle (*Bromus tectorum/Salsola kali).* The soils at most of these sites consist of rocky backfill from site stabilization. Some nonvegetated sites have been kept free of plants through the use of herbicides to prevent biotic intrusion of plant roots and subsequent uptake of radionuclides.

The vegetative status of the 600 Area of the Hanford Site ranges from completely nonvegetated to vegetation with high-quality late successional species, such as native bunchgrasses and

sagebrush. High-quality shrub-steppe habitat has been declared as priority habitat by the Washington Department of Fish and Wildlife. Waste site remediation in the 600 Area would be unlikely to impact high-quality habitat, as most of the sites consist of previously disturbed soils with early successional plants.

Highly disturbed and more recently disturbed sites are unlikely to consist of high-quality vegetation. The majority of the waste sites addressed in this MAP are either devoid of vegetation or consist of sparse, low-quality vegetation. Dominant vegetation in these areas typically includes cheatgrass, Sandberg's bluegrass, rabbitbrush, Russian thistle, and tumblemustard (*Sisymbrium altissimum*). The areas surrounding or adjacent to these waste sites, however, may consist of small shrubs (e.g., rabbitbrush, sagebrush, and snow buckwheat [*Eriogonum niveum*]).

Habitat types, including those that are considered rare or sensitive, are described in the BRMaP (DOE-RL 2000a). To address resource "value," four levels (I through IV) of management concern have been established for biological resources. The four levels are described below.

Level I biological resources are those with recreational, commercial, or ecological status (such as introduced species) that do not qualify for focused management attention, but require some element of monitoring.

Level II biological resources are those requiring consideration of potential adverse impacts and compliance with procedural and substantive laws such as the *National Environmental Policy Act of 1969* (42 U.S.C. 4321, et seq.), the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) (42 U.S.C. 9601, et seq.), and the *Migratory Bird Treaty Act* (16 U.S.C. 703, et seq.). Examples of Level II resources include migratory birds and plant communities ranging from cheatgrass-dominated to recovering shrub areas.

Level III biological resources include state-listed species or those that have the potential for federal or state listing; unique or significant plant, fish, or wildlife species; or areas that have specific ecological sensitivity. Examples of Level III biological resources include mature stands of shrub-steppe habitat and wetlands. Impacts to these resources should be avoided or minimized; however, when impacts are above a specified threshold, mitigation by rectification or compensation is required.

Level IV biological resources include federally protected species or habitats of high quality and/or rarity that often require consultation with other federal agencies to establish mitigation strategies and the threshold level for compensatory mitigation. Examples of Level IV resources include the bald eagle (*Haliaeetus leucocephalus*), steelhead trout (*Oncorhynchus mykiss*), and Chinook salmon (*Oncorhynchus tshawytscha*). Element occurrences, as defined by the Washington Natural Heritage Program, are entire ecological systems, such as a plant community or wetland ecosystems, that include the common plant and animals of that system and the necessary components of a system of natural areas (WDNR 1995). Element occurrences are identified as Level IV resources. Rare and pristine plant communities that are of high quality indicating little or no human impact are also identified as Level IV resources. These resources are federally protected or have regional or national significance and therefore must be preserved.

Six administrative designations under the BRMaP (DOE-RL 2000a) that require mitigation for any impacts from remedial actions are as follows:

- Areas containing rare plant communities (element occurrences)
- The Columbia River Corridor
- Mitigation/restoration areas
- Collection/propagation areas for native plant materials
- Lands used under permit/leased lands
- Species of concern administrative control areas (i.e., bald eagle buffer zone, fall Chinook salmon spawning locations, plant species of concern populations [Levels III and IV]).

While impacts to these habitats are not anticipated from remedial actions, mitigation for impacts to these habitats is required.

The Hanford Reach, which flows through the Hanford Site, represents the last free-flowing stretch of the Columbia River upriver of Bonneville Dam. As such, it contains many characteristics that are unique to this stretch of river, including gravel bars, free-flowing riffles, and backwater sloughs that provide valuable habitat for a number of species. The Hanford Reach serves as an important spawning ground and/or migratory corridor for species of concern, such as steelhead trout and spring-run Chinook salmon, which are listed as federally endangered. Life histories, identification of potential impacts to, and guidelines to protect these species are described in the *U.S. Department of Energy Hanford Site Threatened and Endangered Species Management Plan, Salmon and Steelhead* (DOE-RL 2000c).

The presence of riparian and wetland areas on the Hanford Site and along the Columbia River is important because of the increased habitat diversity they provide. Washington State populations of the state-endangered plant species Columbia yellowcress (*Rorippa columbiae*) occur in scattered locations along the Columbia River shoreline. Other riparian vegetation along the Hanford Reach is important, as it provides forage, cover, and breeding habitat for a variety of resident and migratory birds, and for waterfowl. Canada geese (*Branta canadensis*) and other waterfowl use the river, its islands, and the associated riparian corridor for portions of their life cycles. The bald eagles roost and forage along the Columbia River shoreline during the winter months, with nesting attempts made in recent years.

The Hanford Site hosts a number of species that have been designated as species of concern by the state and/or federal government (Table 2). These designations may be as a state or federal threatened, endangered, or candidate species as defined by the *Endangered Species Act of 1973* for federally listed species, or by the Washington Department of Natural Resources and the Washington Department of Fish and Wildlife for state-listed species. The designations are periodically updated by the respective agencies. Current listings for priority habitats and species are generated by the Washington Department of Natural Resources[1] and the Washington Department of Fish and Wildlife[2] and are available on the World Wide Web. Categorical definitions for species listings are defined in the BRMaP (DOE-RL 2000a).

Table 2. Endangered, Threatened, and Candidate Species That Have Been Observed on the Hanford Site. (2 Pages)

Common Name	Habitat	Federal Status	State Status
Birds			
Aleutian Canada Goose[a]	Riverine	Endangered	Endangered
American white pelican	Riverine	--	Endangered
Bald eagle	Riverine	Threatened	Threatened
Black tern[a]	Riverine	Former candidate 2	Monitor
Burrowing owl	Shrub-steppe	Former candidate 2	Candidate
Common loon	Riverine	--	Candidate
Ferruginous hawk	Shrub-steppe	Former candidate 2	Threatened
Flammulated owl[a]	Shrub-steppe	--	Candidate
Golden eagle	Shrub-steppe	--	Candidate
Lewis woodpecker[a]	Riparian/shrub-steppe	--	Candidate
Loggerhead shrike	Shrub-steppe	Former candidate 2	Candidate
Long-billed curlew	Shrub-steppe	Former candidate 3	Monitor
Northern goshawk[a]	Shrub-steppe	Former candidate 2	Candidate
Peregrine falcon[a]	Riparian/shrub-steppe	Endangered	Endangered
Sage sparrow	Shrub-steppe	--	Candidate
Sage thrasher	Shrub-steppe	--	Candidate
Sandhill crane	Riparian/riverine	--	Endangered
Swainson's hawk	Shrub-steppe	Former candidate 3	Candidate
Trumpeter swan[a]	Riverine	Former candidate 2	--
Western bluebird[a]	Riparian/shrub-steppe	--	Candidate

[1] Updated species list are available at the Washington Department of Natural Resources Web site: http://www.wa.gov/dnr/htdocs/fr/nhp/refdesk/fsrefix.htm
[2] Updated state-listed species are listed at the Washington Department of Fish and Wildlife Web site: http://www.wa.gov:80/wdfw/hab/phslist.htm

Table 2. Endangered, Threatened, and Candidate Species That Have Been Observed on the Hanford Site. (2 Pages)

Common Name	Habitat	Federal Status	State Status
Western sage grouse	Shrub-steppe	Former candidate 2	Candidate
Fishes			
Upper Columbia River steelhead	Aquatic	Endangered	Candidate
Upper Columbia River Spring Chinook salmon	Aquatic	Endangered	Candidate
Bull trout[a]	Aquatic	Threatened	Candidate
Mollusks			
Columbia pebblesnail	Riverine	Former candidate 2	Candidate
Shortface lanx	Riverine	Former candidate 2	Candidate
Mammals			
Merriam's shrew	Shrub-steppe	--	Candidate
Pygmy rabbit	Shrub-steppe	Former candidate 2	Endangered
Small-footed myotis	Shrub-steppe/buildings	Former candidate 2	--
Yuma myotis	Shrub-steppe/buildings	Former candidate 2	--
Plants			
Columbia River milkvetch	Shrub-steppe	Former candidate 1	Threatened
Columbia yellowcress	Riverine	Former candidate 2	Threatened
Dwarf evening-primrose	Shrub-steppe	--	Threatened
Hoover's desert parsley	Shrub-steppe	--	Threatened
Loeflingia	Shrub-steppe	--	Threatened
Northern wormwood	Riverine	--	Endangered
Umtanum desert buckwheat	Shrub-steppe	--	Endangered
White Bluffs bladderpod	Shrub-steppe	--	Endangered
White eatonella	Shrub-steppe	--	Threatened
Reptiles			
Northern sagebrush lizard	Shrub-steppe	Former candidate 2	--
Striped whipsnake	Shrub-steppe	--	Candidate

[a]Species that when observed at the Hanford Site are considered accidental.

3.0 POTENTIAL IMPACTS

3.1 POTENTIAL IMPACTS TO CULTURAL RESOURCES

Potential impacts to cultural resources may include the inadvertent discovery of artifacts, remains, or cultural materials; impacts to Traditional Cultural Properties; or impacts to historic sites. The most likely impact to cultural resources would be inadvertent discovery of prehistoric sites and artifacts including Native American campsites, pithouses, burial locations, lithic scatters, fishing locations, caches, trails, or rock cairns. Historic sites and materials including farmsteads and associated features, railroad lines, irrigation canals, disposal locations, and equipment may also be encountered. Traditional Cultural Properties and historic sites are described in Section 2.1. Alterations to the natural aesthetics of the landscape, such as the construction of roads or installation of monitoring equipment, may also constitute a cultural impact. A separate plan is being drafted to address landscape issues.

3.2 POTENTIAL IMPACTS TO NATURAL RESOURCES

Restoration activities have the potential to impact sensitive or rare habitats (as defined in the BRMaP [DOE-RL 2000a]) on the Hanford Site. Impacts to natural resources can occur from the removal of late-successional native or recovering vegetation through the excavation and remediation of waste sites, from the use of borrow sites as a source of backfill material, or from the disruption of feeding and nesting activities of sensitive animals. Additional impacts might include direct mortality of biological resources of concern, habitat loss, nest/den/spawning habitat destruction, disturbance during sensitive periods (e.g., nesting or migration), or exposure to toxic substances.

Not all biological resources are considered mitigable resources at the Hanford Site. For projects that do not exceed the thresholds for rectification or compensation as defined by BRMaP (DOE-RL 2000a), mitigation actions will be discussed in the project planning document or site-specific ecological resource reviews as opposed to a MAP. Avoidance and minimization mitigation for low-quality invasive plant species on highly disturbed sites or nonvegetated areas will be employed only as necessary to reduce impacts to site-specific resources such as nesting birds.

Impacts to vegetation in and around borrow pits may be incurred if borrow pits are used after a period of vegetation recovery, or if they are expanded. Expansion of borrow pits is discouraged from encroaching on high-quality habitat. The *Industrial Mineral Resources Management Plan* (DOE-RL 2001b [in print]) establishes criteria for use, expansion, and restoration of borrow sites, and states that before new sites are selected or existing sites are expanded, consideration must be given to the value of the habitat that will be lost and the potential for site restoration. The potential to encounter sensitive species also exists in borrow pits, as two species, Piper's daisy (*Erigeron piperianus*) and dwarf-desert primrose (*Camissonia pygmaea*), have been known to colonize gravelly substrates such as those present in the borrow areas.

Impacts to wildlife may include the disruption of nesting of migratory birds or protected species, such as the long-billed curlew (*Numenius americanus*) or bald eagle, loss of habitat of any species of concern, or activities that have the potential to significantly affect endangered or threatened species. Protective measures for migratory birds and state- or federally-listed species are mandated by the *Migratory Bird Treaty Act* (16 U.S.C. 703) and the *Endangered Species Act* (16 U.S.C. 1531), respectively. Management strategies for these species are provided in the *Hanford Site Bald Eagle Site Management Plan* (Fitzner and Weiss 1994), the BRMaP (DOE-RL 2000a), and the *Hanford Site Biological Resources Mitigation Strategy Plan* (DOE-RL 1996a).

The Hanford Site document *U.S. Department of Energy Threatened and Endangered Species Management Plan, Salmon and Steelhead* (DOE-RL 2000c) identifies typical activities being conducted on the Hanford Site and analyzes the potential threats to spring-run Chinook salmon and steelhead and their habitats. The activities analyzed include water withdrawal, permitted wastewater discharges, groundwater monitoring near the shoreline, groundwater treatment activities conducted near the shoreline, ecological or cultural research and monitoring programs conducted on the river or shoreline, and waste site remediation and decommissioning activities. Potential effects of these activities include shoreline and aquatic habitat exposure from water withdrawal, toxicity of wastewater discharges, shoreline and riverbed modifications that affect siltation of habitat, siltation from surface runoff, toxic modification of groundwater plumes, and harassment of aquatic species by shoreline and river activities.

4.0 GOALS AND OBJECTIVES OF MITIGATION

Mitigation refers to a series of prioritized actions designed to minimize or lessen potential project impacts on cultural or natural resources. The first choice of mitigation is to avoid an impact entirely; for instance, a project can be moved away from ecologically or culturally sensitive habitat. Mitigation may also involve minimizing the impact, rectifying the impact after the project has taken place, reducing or eliminating the impact over time, and/or compensating for impacts. Mitigation measures for biological resources are intended to meet the trust responsibilities of the U.S. Department of Energy, Richland Operations Office under the *National Environmental Policy Act of 1969* (42 U.S.C. 4321, et seq.) and CERCLA (42 U.S.C. 9601, et seq.).

One of the goals of site restoration is to have the remediated waste sites and the sites disturbed during the remedial activities eventually return to a shrub-steppe community with a minimum of non-native species (DOE-RL 2000a). Mitigation of adverse impacts to biological resources via rectification and/or compensation is intended to ensure that there is no net loss of biological resources of concern on the Hanford Site (DOE-RL 2000a). The objectives of the program are to remediate waste sites while keeping short-term impacts to ecological resources to the absolute minimum and to reestablish functional plant communities that resemble the former native communities or the surrounding habitat.

5.0 DESCRIPTION OF MITIGATION MEASURES

5.1 DESCRIPTION OF RECTIFICATION/COMPENSATION

Mitigation actions will be taken to avoid or minimize the impacts to natural and cultural resources during remedial actions. Mitigation for unavoidable impacts to high-quality habitats and species, such as undisturbed or colonized sagebrush areas, may require some form of compensatory mitigation. When these resources are impacted, guidance in the BRMaP (DOE-RL 2000a) and the *Hanford Site Biological Resources Mitigation Strategy Plan* (DOE-RL 1996a) will be used to develop a site-specific strategy.

While most of the waste sites to be remediated are not currently vegetated, and although no impacts are expected, mitigation measures will be taken at each site per procedure BHI-EE-02, *Environmental Requirements,* Section 4.0, "Protection of Natural Resources on the Hanford Site," to determine the level of resources and presence of nesting migratory birds or other species of concern. Site-specific walkdowns that identify potential impacts to natural resources are performed at individual sites before they undergo remediation. If mitigation actions for the remediation of waste sites or expansion of borrow sites fall in the category of rehabilitating or restoring the affected environment (rectification), or compensation by replacing or providing substitute resources or environments, the projects will follow a definitive implementation plan (Section 6.0). Many of the elements of the prescribed implementation plan may not be applicable because of low-quality habitat, no mitigable habitat exists, or the impacts of the project will not degrade existing natural resources. For projects that do not exceed the thresholds for rectification or compensation, mitigation actions may be discussed in the project planning documents.

As prescribed in the BRMaP (DOE-RL 2000a), impacts to areas with habitat Levels III and IV (as defined in the BRMaP and Section 2.2 of this document) are to be mitigated through rectification or compensation. Rectification is defined as replacing lost habitat through onsite revegetation. For sites where rectification by revegetation is unable to be implemented (e.g., land committed to future use), compensatory mitigation may be performed at another location.

5.2 MITIGATION RATIOS

A mitigation ratio, also referred to as a replacement ratio, is defined as "the ratio of area over which mitigation measures are applied to the area receiving adverse impacts" (DOE-RL 2000a). Mitigation ratios are calculated such that lost habitat value is mitigated, rather than simply lost acreage. Habitat value is based on the ability of the environ to provide suitable foraging, nesting, or breeding habitat. An appropriate mitigation ratio may be determined based on the difference between the impact area and the habitat improvement area, or by the amount of value that can be added to an area by habitat improvements. The ratio may also be based on known or expected success and failure rates of mitigation efforts. The mitigation ratios used will be governed on a site-specific basis, contingent upon the level of habitat present, as defined in the BRMaP (DOE-RL 2000a). For example, compensatory mitigation for loss of a Level III sagebrush

habitat would require a mitigation replacement ratio of 3:1 for impacts to habitats greater than 0.5 ha (1.24 ac) in area (i.e. 1.5 ha compensatory mitigation per 0.5 ha of disturbance in this scenario). Onsite rectification, as opposed to compensatory mitigation, is the preferred mitigation alternative and would require a mitigation ratio of 1:1 for the same level of habitat.

6.0 IMPLEMENTATION PLAN

6.1 CULTURAL RESOURCE MITIGATION

Surface-disturbing activities and building-disturbing activities will be preceded by a cultural resource review and will comply with the recommendations resulting from that review, per BHI-EE-02, Section 5, "Preservation of Cultural Resources on the Hanford Site." Discussions may be held with the State Historic Preservation Office and the Native American Tribes and Nations regarding the nature and extent of protective measures that may be needed. The cultural resource review process includes the following:

- Research of the areas to be impacted to determine the potential of the area to contain cultural resources based on site location factors such as soil, slope, and exposure. Field visits may be needed as part of the assessment, depending on factors such as the degree of previous disturbance, extent of previous field surveys in the area, and the likelihood that cultural resources are present.

- Written directions will be developed to implement the appropriate measures. Recommendations may include the following, depending on the site:

    - Project activities will be moved away from sensitive areas, or sensitive areas will otherwise be protected where possible (e.g., not scraping the ground surface when placing support facilities).

    - Surface surveys and test excavations will be made, when needed, to determine the presence or absence of cultural resources.

    - Project activities will be monitored to minimize disturbance to cultural resources.

    - Mitigation measures such as archaeological excavations or detailed building documentation will be conducted when adverse impacts to cultural resources cannot be avoided. Human remains, if encountered, will be dispositioned according to "Native American Graves Protection and Repatriation Act of 1990" (43 CFR 10) protocol.

Mitigation may be performed for impacts to the aesthetic and visual resources generated by remedial action activities. Strategies for avoiding these impacts include restrictions on development within known or suspected sacred areas, sensitivity to ethnographic practices that leave limited or no physical evidence to denote their occurrence, imposition of codes and

standards for rehabilitation of historic buildings and new construction, and conducting visual impact assessments commensurate with the scope of undertaking .

The State Historic Preservation Office and Native American Tribes and Nations will be consulted in the development of appropriate mitigation actions. All mitigation actions are to be consistent with the *Archaeological Resources Protection Act of 1974* (16 U.S.C. 470aa, et seq.), the *National Historic Preservation Act of 1966* (16 U.S.C. 470, et seq.), and the *Hanford Cultural Resources Management Plan* (DOE-RL 2001a).

6.2 NATURAL RESOURCE MITIGATION

Surface-disturbing activities and building-disturbing activities will be preceded by an ecological resource review and will comply with the recommendations resulting from that review, per BHI-EE-02, Section 4.0. The ecological resource review process begins with an ecological survey performed in the project area, before activities begin, to identify and avoid species and habitats of concern. As necessary, the ecological survey report identifies actions to avoid and minimize impacts to ecological resources such as the following:

- Limiting encroachment (e.g., new roads, support facilities, borrow pit operations) into areas with native vegetation to the smallest area needed for the task.

- Preventing use of long-lasting herbicides to control unwanted vegetation near facilities, except as necessary to control the spread of contamination. This practice will help the areas to revegetate when the facilities are removed.

- Exercising prudent fire prevention and control practices while minimizing the vegetation disturbances for firebreaks.

- Using backfill materials from previously undisturbed vegetated areas only as a last resort.

The eventual goal is to revegetate the waste sites, support areas (such as roads and staging areas), and borrow areas to communities dominated by native plant species. Because of the large amount of land that will be revegetated, the methods used will reflect what is feasible on a large-scale basis. Ecological impacts from remediation and revegetation activities at surrounding areas and borrow sites will be minimized.

Site-specific mitigation measures may also be undertaken. Restrictions on activities near bald eagle night roosts and nesting areas are specified in the *Hanford Site Bald Eagle Management Plan* (Fitzner and Weiss 1994). Bald eagle night roosts have been historically present at the Columbia River shoreline along the 100-F and 100-K Areas, between the 100-D/100-H Areas, and near the White Bluffs boat launch area between the 100-F and 100-H Areas. Nesting attempts have been made at the 100-F Area shoreline and the White Bluffs boat launch. The *Hanford Site Bald Eagle Management Plan* (Fitzner and Weiss 1994) mandates that an 800-m (0.5-mi) line-of-sight, or 400-m (0.25-mi) out of the line-of-sight, buffer zone be maintained around bald eagle nest sites and roosting areas. Any disruptive work performed near or within

an area of potential roosting or nesting must be performed to the specifications described in the management plan or ecological review. Variances to the management plan may be obtained through consultation with the U.S. Fish and Wildlife Service and will be coordinated through the Bechtel Hanford, Inc. Natural Resources and Risk Assessment Group. Impacts to other nesting birds, such as long-billed curlews, may be avoided by scheduling work activities at times that do not coincide with the breeding/nesting season, or avoidance of nesting areas.

The Hanford Site document *U.S. Department of Energy Threatened and Endangered Species Management Plan, Salmon and Steelhead* (DOE-RL 2000c) identifies potential threats to spring-run Chinook salmon and steelhead and their habitats. Mitigation measures identified for the protection of these species include avoidance of adverse impacts to steelhead and salmon while present in the Hanford Reach, prevention of all discharges (including National Pollution Discharge Elimination System permitted) to potential spawning habitat, minimization of surface runoff, minimization of native and riparian vegetation removal, riverbank protection, maintenance of hydrology and soil conditions, and avoidance of activities that could result in the capture or harm of steelhead or Chinook salmon (DOE-RL 2000c). Activities that could potentially impact these species may involve formal or informal consultation with the National Marine Fisheries Service as required by the *Endangered Species Act of 1973* (16 U.S.C. 1531, et seq.).

6.3 POST-REMEDIATION SITE PREPARATION

6.3.1 Soil Stockpiling

During waste site remediation, the noncontaminated surface soils, which are mostly associated with the construction of support areas, will be stockpiled at a nearby location. The surface layer of these soils may contain living vegetative materials; therefore, the stockpiled soils are best used within 2 years to ensure the viability of soil microbes and dormant plants. The stockpiled soil may need to be covered with a crusting agent to prevent wind erosion.

6.3.2 Backfill

The aim of site restoration is to have the remediated sites and sites disturbed during remedial activities eventually return to a shrub-steppe community with a minimum of non-native species. The revegetation part of each site's post-cleanup restoration may need to be delayed to allow for future activities such as cleanup of nearby waste sites. Thus, the final cleanup stages of restoration should allow for the most efficient future revegetation.

The percentages of sand, loam, and organic material, which contribute to the overall soil structure, will play an important part in final revegetation. It is also probable that areas surrounding each remediated waste site will not be revegetated with intensive methods such as the importation of large amounts of soil. Generally, the best interim backfill strategy is to approximate the soil structure found in the top 1 m (~3 ft) of the surrounding nonremediated area. This soil structure varies to a limited degree but, in general, the soils in these areas are disturbed and tend to be silty, sandy, gravels with boulders (DOE-RL 1992). Sources of topsoil

similar to surrounding undisturbed areas are not readily available without causing significant disturbance elsewhere. Most of the remediated waste sites will eventually support a shrub-dominated vegetation community; however, the poorer quality topsoil will delay the development of plant communities that match surrounding undisturbed areas.

Several sources of backfill exist. The order of preference is to (1) stockpile and reuse clean soil from the remediated site, (2) use backfill left over from earlier facility construction, (3) use materials from existing borrow areas, and, as a last resort, (4) use backfill from new borrow areas. Existing borrow locations in the 100 Areas are shown in Figure 2. Backfill removal that involves disturbing overburden or topsoil will require an excavation permit. If spoil piles that have become naturally revegetated are used for backfill, the topsoil will be salvaged and used as topsoil in final restoration and the site of the spoil pile revegetated.

Ideally, excavating topsoil material at the borrow site should not cause the loss of vegetation or it should impact only very low-quality habitat such as cheatgrass fields. However, careful consideration should be given when borrowing topsoil from sites that support stands of only or predominantly cheatgrass, because their suitability for restoring native vegetation may be limited. Some soils at the Hanford Site appear to be much better at naturally revegetating to native species, while others, such as the old farm fields in the 100 Areas and parts of the McGee Ranch, remain virtually all cheatgrass after 50 years.

6.3.3 Surface Recontouring

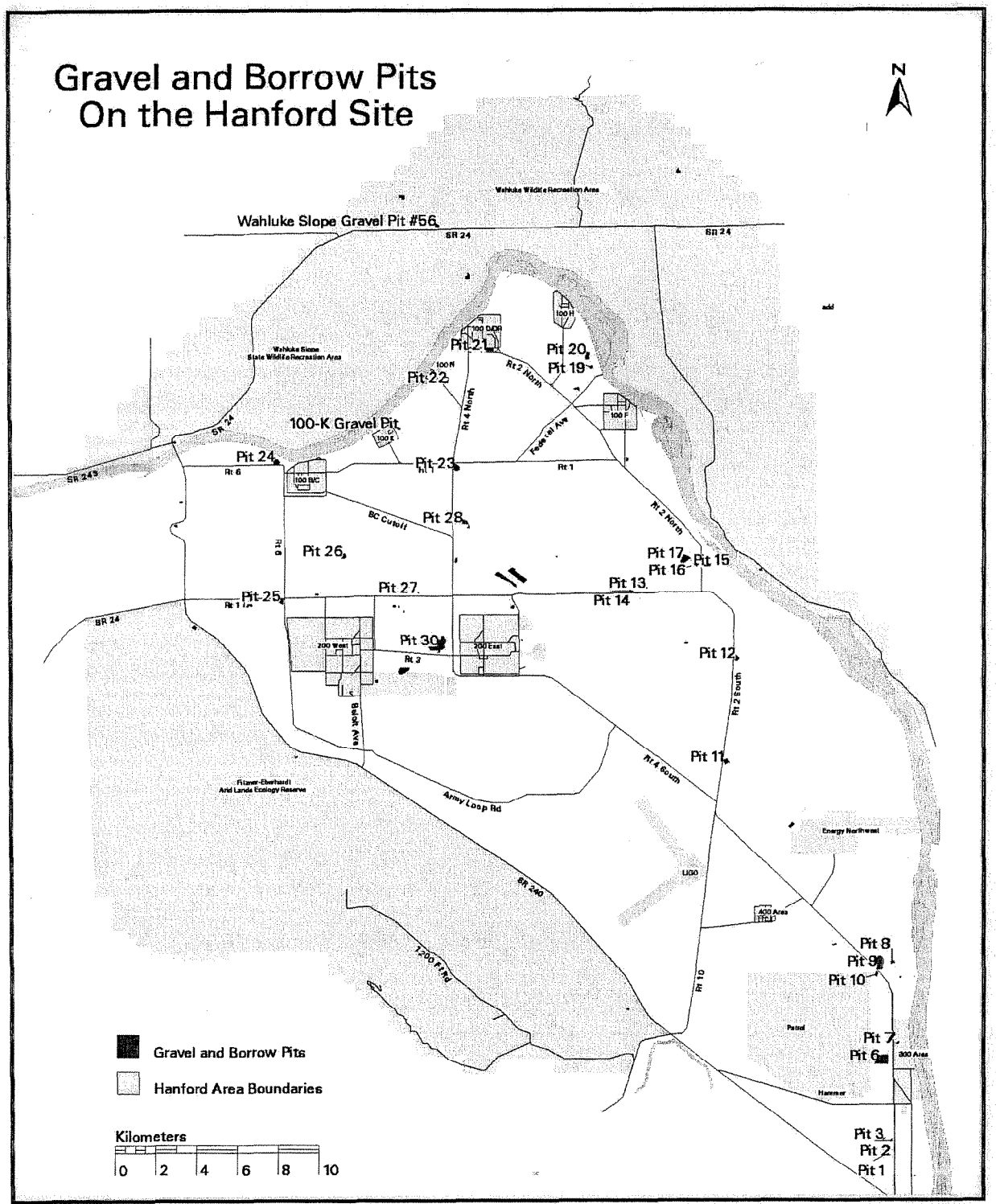
The final contour of the remediated sites should reflect the surrounding terrain to the extent practical. For most of the area, this will be approximately to grade, which is essentially flat to gently sloping. For sites not requiring the backfill to match the surrounding grade, depressions may remain. Slopes should be sinuous, with a varying and stabilized grade. Rectilinear topography should be avoided. Natural revegetation may be promoted by orienting or ripping the ground surface across slopes to trap soil and seeds.

It should be noted that the quantity of backfill required to bring all remediated waste sites back to an essentially flat contour will be significant. The benefits of restoring such a contour will have to be weighed against the potentially significant impacts to borrow sites and surrounding native vegetation.

6.3.4 Revegetation

The eventual goal is to revegetate the waste sites, support-facility areas, and borrow areas to communities dominated by native plant species. Native species of a Hanford Site genotype will be used for all revegetation efforts. Sandberg's bluegrass and needle-and-thread grass (*Stipa comata*) have been collected on the Hanford Site and grown under controlled agricultural production methods to provide a source of seeds for revegetation. Seeds of other native plants, such as sagebrush, yarrow (*Achillea millefolium*), Carey's balsamroot (*Balsamorhiza careyana*), Indian ricegrass (*Oryzopsis hymenoides*), and snow buckwheat, have also been collected on the Hanford Site and may be added to the planting mixture as available and as appropriate to

Figure 2. Borrow Pit Locations Used for 100 Area Remediation.



BHL:maa 2/1/01 /home/maayc/arnls/gravelpit Plotted 02-APR-2001 Rev 1

each site. Additional species will be collected as needed for each site; for example, rhizomes of dune scurfpea (*Psoralea lanceolata*) and seeds of sand dropseed (*Sporobolus cryptandrus*) and antelope bitterbrush (*Purshia tridentata*) may be used at sandy sites. Additional seeds of other species may be provided by the Tribes and combined with the species described above. Consultations with the Natural Resource Trustee Council will also be made as appropriate for additional input and involvement in the revegetation process.

Site-specific revegetation plans will be developed using revegetation criteria in Appendix H of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2000b). Guidance for the number of pounds of seeds per acre planted is provided in the *Revegetation Manual for the Environmental Restoration Contractor* (McLendon and Redente 1997). The sites will generally be drill or broadcast seeded. A seed drill is typically used for planting in areas with fine soils and a minimum of rocks. Seeds that are uncleaned or of an unsuitable shape or size may be hand broadcast or hydroseeded. Specific planting techniques will be tailored to the soil and moisture conditions at each site.

Broadcast seeding may be used to distribute native seeds over a large area. Site preparation techniques used during revegetation may include the addition of fertilizers and nutrients in areas of nutrient-deficient cobble backfill from deeper borrow areas. Straw mulch may also be spread on the surface of remediated sites at a rate of 4.5 metric tons/hectare (2 tons/acre) after seeding, and then crimped into the seedbed or held in place using a tackifier (an emulsion that holds the straw together).

Areas that have been used for support facilities may have ground that is more hard-packed than recent backfill and not suitable for a seed drill. If necessary, the soils in these areas will be loosened by ripping the surface with heavy equipment. If a seed drill will not work in these areas, broadcast seeding (with subsequent harrowing or disking) or land imprinting may be used to plant seeds. Seeding for each year should occur between mid-October and January.

Tubeling sagebrush may be planted on remediated sites. Sagebrush should be planted at a density ranging from roughly 500 to 1,000 plants per hectare (200 to 400 plants per acre) between mid-October and January, after sufficient soil moisture has been received from fall precipitation.

6.4 OTHER MITIGATION ACTIONS

6.4.1 Air Quality

Preservation of air quality will require specific mitigation actions during remedial action work because of the dry, relatively windy climate at the Hanford Site. Dust suppression will be a vital component to prevent the potential spread of contamination from exposed soils. Dust will be controlled by spraying with water or other approved methods and controlled as necessary when excavation or other work activities are not occurring. A crusting agent or fixative may be applied to any disturbed portion of the contamination area, in accordance with air monitoring

plan requirements. Controlled locations include, but are not limited to, the limits of waste site excavations, access ramps, roads, parking areas, and stockpiles.

6.4.2 Noise

Remediation activities will generate noise, primarily through the use of heavy earthmoving equipment. Noise impacts will be highest inside the sites being remediated, with secondary effects along the roads. Because most noise will be confined to the immediate project site and access areas, significant environmental impacts are not anticipated.

7.0 MAINTENANCE PLAN

Chemical weed control may be performed at remediated sites, as necessary, to prevent the spread of noxious weeds. The intent of final restoration is to establish a self-sustaining plant community. Therefore, no other active maintenance is planned for restoration sites.

8.0 MONITORING AND CONTINGENCY PLANS

8.1 MONITORING PLAN

Monitoring of vegetation recovery on remediated sites will be assessed on an annual basis for 5 years after revegetation. Vegetation monitoring on representative sites will consist of measuring percent canopy cover for all plant species found at a site, the percent frequency of occurrence, and the survival of transplanted shrubs or bunchgrasses (where applicable). The frequency of monitoring activities may be adjusted, as necessary, and should not be required after 5 years.

Success criteria may vary between sites due to different objectives of each revegetation effort. However, all sites will be evaluated based on plant canopy cover, plant community composition, and survival and growth of transplants (where applicable). These criteria are detailed in the *Revegetation Manual for the Environmental Restoration Contractor* (McLendon and Redente 1997). Revegetation efforts are considered successful if the areas are stabilized to prevent erosion and dominated by recovering stands of native shrubs, grasses, and annual and perennial species.

Results of annual monitoring of revegetated sites will be reported in the annual *Environmental Restoration Contractor Revegetation Monitoring Report* (e.g., Gano et al. 1999).

8.2 CONTINGENCY PLAN

Corrective actions may be taken if performance for plant canopy cover, plant community composition, and survival and growth of transplants (where applicable) standards are not met. An example of a criterion for success may be based on a greater than 50% shrub survival and a total native species canopy cover of greater than 30% of the surrounding community in 3 to 5 years or other criteria for success as defined by the *Revegetation Manual for the Environmental Restoration Contractor* (McLendon and Redente 1997). If the success criterion is not achieved, the cause for failure should be identified and may be rectified with additional plantings, fertilization, irrigation, or soil amendments, as applicable.

9.0 REFERENCES

10 CFR 1021.331, "National Environmental Policy Act Implementing Procedures; Mitigation Action Plans," *Code of Federal Regulations*, as amended.

40 CFR 1508.20, "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act," *Code of Federal Regulations*, as amended.

43 CFR 10, "Native American Graves Protection and Repatriation Act of 1990," *Code of Federal Regulations*, as amended.

Archaeological Resources Protection Act of 1974, 16 U.S.C. 470aa, et seq.

BHI-EE-02, *Environmental Requirements*, Section 4.0, "Protection of Natural Resources on the Hanford Site," as amended, Bechtel Hanford, Inc., Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, et seq.

DOE-RL, 1992, *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-1 Operable Unit, Hanford Site, Washington*, DOE/RL-90-07, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1996a, *Hanford Site Biological Resources Mitigation Strategy Plan*, DOE/RL-96-88, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1996b, *Mitigation Action Plan for Liquid Waste Sites in the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units*, DOE/RL-96-19, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1996c, *Mitigation Action Plan for the Environmental Restoration Disposal Facility*, DOE/RL-95-24, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998, *Mitigation Action Plan for the U. S. Department of Energy, Hanford Site, Tank Waste Remediation System - Privatization, Phase I Facility Construction*, May 1998. U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000a, *Hanford Site Biological Resources Management Plan*, DOE/RL-96-32, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE/RL-96-17, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000c, *U.S. Department of Energy Hanford Site Threatened and Endangered Species Management Plan, Salmon and Steelhead*, DOE/RL-2000-27, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2001a, *Hanford Cultural Resources Management Plan*, DOE/RL-98-10, Rev.1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2001b, *Industrial Mineral Resources Management Plan*, DOE/RL-2000-61, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Downs J. L., W. H. Rickard, C. A. Brandt, L. L. Cadwell, C. E. Cushing, R. R. Geist, R. M. Mazaika, D. A. Neitzel, L. E. Rogers, M. R. Sackschewsky, and J. J. Nugent, 1993, *Habitat Types on the Hanford Site: Wildlife and Plant Species of Concern*, PNL-8942, Pacific Northwest Laboratory, Richland, Washington.

Ecology, EPA, and DOE, 1999, *Action Memorandum for the 100-N Ancillary Facilities, Hanford Site, Benton County, Washington*, Washington State Department of Ecology, U.S. Environmental Protection Agency, Region 10, and U.S. Department of Energy, Richland, Washington.

Endangered Species Act of 1973, 16 U.S.C. 1531, et seq.

EPA, 1995, *Interim Action Record of Decision for the 100-BC-1, 100-DR-1 and 100-HR-1 Operable Units*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 1997, *Amended Record of Decision, Decision Summary and Responsiveness Summary, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2000a, *Interim Remedial Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2000b, *Interim Remedial Action Record of Decision for the 100-NR-1 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

Fitzner, R. E. and S. G. Weiss, 1994, *Bald Eagle Site Management Plan for the Hanford Site, South-Central Washington*, DOE/RL-94-150, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Fitzner, R. E., S. G. Weiss, and J. A. Stegen, 1994, *Threatened and Endangered Wildlife Species of the Hanford Site Related to CERCLA Characterization Activities*, WHC-EP-0513, Westinghouse Hanford Company, Richland, Washington.

Gano, K. A., A. L. Johnson, and J. K. Linville, 1999, *1999 Environmental Restoration Contractor Revegetation Monitoring Report*, BHI-01310, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

McLendon, T. and E. F. Redente, 1997, *Revegetation Manual for the Environmental Restoration Contractor*, BHI-00971, Bechtel Hanford, Inc., Richland, Washington.

Migratory Bird Treaty Act, 16 U.S.C. 703, 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.

Sackschewsky, M. R., 1992, *Biological Assessment for Rare and Endangered Plant Species Related to CERCLA Characterization Activities*, WHC-EP-0526, Westinghouse Hanford Company, Richland, Washington.

Sackschewsky, M. R. and D. S. Landeen, 1992, *Fiscal Year 1991 100 Areas CERCLA Ecological Investigations*, WHC-EP-0448, Westinghouse Hanford Company, Richland, Washington.

Shelford, V. E., 1974, *The Ecology of North America*, University of Illinois Press, Urbana, Ohio, 610 p.

Stegen, J. A., 1993, *Vegetation Communities Associated with the 100 Area and the 200 Area Facilities on the Hanford Site*, WHC-SD-EN-TI-216, Westinghouse Hanford Company, Richland Washington.

Tisdale, E. W., 1994, "Bluebunch Wheatgrass Cover Type," In: T. N. Shiflet (ed.), *Rangeland Cover Types of the United States*, Society of Range Management, Denver, pp. 1-2.

USACE, 1991, *Habitat Mitigation and Monitoring Proposal Guidelines*, U.S. Army Corps of Engineers, Washington, D.C.

WDFW, 1992, *Policy-3000, Requiring or Recommending Mitigation*, Washington Department of Fish and Wildlife, Olympia, Washington.

WDNR, 1995, *State of Washington Natural Heritage Plan: 1993/1995 Update*, Washington Department of Natural Resources, Washington Natural Heritage Program, Olympia, Washington.

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