5.5 Ecological Resources

Potential impacts on ecological resources as a result of implementing Alternative Groups A, B, C, D_1, D_2, D_3, E_1, E_2, and E_3, and the No Action Alternative are discussed in the following sections. Additional information is provided in Appendix I (see Volume II of this EIS).

Near-term impacts on terrestrial habitats and species relate primarily to surface disturbance associated with use of the existing LLBGs, a proposed Hanford solid waste (HSW) disposal facility near the PUREX Plant, borrow sites in Area C from which capping materials would be obtained, and construction sites for new facilities. The potential for impacts during future waste management operations was determined by field surveys in those areas to identify the presence of sensitive species or habitats that might be affected. Potential long-term impacts on aquatic and riparian organisms would be associated with eventual migration of radionuclides and other hazardous chemicals through the vadose zone to groundwater and on to the Columbia River. (Potential impacts to groundwater are presented in Section 5.3.) Results of the field surveys conducted for this HSW EIS, and the methods used to assess long-term impacts are described further in Volume II, Appendix I.

Areas associated with activities described in the HSW EIS have typically been extensively disturbed, or they consist of relatively low quality habitat. These areas were previously designated for waste management operations and conservation/mining in decisions resulting from the Hanford Comprehensive Land-Use Plan EIS (DOE 1999) in order to protect higher quality resources elsewhere on the Hanford Site. DOE manages potential operational impacts on biological resources in accordance with the Hanford Site Biological Resources Management Plan (BRMaP) (DOE-RL 2001a) and the Hanford Site Biological Resources Mitigation Strategy (BRMiS) (DOE-RL 2003c). These plans were developed following extensive public input and in consultation with regulatory agencies. In general, pre-construction surveys of these areas would be conducted, and any mitigation measures needed to protect resources noted during those surveys would be identified and agreed upon by DOE before construction begins. Potential mitigation measures are discussed further in Section 5.18 and in Volume II, Appendix I.

The 24 Command Fire, a range fire that burned over parts of the Hanford Site in late June–early July 2000, removed large amounts of vegetation in areas of interest, particularly in the western half of the 200 West Area and westward and southward from that area (DOE-RL 2000c). The 24 Command Fire did not reach the 200 West LLBGs or the 200 East Area. The lack of vegetation has resulted in considerable movement of soil by wind since the fire. In the absence of similar fires in the future, ecological resources might begin to restore themselves naturally prior to initiation of some project activities. In the near term, nuisance species such as Russian thistle (*Salsola kali*) and cheatgrass (*Bromus tectorum*) likely are to be particularly abundant.

Impacts on ecological resources are sufficiently similar among the alternative groups in that they would not be expected to be an important discriminator in the selection process. Conclusions regarding potential impacts to terrestrial biota were based on spring/summer field surveys conducted from 1998 to 2003. Conclusions regarding potential impacts to Columbia River aquatic and riparian biota were based on an ecological risk assessment of future contaminant releases.

5.5.1 Alternative Group A

5.5.1.1 LLBGs

Currently, the 200 East Area LLBGs contain about 106 ha (262 ac) of land, most of which has been surface disturbed. Approximately 64 ha (158 ac) of this area already have been used for waste disposal. In Alternative Group A, the disposal area would be expanded from about 64 ha to about 66 ha (163 ac) for the Hanford Only and Lower Bound waste volumes and to about 70 ha (173 ac) for the Upper Bound waste volume.

Cheatgrass and Sandberg's bluegrass (*Poa sandbergii*) dominate approximately two-thirds of the 200 East Area LLBGs. The planted perennial, crested wheatgrass (*Agropyron cristatum*), dominates the other one-third. The 200 East Area LLBGs receive regular herbicide applications and thus have limited habitat value for native species. Consequently, continued use of these LLBGs, or new disturbance of the extant plant communities within them via expansion of the disposal area, would not result in the loss of any State of Washington-designated priority habitat.

Several plant species of concern have been noted within the 200 East Area LLBGs. The most notable of these is Piper's daisy (*Erigeron piperianus*), listed by Washington State as a Sensitive species (a taxon that is vulnerable or declining and could become endangered or threatened in Washington without active management or removal of threats). This species was noted on the 218-E-10 and 218-E-12B LLBGs during spring 1999 but not in spring 2000, 2001, or 2002. Piper's daisy populations on these LLBGs have been reduced or eliminated, likely as a result of regular herbicide applications. If herbicide spraying were to cease, these populations could regenerate from buried seed and be disturbed by waste management activities. However, continuing maintenance of the burial grounds is necessary to prevent the growth of deep-rooted species that could transfer contaminants to the surface before final closure. DOE's biological control program is discussed further in Volume II, Appendix I, and in Section 5.11.2.2.4.

The other plant species of concern observed within the 218-E-10 and 218-E-12B LLBGs is crouching milkvetch (*Astragalus succumbens*), a Washington State Watch List species (plant taxon that is of concern but is considered to be more abundant and/or less threatened in Washington than previously assumed). This species was observed in spring 2000, 2001, and 2002 within Trench 94 in the 218-E-12B LLBG and on the northeast side of the 218-E-10 LLBG. Because crouching milkvetch is relatively common on the Central Plateau, disturbance of those individuals on the 218-E-12B and 218-E-10 LLBGs likely would not adversely affect the overall local population.

The 200 West Area LLBGs contain about 319 ha (788 ac), most of which has been surface disturbed. About 67 ha (166 ac) already have been used for burial of solid waste. In Alternative Group A, the disposal area would be expanded from about 67 ha to about 70 ha (173 ac) for the Hanford Only waste volume, to 71 ha (175 ac) for the Lower Bound waste volume, and to 76 ha (188 ac) for the Upper Bound waste volume.

Virtually all the 200 West Area LLBGs are sparsely colonized by cheatgrass, Russian thistle, and crested wheatgrass. These LLBGs also receive regular herbicide applications and thus have limited

habitat value for native species. Consequently, continued use of these LLBGs, or new disturbance of the extant plant communities within them via expansion of the disposal area, would not result in the loss of any Washington State-designated priority habitat.

The undeveloped southeastern portion of the 218-W-4C LLBG in the 200 West Area is dominated by mature shrub-steppe, designated a Washington State priority habitat. However, because the 5 ha (12 ac) that currently are being used would not be expanded, no impacts to shrub-steppe are expected.

One plant species of concern has been observed within some of the 200 West LLBGs—stalked-pod milkvetch (*Astragalus sclerocarpus*), a Washington State Watch List species. Stalked-pod milkvetch was observed in spring 1998, 1999, 2000, 2001, and 2002 at the extreme western edge of the 218-W-5 LLBG and within the undeveloped portion of the 218-W-4C LLBG. Because Stalked-pod milkvetch is relatively common on the Central Plateau (Sackschewsky and Downs 2001), disturbance of those individuals on the 218-W-5 and 218-W-4C LLBGs likely would not adversely affect the overall local population.

Wildlife that could be affected by disturbance of the 200 East and 200 West LLBGs includes the mule deer (*Odocoileus hemionus*), Great Basin pocket mouse (*Perognathus parvus*), side-blotched lizard (*Uta stansburiana*), and several migratory bird species. Ground-nesting birds that have been observed and that may nest within the 200 East and 200 West LLBGs include the horned lark (*Eremophila alpestris*), killdeer (*Charadrius vociferous*), long-billed curlew (*Numenius americanus*), and Western meadowlark (*Sturnella neglecta*). If excavation activities were to occur during the nesting season, generally March through July, they could destroy eggs or young birds and temporarily displace nesting individuals into other areas of the Hanford Site. As noted previously in this section and in Volume II, Appendix I, DOE would typically take measures to avoid or mitigate these potential consequences (such as limiting major excavation during the nesting season) before proceeding with construction.

5.5.1.2 HSW Disposal Facility Near the PUREX Plant in the 200 East Area

Currently, the proposed HSW disposal facility near the PUREX Plant contains about 41 ha (101 ac), of which none has been cleared or used for burial of solid waste. The overstory in this area is dominated by sagebrush; the understory is dominated by cheatgrass and Sandberg's bluegrass. Development of the new HSW disposal facility for ILAW near the PUREX Plant would result in the loss of 32 ha (79 ac) (all waste volumes) of shrub-steppe. No plant species of concern were observed on the disposal area near the PUREX Plant during the summer field survey of 2002.

Wildlife that could be affected by disturbance of the new HSW disposal facility near the PUREX Plant includes the black-tailed jackrabbit (*Lepus californicus*), mule deer, coyote (*Canis latrans*), and Northern pocket gopher (*Thomomys talpoides*), as well as several migratory bird species. Shrub- and ground-nesting birds that have been observed and that likely nest within the disposal area near the PUREX Plant include the sage sparrow (*Amphispiza belli*) and Western meadowlark, respectively. If excavation activities were to occur during the nesting season, generally March through July, they could destroy eggs or young birds and temporarily displace nesting individuals into other areas of the Hanford Site. As noted previously in this section and in Volume II, Appendix I, DOE would typically take

measures to avoid or mitigate these potential consequences (such as limiting major excavation during the nesting season) before proceeding with construction.

The black-tailed jackrabbit and sage sparrow are considered Washington State Candidate species (species that the Washington Department of Fish and Wildlife will review for possible listing as state-endangered, -threatened, or -sensitive). The distribution of the black-tailed jackrabbit and sage sparrow within Washington is limited mostly to the Columbia Basin. Both species have a strong affinity for sagebrush habitat. The area of sagebrush habitat to be disturbed by waste management activities is small relative to the overall area of such habitat on the Hanford Site and in the Columbia Basin. Consequently, removal of sagebrush within the proposed HSW disposal facility near the PUREX Plant would have, at most, a small impact on populations of these species within the Columbia Basin.

5.5.1.3 Facilities

The CWC and WRAP lie in an industrialized area of about 90 ha (222 ac). No new impacts are expected to result from continued operation of these facilities or installation and operation of APLs to facilitate expedited processing of TRU waste.

The T Plant Complex, which covers about 8 ha (20 ac), also lies within an industrial area and provides habitat only for those birds that use the exterior of these buildings. Because modifications of the T Plant Complex would be carried out within the T Plant, no new impacts are expected.

The 200 Area Effluent Treatment Facility (ETF) and Liquid Effluent Retention Facility (LERF) lie in an industrialized area of about 65 ha (161 ac). No new impacts are expected to result from continued operation of these facilities.

5.5.1.4 Borrow Pit

Basalt, gravel, and silt/loam for use in capping the HSW disposal facilities would be obtained from borrow pits in Area C, an area of about 926 ha (2288 ac). This area also was burned in the 24 Command Fire; however, some of the pre-fire shrub and understory vegetation survived, so the underlying soil surface has not been as severely affected by wind erosion. The associated stockpile area east of SR 240 and the area designated for the conveyance roads to the 200 Areas were burned severely in the 24 Command Fire, removing all the vegetation.

Excavation of borrow materials would require about 69 ha (170 ac), 70 ha (173 ac), and 73 ha (180 ac) for the Hanford Only, Lower Bound, and Upper Bound waste volumes, respectively. Impacts to habitats and species would depend largely on the locations of borrow pits within Area C. The locations of these areas of disturbance have not yet been determined.

Three habitats of concern within Area C may be affected by the excavation of borrow materials, depending on the location of the borrow pits. These three habitats are designated element occurrences of plant community types by the State of Washington Natural Heritage Program (NHP). An element occurrence of a plant community type is one that meets the minimum standards set by NHP for ecological

condition, size, and the surrounding landscape. Element occurrences are generally considered to be of substantial conservation value from a state and/or regional perspective. The largest of these is a cheatgrass/needle-and-thread grass/Indian ricegrass community, an element occurrence of the bitterbrush/Indian ricegrass sand dune complex community type, consisting of 97 ha (241 ac). The other two communities are much smaller. The needle-and-thread grass/cheatgrass community, an element occurrence of the sagebrush/needle-and-thread grass community type, consists of 5 ha (12 ac). The Sandberg's bluegrass/cheatgrass community, an element occurrence of the big sagebrush/bluebunch wheatgrass community type, consists of 1.5 ha (4 ac). These and other habitats that could be disturbed or eliminated by excavation of borrow materials within Area C are discussed in detail in Volume II, Appendix I. As noted previously in this section and in Volume II, Appendix I, DOE typically would establish measures to avoid or mitigate these potential consequences before proceeding with construction.

The only plant species of concern observed in Area C during the summer 2002 field survey were purple mat (*Nama densum* var. *parviflorum*), crouching milkvetch, and stalked-pod milkvetch. Purple mat is a Washington State Review 1 species (plant taxon of potential concern that is in need of additional field work before a status can be assigned). Purple mat occurs occasionally throughout central Hanford, and crouching milkvetch and stalked-pod milkvetch are relatively common on the Central Plateau. Consequently, disturbance of the individual plants located in Area C likely would not adversely affect the overall local populations of these species.

Wildlife that could be impacted by disturbance of Area C includes the badger (*Taxidea taxus*), coyote, elk (*Cervus elaphus*), mule deer, northern pocket gopher, and several migratory birds. No wildlife species of concern were observed in Area C. However, a herd of several hundred elk currently uses the Fitzner/Eberhardt Arid Lands Ecology (ALE) Reserve and surrounding private lands. Elk have been observed using Area C for foraging and loafing. Calving generally occurs at the upper elevations of Rattlesnake Mountain. Blasting and use of heavy equipment to remove borrow materials from Area C, particularly if conducted during the winter months, might disturb elk and displace some animals into adjacent areas. However, because Area C is only a small portion of their overall range and is not known to be particularly important for either overwintering or calving, the effect on the population likely is to be minimal.

The stockpile and conveyance road area currently supports Russian thistle, cheatgrass, and dune scurfpea (*Psoralea lanceolata*). The only plant species of concern observed in this area during the summer 2002 field survey was stalked-pod milkvetch. Because Stalked-pod milkvetch is relatively common on the Central Plateau (Sackschewsky and Downs 2001), disturbance of the individual plants in the stockpile and conveyance road area likely would not adversely affect the overall local population of this species.

The black-tailed jackrabbit is the only wildlife species of concern observed within the stockpile and conveyance road area. Other wildlife species observed include the coyote. Some local jackrabbit mortalities may result from increased vehicular traffic. However, because this area is relatively small and

because sagebrush recovery in the area would be expected to be minimal before the start of new construction, the impact of its disturbance on the black-tailed jackrabbit population within the Columbia Basin likely would be minimal.

Ground-nesting birds that have been observed and that may nest in Area C and within the stockpile and conveyance road area include the horned lark and Western meadowlark. If excavation activities were to occur during the nesting season, generally March through July, they could destroy eggs or young birds and temporarily displace nesting individuals into other areas of the Hanford Site. As noted previously in this section and in Volume II, Appendix I, DOE would typically take measures to avoid or mitigate these potential consequences (such as limiting major excavation during the nesting season) before proceeding with construction.

5.5.2 Alternative Group B

5.5.2.1 LLBGs

The impacts on ecological resources in the 200 East and 200 West LLBGs in Alternative Group B would be essentially the same as for Alternative Group A, although the scale of disturbance would be somewhat larger. The area occupied by LLW and MLLW in Alternative Group B would increase by about 15 to 30 percent, depending on waste volume, over that specified in Alternative Group A. Because this expanded area still would be within the boundaries of the existing 200 East and 200 West LLBGs, which have limited habitat value for native species due to regular herbicide applications, any additional impacts on ecological resources are expected to be minimal.

5.5.2.2 Facilities

Impacts from the operation of the CWC, WRAP, APLs, ETF, T Plant Complex, and LERF would be essentially the same as those described for Alternative Group A.

The new waste processing facility would be located just west of WRAP. Constructing this facility would disturb about 4 ha (10 ac) of habitat. This area was burned severely in the 24 Command Fire and continues to be severely eroded by wind. The dominant plant species in the area is bur ragweed (*Ambrosia acanthacarpa*), a native annual. The only wildlife observed in this area was the coyote. No plant or wildlife species of concern occur in the area, except crouching milkvetch. Because crouching milkvetch is relatively common on the Central Plateau, disturbance of individual plants in this area likely would not adversely affect the overall local population of this species.

The CWC expansion area is located north of 16th Street and west of Dayton Avenue to the north-south line of the CWC. This area was burned in the 24 Command Fire and continues to be severely eroded by wind. Disposal of ILAW would disturb about 26 ha (64 ac) of habitat in this area. The dominant plant species in the CWC expansion area is Russian thistle. Stalked-pod milkvetch and purple mat were the only plant species of concern observed in the CWC expansion area. Because purple mat occurs occasionally throughout central Hanford and Stalked-pod milkvetch is relatively common on the

Central Plateau (Sackschewsky and Downs 2001), disturbance of the individual plants of these two species located in the CWC expansion area likely would not adversely affect the overall local populations.

The only wildlife species observed in the CWC expansion area was the coyote. Ground-nesting birds that were observed and may nest within the CWC expansion area include the horned lark and Western meadowlark. If excavation activities were to occur during the nesting season, generally March through July, they could destroy eggs or young birds and temporarily displace nesting individuals into other areas of the Hanford Site. As noted previously in this section and in Volume II, Appendix I, DOE would typically take measures to avoid or mitigate these potential consequences (such as limiting major excavation during the nesting season) before proceeding with construction. No wildlife species of concern were observed in the CWC expansion area.

Although there are no plans at present to use the 218-W-5 Expansion Area, it could be used in the future. The dominant plant species in the 218-W-5 Expansion Area are Sandberg's bluegrass, cheatgrass, Indian ricegrass, and Russian thistle. The only plant species of concern observed in the 218-W-5 Expansion Area were crouching milkvetch, stalked-pod milkvetch, and purple mat. Because purple mat occurs occasionally throughout central Hanford, and crouching milkvetch and stalked-pod milkvetch are relatively common on the Central Plateau, disturbance of the individual plants of these three species located in the 218-W-5 Expansion Area likely would not adversely affect the overall local populations.

Wildlife that could be impacted by disturbance of the 218-W-5 Expansion Area include the badger, coyote, Great Basin pocket mouse, and mule deer. Ground-nesting birds that were observed and may nest within the 218-W-5 Expansion Area include the horned lark and Western meadowlark. If excavation activities were to occur during the nesting season, generally March through July, they could destroy eggs or young birds and temporarily displace nesting individuals into other areas of the Hanford Site. As noted previously in this section and in Volume II, Appendix I, DOE would typically take measures to avoid or mitigate these potential consequences (such as limiting major excavation during the nesting season) before proceeding with construction. No wildlife species of concern were observed in the 218-W-5 Expansion Area.

5.5.2.3 Borrow Pit

Impacts associated with use of Area C in Alternative Group B would be slightly greater compared with those in Alternative Group A because the scale of disturbance would be somewhat larger. The area to be excavated in Alternative Group B would be about 10 to 20 percent greater, depending on waste volume, over that specified in Alternative Group A. The area of the associated stockpile and conveyance road would remain the same in Alternative Group B as in Alternative Group A.

5.5.3 Alternative Group C

5.5.3.1 LLBGs

The impacts on ecological resources in Alternative Group C would be the same as those for Alternative Group A because the areas occupied by LLW and MLLW in Alternative Group C would be the same as those in Alternative Group A.

5.5.3.2 HSW Disposal Facility near the PUREX Plant in the 200 East Area

The impacts on ecological resources in Alternative Group C would be substantially smaller compared with those in Alternative Group A; the scale of disturbance would be reduced by about 55 percent for all waste volumes because of the reduced area required for ILAW disposal.

5.5.3.3 Facilities

Impacts from the operation of the CWC, WRAP, APLs, ETF, LERF, and the T Plant Complex would be essentially the same as those described for Alternative Group A.

5.5.3.4 Borrow Pit

Impacts associated with use of Area C in Alternative Group C would be slightly smaller compared with those in Alternative Group A because the scale of disturbance would be somewhat smaller. The area to be excavated in Alternative Group C would be about 10 percent less for all waste volumes than that specified in Alternative Group A. The area of the associated stockpile and conveyance road would remain the same in Alternative Group C as in Alternative Group A.

5.5.4 Alternative Group D_1

5.5.4.1 LLBGs

Because the 200 East and 200 West LLBGs have limited habitat value for native species due to regular herbicide applications, the impacts on ecological resources in Alternative Group D_1 would be essentially the same as for Alternative Group A, although the scale of disturbance would be somewhat smaller. The LLW and MLLW for all waste volumes in Alternative Group D_1 would use only the areas that already have been used for disposal of solid waste (64 ha [158 ac] in the 200 East LLBGs and 67 ha [166 ac] in the 200 West LLBGs), representing about 5 to 15 percent less area disturbed, depending on waste volume, than Alternative Group A.

5.5.4.2 HSW Disposal Facility near the PUREX Plant in the 200 East Area

The impacts on ecological resources in Alternative Group D_1 would be smaller than those in Alternative Group A. The scale of disturbance in Alternative Group D_1 would be smaller than that of Alternative Group A by about 25 percent for the Upper Bound waste volume but by about 40 percent for the Hanford Only and Lower Bound waste volumes because of the reduced area required for ILAW disposal.

5.5.4.3 Facilities

Impacts from the operation of the CWC, WRAP, APLs, ETF, LERF, and the T Plant Complex would be essentially the same as those described for Alternative Group A.

5.5.4.4 Borrow Pit

Impacts associated with use of Area C in Alternative Group D_1 would be slightly smaller than those in Alternative Group A because the scale of disturbance would be somewhat smaller. The area to be excavated in Alternative Group D_1 would be about 10 percent less for all waste volumes than that specified in Alternative Group A. The area of the associated stockpile and conveyance road would remain the same in Alternative Group D_1 as in Alternative Group A.

5.5.5 Alternative Group D_2

5.5.5.1 LLBGs

Because the 200 West LLBGs have limited habitat value for native species due to regular herbicide applications, the impacts on ecological resources in Alternative Group D_2 would be essentially the same as those in Alternative Group A, although the scale of disturbance would be somewhat smaller. The LLW and MLLW for all waste volumes in Alternative Group D_2 would use only the areas that already have been used for disposal of solid waste (67 ha [166 ac]), representing about 5 to 10 percent less area of disturbance, depending on waste volume, than Alternative Group A.

The impacts on ecological resources in the 200 East LLBGs in Alternative Group D_2 would be essentially the same as those for Alternative Group A, although the scale of disturbance would be somewhat larger due to ILAW disposal. The area occupied by LLW, MLLW, and ILAW in Alternative Group D_2 would be about 25 percent less for all waste volumes over that specified for LLW and MLLW in Alternative Group A. Because this expanded area still would be within the boundaries of the existing 200 East LLBGs, which have limited habitat value for native species due to regular herbicide applications, any additional impacts on ecological resources are expected to be minimal.

5.5.5.2 Facilities

Impacts from the operation of the CWC, WRAP, APLs, ETF, LERF, and the T Plant Complex would be essentially the same as those described for Alternative Group A.

5.5.5.3 Borrow Pit

Impacts associated with use of Area C in Alternative Group D_2 would be slightly less than those in Alternative Group A because the scale of disturbance would be somewhat smaller. The area to be excavated in Alternative Group D_2 would be about 10 percent less for all waste volumes than that specified in Alternative Group A. The area of the associated stockpile and conveyance road would remain the same in Alternative Group D_2 as in Alternative Group A.

5.5.6 Alternative Group D_3

5.5.6.1 LLBGs

Because the 200 East and 200 West LLBGs have limited habitat value for native species due to regular herbicide applications, the impacts on ecological resources in Alternative Group D_3 would be essentially the same as those for Alternative Group A, although the scale of disturbance would be somewhat smaller. The LLW and MLLW for all waste volumes in Alternative Group D_3 would use only the areas that already have been used for disposal of solid waste (64 ha [158 ac] in the 200 East LLBGs and 67 ha [166 ac] in the 200 West LLBGs), representing about 5 to 15 percent less area disturbed, depending on waste volume, than Alternative Group A.

5.5.6.2 ERDF

About 19 to 20 ha (47 to 49 ac) (Hanford Only and Lower Bound waste volumes) to 25 ha (62 ac) (Upper Bound waste volume) at ERDF would be cleared for disposal of ILAW, which most likely would be located just east of the existing ERDF disposal cells. Therefore, the area within 1 km (0.62 mi) of the existing ERDF disposal cells was surveyed in spring 2003. This site and some of the surrounding area, including the area surveyed, was burned in the 24 Command Fire. Currently, vegetation in the surveyed area consists primarily of cheatgrass. The only observed plant species of concern was stalked-pod milkvetch. Stalked-pod milkvetch is relatively common on the Central Plateau (Sackschewsky and Downs 2001). Therefore, disturbance of those individuals in the surveyed area likely would not adversely affect the local population.

Wildlife observed within 1 km of the current ERDF eastern boundary includes the coyote, northern pocket gopher, side-blotched lizard, and several migratory bird species—the horned lark, Western meadowlark, and loggerhead shrike (*Lanius ludovicianus*). The latter species is a Washington State Candidate species and a Federal Species of Concern (species whose conservation standing is of concern to the U.S. Fish and Wildlife Service but for which status information still is needed).

The horned lark and Western meadowlark are ground-nesting species. The same temporal restrictions as set forth above apply for conducting ground-disturbing activities outside the nesting season to protect the nests, eggs, and young of these species in this area. The loggerhead shrike generally nests in shrubs and trees. There are no trees in the surveyed area and shrubs are very scarce. Therefore, it is unlikely that the shrikes observed during the spring 2003 survey were nesting in the surveyed area.

5.5.6.3 Facilities

Impacts from the operation of the CWC, WRAP, APLs, ETF, LERF, and the T Plant Complex would be essentially the same as those described for Alternative Group A.

5.5.6.4 Borrow Pit

Impacts associated with use of Area C in Alternative Group D_3 would be slightly less than those in Alternative Group A because the scale of disturbance would be somewhat smaller. The area to be excavated in Alternative Group D_3 would be about 10 percent less for all waste volumes than that specified in Alternative Group A. The area of the associated stockpile and conveyance road would remain the same in Alternative Group D_3 as in Alternative Group A.

5.5.7 Alternative Group E_1

5.5.7.1 LLBGs

Because the 200 West LLBGs have limited habitat value for native species due to regular herbicide applications, the impacts on ecological resources in Alternative Group E_1 would be essentially the same as in Alternative Group A, although the scale of disturbance would be somewhat smaller. The LLW and MLLW for all waste volumes in Alternative Group E_1 would use only the areas that already have been used for disposal of solid waste (67 ha [166 ac]), representing about 5 to 10 percent less area disturbed, depending on waste volume, than Alternative Group A.

Because the 200 East LLBGs have limited habitat value for native species due to regular herbicide applications, the impacts on ecological resources in Alternative Group E_1 would be essentially the same as in Alternative Group A, although the scale of disturbance would be somewhat larger. The area occupied by LLW and MLLW for all waste volumes in Alternative Group E_1 would be about 5 percent greater than that specified in Alternative Group A.

5.5.7.2 ERDF

Impacts on ecological resources in Alternative Group E_1 would be smaller than those in Alternative Group D_3. The scale of disturbance in Alternative Group E_1 would be less than that in Alternative Group D_3 by about 30 percent for the Hanford Only and Lower Bound waste volumes but by about 45 percent for the Upper Bound waste volume because of the smaller area required for ILAW disposal.

5.5.7.3 Facilities

Impacts from the operation of the CWC, WRAP, APLs, ETF, LERF, and the T Plant Complex would be essentially the same as those described for Alternative Group A.

5.5.7.4 Borrow Pit

Impacts associated with use of Area C in Alternative Group E_1 would be less than those in Alternative Group A because the scale of disturbance would be somewhat smaller. The area to be excavated in Alternative Group E_1 would be about 10 percent less for all waste volumes than that specified in Alternative Group A. The area of the associated stockpile and conveyance road would remain the same in Alternative Group E_1 as in Alternative Group A.

5.5.8 Alternative Group E_2

5.5.8.1 LLBGs

Because the 200 East and 200 West LLBGs have limited habitat value for native species due to regular herbicide applications, the impacts on ecological resources in Alternative Group E_2 would be essentially the same as those in Alternative Group A, although the scale of disturbance would be somewhat smaller. The LLW and MLLW for all waste volumes in Alternative Group E_2 would use only the areas that already have been used for disposal of solid waste (64 ha [158 ac] in the 200 East LLBGs and 67 ha [166 ac] in the 200 West LLBGs), representing about 5 to 15 percent less area of disturbance, depending on waste volume, than Alternative Group A.

5.5.8.2 ERDF

The impacts on ecological resources in Alternative Group E_2 would be smaller than those in Alternative Group D_3. The scale of disturbance in Alternative Group E_1 would be less than that in Alternative Group D_3 by about 30 percent for the Hanford Only and Lower Bound waste volumes but by about 45 percent for the Upper Bound waste volume because of the smaller area required for ILAW disposal.

5.5.8.3 HSW Disposal Facility near the PUREX Plant in the 200 East Area

The impacts on ecological resources in Alternative Group E_2 would be much smaller compared with those in Alternative Group A; the scale of disturbance would be about 65 percent less for the Upper Bound waste volume and about 85 percent less for the Hanford Only and Lower Bound waste volumes because of the smaller area required for ILAW disposal.

5.5.8.4 Facilities

Impacts from the operation of the CWC, WRAP, APLs, ETF, LERF, and the T Plant Complex would be essentially the same as those described for Alternative Group A.

5.5.8.5 Borrow Pit

Impacts associated with use of Area C in Alternative Group E_2 would be slightly smaller than those in Alternative Group A because the scale of disturbance would be somewhat smaller. The area to be excavated

in Alternative Group E_2 would be about 10 percent less for all waste volumes than that specified in Alternative Group A. The area of the associated stockpile and conveyance road would remain the same in Alternative Group E_2 as in Alternative Group A.

5.5.9 Alternative Group E_3

5.5.9.1 LLBGs

Because the 200 East and 200 West LLBGs have limited habitat value for native species due to regular herbicide applications, the impacts on ecological resources in Alternative Group E_3 would be essentially the same as those in Alternative Group A, although the scale of disturbance would be somewhat smaller. The LLW and MLLW for all waste volumes in Alternative Group E_3 would use only the areas that already have been used for disposal of solid waste (64 ha [158 ac] in the 200 East LLBGs and 67 ha [166 ac] in the 200 West LLBGs), representing about 5 to 15 percent less area disturbed, depending on waste volume, than Alternative Group A.

5.5.9.2 ERDF

The impacts on ecological resources in Alternative Group E_3 would be much smaller compared with those in Alternative Group A because the scale of disturbance would be about 60 percent less for the Upper Bound waste volume and about 75 percent less for the Hanford Only and Lower Bound waste volumes.

5.5.9.3 HSW Disposal Facility near the PUREX Plant in the 200 East Area

The impacts on ecological resources in Alternative Group E_3 would be substantially smaller compared with those in Alternative Group A; the scale of disturbance would be about 55 percent less for all waste volumes because of the smaller area required for ILAW disposal.

5.5.9.4 Facilities

Impacts from the operation of the CWC, WRAP, APLs, ETF, LERF, and the T Plant Complex would be essentially the same as those described for Alternative Group A.

5.5.9.5 Borrow Pit

Impacts associated with use of Area C in Alternative Group E_3 would be slightly smaller than those in Alternative Group A because the scale of disturbance would be somewhat smaller. The area to be excavated in Alternative Group E_3 would be about 10 percent less for all waste volumes from that specified in Alternative Group A. The area of the associated stockpile and conveyance road would remain the same in Alternative Group E_3 as in Alternative Group A.

5.5.10 No Action Alternative

5.5.10.1 LLBGs

The impacts on ecological resources in the 200 West LLBGs in the No Action Alternative would be essentially the same as those in Alternative Group A, although the scale of disturbance would be somewhat larger. The area occupied by LLW and MLLW in the No Action Alternative would be about 13 percent greater for the Hanford Only and Lower Bound waste volumes over that specified in Alternative Group A. Because this expanded area still would be within the boundaries of the existing 200 West LLBGs, which have limited habitat value for native species due to regular herbicide applications, any additional impacts on ecological resources would be expected to be minimal.

Because the 200 East LLBGs have limited habitat value for native species due to regular herbicide applications, the impacts on ecological resources in the No Action Alternative would be essentially the same as those in Alternative Group A, although the scale of disturbance would be somewhat larger. The area occupied by LLW and MLLW for the Hanford Only and Lower Bound waste volumes in the No Action Alternative would be about 3 percent larger than that specified in Alternative Group A.

5.5.10.2 HSW Disposal Facility near the PUREX Plant in the 200 East Area

Impacts on ecological resources in the No Action Alternative would be much smaller compared with those in Alternative Group A. The scale of disturbance would be about 70 percent less for the Hanford Only and Lower Bound waste volumes because of the smaller area required for ILAW disposal.

5.5.10.3 Facilities

Impacts from the operation of the CWC, WRAP, APLs, T Plant Complex, ETF, and LERF would be essentially the same as those described for Alternative Group A.

The CWC expansion in the No Action Alternative is intended for the purpose of facilities construction, whereas the CWC expansion in Alternative Group B is intended for the purpose of ILAW disposal. These two CWC expansion areas occur at different but nearby locations. Both locations were burned in the 24 Command Fire, and the ecological resources at both sites are essentially the same.

Consequently, the impacts on ecological resources in the CWC expansion area for the Hanford Only waste volume for the No Action Alternative would be essentially the same as those in Alternative Group B, although the scale of disturbance would be about 10 percent smaller.

Likewise, the impacts on ecological resources in the CWC expansion area for the Lower Bound waste volume for the No Action Alternative would be essentially the same as those in Alternative Group B, although the scale of disturbance would be about 15 percent larger.

5.5.10.4 Borrow Pit

Impacts associated with use of Area C in the No Action Alternative would be very small compared with those in Alternative Group A because the scale of disturbance would be about 80 percent less for the Hanford Only and Lower Bound waste volumes. The area of the associated stockpile and conveyance road would remain the same in the No Action Alternative as in Alternative Group A.

5.5.11 Microbiotic Crusts

Disruption of microbiotic crusts (cryptogams) may result in decreased diversity of microbiota, soil nutrients, and organic matter (Belnap and Harper 1995; Belnap et al. 2001). The 24 Command Fire during summer 2000 intensely burned the soil surface in areas (outside the LLBGs) that would be disturbed by new construction as described in the HSW EIS (that is, Area C and the associated stockpile and conveyance road areas, the two CWC expansion areas identified for facilities construction and ILAW disposal, and the area identified for the new waste processing facility). This undoubtedly resulted in the destruction of soil microbiota, facilitating the severe wind erosion experienced in these areas (Becker and Sackschewsky 2001; Sackschewsky and Becker 2001). Recovery of microbiotic crusts following disturbance is generally a slow process. For example, in burned areas on the ALE Reserve, soil algae recovery took place during the winter months of the second year following the fire of 1984 (Johansen et al. 1993). The recovery time required by soil microbiota following construction is no exception.

Although microbiotic crusts may tolerate shallow burial, deep burial such as would result from construction described in the HSW EIS will kill crusts (Shields et al. 1957). Recolonization of Area C and the associated stockpile and conveyance road area, the two CWC expansion areas identified for facilities construction and ILAW disposal, and the area identified for the new waste processing facility undoubtedly would require several years following construction, the speed of which may depend largely on the availability of nearby sources of cryptogams (Belnap 1993). Consequently, a temporary loss of benefits derived from microbiotic crusts would ensue.

5.5.12 Threatened or Endangered Species

In November 1998, DOE initiated consultation with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) regarding the LLBGs. At that time, DOE requested a listing of federally protected species that might occur in these and other areas potentially disturbed by waste management activities. The FWS response, which identified species protected under the Endangered Species Act (ESA), contained no species known to occur in the LLBGs and other project areas covered under the 1998 consultation (see Volume II, Appendix I, Attachment B). In addition, these same areas have been surveyed annually under the DOE Ecological Compliance Assessment Project (DOE-RL 1995), and no federally protected species have been documented (see Volume II, Appendix I of the HSW EIS).

However, the footprint of potential surface disturbance since has expanded beyond that of 1998 (for example, addition of Area C). Consequently, DOE re-initiated consultation with the NMFS and FWS in March 2002 (see Volume II, Appendix I, Attachment B), again requesting a listing of federally protected

species that could occur in all areas potentially disturbed by waste management activities. The NMFS responded by telephone on April 26, 2002, and provided a web site (http://www.nwr.noaa.gov/1habcon/habweb/listnwr.htm) containing currently listed threatened and endangered species in the Pacific Northwest (see Volume II, Appendix I, Attachment B). The FWS responded in April 2002 by letter containing currently listed threatened and endangered species that may be present near the proposed project site in Benton County (see Volume II, Appendix I, Attachment B). The NMFS- and FWS-listed threatened and endangered species known to occur on the Hanford Site are tabulated in Section 4.6.4.

In February 2003, DOE again requested from the FWS a listing of federally protected species that could occur in all areas potentially disturbed by waste management activities (Volume II, Appendix I, Attachment B). DOE revisited the NMFS web site noted above in March 2003. The FWS responded by letter in February 2003 (see Volume II, Appendix I, Attachment B). The result of revisiting the NMFS web site also is provided in Attachment B of Volume II, Appendix I.

The terrestrial habitats that potentially could be disturbed have been surveyed previously, and none of the federally listed threatened or endangered species tabulated in Section 4.6.4 were observed (see Volume II, Appendix I). The aquatic endangered species that potentially could be affected are the upper Columbia River spring-run evolutionarily significant unit (ESU) of Chinook salmon (*Oncorhynchus tshawytscha*) and the upper Columbia River ESU of steelhead (*Oncorhynchus mykiss*). Spring Chinook salmon do not spawn within the Hanford Reach; instead, the reach is used by in-migrating salmon as a passage corridor and by out-migrating juvenile salmon as a corridor and for interim feeding. Steelhead are present in the Hanford Reach all year, with most adults residing from 6 to 8 months. Juveniles usually spend 1 to 3 years in freshwater before migrating downstream to the ocean. It has long been believed that limited spawning occurs within the Hanford Reach (DOE-RL 2000b). This was verified in February 2003 when at least two redds were observed near the shoreline of the 300 Area (Lohn 2004, Sackschewsky et al. 2003 [see Volume II, Appendix O]). The risk of future adverse effects to these two species posed by contaminants migrating through the vadose zone and into groundwater, and ultimately entering the Columbia River, is expected to be negligible (see Volume II, Appendix I).

The threatened bull trout (*Salvelinus confluentus*) spends the majority of its life cycle in Columbia River tributaries, of which the Hanford Reach has none. The bull trout has been observed only a very few times in the Hanford Reach within the last 30 years. Consequently, the probability that this species could be exposed to contaminants reaching the Columbia River would be near zero. In addition, the risk of future adverse effects to the bull trout posed by contaminants migrating through the vadose zone and into the groundwater, and, ultimately, entering the Columbia River, would be negligible (see Volume II, Appendix I). Critical habitat for the bull trout is proposed for the mainstem Columbia River, including the Hanford Reach. No actions that would physically modify proposed critical habitat for this species would occur under any of the alternative groups of the HSW EIS. Further, because the species occurs so rarely in the Hanford Reach, contaminants reaching the Columbia River would not be expected to affect its use of proposed critical habitat.

5.5.13 Potential Impacts on Columbia River Aquatic and Riparian Biota in the Long Term

Leaching of radionuclides and other hazardous chemicals from the waste via infiltrating precipitation would eventually result in small quantities of long-lived mobile radionuclides reaching the Columbia River. The following is a general discussion of the risk of future adverse impacts to Columbia River aquatic and riparian biota posed by these contaminant releases within 10,000 years of 2046, and of risk as a discriminator among the alternative groups.

Risk of radiological impacts is not an important discriminator among the alternative groups within 0 to 2500 years following 2046 (see Volume II, Appendix I, Section I.3.4). However, in the time period 2,500 to 10,000 years following 2046, risks of radiological impacts are about one order of magnitude higher in the No Action Alternative and about half an order of magnitude higher in Alternative Group B than in the other alternative groups (see Volume II, Appendix I, Section I.3.4). These higher risks are the result of larger quantities of uranium reaching the river environment in the latter time period under the conditions inherent in these two alternative groups. Further, the risks of uranium chemical toxicological impacts to terrestrial and aquatic animal receptors are about two orders of magnitude higher for the No Action Alternative and about one order of magnitude higher for Alternative Group B than for the other alternative groups during the time period extending from 2,500 to 10,000 years after 2046 (see Volume II, Appendix I, Section I.3.5). These relative risks are described below in absolute terms.

Based on results presented in Volume II, Appendix I, Section I.3.5, the risk of radiological impacts to aquatic and terrestrial animals and plants from future contaminant releases would be very small. The risk of chronic uranium chemical toxicological impacts to terrestrial animal receptors also would be very small. The risk of chronic uranium chemical toxicological impacts to the carp (*Cyprinus carpio*), largescale/mountain sucker (*Catostomus macrocheilus*/*C. platyrhynchus*), and smallmouth bass (*Micropterus dolomieui*) would be negligible. The risk of uranium chemical toxicological impacts to all other aquatic animal species evaluated would be less than that of these three fish species, with the possible exception of the Woodhouse's toad (*Bufo woodhousii*) tadpole. The potential impact on this species is inconclusive because of the lack of species-specific uranium uptake and toxicity data and uncertainty regarding the applicability of available data (from fish studies) used to prepare risk calculations for this species in the HSW EIS (see Volume II, Appendix I, Section I.3.5). However, impacts to Woodhouse's toad populations are unlikely considering 1) the conservatism in the groundwater modeling that produced the uranium concentrations used in the risk assessment (see Volume II, Appendix G of this EIS) and 2) the assumption of simultaneous exposure to maximum uranium concentrations entering the river at different times from different disposal facilities. Uranium chemical toxicological impacts, if any, would not occur until approximately 10,000 years following 2046.