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River Corridor
Closure Contract

2008 River Corridor Closure Contractor Revegetation and Mitigation Monitoring Report

September 2008

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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Author Name: C.T. Lindsey
K.A. Gano

Approval: T.E. Marceau, Environmental Sciences Manager

Thomas E Marc — Signature

9/30/08 — Date

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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 a native vegetation community. 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 2008 and includes 22 revegetation/restoration projects, one revegetation/mitigation project, and two bat habitat mitigation projects.

Revegetation/Restoration Projects:

- Fifth-year monitoring at the 300-FF-1 Operable Unit sites;
- Fourth year monitoring of 100-F area sites and 116-N-3 Trench in the 100 N Area;
- Third 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;
- Second year monitoring of the ERDF Mitigation on the Army Loop Road, 116-N-1 Trench, 100-B/C Area, and 300-FF-2 Operable Unit sites;
- First year monitoring of 118-F-1&2, 182-F, 183-F East Clearwell, 100-F-26, 118-F-5, 118-B-1, 100-B-14, and 118-C-1.

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, 105-F Reactor, and the 183-F west Clearwell and Flume.

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 are 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 stabilize the soil surface. To facilitate successful germination, 16.8 kg/ha polyacrylamide (water retaining crystals) 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. Fifth year data was collected from the 300-FF-1 Process Ponds in May 2008. This site showed an increase in native canopy cover of 12% from 2007, and 27% since 2006. This is the kind of succession that is indicative of a successful revegetation. Non-native cover is still dominant at this site (58% cover), but 20% of this is crested wheatgrass (*Agropyron cristatum*), which was included in the seed mix in 2004. Though this site is designated for industrial use, this revegetation effort has been very successful. Continued succession will likely show seeded plants dominating the site.

Second year monitoring was conducted in May of 2008 on the 618-2 and -3 solid waste burial grounds and the 300-8 Aluminum shavings waste site. The 618-2 and -3 sites are dominated by the seeded crested wheatgrass, at 21% cover. Native cover remains low (8%), but the 11 documented native species on the site show relatively high diversity. Invasive species cover, not counting the seeded crested wheatgrass, is 17%.

The dominant native plant species at the 300-8 site was slender sixweeks (*Festuca octaflora*), while ten other native species occur on the site. A dramatic decrease in native plant cover at this site is likely due to the abundant germination and subsequent die-off that is often seen in the first year at the revegetation of a site with no vegetation. The native plants presence will likely increase in cover as time passes.

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 (*Artemisia tridentata*) the first week of February 2006. Shrub survival monitoring transects were established in late April 2006 to capture baseline survival counts.

In May 2008 monitoring showed 68% survival. This plot has become very diverse, with 16 native plant species present onsite.

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. Third-year monitoring was conducted in April 2008. Native cover showed an increase of 20% on the cobble site, but down 37% on the topsoil site. The topsoil site also had greater invasive species cover. These sites continue to change rapidly, but will likely stabilize during the fourth and fifth years of monitoring. The comparison of these two sites will provide valuable information to use in future revegetation efforts.

The 116-N-3 Trench was seeded in January 2005, with native grass species and planted with sagebrush and hopsage (*Grayia spinosa*) seedlings propagated from seed collected on the Hanford site. Fourth year monitoring was conducted at this site in 2008. This site showed positive signs of succession, with a 10% decrease in canopy cover of invasive species, along with an increase of 45% for native species canopy cover.

The 116-N-1 Crib and Trench were revegetated in December 2006 with native grass species and planted with sagebrush at 1,235 plants/hectare. Second year monitoring showed Sandberg's bluegrass (*Poa sandbergii*) dominating the site, with 41% canopy cover, while non-native plant cover decreased to 8%. Sagebrush monitoring showed an extremely high 90% survival rate. This high percentage of surviving shrubs will soon provide a seed source to the surrounding area.

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 (*Agropyron spicatum*), thickspike wheatgrass (*Agropyron dasytachyum*), Indian ricegrass (*Oryzopsis hymenoides*), prairie junegrass (*Koeleria cristata*), and needle-and-thread grass (*Stipa comata*). 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. Fourth year monitoring was performed at the 100-F area sites in May of 2008. Cheatgrass (*Bromus techtorum*) was the dominant plant on the site, with 53% canopy cover. Native plant canopy continues to increase, and was at 47% in 2008. Fifty random sagebrush from across the site were measured and the average height was 20 cm.

The 118-F-1, 118-F-2, 182-F, 183-F East Clearwell, 100-F-26, and 118-F-5 Areas were revegetated between December 2007 and February 2008, and monitored in 2008. These sites were broadcast seeded with a mixture of native grasses including Sandberg's bluegrass, Indian rice grass, bluebunch wheatgrass, prairie junegrass, bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread grass. In addition, 134kg/ha of Triple-16 fertilizer was added to the sites along with 4,480 kg/ha of straw mulch that was spread and crimped into the soil surface. Sagebrush plugs were then planted into the seeded areas at 1,200 plants/ha.

First year monitoring was conducted at the 118-F-1 site in 2008. Vegetation was relatively thin across the site, but native grass seedlings occurred in 100% of the plot frames. Sagebrush transects were established, and hopsage tublings were also observed within these transects. Survival and growth rates will be monitored in 2009.

The 118-F-2 site was monitored for the first time in 2008. Native grasses dominated the site at 19% cover, while Russian thistle (*Salsola kali*) was present at 10%. Forty-eight sagebrush and one hopsage were counted in a transect that was established to monitor shrub survival in future years.

First year monitoring was performed at the 182-F site in 2008. The site was dominated by native grasses, showing ~40% cover across the site. The site was divided into a North and South plot,

with the South plot showing more invasive species cover than the North site. These changes will likely diminish as each site proceeds through successional stages.

The 183-F East Clearwell site was monitored in 2008 for the first time. The area showed 52% cover of native grasses, and only 7% cover of Russian thistle. Species diversity was relatively high for a young site, with eight native forbs present on the site.

First year monitoring was conducted on the 100-F-26 site in 2008. Native grasses had 23% canopy cover, while cheatgrass and Russian thistle combined for 32% cover. Fifteen other species were present on the site, indicating rich species diversity for such a young site.

First year monitoring was conducted at the 118-F-5 site in 2008. The site was monitored separately at the burial ground and the soil staging area. Cheatgrass dominated both sites, but had much higher canopy coverage at the soil staging area (49%) than at the burial ground (14%). Native grass canopy cover was 16% at the soil staging area and 4% at the burial ground. Sagebrush monitoring transects were established, counting 58 sagebrush on the burial ground transect, and 41 sagebrush and 11 hopsage on the soil staging area transect.

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 were 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. Third year monitoring at 100-B-1 showed Sandberg's bluegrass as the dominant plant at 44% cover, while cheatgrass cover remained high

at 24%. Cheatgrass remained the dominant single species at the 128-C-1 site, but native species canopy cover (40%) surpassed non-native cover (33%) for the first time in 2008. Sagebrush monitoring at 100-B-1 showed 43% survival, while 128-C-1 showed 55% survival.

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-B2. The total area was approximately 40.5 ha (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 1,300 plants/ha (530 plants/ac).

Second year monitoring was conducted at 100-C-9 on April 29, 2008. Because the site is long and narrow, it was separated into three transects to show potential variations across the site. Native vegetation decreased from first year observations, likely due to the rapid germination and subsequent die-off often seen during revegetation. It is expected that the competition at the beginning reduces invasive species colonization, and the plants that do survive will increase in canopy cover and will provide seed to fill in void spaces. Sagebrush monitoring showed cumulative survival at 88%.

The 118-B 2 and 3 sites were not monitored this year.

In December 2007 and January 2008, the 100-B-14, 118-B-1, and 118-C-1 sites were revegetated. These areas were broadcast seeded with a mixture of native grasses including Sandberg's bluegrass, Indian rice grass, bluebunch wheatgrass, prairie junegrass, bottlebrush squirreltail, and needle-and-thread grass. In addition, 134kg/ha of Triple-16 fertilizer was added

to the sites along with 4,480 kg/ha of straw mulch that was spread and crimped into the soil surface. Sagebrush plugs were then planted into the seeded areas at 930 plants/ha.

First year monitoring was conducted at the 100-B-14 site on May 7, 2008. Russian thistle was the dominant species, at 31% cover, while native grasses showed 7% cover. Sagebrush transects were established and survival will be documented during the 2009 monitoring.

First year monitoring was conducted at the 118-B-1 site on May 6, 2008. The soil staging area and burial ground were dominated by Sandberg's bluegrass, at 11% and 14% respectively. Sagebrush monitoring transects were established on the soil staging area and burial ground, and survival will be documented during the 2009 monitoring.

First year monitoring was conducted at the 118-C-1 site on May 6, 2008. Russian thistle dominated the site at 21% cover, while native grasses showed 10% cover. A sagebrush monitoring transect was established that counted 33 shrubs with an average height of 10 cm. Survival will be recorded during 2009 monitoring.

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. Third-year monitoring was conducted at these sites during 2008. Invasive species cover decreased drastically across the sites (9-30% decreases), while native species showed an overall increase in canopy cover. The most promising statistic from this year's sagebrush monitoring is that ~98% of the shrubs that were alive in 2007 were still surviving in 2008. This is a strong sign that the shrubs have become established to the point that significant die-off should no longer be a concern, and the remaining shrubs are beginning to provide seeds to the surrounding areas.

The Horseshoe Landfill is located on the Fitzner-Eberhardt Arid Lands Ecology Reserve (ALE) and served as a military landfill for the nearby Nike missile base. The landfill underwent a

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 of 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 erosion. The landfill and soil staging area were planted with sagebrush 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 is 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. Third-year observations were made at the landfill in May of 2008. Native plant cover increased 42% at the landfill and 27% at the soil staging area. Sandberg's bluegrass was the dominant plant at both sites. These sites have become very diverse, with 16 native species observed across the two locations. Sagebrush survival is promising, with 71% total survival, and 97% surviving from 2007 monitoring.

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 a fire break or natural location to fight a fire if one should threaten this area. In addition to planting sagebrush, 10 artificial burrowing owl nest boxes were installed in the area. Sagebrush transects were monitored during April of 2008. The sites showed significant die-off, with 26% surviving at the northeast plot and 38% surviving at the southwest plot. Reasons for the die-off are not well known, but a similar planting project by another Hanford contractor conducted in an adjacent area during the same time period, showed similar results.

The burrowing owl boxes were observed in 2008. The natural burrows that were active when the site was selected have since collapsed, and no owls were observed in the immediate area using natural or artificial burrows. Debris was cleared from the nest box entrances and monitoring will continue in 2009.

Bat Habitat Mitigation:

Bat mitigation projects have been conducted at two 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 monitoring was 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 two sites. DNA analysis shows that the species present in the 190-DR Tunnel are Yuma Myotis (*Myotis yumanensis*). Eighteen bats were captured on August 28, 2007, and four on September 11, 2007. The population was a mix of adults and juveniles, and only three 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 and 108 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.

On September 22, 2008, the 190-DR process water tunnel was entered to retrieve the data loggers and to inspect the tunnel for roosting bats. The temperature data has not yet been analyzed and will be included in the 2009 monitoring report. Bats were again photographed and counted. There were several individual bats roosting in the tunnel. These bats are likely males that have entered the roost site preparing to breed. One of these individuals was captured and confirmed to be a male.

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. On September 25, 2008, mist netting was conducted at the 105-F Reactor to determine if the roost site was still active. Pallid bats were observed in 3 of the 8 boxes (boxes 2, 7, and 8). Nine pallid bats and one *Myotis yumanensis* were captured in two mist nets. All of the pallid bats were female and some appeared to have given bith this year indicating this is still a successful maternity colony. One of the bats captured was a recapture of an individual that was banded in September 2006.

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. Data loggers were deployed in the clearwell and flume structures in the fall of 2007, and were collected during September of 2008, but the data has not been analyzed yet. In May of 2008, 60 bats were collected using mist nets, in order to increase the number of DNA samples available for analysis. A separate document will be composed outlining the detailed findings of the study performed at the 183-F facility, including the proposed preferred outcome, resulting from the findings of the study, as well as potential alternatives for the final endstate of the facility.

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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 2008 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, 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.

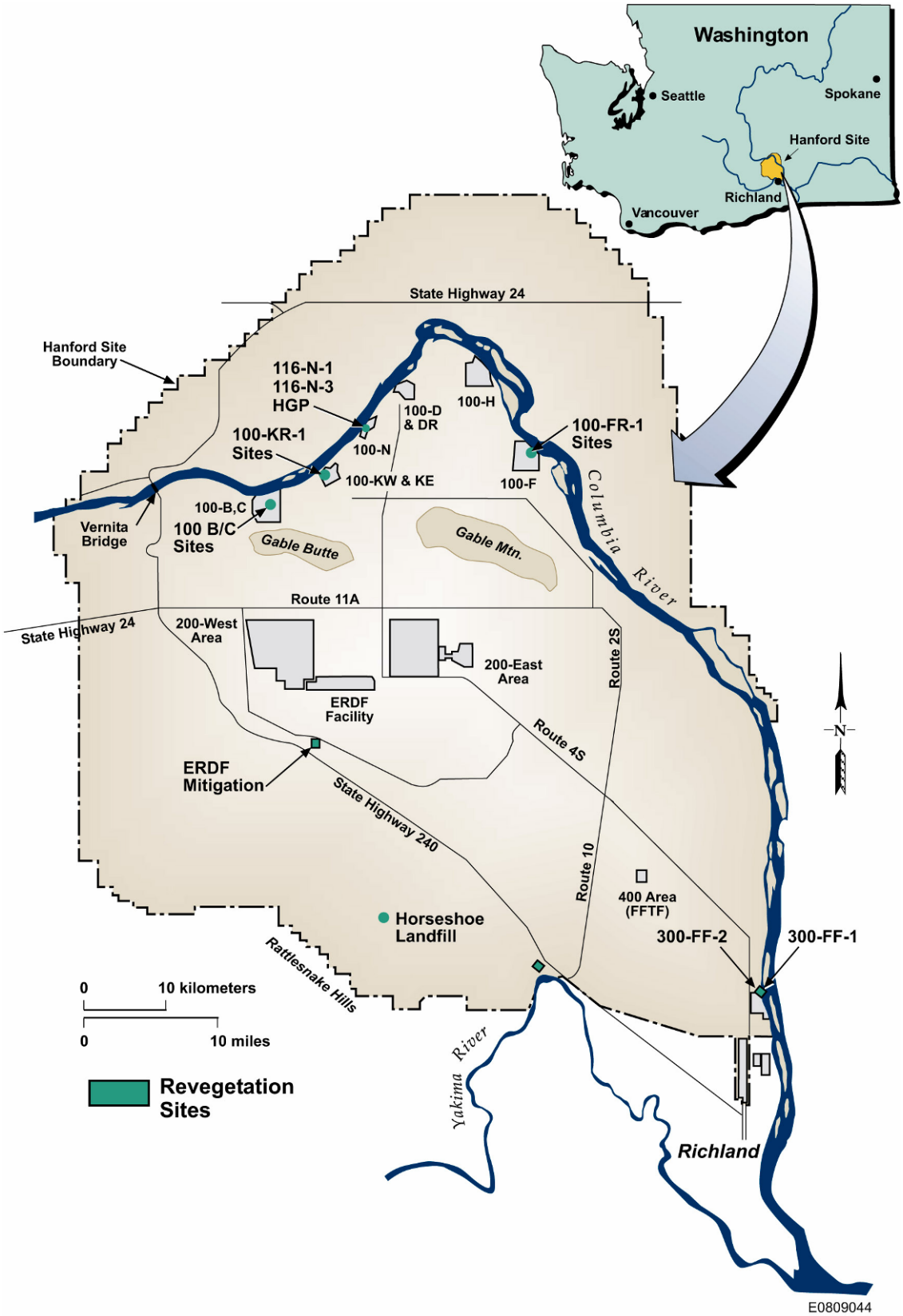
The extent of each revegetation effort varied depending on the surrounding habitat, existing conditions, and future land use designation of the area. The purpose of monitoring revegetation efforts is to measure the progress of plant succession and to evaluate the success of different planting techniques 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 2008 monitoring efforts and data collection activities.

This report provides fifth-year data collected on the 300-FF-1 Process Ponds and Burial Grounds. Fourth-year surveys were completed on the 100-F area sites and the 116-N-3 Trench. Third-year survey results are included for the revegetated areas at 116-K-2 (MLT), Hanford Generating Plant at the 100 N Area, 618-4 Burial Ground sagebrush planting, Horseshoe landfill on the ALE, 128-C-1, and 100-B-1. Second year monitoring results were collected from 116-N-1, 100-C-9, and 300-FF-2. First year monitoring was conducted at 182-F, 118-F-2, 118-F-1, 183-F East Clearwell, 100-F-26, 118-F-5, 118-C-1, 100-B-14, and 118-B-1. Results from previous years' monitoring are provided in reports for each respective year (Gano and Lindsey 2007, Johnson and Gano 2006, 2005 Johnson, and Johnson 2004). 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, survival 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. 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. For example, 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 shrubs, 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 polyacrylamide (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.

Fifth year data was collected from the 300-FF-1 Process Ponds in May 2008 (Table 1). Though this site was intended for stabilization with crested wheatgrass, the addition of native seed into the mix proved very successful. Although cheatgrass (*Bromus tectorum*) was the dominant species (38% cover) bluebunch wheatgrass (*Agropyron spicatum*) and Sandberg's bluegrass (*Poa sandbergii*) were the most dominant native grasses combining for 45% canopy cover. Crested wheatgrass (*Agropyron cristatum*) accounted for 20% of the total non-native canopy cover. This site is showing signs of continuing succession toward a native community, with native cover increasing by 12% from 2007 and 27% since 2006. This revegetation successfully attained the goal of a stabilized site, while also trending toward a native community.

Second year monitoring was conducted in May of 2008, on the 618-2 and 618-3 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 dominant species with respect to canopy cover was Russian thistle (12%) in 2007, but in 2008 the dominant species was the planted crested wheatgrass (21%), with Russian thistle canopy cover reducing to only 2% (Table 2). Bluebunch wheatgrass (*Agropyron spicatum*) was the native species with the greatest canopy cover, at 5%.

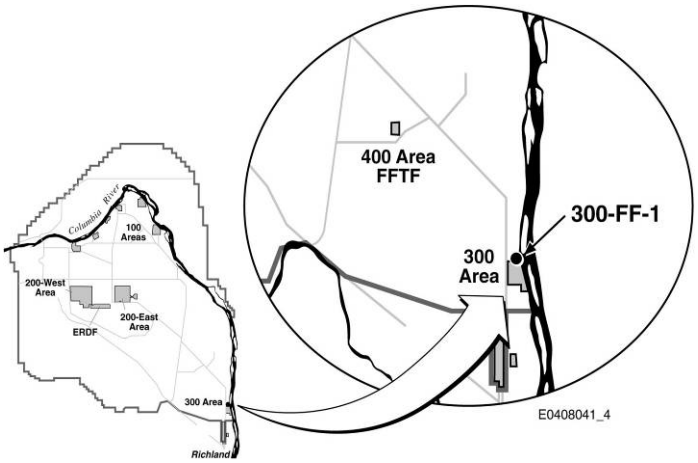
The 300-8 site showed a dramatic decrease in native plant cover, reducing by 33.5% (Table 3). This is not uncommon, as many seeded plants germinate in the first year, but do not survive to the following year. In addition, the group previously treated as native "wheatgrasses" was

separated out to show the non-native crested wheatgrass, and the native bluebunch wheatgrass. Slender sixweeks (*Festuca octoflora*) was the native plant with the greatest canopy cover, at 2%. Cheatgrass was the most dominant non-native species, at 38% canopy cover. There are many native forbs and grasses present on this site that will likely begin to out-compete the non-native perenials in the years to come.

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 was 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. Shrub survival counts in May 2008 showed 68% survival. The average shrub height was 25.8±7.5cm, with 7% of surviving shrubs blooming in the previous year. This has become a very diverse plot, with 16 native plant species observed during monitoring.

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

Sagebrush transect at 618-4 in May 2008



Sagebrush transect and vegetation at 618-4 during May 2008

Table 1. Percent Canopy Cover and Frequency of Occurrence at the 300-FF-1 Process Ponds in 2008.

Species	% Cover	Freq of Occ %
*Bromus tectorum** (cheatgrass)	37.6	94.3
Agropyron spicatum (bluebunch wheatgrass)	26.9	82.9
Poa sandbergii (Sandberg's bluegrass)	18.1	82.9
*Agropyron cristatum** (Crested Wheatgrass)	11.4	48.6
*Salsola kali** (Russian thistle)	4.0	91.4
*Vulpia myuros** (rattail fescue)	2.2	20.0
*Erodium cicutarium** (storksbill)	1.9	62.9
Descurainia pinnata (western tansymustard)	1.1	5.7
*Centaurea diffusa** (diffuse knapweed)	0.6	11.4
*Holosteum umbellatum** (jagged chickweed)	0.3	11.4
Epilobium paniculatum (tall willowherb)	0.3	11.4
Machaeranthera canescens (hoary aster)	0.2	8.6
*Sisymbrium altissimum** (tumble mustard)	0.1	5.7
Amsinckia lycopsoides (tarweed fiddleneck)	0.1	2.9
Agropyron dasytachyum (thickspike wheatgrass)	0.1	2.9
*Hordeum leporinum** (hare barley)	0.1	2.9
*Lactuca serriola** (prickly lettuce)	0.1	2.9
*Chondrilla juncea** (rush skeletonweed)	0.1	2.9
*Melilotus officinalis** (sweetclover)	0.1	2.9
*Tragopogon dubius** (yellow salsify)	0.1	2.9
*Malva neglecta** (cheeseweed)	0.1	2.9
Petalostemon ornatum (prairie clover)	X	X
*Taraxacum officinale** (common dandelion)	X	X
Erigeron filifolius (threadleaf fleabane)	X	X
Lepidium perfoliatum (clasping pepperweed)	X	X
Achillea millefolium (yarrow)	X	X
Oryzopsis hymenoides (Indian ricegrass)	X	X
Sphaeralcea munroana (globemallow)	X	X
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Astragalus caricinus (buckwheat milkvetch)	X	X
*Cardaria draba ** (whitetop)	X	X
Hymenopappus filifolius (Columbia cutleaf)	X	X
Biotic crust	10.8	60.0
Bare Soil	46.9	97.1
Litter	42.6	100.0
Total canopy cover (litter not included)	105.4	

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

Total Introduced % Cover 2008	58.6
Total Native % Cover 2008	46.7
Change in Native Plant % Cover from 2007 to 2008	+12.3

Table 2. Percent Canopy Cover and Frequency of Occurrence at 618-2 &-3 in 2008.

Species	% Cover	Freq of Occ %
*Agropyron cristatum** (crested wheatgrass)	21.7	100.0
*Bromus tectorum** (cheatgrass)	15.3	93.3
Agropyron spicatum (bluebunch wheatgrass)	4.7	86.7
Poa sandbergii (Sandberg's bluegrass)	3.2	93.3
*Salsola kali** (Russian thistle)	2.2	86.7
Chrysothamnus nauseosus (gray rabbitbrush)	0.2	6.7
Oryzopsis hymenoides (Indian ricegrass)	0.2	6.7
*Centaurea diffusa** (diffuse knapweed)	0.2	6.7
*Sisymbrium altissimum** (tumble mustard)	0.2	6.7
Epilobium paniculatum (tall willowherb)	0.2	6.7
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
Ambrosia acanthicarpa (bur ragweed)	X	X
*Lactuca serriola** (prickly lettuce)	X	X
Machaeranthera canescens (hoary aster)	X	X
Agropyron dasytachyum (thickspike wheatgrass)	X	X
Eriogonum niveum (snow buckwheat)	X	X
Achillea millefolium (yarrow)	X	X
Biotic crust	0.0	0.0
Bare Soil	46.7	93.3
Litter	46.8	100.0
Total canopy cover (litter not included)	47.8	

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

Total Invasive % Cover	39.5
Total Native % Cover	8.3
Total Change in Native Cover from 2007	-3.4

Table 3. Percent Canopy Cover and Frequency of Occurrence at 300-8 in 2008.

Species	% Cover	Freq of Occ %
*Bromus tectorum** (cheatgrass)	37.6	96.0
*Agropyron cristatum** (crested wheatgrass)	16.4	96.0
*Salsola kali** (Russian thistle)	3.9	96.0
*Holosteum umbellatum** (jagged chickweed)	2.3	52.0
Festuca octoflora (slender sixweeks)	1.9	20.0
Oenothera pallida (evening primrose)	1.5	4.0
Poa sandbergii (Sandberg's bluegrass)	1.4	56.0
Chrysothamnus nauseosus (gray rabbitbrush)	1.0	20.0
*Draba verna** (spring whitlowgrass)	0.9	36.0
Machaeranthera canescens (hoary aster)	0.4	16.0
*Erodium cicutarium** (storksbill)	0.3	12.0
Oryzopsis hymenoides (Indian ricegrass)	0.2	8.0
Agropyron spicatum (bluebunch wheatgrass)	0.2	8.0
*Poa bulbosa** (bulbous bluegrass)	0.1	4.0
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
*Chondrilla juncea** (rush skeletonweed)	X	X
Crepis atrabarba (slender hawksbeard)	X	X
*Centaurea diffusa** (diffuse knapweed)	X	X
*Sisymbrium altissimum** (tumble mustard)	X	X
Stipa comata (needle-and-thread grass)	X	X
Artemisia tridentata (sagebrush)	X	X
Biotic crust	0.0	0.0
Bare Soil	58.5	96.0
Litter	34.9	100.0
Total canopy cover (litter not included)	68.1	

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

Total Invasive % Cover	61.5
Total Native % Cover	6.6
Change in Native Cover from 2007	-33.5

3.0 100 AREA SITES

3.1 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).

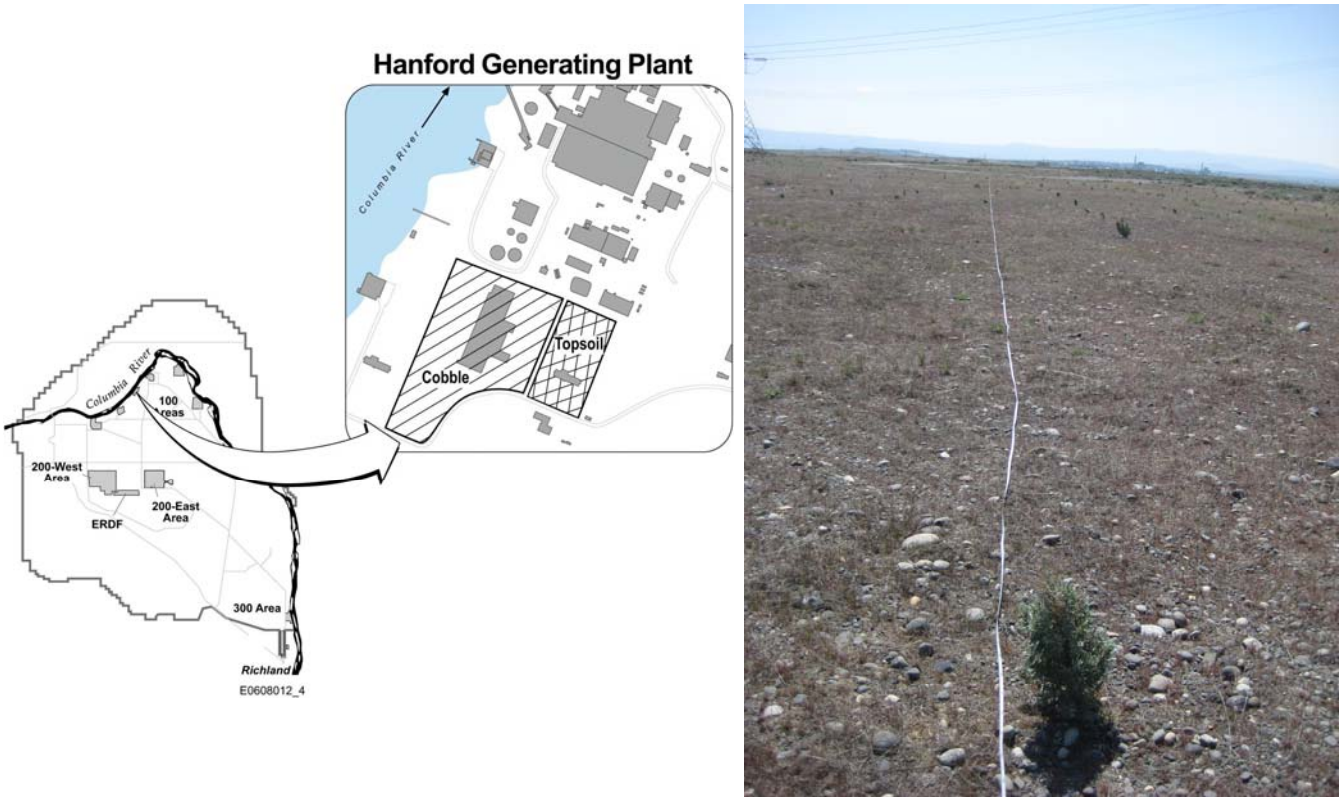
The Hanford Generating Plant was transferred from Energy Northwest Inc. to the Environmental Restoration Contractor in August 2004 and included into the River Corridor Closure Contractor work scope in August 2006. Revegetation of the area disturbed during the demolition and remediation activities was 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 3).

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. Third-year monitoring was conducted in April 2008. Native cover showed an increase of 20% on the cobble site, but reduced 37% on the topsoil site (Table 4). The topsoil site, with its increased water retaining ability, is more suitable to the invasive species in the first years following disturbance. These plants compete with the native species for moisture. Because of this, invasive species canopy cover on the topsoil site was 100%, while it was only 29% on the cobble site. The total cover of Russian thistle reduced from 27% to only 2% on the cobble site. This shows that the native species out-compete the invasive species more quickly on a cobble surface. Although cheatgrass is still the present at 45% cover on the topsoil site, the native Sandberg's bluegrass is now the dominant species, at 47% canopy cover. Sandberg's bluegrass is now the most dominant species on the topsoil plot and the cobble plot. The significant difference between the plots is in the amount of invasive species canopy cover. The cobble site also showed greater native species diversity (11) than the topsoil site (7). In contrast, the cobble site had 10 invasive species while the topsoil site had only 8. The comparison between these two sites will continue to provide valuable information during the fourth and fifth years of monitoring.

Sagebrush survival monitoring was performed again in 2008. Although survival was greatly reduced from 2006 to 2007, 88% of the topsoil site shrubs surviving during the 2007 monitoring were still present in 2008. The cobble site had 100% of the shrubs monitored in 2007 surviving in 2008. Total shrub survival was 12% for the topsoil site, and 39% for the cobble site. Average shrub height was 36.1±14.4cm on the topsoil site and 25.1±6.5 on the cobble site. The topsoil site had 57% of the shrubs blooming in the last year, while the cobble site had only 24%

blooming. This monitoring data shows that the topsoil site has lower sagebrush survival, but the surviving shrubs grow larger and produce seed earlier, likely due to the increased moisture available. Continued monitoring will show if the cobble site shrubs catch up, or if the topsoil site shrubs will begin to produce recruits. This comparison between topsoil and cobble continues to be an interesting and valuable tool for planning future revegetation.

Figure 3. Hanford Generating Plant.



Sagebrush transect at the Hanford Generating Plant Cobble Site April 2008

Revegetated Topsoil area at Hanford Generating Plant May 2007

Table 4. Percent Canopy Cover and Frequency of Occurrence at the Hanford Generating Plant Topsoil and Cobble Sites in 2008.

Species	% Cover Topsoil	% Cover Cobble	Freq of Occ % Topsoil	Freq of Occ % Cobble
Poa sandbergii (Sandberg's bluegrass)	47.3	47.0	88.0	100.0
*Bromus tectorum** (cheatgrass)	45.2	15.8	100.0	80.0
*Holosteum umbellatum** (jagged chickweed)	43.2	8.6	92.0	40.0
*Chorispora tenella** (blue mustard)	6.1	--	56.0	--
Agropyron Spp.	--	4.7	--	36.0
*Ranunculus testiculatus** (bur buttercup)	3.4	--	40.0	--
*Sisymbrium altissimum** (tumble mustard)	1.1	0.7	44.0	28.0
*Centaurea diffusa** (diffuse knapweed)	0.9	0.5	16.0	20.0
Sitanion hystrix (bottlebrush squirreltail)	0.2	3.4	8.0	40.0
*Salsola kali** (Russian thistle)	0.4	1.6	16.0	64.0
Chrysothamnus nauseosus (gray rabbitbrush)	0.1	1.6	4.0	8.0
*Draba verna** (spring whitlow)	X	1.5	X	20.0
Agropyron spicatum (bluebunch wheatgrass)	0.8	--	12.0	--
Amsinckia lycopsoides (tarweed fiddleneck)	0.5	--	20.0	--
*Erodium cicutarium** (storksbill)	--	0.4	--	16.0
Festuca octoflora (six-weeks fescue)	--	0.4	--	16.0
Microsteris gracilis (annual phlox)	--	0.4	--	16.0
Artemisia tridentata (sagebrush)	0.2	0.3	8.0	12.0
Descurainia pinnata (western tansymustard)	--	0.2	--	8.0
Achillea millefolium (yarrow)	0.1	0.2	4.0	8.0
*Chorispora tenella** (blue mustard)	--	0.1	--	4.0
*Poa bulbosa** (bulbous bluegrass)	--	0.1	--	4.0
Machaeranthera canescens (hoary aster)	--	X	--	X
Agropyron dasytachyum (thickspike wheatgrass)	--	X	--	X
Verbascum thapsus * (common mullein)	--	X	--	X
Biotic Crust	0.0	0.0	0.0	0.0
Bare Soil	19.2	45.9	84.0	96.0
Litter	84.5	53.6	100.0	100.0
Total canopy cover (litter not included)	149.5	87.5		
* Invasive species				
X=present but not counted in plot frames				
Total Invasive % Cover	100.3	29.3		
Total Native % Cover	49.2	58.2		
Change in Native Cover % from 2007 to 2008	-36.6	+20.2		

3.2 116-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 remains 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 onsite 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.

In April of 2008, fourth-year vegetation monitoring surveys were conducted on the 116-N-3 Trench. Invasive plant cover showed a near 10% decrease in total canopy cover, while native cover increased by 7%, to 45% canopy cover (Table 5). Most of the increase in native cover can be attributed to the increase in canopy cover of the native bluebunch wheatgrass (from 5% cover in 2007 to 10% cover in 2008), which was included in the seed mix. The reduction in non-native plant cover is a result of the 10% drop in canopy cover of Russian thistle from 2007. The dominant native species was Sandberg's bluegrass (33%) while cheatgrass (20%) had the

greatest canopy cover for nonnative species. The changes observed in canopy cover, with native cover increasing and non-native cover decreasing, are indicative of an active successional trend toward a native community.

3.3 116-N-1

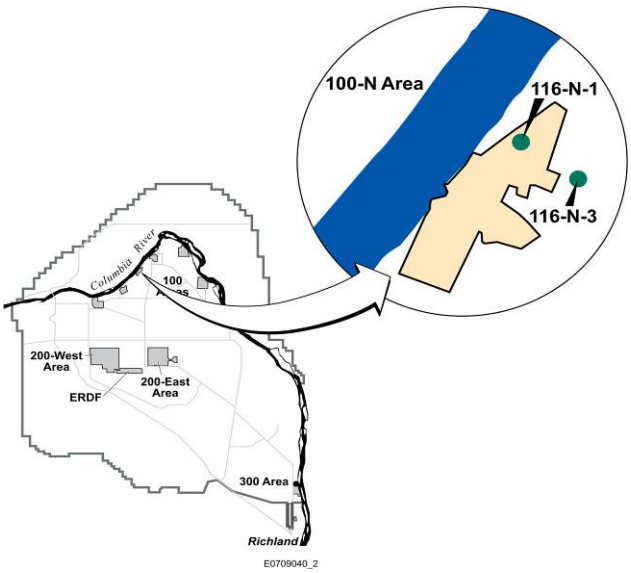
The 116-N-1 Crib and Trench were remediated to Remedial Action Objectives, Remedial Action Goals, and closure performance standards established by the EPA and Ecology in concurrence with RL. The goals and objectives are documented in the *100-NR-1 Interim Remedial Action Record of Decision* (Ecology 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.

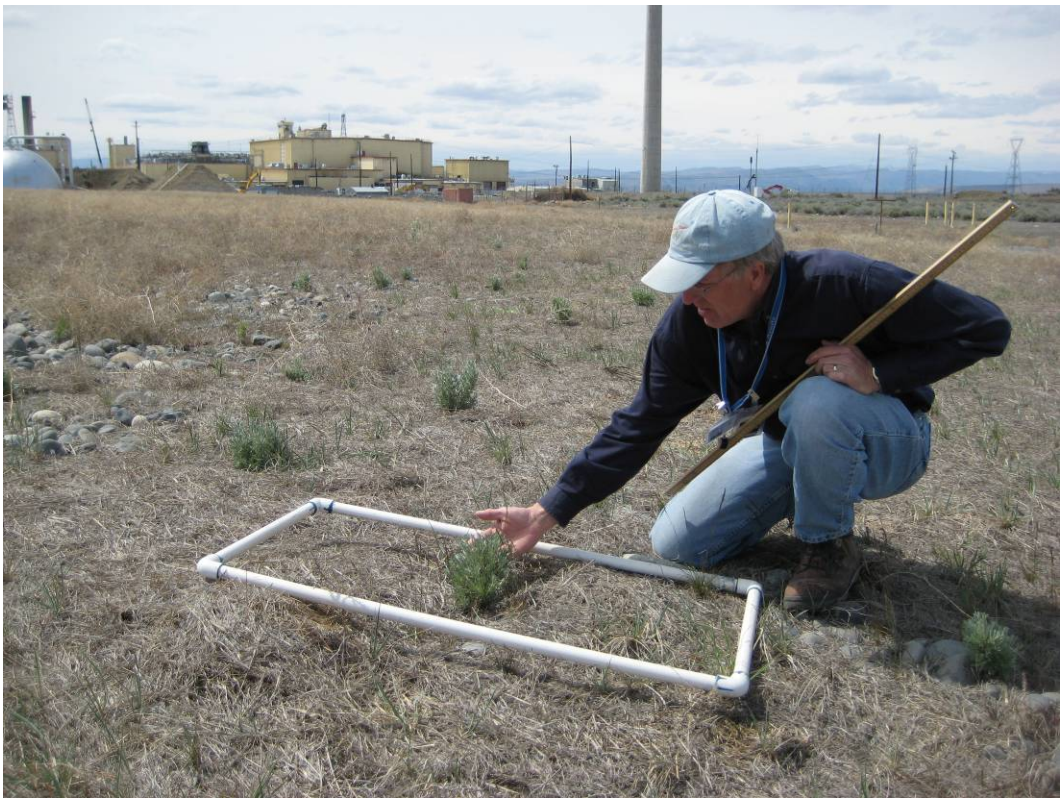
Second year vegetation monitoring was conducted in April 2008. Native grasses continue to dominate this site, with Sandberg's bluegrass and bluebunch wheatgrass showing the greatest canopy cover (41% and 7% respectively). Non-native plant cover decreased by 15% to only 8% (Table 6). This is mostly due to a dramatic decrease in the canopy cover of tumblemustard (*Sisymbrium altissimum*).

The sagebrush transect monitoring performed at this site showed 90% shrub survival, which is extremely high for second year monitoring. Sagebrush along the transect were 16.1±4.9cm tall. The 90% survival within the transect indicates that of the 1,235 plants/hectare originally planted in 2006, approximately 1,100 plants/hectare are still surviving. If this high survival rate continues, it will provide a good seed source and an increasing canopy cover in coming years.

Figure 4. 116-N-1 Revegetation and Sagebrush Monitoring.



Sagebrush at 116-N-1 in April 2008



Vegetation monitoring at 116-N-1 in April 2008

Table 5. Percent Canopy Cover and Frequency of Occurrence at 116-N-3 in 2008.

Species	% Cover	Freq of Occ %
Poa sandbergii (Sandberg's bluegrass)	33.0	88.0
*Bromus tectorum** (cheatgrass)	20.3	84.0
Agropyron spicatum (bluebunch wheatgrass)	9.9	52.0
*Salsola kali** (Russian thistle)	4.2	92.0
*Holosteum umbellatum** (jagged chickweed)	1.5	20.0
Sitanion hystrix (bottlebrush squirreltail)	1.5	4.0
*Sisymbrium altissimum** (tumblemustard)	1.0	40.0
*Lactuca serriola** (prickly lettuce)	0.4	16.0
*Centaurea diffusa** (diffuse knapweed)	0.3	12.0
Amsinckia lycopsoides (tarweed fiddleneck)	0.2	8.0
*Draba verna** (spring whitlowgrass)	0.1	4.0
Epilobium paniculatum (tall willowherb)	0.1	4.0
Oryzopsis hymenoides (Indian ricegrass)	X	X
*Melilotus alba** (sweetclover)	X	X
Artemisia tridentata (big sagebrush)	X	X
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Machaeranthera canescens (hoary aster)	X	X
Biotic crust	0.0	0.0
Bare soil	53.3	100.0
Litter	31.9	92.0
Total canopy cover (litter not included)	72.5	

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

Total Invasive % Cover	27.8
Total Native % Cover	44.7
Change in Native Cover from 2007	+6.7

Table 6. Percent Canopy Cover and Frequency of Occurrence at 116-N-1 in 2008.

Species	% Cover	Freq of Occ %
Poa sandbergii (Sandberg's bluegrass)	40.5	96
Agropyron spicatum (bluebunch wheatgrass)	6.5	68
*Salsola kali** (Russian thistle)	5	84
*Sisymbrium altissimum** (tumble mustard)	1.9	76
*Bromus tectorum** (cheatgrass)	1.9	76
Artemisia tridentata (sagebrush)	1.2	28
Oryzopsis hymenoides (Indian ricegrass)	0.3	12
Descurainia pinnata (western tansymustard)	0.3	12
Chrysothamnus nauseosus (gray rabbitbrush)	0.1	4
Epilobium paniculatum (tall willowherb)	0.1	4
Achillea millefolium (yarrow)	0.1	4
*Lactuca serriola** (prickly lettuce)	0.1	4
Centaurea diffusa * (diffuse knapweed)	X	X
Tragopogon dubius * (yellow salsify)	X	X
Biotic crust	0	0
Bare Soil	38.5	92
Litter	64.1	100
Total canopy cover (litter not included)	58.0	
* Invasive species		
X=present but not counted in plot frames		
Total Invasive % Cover	8.9	
Total Native % Cover	49.1	
Change in Native Cover % from 2007	+16.43	

3.4 100 F AREA SITES

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

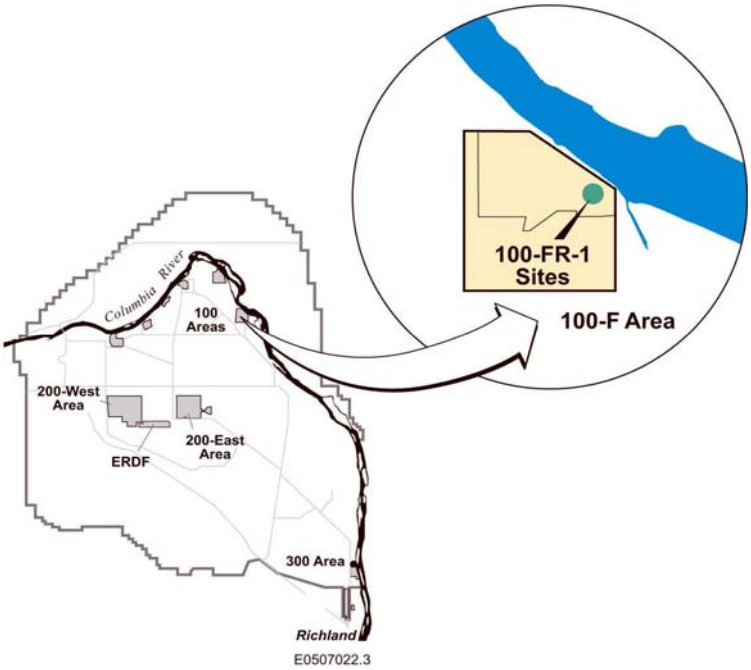
(DOE/EA-1454). Prior to expanding the borrow area, the top 30.5 cm of topsoil was stockpiled. Following the completion of borrow pit operations, the topsoil was redistributed across the excavated areas. The borrow area was broadcast seeded with native grasses and planted with sagebrush seedlings.

The backfilled and re-contoured waste sites were revegetated in January 2005. The objective of revegetating the area was to stabilize the soil, and to show successional vegetation trends toward a native-plant dominated community.

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 5).

Fourth-year observations and measurements were taken at the 100-F area sites in May of 2008. Cheatgrass cover continues to increase from 46% in 2007 to 54% in 2008 (Table 7). Russian thistle and jagged chickweed were the other two dominant invasive species, and they each showed dramatic decreases in canopy cover from 2007. Native species canopy continued to increase, up 9% from 2007 and 24% from 2006. Sandberg's bluegrass and bluebunch wheatgrass were the dominant native species, showing 29% and 12% canopy cover respectively. As native plant cover continues to increase, it is likely that the invasive species will begin to decline. This is the successional trend expected of a recovering site. Fifty random sagebrush across the site were measured and the average height was 20±6.6 cm.

Figure 5. 100-F Area.



Sagebrush at 100-F area sites May 2008

Revegetation monitoring at 100-F area sites May, 2008

Table 7. Percent Canopy Cover and Frequency of Occurrence at 100-F Area Sites in 2008.

Species	% Cover	Freq of Occ %
*Bromus tectorum** (cheatgrass)	53.9	100.0
Poa sandbergii (Sandberg's bluegrass)	28.9	94.3
Agropyron spicatum (bluebunch wheatgrass)	11.8	71.4
*Salsola kali** (Russian thistle)	2.4	82.9
Achillea millefolium (yarrow)	2.3	8.6
Oryzopsis hymenoides (Indian ricegrass)	1.4	17.1
Chrysothamnus nauseosus (gray rabbitbrush)	1.1	5.7
*Holosteum umbellatum** (jagged chickweed)	0.7	14.3
Artemisia tridentata (sagebrush)	0.5	5.7
Agropyron dasytachyum (thickspike wheatgrass)	0.4	2.9
*Erodium cicutarium** (storksbill)	0.3	11.4
*Draba verna** (spring whitlow)	0.3	11.4
Sitanion hystrix (bottlebrush squirreltail)	0.1	2.9
*Sisymbrium altissimum** (tumble mustard)	0.1	2.9
*Lepidium perfoliatum** (clasping pepperweed)	0.1	2.9
Centaurea diffusa * (diffuse knapweed)	X	X
Chrysothamnus viscidiflorus (green rabbitbrush)	X	X
Agoseris heterophylla (mountain dandelion)	X	X
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
Sporobolus cryptandrus (sanddrop seed)	X	X
Machaeranthera canescens (hoary aster)	X	X
Astragalus sclerocarpus (stalk-pod milkvetch)	X	X
Astragalus caricinus (buckwheat milkvetch)	X	X
Astragalus succumbens (crouching milkvetch)	X	X
*Lactuca serriola** (prickly lettuce)	X	X
*Vicia cracca** (bird vetch)	X	X
Koeleria cristata (prairie junegrass)	X	X
Tragopogon dubius * (yellow salsify)	X	X
*Poa bulbosa** (bulbous bluegrass)	X	X
Ambrosia acanthicarpa (bur ragweed)	X	X
Biotic crust	1.4	28.6
Bare Soil	28.5	94.3
Litter	64.4	100.0
Total canopy cover (litter not included)	104.3	

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

Total Introduced % Cover 2008	57.43
Total Native % Cover 2008	46.57
Change in Native Plant % Cover from 2007 to 2008	+8.9

3.5 2008 REVEGETATION AT 100-F

Areas that were revegetated between December 2007 and February 2008, and were monitored in 2008, include the 118-F-1, 118-F-2, 182-F, 183-F East Clearwell, 100-F-26, and 118-F-5. 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). These sites were broadcast seeded with a mixture of native grasses including Sandberg's bluegrass, indian rice grass, bluebunch wheatgrass, prairie junegrass, bottlebrush squirreltail, and needle-and-thread grass. In addition, 134kg/ha of Triple-16 fertilizer was added to the sites along with 4,480 kg/ha of straw mulch that was spread and crimped into the soil surface. Sagebrush plugs were then planted into the seeded areas at 1,200 plants/ha.

118-F-1

First year monitoring was conducted at the 118-F-1. The area showed significant germination of the seeded native grasses, with seedlings occurring in 100% of the plot frames. Other native species present on the site included sagebrush (planted), hopsage (planted), and gray rabbitbrush. There was little other vegetation on the site, with 2.8% cover of Russian thistle, and only occurrences of other non-native species (Table 8). Two sagebrush transects were established on the 118-F-1 site to monitor shrub survival. The first sagebrush transect showed 100% survival, with an average height of 12.9±3.5 cm. In addition, six hopsage were recorded in this transect, with an average height of 10 cm. The second transect showed very similar results, with 100% survival and an average height of 12.5±4.0 cm. In addition, 18 hopsage were recorded in transect 2, with an average height of 8.9 cm. A total of 102 sagebrush were counted across the two transects.

118-F-2

First year monitoring was performed at the 118-F-2 site in 2008. Native grasses were dominant at the sites, at 19% cover (Table 9). Russian thistle was the dominant non-native species at 10% cover. Other native species accounted for only 0.7% cover. This is a typical result for first-year monitoring. Subsequent monitoring will likely show a greater frequency of native forbs. A monitoring transect was established that recorded 48 sagebrush and one hopsage. The average sagebrush height was 12.8±3.2 cm. and the hopsage was 8 cm. tall.

Figure 6. 118-F-1 and 118-F-2 Sites in 2008.

Sagebrush transect at 118-F-1 looking west in 2008

Revegetated area at 118-F-1 in 2008

Revegetated area at 118-F-2 looking south toward Gable Mountain in 2008

Table 8. Percent Canopy Cover and Frequency of Occurrence at 118-F-1 in 2008.

Species	% Cover	Freq of Occ %
Native Grasses[b]	3.5	100.0
*Salsola kali** (Russian thistle)	2.8	56.0
Artemisia tridentata (sagebrush)	0.2	8.0
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
*Erodium cicutarium** (storksbill)	X	X
*Bromus tectorum** (cheatgrass)	X	X
*Lactuca serriola * (prickly lettuce)*	X	X
Grayia spinosa (hopsage)	X	X
*Sisymbrium altissimum** (tumble mustard)	X	X
*Poa bulbosa** (bulbous bluegrass)	X	X
Biotic crust	0	0.0
Bare soil	40.8	100.0
Litter	57	100.0
Total canopy cover (litter not included)	6.5	

* Invasive 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 Invasive % Cover	2.8
Total Native % Cover	3.7

Table 9. Percent Canopy Cover and Frequency of Occurrence at 118-F-2 in 2008.

Species	% Cover	Freq of Occ %
Native Grasses[b]	18.7	96.0
*Salsola kali** (Russian thistle)	9.5	88.0
Nama densum (purplemat)	0.1	4.0
Amsinckia lycopsoides (tarweed fiddleneck)	0.1	4.0
*Sisymbrium altissimum** (tumble mustard)	2.6	28.0
*Lactuca serriola** (prickly lettuce)	0.1	4.0
*Bromus tectorum** (cheatgrass)	4.2	16.0
*Poa bulbosa** (bulbous bluegrass)	0.2	8.0
Artemisia tridentata (sagebrush)	0.1	4.0
Descurainia pinnata (western tansymustard)	0.1	4.0
Grayia spinosa (Spiny hopsage)	0.1	4.0
*Draba verna** (spring whitlow)	0.1	4.0
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
*Holosteum umbellatum** (jagged chickweed)	X	X
*Cardaria draba** (whitetop)	X	X
*Vicia cracca** (bird vetch)	X	X
Lepidium perfoliatum (clasping pepperweed)	X	X
Biotic Crust	0	0.0
Bare Soil	52.9	100.0
Litter	41.9	100.0
Total canopy cover (litter not included)	35.9	

* Invasive 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 Invasive % Cover	16.7
Total Native % Cover	19.2

182-F

First-year monitoring was performed at the 182-F site (Figure 7 and Table 10). This site was divided into a North and South area, to distinguish between the cobbled northern plot, and the more fine grained soil on the southern plot. The South plot was used as a staging area, and had been invaded by non-native species prior to revegetation, while the North plot lacked vegetation. Native grasses dominated at the North and South plots (47 and 35%). The North plot had very little other vegetation, but the South plot had high canopy cover of cheatgrass and Russian thistle (34 and 29%). The differences between these sites will likely diminish as monitoring continues.

183-F East Clearwell

First-year monitoring was performed at the 183-F East Clearwell (Figure 7 and Table 11). This area was backfilled with pit-run cobble and revegetated. Initial monitoring showed significant germination of seeded grasses, with a canopy cover of 52%. Russian thistle was the dominant non-native species, at 7% cover. Species diversity was relatively high at this site for first year monitoring, with eight native forbs present on the site.

Figure 7. 182-F and 183-F East Clearwell Sites in 2008.

182-F North looking north toward the Saddle Mountains

Munroe's Globemallow at 182-F South looking south toward the 105-F Reactor

183 East Clearwell showing plot frame and planted sagebrush in 2008

Table 10. Percent Canopy Cover and Frequency of Occurrence at 182-F North and South in 2008.

Species	% Cover North	% Cover South	Freq of Occ % North	Freq of Occ % South
Native Grasses[b]	47.2	35.2	100.0	100.0
*Bromus tectorum** (cheatgrass)	17.7	33.8	73.3	96.0
*Salsola kali** (Russian thistle)	1.2	29.4	46.7	92.0
*Sisymbrium altissimum** (tumble mustard)	0.3	2.4	13.3	56.0
*Poa bulbosa** (Bulbous bluegrass)	1.3	1.2	20.0	28.0
*Draba verna** (spring whitlowgrass)	0.2	0.4	6.7	16.0
Artemisia tridentata (sagebrush)	0.2	0.1	6.7	4.0
*Erodium cicutarium** (storksbill)	--	0.9	--	16.0
Sporobolus cryptandrus (sand dropseed)	X	0.6	X	4.0
Verbena bracteata (big-bract verbena)	--	0.1	--	4.0
*Vicia cracca** (bird vetch)	--	0.1	--	4.0
Achillea millefolium (yarrow)	--	X	--	X
*Triticum aestivum** (wheat)	--	X	--	X
Artemisia ludoviciana (white sagebrush)	X	X	X	X
*Centaurea diffusa** (diffuse knapweed)	X	X	X	X
Chrysothamnus nauseosus (gray rabbitbrush)	X	X	X	X
Sphaeralcea munroana (globemallow)	--	X	--	X
Astragalus succumbens (Collumbia milk-vetch)	--	X	--	X
*Lactuca serriola** (prickly lettuce)	--	X	--	X
Machaeranthera canescens (hoary aster)	X	X	X	X
Astragalus spp.	X	X	X	X
*Melilotus alba ** (sweetclover)	X	--	X	--
Biotic crust	0.0	0.0	0.0	0.0
Bare soil	20.5	16.8	80.0	80.0
Litter	75.8	75.9	100.0	100.0
Total canopy cover (litter not included)	68.0	104.2		

* Invasive species
X=present but not counted in plot frames
-- species not recorded

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

Total Invasive % Cover	20.7	68.2
Total Native % Cover	47.3	36.0

Table 11. Percent Canopy Cover and Frequency of Occurrence at the 183-F East Clearwell in 2008.

Species	% Cover	Freq of Occ %
Native grasses[b]	52.3	100.0
*Bromus tectorum** (cheatgrass)	1.3	20.0
*Salsola kali** (Russian thistle)	6.7	100.0
*Ranunculus testiculatus** (bur buttercup)	1.5	26.7
Grayia spinosa (hopsage)	0.2	6.7
Festuca octoflora (slender sixweeks)	0.2	6.7
Astragalus succumbens (Columbia milk-vetch)	0.2	6.7
*Erodium cicutarium** (storksbill)	0.2	6.7
*Poa bulbosa** (bulbous bluegrass)	0.2	6.7
Nama densum (purplemat)	0.2	6.7
Cryptantha circumscissa (matted cryptantha)	0.2	6.7
Chrysothamnus nauseosus (gray rabbitbrush)	0.2	6.7
*Sisymbrium altissimum** (tumble mustard)	0.3	13.3
Artemisia tridentata (big sagebrush)	0.2	6.7
*Lactuca serriola** (prickly lettuce)	0.2	6.7
*Chorispora tenella** (blue mustard)	X	X
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
Biotic crust	0.0	0.0
Bare soil	45.2	100.0
Litter	46.0	100.0
Total canopy cover (litter not included)	63.8	

* Invasive 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 Invasive % Cover	10.3
Total Native % Cover	53.5

100-F-26

First-year monitoring was performed at the 100-F-26 site (Figure 8). Native grasses had a canopy cover of 23%, while cheatgrass and Russian thistle combined for 32% cover (Table 12). The other 15 species present represented <1% canopy cover each, but this high species diversity was dominated by natives (9 of 15). Successional changes at this diverse plot will likely show the native species out-competing the invasive species in the years to come.

118-F-5

First-year monitoring was conducted at the 118-F-5 site (Figure 8). This site consists of a burial ground and a soil staging area. These areas were treated separately during monitoring because the burial ground was backfilled with pit-run cobble, while the staging area has relatively fine-grained soils. Cheatgrass was the dominant species at both sites, but had a much greater canopy cover at the soil staging area (49%) than at the burial ground (14%). Native grasses showed 16%

canopy cover at the soil staging area, and 4% cover at the burial ground (Table 13). Sagebrush monitoring transects were established on each sub-site. The burial ground had 58 sagebrush shrubs in the transect, with an average height of 12.3±3.5 cm. The soil staging area had 41 sagebrush, with an average height of 12.2±2.5, and 11 hopsage, with an average height of 10.4±2.8 cm. As these sites mature they will be useful for comparing the effects of soil texture on revegetation success and sagebrush survival.

Figure 8. 100-F-26 and 118-F-5 Sites in 2008.

Sagebrush transect at 118-F-5 looking west toward the 105-F Reactor

Spiny hopsage in a plot frame at 100-F-26 in 2008

Table 12. Percent Canopy Cover and Frequency of Occurrence at 120-F-26 in 2008.

Species	% Cover	Freq of Occ %
Native grasses[b]	22.7	86.7
*Bromus tectorum** (cheatgrass)	16.2	73.3
*Salsola kali** (Russian thistle)	16.3	100.0
Festuca octoflora (slender sixweeks)	0.2	6.7
*Sisymbrium altissimum** (tumble mustard)	0.7	26.7
Chenopodium album (lambsquarters)	0.3	13.3
Artemisia tridentata (big sagebrush)	0.2	6.7
*Erodium cicutarium** (storksbill)	0.2	6.7
*Chorispora tenella** (blue mustard)	0.2	6.7
Lepidium perfoliatum (clasping pepperweed)	X	X
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
*Poa bulbosa** (bulbous bluegrass)	X	X
*Ranunculus testiculatus** (bur buttercup)	X	X
Achillea millefolium (yarrow)	X	X
Chrysothamnus nauseosus (gray rabbitbrush)	X	X
Sphaeralcea munroana (Munro's globemallow)	X	X
Grayia spinosa (hopsage)	X	X
*Centaurea diffusa** (diffuse knapweed)	X	X
Biotic crust	0.0	0.0
Bare soil	41.3	100.0
Litter	53.0	100.0
Total canopy cover (litter not included)	56.8	

* Invasive 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 Invasive % Cover	33.5
Total Native % Cover	23.3

Table 13. Percent Canopy Cover and Frequency of Occurrence at 118-F-5 Soil Staging Area and Burial Ground in 2008.

Species	% Cover SSA	% Cover BG	Freq of Occ % SSA	Freq of Occ % BG
*Bromus tectorum** (cheatgrass)	49.2	13.5	100.0	93.3
Native Grasses[b]	16.0	4.2	100.0	100.0
*Salsola kali** (Russian thistle)	3.5	3.8	73.3	86.7
Ambrosia acanthicarpa (bur ragweed)	1.2	--	13.3	--
*Sisymbrium altissimum** (tumble mustard)	0.5	0.2	20.0	6.7
Chenopodium leptophyllum (slimeleaf goosefoot)	0.3	--	13.3	--
*Triticum aestivum** (common wheat)	0.3	X	13.3	X
Plantago patagonica (Indian wheat)	0.3	--	13.3	--
Amsinckia lycopsoides (tarweed fiddleneck)	0.2	0.2	6.7	6.7
*Holosteum umbellatum** (jagged chickweed)	0.2	--	6.7	--
*Draba verna** (spring whitlow)	0.2	--	6.7	--
Astragalus spp.	0.2	--	6.7	--
Microsteris gracilis (annual phlox)	0.2	--	6.7	--
Achillea millefolium (yarrow)	0.2	X	6.7	X
Grayia spinosa (hopsage)	X	X	X	X
Machaeranthera canescens (hoary aster)	X	--	X	--
Hackelia diffusa (sagebrush stickseed)	X	--	X	--
*Chondrilla juncea** (rush skeletonweed)	X	--	X	--
Artemisia tridentata (sagebrush)	X	0.3	X	13.3
Chenopodium album (lambsquarters)	X	--	X	--
*Lactuca serriola** (prickly lettuce)	X	X	X	X
*Hordeum leporinum** (hare barley)	X	--	X	--
Chrysothamnus nauseosus (gray rabbitbrush)	--	0.3	--	13.3
*Poa bulbosa** (bulbous bluegrass)	--	X	--	X
Agoseris heterophylla (mountain-dandelion)	--	X	--	X
Machaeranthera canescens (hoary aster)	--	X	--	X
Biotic crust	0.0	0.0	0.0	0.0
Bare Soil	46.3	37.2	100.0	100.0
Litter	45.2	50.7	100.0	100.0
Total Canopy Cover (litter not included)	72.3	22.5		

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

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

Total Introduced % Cover 2008	53.8	17.5
Total Native % Cover 2008	18.5	5.0

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 9).

Third-year vegetation analysis was performed at 100-B-1 and 128-C-1 during May of 2008. Sandberg's bluegrass remained the dominant plant at 100-B-1 (44% cover) while cheatgrass had the greatest non-native canopy cover (24%), both up slightly from 2007 (Table 14). The 100-B-1 site did show a significant decrease in Russian thistle cover (from 18% in 2007 to 6% in 2008). This change is mostly responsible for the decrease in total non-native canopy cover, native cover increased slightly. Cheatgrass remained the dominant species at 128-C-1, but native canopy cover (40%) surpassed invasive cover (33%) for the first time in 2008. This is largely due to the increases in canopy cover for Sandberg's bluegrass (up 6%) and bottlebrush squirreltail (up 3%).

Sagebrush monitoring at 100-B-1 showed 43% survival, with 98% of shrubs counted in 2007 still surviving in 2008. This is the decreased mortality rate that is expected of a maturing revegetation. Average sagebrush height was 32.2±14.8 cm, and 37% of the monitored shrubs bloomed in the previous year. In addition, Sagebrush monitoring results from 128-C-1 were very similar, with 55% total survival, and 94% surviving from 2007 counts. Average shrub height was 44.1±14.8 cm, with 65% blooming in the previous year (Figure 9).

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 area that was revegetated was approximately 100 acresThe 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 1,300 plants/ha (530 plants/ac).

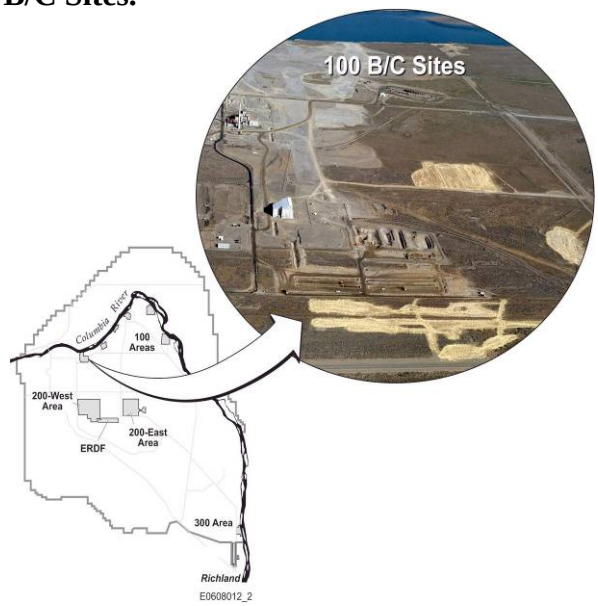
Second year vegetation monitoring was conducted at the 100-C-9 site on April 29, 2008 (Figure 9). The site was divided into three vegetation transects, each with a correlating sagebrush transect. The relatively high reports of native vegetation recorded during the first-year, along with a significant drop in native cover for the second-year, follows a typical monitoring trend. Many native plants germinate in the first-year, and then do not survive, due to competition and other factors, through the second-year. This high level of competition for resources in the first-year is important, as it restricts the growth of invasive species that would thrive in a resource rich environment. Invasive species cover showed significant decreases across the transects. These continuing trends show positive succession toward a site dominated by native species. The most significant change in the vegetative community in 2008, was the drastic reduction in Russian thistle cover, with the greatest reduction in canopy cover observed on Transect 3 (36%)(Tables 15 & 16).

Sagebrush monitoring results from 100-C-9 were as follows, Transect 1: 94% total survival, 96% surviving from 2007 monitoring, average height 15.2±5.0 cm., Transect 2: 95% total survival, average height 14.5±4.2 cm., Transect 3: 70% survival, with 72% surviving from 2007 monitoring, average height 18.7±3.8 cm. These results (88% cumulative survival) are extremely promising, as the majority of sagebrush mortality typically occurs within the first few years after planting. If this high survival rate continues there will be a stable source of seed in the upcoming years to help with the reclamation of this site.

The 118-B-2 and 118-B-3 Burial Grounds were not monitored in 2008, monitoring will be resumed in 2009.

Figure 9. 100 B/C Sites.

Vegetation monitoring at 100-C-9 in 2008



Sagebrush recruits at 100-B-1 in 2008.

Revegetated area at 100-B-1 in 2008

Sagebrush monitoring at 100-B-1 in 2008

Hopsage at 100-B-1in 2008

Table 14. Percent Canopy Cover and Frequency of Occurrence at 100-B-1 and 128-C-1 in 2008.

Species	% Cover 100-B-1	% Cover 128-C-1	Freq of Occ %	Freq of Occ %
Poa sandbergii (Sandberg's bluegrass)	43.9	15.3	100.0	100.0
*Bromus tectorum** (cheatgrass)	23.6	24.8	100.0	100.0
*Salsola kali** (Russian thistle)	5.9	5.2	100.0	80.0
Agropyron spicatum (bluebunch wheatgrass)	2.5	2.7	40.0	40.0
*Sisymbrium altissimum** (tumble mustard)	1.7	0.7	28.0	26.7
Artemisia tridentata (sagebrush)	0.1	5.7	4.0	6.7
Oryzopsis hymenoides (Indian ricegrass)	0.6	1.2	4.0	13.3
Sitanion hystrix (bottlebrush squirreltail)	--	14.7	--	73.3
Microsteris gracilis (annual phlox)	0.1	--	4.0	--
Lomatium macrocarpum (bigseed desertparsley)	0.1	--	4.0	--
Sitanion hystrix (bottlebrush squirreltail)	X	--	X	--
Grayia spinosa (hopsage)	X	--	X	--
Tragopogon dubius (yellow salsify)	X	--	X	--
Sphaeralcea munroana (Munro's globemallow)	X	--	X	--
Koeleria cristata (prairie junegrass)	X	--	X	--
Hordeum leporinum * (hare barley)	X	--	X	--
Amsinckia lycopsoides (tarweed fiddleneck)	X	--	X	--
Descurainia pinnata (western tansymustard)	X	--	X	--
Astragalus purshii (wolly-pod milkvetch)	X	--	X	--
Machaeranthera canescens (hoary aster)	X	--	X	--
*Lactuca serriola** (prickly lettuce)	--	0.5	--	20.0
Chrysothamnus nauseosus (gray rabbitbrush)	--	0.2	--	6.7
*Draba verna** (spring whitlowgrass)	--	1.3	--	20.0
*Erodium cicutarium** (storksbill)	--	X	--	X
*Tragopogon dubius** (yellow salsify)	--	X	--	X
Biotic crust	29.2	0.0	96.0	0.0
Bare Soil	49.5	37.5	100.0	100.0
Litter	43.2	57.8	100.0	100.0
Total canopy cover (litter not included)	34.6	56.8		
* Invasive species				
X=present but not counted in plot frames				
-- species not present on site				
Total Invasive % Cover	31.2	32.5		
Total Native % Cover	47.3	39.7		
Total Change in Native Cover from 2007	+1.9	+14.7		

Table 15. Percent Canopy Cover at 100-C-9 in 2008.

Species	T1	T2	T3
Poa sandbergii (Sandberg's bluegrass)	12.0	5.0	17.0
Agropyron spicatum (bluebunch wheatgrass)	9.5	1.3	9.2
*Bromus tectorum** (cheatgrass)	4.8	11.3	33.0
*Salsola kali** (Russian thistle)	2.5	2.3	4.2
*Draba verna** (spring whitlowgrass)	0.3	0.2	0.5
Festuca octoflora (slender sixweeks)	0.3	1.0	--
*Sisymbrium altissimum** (tumble mustard)	0.5	1.8	11.5
Descurainia pinnata (western tansymustard)	0.3	0.7	0.5
Oryzopsis hymenoides (Indian ricegrass)	1.5	--	0.2
Artemisia tridentata (sagebrush)	0.2	X	0.2
*Lactuca serriola** (prickly lettuce)	0.2		0.2
*Holosteum umbellatum** (jagged chickweed)	X	0.2	2.8
*Poa bulbosa** (bulbous bluegrass)	X	0.3	--
Chrysothamnus nauseosus (gray rabbitbrush)	X	--	--
Machaeranthera canescens (hoary aster)	X	--	--
*Erodium cicutarium** (storksbill)	--	0.2	0.2
Amsinckia lycopsoides (tarweed fiddleneck)	--	--	0.2
*Centaurea diffusa** (diffuse knapweed)	--	X	0.5
*Verbena bracteata** (big-bract verbena)	--		X
Eriogonum vimineum (broom buckwheat)	--	0.7	--
Sitanion hystrix (bottlebrush squirreltail)	--	0.2	--
Sphaeralcea munroana (Munro's globemallow)	--	X	--
Chaenactis douglasii (hoary falseyarrow)	--	X	--
Chorispora tenella [a] (blue mustard)	--	X	--
Biotic crust	0.0	0.0	0.0
Bare Soil	54.8	42.0	34.2
Litter	43.5	57.8	64.2
Total canopy cover (litter not included)	32.2	25.2	80.0
*= Invasive species			
X=present but not counted in plot frames			
--=not present in plot			
Total Invasive % Cover	8.3	16.3	52.8
Total Native % Cover	23.8	8.8	27.2
Change in Native Cover % from 2007	-30.8	-9.7	-15.5

Table 16. Frequency of Occurrence at 100-C-9 in 2008.

Species	T1		T2		T3	
*Salsola kali** (Russian thistle)		100.0		93.3		100.0
Poa sandbergii (Sandberg's bluegrass)		100.0		100.0		100.0
Agropyron spicatum (bluebunch wheatgrass)		60.0		53.3		73.3
*Bromus tectorum** (cheatgrass)		66.7		100.0		86.7
*Sisymbrium altissimum** (tumble mustard)		20.0		73.3		100.0
Descurainia pinnata (western tansymustard)		13.3		26.7		20.0
*Draba verna** (spring whitlowgrass)		13.3		6.7		20.0
Festuca octoflora (slender sixweeks)		13.3		40.0	--	
Oryzopsis hymenoides (Indian ricegrass)		26.7	--			6.7
Artemisia tridentata (sagebrush)		6.7	X			6.7
*Lactuca serriola** (prickly lettuce)		6.7	--			6.7
*Holosteum umbellatum** (jagged chickweed)	X			6.7		20.0
*Poa bulbosa** (bulbous bluegrass)	X			13.3	--	
Chrysothamnus nauseosus (gray rabbitbrush)	X		--		--	
Machaeranthera canescens (hoary aster)	X		--		--	
*Erodium cicutarium** (storksbill)	--			6.7		6.7
Amsinckia lycopsoides (tarweed fiddleneck)	--		--			6.7
*Centaurea diffusa** (diffuse knapweed)	--		X			20.0
Verbena bracteata (big-bract verbena)	--				X	
Eriogonum vimineum (broom buckwheat)	--			26.7	--	
Sitanion hystrix (bottlebrush squirreltail)	--			6.7	--	
Sphaeralcea munroana (Munro's globemallow)	--		X		--	
Chaenactis douglasii (hoary falseyarrow)	--		X		--	
Chorispora tenella [a] (blue mustard)	--		X		--	
Biotic crust		0.0		0.0		0.0
Bare Soil		100.0		100.0		100.0
Litter		100.0		100.0		100.0

*= Invasive species
X=present but not counted in plot frames
--=not present in plot

3.8 100 B/C SITES PLANTED IN 2008

In December 2007 and January 2008 the 100-B-14, 118-B-1, and 118-C-1 sites were revegetated. 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). These areas were broadcast seeded with a mixture of native grasses including Sandberg's bluegrass, indian rice grass, bluebunch wheatgrass, prairie junegrass, bottlebrush squirreltail, and needle-and-thread grass. In addition, 134kg/ha of Triple-16 fertilizer was added to the sites along with 4,480 kg/ha of straw mulch that was spread and crimped into the soil surface. Sagebrush plugs were then planted into the seeded areas at 930 plants/ha.

First year monitoring was performed at the 100-B-14 site on May 7, 2008 (Figure 10). The dominant species on the site was Russian thistle, showing 31% canopy cover. Native grasses and tumble mustard showed 7% canopy cover respectively (Table 17). All other species present (11) showed <1% canopy cover. Sagebrush monitoring transects were established to show representative survival and growth of sagebrush at the site. Two transects were established, the first transect had 56 sagebrush, averaging 11.9±2.9 cm. The second transect had 55 sagebrush averaging 11.3±3.1 cm. These same shrubs will be monitored for the next four years to establish survivorship, growth rates, and seed production for this site.

Figure 10. 100-B-14 in 2008.

Revegetated area looking east toward the 105-B Reactor in 2008

Revegetated area and sagebrush transect, looking south toward the 151-B Electrical Substation

Revegetated area and sagebrush transect, looking north toward the Saddle Mountains

Table 17. Percent Canopy Cover and Frequency of Occurrence at 100-B-14 South in 2008.

Species	% Cover	Freq. of Occ.
*Salsola kali** (Russian thistle)	31.4	100
*Sisymbrium altissimum** (tumble mustard)	7.3	76
Native Grasses[b]	6.7	76
Artemesia tridentata (sagebrush)	0.1	4
*Bromus tectorum** (cheatgrass)	1.1	24
Chrysothamnus nauseosus (gray rabbitbrush)	0.9	16
*Melilotus alba** (sweetclover)	0.6	4
*Chorispora tenella** (blue mustard)	0.1	4
Festuca octoflora (slender sixweeks)	0.1	4
*Poa bulbosa** (Bulbous bluegrass)	X	X
Epilobium paniculatum (tall willowherb)	X	X
Lactuca serriola * (prickly lettuce)	X	X
Centaurea diffusa * (diffuse knapweed)	X	X
*Ranunculus testiculatus** (bur buttercup)	X	X
Biotic Crust	0	0
Bare Soil	50.8	96
Litter	46.8	88
Total canopy cover (litter not included)	48.3	

* Invasive 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 Invasive % Cover	40.5
Total Native % Cover	7.8

First-year monitoring was performed at the 118-B-1 site on May 6, 2008 (Figure 11). This site was separated into two monitoring areas, the soil staging area and burial ground, to show differences between the two areas. The sites showed very similar results during the first-year monitoring. Canopy cover of native grasses was 11% at the soil staging area and 14% at the burial ground (Table 18). Russian thistle showed ~4% cover at both sites and cheatgrass was seen at 1% cover on the soil staging area and 2% cover at the burial ground. Sagebrush monitoring at the burial ground resulted in a transect containing 50 shrubs with an average height of 12±2.7 cm. The sagebrush transect at the soil staging area contained 53 shrubs with an average height of 13.7±3.9.

First-year monitoring was conducted at the 118-C-1 on May 6, 2008 (Figure 11). Russian thistle was the dominant plant on the site, with 21% canopy cover (Table 19). Native grasses had a 10% canopy cover, while tumble mustard was the only other plant with greater than 1% canopy cover (2%). These findings are typical of early successional areas. The sagebrush monitoring transect showed covered 33 shrubs with an average height of 9.8±2.9 cm. These shrubs will be counted and measured for the next four years to find survival and growth rates of the planted sagebrush.

Figure 11. 118-B-1 and 118-C-1 in 2008.

Revegetated area and sagebrush transect at the 118-C-1 site in 2008

Revegetated area at the 118-B-1 site in 2008 showing native grasses and planted sagebrush

Table 18. Percent Canopy Cover and Frequency of Occurrence at the 118-B-1 Burial Ground and Soil Staging Area 2008.

Species	% Cover SSA	% Cover BG	Freq of Occ % SSA	Freq of Occ % BG
Native Grasses[b]	11.0	13.6	76.0	84.0
*Salsola kali** (Russian thistle)	4.5	3.8	64.0	72.0
*Bromus tectorum** (cheatgrass)	1.2	2.0	28.0	24.0
*Lactuca seriola** (prickly lettuce)	0.1	--	4.0	--
*Sisymbrium altissimum** (tumble mustard)	0.3	0.6	12.0	24.0
*Poa bulbosa** (Bulbous bluegrass)	0.2	X	8.0	X
Chrysothamnus nauseosus (gray rabbitbrush)	0.1	0.4	4.0	16.0
Festuca octoflora (slender sixweeks)	0.1	0.6	4.0	4.0
Ambrosia acanthicarpa (bur ragweed)	0.1	--	4.0	--
Melilotus alba * (sweetclover)	0.1	X	4.0	X
Microsteris gracilis (pink microsteris)	X	--	X	--
Chenopodium leptophyllum (slimleaf goosefoot)	X	X	X	X
*Erodium cicutarium** (storksbill)	X	0.2	X	8.0
*Lactuca serriola** (prickly lettuce)	X	0.1	X	4.0
Artemesia tridentata (sagebrush)	X	0.3	X	12.0
Amsinckia lycopsoides (fiddleneck)	X	X	X	X
Achillea millefolium (yarrow)	X	--	X	--
Centaurea diffusa * (diffuse knapweed)	--	0.2	--	8.0
Descurainia pinnata (western tansymustard)	--	X	--	X
*Chorispora tenella** (blue mustard)	--	X	--	X
Hordeum leporinum * (hare barley)	--	X	--	X
Biotic crust	0.0	0.0	0.0	0.0
Bare soil	48.8	38.7	92.0	92.0
Litter	50.0	58.6	100.0	100.0
Total canopy cover (litter not included)	17.7	21.8		

* Invasive species

X=present but not counted in plot frames

--=species not observed in area

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

Total Invasive % Cover	6.4	6.9
Total Native % Cover	11.3	14.9

Table 19. Percent Canopy Cover and Frequency of Occurrence at 118-C-1 in 2008.

Species	% Cover	Freq of Occ %
*Salsola kali** (Russian thistle)	21.2	100
Native Grasses[b]	9.7	100
*Sisymbrium altissimum** (tumble mustard)	1.6	44
*Bromus tectorum** (cheatgrass)	0.6	24
Chrysothamnus nauseosus (gray rabbitbrush)	0.2	8
*Lactuca serriola** (prickly lettuce)	0.2	8
Amsinckia lycopsoides (tarweed fiddleneck)	X	X
*Kochia scopari** (kochia)	X	X
*Melilotus alba ** (sweetclover)	X	X
Biotic crust	0	0
Bare soil	33.2	92
Litter	62.6	100
Total canopy cover (litter not included)	33.5	

* Invasive 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 Invasive % Cover	23.6
Total Native % Cover	9.9

3.9 100 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).

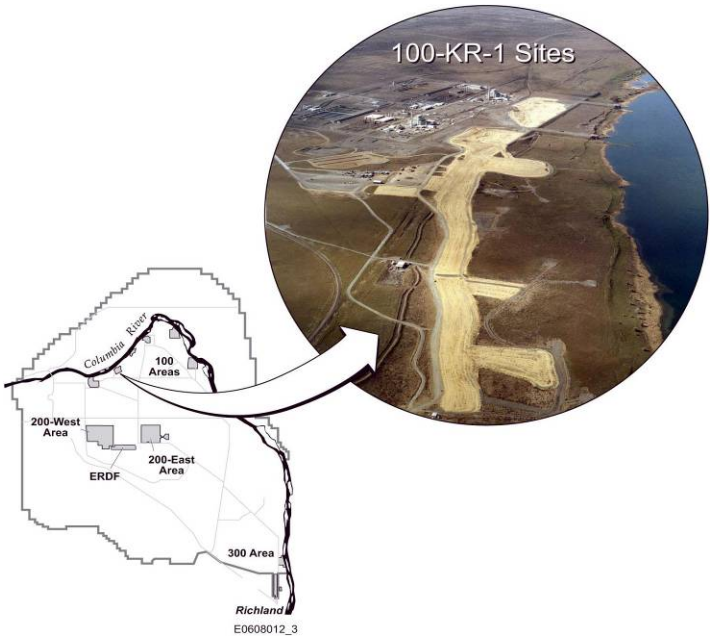
In late February 2006, the backfilled sites were broadcast seeded with a mix of native grass seed that included Sandberg's bluegrass, needle-and-thread grass, Indian ricegrass, bluebunch wheatgrass, prairie junegrass, and thickspike wheatgrass. Triple-16 fertilizer and polyacrylamide was applied at the 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. Third-year monitoring was conducted on April 24, 2008. Native plant canopy cover increased at T2, T3, and T4, but decreased at T1 (Table 20). Invasive cover decreased drastically across the transects (-9% at T1, -28% at T2, -26% at T3, and -30% at T4). This shows a significant shift toward a community dominated by native species. The decrease in invasive species cover is directly related to a reduction in Russian thistle cover. Another positive sign was the increase in frequency of occurrence of sagebrush, with T1, T2, and T3 showing greater than 20% frequency of occurrence of sagebrush. This shows that the relatively high survival across the corresponding sagebrush transects (T1-T3 at 65%), has an even distribution across the sites.

Transect 4 has the highest invasive species cover, and showed significant sagebrush loss in the first two years. Total survival at Transect 4 in 2008 was 21%, with 80% surviving from 2007 monitoring. A positive note for T4 was that 38% of shrubs monitored in 2008 had bloomed the previous year. No surviving hopsage were observed in the transects during 2008. Transect 1 had 71% total survival, 98% surviving from 2007 monitoring, an average height of 24.1±7.3 cm., and 15% of the shrubs bloomed in the previous year. Transect 2 had 52% survival, with no shrubs lost since the 2007 monitoring. Average shrub height at T2 was 30.3±8.1 cm., with 9% blooming in the previous year. Transect 3 had 78% surviving for the 2008 monitoring; only losing one shrub from the previous year. Average shrub height was 33.4±11.4 cm. at T3, with 43% blooming in the previous year. With the sagebrush monitoring showing high survival rates and many shrubs already putting out seed, along with decreasing invasive species cover, this site is showing active positive succession.

Figure 12. 100-KR-1 Sites.



Sagebrush planted in 2006, from 2008 monitoring

Revegetated area looking west toward 105-K and 105-KR along the Mile Long Trench, 2008

Table. 20 Percent Canopy Cover at the 116-K-2 (MLT) in 2008.

Species	T1		T2		T3		T4
Agropyron spicatum (bluebunch wheatgrass)	27.2		22.0		16.3		6.5
Poa sandbergii (Sandberg's bluegrass)	7.8		14.7		30.0		13.5
*Bromus tectorum** (cheatgrass)	12.0		15.2		15.8		25.8
*Salsola kali** (Russian thistle)	2.3		3.7		3.0		14.3
Artemisia tridentata (sagebrush)	4.0		2.7		3.2	X	
*Draba verna** (spring whitlowgrass)	0.2		1.5		1.7		0.3
Amsinckia lycopsoides (tarweed fiddleneck)	0.2		1.0		0.2		0.2
*Centaurea diffusa** (diffuse knapweed)	0.7		0.2		6.0		0.2
*Sisymbrium altissimum** (tumble mustard)	0.5		0.5		0.2		0.2
Descurainia pinnata (western tansymustard)	X	--			0.2	--	
*Lactuca serriola** (prickly lettuce)	0.7		0.3		0.3		0.2
Tragopogon dubius (yellow salsify)	--		0.3		0.2	--	
*Holosteum umbellatum** (jagged chickweed)	--		0.5	X			0.2
Achillea millefolium (yarrow)	--	X		X		X	
Festuca octoflora (slender sixweeks)	--	--		--			0.2
Agoseris heterophylla (mountain-dandelion)	--	--		--			0.2
Gilia leptomeria (Great Basin gilia)	--	--		--		X	
Oryzopsis hymenoides (Indian ricegrass)	--	--		--		X	
Microsteris gracilis (annual phlox)	--		0.5	--		--	
Epilobium paniculatum (tall willowherb)	--		0.2	--		--	
Verbascum thapsus * (common mullein)	X						
Biotic crust	0.0		0.0		1.8		0.0
Bare Soil	21.8		25.8		31.7		23.3
Litter	74.3		65.7		64.2		63.2
Total canopy cover (litter not included)	55.5		63.2		77.0		61.5
* Invasive species							
X=present but not counted in plot frames							
-- species not recorded							
Total Invasive % Cover	16.3		22.2		27.2		41.2
Total Native % Cover	39.2		41		49.8		20.5
Change in Native Cover from 2007	-11.6	+1		+5.1		+8.1	

Table 21. Frequency of Occurrence at 116-K-2 (MLT) in 2008.

Species	T1	T2	T3	T4
Agropyron spicatum (bluebunch wheatgrass)	93.3	80.0	80.0	40.0
Poa sandbergii (Sandberg's bluegrass)	86.7	100.0	93.3	86.7
*Bromus tectorum** (cheatgrass)	93.3	93.3	86.7	80.0
*Salsola kali** (Russian thistle)	60.0	80.0	86.7	100.0
Artemisia tridentata (sagebrush)	33.3	40.0	26.7	X
*Draba verna** (spring whitlowgrass)	6.7	60.0	33.3	13.3
Amsinckia lycopsoides (tarweed fiddleneck)	6.7	40.0	6.7	6.7
*Centaurea diffusa** (diffuse knapweed)	26.7	6.7	46.7	6.7
*Sisymbrium altissimum** (tumble mustard)	20.0	20.0	6.7	6.7
*Lactuca serriola** (prickly lettuce)	26.7	13.3	13.3	6.7
Descurainia pinnata (western tansymustard)	X	--	6.7	--
Tragopogon dubius (yellow salsify)	--	13.3	6.7	--
Holosteum umbellatum (jagged chickweed)	--	20.0	X	6.7
Achillea millefolium (yarrow)	--	X	X	X
Festuca octoflora (slender sixweeks)	--	--	--	6.7
Agoseris heterophylla (mountain-dandelion)	--	--	--	6.7
Gilia leptomeria (Great Basin gilia)	--	--	--	X
Oryzopsis hymenoides (Indian ricegrass)	--	--	--	X
Microsteris gracilis (annual phlox)	--	20.0	--	--
Epilobium paniculatum (tall willowherb)	--	6.7	--	--
Verbascum thapsus * (common mullein)	X	--	--	--
Biotic crust	0.0	0.0	40.0	0.0
Bare Soil	80.0	86.7	93.3	80.0
Litter	100.0	100.0	100.0	100.0

* Invasive species
X=present but not counted in plot frames
-- species not recorded

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 13 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).

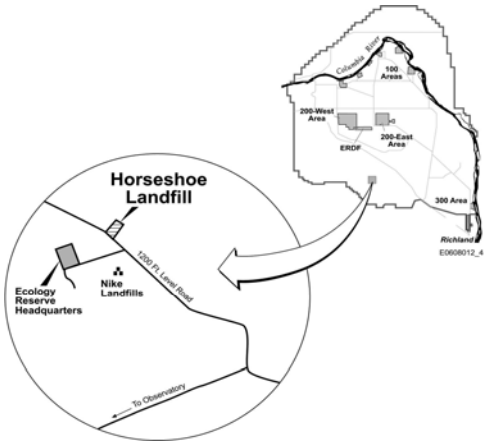
Remediation of the Horseshoe Landfill was initiated on May 17, 2005, and completed on August 24, 2005. Approximately 4,935 bulk cubic meters (bcm) of contaminated soil was excavated from the landfill and disposed of at the ERDF. On the return trip, the remediation contractor hauled clean soil (excavated 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) were 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. Third-year vegetation and sagebrush transect monitoring were conducted during May of 2008 (Figure 13). Vegetation monitoring showed very positive results; the landfill had a 42% increase in native plant cover, while the soil staging area had a 27% increase (Tables 22 and 23). These increases are directly correlated to increases in the Sandberg's bluegrass cover (the dominant plant at both sites, with 60 and 46% cover, respectively). Invasive species cover at the landfill decreased by 22% to only 4% canopy cover. Invasive cover also decreased in the soil staging area, down to 35% from 66% in 2007. These changes show that native species are out-competing the non-natives for resources, while maintaining high species diversity (16 native species across the two sites).

Sagebrush survival transects at the landfill show 71% total survival of planted shrubs, with 97% of the shrubs monitored in 2007 still alive in 2008. While some shrub loss occurred in the first two years, third year monitoring showed a stabilized sagebrush community. Sagebrush survival transects at the soil staging area showed similar total survival (72%), but a greater die-off was seen in 2008 (24%). It is expected that both of these sites will show high shrub survival in the coming years of monitoring, and that overall shrub survival will remain above 50%.

Figure 13. Horseshoe Landfill and Soil Staging Area Sites.



Sagebrush at the Soil Staging Area with Rattlesnake Mountain, 2008

Revegetated Soil Staging Area with the Ecology Reserve Headquarters, 2008

Horseshoe Landfill Sagebrush transect, 2008

Table 22. Percent Canopy Cover at the Horseshoe Landfill and Soil Staging Area in 2008.

Species	HSLF	SSA
Poa sandbergii (Sandberg's bluegrass)	60.0	46.0
Agropyron spicatum (bluebunch wheatgrass)	7.2	3.7
*Bromus tectorum** (cheatgrass)	2.5	13.5
*Salsola kali** (Russian thistle)	0.8	17.0
Artemisia tridentata (sagebrush)	2.2	4.8
Sitanion hystrix (bottlebrush squirreltail)	3.7	1.3
Lupinus leucophyllus (velvet lupine)	1.0	0.7
Epilobium paniculatum (tall willowherb)	0.8	0.2
*Agropyron cristatum** (crested wheatgrass)	0.2	0.2
*Lactuca serriola** (prickly lettuce)	0.3	0.2
Crepis atrabarba (slender hawksbeard)	--	3.7
*Sisymbrium altissimum** (tumble mustard)	X	2.3
Oryzopsis hymenoides (Indian ricegrass)	1.7	X
Amsinckia lycopsoides (tarweed fiddleneck)	--	1.5
Festuca octoflora (slender sixweeks)	--	0.3
*Kochia scoparia** (kochia)	--	0.3
Machaeranthera canescens (hoary aster)	0.3	X
*Draba verna** (spring whitlowgrass)	--	0.2
Descurainia pinnata (western tansymustard)	--	0.2
Chrysothamnus nauseosus (gray rabbitbrush)	0.2	--
Lomatium macrocarpum(bigseed desertparsley)	--	X
Phlox longifolia (longleaf phlox)	--	X
*Erodium cicutarium** (storksbill)	--	X
Achillea millefolium (yarrow)	--	X
*Tragopogon dubius** (yellow salsify)	--	X
Biotic crust	43.3	42.0
Bare Soil	52.2	42.0
Litter	45.2	45.3
Total Canopy Cover (excludes litter)	80.8	96.0

* Invasive species
X=present but not counted in plot frames
-- species not recorded

Total Invasive % Cover	3.8	33.7
Total Native % Cover	77.0	62.3
Change in Native Cover from 2007	^41.7	^27.0

Table 23. Frequency of Occurrence at the Horseshoe Landfill and Soil Staging Area in 2008.

Species	HSLF	SSA
*Sisymbrium altissimum** (tumble mustard)	X	93.3
*Bromus tectorum** (cheatgrass)	100.0	93.3
Poa sandbergii (Sandberg's bluegrass)	100.0	100.0
Agropyron spicatum (bluebunch wheatgrass)	60.0	20.0
Sitanion hystrix (bottlebrush squirreltail)	46.7	20.0
*Salsola kali** (Russian thistle)	33.3	80.0
Lupinus leucophyllus (velvet lupine)	--	26.7
Festuca octoflora (slender sixweeks)		13.3
*Kochia scoparia** (kochia)	--	13.3
Artemisia tridentata (sagebrush)	20.0	33.3
*Lactuca serriola** (prickly lettuce)	13.3	6.7
Amsinckia lycopsoides (tarweed fiddleneck)	--	26.7
*Draba verna** (spring whitlowgrass)	--	6.7
Crepis atrabarba (slender hawksbeard)	--	20.0
Descurainia pinnata (western tansymustard)	--	6.7
Epilobium paniculatum (tall willowherb)	33.3	6.7
*Agropyron cristatum** (crested wheatgrass)	6.7	6.7
Oryzopsis hymenoides (Indian ricegrass)	33.3	X
Lomatium macrocarpum(bigseed desertparsley)	--	X
Phlox longifolia (longleaf phlox)	--	X
*Erodium cicutarium** (storksbill)	--	X
Machaeranthera canescens (hoary aster)	13.3	X
Achillea millefolium (yarrow)	--	X
*Tragopogon dubius** (yellow salsify)	--	X
Chrysothamnus nauseosus (gray rabbitbrush)	6.7	--
Biotic crust	100.0	100.0
Bare Soil	100.0	100.0
Litter	100.0	100.0

* Invasive species
X=present but not counted in plot frames
-- species not recorded

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) in February 2007. 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 14). 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 (Figure 15). 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.

Second-year monitoring for sagebrush survival was conducted during April of 2008. The northeast plot showed significant die-off, down to 26% survival, from 96% in 2007 (which was first year monitoring). Average shrub height was 10.4±2.4 cm. in the northeast transect. The southwest plot faired better, showing 38% survival. Average shrub height was 10.5±3.7 cm. in the southwest transect. This is the significant die-off often seen during the first full year after the sagebrush is planted, but to a greater extent than typical. Reasons for the die-off could be lack of moisture, or competition from the established vegetation. Similar mitigation plots from other contractors in the area showed significant die-off as well. Consideration will be made to

determine if this area will have shrubs implanted again, as part of continuing mitigation, or whether other sites will be selected, with a greater chance of survival success.

No burrowing owl occupation was observed during the 2008 monitoring. The natural burrows that were active when the site was selected have since collapsed, and no burrowing owls were observed in the immediate area. Debris was cleared from the nest entrances, and monitoring will continue next year. Continuing mitigation will likely occur in areas with current active burrows, which have been located around the Hanford Site.

Figure14. ERDF Mitigation Site Along Army Loop Road.

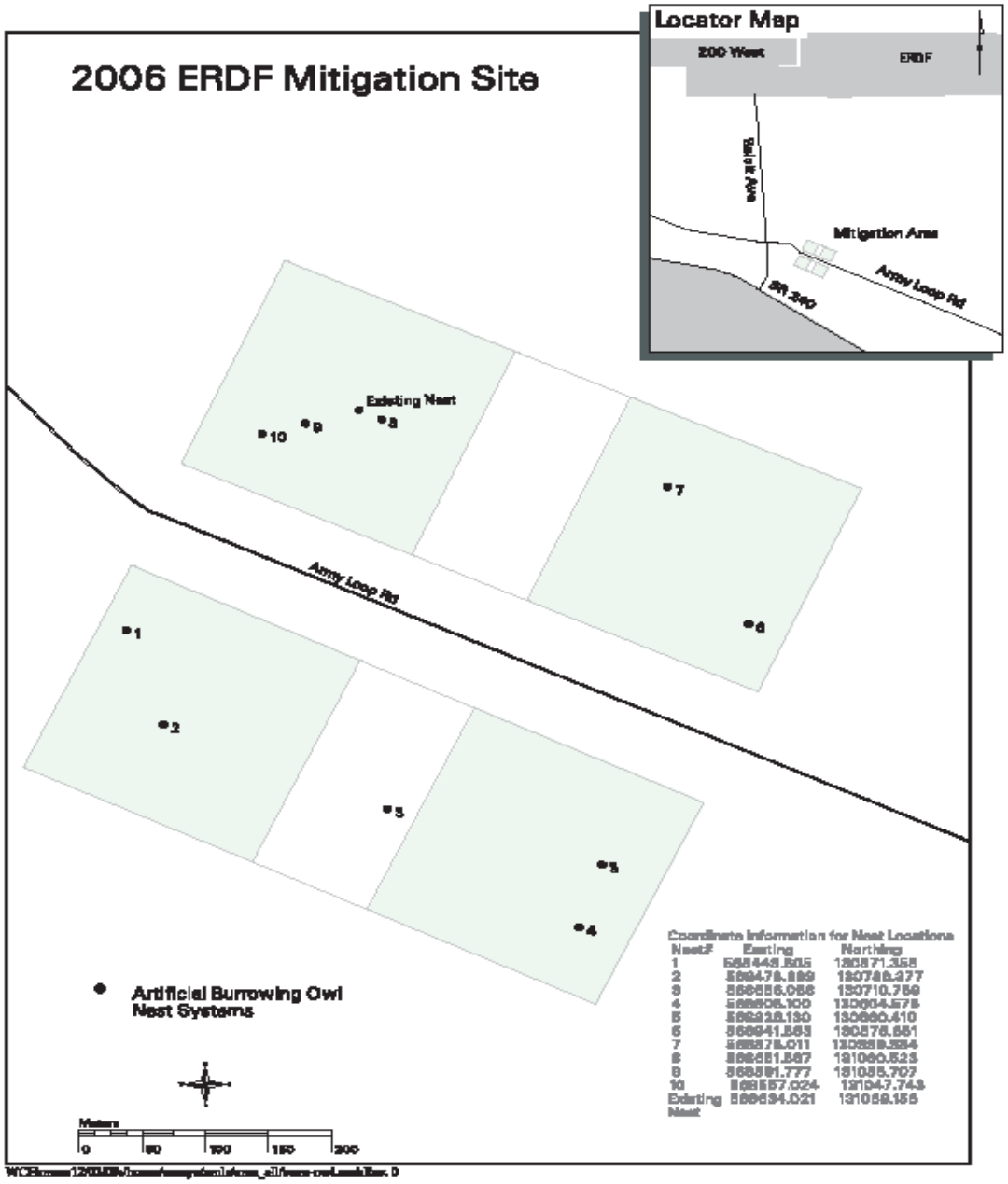


Figure15. ERDF Mitigation: Owl Nest Box and Sagebrush Transects.

Artificial burrowing owl nest, 2008

Native bunchgrasses along a transect, 2008

Planted Sagebrush and naturally occurring phlox at the ERDF mitigation site on the Army Loop Road, 2008

6.0 BAT MITIGATION PROJECTS

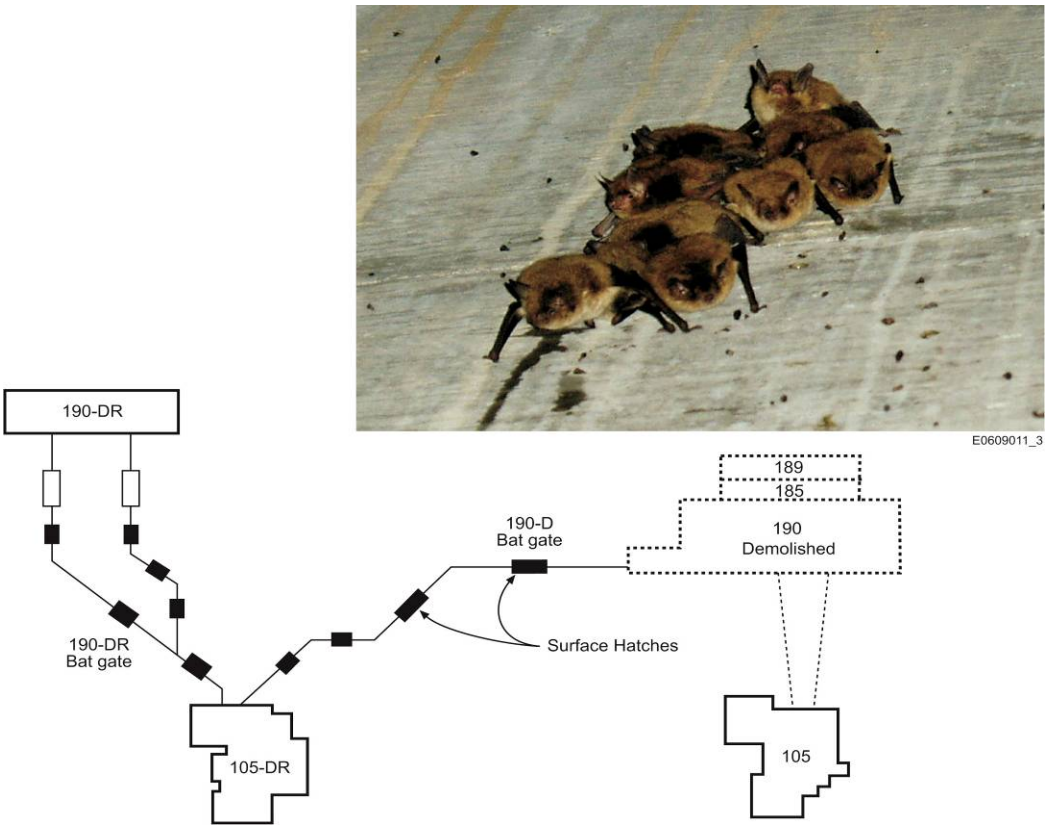
Bat mitigation projects have been conducted at 2 reactor sites, 105-D/DR and 105-F, to mitigate for roosting habitat that was lost as a result of the Interim Safe Storage (ISS) projects at these reactors. The purpose of the ISS projects was to remove all of the ancillary structures from the reactor buildings, 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 colony of more than 2,000 bats that are using that facility. The facility is slated for eventual demolition, so a mitigation plan was needed to determine the path forward for this facility and the bats occupying it.

Bat Mitigation at 100-D Area

The mitigation project at 100-D Area was initiated when a suspected 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 16). 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 17). 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 16. 190-DR Bate Gate.

Figure 17. 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.

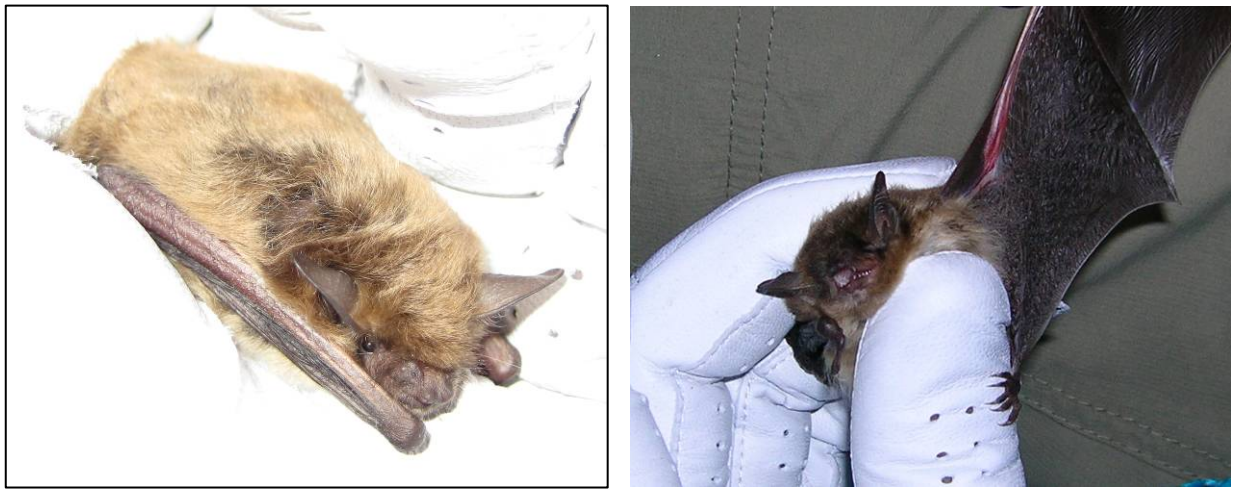
The 190-D tunnel has not been entered since the reactor valve pit was backfilled because there is no walk-in access available. The 190-DR tunnels were accessible from the 190-DR north Valve House (at the west end of the tunnel) until 2005 when the valve houses were demolished along with the 190-DR facility. 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. The species present in the 190-DR Tunnel are Yuma Myotis (*Myotis yumanensis*), as determined by morphometrics, acoustic analysis, and DNA analysis. Eighteen bats were captured on August 28, 2007, and 4 on September 11, 2007 (Figure 18). 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.

On September 22, 2008, the 190-DR process water tunnel was entered to retrieve the data loggers and to inspect the tunnel for roosting bats. The temperature data has not yet been analyzed and will be included in the 2009 monitoring report. Bats were again photographed and counted. There were several individual bats roosting in the tunnel. These bats are likely males that have entered the roost site preparing to breed. One of these individuals was captured and confirmed to be a male.

Figure 18. Bats from 190-DR Mist Netting.



Bats typically breed in the fall prior to leaving the summer roost. The females store the sperm and do not complete fertilization until spring when they emerge from hibernating in their winter roosts. Several clusters of bats were observed in one of the hatches indicating the site is still functioning as a maternity roost. The total number of bats observed in the 190-DR tunnel in 2008 was 67.

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 (*Antrozous pallidus*) was observed in the upper areas of the reactor building (Figure 19). 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 20). 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 guano was 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.

On September 25, 2008, mist netting was conducted at the 105-F Reactor to determine if the roost site was still active. Pallid bats were observed in 3 of the 8 boxes (boxes 2, 7, and 8). Nine pallid bats and one *Myotis yumanensis* were captured in two nets (Figure 20). All of the pallid bats were female and some appeared to have given bith this year indicating this is still a successful maternity colony. One of the bats captured was a recapture of an individual that was banded in September 2006.

Figure 19. 105-F Bat Houses.

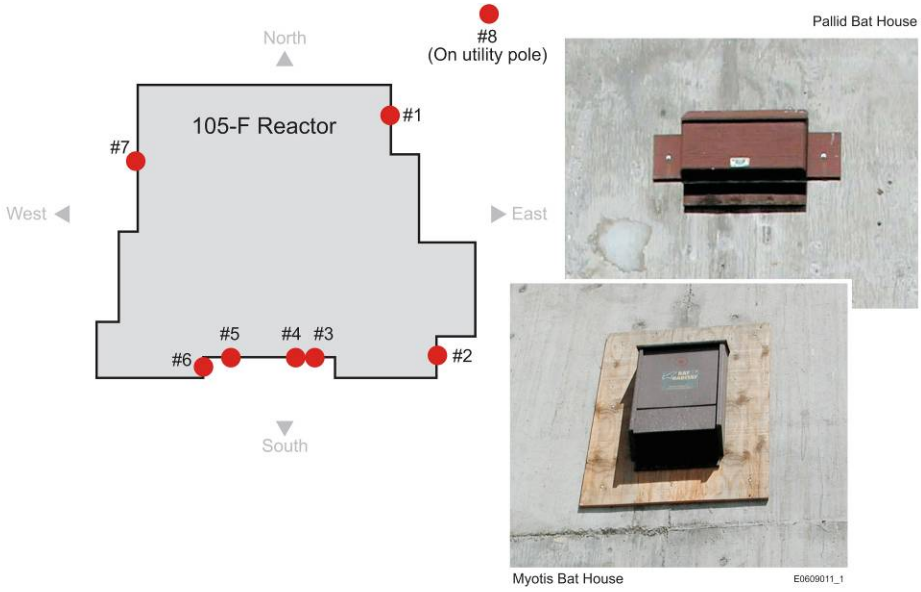


Figure 20. Monitoring at the 105-F Reactor

Removing a Pallid bat from a mist net in 2008.

Pallid bat that was banded in 2003, and was recaptured in 2008.

Pallid bat captured at the 105-F Reactor in 2008

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. 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 prevent significant impact or loss of this maternity colony. Information needed in order to advise on mitigation actions includes determining the bat species present, and the habitat conditions that make the Clearwell such an attractive and successful roost site. Roost sites with this many individuals are unusual and it is important to understand how the facility is being used to determine the potential impacts from the various endstate options.

In May of 2008, mist netting was performed to increase the number of DNA samples available for analysis. On May 28, 60 bats were collected using mist nets. A combination of morphological measurements, acoustic analysis of ecolocation calls, and DNA analysis was performed on bats collected during 2007 and 2008, and this data was used for species determination (Figure 21). The initial morphological measurements and acoustic analysis indicated that the colony is composed of Yuma Myotis (*Myotis yumanensis*). Results from the DNA analysis of skin tissue samples confirms that the species present is Yuma Myotis. A separate document will be composed outlining the detailed findings of the study performed at the 183-F facility, including the proposed preferred outcome, resulting from the findings of the study, as well as potential alternatives for the final endstate of the facility.

Figure21. 183-F Clearwell Bat Work.

Bats observed in the 183-F East Flume during October of 2007

Bats hanging on the wall inside the 183-F East Flume during October of 2007

Mist netting at the 183-F Clearwell, May 2008

7.0 REFERENCES

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APPENDIX A

2007 REVEGETATION MONITORING RESULTS

Table A-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 serriola** (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 A-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 A-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
Artemisia 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

Table A-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	--
Artemisia 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 A-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	--	--	--
Artemisia 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.

TableA-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 serriola** (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
Artemisia 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 A-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 serriola** (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
Artemisia 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.

Table A-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

Table A-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 serriola** (prickly lettuce)	0.8	30
*Bromus tectorum** (cheatgrass)	0.9	37
*Salsola kali** (Russian thistle)	4.4	93
Artemisia 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

Table A-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
Artemisia 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

Table A-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	--
Artemisia 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 serriola** (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 A-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
Artemisia tridentata (sagebrush)	0.2	0.5	0.2	0.2
*Lactuca serriola** (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 A-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
Artemisia tridentata (sagebrush)	7	20	7	7
*Lactuca serriola** (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 A-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
Artemisia 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

Table A-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
Artemisia 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 serriola** (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**
*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	25.0	50.2	53.2	70.8
Total Native % Cover 2007	50.8	90.2	44.7	12.3

Table A-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
Artemisia 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 serriola** (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.

Table A-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
Artemisia 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 serriola** (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 A-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
Artemisia 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 serriola** (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.

APPENDIX B

2006 REVEGETATION MONITORING RESULTS

Table B-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 B-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 B-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 ounted in a plot frame.
-- = Species not observed on the treatment.

Table B-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 B-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 B-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 B-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 B-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 B-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 B-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 B-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 B-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 C

2005 REVEGETATION MONITORING RESULTS

Table C-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 C-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 C-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 C-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 C-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.

APPENDIX D

2004 REVEGETATION MONITORING RESULTS

Table D-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 D-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 D-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

APPENDIX E
NAME CHANGES INCLUDED IN INTEGRATED TAXONOMIC INFORMATION SYSTEM

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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