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River Corridor
Closure Contract

2007 River Corridor Closure Contractor Revegetation and Mitigation Monitoring Report

September 2007

Washington Closure Hanford

Prepared for the U.S. Department of Energy, Richland Operations Office
Office of Assistant Manager for River Corridor

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EXECUTIVE SUMMARY

The purpose of this report is to document the status of revegetation projects and natural resources mitigation efforts that have been conducted for remediated waste sites and other activities associated with the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) cleanup of National Priorities List waste sites at Hanford. One of the objectives of restoration is the revegetation of remediated waste sites to stabilize the soil and restore the land to native vegetation. In addition, mitigation measures are taken to reduce impacts from the cleanup activities. This report documents the results of revegetation and mitigation monitoring conducted in 2007 and includes 11 revegetation/restoration projects, one revegetation/mitigation project, and 3 bat habitat mitigation projects.

Revegetation / Restoration Projects:

- fifth-year monitoring at the120-N revegetation area;
- fourth-year monitoring at the 300-FF-1 Operable Unit sites;
- third year monitoring of 100- FR-1 Operable Unit waste sites and 116-N-3 Trench in the 100 N Area;
- second year monitoring of waste sites in the 100 K Area, 100 B/C Area, the former Hanford Generating Plant, 618-4 Burial Ground shrub planting, and Horseshoe Landfill;
- first year monitoring of 116-N-1 Trench, 100-B/C Area, and 300-FF-2 Operable Unit sites.

Mitigation / Restoration Projects:

Monitoring of these revegetation and mitigation projects are conducted annually to ensure the objectives of the revegetation efforts are accomplished, to note planting techniques that yield the greatest success, and to document successional recovery. It is important to remember that it typically takes 3 to 5 years before revegetation efforts in arid regions show signs of success. Bat mitigation work was conducted at the 190-DR Process Water Tunnels, at the 105-F Reactor, and the183-F west Clearwell.

Revegetation/Restoration Projects

The 300-FF-1 Process Ponds and Burial Grounds were seeded in February 2004. A majority of the 300-FF-1 Operable Unit is within an area designated for future industrial use in the Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement (DOE/EIS-0222-F), therefore, the area was broadcast seeded with only grass species. To facilitate successful germination, 16.8 kg/ha Terrabond was applied during seeding. The seeded area was irrigated with 0.62 cm/ha, mulched with grass straw, and crimped with a crimper to minimize wind erosion. Fourth year data was collected from the 300-FF-1 Process Ponds in April 2007. Canopy cover has native species has increased by 15.7% since 2006 and cheatgrass has also increased by 15%. The planted wheatgrass (*Agropyron spicatum*) was the dominant native species. There were 21 native species present and 13 introduced species.

First year monitoring was conducted in April of 2007 on the 618-2 and -3 solid waste burial grounds and the 300-8 Aluminum shavings waste site. The 618-2 and -3 Burial Grounds are one contiguous site with total canopy cover measured at 35.8%; 24.1% consisting of introduced species and 11.7% native. The planted wheatgrasses (*Agropyron sp.*) made up 11.2% of the canopy cover. The 300-8 waste site had a 41.9% introduced species and 40.1% native species. The planted wheatgrasses (*Agropyron sp.*) made up 36.2% of the canopy cover.

The 618-4 Burial Ground is located just outside of but adjacent to the industrial use designated area, therefore, the 2-ha site and the area to the east of the burial ground were planted with 4,000, sagebrush tublings the first week of February 2006. Shrub survival monitoring transects were established in late April 2006 to capture baseline survival counts. Initial shrub survival on the burial ground recorded 85.8% of the February planted seedlings were still alive. Survival counts recorded in April 2007 were 66.5%.

The 120-N-1 and 120-N-2 sites were remediated then backfilled with clean material in December 2002. The remediated area was broadcast seeded with a mix including Sandberg's bluegrass, needle-and-thread grass (*Stipa comata*), Indian ricegrass (*Oryzopsis hymenoides*), thickspike (*Agropyron dasytachyum*), bluebunch wheat grasses and hand collected amounts of yarrow (*Achillea millefolium*), false yarrow (*Chaenactis douglasii*), wall flower (*Erysimum asperum*), sand beardtongue (*Penstemon acuminatus*), sagebrush (*Artemisia tridentata*), and fleabane (*Erigeron* sp.) in mid January 2003. The 1.6-ha area was separated into four treatment areas. A

combination of two separate fertilizer treatments and two types of mulch were used. The entire area was broadcast seeded and irrigated with 0.62 cm/ha of water. One half of the remediated area was fertilized with triple-16 fertilizer with the other half was fertilized with Biosol, an organic slow release fertilizer. One half of the triple-16 fertilized area and one half of the Biosol fertilized area was mulched with grass straw then crimped into the soil surface. The remaining area was mulched with industry standard hydromulch fiber.

Vegetation surveys were conducted on the four treatments on May 2, 2007, for the fifth and final year of monitoring. The survey identified 22 species across the site and of those species, 12 were native. The triple-16 fertilizer and straw mulch treatment site continued to have the greatest species diversity with 15 species observed, of which 7 were native contributing 63.7% of the 99.5% total cover. The Biosol treatment plots had the lowest species diversity and were dominated by cheatgrass.

The data from these 4 plots have provided an interesting trend over the 5 years of monitoring. The plots treated with the Biosol fertilizer have resulted in cheatgrass being the dominant plant in every year. The 2 plots fertilized with triple-16 advanced rapidly with native species dominating and increasing steadily. The plot treated with triple-16 and straw mulch performed the best and has continued to improve steadily with and increase of 38% native species in the fifth year. The soil type in all 4 plots was from the same source and consisted of a coarse sand and gravel; very similar to many restored waste sites in the 100 Areas. Experience from many revegetation projects in this type of soil has shown that the native species tend to become established and dominate the plant community. When fine grain soil is present at a restored site, the cheatgrass tends to have an advantage and often becomes the dominant species. This is possibly related to a better seed-to-soil contact and moisture retention in fine-grained soils, resulting in better germination of the cheatgrass seeds. At 120-N-1, the Biosol fertilizer along with hydromulch provided good seed contact and moisture retention as well as a ready supply of nitrogen; both of which appear to favor cheatgrass. This test was valuable in assuring that the standard planting technique that is currently used on restored waste sites in the 100-Areas (using a light application of triple-16 and crimping straw mulch) is the most effective in coarse soils.

The 185-N Hanford Generating Plant complex was demolished from 2001 through 2004. Revegetation of the disturbed area was initiated in early-February and continued through mid-March 2006. Prior to seeding the area disturbed by demolition activities, the compacted soils were loosened with a disk. The area was broadcast seeded with a mix of native grass seed, fertilized with 112 kg/ha triple-16 fertilizer, and mulched with grass straw. The entire seeded area was planted with 10-in sagebrush plugs. The revegetated area was separated into two analysis areas; the eastern half of the area had native fine grained soil while the western area was rocky cobble material from a nearby borrow pit. Second year monitoring was conducted on May 2, 2007. The total measured cover on the eastern portion of the site (topsoil) in 2007 was 131.6% and 85% on the western (cobble) area. The topsoil area had 73.5% cheatgrass cover with 21.1% Sandberg's bluegrass. The fine grained soil at this site appears to have favored many of the introduced and early successional species. The Cobble site had 27% canopy cover for Russian thistle, however, most plants were stressed and of small stature. Sandberg's bluegrass had 26% cover and cheatgrass was only 15%. These 2 sites provide another example of how cheatgrass is favored in fine-grain soil. It certainly provides better moisture holding capacity, which favors the fast-growing cheatgrass, and likely provides a better soil-to-seed contact for better germination. Sagebrush survival monitoring transects were established within each of the monitoring areas again in 2007. Survival was greatly reduced this year with only 26% total sagebrush survival estimated, compared to 96% at the beginning of the 2006 summer. The top soil area had only 14% survival and the cobble area had 40%.

The 116-N-3 Trench was seeded in January 2005, with native grass species and planted with sagebrush and hopsage seedlings propagated from seed collected on the Hanford site. Third-year vegetation surveys were conducted on the 116-N-3 trench on May 3, 2007. Seventeen species were observed within the revegetated area; 8 of those were native. Sandberg's bluegrass cover increased this year to 30.8% cover. The total cover for all introduced species in 2007 was 36.2%. The total cover for native species was 38%.

The 116-N-1 Crib and Trench were revegetated in December 2006 with native grass species and planted with sagebrush at 1235 plants/hectare. First-year vegetation surveys were conducted on May 8, 2007. Seventeen species were present, 11 of which were native. The planted native grasses dominated the vegetation with 31.8% canopy cover. The total cover was 56.6%.

Introduced species made up 23.9% and native species were 32.7%. A sagebrush monitoring transect was established on this site and the estimated survival was 95%.

Several waste sites in the 100-FR-1 Operable Unit were remediated and backfilled with clean material from a local borrow area in the summer of 2003. The remediated waste sites were revegetated in January 2005. Approximately 34.4 hectares impacted by cleanup activities were broadcast seeded with a mix of Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, prairie junegrass (*Koeleria cristata*), and needle-and-thread grass. The remediated waste sites and an on site borrow area, that was seeded with grasses in December 2003 were planted with 43,500 sagebrush seedlings. Third-year observations and measurements were taken at the 100-F revegetation sites on May 17, 2007. Cheatgrass canopy cover doubled to 46% canopy cover from 2006. Native bluebunch wheatgrass and Sandberg's bluegrass also increased canopy cover two-fold, and were the dominant revegetated species, at 12% and 19% cover respectively. Russian thistle frequency of occurance increased sharply to 94%, though it had a relatively low 4.4% canopy cover. Native canopy cover increased 15% from measurements in 2006, showing positive succession toward a native plant community.

In 2006, waste sites 100-B-1, 128-C-1, and 600-232 in the 100 B/C Area were revegetated . The 100-B-1 site was backfilled with borrow pit material, then a thin layer of topsoil that was salvaged from the waste staging pile area was spread over the borrow pit material. The 128-C-1 site was backfilled to grade with pit run cobble. The 600-232 site did not require backfill as the site was primarily surface debris that was picked up, with only the top 12 inches of soil being removed from a portion of the site. All three sites were broadcast seeded in winter of 2006 with a native grass seed mix that included Sandberg's bluegrass, needle-and-thread grass, Indian ricegrass, bluebunch wheatgrass, prairie junegrass, and thickspike wheatgrass. Triple-16 fertilizer and polyacrylamide was applied with the grass seed. Upon the completion of seeding, the entire area was irrigated with 23,400 L/ha then mulched with 4.5 metric tons/ ha straw and crimped into the soil surface to prevent wind erosion. The sites were then planted with 16,000 sagebrush and 600 spiny hopsage seedlings.

Second-year vegetation analysis was performed at 100-B-1 and 128-C-1 on May 10, 2007. Results showed that canopy cover increased 62% for 100-B-1 and 55% for 128-C-1, with half of

the increase being native cover. Native plant species diversity more than doubled from 2006, with 11 species identified in addition to the native grasses. Sandberg's bluegrass was the dominant plant on the 100-B-1 site, with over 44% canopy cover, even though it was not observed on site in 2006. The most dominant native species on the 128-C-1 site was bottlebrush squirreltail at over 12% cover, though Russian thistle and cheatgrass have slightly greater canopy covers respectively. The 100-B-1 site showed 55% of the planted sagebrush surviving; down 26% from 2006. Sagebrush on the 128-C-1 fared better; down only 16% from 2006.

In 2007, the following waste sites in the 100 B/C Area were revegetated: 100-B-8, apportion of 100-B-14, 100-C-9, 126-B-3, 128-B-2, 128-B-3, 118-B-2, 118-B-3, and 1607-B2. The total acreage was approximately 100 acres. The sites that were monitored were the 100-C-9 Process Sewer Pipelines and the 118-B-2 and 118-B-3 Burial Grounds. The sites were backfilled with pit-run gravel from borrow pit 24 and then revegetated by broadcast seeding with a native grass seed mix that included Sandberg's bluegrass, needle-and-thread grass, Indian ricegrass, bluebunch wheatgrass, prairie junegrass, and bottlebrush squirreltail. Triple-16 fertilizer and polyacrylamide was applied with the grass seed. Upon the completion of seeding, the entire area was mulched with 4.5 metric tons/ha straw and crimped into the soil surface to prevent wind erosion. Upon completion of seeding, the sites were planted with sagebrush at approximately 1300 plants/ha (530 plants/ac).

First-year vegetation surveys were conducted on May 15, 2007. Since the 100-C-9 pipeline extends from 105-C Reactor, north to the perimeter road, 4 transects of approximately 100 meters each were analyzed for percent canopy cover and percent frequency. Twenty three species were present; 13 of which were native. The grass species planted were not mature enough to identify so they were identified only as "native grasses." The native grasses dominated the vegetation in transects 1, 2, and 4 with 61.7%, 47%, and 42.2% canopy cover. Transect 3 had 18% cover for native grasses. The other dominant species were Russian thistle (on all transects) and tumble mustard (on transects 3 & 4). The Russian thistle was small in stature and stressed, indicating that most plants would remain small or die out. This is a typical condition in the first year after planting. Three sagebrush monitoring transects were established on this site, again, extending from south to north. The measured survival was 99% on Transect #1, 100% on Transect #2, and 98% on Transect #3.

First year vegetation analysis was performed on the 118-B 2 & -3 sites. The sites were combined in the analysis due to their small size and similarity of plant cover. Native grasses were well established for first year plots, at 26.5% cover, while the dominant species on the site was Russian thistle. Sagebrush was present in 7% of the plot frames.

The 116-KW-3, 116-KE-4, 100-K-55, 100-K-56, 116-K-1, and 116-K-2 sites within the 100-KR-1 Operable Unit were revegetated in February and continued through March 2006. The sites were broadcast seeded with a mix of native grass seed, fertilized, treated with polyacrylamide, mulched with straw, and planted with sagebrush plugs. The 116-K-2 site was broken up into four transects (T1-T4) for plot analysis in 2007, to show results on a finer scale. Second-year surveys were conducted on May 8 and 10, 2007, and showed a sharp increase in native grass cover across the site with the T1 transect showing 49% native grass cover. Total native plant cover was at 6.6% in 2006 across the site, but increased between 28 and 84% in the T1, T2, and T3 transects for 2007. The T4 transect showed less native canopy cover and higher introduced cover than the other sites. Native plant diversity also increased across the site, with over 16 native species present (above those grouped as native grasses) as opposed to the 5 seen in 2006. Russian thistle and native grasses showed continued high frequency of occurrence values. T4 showed high sagebrush mortality during the first year, and this continued with an additional loss of 40%, bringing sagebrush survival to 26%. In contrast, sagebrush survival for T1 and T3 was high, at 73% and 78% respectively.

The Horseshoe Landfill is located on the ALE and served as a military landfill for the nearby Nike missile base. The landfill underwent and secondary remedial action that was initiated in mid-May 2005, and completed with backfill of the site on December 1, 2005.

The landfill was revegetated the first week of February 2006. Prior to broadcast seeding the Horseshoe Landfill and soil staging area located south the landfill, the top 23 cm of soil was loosened with a spring tooth drawn implement. The landfill and soil staging area (approximately 1.6 ha) were seeded with Sandberg's bluegrass, Indian ricegrass, bluebunch wheatgrass, and needle-and-thread grass and planted with sagebrush plugs. The areas were fertilized with triple-16 fertilizer and treated with polyacrylamide to facilitate successful germination and to reduce

wind erosion. The seeded areas were mulched with grass straw and crimped into the soil to prevent the straw from blowing away. The landfill and soil staging area were planted with sagebrush seedlings propagated by two native plant nurseries from seed collected on the Hanford Site and grown in 10-in containers.

The landfill and soil staging area are being monitored separately as the landfill was backfilled with Rupert sand imported from the 200 West Area while the soil staging area has Ritzville silt-loam that is native to this location. Second-year vegetation monitoring and sagebrush survival monitoring were conducted at both sites on May 22, 2007. Sandberg's Bluegrass was found to be the dominant plant on the Horseshoe landfill (HSLF) site, and the dominant native plant on the soil staging area, at about 20% cover. The soil staging area also showed high canopy cover of Russian thistle and cheatgrass, at 30 and 20% respectively. The site, as a whole, showed an increase in native plant diversity of 35% and increased native plant cover of around 10%. Four sagebrush monitoring transects are established across the site, with only one showing significant (33%) loss of shrubs since 2006. The two transects in the soil staging area show 84 and 94% total survival of sagebrush, while the last transect at HSLF had a loss of only 10%, with 80% sagebrush survival for 2007.

Revegetation/Mitigation

In 2003 the Environmental Restoration Disposal Facility (ERDF) began Phase III expansion to construct cells 5 and 6. Construction of the new cells occurred entirely within the disturbed footprint of the ERDF fence. However, an area south of the perimeter fence was impacted by placement of the overburden pile. The Mitigation Action Plan for ERDF was updated to develop appropriate mitigation strategies for this and future expansions. The Plan determined that approximately 20-ha of mitigation be performed. To maximize the effectiveness of the mitigation effort, sagebrush was planted on 25-ha (62 acres) that included four 4-ha (10 acre) islands separated by 100 meters (328 ft). Each island was planted at a density of 1,000 plants per hectare (400 plants/acre). The areas between the islands were planted at a density of 444 plants per hectare (180 plants/acre) in an area south of ERDF that straddles the Army Loop Road. This configuration takes advantage of the Army Loop Road, which could serve as fire break or natural location to fight a fire if one should threaten this area. In addition to planting sagebrush, ten artificial burrowing owl nest boxes were installed in the area. Monitoring of the sagebrush

survival was conducted on April 19, 2007 using two 100 meter transects. The transect in the northeast quadrant of the ERDF mitigation site had 96% survival and the transect in the southeast quadrant had 100% survival. The high survivorship of these transects reflects the fact that none of the plants have been subjected to harsh summer conditions yet. Monitoring results in 2008 will be more indicative of actual plant survival.

The burrowing owl nest boxes were all checked for occupancy but none had been used yet. Installation of the nest boxes was conducted in late February, which may have been too late in the season for some owls to take up residence.

Bat Habitat Mitigation

Bat mitigation projects have been conducted at 2 reactor sites, 105-D/DR and 105-F, to mitigate for roosting habitat that was lost as a result of the Interim Safe Storage (ISS) projects at these reactors. The mitigation projects conducted at the reactor sites included establishing the process water tunnels at 100 D Area as alternative roost sites and installing artificial roost boxes at 105-F Reactor. A third mitigation project was initiated at the 183-F Clearwell in July 2007 to begin investigating a large colony of more than 2,000 bats that are using that facility. The facility is slated for eventual demolition, so a mitigation plan must be developed to accommodate the colony before the facility is removed.

In 2007 mist netting was performed at the 190-DR process water tunnel, in order to capture bats. This was done in conjunction with other bat monitoring activities going on the 183-F Clearwell. The purpose was to determine which species were present and to determine genetic relationships of the bats at the D Area site to bats of the same species in the 183-F Clearwell. Morphometric measurements and DNA samples were collected to definitively determine the species and any genetic relationships between the 2 sites. Perliminary data indicates that the species present in the 190-DR Tunnel are Yuma Myotis (*Myotis yumanensis*). Eighteen bats were captured on August 28, 2007, and 4 on September 11, 2007. The population was a mix of adults and juveniles, and only 3 individuals were males. On September 13, 2007, a team entered the 190-DR tunnels to do a visual inspection of the bats present. Video and still photographs were taken of the bats within the roost and108 bats were counted on the video. Several clusters of 10-25

bats were observed, indicating the hatches within the tunnels are being used as a maternity roost. Two data loggers were deployed during the same entrance; they will log temperature/relative humidity data at the roost sites. This data will be compared to that found in the 183-F Clearwell to see how the temperature trends compare between the structures.

Due to recent excavation around the 105-F Reactor building, no surveys or counts were conducted at the bat houses in 2007. Visual inspections, as well as acoustic surveys and the presence of bat guano have all confirmed that the Palid bats did return this season. After excavations at that site are closed it will once again be possible to do emergence counts, in order to determine if the size of the population is changing. This will likely be possible when the bats return in the spring of 2008.

Bat habitat mitigation projects began at the 183-F Clearwell during the summer of 2007. Work is being performed on a very large colony of bats that is residing in the Clearwell structure. Preliminary counts estimate the population at over 2,000 individuals, making this colony one of the largest in the State of Washington. So far in 2007 several mist netting sessions have been perfomed at the 183-F Clearwell, and data is being collected on the bats caught. A one hour video of emerging bats was taken at the Clearwell entrance during August. A total of 1693 bats were seen emerging from the hatch during that time; the tape ran out at the end of that hour and bats were still rapidly emerging from the Clearwell. Data loggers will be deployed in the Clearwell before the bats leave the structure for the winter to determine the temperature of the structure when the bats leave. The loggers will also be in place when the bats return in 2008, and will log temperatures for the entire season next year (March-October). These data will be used to determine the temperature and humidity the bats are selecting for their roost site. This information can then be used to help design an alternate roost as a mitigation site for the eventual demolition of the clearwell.

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FIGURES

TABLES

METRIC CONVERSION CHART

Into Metric Units

If You Know	*Multiply By*	*To Get*
Length		
inches	25.4	Millimeters
inches	2.54	Centimeters
feet	0.305	Meters
yards	0.914	Meters
miles	1.609	Kilometers
Area		
sq. inches	6.452	sq. centimeters
sq. feet	0.093	sq. meters
sq. yards	0.0836	sq. meters
sq. miles	2.6	sq. kilometers
acres	0.405	hectares
Mass (weight)		
ounces	28.35	grams
pounds	0.454	kilograms
ton	0.907	metric ton
Volume		
teaspoons	5	milliliters
tablespoons	15	milliliters
fluid ounces	30	milliliters
cups	0.24	liters
pints	0.47	liters
quarts	0.95	liters
gallons	3.8	liters
cubic feet	0.028	cubic meters
cubic yards	0.765	cubic meters
Temperature		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius

Out of Metric Units

If You Know	*Multiply By*	*To Get*
Length		
Millimeters	0.039	Inches
Centimeters	0.394	Inches
Meters	3.281	feet
Meters	1.094	yards
Kilometers	0.621	miles
Area		
sq. centimeters	0.155	sq. inches
sq. meters	10.76	sq. feet
sq. meters	1.196	sq. yards
sq. kilometers	0.4	sq. miles
Hectares	2.47	acres
Mass (weight)		
Grams	0.035	ounces
Kilograms	2.205	pounds
metric ton	1.102	ton
Volume		
Milliliters	0.033	fluid ounces
Liters	2.1	pints
Liters	1.057	quarts
Liters	0.264	gallons
cubic meters	35.315	cubic feet
cubic meters	1.308	cubic yards
Temperature		
Celsius	multiply by 9/5, then add 32	Fahrenheit

1.0 INTRODUCTION

This report contains a compilation of the results of vegetation monitoring data that were collected in the spring and summer of 2007 from the River Corridor Closure Contractor's (RCCC) revegetation and mitigation areas on the Hanford Site. The vegetation monitoring sites included in this report are the 300-FF-1 sites, 300-FF-2 sites, 618-4 sagebrush monitoring, 120-N-1 & -2 sites, 116-N-3, 116-N-1, Hanford Generating Plant (HGP) sites, 100-FR-1 Operable Unit revegetation area, 100 B/C sites, 100-KR-1 Operable Unit sites, Horseshoe landfill, and Environmental Restoration Disposal Facility (ERDF) Phase III Expansion mitigation. It also contains monitoring results of bat habitat mitigation projects. The locations of these sites are shown in Figure 1. The bat habitat mitigation projects are located at 100-D/DR Area and 100-F Area.

The extent of each revegetation effort varied depending on the surrounding habitat, existing conditions, and future land use designation of the area. The purpose of monitoring revegetation efforts is to measure the progress of plant succession and to evaluate the success of different planting techniques to improve RCCC site restoration success. Each area will be discussed separately and will include a brief description of the revegetation activities and the results from the 2007 monitoring efforts and data collection activities.

This report provides fifth-year data from the 120-N sites, fourth-year data was collected on the 300-FF-1 Process Ponds and Burial Grounds, and third-year surveys were completed on the 100-FR-1 Operable Unit sites and the 116-N-3 Trench. Second-year survey results are included for the revegetated areas at 100-KR-1, Hanford Generating Plant at the 100 N Area, 618-4 Burial Ground sagebrush planting, Horseshoe landfill on the ALE, and 100 B/C Area. First year monitoring results were collected from 116-N-1, 100-B/C, and 300-FF-2. Results from previous years' monitoring are provided in reports for each respective year (Johnson and Gano 2006, Johnson 2004, Johnson 2003, and Johnson 2002). The data tables from the previous revegetation monitoring reports are in Appendices A, B, C, and D of this report.

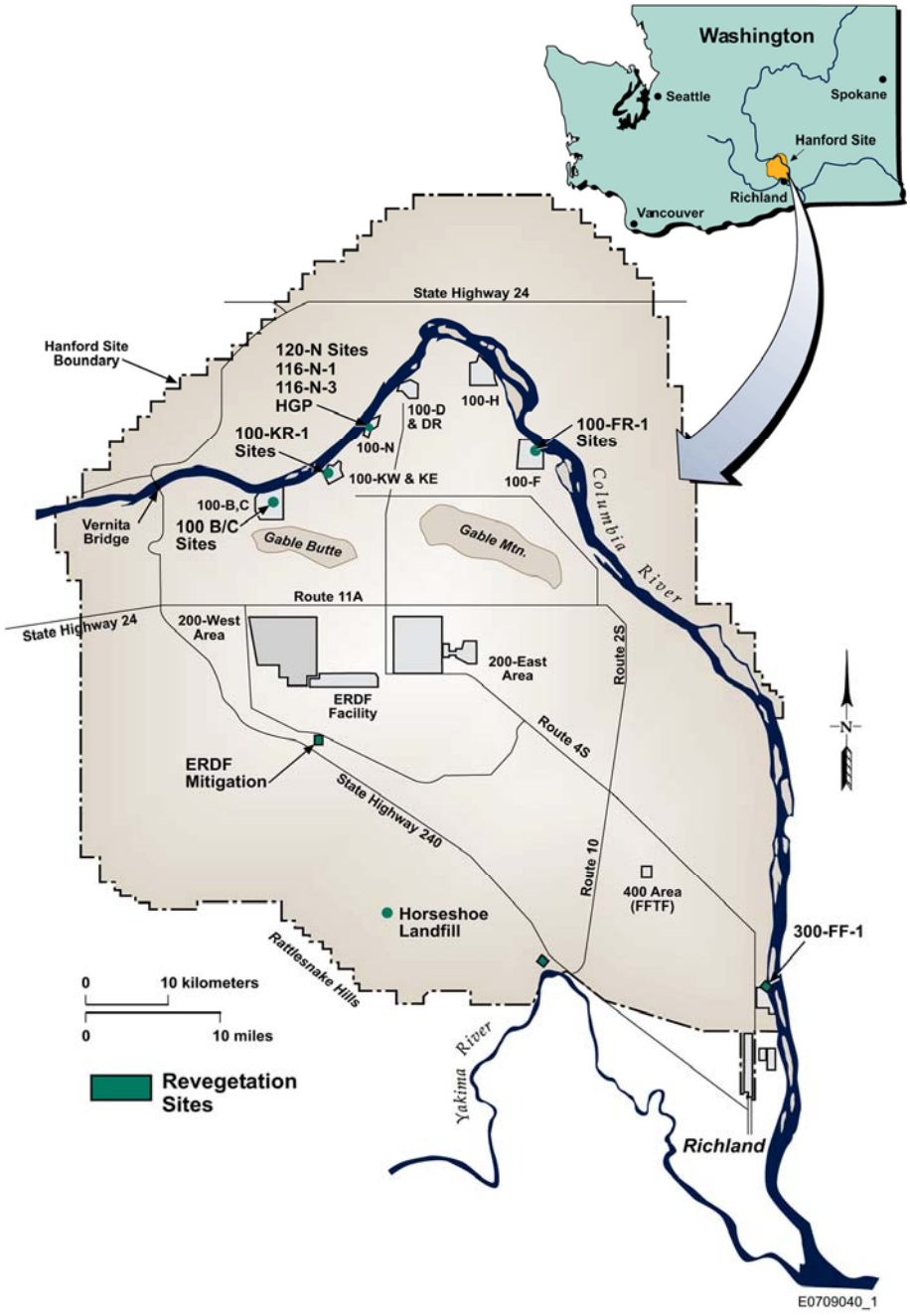
1.1 METHODS USED TO EVALUATE VEGETATION RECOVERY

Monitoring of revegetation and mitigation areas consisted of measuring the canopy cover of all plant species found on a site, the frequency of occurrence, and the survival of transplanted sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*), and spiny hopsage (*Grayia spinosa*) seedlings. All values were then converted to percentages. Canopy cover and frequency measurements were obtained using the methods described in *Steppe Vegetation of Washington* (Daubenmire 1970). Canopy coverage is defined in Daubenmire (1970) as "the percentage of ground surface included in the vertical projection of a polygon drawn around the extremities of undisturbed foliage of a plant." This method provides a measure of the amount

of ground covered by each species. Because it is possible, in dense stands of vegetation for species to overlap one another, total measured vegetative cover can exceed 100%. Within each

location, a series of plot frames were analyzed for the canopy cover of each species present. Frequency is represented as the percentage of occurrences that a species is observed in the number of plot frames measured. For example, if a species was represented in 10 out of 25 plot frames, its frequency would be 10/25 x 100 = 40%.

Figure 1. Hanford Site Showing Locations of Revegetation Sites.



The relative magnitude of a frequency rating in comparison to a canopy coverage rating provides an index of species distribution and its influence within a vegetation community. At sites where shrubs were planted, the survival rate was measured by counting a representative number of plants at the site, determining if the plants were dead or alive, and then calculating the percent survival rate.

This report uses taxonomic nomenclature from *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973). Some of the plant taxonomic names have been updated, and the revised names are provided in Appendix E of this report. Plant identification was conducted using the nomenclature in Hitchcock and Cronquist (1973) and also in *Vascular Plants of the Hanford Site* (Sackschewsky et al. 2001).

The type and extent of each revegetation effort is based on the location of the project and the future land designation of that area. The objective of revegetating the 120-N-1 and 120-N-2 sites was to stabilize the soils and initiate the establishment of native species. The restoration effort included the combined use of two fertilizer and two mulch types. The sites will be evaluated to document the effect of the material type on plant establishment and success over a five year period.

In the long-range planning, portions of the 300 Area, including the 300-FF-1 Process Ponds and Burial Grounds restoration area have been designated for future industrial use. Therefore, the objective of the revegetation effort is long term interim stabilization. The Biological Resources Management Plan (BRMaP) (DOE-RL 2001) prescribes seeding crested wheatgrass (*Agropyron cristatum*), however, to increase species diversity over the 28.3 hectare area, five additional grass species were planted. The objective of revegetation at most remedial action sites is to restore the land to plant communities that are dominated by native plants that will eventually provide wildlife habitat. Secondary objectives often include using different planting methods and techniques to improve success, while incorporating experience and knowledge gained from previous plantings.

Success criteria differ for each site with consideration of varying soil types and microclimatic conditions. For example, sandy areas promote different species with differing recovery rates and plant densities than those found in rocky soils; therefore, the criteria for judging success will be different. All sites will be evaluated based on the plant canopy cover, plant community composition, and survival and growth rates of the planted shrubs. These criteria are detailed in the *Revegetation Manual for the Environmental Restoration Contractor* (McLendon et al. 1997). A revegetation effort will be considered successful if the area is stabilized to prevent erosion and is dominated by recovering stands of native sagebrush, forbs, and grasses. Areas identified for future industrial use will be stabilized with wheatgrass (*Agropyron*) varieties because of the potential for future land disturbance.

2.0 300 AREA

2.1 300-FF-1 PROCESS PONDS AND BURIAL GROUNDS

The process pond system received cooling water and low level liquid process wastes from the fuel fabrication facilities and early laboratories. The two solid waste burial grounds, 618-4 and 618-5 received dry waste from the 300 Area operations. Remediation on the 300-FF-1 Operable Unit waste sites were initiated in 1997 and completed in 2004 with the completion of backfill and revegetation in February 2004. The 618-2 and -3 solid waste burial grounds, the 300-8 Aluminum shavings waste site, 600-47, and 300-18 waste sites are in the 300-FF-2 Operable Unit (Figure 2) and were remediated between 2004 and 2006 and revegetated in February, 2007. The 600-47 and 300-18 were not monitored because they are very small sites.

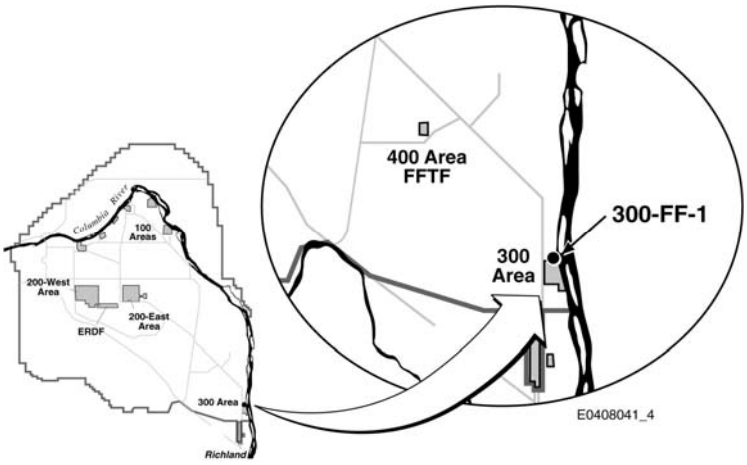
In long range planning a majority of theses sites are within the 300 Area that has been designated as future industrial use (EPA et al. 1996). Guidance provided in BRMaP prescribes industrial areas to be stabilized with crested wheatgrass. To promote a more diverse vegetative community, the 28.3 ha area was broadcast seeded with 11.2 kg/ha crested wheatgrass as well as 11.2 kg/ha Sandberg's bluegrass, 5.6 kg/ha Regreen (*Agropyron* hybrid), 5.6 kg/ha Indian Ricegrass (*Oryzopsis hymenoides*), 5.6 kg/ha Thickspike wheatgrass (*Agropyron dasytachyum*), 5.6 kg/ha Bluebunch wheatgrass, and 2.45 kg/ha needle-and-thread grass (*Stipa comata*). This planting effort was initiated in mid February, and to help promote successful germination, 16.8 kg/ha of Terra Bond (water retaining crystals) was applied during seeding. Straw mulch was distributed across the seeded areas and crimped into the soil surface to prevent wind erosion.

Fourth year data was collected from the 300-FF-1 Process Ponds in April 2007. Canopy cover of native species has increased by 15.7% since 2006 and cheatgrass has also increased by 15%. The planted wheatgrasses (*Agropyron spicatum* and *A. dasytachyum*) were the dominant native species (Table 1). There were 21 native species present and 13 introduced species.

First year monitoring was conducted in April of 2007, on the 618-2 and -3 solid waste burial grounds and the 300-8 Aluminum shavings waste site. The 618-2 and -3 Burial Grounds are connected and were revegetated as one site. Therefore, they are being monitored as a single site. The total canopy cover was measured at 35.8%, with 24.1% consisting of introduced species and 11.7% native. The planted wheatgrasses (*Agropyron sp.*) made up 11.2% of the canopy cover (Table 2). The 300-8 waste site had a 41.9% introduced species and 40.1% native species. The planted wheatgrasses (*Agropyron sp.*) made up 36.2% of the canopy cover (Table 3).

The 618-4 Burial Ground is located just outside of, but adjacent to the industrial use designated area, therefore, the 2-ha site and the area to the east of the burial ground were planted with 4,000 sagebrush tublings the first week of February 2006. Shrub survival monitoring transects were established in late April 2006, to capture baseline survival counts. The initial shrub survival monitoring on the burial ground indicated 85.8% of the February planted seedlings were still alive. Survival counts recorded in April 2007, were 66.5%.

Figure 2. 300 Area and 618-4 Burial Ground Sagebrush Monitoring.



Sagebrush at 618-4 in April, 2007

Sagebrush transect at 618-4, conducted during April, 2007

Table 1. Percent Canopy Cover and Frequency of Occurrence at the 300-FF-1 Process Ponds and Burial Grounds 2007.

Species	% Cover	% Frequency
Poa sandbergii (Sandberg's bluegrass)	7.9	57
*Bromus tectorum** (cheatgrass)	32.0	97
*Salsola kali** (Russian thistle)	3.4	80
Ag. Spp.(Wheatgrasses)	20.4	74
Oryzopsis hymenoides (Indian ricegrass)	0.1	3
*Vulpia myuros** (rattail fescue)	3.7	51
*Lactuca seriola** (prickly lettuce)	0.9	37
*Centaurea diffusa** (diffuse knapweed)	0.8	17
Festuca octoflora (six-weeks fescue)	0.4	17
*Erodium cicutarium** (storksbill)	5.3	51
*Sisymbrium altissimum** (tumble mustard)	0.8	31
Epilobium paniculatum (tall willowherb)	0.2	9
*Agropyron cristatum** (Crested Wheatgrass)	3.1	40
Senecio vulgaris (common groundsel)	0.1	6
Amsinckia lycopsoides (tarweed fiddleneck)	0.3	11
Lepidium perfoliatum (clasping pepperweed)	4.7	11
Descurainia pinnata (western tansymustard)	0.1	6
*Tragopogon dubius** (yellow salsify)	0.1	3
Hordeum leporinum(hare barley)	0.1	3
Holosteum umbellatum (jagged chickweed)	0.0	0
Petalostemon ornatum (prairie clover)	X	X
Melilotus alba * (sweetclover)	X	X
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Artemisia tridentata (sagebrush)	X	X
Tragopogon dubius (yellow salsify)	X	X
Achillea millefolium (yarrow)	X	X
Cardaria draba * (whitetop)	X	X
Machaeranthera canescens (hoary aster)	X	X
Descurainia pinnata (western tansymustard)	X	X
Agoseris heterophylla (mountain dandelion)	X	X
*Malva neglecta** (cheeseweed)	X	X
Centaurea repens * (Russian knapweed)	X	X
Biotic crust	7.2	31
Bare Soil	34.5	100
Litter	62.0	100
Total canopy cover (Biotic crust and litter not included)	**84.4**	

*Introduced species.
X = Species present on the site but not counted in a plot frame.

Total Introduced species % Cover 2007	50.0
Total Native % Cover 2007	34.4
Change in Native Plant % Cover from 2006 to 2007	+15.7

Table 2. Percent Canopy Cover and Frequency of Occurrence at 618-2 & 618-3 in 2007.

Species	% Cover	% Freq
*Salsola kali** (Russian thistle)	11.8	100
*Sisymbrium altissimum** (tumble mustard)	7.6	88
*Bromus tectorum** (cheatgrass)	4.6	84
Agropyron spp. (wheatgrasses)	11.2	100
Ambrosia acanthicarpa (bur ragweed)	0.3	12
Amsinckia lycopsoides (tarweed fiddleneck)	0.1	4
Epilobium paniculatum (tall willowherb)	0.1	4
*Erodium cicutarium** (storksbill)	0.1	4
Bare Soil	58.9	100
Litter	35.5	96
Total canopy cover (Litter not included)	**35.8**	

* Intoduced Species
X= present but not counted in plot frames

Total Introduced Species % Cover 2007	24.1
Total Native % Cover 2007	11.7

Table 3. Percent Canopy Cover and Frequency of Occurrence at 300-8 in 2007.

Species	% Cover	% Freq
*Salsola kali** (Russian thistle)	12.6	100
*Sisymbrium altissimum** (tumble mustard)	12.6	96
*Bromus tectorum** (cheatgrass)	16.2	88
Ambrosia acanthicarpa (bur ragweed)	0.3	12
Agropyron spp. (wheatgrasses)	36.2	100
*Holosteum umbellatum** (jagged chickweed)	0.2	8
Machaeranthera canescens (hoary aster)	0.3	12
Plantago patagonica (indian wheat)	0.1	4
Vulpia myuros (rattail fescue)	1.2	8
*Draba verna** (spring whitlowgrass)	0.4	16
Artemesia tridentata (sagebrush)	0.3	12
Oenothera pallida (primerose)	1.5	4
*Erodium cicutarium** (storksbill)	0.1	4
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
*Lactuca serriola * (prickly lettuce)*	X	X
Conyza canadensis * (horseweed)	X	X
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
*Centaurea diffusa * (diffuse knapweed)	X	X
Bare Soil	54.2	100
Litter	45.9	100
Total canopy cover (Litter not included)	**82.0**	

* Introduced Species
X= present but not counted in plot frames

Total Introduced Species % Cover 2007	41.9
Total Native % Cover 2007	40.1

3.0 100 AREA SITES

3.1 120-N-1 AND 120-N-2 SITES

The 120-N-1 and 120-N-2 ponds were operated from 1977 - 1986 and 1986 - 1988 respectively, receiving process effluent from the 163-N De-mineralization Plant. The two sites were remediated as part of the *100-NR-1 Interim Remedial Action Record of Decision* (Ecology 2000). Following remediation in the fall of 2002, the sites were backfilled to grade using material from a nearby borrow pit. Just prior to seeding, the top 12.7 cm of the entire area was ripped with a spring tooth implement. In mid January 2003, the 1.6 hectare area was broadcast seeded with 11.2 kg/ha Sandberg's bluegrass, 2.8 kg/ha Indian ricegrass, 2.8 kg/ha Thickspike wheatgrass, 2.8 kg/ha Bluebunch wheatgrass, 1.12 kg/ha Needle-and-thread grass, 0.56 kg/ha sagebrush seed, 0.14 kg/ha yarrow, and small amounts of cushion fleabane (*Erigeron poliospermus*), false yarrow, phlox, wallflower, and rabbitbrush seeds. One half of the 1.6 hectare area had 112 kg/ha triple-16 fertilizer applied during seeding, while the remaining area was treated with Biosol, an organic, slow release fertilizer at a rate of approximately 1,120 kg/ha. Upon completion of seeding and fertilizer application, the entire area was irrigated with 0.62 cm of water per hectare. One half of the triple-16 fertilizer area and one half of the Biosol treated area was hydro-mulched with industry standard mulch fiber. The remaining triple-16 fertilizer area and Biosol treated area was mulched with grass straw at approximately 4.5 metric tons per hectare then crimped into the soil surface (Figure 3).

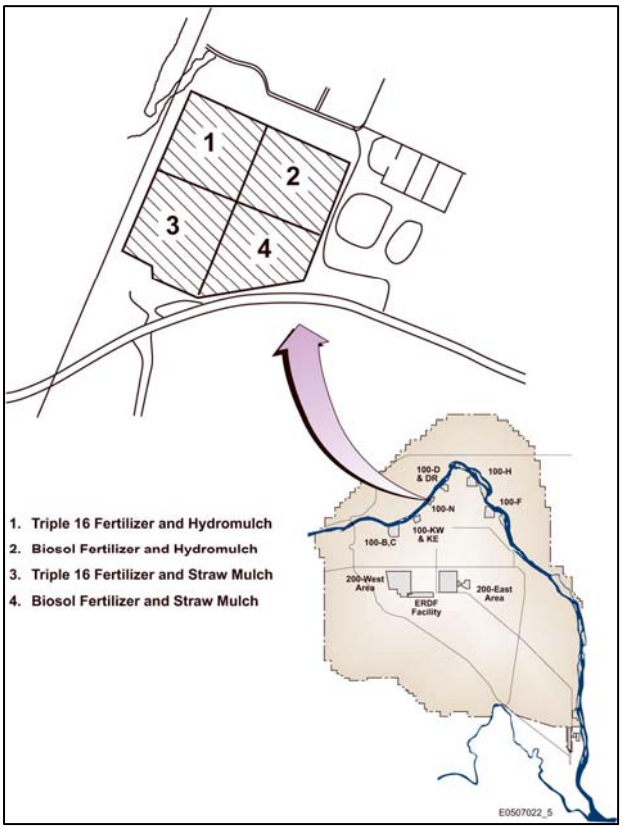
Vegetation surveys were conducted on the four treatments on May 2, 2007, for the fifth and final year of monitoring. The survey identified 22 species across the site and of those species, 12 were native. The triple-16 fertilizer and straw mulch treatment site continued to have the greatest species diversity with 15 species observed, of which 7 were native contributing 63.7% of the 99.5% total cover (Table 4). Native species increased by 38.5% since last year. Nine of the 16 species observed on the triple-16 fertilizer and hydro-mulch treatment were native contributing 40.2% of the total cover. This was a 15% increase over 2006.

The Biosol fertilizer treatments with straw and hydromulch had 102.5% and 81.3% total cover, respectively. This was only a slight change from 2006 which had 99.7% and 70.1% total cover, respectively. Cheatgrass was the dominant species on both Biosol fertilized treatments with 83.7% and 71.3% cover and 100% occurrence (Table 5). Canopy cover of native species decreased by 18.3% on the Biosol/straw treatment and 7% on the Biosol/hydromulch treatment. The Biosol/straw treatment had 11.7% Sandberg’s bluegrass and 5.2% bluebunch wheatgrass covers this year; down from 24.7% and 8.8% last year. The Biosol/hydromulch treatment changed only slightly from 1.2% Sandberg’s bluegrass cover and 2.7% bluebunch wheatgrass this year compared to 3.1% and a trace of bluebunch wheatgrass in 2006.

The data from these 4 plots have provided an interesting trend over the 5 years of monitoring. The plots treated with the Biosol fertilizer have resulted in cheatgrass being the dominant plant in every year. The 2 plots fertilized with triple-16 advanced rapidly with native species dominating and increasing steadily. The plot treated with triple-16 and straw mulch performed the best and has continued to improve steadily with and increase of 38% native species in the

fifth year. The soil type in all 4 plots was from the same source and consisted of a coarse sand and gravel; very similar to many restored waste sites in the 100Areas. Experience from many revegetation projects in this type of soil has shown that the native species tend to become established and dominate the plant community. When fine grain soil is present at a restored site, the cheatgrass tends to have an advantage and often becomes the dominant species. This is possibly related to a better seed-to-soil contact and moisture retention in fine-grained soils, resulting in better germination of the cheatgrass seeds. At 120-N-1, the Biosol fertilizer along with hydromulch provided good seed contact and moisture retention as well as a ready supply of nitrogen; both of which appear to favor cheatgrass. This test was valuable in assuring that the standard planting technique that is currently used on restored waste sites in the 100Areas (using a light application of triple-16 and crimping straw mulch) is the most effective in coarse soils.

Figure 3. 120-N Sites.



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Triple 16 Fertilizer and Straw Mulch plot
(3 on map)

Biosol Fertilizer and Straw Mulch plot
(4 on map)

Table 4. Percent Canopy Cover on the 120-N-1 and 120-N-2 Sites in 2007.

Species	Biosol and Straw Mulch	Biosol and Hydromulch	Triple-16 and Straw Mulch	Triple-16 and Hydromulch
*Bromus tectorum** (cheatgrass)	83.7	71.3	34.3	16.2
Poa sandbergii (Sandberg's bluegrass)	11.7	1.2	29.3	23.2
Agropyron spicatum (bluebunch wheatgrass)	5.2	2.7	33.7	3.3
Agropyron dasytachyum (thickspike wheatgrass)	--	--	0.2	--
*Centaurea diffusa** (diffuse knapweed)	0.2	0.3	0.8	1.5
*Poa bulbosa** (bulbous bluegrass)	--	1.0	0.3	--
Artemesia tridentata (sagebrush)	--	0.0	0.2	--
*Salsola kali** (Russian thistle)	1.5	1.3	0.2	3.0
Achillea millefolium (yarrow)	0.2	--	0.3	6.2
*Holosteum umbellatum** (jagged chickweed)	--	0.2	0.2	0.7
Erysimum asperum (wallflower)	--	0.0	--	0.0
Chrysothamnus nauseosus (gray rabbitbrush)	--	0.2	--	4.5
Oryzopsis hymenoides (Indian ricegrass)	--	2.0	--	2.0
*Sisymbrium altissimum** (tumble mustard)	0.2	1.0	X	0.2
*Tragopogon dubius** (yellow salsify)	--	--	--	0.2
Erigeron poliospermus (cushion fleabane)	--	--	X	1.0
*Draba verna** (spring whitlow)	--	0.2	--	--
*Lactuca serriola** (prickly lettuce)	--	--	X	0.2
Penstemon acuminatus (sand beardtongue)	--	--	--	X
Chaenactis douglasii (hoary falseyarrow)	--	--	--	X
Erysimum asperum (rough wallflower)	--	--	X	--
*Hordeum leporinum** (hare barley)	--	--	X	--
Biotic crust	--	--	3.00	2.33
Bare soil	23.83	39.17	24.00	78.83
Litter	76.50	54.17	59.50	11.33
Total canopy cover (Biotic crust or Litter not included)	**102.5**	**81.3**	**99.5**	**62.0**

* Introduced species.
X = Species observed but not counted in a plot frame.
-- = Not present on site.

% Cover Introduced Species	85.5	75.3	35.8	21.8
% Cover Native	17.0	6.0	63.7	40.2
Change in Native Plant % Cover from 2006 to 2007	-18.3	+0.7	+38.5	+15.0

Table 5. Percent Frequency on the 120-N-1 and 120-N-2 Sites in 2007.

Species	Biosol and Straw Mulch	Biosol and Hydromulch	Triple-16 and Straw Mulch	Triple-16 and Hydromulch
*Bromus tectorum** (cheatgrass)	100	100	100	100
Poa sandbergii (Sandberg's bluegrass)	87	100	80	47
*Salsola kali** (Russian thistle)	7	87	60	53
Achillea millefolium (yarrow)	13	80	7	--
Agropyron spicatum (bluebunch wheatgrass)	87	67	47	13
*Centaurea diffusa** (diffuse knapweed)	33	27	7	13
*Holosteum umbellatum** (jagged chickweed)	7	27	--	7
Chrysothamnus nauseosus (gray rabbitbrush)	X	20	--	7
Oryzopsis hymenoides (Indian ricegrass)	--	13	--	13
Erigeron poliospermus (cushion fleabane)	X	7	--	--
*Lactuca serriola** (prickly lettuce)	X	7	--	--
*Sisymbrium altissimum** (tumble mustard)	X	7	7	40
*Tragopogon dubius** (yellow salsify)	--	7	--	--
Agropyron dasytachyum (thickspike wheatgrass)	7	--	--	--
Artemesia tridentata (sagebrush)	7	--	--	--
*Draba verna** (spring whitlow)	--	--	--	7
Erysimum asperum (wallflower)	--	--	--	--
*Poa bulbosa** (bulbous bluegrass)	13	--	--	7
Penstemon acuminatus (sand beardtongue)	--	X	--	--
Chaenactis douglasii (hoary falseyarrow)	--	X	--	--
Erysimum asperum (rough wallflower)	X	--		--
*Hordeum leporinum** (hare barley)	X	--	--	--
Biotic crust	53	60	--	--
Bare soil	80	100	100	100
Litter	100	100	100	100

* Introduced species.

X = present but not counted in a plot frame.

-- = Not present on site.

3.2 HANFORD GENERATING PLANT

Energy Northwest Inc. worked on demolition of the 185-N Hanford Generating Plant complex from 2001 through 2004. The remedial action objectives and goals were attained for the sites in accordance with the 100 N Area Ancillary Facilities Action Memorandum (Ecology 1999) and in accordance with the Interim Remedial Action Record of Decision for the 100-NR-1 Operable Unit (Ecology 2000) and Removal Action Work plan for the Hanford Generating Plant Ancillary Facilities (DOE-RL 1999).

The Hanford Generating Plant was transferred from Energy Northwest Inc. to the Environmental Restoration Contractor in August 2004 and included into the River Corridor Closure Contractor

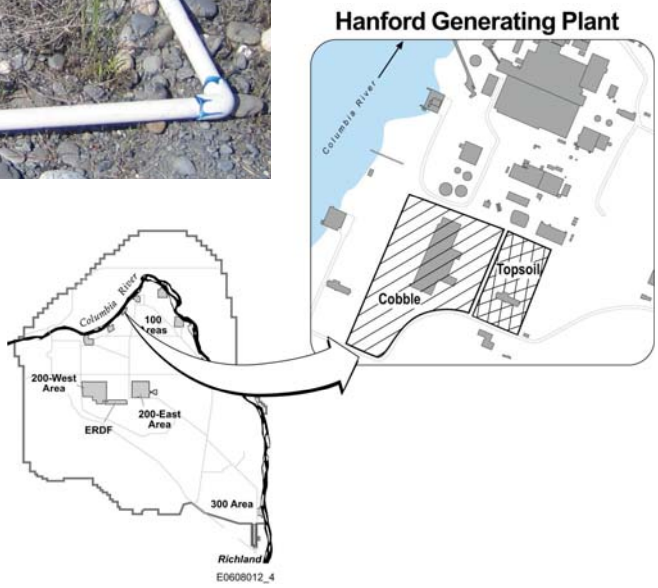
work scope in August 2006. Revegetation of the area disturbed during the demolition and remediation activities was initiated in early February and continued through mid-March 2006. Prior to seeding, the compacted soils were loosened with a disk. The area was broadcast seeded with a mix of native grass seed that included Sandberg's bluegrass, Indian ricegrass, thickspike wheatgrass, bluebunch wheatgrass, Prairie junegrass (*Koeleria cristata*), and needle-and-thread grass. Triple-16 fertilizer and polyacrylamide (water retaining crystals) were applied during seeding. The seeded area was mulched with straw and planted with sagebrush seedlings that were grown in 10-in tubes from seed collected on the Hanford site (Figure 4).

The planted area was separated into two analysis sections; the eastern half of the area has native fine grained topsoil that was not removed during the demolition activities while the western area has rocky cobble backfill material from a nearby borrow pit. Second year monitoring was conducted on May 2, 2007. The total measured cover on the eastern portion of the site (topsoil) was 131.6% while the western (cobble) area had 85% canopy cover (Tables 6 & 7). The topsoil area had 73.5% cheatgrass cover with 21.1% Sandberg's bluegrass. The fine grained soil at this site appears to have favored many of the introduced and early successional species. The cobble site had 27% canopy cover for Russian thistle, however, most plants were stressed and of small stature. Sandberg's bluegrass had 26% cover and cheatgrass was only 15%. These 2 sites provide another example of how cheatgrass is favored in fine-grain soil. It certainly provides better moisture holding capacity, which favors the fast-growing cheatgrass, and likely provides a better soil-to-seed contact for better germination.

Sagebrush survival monitoring transects were established within each of the monitoring areas again in 2007. Survival was greatly reduced this year with only 26% total sagebrush survival in the coble area; down from 96% at the beginning of the 2006 summer. The top soil area had only 14% sagebrush survival; down from 95% in 2006.

Figure 4. Hanford Generating Plant.

Sagebrush at Hanford Generating Plant
May, 2007



Revegetated Cobble area at Hanford Generating Plant
May, 2007

Table 6. Percent Canopy Cover at the Hanford Generating Plant in 2007.

Species	Topsoil	Cobble
Poa sandbergii (Sandberg's bluegrass)	21.1	26
Native Grasses [b]	2.6	9
*Bromus tectorum** (cheatgrass)	73.5	15
*Sisymbrium altissimum** (tumble mustard)	3.1	3
*Salsola kali** (Russian thistle)	1.1	27
*Erodium cicutarium** (storksbill)	0.3	0
*Lactuca seriola** (prickly lettuce)	0.3	1
Chrysothamnus nauseosus (gray rabbitbrush)	X	0
*Draba verna** (spring whitlow)	0.3	1
*Holosteum umbellatum** (jagged chickweed)	22.1	1
*Vulpia myuros** (rattail fescue)	0.1	1
Artemesia tridentata (sagebrush)	0.3	0
*Centaurea diffusa** (diffuse knapweed)	X	0
Achillea millefolium (yarrow)	--	0
*Chorispora tenella** (blue mustard)	5.4	0
Amsinckia lycopsoides (tarweed fiddleneck)	0.3	0
Descurainia pinnata (western tansymustard)	--	0
*Ranunculus testiculatus** (bur buttercup)	1.3	X
Poa bulbosa * (Bulbous bluegrass)	X	X
Hordeum leporinum * (hare barley)	X	--
Machaeranthera canescens (hoary aster)	--	X
Sphaeralcea munroana (Munro's globemallow)	--	X
Bare Soil	3.6	38
Litter	85.9	56
Total canopy cover (Biotic crust or Litter not included)	**131.6**	**85**

*Introduced species.
[b]Includes Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.

X = Species present on the site but not counted in a plot frame
-- = Not observed on the site.

Total Introduced % Cover 2007	3.63	56
Total Native % Cover 2007	85.88	38
Change in Native Plant % Cover from 2006 to 2007	+64.68	+2.7

Table 7. Frequency of Occurrence at the Hanford Generating Plant in 2007.

Species	Topsoil	Cobble
Poa sandbergii (Sandberg's bluegrass)	65	92
Native Grasses [b]	35	72
*Bromus tectorum** (cheatgrass)	100	96
*Sisymbrium altissimum** (tumble mustard)	75	80
*Salsola kali** (Russian thistle)	45	92
*Erodium cicutarium** (storksbill)	10	12
*Lactuca seriola** (prickly lettuce)	10	28
Chrysothamnus nauseosus (gray rabbitbrush)	X	4
*Draba verna** (spring whitlow)	10	20
*Holosteum umbellatum** (jagged chickweed)	80	28
*Vulpia myuros** (rattail fescue)	5	28
Artemesia tridentata (sagebrush)	10	4
*Centaurea diffusa** (diffuse knapweed)	X	12
Achillea millefolium (yarrow)	X	8
*Chorispora tenella** (blue mustard)	50	4
Amsinckia lycopsoides (tarweed fiddleneck)	10	4
Descurainia pinnata (western tansymustard)	X	4
*Ranunculus testiculatus** (bur buttercup)	25	X
Poa bulbosa * (Bulbous bluegrass)	X	X
Hordeum leporinum * (hare barley)	X	--
Machaeranthera canescens (hoary aster)	--	X
Sphaeralcea munroana (Munro's globemallow)	--	X
Bare Soil	70	92
Litter	100	100

* Introduced species.

[b]Includes Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.

X = Species present but not counted in a plot frame

-- = Not present on site.

3.3 116-N-3

The 116-N-3 crib, trench, and pipeline were remediated to Remedial Action Objectives, Remedial Action Goals, and closure performance standards established by the EPA and Ecology in concurrence with RL. The goals and objections are documented in the *100-NR-1 Interim Remedial Action Record of Decision* (Ecology 2000) and *Remedial Design Report / Remedial Action Work Plan for the 100-NR-1 Treatment, Storage, and Disposal Units* (DOE-RL 2000B).

The area in and around the 116-N-3 trench contain unusual depositional features referred to as giant ripples, created by cataclysmic floods from 20,000 to 10,000 years ago. These features appear as small hills north and east of N Reactor and portions of the project area were located within these features. This area is known as *Mooli Mooli* (stacked hills) to local Native American Tribes, and is significant as an area that contains legends, stories, and spiritual power that remain important to their religion, traditions, and cultural heritage. The 116-N-3 trench was constructed within a portion of *Mooli Mooli* (Figure 5). The *Mooli Mooli* within the trench construction and remediation boundary were removed leaving a flat linear structure within the traditional cultural area. Because of the significance of *Mooli Mooli* to local Native American Tribes, Environmental Restoration Conctactor's Remedial Action and Cultural Resources staff, in conjunction with tribal members developed a backfill recontour design to restore the previously removed portions of *Mooli Mooli.* Backfill and recontour operations were initiated in August and continued through the end of December 2004. Revegetation activities on the 116-N-3 area were initiated in mid-January 2005 and continued for five weeks. Revegetation of the trench included broadcast seeding a native grass seed mix consisting of Sandberg's bluegrass, Indian ricegrass, prairie junegrass, bluebunch wheatgrass, thickspike wheatgrass, and needle-and-thread grass with a hydroseeder. The seeds were originally collected on the Hanford site and grown under agricultural conditions for seed production or cultivars of species occurring on site purchased from a local seed producer. Triple-16 fertilizer was applied during seeding, as the material used as backfill was excavated from depths up to 9 m below grade and was nutrient deficient. Industry standard hydromulch was added to the tank mix at 225 kg/ha to help ensure even seed distribution. Upon the completion of seeding, the entire area was irrigated with 23,400 L/ha and then mulched with 4.5 metric tons/ha grass straw which was crimped into the soil surface to help hold it in place.

Sagebrush and spiny hopsage (*Grayia spinosa*) seedlings were grown by a native plant nursery from seed collected on the Hanford Site. There were 13,050 shrubs; 11,500 sagebrush and 1,550 spiny hopsage planted across the remediated waste site and a small area adjacent to the trench that was used for backfill material. Shrub survival monitoring plots were established in the spring of 2005 within the planted area to mark sagebrush and spiny hopsage plants for future plant survival counts.

On May 3, 2007, third-year vegetation monitoring surveys were conducted on the 116-N-3 Trench. Seventeen species were observed within the revegetated area; 8 of those were native. Sandberg's bluegrass cover increased this year to 30.8% cover (Table 8). The total cover for all introduced species in 2007 was 36.2%. The total cover for native species was 38%.

3.4 116-N-1

The 116-N-1 Crib and Trench were remediated to Remedial Action Objectives, Remedial Action Goals, and closure performance standards established by the EPA and Ecology in concurrence with RL. The goals and objectives are documented in the *100-NR-1 Interim Remedial Action Record of Decision* (Ecology 2000) and *Remedial Design Report / Remedial Action Work Plan for the 100-NR-1 Treatment, Storage, and Disposal Units* (DOE-RL 2000B).

Revegetation activities on the 116-N-1 crib and trench were conducted in December 2006. Native grass species were planted along with sagebrush at 1235 plants/hectare.

First year vegetation surveys were conducted on May 8, 2007. Seventeen species were present; 11 of which were native. The grass species planted were not mature enough to identify so they are listed in Table 9 as "Native Grasses." The native grasses dominated the vegetation with 31.8% canopy cover. The total cover was 56.6%. Introduced species made up 23.9% and native species were 32.7%. A sagebrush monitoring transect was established on this site and the estimated survival was 95%.

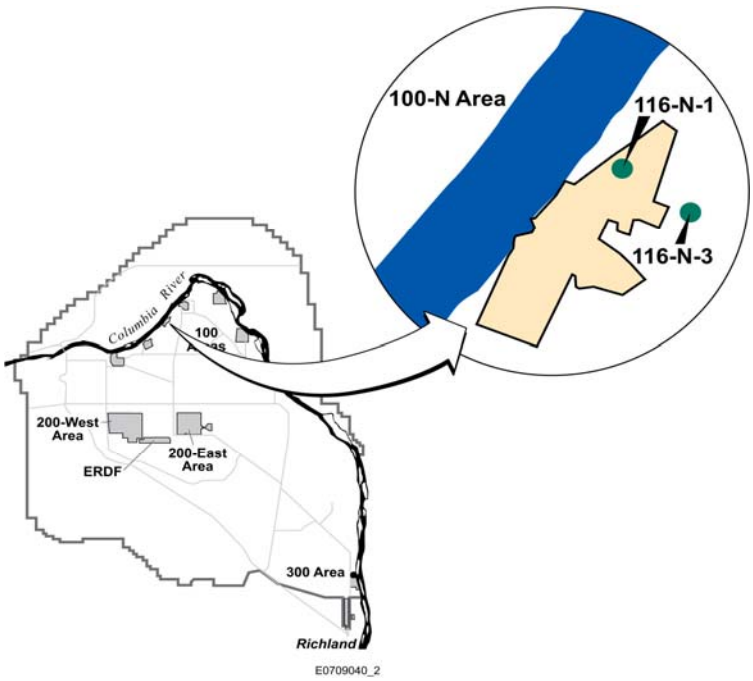
Table 8. Percent Canopy Cover and Frequency of Occurrence at 116-N-3 in 2007.

Species	% Cover	% Freq
Agropyron spicatum (bluebunch wheatgrass)	5.1	43
*Bromus tectorum** (cheatgrass)	16.8	97
*Salsola kali** (Russian thistle)	14.8	100
*Lactuca serriola** (prickly lettuce)	1.8	23
*Sisymbrium altissimum** (tumble mustard)	1.5	60
Poa sandbergii (Sandberg's bluegrass)	30.8	90
*Holosteum umbellatum** (jagged chickweed)	0.8	30
*Draba verna** (spring whitlow)	0.3	10
Agoseris heterophylla (mountain-dandelion)	0.3	13
*Erodium cicutarium** (storksbill)	0.5	3
Amsinckia lycopsoides (tarweed fiddleneck)	0.2	7
*Vulpia myuros** (Rattail fescue)	0.1	3
Oryzopsis hymenoides (Indian ricegrass)	0.1	3
Sitanion hystrix (bottlebrush squirreltail)	1.5	13
*Centaurea diffusa** (diffuse knapweed)	0.5	3
Koeleria cristata (prairie Junegrass)	X	X
Machaeranthera canescens (hoary aster)	X	X
Bare Soil	53.9	93
Litter	35.8	100
Total canopy cover (Litter not included)	**74.9**	

* Introduced species.
X = Species observed not counted in a plot frame.

Total Introduced % Cover 2007	36.17
Total Native % Cover 2007	38.00
Change in Native Plant % Cover from 2006 to 2007	+21.1

Figure 5. 116-N-1 and 116-N-3 Sites.



Sagebrush at 116-N-1
May, 2007

Revegetated native grasses growing at 116-N-1 in May of 2007

Table 9. Percent Canopy Cover and Frequency of Occurrence at 116-N-1 in 2007.

Species	% Cover	Freq. of Occ.
Native Grasses [b]	31.8	100
*Sisymbrium altissimum** (tumble mustard)	17.7	87
*Lactuca seriola** (prickly lettuce)	0.8	30
*Bromus tectorum** (cheatgrass)	0.9	37
*Salsola kali** (Russian thistle)	4.4	93
Artemesia tridentata (sagebrush)	0.8	30
Poa sandbergii (Sandberg's bluegrass)	0.1	3
Chrysothamnus nauseosus (gray rabbitbrush)	0.1	3
*Kochia scopari** (kochia)	0.2	7
Descurainia pinnata (western tansymustard)	X	X
Conyza canadensis * (horseweed)	X	X
Epilobium paniculatum (tall willowherb)	X	X
Achillea millefolium (yarrow)	X	X
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
Oryzopsis hymenoides (Indian ricegrass)	X	X
Agropyron spicatum (bluebunch wheatgrass)	X	X
Poa sandbergii (Sandberg's bluegrass)	X	X
Bare Soil	31.3	97
Litter	63.7	100
Total canopy cover (Litter not included)	**56.6**	

* Introduced species
X=present but not counted in plot frames

[b]Includes Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.

Total Introduced % Cover	23.92
Total Native % Cover	32.67

3.5 100 F AREA

Remedial action of several waste sites within the 100-FR-1 Operable Unit in the 100-F Area were initiated in 2000. The remedial action objectives and goals were established by the U.S. Environmental Protection Agency and the Washington State Department of Ecology, in concurrence with the U. S. Department of Energy, Richland Operations Office and documented in the *Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units* (ROD) (EPA 1997) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2000A). The sites were excavated to the extent required to meet specified soil cleanup levels, the contaminated materials were disposed of at the ERDF, and the sites were backfilled with material from a local borrow source and contoured to match

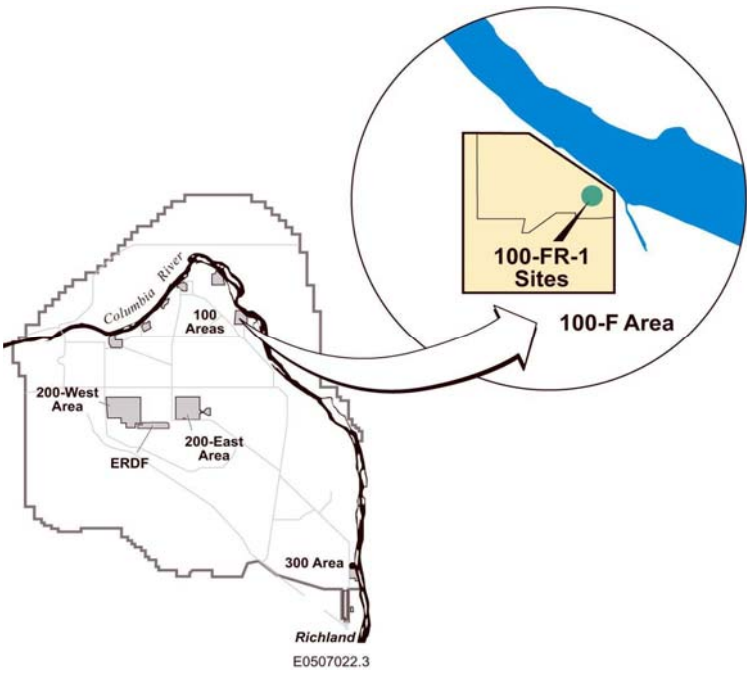
the adjacent area in the fall 2003. The borrow area used for fill material is located 732 meters northwest of the 105- F Reactor and is within the 100-F Area perimeter road. The area was used as a borrow site in the 1970s. Since the 1970s the former borrow area, consisting of exposed rocky cobble with some course sand, had started to naturally recover but was noted as having only a very sparse stand of small stature gray rabbitbrush with scattered understory species, with the total cover of less than 5%. The borrow pit was expanded to the west of previously mined area to accommodate waste site backfill requirements. The expansion area had been lightly disturbed but recovered to a community dominated by cheatgrass and Sandberg's bluegrass (DOE/EA-1454). Prior to expanding the borrow area, the top 30.5 cm of topsoil was stockpiled. Following the completion of borrow pit operations, the topsoil was redistributed across the excavated areas. The borrow area was broadcast seeded with native grasses and planted with sagebrush seedlings.

The backfilled and recontoured waste sites were revegetated in January 2005. The objective of revegetating the area was to establish a plant community dominated by native species with a limited number of introduced species within the community after establishment.

A native seed mix was broadcast with a hydroseeder across all the sites. The seed mix included Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, prairie junegrass, and needle-and-thread grass. The seed comprising the mix was grown on contract from seed collected on the Hanford site or cultivars purchased from a local seed producer. Triple-16 fertilizer was applied with the grass seed mixture. Industry standard hydromulch was added to the tank mix at 225 kg/ha to help ensure an even seed distribution. Upon the completion of seeding, the entire area was irrigated with 23,400 L/ha then mulched with 4.5 metric tons/ ha of straw and crimped into the soil surface to prevent wind erosion. Sagebrush seedlings were grown in 4-in tubes from seed collected on the Hanford Site and fifty-five thousand sagebrush plants were planted across the remediated waste sites and borrow area. (Figure 6).

Third-year observations and measurements were taken at 100-F on May 17, 2007. Cheatgrass canopy cover doubled to 46% canopy cover from 2006. Native bluebunch wheatgrass and Sandberg's bluegrass also increased canopy cover two-fold, and were the dominant revegetated species, at 12% and 19% cover respectively (Table 10). Russian thistle frequency of occurance increased sharply to 94%, though it had a relatively low (4.4%) canopy cover and most plants were stunted and small in stature. Native canopy cover increased 15% from measurements in 2006, showing positive succession toward a native plant community.

Figure 6. 100-F Area



January 2005 Sagebrush at 100-F, May, 2007

Sagebrush and Rabbitbrush at 100-F from May, 2007.

Table 10. Percent Canopy Cover and Frequency of Occurrence at 100-F Area Sites in 2007.

Species	% Cover	% Freq
Agropyron spicatum (bluebunch wheatgrass)	11.6	69
*Bromus tectorum** (cheatgrass)	45.6	97
*Salsola kali** (Russian thistle)	4.4	94
*Sisymbrium altissimum** (tumble mustard)	0.3	11
Artemesia tridentata (sagebrush)	0.1	3
Poa sandbergii (Sandberg's bluegrass)	18.7	94
Sitanion hystrix (bottlebrush squirreltail)	0.1	3
Achillea millefolium (yarrow)	0.1	6
*Holosteum umbellatum** (jagged chickweed)	5.4	26
*Draba verna** (spring whitlow)	0.3	11
*Poa bulbosa** (bulbous bluegrass)	0.4	14
Sporobolus cryptandrus (sanddrop seed)	0.1	3
*Erodium cicutarium** (storksbill)	0.3	11
*Vicia cracca** (bird vetch)	1.1	3
Festuca octoflora (slender sixweeks)	0.1	3
Oryzopsis hymenoides (Indian ricegrass)	0.4	3
Astragalus sclerocarpus (stalk-pod milkvetch)	0.4	3
Lepidium perfoliatum (clasping pepperweed)	0.1	3
Astragalus succumbens (crouching milkvetch)	X	X
Phacelia linearis (threadleaf scorpionweed)	X	X
Koeleria cristata (prairie junegrass)	X	X
Centaurea diffusa * (diffuse knapweed)	X	X
Agoseris heterophylla (mountain dandelion)	X	X
Machaeranthera canescens (hoary aster)	X	X
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Tragopogon dubius * (yellow salsify)	X	X
Astragalus caricinus (buckwheat milkvetch)	X	X
Chrysothamnus viscidiflorus (green rabbitbrush)	X	X
Bare Soil	28.3	80
Litter	69.0	100
Total canopy cover (Litter not included)	**89.4**	

* Introduced species.
X = Species present on the site but not counted in a plot frame.
-- = Not present on site.

Total Introduced % Cover 2007	57.71
Total Native % Cover 2007	31.71
Change in Native Plant % Cover from 2006 to 2007	+15.4

3.6 100 B/C SITES PLANTED IN 2006

In 2006, waste sites 100-B-1, 128-C-1, and 600-232 in the 100 B/C Area were revegetated after completion of remedial actions to meet the objectives for interim closure as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005A) and the *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, Hanford Site, Benton County, Washington* (EPA 1999). The remediated sites that required backfill used material from borrow pit 24, located west of the 100 B/C Area. The 100-B-1 site was backfilled with borrow pit material, then a thin layer of topsoil that was salvaged from the waste staging pile area was spread over the borrow pit material. The 128-C-1 site was backfilled to grade with pit run cobble. The 600-232 site did not require backfill as the site was primarily surface debris that was picked up, with only the top 12 inches of soil being removed from a portion of the site. All three sites were broadcast seeded in winter of 2006 with a native grass seed mix that included Sandberg's bluegrass, needle-and-thread grass, Indian ricegrass, bluebunch wheatgrass, prairie junegrass, and thickspike wheatgrass. Triple-16 fertilizer and polyacrylamide was applied with the grass seed. Upon the completion of seeding, the entire area was irrigated with 23,400 L/ha then mulched with 4.5 metric tons/ ha straw and crimped into the soil surface to prevent wind erosion. The sites were then planted with 16,000 sagebrush and 600 spiny hopsage seedlings (Figure 7).

Second-year vegetation analysis was performed at 100-B-1 and 128-C-1 on May 10, 2007. Results showed that canopy cover increased 62% for 100-B-1 and 55% for 128-C-1, with half of the increase being native cover. Native plant species diversity more than doubled from 2006, with 11 species identified in addition to those grouped as native grasses (Table 11). Sandberg's bluegrass was the dominant plant on the 100-B-1 site, with over 44% canopy cover, even though it was not observed on site in 2006. The most dominant native species on the 128-C-1 site was bottlebrush grass at over 12% cover, though Russian thistle and cheatgrass have slightly greater canopy covers respectively. The 100-B-1 site showed 55% of the originally planted sagebrush surviving; down 26% from 2006. Sagebrush on the 128-C-1 fared better with 58% survival this year; down 16% from 2006.

3.7 100 B/C SITES PLANTED IN 2007

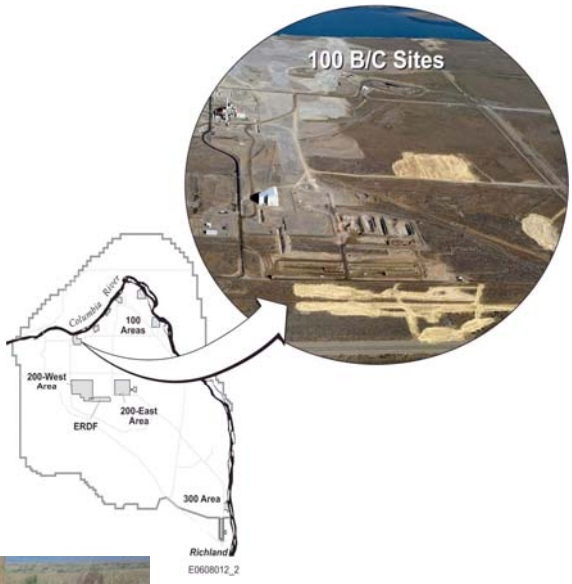
In 2007, the following waste sites in the 100 B/C Area were revegetated: 100-B-8, a portion of 100-B-14, 100-C-9, 126-B-3, 128-B-2, 128-B-3, 118-B-2, 118-B-3, and 1607-B-2. These sites were remediated to meet the objectives for interim closure as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005A) and in the Declaration of the Record of Decision for the selected Interim Remedial Action for the 100 Area 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, and 200-CE-3 Operable Units, CCN 071363, (EPA 1999).

The total acreage that was revegetated was approximately 100 acres. The sites that were monitored were the 100-C-9 Process Sewer Pipelines and the 118-B-2 and 118-B-3 Burial Grounds. The sites were backfilled with pit-run gravel from borrow pit 24 and then revegetated by broadcast seeding with a native grass seed mix that included Sandberg's bluegrass, needle-and-thread grass, Indian ricegrass, bluebunch wheatgrass, prairie junegrass, and bottlebrush squirreltail. Triple-16 fertilizer and polyacrylamide was applied with the grass seed. Upon the completion of seeding, the entire area was mulched with 4.5 metric tons/ha straw and crimped into the soil surface to prevent wind erosion. Upon completion of seeding, the sites were planted with sagebrush at approximately 1300 plants/ha (530 plants/ac).

The first year vegetation surveys were conducted on May 15, 2007. Since the 100-C-9 pipeline extends from 105-CReactor, north to the perimeter road, 4 transects of approximately 100 meters each were analyzed for percent canopy cover and percent frequency (Tables 12 and 13). Transects begin at the south end with transect 1 and extend north in sequence to transect 4 at the north end of the waste site. Twenty three species were present, 13 of which were native. The grass species planted were not mature enough to identify so they were identified only as "native grasses." The native grasses dominated the vegetation in transects 1, 2, and 4 with 61.7%, 47%, and 42.2% canopy cover. Transect 3 had 18% cover for native grasses. The other dominant species were Russian thistle (on all transects) and tumble mustard (on transects 3 & 4). The Russian thistle was small in stature and stressed, indicating that most plants would remain small or die out. This is a typical condition in the first year after planting. Three sagebrush monitoring transects were established on this site, again, extending from south to north. The measured survival was 99% on Transect #1, 100% on Transect #2, and 98% on Transect #3.

First year vegetation analysis was also performed on the 118-B-2 and 118-B-3 Burial Grounds. The sites were combined in the analysis due to their small size and similarity of plant cover. Native grasses were well established for first year plots, at 26.5% cover, while the dominant species on the site was Russian thistle. Sagebrush was present in 7% of the plot frames, and other incidental introduced species were also seen including cheatgrass and tumble mustard (Table 14).

Figure 7. 100 B/C Sites.



100-C-9 sagebrush monitoring transect,
May 2007.

2006 planted sagebrush at 100-B-1,
May 2007.

Sagebrush monitoring transect at 100-B-1,
May 2007.

Table 11. Percent Canopy Cover and Frequency on the 100-B-1 and 128-C-1 Sites in 2007.

Species	% Cover on 100-B-1	% Cover on 128-C-1	% Frequency on 100-B-1	% Frequency on 100-C-1
*Sisymbrium altissimum** (tumble mustard)	6.1	1.2	84	47
*Salsola kali** (Russian thistle)	17.8	19.2	100	100
Poa sandbergii (Sandberg's bluegrass)	41.6	8.8	100	67
Agropyron spp.(Wheatgrasses)	2.7	1.5	68	60
*Bromus tectorum** (cheatgrass)	18.5	17.7	84	100
Poa bulbosa (Bulbous bluegrass)	0.1	--	4	--
*Hordeum leporinum** (hare barley)	0.2	--	8	--
Amsinckia lycopsoides (tarweed fiddleneck)	0.7	--	8	--
Agoseris heterophylla (mountain dandelion)	0.1	0.2	4	7
*Vulpia myuros** (rattail fescue)	0.1	--	4	--
Artemesia tridentata (sagebrush)	0.1	1.0	4	7
Grayia spinosa (hopsage)	X	--	X	--
Descurainia pinnata (western tansymustard)	X	--	X	--
Hordeum leporinum * (hare barley)	X	--	X	--
Kochia scoparia * (kochia)	X	--	X	--
Amsinckia lycopsoides (fiddleneck)	X	--	X	--
*Lactuca seriola** (prickly lettuce)	--	0.7	--	27
Sitanion hystrix (bottlebrush squirreltail)	--	12.2	--	73
Draba verna (spring whitlowgrass)	--	0.5	--	20
Oryzopsis hymenoides (Indian ricegrass)	--	1.3	--	20
Bare Soil	30.5	34.2	96	100
Litter	57.2	55.2	100	100
Total Canopy Cover (litter not included)	**88.0**	**64.2**		

* Introduced species.
X = Observed on the site but not counted in a plot frame.
-- = Not present on site.

Total Introduced % Cover 2007	42.6	39.2
Total Native % Cover 2007	45.4	25.0
Difference in % Cover of Native Plants from 2006 to 2007	+31.2	+20.8

Table 12. Percent Canopy Cover at 100-C-9 Transects 1, 2, 3, & 4 in 2007.

Species	T-1 % Cover	T-2 % Cover	T-3 % Cover	T-4 % Cover
*Salsola kali** (Russian thistle)	12.3	24.7	25.7	39.8
*Bromus tectorum** (cheatgrass)	0.2	5.7	10.0	3.0
Native Grasses [b]	61.7	47.0	18.0	42.2
*Sisymbrium altissimum** (tumble mustard)	1.3	1.5	13.2	25.5
Artemesia tridentata (sagebrush)	0.2	0.5	0.2	0.2
*Lactuca seriola** (prickly lettuce)	0.5	0.2	1.0	0.3
*Holosteum umbellatum** (jagged chickweed)	--	1.0	--	--
*Poa bulbosa** (bulbous bluegrass)	X	X	0.2	--
Draba verna (spring whitlowgrass)	--	--	0.5	0.2
Epilobium paniculatum (tall willowherb)	--	--	0.2	--
Eriogonum niveum (snow buckwheat)	--	--	0.3	--
*Centaurea diffusa** (diffuse knapweed)	--	--	X	0.7
Festuca octoflora (slender sixweeks)	X	--	--	0.2
Agropyron spp. (wheatgrasses)	--	--	--	0.2
*Erodium cicutarium** (storksbill)	--	--	X	0.2
Tragopogon dubius * (yellow salsify)	--	X	--	--
Amsinckia lycopsoides (tarweed fiddleneck)	--	X	--	--
Agastache occidentalis (western horsemint)	--	--	--	X
Chrysothamnus nauseosus (gray rabbitbrush)	--	X	X	--
Chaenactis douglasii (hoary falseyarrow)	--	--	X	--
Machaeranthera canescens (hoary aster)	--	--	X	--
Gnaphalium chilense (cottonbatting cudweed)	--	--		X
Melilotus officinalis * (sweetclover)	--	--	--	--
Bare Soil	48.5	32.2	40.5	37.2
Litter	52.8	70.5	60.8	60.8
Total canopy cover (Litter not included)	**76.2**	**80.5**	**69.2**	**112.3**
* Introduced species				
[b]Includes Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.				
X=present but not counted in plot frames				
-- = Not present on site.				
Total Introduced % Cover 2007	14.33	33	50.5	69.7
Total Native % Cover 2007	61.83	47.5	18.7	42.7

Table 13. Percent Frequency of Occurrence at 100-C-9 Transects 1, 2, 3, & 4 in 2007.

Species	T-1 Freq. of Occ.	T-2 Freq. of Occ.	T-3 Freq. of Occ.	T-4 Freq. of Occ.
*Salsola kali** (Russian thistle)	100	100	100	100
*Bromus tectorum** (cheatgrass)	7	7	80	53
Native Grasses[b]	100	100	100	100
*Sisymbrium altissimum** (tumble mustard)	53	27	100	93
Artemesia tridentata (sagebrush)	7	20	7	7
*Lactuca seriola** (prickly lettuce)	20	7	40	13
*Holosteum umbellatum** (jagged chickweed)	--	7	--	--
*Poa bulbosa** (bulbous bluegrass)	X	X	7	--
Draba verna (spring whitlowgrass)	--	--	20	7
Epilobium paniculatum (tall willowherb)	--	--	7	--
Eriogonum niveum (snow buckwheat)	--	--	13	--
*Centaurea diffusa** (diffuse knapweed)	--	--	X	27
Festuca octoflora (slender sixweeks)	X	--	--	7
Ag spp. (wheatgrasses)	--	--	--	7
*Erodium cicutarium** (storksbill)	--	--	X	7
Tragopogon dubius * (yellow salsify)	--	X	--	--
Amsinckia lycopsoides (tarweed fiddleneck)	--	X	--	--
Agastache occidentalis (western horsemint)	--	--	--	X
Chrysothamnus nauseosus (gray rabbitbrush)	--	X	X	--
Chaenactis douglasii (hoary falseyarrow)	--	--	X	--
Machaeranthera canescens (hoary aster)	--	--	X	--
Gnaphalium chilense (cottonbatting cudweed)	--	--		X
Melilotus officinalis * (sweetclover)	--	--	--	--
Bare Soil	100	93	100	100
Litter	93	100	100	100

* Introduced species

[b]Includes Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.

X=present but not counted in plot frames

-- = Not present on site.

Table 14. Percent Canopy Cover and Frequency of Occurrence at 118-B 2 &118-B- 3 in 2007.

Species	% Cover	% Freq
Native Grasses	26.5	100
*Salsola kali** (Russian thistle)	61.7	100
*Sisymbrium altissimum** (tumble mustard)	0.5	20
*Bromus tectorum** (cheatgrass)	0.2	7
Artemesia tridentata (sagebrush)	0.2	7
Lactuca serriola * (prickly lettuce)	X	X
Chondrilla juncea * (rush skeletonweed)	X	X
Bare Soil	39.8	100
Litter	55.2	100
Total canopy cover (Litter not included)	**89.0**	
* Introduced species		
X=present but not counted in plot frames		
Total Introduced % Cover 2007	62.3	
Total Native % Cover 2007	26.7	

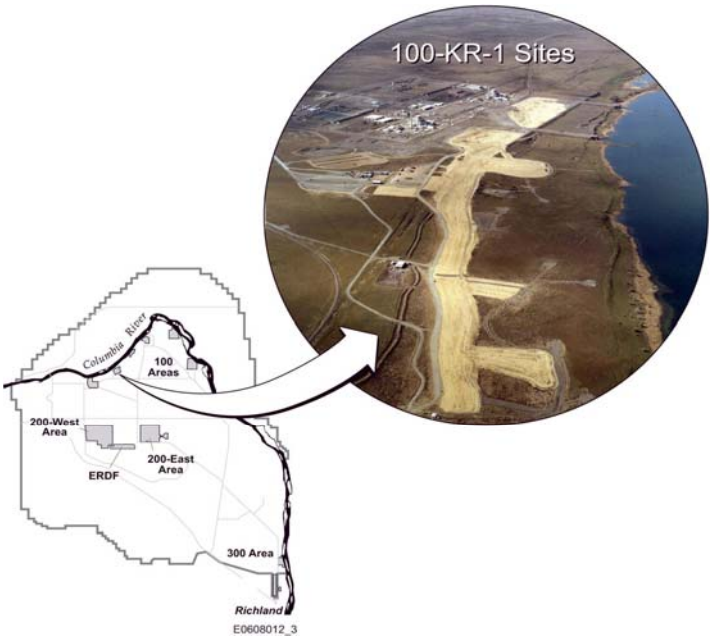
3.8 100 K AREA

Remedial action of the large liquid waste sites; 116-KE-3, 116-KW-4, 116-K-1, 100-K-55, 100-K-56, and 116-K-2 in the 100-KR-1 Operable Unit was initiated in October 2002, and continued through October 2005. Remediation of the sites was in accordance with the *Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington* (EPA 1997). Remedial action objectives (RAOs) and remedial action goals (RAGs) for these sites are documented in the *Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington* (EPA 1995) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005A). The selected remedial action involved (1) excavating the sites to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the ERDF in the 200 Area of the Hanford Site, and (3) backfilling the sites with clean soil to adjacent grade elevations. The sites meet cleanup standards and have been reclassified as "interim closed out" in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1998) and the Waste Site Reclassification Guideline TPA-MP-14 (RL-TPA-90-0001) (DOE-RL 1998).

In late February 2006, the backfilled sites were broadcast seeded with a mix of native grass seed that included Sandberg's bluegrass, needle-and-thread grass, Indian ricegrass, bluebunch wheatgrass, prairie junegrass, and thickspike wheatgrass. Triple-16 fertilizer and polyacrylamide was applied at the time of seeding. The seeded areas were mulched with 4.5 metric tons/ha straw and crimped into the soil surface to prevent wind erosion. Upon completion of seeding, the sites were planted with 37,000 sagebrush and 600 spiny hopsage seedlings.

The 116-K-2 site was broken up into four transects (T1-T4), for vegetation analysis in order to show results on a finer scale. The transects each extend approximately 100 meters and are laid out along the 116-K-2 (a.k.a Mile Long Trench) to represent the entire site. Second-year surveys were conducted on May 8 and 10, 2007, and showed a sharp increase in native grass cover across the site; with the T1 transect showing 49% native grass cover (Tables 15 and 16). Total native plant cover was at 6.6% in 2006 across the site, but increased between 28 and 84% in the T1, T2, and T3 transects for 2007. The T4 transect showed less native canopy cover and higher introduced cover than the other sites. Native plant diversity also increased across the site, with over 16 native species present (above those grouped as native grasses) as opposed to the 5 seen in 2006. Russian thistle and native grasses showed continued high frequency of occurrence values. Transect T4 showed high sagebrush mortality during the first year, and this continued with an additional loss of 40%, bringing sagebrush survival to 26%. In contrast, sagebrush survival for T1 was 73%, T2 was 52%, and T3 was 78%.

Figure 8. 100-KR-1 Sites.



Sagebrush transect at 116-K-2 May, 2006.

Sagebrush at 116-K-2 in May, 2007.

Slender Hawksbeard and Bluebunch Wheatgrass at 116-K-2 in May, 2007.

Table 15. Percent Canopy Cover on 116-K-2 in 2007.

Species	116-K2-T1	116-K2-T2	116-K2-T3	116-K2-T4
Native Grasses [b]	49.2	37.5	42.7	12.0
*Bromus tectorum** (cheatgrass)	8.7	7.8	4.5	6.1
Artemesia tridentata (sagebrush)	0.3	1.2	1.0	--
*Salsola kali** (Russian thistle)	13.7	39.0	47.3	63.0
*Sisymbrium altissimum** (tumble mustard)	1.7	1.5	1.0	0.8
Epilobium paniculatum (tall willowherb)	0.2	--	--	--
Agoseris heterophylla (mountain-dandelion)	0.5	0.8	0.5	0.2
Amsinckia lycopsoides (tarweed fiddleneck)	0.3	0.3	0.2	--
Holosteum umbellatum (jagged chickweed)	0.3	--	0.3	--
*Draba verna** (spring whitlow)	0.7	0.7	--	--
*Lactuca seriola** (prickly lettuce)	0.2	0.7	0.2	0.9
*Centaurea diffusa** (diffuse knapweed)	0.2	1.0	0.2	--
Tragopogon dubius (yellow salsify)	--	0.2	--	--
Microsteris gracilis (annual phlox)	--	0.2	--	--
Gnaphalium chilense (Cudweed)	--	--	--	0.2
Layia glandulosa (white daisy tidytips)	X	--	--	--
Chaenactis douglasii(hoary falseyarrow)	X	--	--	--
Oryzopsis hymenoides (Indian ricegrass)	X	--	--	--
Verbascum thapsus * (common mullein)	X	--	--	--
Poa sandbergii (Sandberg's bluegrass)	--	X	--	--
Astragalus sclerocarpus (stalked pod milkvetch)	--	--	X	--
Oenothera pallida (evening primrose)	--	--	X	--
Achillea millefolium (yarrow)	--	--	X	--
Epilobium paniculatum (tall willowherb)	--	--	--	X
Bare Soil	21.3	17.7	27.7	13.0
Litter	70.2	75.3	67.3	77.2
Total canopy cover (Litter not included)	**75.8**	**90.8**	**97.8**	**83.1**
Total Introduced % Cover 2007	25.0	50.2	53.2	70.8
Total Native % Cover 2007	50.8	90.2	44.7	12.3

*Introduced Species.

[b]Includes Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.

X= Present but not counted in plot frames.

-- = Not present on site.

Table 16. Frequency of Occurance on 116-K-2 in 2007.

Species	116-K2-T1	116-K2-T2	116-K2-T3	116-K2-T4
Native Grasses[b]	100	100	93	100
*Bromus tectorum** (cheatgrass)	87	87	80	63
Artemesia tridentata (sagebrush)	13	13	7	--
*Salsola kali** (Russian thistle)	100	100	100	100
*Sisymbrium altissimum** (tumble mustard)	67	60	40	31
Epilobium paniculatum (tall willowherb)	7	--	--	--
Agoseris heterophylla (mountain-dandelion)	20	33	20	6
Amsinckia lycopsoides (tarweed fiddleneck)	13	13	7	--
Holosteum umbellatum (jagged chickweed)	13	--	13	--
*Draba verna** (spring whitlow)	27	27	--	--
*Lactuca seriola** (prickly lettuce)	7	27	7	38
*Centaurea diffusa** (diffuse knapweed)	7	7	7	--
Tragopogon dubius (yellow salsify)	--	7	--	--
Microsteris gracilis (annual phlox)	--	7	--	--
Gnaphalium chilense (Cudweed)	--	--	--	6
Layia glandulosa (white daisy tidytips)	X	--	--	--
Chaenactis douglasii(hoary falseyarrow)	X	--	--	--
Oryzopsis hymenoides (Indian ricegrass)	X	--	--	--
Verbascum thapsus * (common mullein)	X	--	--	--
Poa sandbergii (Sandberg's bluegrass)	--	X	--	--
Astragalus sclerocarpus (stalked pod milkvetch)	--	--	X	--
Oenothera pallida (evening primrose)	--	--	X	--
Achillea millefolium (yarrow)	--	--	X	--
Epilobium paniculatum (tall willowherb)	--	--	--	X
Bare Soil	93	73	93	81
Litter	100	100	100	100

*Introduced Species.

[b]Includes Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.

X= Present but not counted in plot frames.

-- = Not present on site.

4.0 HORSESHOE LANDFILL

The Horseshoe Landfill is located on the Fitzner-Eberhardt Arid Lands Ecology Reserve and served as a military landfill for the nearby Nike missile base. Figure 9 provides a map of the Horseshoe Landfill location. The Horseshoe Landfill is a former CERCLA waste site that was part of the 1100-IU-1 Operable Unit. In 1994, approximately 1,911 m^3 of soil contaminated with DDT and other hazardous material and debris were excavated from the landfill (DOE-RL 1996) It was remediated as part of the activities outlined in the ROD for the 1100 Area National Priorities List site (EPA 1993) and was removed from the National Priorities List in 1996 (61 *Federal Register* 51019). The primary contaminant of concern at this site was dichlorodiphenyltrichloroethane (DDT).

Post-closure biota sampling and soil sampling performed between 1998 and 2003 at the site indicated that concentrations of DDT and its breakdown products dichlorodiphenyldichloroethylene (DDE) and dichlorodiphenyldichloroethane (DDD) were present in low concentrations within the landfill surface soils exceeding the 1994 cleanup criteria of 1 mg/kg (DOE-RL 2002).

The May 2005, remediation of the Horseshoe Landfill was initiated in response to post-closure surface soil sampling performed between 1998 and 2003 that indicated the presence of residual DDT contamination exceeding the cleanup criteria of 1 mg/kg that was established for the original 1994 cleanup activities (EPA 1993). The original cleanup level for DDT was based on *Washington Administrative Code* [WAC] 173-340-740, Method A. However, for this additional remediation, the DDT was removed to meet the more stringent ecological soil indicator concentration for protection of terrestrial plants and animals for total DDT/DDE/DDD of 0.75 mg/kg (WAC 173-340, Table 749-3).

Remediation of the Horseshoe Landfill was initiated on May 17, 2005, and completed on August 24, 2005. Approximately 4,935 bulk cubic meters (bcm) of contaminated soil was excavated from the landfill and disposed of at the ERDF. On the return trip, the remediation contractor hauled clean soil (excavated during ERDF construction) back to the Horseshoe Landfill and stockpiled it for use as backfill material. Prior to stockpiling, the top 46 cm of native soil was pushed to the side for redistribution across the soil staging area upon completion of the project.

The Horseshoe Landfill (HSLF) and clean soil staging area (SSA) was revegetated with native species the first week of February 2006. In preparation for broadcast seeding the area, the top 23 cm of soil was loosened with a spring tooth implement. The Horseshoe Landfill and soil staging area were seeded with Sandberg's bluegrass, Indian ricegrass, bluebunch wheatgrass, and needle-and-thread grass. The areas were fertilized with triple-16 fertilizer and treated with polyacrylamide to facilitate successful germination and to reduce wind erosion. The seeded areas were mulched with grass straw and crimped into the soil to prevent the straw from blowing away. The landfill and soil staging area were planted with sagebrush seedlings propagated by two native plant nurseries from seed collected on the Hanford Site and grown in 10-in containers.

The landfill and soil staging area are being monitored separately as the landfill was backfilled with Rupert sand imported from the 200 West Area while the soil staging area has Ritzville silt-loam that is native to this location. Second year vegetation monitoring and sagebrush survival monitoring were conducted at both sites on May 22, 2007. Sandberg's Bluegrass was found to be the dominant plant on the HSLF site, and the dominant native plant on the SSA site, at about 20% cover (Tables 17 and 18). The SSA site also showed high canopy cover of Russian thistle and cheatgrass, at 30 and 20% respectively. The site, as a whole, showed an increase in native plant diversity of 35% and increased native plant cover of around 10%. Four sagebrush monitoring transects are established across the site. Only one transect (T1 on the eastern half of the Horseshoe Landfill) showed significant loss (33%) of shrubs; down from 97% in 2006 to 64% in 2007. Transect T2 on the western half of the landfill had 80% survival, down 10% from 2006. The two transects in the SSA showed 94% for T3 (on the eastern half) and 84% survival on T4 (western half).

Figure 9. Horseshoe Landfill and Soil Staging Area sites.

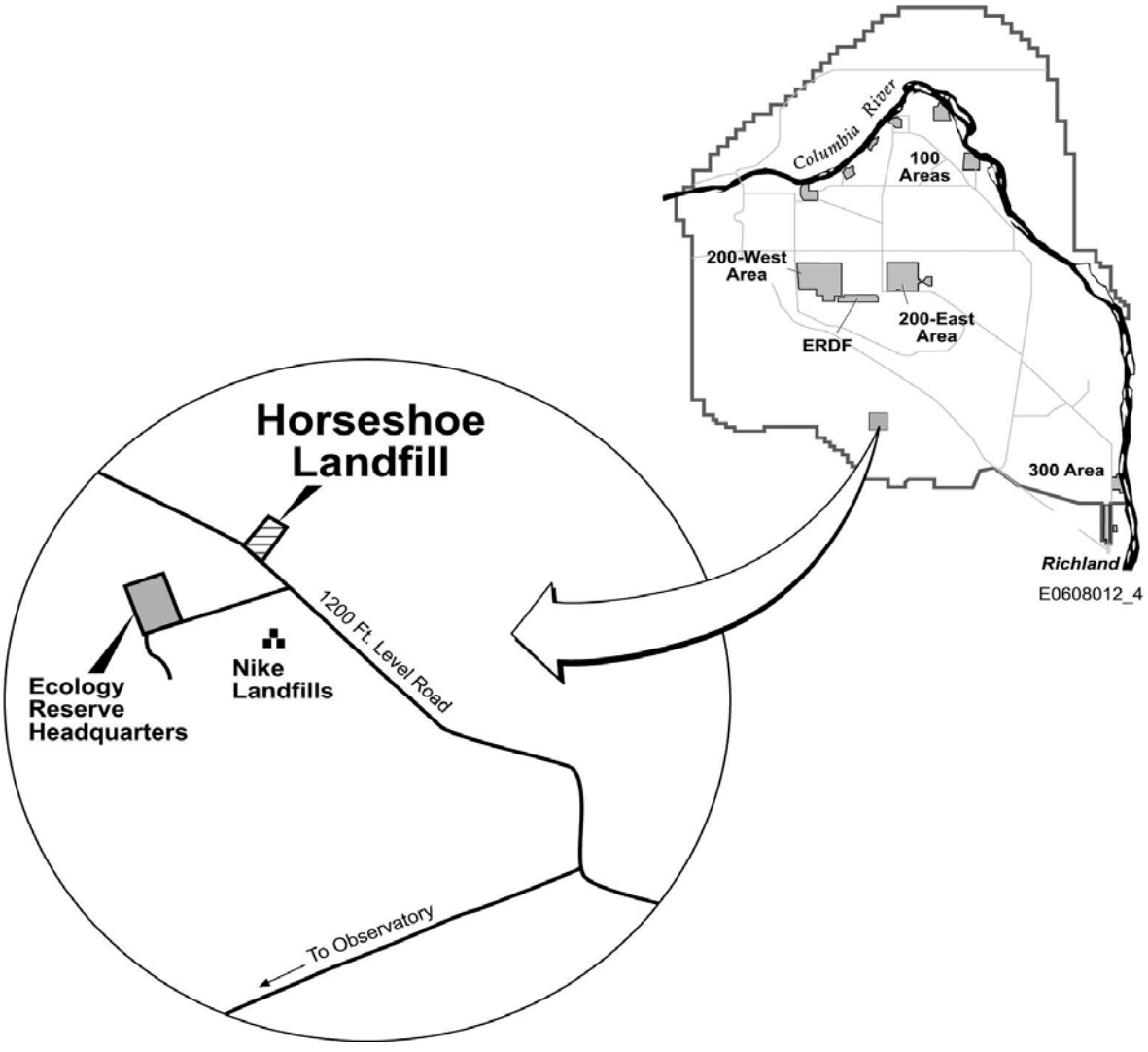


Table 17. Percent Canopy Cover on the Horseshoe Landfill and Soil Staging Area 2007.

Species	Horseshoe Landfill	Soil Staging Area
*Salsola kali** (Russian thistle)	5.8	30.0
*Bromus tectorum** (cheatgrass)	15.5	20.0
Artemesia tridentata (sagebrush)	0.2	2.3
*Sisymbrium altissimum** (tumble mustard)	2.0	12.8
Poa sandbergii (Sandberg's bluegrass)	18.0	20.8
Agropyron spicatum (bluebunch wheatgrass)	5.7	--
Sitanion hystrix (bottlebrush squirreltail)	6.3	4.3
*Lactuca seriola** (prickly lettuce)	1.7	1.3
Oryzopsis hymenoides (Indian ricegrass)	3.8	--
*Agropyron cristatum** (crested wheatgrass)	0.2	--
Epilobium paniculatum (tall willowherb)	0.5	0.2
*Vulpia myuros** (rattail fescue)	0.3	--
Lupinus leucophyllus (velvet lupine)	0.2	0.5
*Kochia scopari** (kochia)	0.5	0.2
Amsinckia lycopsoides (tarweed fiddleneck)	--	0.7
*Amaranthus albus** (white pigweed)	--	0.8
Agropyron spp. (wheatgrasses)	--	5.8
*Draba verna** (spring whitlowgrass)	--	0.2
*Holosteum umbellatum** (jagged chickweed)	--	0.2
Agoseris heterophylla (mountain dandelion)	--	0.2
Descurainia pinnata (western tansymustard)	--	0.3
Crepis atrabarba (slender hawksbeard)	--	0.2
Linum perenne (wild blueflax)	--	X
Achillea millefolium (yarrow)	--	X
*Melilotus alba ** (sweetclover)	X	--
Bare Soil	50.0	39.7
Litter	39.0	55.2
Total canopy cover (Litter not included)	**60.7**	**100.8**
* Introduced species X = Species present on the site but not counted in a plot frame. -- = Not present on site.		
Total Introduced % Cover 2007	26.00	65.50
Total Native % Cover 2007	34.67	35.33
Change in Native Plant % Cover from 2006 to 2007	+8.7	+13.2

Table 18. Frequency of Occurrence on the Horseshoe Landfill and Soil Staging Area 2007.

Species	Horseshoe Landfill	Soil Staging Area
*Salsola kali** (Russian thistle)	100	93
*Bromus tectorum** (cheatgrass)	100	100
Artemesia tridentata (sagebrush)	7	27
*Sisymbrium altissimum** (tumble mustard)	47	100
Poa sandbergii (Sandberg's bluegrass)	100	100
Agropyron spicatum (bluebunch wheatgrass)	93	--
Sitanion hystrix (bottlebrush squirreltail)	60	47
*Lactuca seriola** (prickly lettuce)	33	53
Oryzopsis hymenoides (Indian ricegrass)	53	--
*Agropyron cristatum** (crested wheatgrass)	7	--
Epilobium paniculatum (tall willowherb)	20	7
*Vulpia myuros** (rattail fescue)	13	--
Lupinus leucophyllus (velvet lupine)	7	20
*Kochia scopari** (kochia)	20	7
Amsinckia lycopsoides (tarweed fiddleneck)	--	27
*Amaranthus albus** (white pigweed)	--	33
Agropyron spp. (wheatgrasses)	--	100
Draba verna (spring whitlowgrass)	--	7
*Holosteum umbellatum** (jagged chickweed)	--	7
Agoseris heterophylla (mountain dandelion)	--	7
Descurainia pinnata (western tansymustard)	--	13
Crepis atrabarba (slender hawksbeard)	--	7
Linum perenne (wild blueflax)	--	X
Achillea millefolium (yarrow)	--	X
*Melilotus alba ** (sweetclover)	X	--
Bare Soil	100	100
Litter	100	100

* Introduced species
X = Species present on the site but not counted in a plot frame.
-- = Not present on site.

5.0 REVEGETATION MITIGATION

In 2003 the Environmental Restoration Disposal Facility (ERDF) began Phase III expansion to construct cells 5 and 6. Construction of the new cells occurred entirely within the disturbed footprint of the ERDF fence. However, an area south of the perimeter fence was impacted by placement of the overburden pile. The Mitigation Action Plan for ERDF was updated to develop appropriate mitigation strategies for this and future expansions (DOE-RL 2005B).

At the time of the initial construction of the ERDF in 1995, a majority of the 4.1 km^2 (1.6 mi^2) area was dominated by mature sagebrush and late successional grasses and forbs and considered

high quality, Level III habitat, as defined in BRMaP (DOE-RL 2001). Compensatory mitigation actions conducted for the construction of ERDF Cells 1 through 4 were based on a replacement ratio of 3:1 as appropriate for Level III sagebrush habitat. The large fire in the summer of 2000 burned most of the 4.1 km^2 (1.6 mi^2) area identified for future ERDF expansion. Although the area has started to recover, it is no longer dominated by an overstory of sagebrush and no longer fits the definition of Level III habitat. Late successional grasses and forbs are still present, however, live mature sagebrush are sparse and the area now meets the definition of Level II habitat. However, since the understory of grasses and forbs are still intact and a small component of sagebrush still exists, some level of mitigation/rectification was needed. The Mitigation Action Plan determined that the appropriate mitigation ratio for the area south and east of ERDF would be 1:1. Construction activities at ERDF and impacts from expanding Borrow Pit 30 to supply gravel, required that approximately 20-ha (50 acres) of mitigation be performed. To maximize the effectiveness of the mitigation effort, sagebrush was planted on 25-ha (62 acres) that included four 4-ha (10 acre) islands separated by 100 meters (328 ft). Each island was planted at a density of 1,000 plants per hectare (400 plants/acre). The areas between the islands were planted at a density of 444 plants per hectare (180 plants/acre) in an area south of ERDF that straddles the Army Loop Road (Figure 10). This configuration takes advantage of the Army Loop Road, which could serve as fire break or natural location to fight a fire if one should threaten this area.

In addition to planting sagebrush, ten artificial burrowing owl nest boxes were installed in the area. Burrowing owls have been observed in this area previously, and this will increase the opportunity for more nesting pairs to become established in the area.

Monitoring of the sagebrush survival was conducted on April 19, 2007 using two 100-meter transects. The transect in the northeast quadrant of the ERDF mitigation site had 96% survival and the transect in the southeast quadrant had 100% survival (Figure 11). The high survivorship of these transects reflects the fact that none of the plants have been subjected to harsh summer conditions yet. Monitoring results in 2008 will be more indicative of actual revegetation success.

The burrowing owl nest boxes were all checked for occupancy but none had been used yet. Installation of the nest boxes was conducted in late February, which may have been too late in the season for some owls to take up residence.

Figure 10. ERDF Mitigation Site Along Army Loop Road.

Figure 11. ERDF Mitigation.

Mitigation sites for ERDF, April 2007.

February planted sagebrush in April 2007.

Completed owl nest box.

6.0 BAT MITIGATION PROJECTS

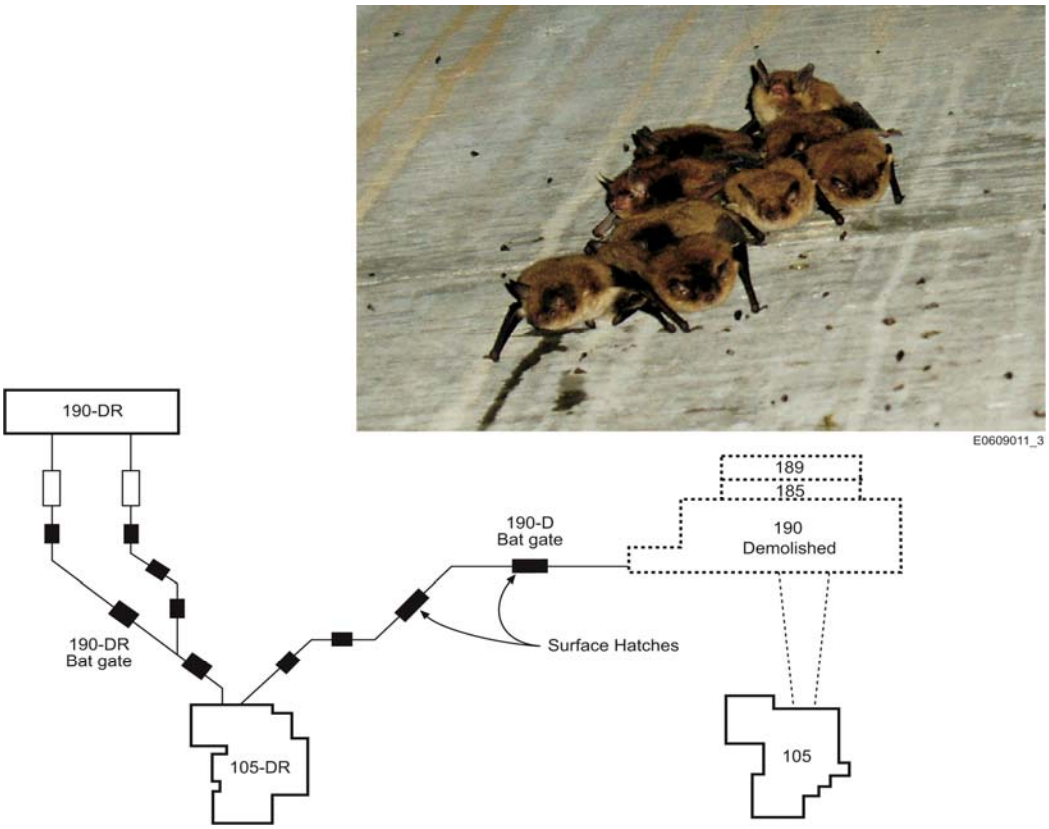
Bat mitigation projects have been conducted at 2 reactor sites, 105-D/DR and 105-F, to mitigate for roosting habitat that was lost as a result of the Interim Safe Storage (ISS) projects at these reactors. The purpose of the ISS projects was to remove all the ancillary structures from the reactor buildings, seal all penetrations, and install new steel roofs to prevent intrusion from animals. Ecological reviews conducted prior to the initiation of these projects, identified the presence of multiple bat species utilizing the reactors as maternity roosts where they rear their young. These bats are listed as Washington State priority species at communal roosts and breeding areas and require mitigation according to the BRMaP (DOE-RL 2001). The mitigation projects conducted at the reactor sites included establishing the process water tunnels at D Area as alternative roost sites and installing artificial roost boxes at 105-F Reactor. A third mitigation project was initiated at the 183-F Clearwell in July 2007 to begin investigating a large colony of more than 2,000 bats that are using that facility. The facility is slated for eventual demolition, so a mitigation plan must be developed to accommodate the colony before the facility is removed.

Bat Mitigation at 100-D Area

The mitigation project at 100-D Area was initiated when a maternity roost was discovered in one of the process water tunnels connected to the 105-DR Reactor. The ISS project plan included isolating the tunnels from the reactor, which would eliminate the bats'access to the tunnels and cause the loss of the maternity roost. Approval and concurrence from the U.S. Department of Energy, Richland Operations Office in a letter from James D. Goodenough to S. D. Liedle, dated July 28, 1998, (CCN# 060625) provided direction to maintain bat access and mitigate for roosting habitat that would be lost as a result of ISS. Alternate accesses were provided on both tunnel systems that entered the 105-DR valve pit by installing bat gates on access hatches (Figure 12). One tunnel originated at the 190-D Water Pump House, as a redundant water supply, and two tunnels originated from the 190-DR Water Pump House that come together just west of the valve pit. The original purpose of these tunnels was to provide the primary cooling water supply for the 105-DR Reactor (Figure 13). The non-contaminated process water tunnels are built with a zig-zag design to allow for expansion of the piping. Each straight leg of the tunnels contains a surface hatch to provide access in case a pipe section had to be replaced. These surface hatches provide the actual roost sites for the bats because of the solar heating of the hatch covers, providing a favorable site to rear young. The bat gates were placed over hatches on both tunnel systems. The gate on the 190-D tunnel was installed in the fall of 1998 and the gate on the 190-DR tunnel system was installed in the fall of 1999.

Figure 12. 190-DR Bate Gate.

Figure 13. 190-D/DR Tunnel System.



Monitoring of bat roosting began in July 1999. The gate on the 190-D tunnel had been installed and the tunnels were still accessible from the Reactor valve pit. There were approximately 19 bats observed in the 190-D tunnel and 36 in the 190-DR tunnels. No inspection of the tunnels was made during the year 2000; however a small number of bats were observed emerging from the gates in August 2000 approximately 1 hour after sun-down which verified that they had found the bat gate entrance and were continuing to use the tunnels. No observations were made during 2001.

The 190-D tunnel has not been entered since the reactor valve pit was backfilled because there is no walk-in access available. The 190-DR tunnels were accessible from the 190-DR north Valve House (at the west end of the tunnel) until 2005 when the valve houses were demolished along with the 190-DR facility. At the completion of the demolition project, a walk-in door was provided in the south tunnel where it connected to the valve house. Inspections of the 190-DR tunnels have been conducted from 2002 to 2005 and the number of bats roosting in the hatches was counted. The numbers counted were: 107 in 2002, 99 in 2003, 98 in 2004, and 97 in 2005. A second inspection was made on July 27, 2005 and a total of 170 bats were counted. The bats appeared to roost at all the hatches except the ones where the bat gates are located. Often the majority of the population would roost in the same hatch which would contain several small clusters ranging from 5 to 50. These clusters are maternity colonies consisting of mothers with their young.

In July, 2006, it was discovered that someone had placed chicken wire over the entrance to the 190-DR bat gate during the previous winter which prevented the bats from flying through the gate and roosting in the tunnel. The chicken wire was immediately removed and the tunnel was again inspected for bats on September 21, 2006. There were about 20 bats found roosting as individuals and small clusters. Because the roost site in 190-DR was not abailable to the bats for most of the summer of 2006, the bat gate on190-D tunnel was monitored for emerging bats on August 9, 2006, and 25 to 35 bats were counted emerging from the tunnel. The bats would often circle the bat gate and occasionally go back in, making it difficult to get an accurate count.

In 2007 mist netting was performed at the 190-DR process water tunnel, in order to capture bats. This was done in conjunction with other bat monitoring activities going on the 183-F Clearwell. The purpose was to determine which species were present and to determine genetic relationships of the bats at the D Area site to bats of the same species in the 183-F Clearwell. Morphometric measurements and DNA samples were collected to definitively determine the species and any genetic relationships between the 2 sites. Perliminary data indicates that the species present in the 190-DR Tunnel are Yuma Myotis (*Myotis yumanensis*). Eighteen bats were captured on August 28, 2007, and 4 on September 11, 2007 (Figure 14). The population was a mix of adults and juveniles, and only 3 individuals were males. On September 13, 2007, a team entered the 190-DR tunnels to do a visual inspection of the bats present. Video and still photographs were taken of the bats within the roost and108 bats were counted on the video. Several clusters of 10-25 bats were observed, indicating the hatches are again being used as a maternity roost. Two data loggers were deployed during the same entrance; they will log temperature/relative humidity data at the roost sites. This data will be compared to that found in the 183-F Clearwell, to see how the temperature trends compare between the structures.

Figure 14. Bats from 190-DR Mist Netting.

Bat Mitigation at 100-F Reactor

Bats had been observed on several occasions roosting inside the 105-F Reactor building during the initial phases of the ISS project which began in FY 2000. In the spring of 2003, a maternity colony of pallid bats was observed in the upper areas of the reactor building (Figure 15). Other species (*Myotis sp.*) were also observed in the reactor. The 105-F Reactor had served as both a communal roost and a breeding area for these bat species, therefore, mitigation efforts were initiated to remove the bats from the building unharmed and provide alternate roosting habitat.

As the new roof was being completed in August 2003, steps were taken to remove the bats from the building to prevent them from being trapped inside. The main ground-floor entrance to the building was left open to serve as the only access to the building. After a week of acclimation to the new access, a piece of plywood with three 2-inch slots cut in it was placed over the door to narrow the entrance. The slots were fitted with landing boards mounted on the inside of the door to allow the bats to land and crawl out. The first night after the board was installed, the narrowed entrance was observed to insure the bats could get out. The slotted door was left in place for one week and on September 8, 2003, exclusion netting was installed loosely over the slotted door and stapled to the top and sides so the bats had to crawl through the slots and out the bottom of the netting to get out. Once out, they could not get back in.

Alternative roosts were provided by installing 8 commercially made bat roosts (Figure 16). Bat boxes designed to house pallid bats were installed on the east side of the building (boxes 1 & 2), the south side (boxes 4 & 6), the west side of the building (box 7), and one on a utility pole approximately 50 m NE of the building (box 8). Two boxes designed for *Myotis* bats were installed on the south side of the building (boxes 3 & 5).

Follow-up surveys confirmed that the pallid bats were utilizing the houses mounted on the building. Because of the difficulty in counting bats inside the boxes, it is impossible to get an exact count, however, it was estimated that the colony contained approximately 30 individuals in September 2003 using box number 1 exclusively. Very few *Myotis* bats were observed roosting in bat boxes designed for them (boxes 3 and 5).

The following spring, the pallid bats returned from winter hibernation to use the boxes on the reactor. During 2004, they continued to primarily use box 1 on the NE side of the building, but by the end of the summer, they had used all of the pallid bat boxes on the reactor building (1, 2, 4, 6, & 7) but had not used the one mounted on the utility pole (8). Myotis continued to infrequently use boxes 3 and 5, but not as a maternity colony.

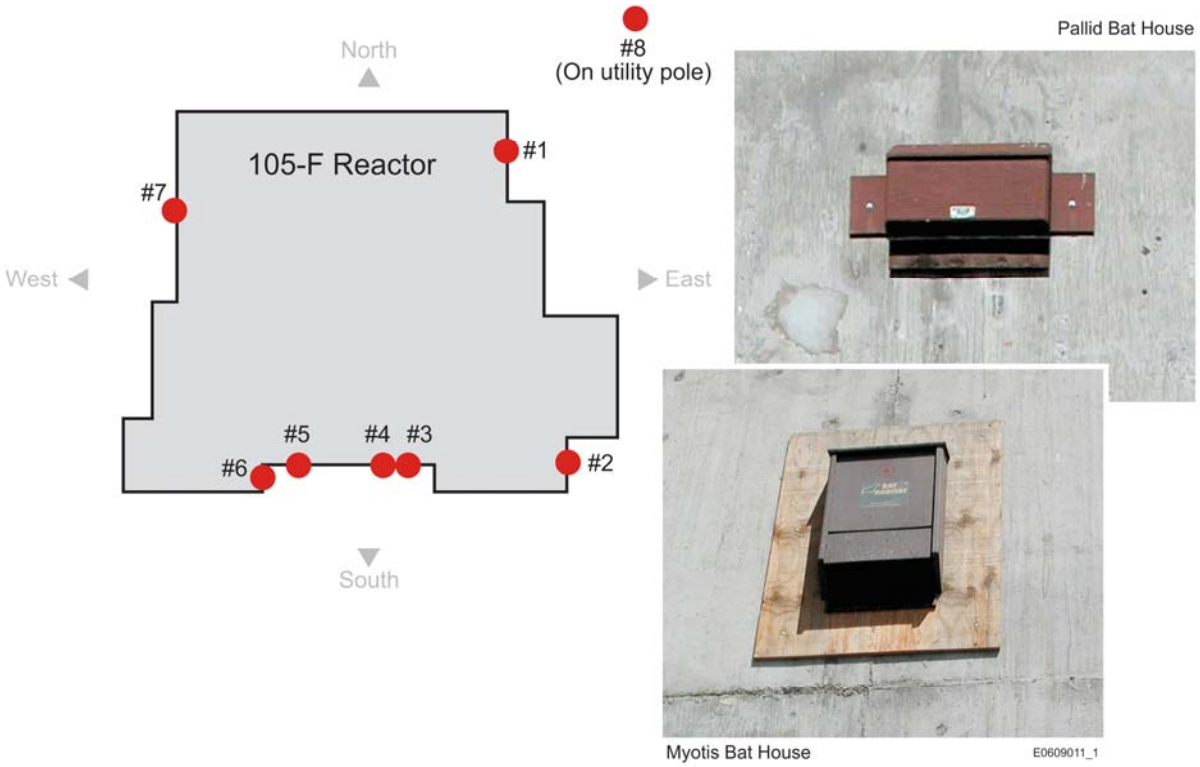
In 2006, the pallid bats began returning to the roost site at 105-F Reactor in April. Fresh pallid bat fecal pellets were observed under the boxes on April 11, 2006. During the spring months (April & May) the bats appeared to prefer the roosts on the south side of the building, probably because these sites were the warmest. As the summer progressed, they appeared to prefer boxes 1 & 2 on the east side of the building. On August 3, 2006, all boxes were inspected for the presence of bats. Boxes 1 and 2 appeared to have approximately the same number of bats present (judged by how many could be counted by looking into the entrance from below). The emergence of bats from box 2 was observed and a total of 41 bats were counted. Assuming box

1 had approximately the same number of individuals present, the population could have been as high as 80 individuals. This is a substantial increase since the mitigation project began in 2003 when the population was estimated to be approximately 30.

Due to recent excavation around the 105-F Reactor building, no surveys or counts were conducted at the bat houses in 2007. Visual inspections, as well as acoustic surveys and the presence of bat guano have all confirmed that the Pallid bats did return this season. After excavations at that site are closed it will once again be possible to do an emergence count, in order to determine if the size of the population is changing. This will likely be possible when the bats return in the spring of 2008.

Figure 15. Pallid Bats at 105-F Reactor.

Figure 16. 105-F Bat Houses.



183-F Clearwell Maternity Colony

A bat habitat mitigation project began at the 183-F Clearwell during the summer of 2007. Work is being performed on a very large colony of bats that is residing in the Clearwell structure. Preliminary counts estimate the population at over 2,000 individuals, making this colony one of the largest in the state of Washington. Because the Clearwell roost site maintains a very large colony, and because it is a maternity roost, it is considered a priority habitat by the Washington Department of Fish and Wildlife. This colony is being studied because the Clearwell structure is currently slated to be demolished and a mitigation plan must be developed to provide a viable alternate roost site. Information needed in order to advise on mitigation actions includes determining the bat species present, and the conditions in the Clearwell that the bats are selecting. Understanding which bats species (possibly more than one) is present is necessary in order to determine species listing status on State and Federal species lists. This can be difficult, as many species appear very similar. A combination of morphological measurements, DNA analysis, and acoustic analysis are being used for species determination (Figure 17). Current data indicate that the colony is composed of Yuma Myotis (*Myotis yumanensis*), but this may change with further research and DNA analysis.

A major part of determining mitigation options is to understand the conditions of the roost that the bats are currently using. Bats select roosts with very specific conditions, with the most important variable being temperature. Roosts that are too hot or too cold require the bats to use too much energy, so they select an optimum roost site even if it is further from other resources, such as food and water. Because there are so many bats using the Clearwell structure, it obviously has very good roosting conditions. In order to determine if mitigation sites would be able to match the conditions of the roost, we must first determine the conditions present in the Clearwell. This will be done by affixing temperature/relative-humidity data loggers in several roost locations within the Clearwell, as well as into proposed mitigation sites. This will allow the determination of similarity of proposed mitigation sites to the Clearwell conditions. All information collected will be compiled and analyzed in order to determine proper mitigation strategies. A one hour video of emerging bats was taken at the Clearwell entrance during August 2007. A total of 1693 bats were seen emerging from the hatch during that time; the tape ran out at the end of that hour and bats were still rapidly emerging from the Clearwell. Data loggers will be deployed in the Clearwell before the bats leave the structure for the winter to determine the temperature of the structure when the bats leave. The loggers will also be in place when the bats return in 2008, and will log temperatures for the entire season next year (March-October). These data will be used to determine the temperature and humidity the bats are selecting for their roost site. This information can then be used to help design an alternate roost as a mitigation site for the eventual demolition of the clearwell.

Figure 17. 183-F Clearwell Bat Work.

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APPENDIX A

2006 REVEGETATION MONITORING RESULTS

Table A-1. Percent Canopy Cover and Frequency of Occurrence at the 300-FF-1 Process Ponds and Burial Grounds 2006.

Species	% Cover	% Frequency
Agropyron dasytachyum (thickspike wheatgrass)	X	X
Agropyron spicatum (bluebunch Wheatgrass)	7.6	68.6
Agropyron cristatum [a] (crested Wheatgrass)	4.9	42.9
Stipa comata (needle-and-thread grass)	X	X
Oryzopsis hymenoides (Indian ricegrass)	0.2	8.6
Vulpia myuros [a] (rattail)	3.0	51.4
Melilotus officinalis [a] (sweetclover)	0.0	0.0
Eriogonum niveum (snow buckwheat)	X	X
Poa sandbergii (Sandberg's bluegrass)	9.4	77.1
Centaurea diffusa [a] (diffuse knapweed)	0.1	2.9
Sisymbrium altissimum [a] (tumble mustard)	3.0	77.1
Bromus tectorum [a] (cheatgrass)	16.9	94.3
Lactuca serriola [a] (prickly lettuce)	0.3	11.4
Amsinckia lycopsoides (tarweed fiddleneck)	0.6	25.7
Phacelia hastata (whiteleaf scorpionweed)	0.1	2.9
Ambrosia acanthicarpa (bur ragweed)	0.1	5.7
Erodium cicutarium [a] (storksbill)	1.1	42.9
Senecio vulgaris (common groundsel)	0.1	2.9
Salsola kali [a] (Russian thistle)	2.1	68.6
Lepidium perfoliatum (clasping pepperweed)	X	X
Oenothera pallida (pale evening primrose)	X	X
Psoralea lanceolata (dune scurfpea)	X	X
Cryptantha circumscissa (matted cryptantha)	X	X
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Poa bulbosa [a] (bulbous bluegrass)	0.2	8.6
Hymenopappus filifolius (Columbia cutleaf)	X	X
Petalostemon ornatum (prairie clover)	X	X
Sphaeralcea munroana (globemallow)	X	X
Achillea millefolium (yarrow)	X	X
Epilobium paniculatum (tall willowherb)	0.2	8.6
Descurainia pinnata (western tansymustard)	0.2	8.6
Artemisia tridentata (sagebrush)	X	X
Draba verna (spring whitlowgrass)	0.1	2.9
Tragopogon dubius (yellow salsify)	0.1	2.9
Gilia leptomeria (Great Basin gilia)	X	X
Verbascum thapsus [a] (common mullein)	X	X
Biotic crust	0.8	31.4
Bare Soil	33.9	94.3
Litter	51.2	100.0
Total cover (does not include biotic crust or litter)	**50.2**	

[a] Introduced species.

X = Species present on the site but not counted in a plot frame.

Table A-2. Percent Canopy Cover on the 120-N-1 and 120-N-2 Sites in 2006.

Species	Triple 16 and Straw Mulch	Triple 16 and Hydromulch	Biosol and Straw Mulch	Biosol and Hydromulch
Agropyron dasytachyum (thickspike wheatgrass)	X	0.3	X	--
Agropyron spicatum (bluebunch wheatgrass)	15.8	2.0	8.8	X
Poa sandbergii (Sandberg's bluegrass)	20.7	17.7	24.7	3.1
Stipa comata (needle-and-thread grass)	X	X	X	--
Bromus tectorum [a] (cheatgrass)	23.2	2.5	60.8	62.1
Salsola kali [a] (Russian thistle)	1.2	1.7	0.5	1.0
Achillea millefolium (yarrow)	2.2	3.7	0.2	X
Vulpia myuros [a] (rattail fescue)	0.2	--	1.3	--
Artemisia tridentata (big sagebrush)	0.5	X	X	X
Centaurea diffusa [a] (diffuse knapweed)	0.7	0.7	0.2	0.2
Chrysothamnus nauseosus (gray rabbitbrush)	0.2	0.3	0.2	0.2
Eriogonum niveum (snow buckwheat)	--	X	--	--
Erodium cicutarium [a] (storksbill)	X	--	--	0.2
Lactuca serriola [a] (prickly lettuce)	0.3	X	0.2	--
Festuca octoflora (slender sixweeks)	0.2	--	1.0	0.6
Sisymbrium altissimum [a] (tumblemustard)	0.5	0.7	1.2	1.9
Tragopogon dubius [a] (yellow salsify)	X	--	--	--
Machaeranthera canescens (hoary aster)	X	X	--	X
Chaenactis douglasii (hoary falseyarrow)	X	X	--	X
Microsteris gracilis (pink microsteris)	--	--	0.2	--
Penstemon acuminatus (sand beardtongue)	--	X	--	--
Erigeron poliospermus (cushion fleabane)	X	X	--	X
Oryzopsis hymenoides (Indian ricegrass)	--	0.3	X	0.4
Draba verna (spring whitlowgrass)	0.2	0.2	0.2	0.6
Holosteum umbellatum (jagged chickweed)	X	0.7	--	0.4
Erysimum asperum (rough wallflower)	--	X	X	X
Erigeron pumilis (shaggy fleabane)	X	--	--	--
Erigeron filifolius (threadleaf fleabane)	X	--	--	--
Poa bulbosa [a] (bulbous bluegrass)	0.3	X	X	X
Ranunculus testiculatus [a] (bur buttercup)	0.2	--	0.2	--
Biotic crust	0.7	0.2	--	--
Bare soil	27.8	82.0	20.0	47.9
Litter	58.5	5.8	77.7	44.0
Total Cover (does not include biotic crust or litter)	**66.2**	**30.7**	**99.5**	**70.8**

[a] Introduced species.
X = Species observed on the treatment but not counted in a plot frame.
-- = Species not observed on the treatment.

Table A-3. Percent Frequency of Occurrence on the 120-N-1 and 120-N-2 Sites in 2006.

Species	Triple 16 and Straw Mulch	Triple 16 and Hydromulch	Biosol and Straw Mulch	Biosol and Hydromulch
Agropyron dasytachyum (thickspike wheatgrass)	X	13	X	--
Agropyron spicatum (bluebunch wheatgrass)	93	47	66.7	X
Poa sandbergii (Sandberg's bluegrass)	100	100	100	83.3
Stipa comata (needle-and-thread grass)	X	X	X	--
Bromus tectorum [a] (cheatgrass)	100	100	100	100
Salsola kali [a] (Russian thistle)	47	67	20	41.7
Achillea millefolium (yarrow)	53	80	6.7	X
Vulpia myuros [a] (rattail fescue)	7	--	20	--
Artemisia tridentata (big sagebrush)	20	X	X	X
Centaurea diffusa [a] (diffuse knapweed)	27	27	6.7	8.3
Chrysothamnus nauseosus (gray rabbitbrush)	7	13	6.7	8.3
Eriogonum niveum (snow buckwheat)	--	X	--	--
Erodium cicutarium [a] (storksbill)	X	--	--	8.3
Lactuca serriola [a] (prickly lettuce)	13	X	6.7	--
Festuca octoflora (slender sixweeks)	7	--	40	25
Sisymbrium altissimum [a] (tumblemustard)	20	27	46.7	75
Tragopogon dubius [a] (yellow salsify)	X	--	--	--
Machaeranthera canescens (hoary aster)	X	X	--	X
Chaenactis douglasii (hoary falseyarrow)	X	X	--	X
Microsteris gracilis (pink microsteris)	--	--	6.7	--
Penstemon acuminatus (sand beardtongue)	--	X	--	--
Erigeron poliospermus (cushion fleabane)	X	X	--	X
Oryzopsis hymenoides (Indian ricegrass)	--	13	X	16.7
Draba verna (spring whitlowgrass)	7	7	6.7	25
Holosteum umbellatum (jagged chickweed)	X	27	--	16.7
Erysimum asperum (rough wallflower)	--	X	X	X
Erigeron pumilis (shaggy fleabane)	X	--	--	--
Erigeron filifolius (threadleaf fleabane)	X	--	--	--
Poa bulbosa [a] (bulbous bluegrass)	13	X	X	X
Ranunculus testiculatus [a] (bur buttercup)	--	--	6.7	--
Biotic crust	27	7	--	--
Bare soil	100	100	100	100
Litter	100	100	100	100

[a] Introduced species.
X = Species observed on the treatment but not counted in a plot frame.
-- = Species not observed on the treatment.

Table A-4. Percent Canopy Cover at the Hanford Generating Plant in 2006.

Species	Topsoil	Cobble
Native Grasses [b]	20.4	34.8
Bromus tectorum [a] (cheatgrass)	15.0	2.1
Salsola kali [a] (Russian thistle)	26.1	19.9
Artemisia tridentata (sagebrush)	0.3	0.1
Chorispora tenella [a] (blue mustard)	1.8	1.5
Amsinckia lycopsoides (fiddleneck)	0.1	0.1
Draba verna (spring whitlowgrass)	X	0.1
Ranunculus testiculatus [a] (bur buttercup)	0.3	--
Lactuca serriola [a] (prickly lettuce)	X	0.4
Melilotus alba [a] (sweetclover)	0.1	X
Festuca octoflora (slender sixweeks)	--	0.3
Sisymbrium altissimum [a] (tumble mustard)	1.0	9.1
Poa bulbosa [a] (Bulbous bluegrass)	--	X
Holosteum umbellatum (jagged chickweed)	0.4	0.3
Centaurea diffusa [a] (diffuse knapweed)	0.5	0.4
Sphaeralcea munroana (Munro's globemallow)	X	X
Erodium cicutarium [a] (storksbill)	0.1	X
Kochia scoparia [a] (kochia)	0.1	--
Tragopogon dubius (yellow salsify)	--	0.1
Chrysothamnus nauseosus (gray rabbitbrush)	--	X
Machaeranthera canescens (hoary aster)	--	X
Achillea millefolium (yarrow)	--	X
Epilobium paniculatum (tall willowherb)	--	X
Bare Soil	34.4	31.7
Litter	30.4	64.6
Total Cover (does not include litter)	**66.1**	**69.2**

[a] Introduced species.
[b] Includes Sandberg's bluegrass, bluebunch wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.
X = Species present on the site but not counted in a plot frame.
-- = Not observed on the site.

Table A-5. Frequency of Occurrence at the Hanford Generating Plant in 2006.

Species	Topsoil	Cobble
Native Grasses [b]	100	100
Bromus tectorum [a] *(cheatgrass)*	90	64
Salsola kali [a] *(Russian thistle)*	100	96
Artemisia tridentata (sagebrush)	15	4
Chorispora tenella [a] (blue mustard)	20	4
Amsinckia lycopsoides (fiddleneck)	5	4
Draba verna (spring whitlowgrass)	X	4
Ranunculus testiculatus [a] (bur buttercup)	10	--
Lactuca serriola [a] (prickly lettuce)	X	16
Melilotus alba [a] (sweetclover)	5	X
Festuca octoflora (slender sixweeks)	--	12
Sisymbrium altissimum [a] (tumble mustard)	60	92
Poa bulbosa [a] (Bulbous bluegrass)	--	X
Holosteum umbellatum (jagged chickweed)	40	12
Centaurea diffusa [a] (diffuse knapweed)	20	16
Sphaeralcea munroana (Munro's globemallow)	X	X
Erodium cicutarium [a] (storksbill)	5	X
Kochia scoparia [a] (kochia)	5	--
Tragopogon dubius (yellow salsify)	--	4
Chrysothamnus nauseosus (gray rabbitbrush)	--	X
Machaeranthera canescens (hoary aster)	--	X
Achillea millefolium (yarrow)	--	X
Epilobium paniculatum (tall willowherb)	--	X
Bare Soil	100	88
Litter	100	100

[a] Introduced species.

[b] Includes Sandberg's bluegrass, Bluebunch wheatgrass, Indian ricegrass, Needle-and-thread grass, and Prairie junegrass seedlings.

X = Species present on the site but not counted in a plot frame.

-- = Not observed on the site

Table A-6. Percent Canopy Cover and Frequency of Occurrence at the 116-N-3 Site in 2006.

Species	% Cover	% Frequency
Agropyron spicatum (bluebunch wheatgrass)	7.8	86.7
Salsola kali [a] (Russian thistle)	14.5	86.7
Sitanion hystrix (bottlebrush squirreltail)	1.9	43.3
Koeleria cristata (prairie junegrass)	0.3	10.0
Bromus tectorum [a] (cheatgrass)	3.8	66.7
Stipa comata (needle-and-thread grass)	0.5	20.0
Poa sandbergii (Sandberg's bluegrass)	5.8	73.3
Sisymbrium altissimum [a] (tumblemustard)	0.2	6.7
Artemisia tridentata (big sagebrush)	X	X
Oryzopsis hymenoides (Indian ricegrass)	0.3	13.3
Holosteum umbellatum (jagged chickweed)	0.3	13.3
Agropyron dasytachyum (thickspike wheatgrass)	X	X
Achillea millefolium (yarrow)	X	X
Draba verna (spring whitlowgrass)	0.1	3.3
Lactuca serriola [a] (prickly lettuce)	0.6	23.3
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
Machaeranthera canescens (hoary aster)	X	X
Poa bulbosa [a] (bulbous bluegrass)	X	X
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Grayia spinosa (hopsage)	X	X
Vulpia myuros [a] (rattail fescue)	X	X
Senecio vulgaris [a] (common groundsel)	X	X
Melilotus officinalis [a] (sweetclover)	X	X
Erodium cicutarium [a] (storksbill)	X	X
Centaurea diffusa [a] (diffuse knapweed)	X	X
Bare soil	41.0	90.0
Litter	44.4	100.0
Total Cover (does not include biotic crust or litter)	**36.0**	

[a] Introduced species.

X = Species observed on the site but not counted in a plot frame.

Table A-7. Percent Canopy Cover and Frequency of Occurrence at the 100 F Area Sites in 2006.

Species	% Cover	% Frequency
Agropyron spicatum (bluebunch wheatgrass)	6.3	96
Oryzopsis hymenoides (Indian ricegrass)	0.7	28
Stipa comata (needle-and-thread grass)	0.1	4
Poa sandbergii (Sandberg's bluegrass)	7	88
Sitanion hystrix (squirreltail grass)	0.7	8
Salsola kali [a] (Russian thistle)	1.9	56
Achillea millefolium (yarrow)	0.3	12
Sisymbrium altissimum [a] (tumblemustard)	0.5	20
Descurainia pinnata (western tansymustard)	0.1	4
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
Artemisia tridentata (big sagebrush)	X	X
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Chrysothamnus viscidiflorus (green rabbitbrush)	X	X
Erodium cicutarium [a] (storksbill)	X	X
Bromus tectorum [a] (cheatgrass)	23	100
Phacelia hastata (threadleaf scorpionweed)	X	X
Cryptantha leucophaea (gray cryptantha)	X	X
Lactuca serriola [a] (prickly lettuce)	0.1	4
Machaeranthera canescens (hoary aster)	X	X
Epilobium paniculatum (tall willowherb)	X	X
Poa bulbosa [a] (bulbous bluegrass)	0.4	16
Agropyron dasytachyum (thickspike wheatgrass)	0.1	4
Tragopogon dubius [a] (yellow salsify)	0.2	8
Lepidium perfoliatum [a] (clasping pepperweed)	X	X
Holosteum umbellatum (jagged chickweed)	0.8	32
Sphaeralcea munroana (globemallow)	X	X
Centaurea diffusa [a] (diffuse knapweed)	X	X
Ambrosia acanthicarpa (bur ragweed)	X	X
Astragalus sclerocarpus (stalked pod milkvetch)	X	X
Astragalus succumbens (crouching milkvetch)	X	X
Vicia cracca [a] (bird vetch)	X	X
Festuca octoflora (slender sixweeks)	0.2	8
Draba verna (spring whitlowgrass)	0.1	4
Eriogonum niveum (snow buckwheat)	X	X
Bare soil	25.7	64
Litter	68.1	100
Total Cover (does not include litter)	**42.5**	

[a] Introduced species.

X = Species present on the site but not counted in a plot frame.

Table A-8. Percent Frequency of Occurrence at the 100 B/C Sites in 2006.

Species	100-B-1	128-C-1
Native Grasses [b]	100	100
Bromus tectorum [a] (cheatgrass)	56	26.7
Salsola kali [a] (Russian thistle)	96	100
Artemisia tridentata (sagebrush)	4	X
Ambrosia acanthicarpa (bur ragweed)	4	--
Amsinckia lycopsoides (fiddleneck)	4	X
Balsamorhiza careyana (Carey's balsamroot)	X	--
Lactuca serriola [a] (prickly lettuce)	--	X
Grayia spinosa (Spiny hopsage)	X	--
Sisymbrium altissimum [a] (tumble mustard)	72	20
Vulpia myuros [a] (rattail fescue)	--	6.7
Sphaeralcea munroana (globemallow)	X	--
Kochia scoparia [a] (kochia)	4	--
Bare Soil	100	100
Litter	100	100

[a] Introduced species

[b] Includes Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.

X = Observed on the site but not counted in a plot frame.

-- = Not observed on the site.

Table A-9. Percent Canopy Cover on the 100 B/C Sites in 2006.

Species	100-B-1	128-C-1
Native Grasses [b]	13.9	4.2
Bromus tectorum [a] (cheatgrass)	0.7	1.5
Salsola kali [a] (Russian thistle)	9.6	3.3
Artemisia tridentata (sagebrush)	0.1	X
Ambrosia acanthicarpa (bur ragweed)	0.1	--
Amsinckia lycopsoides (fiddleneck)	0.1	X
Balsamorhiza careyana (Carey's balsamroot)	X	--
Lactuca serriola [a] (prickly lettuce)	--	X
Grayia spinosa (Spiny hopsage)	X	--
Sisymbrium altissimum [a] (tumble mustard)	1.6	0.5
Vulpia myuros [a] (rattail fescue)	--	0.2
Sphaeralcea munroana (globemallow)	X	--
Kochia scoparia [a] (kochia)	0.1	--
Bare Soil	38.4	40.5
Litter	18.7	31.9
Total Cover (does not include bare soil or litter)	**26.2**	**9.7**

[a] Introduced species.
[b] Includes Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.
X = Observed on the site but not counted in a plot frame.
-- = Not observed on the site.

Table A-10. Percent Canopy Cover and Frequency of Occurrence on the 100-KR-1 in 2006.

Species	% Cover	% Frequency
Salsola kali [a] (Russian thistle)	9.4	81.7
Native grasses [b]	5.7	90
Sisymbrium altissimum [a] (tumblemustard)	2.5	51.7
Bromus tectorum [a] (cheatgrass)	0.8	30
Artemisia tridentata (big sagebrush)	0.6	23.3
Centaurea diffusa [a] (diffuse knapweed)	0.04	1.7
Amsinckia lycopsoides (tarweed)	0.3	10
Grayia spinosa (spiny hopsage)	X	X
Machaeranthera canescens (hoary aster)	X	X
Ambrosia acanthicarpa (bur ragweed)	X	X
Lactuca serriola [a] (prickly lettuce)	X	X
Bare soil	15	93.3
Litter	77.5	100
Total Cover (does not include litter)	**19.2**	

[a] Introduced Species.
[b] Includes Sandberg's bluegrass, bluebunch wheatgrass, thickspike wheatgrass, Indian ricegrass, needle-and-thread grass, and prairie junegrass seedlings.
X= Present but not counted in plot frames.

Table A-11. Percent Canopy Cover on the Horseshoe Landfill and Soil Staging Area 2006.

Species	Horseshoe Landfill	Soil Staging Area
Native Grasses [b]	25.7	20.2
Bromus tectorum [a] (cheatgrass)	2	2.8
Artemisia tridentata (sagebrush)	0.3	0.5
Ambrosia acanthicarpa (bur ragweed)	X	--
Amsinckia lycopsoides (fiddleneck)	X	0.7
Amaranthus albus [a] (white pigweed)	X	1.3
Hordeum leporinum [a] (hare barley)	X	--
Lactuca serriola [a] (prickly lettuce)	X	0.2
Melilotus alba [a] (sweetclover)	X	--
Festuca octoflora (slender sixweeks)	X	--
Sisymbrium altissimum [a] (tumble mustard)	X	8
Descurainia pinnata (western tansymustard)	--	0.3
Lupinus leucophyllus (velvet lupine)	--	0.2
Crepis atrabarba (slender hawksbeard)	--	X
Linum perenne (wild blueflax)	--	0.2
Erodium cicutarium [a] (storksbill)	--	X
Kochia scoparia [a] (kochia)	--	X
Bare Soil	52.8	50.2
Litter	38	38.8
Total cover (does not include litter)	**28.2**	**34.3**

[a] Introduced species
[b] Sandberg's bluegrass, Indian ricegrass, Bluebunch wheatgrass, Needle-and-Thread grass, and Squirreltail grass
X = Species present on the site but not counted in a plot frame.
-- Not observed the site.

Table A-12. Frequency of Occurrence on the Horseshoe Landfill and Soil Staging Area 2006.

Species	Horseshoe Landfill	Soil Staging Area
Native Grasses [b]	100	100
Bromus tectorum [a] (cheatgrass)	80	46.7
Artemisia tridentata (sagebrush)	13.3	20
Ambrosia acanthicarpa (bur ragweed)	X	--
Amsinckia lycopsoides (fiddleneck)	X	26.7
Amaranthus albus [a] (white pigweed)	X	53.3
Hordeum leporinum [a] (hare barley)	X	--
Lactuca serriola [a] *(prickly lettuce)*	X	6.7
Melilotus alba [a] (sweetclover)	X	--
Festuca octoflora (slender sixweeks)	X	--
Sisymbrium altissimum [a] (tumble mustard)	X	93.3
Descurainia pinnata (western tansymustard)	--	13.3
Lupinus leucophyllus (velvet lupine)	--	6.7
Crepis atrabarba (slender hawksbeard)	--	X
Linum perenne (wild blueflax)	--	6.7
Erodium cicutarium [a] (storksbill)	--	X
Kochia scoparia [a] (kochia)	--	X
Bare Soil	100	100
Litter	100	100

[a] Introduced species
[b] Sandberg's bluegrass, Indian ricegrass, Bluebunch wheatgrass, Needle-and-Thread grass, and Squirrel tail grass
X = Species present on the site but not counted in a plot frame.
-- Not observed the site.

APPENDIX B

2005 REVEGETATION MONITORING RESULTS

Table B-1. 300-FF-1 Process Ponds and Burial Grounds 2005.

Species	% Cover	% Frequency
Agropyron dasytachyum (thickspike wheatgrass)	0.4	17.1
Agropyron spicatum (bluebunch wheatgrass)	10.0	68.6
Agropyron hybrid (regreen)	0.0	0.0
Agropyron cristatum [a] (crested wheatgrass)	19.3	94.3
Stipa comata (needle-and-thread grass)	0.1	2.9
Oryzopsis hymenoides (Indian ricegrass)	1.1	31.4
Vulpia myuros [a] (rattail fescue)	0.4	14.3
Melilotus officinalis [a] (sweetclover)	0.1	5.7
Eriogonum niveum (snow buckwheat)	X	X
Poa sandbergii (Sandberg's bluegrass)	3.7	65.7
Chaenactis douglasii (hoary falseyarrow)	X	X
Centaurea diffusa [a] (diffuse knapweed)	X	X
Sisymbrium altissimum [a] (tumble mustard)	0.1	2.9
Bromus tectorum [a] (cheatgrass)	4.1	65.7
Lactuca serriola [a] (prickly lettuce)	X	X
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
Phacelia hastata (whiteleaf scorpionweed)	0.1	2.9
Erodium cicutarium [a] (storksbill)	0.1	5.7
Senecio vulgaris (common groundsel)	X	X
Amaranthus albus (white pigweed)	0.0	0.0
Kochia scoparia [a] (kochia)	0.1	2.9
Salsola kali [a] (Russian thistle)	0.6	25.7
Lepidium perfoliatum (clasping pepperweed)	X	X
Hordeum leporinum [a] (hare barley)	0.1	2.9
Oenothera pallida (evening primrose)	X	X
Psoralea lanceolata (dune scurfpea)	X	X
Cryptantha circumscissa (matted cryptantha)	0.0	0.0
Plantago patagonica (Indian wheat)	0.0	0.0
Cardaria draba [a] (whitetop)	X	X
Polypogon monspeliensis [a] (rabbitfoot grass)	0.0	0.0
Poa annua [a] (annual bluegrass)	0.0	0.0
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Poa bulbosa [a] (bulbous bluegrass)	0.1	2.9
Hymenopappus filifolius (Columbia cutleaf)	X	X
Phacelia linearis (threadleaf scorpionweed)	X	X
Petalostemon ornatum (prairie clover)	X	X
Chondrilla juncea [a] (rush skeletonweed)	X	X
Machaeranthera canescens (hoary aster)	X	X
Sphaeralcea munroana (globemallow)	X	X
Achillea millefolium (yarrow)	X	X
Epilobium paniculatum (tall willowherb)	X	X
Descurainia pinnata (western tansymustard)	X	X
Artemisia tridentata (big sagebrush)	X	X
Bare Soil	29.9	94.3
Litter	46.4	100.0
Total cover (does not include litter)	**40.4**	

[a] Introduced Species.
X= Present but not counted in plot frames.

Table B-2. Percent Canopy Cover on the 120-N-1 and 120-N-2 Sites in 2005.

Species	Triple 16 & Straw Mulch	Triple 16 & Hydromulch	Biosol & Straw Mulch	Biosol & Hydromulch
Agropyron dasytachyum (thickspike wheatgrass)	X	--	X	--
Agropyron spicatum (bluebunch wheatgrass)	26.3	1.8	4.7	1.7
Poa sandbergii (Sandberg's bluegrass)	10.3	3.7	3.3	2.3
Stipa comata (needle-and-thread grass)	X	0.2	0.2	0.2
Bromus tectorum [a] (cheatgrass)	2.2	6.0	8.0	23.3
Salsola kali [a] (Russian thistle)	0.3	2.8	0.5	1.3
Achillea millefolium (yarrow)	2.3	1.5	0.2	X
Vulpia myuros [a] (rattail fescue)	2.7	--	5.2	0.3
Artemisia tridentata (big sagebrush)	0.3	X	X	X
Centaurea diffusa [a] (diffuse knapweed)	0.2	0.3	X	0.3
Chrysothamnus nauseosus (gray rabbitbrush)	X	X	X	X
Descurainia pinnata (western tansymustard)	--	0.3	0.3	0.2
Epilobium paniculatum (tall willowherb)	--	0.2	--	--
Eriogonum niveum (snow buckwheat)	--	0.2	--	--
Erodium cicutarium [a] (storksbill)	X	--	--	--
Lactuca serriola [a] (prickly lettuce)	X	--	--	X
Festuca octoflora (slender sixweeks)	0.2	--	0.5	--
Sisymbrium altissimum [a] (tumblemustard)	0.5	1.0	0.7	1.0
Tragopogon dubius [a] (yellow salsify)	X	--	--	--
Machaeranthera canescens (hoary aster)	X	X	--	--
Chaenactis douglasii (hoary falseyarrow)	X	1.5	X	3.8
Penstemon acuminatus (sand beardtongue)	--	X	--	--
Erigeron poliospermus (cushion fleabane)	X	X	--	--
Oryzopsis hymenoides (Indian ricegrass)	0.3	0.5	X	X
Draba verna (spring whitlowgrass)	--	0.2	--	--
Erysimum asperum (wall flower)	0.3	0.8	X	0.2
Amsinckia lycopsoides (tarweed fiddleneck)	0.3	--	0.3	0.2
Erigeron pumilis (shaggy fleabane)	X	X	--	--
Erigeron filifolius (threadleaf fleabane)	X	X	--	--
Poa bulbosa [a] (bulbous bluegrass)	0.2	0.3	--	--
Biotic crust	0.3	0.5	0.5	0.3
Bare soil	33.0	46.7	32.8	41.0
Litter	31.3	5.7	29.5	6.7
Total cover (does not include crust or litter)	**46.5**	**21.3**	**23.8**	**34.8**

[a] Introduced Species.

X= Present but not counted in plot frames.

Table B-3. Percent Frequency of Occurrence on the 120-N-1 and 120-N-2 Sites in 2005.

Species	Triple 16 & Straw Mulch	Triple 16 & Hydromulch	Biosol & Straw Mulch	Biosol & Hydromulch
Agropyron dasytachyum (thickspike wheatgrass)	X	--	X	--
Agropyron spicatum (bluebunch wheatgrass)	100	73	87	67
Poa sandbergii (Sandberg's bluegrass)	100	80	100	60
Stipa comata (needle-and-thread grass)	X	7	7	7
Bromus tectorum [a] (cheatgrass)	87	80	93	100
Salsola kali [a] (Russian thistle)	13	47	20	53
Achillea millefolium (yarrow)	60	60	7	X
Vulpia myuros [a] (rattail fescue)	40	--	73	13
Artemisia tridentata (big sagebrush)	13	X	X	X
Centaurea diffusa [a] (diffuse knapweed)	7	13	X	13
Chrysothamnus nauseosus (gray rabbitbrush)	X	27	X	X
Descurainia pinnata (western tansymustard)	--	13	13	7
Epilobium paniculatum (tall willowherb)	--	7	--	--
Eriogonum niveum (snow buckwheat)	--	7	--	--
Erodium cicutarium [a] (storksbill)	X	--	--	--
Lactuca serriola [a] (prickly lettuce)	X	--	--	X
Festuca octoflora (slender sixweeks)	7	--	20	--
Sisymbrium altissimum [a] (tumblemustard)	20	40	27	40
Tragopogon dubius [a] (yellow salsify)	X	--	--	--
Machaeranthera canescens (hoary aster)	X	X	--	--
Chaenactis douglasii (hoary falseyarrow)	X	27	X	27
Penstemon acuminatus (sand beardtongue)	--	X	--	--
Erigeron poliospermus (cushion fleabane)	X	20	--	--
Oryzopsis hymenoides (Indian ricegrass)	13	20	X	X
Draba verna (spring whitlowgrass)	--	7	--	--
Erysimum asperum (wall flower)	13	33	X	7
Amsinckia lycopsoides (tarweed fiddleneck)	13	--	13	7
Erigeron pumilus (shaggy fleabane)	X	X	--	--
Erigeron filifolius (threadleaf fleabane)	X	X	--	--
Poa bulbosa [a] (bulbous bluegrass)	7	13	--	--
Biotic crust	13	20	20	13
Bare soil	93	93	100	100
Litter	100	93	100	100

[a] Introduced Species.

X= Present but not counted in plot frames.

Table B-4. Percent Canopy Cover and Frequency of Occurrence on the 100 F Liquid Sites in 2005.

Species	% Cover	% Frequency
Agropyron spicatum (bluebunch wheatgrass)	4.0	80
Oryzopsis hymenoides (Indian ricegrass)	0.8	32
Stipa comata (needle-and-thread grass)	0.4	16
Poa sandbergii (Sandberg's bluegrass)	1.0	40
Sitanion hystrix (bottlebrush squirreltail)	0.5	20
Salsola kali [a] (Russian thistle)	25.0	100
Achillea millefolium (yarrow)	X	X
Sisymbrium altissimum [a] (tumblemustard)	0.5	20
Descurainia pinnata (western tansymustard)	X	X
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
Artemisia tridentata (big sagebrush)	0.2	8
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Erodium cicutarium (storksbill)	X	X
Bromus tectorum [a] (cheatgrass)	0.7	28
Phacelia hastata (threadleaf scorpionweed)	X	X
Melilotus officinalis [a] (sweetclover)	X	X
Lactuca serriola [a] (prickly lettuce)	0.4	16
Machaeranthera canescens (hoary aster)	X	X
Epilobium paniculatum (tall willowherb)	0.2	8
Poa bulbosa [a] (bulbous bluegrass)	0.1	4
Agropyron dasytachyum (thickspike wheatgrass)	X	X
Tragopogon dubius (yellow salsify)	X	X
Lepidium perfoliatum [a] (clasping pepperweed)	X	X
Holosteum umbellatum (jagged chickweed)	0.4	16
Sphaeralcea munroana (globemallow)	X	X
Chaenactis douglasii (hoary falseyarrow)	X	X
Centaurea solstitialis [a] (yellow starthistle)	X	X
Triticum aestivum [a] (wheat)	X	X
Astragalus sclerocarpus (stalked pod milkvetch)	X	X
Astragalus succumbens (crouching milkvetch)	X	X
Lupinus pusillus (low lupine)	X	X
Vicia cracca [a] (bird vetch)	X	X
Bare soil	22.9	76
Litter	59.5	100
Total cover (does not include litter)	**34.2**	

[a] Introduced Species.
X= Present but not counted in plot frames.

Table B-5. Percent Canopy Cover and Frequency of Occurrence on the 116-N-3 Site in 2005.

Species	% Cover	% Frequency
Agropyron spicatum (bluebunch wheatgrass)	7.7	76
Salsola kali [a] (Russian thistle)	25.5	100
Sitanion hystrix (bottlebrush squirreltail)	8.3	60
Bromus tectorum [a] (cheatgrass)	0.4	16
Stipa comata (needle-and-thread grass)	0.6	24
Poa sandbergii (Sandberg's bluegrass)	0.9	36
Sisymbrium altissimum [a] (tumblemustard)	0.3	12
Artemisia tridentata (big sagebrush)	0.1	4
Oryzopsis hymenoides (Indian ricegrass)	0.6	24
Amaranthus albus [a] (pigweed)	X	X
Lactuca serriola [a] (prickly lettuce)	X	X
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
Machaeranthera canescens (hoary aster)	X	X
Hordeum leporinum [a] (hare barley)	X	X
Calochortus macrocarpus (mariposa lily)	X	X
Grayia spinosa (hopsage)	X	X
Kochia scoparia [a] (kochia)	X	X
Senecio vulgaris [a] (common groundsel)	X	X
Melilotus officinalis [a] (sweetclover)	X	X
Bare soil	30.9	100
Litter	49	100
Total cover (does not include litter)	**44.4**	

[a] Introduced Species.
X= Present but not counted in plot frames.

APPENDEX C

2004 REVEGETATION MONITORING RESULTS

Table C-1. Percent Canopy Cover and Frequency of Occurrence at the 300-FF-1 Process Ponds and Burial Grounds, 2004.

Species	% Cover	% Frequency
Agropyron dasytachyum (thickspike wheatgrass)	19	91.4
Agropyron spicatum (bluebunch wheatgrass)	2.9	60
Agropyron hybrid (Regreen)	1.9	62.9
Agropyron cristatum [a] (crested wheatgrass)	6.6	80
Stipa comata (needle-and-thread grass)	0.9	37.1
Oryzopsis hymenoides (Indian ricegrass)	1.3	51.4
Vulpia myuros [a] (rattail)	0.6	25.7
Melilotus alba [a] (sweetclover)	X	X
Eriogonum niveum (snow buckwheat)	X	X
Poa sandbergii (Sandberg's bluegrass)	1.4	57.1
Chaenactis douglasii (hoary falseyarrow)	X	X
Centaurea diffusa [a] (diffuse knapweed)	X	X
Sisymbrium altissimum [a] (tumble mustard)	1.0	40
Bromus tectorum [a] (cheatgrass)	2.6	62.9
Lactuca serriola [a] (prickly lettuce)	X	X
Amsinckia lycopsoides (tarweed fiddleneck)	0.3	11.4
Phacelia hastata (whiteleaf scorpionweed)	0.1	2.9
Ambrosia acanthicarpa (bur ragweed)	0.1	2.9
Erodium cicutarium [a] (storksbill)	0.1	5.7
Senecio vulgaris [a] (common groundsel)	0.4	14.3
Amaranthus alba [a] (pigweed)	0.1	2.9
Kochia scoparia [a] (Kochia)	X	X
Salsola kali [a] (Russian thistle)	1.1	28.6
Lepidium perfoliatum (clasping pepperweed)	X	X
Hordeum leporinum [a] (hare barley)	0.1	2.9
Oenothera pallida (primrose)	X	X
Psoralea lanceolata (dune scurfpea)	X	X
Cryptantha circumscissa (matted cryptantha)	X	X
Plantago patagonica (Indian wheat)	X	X
Cardaria draba [a] (whitetop)	X	X
Polypogon monspeliensis [a] (rabbitfoot grass)	0.3	11.4
Poa annua [a] (annual bluegrass)	0.1	2.9
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Bare Soil	25.9	100
Litter	52.7	100
Total cover (does not include biotic crust or litter)	**41**	

[a] Introduced species.
X = Present but not counted in plot frames

Table C-2. Percent Canopy Cover on the 120-N-1 and 120-N-2 Sites in 2004.

Species	Triple 16 and Straw Mulch	Triple 16 and Hydromulch	Biosol and Straw Mulch	Biosol and Hydromulch
Agropyron dasytachyum (thickspike wheatgrass)	4.3	4.4	5.0	0.5
Agropyron spicatum (bluebunch wheatgrass)	3.8	0.8	0.5	0.4
Poa sandbergii (Sandberg's bluegrass)	17.9	10.1	6.4	2.9
Stipa comata (needle-and-thread grass)	0.4	0.6	1.1	0.5
Bromus tectorum [a] (cheatgrass)	4.3	2.4	6.0	7.4
Salsola kali [a] (Russian thistle)	1.9	1.8	2.8	2.0
Achillea millefolium (yarrow)	1.4	3.0	1.9	1.6
Vulpia myuros [a] (rattail fescue)	0.4	--	--	--
Artemisia tridentata (big sagebrush)	0.4	0.1	X	X
Centaurea diffusa [a] (diffuse knapweed)	1.4	--	--	0.4
Chrysothamnus nauseosus (gray rabbitbrush)	--	0.5	--	0.3
Descurainia pinnata (western tansymustard)	--	0.3	0.1	--
Epilobium paniculatum (tall willowherb)	1.1	1.8	1.8	1.4
Lactuca serriola [a] (prickly lettuce)	0.3	0.1	0.8	0.4
Sisymbrium altissimum [a] (tumblemustard)	0.5	0.6	1.3	2.1
Tragopogon dubius [a] (yellow salsify)	--	--	--	0.3
Machaeranthera canescens (hoary aster)	--	--	0.3	0.1
Chaenactis douglasii (hoary falseyarrow)	0.1	1.0	0.1	1.5
Penstemon acuminatus (sand beardtongue)	--	--	0.4	0.3
Erigeron poliospermus (cushion fleabane)	0.1	0.1	0.1	--
Oryzopsis hymenoides (Indian ricegrass)	0.4	0.3	1.0	0.3
Draba verna (spring whitlowgrass)	2.0	0.5	0.5	0.4
Holosteum umbellatum [a] (jagged chickweed)	0.1	--	--	--
Erysimum asperum (wall flower)	0.1	0.6	0.5	1.5
Amsinckia lycopsoides (tarweed fiddleneck)	0.1	--	0.1	X
Poa bulbosa [a] (bulbous bluegrass)	0.1	0.3	--	--
Ranunculus testiculatus (bur buttercup)	0.3	0.3	0.4	--
Erigeron pumilus (shaggy fleabane)	X	--	X	--
Melilotus alba [a] (sweetclover)	X	--	--	X
Bare soil	28.9	47.5	27.1	57.3
Litter	36.9	3.1	48.6	3.1
Total Cover (does not include bare soil or litter)	**41.1**	**29.4**	**30.9**	**24.0**

[a] Introduced species.
X = Present but not counted in plot frames
-- = Not observed on the site

Table C-3. Percent Frequency of Occurrence on the 120-N-1 and 120-N-2 Sites in 2004.

Species	Triple 16 and Straw Mulch	Triple 16 and Hydromulch	Biosol and Straw Mulch	Biosol and Hydromulch
Agropyron dasytachyum (thickspike wheatgrass)	75	55	30	20
Agropyron spicatum (bluebunch wheatgrass)	55	30	20	15
Poa sandbergii (Sandberg's bluegrass)	90	90	85	90
Stipa comata (needle-and-thread grass)	15	25	45	20
Bromus tectorum [a] (cheatgrass)	95	70	95	100
Salsola kali [a] (Russian thistle)	75	45	85	80
Achillea millefolium (yarrow)	55	95	75	65
Vulpia myuros [a] (rattail fescue)	15	--	--	--
Artemisia tridentata (big sagebrush)	15	5	X	X
Centaurea diffusa [a] (diffuse knapweed)	30	--	--	15
Chrysothamnus nauseosus (gray rabbitbrush)	--	20	--	10
Descurainia pinnata (western tansymustard)	--	10	5	--
Epilobium paniculatum (tall willowherb)	45	70	70	55
Lactuca serriola [a] (prickly lettuce)	10	5	30	15
Sisymbrium altissimum [a] (tumblemustard)	20	25	50	85
Tragopogon dubius [a] (yellow salsify)	--	--	--	10
Machaeranthera canescens (hoary aster)	--	--	10	5
Chaenactis douglasii (hoary falseyarrow)	5	40	5	60
Penstemon acuminatus (sand beardtongue)	--	--	15	10
Erigeron poliospermus (cushion fleabane)	5	5	5	--
Oryzopsis hymenoides (Indian ricegrass)	15	10	40	10
Draba verna (spring whitlowgrass)	55	20	20	15
Holosteum umbellatum [a] (jagged chickweed)	5	--	--	--
Erysimum asperum (wall flower)	5	25	20	60
Amsinckia lycopsoides (tarweed fiddleneck)	5	--	5	X
Poa bulbosa [a] (bulbous bluegrass)	5	10	--	--
Ranunculus testiculatus (bur buttercup)	10	10	15	--
Erigeron pumilus (shaggy fleabane)	X	--	X	
Melilotus alba [a] (sweetclover)	X	--	--	X
Bare soil	100	100	100	100
Litter	100	100	100	100

[a] Introduced species.
X = Present but not counted in plot frames
-- = Not observed on the site

APPENDEX D
2003 REVEGETATION MONITORING RESULTS

Table D-1. Percent Frequency of Occurrence on the 120-N-1 and 120-N-2 Sites in 2003.

Species	Triple 16 and Straw Mulch	Triple 16 and Hydromulch	Biosol and Straw Mulch	Biosol and Hydromulch
Agropyron dasytachyum (thickspike wheatgrass)	100	95	100	80
Agropyron spicatum (bluebunch wheatgrass)	25	30	15	X
Poa sandbergii (Sandberg's bluegrass)	85	75	60	X
Stipa comata (needle-and-thread grass)	25	--	10	--
Bromus tectorum [a] (cheatgrass)	30	10	15	25
Salsola kali [a] (Russian thistle)	85	90	65	90
Achillea millefolium (yarrow)	75	65	25	5
Vulpia myuros [a] (rattail fescue)	55	--	25	--
Artemisia tridentata (big sagebrush)	20	5	5	X
Centaurea diffusa [a] (diffuse knapweed)	20	10	15	100
Chrysothamnus nauseosus (gray rabbitbrush)	5	--	--	--
Lactuca serriola [a] (prickly lettuce)	X	--	--	--
Festuca octoflora (slender sixweeks)	5	--	--	--
Sisymbrium altissimum [a] (tumblemustard)	X	X	--	X
Machaeranthera canescens (hoary aster)	5	15	--	X
Chaenactis douglasii (hoary falseyarrow)	5	10	X	5
Phlox longifolia (longleaf phlox)	--	X	--	--
Amaranthus albus [a] (pigweed)	5	--	--	X
Erigeron poliospermus (cushion fleabane)	5	10	--	--
Oryzopsis hymenoides (Indian ricegrass)	--	--	5	--
Erysimum asperum (rough wallflower)	--	--	X	--
Bare soil	100	100	95	100
Litter	100	100	100	100

[a] Introduced species.
X = present but not counted in plot frames
-- = not present on site

APPENDIX E
NAME CHANGES INCLUDED IN INTEGRATED TAXONOMIC INFORMATION SYSTEM

APPENDIX E
NAME CHANGES INCLUDED IN INTEGRATED TAXONOMIC INFORMATION SYSTEM

Name changes included in Integrated Taxonomic Information System (ITIS 1998).

Recent name changes for species mentioned in this report. The first name is that used in Hitchcock and Cronquist (1973) and the second is the more recent version.

Agropyron cristatum = Agropyron desertorum
Agropyron dasytachyum = Elymus lanceolatus var lanceolatus
Agropyron spicatum = Pseudoroegneria spicata ssp. spicata
Chrysothamnus nauseosus = Ericameria nauseosa ssp. *nauseosa* var. *nauseosa*
Cymopterus terebinthinus = Pteryxia terebinthina var. *terebinthina*
Epilobium paniculatum = Epilobium brachycarpum
Erysimum asperum = Erysimum capitatum var capitatum
Festuca octoflora = Vulpia octoflora var. *octoflora*
Koeleria cristata = Koeleria macrantha
Microsteris gracilis = Phlox gracilis ssp. *gracilis*
Oryzopsis hymenoides = Achnatherum hymenoides
Poa sandbergii = Poa secunda
Poa scabrella = Poa secunda
Psoralea lanceolata = Psoralidium lanceolatum
Ranunculus testiculatus = Ceratocephala testiculata
Salsola kali = Salsola tragus
Sitanion hystrix = Elymus elymoides ssp. *elymoides*
Stipa comata = Hesperostipa comata ssp. *comata*

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