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# Hanford Site Revegetation Monitoring Report for Fiscal Year 2020

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-09RL14728

**P.O. Box 650**
**Richland, Washington 99352**

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# Hanford Site Revegetation Monitoring Report for Fiscal Year 2020

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# 1.0 INTRODUCTION

This report describes the monitoring of areas revegetated by the River Corridor Closure Contractor (RCCC) and CH2M Hill Plateau Remediation Company (CHPRC) that were transitioned to and monitored by Mission Support Alliance (MSA) in 2020, along with sites revegetated by MSA. Site monitoring is a continuance of efforts performed by the RCCC from fiscal year (FY) 2007 through FY 2020. This report contains data collected in 2020 documenting the recovery of revegetation areas associated with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* cleanup of National Priorities List waste sites and restoration of lands disturbed by ongoing Site mission activities at the Hanford Site in Richland, Washington. It contains vegetation monitoring data for 41 sites selected to be representative sites for areas planted between the years of FY 2007 and FY 2020.

Typical revegetation monitoring efforts analyze the structure and composition of native and non-native plant species on representative revegetated sites over a 5-year period. This provides a timeline over which to evaluate restoration success and provides insight into which planting methods are most effective. This is achieved by measuring both shrub survival via transects and vegetative cover via plot frames. Revegetation sites are considered successful if after 5 years they have a native shrub density of 240 plants/ac and total canopy cover of 25% or greater for native plants as specified in the DOE/RL-2011-116, *Hanford Site Revegetation Manual*, and in area specific revegetation plans (DOE/RL-96-17, Appendix H; DOE/RL-2005-93, Appendix G, and DOE/RL-2001-47, Appendix C). If the structure and composition of a monitored revegetation site are determined to meet these success criteria by the fifth year, the site is considered "successful."

Monitoring efforts in FY 2020 only included monitoring shrub survival via shrub transects. Plot frame monitoring for vegetative cover must occur between April and June so that emerging vegetation can be identified and so that results can be compared over multiple years. Plot frame monitoring did not occur in FY 2020 due to safety-related work restrictions. Plot frame data in this report is included for reference and is from the previous monitoring year (FY 2019). Shrub transect monitoring typically occurs in May, June, and July so that first-year shrubs can be evaluated before the summer drought. In FY 2020, shrub transect monitoring occurred in September, October, and November. This will have an effect on the results, most notably for first-year shrubs, which would be expected to have higher survival in the spring and lower survival in the fall of the first year. This may make first-year shrubs appear to have lower survival than in previous years. This is addressed in Section 4.0.

Section 4.0 contains a brief summary of revegetation activities and monitoring efforts. Additionally, it summarizes shrub transect monitoring results for FY 2020, and recommends future actions based on FY 2020 shrub monitoring data. Reseeding revegetation sites as a future action is not recommended in this report, as vegetative cover was not evaluated in FY 2020.

Fourty sites were monitored to determine shrub density and shrub survival. This report provides fifth-year monitoring results for 100-B-35, 100-D-100, and 100-H-28:2; fourth-year monitoring results for 100-N-83, 100-D Trailer Village, L-840, and L-525; third-year monitoring results for

L-419; second-year monitoring results for 618-10, L-853/854, and L-894; and first-year monitoring results for C9L3. This report also provides monitoring results for sites that were redone, supplemented with shrubs and forbs, or broadcast seeded with an All Terrain Vehicle (ATV) from the years spanning FY 2017 through FY 2020. Those sites include: 116-C-5, 100-K-95, 100-K-CTA, 128-K-2 Soil Staging Area, 130-N-1:1, 100-N-96, 100-N-CTA, 100-N-61:1, 124-N-10, 100-N-84:9, 128-D-2, 628-3, 600-30, 600-385, 100-F-47, 118-F-1, 118-F-6, 100-F-CTA, 118-F-5, 100-F-57, 100-F-26, 118-F-3, 600-301, 600-356, 600-370, 600-358, 600-100, 600-120, and 600-370.

Selected sites that were determined to need additional revegetation actions in order to meet success criteria were either re-worked or had additional plugs planted in FY 2020. Sites that were re-worked in 2020 were seeded with the FY 2020 seed mix; these sites include 100-N-South, 100-N-96, and 600-30. Reworking at the 100-N-96 and the 600-30 sites included broadcast seeding with an ATV to prevent unnecessary disturbance to existing vegetation. The FY 2020 seed mix used at re-worked sites is listed in Table 1. The following sites had additional shrub plugs planted in FY 2020: 600-30, 100-N-96, 100-N-CTA, 100-N-Tent Area, 100-N-61:1, 130-N-1:1, 124-N-10, 100-N-South, and 600-385. Additionally, there were a number of sites requiring supplemental planting that were not completed in FY 2019. Supplemental planting sites that were not completed in FY 2019 but were completed in FY 2020 included: 100-K-95, 100-K-CTA, 600-301, 600-120, 600-370, 600-100, 116-C-5, 116-B/C-Misc., 100-B-14, 100-C-6, 128-D-2 East, 128-D-2 West, 628-3 Outer, 600-358, and 600-356.

**Table 1. FY 2020 Seed Mix Used at Re-Worked Sites.**

| Species | Pounds per Acre |
|---|---|
| Munro's globemallow (*Sphaeralcea munroana*) | 0.1 |
| Threadleaf fleabane (*Erigeron filifolius*) | 0.1 |
| Shaggy fleabane (*Erigeron pumilus*) | 0.1 |
| Sandberg's bluegrass (*Poa secunda*) | 12.0 |
| Needle-and-thread grass (*Hesperostipa comata*) | 1.2 |
| Bottlebrush squirreltail (*Elymus elymoides*) | 8.0 |

In addition to previously revegetated sites that were re-worked, one site had initial revegetation actions completed in FY 2020. The C9L3 access road was decommissioned and revegetated with the seed mix listed in Table 2. The C9L3 site was also planted with big sagebrush, bitterbrush, and hopsage plugs as described in Section 3.6.7

**Table 2. FY 2020 Seed Mix for the C9L3 Site. (2 Pages)**

| Species | Pounds per Acre |
|---|---|
| Munro's globemallow (*Sphaeralcea munroana*) | 0.1 |
| Threadleaf fleabane (*Erigeron filifolius*) | 0.1 |
| Shaggy fleabane (*Erigeron pumilus*) | 0.1 |

**Table 2. FY 2020 Seed Mix for the C9L3 Site. (2 Pages)**

| Species | Pounds per Acre |
|---|---|
| Douglas' Dustymaiden (*Chaenactis douglasii*) | 0.1 |
| Hoary tansyaster (*Machaeranthera canescens*) | 0.1 |
| Sandberg's bluegrass (*Poa secunda*) | 5.5 |
| Bottlebrush squirreltail (*Elymus elymoides*) | 3.3 |

The locations of the 40 sites monitored in 2020 are shown in Figure 1.

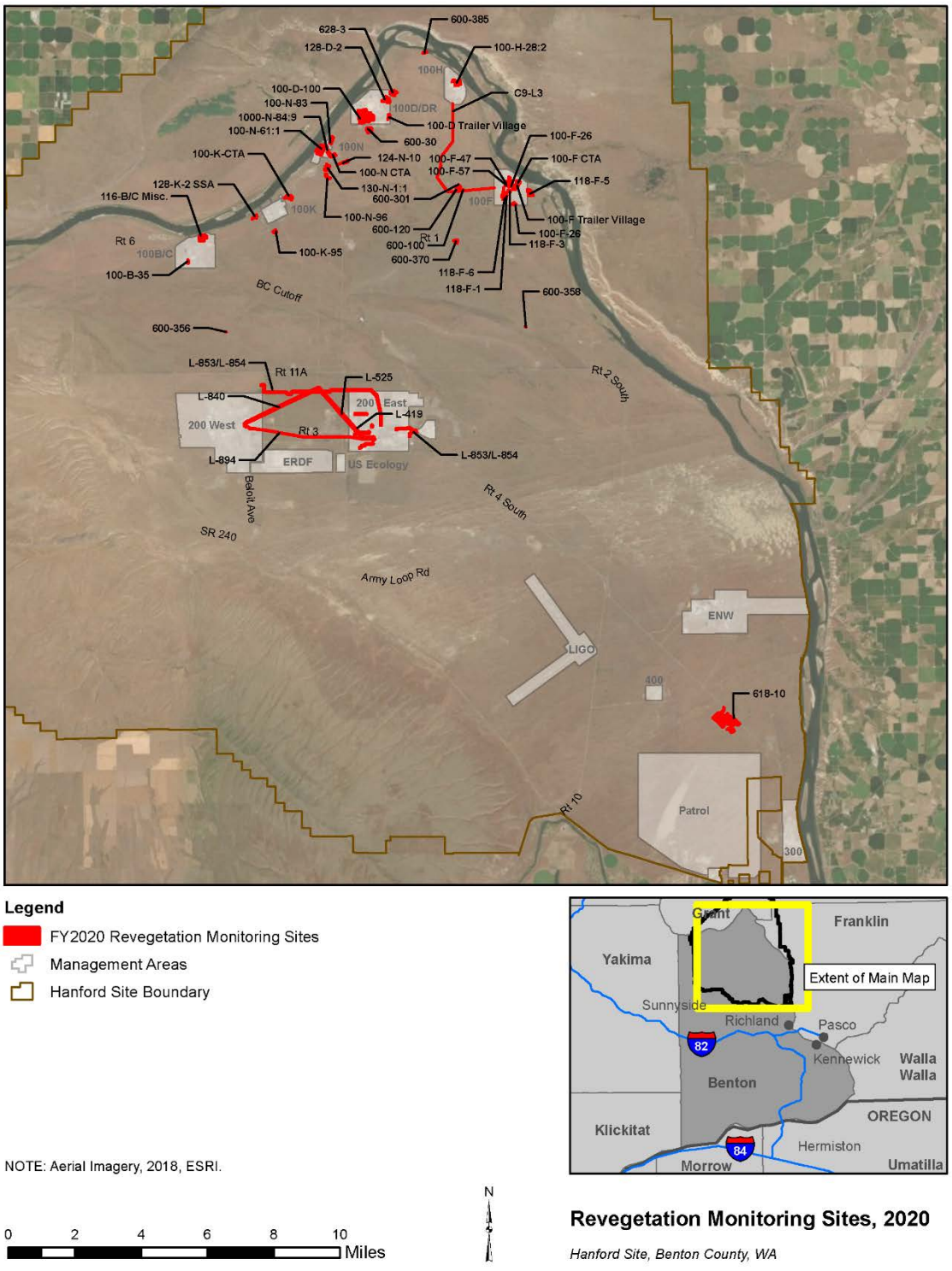


**Figure 1. Map of Revegetation Sites Monitored in 2020.**

# 2.0 METHODS

The 2020 revegetation monitoring of 5-year monitoring sites consisted of shrub survival measurements taken at all sites. This included the counting of transplanted shrubs within an established transect area to estimate overstory density (plants/ha) for the site. Additionally, forb survival was also measured at representative sites where forb plugs were planted in order to assess the effectiveness of planting forb plugs compared to seeding. Planted shrub and tree species include big sagebrush (*Artemisia tridentata*), spiny hopsage (*Grayia spinosa*), and antelope bitterbrush (*Purshia tridentata*) in upland areas. In FY 2019 and FY 2020, select revegetation sites were planted with forb plugs, including snow buckwheat (*Eriogonum niveum*), Munro's globemallow (*Sphaeralcea munroana*), and cushion fleabane (*Erigeron poliospermus*). The data collected using these methods allows the analysis of relative seral stages, general site progression, as well as site trends and provides a way to analyze the long-term achievement of management objectives.

The evaluation of shrub and forb survival and density was determined through the establishment of stationary transect areas that are monitored annually over a 5-year period. In most cases, transects are 100 m (328 ft) in length with offsets to either side of up to 5 m (16.4 ft); shorter (25 to 75 m [82 to 246 ft]) transects have been established at sites too small to support a 100-m (328-ft) transect. The number of live shrubs within the established transect area (typically a 1,000-$m^2$ [10,764-$ft^2$] area) was extrapolated to derive the shrub density for the site each year. For example, the 100-B-35 site in B Area has a 100-m (328-ft) transect with 5-m (16.4-ft) offsets that equates to a 1,000-$m^2$ (10,764-$ft^2$) transect area. A total of 65 native shrubs were recorded within the transect area in 2020 monitoring. Using this data, we can derive that the shrub density for the site in 2020 was 263 plants/ac, meeting the shrub cover success criteria of 240 plants/ac. Using the same methods, planted forbs were monitored for survival at representative sites in 2020. Transect data were collected between September and November 2020.

In previous years, frequency of occurrence and canopy cover measurements were obtained using the methods described in *Steppe Vegetation of Washington* (Daubenmire 1970). As discussed in the introduction, canopy cover measurements were not obtained in FY 2020. The results from FY 2019 canopy cover monitoring are included for each site for reference. The following paragraph explains how those canopy cover measurements were obtained.

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." The plot frame encompasses a 0.5-$m^2$ (5.4-$ft^2$) area. The name and relative amount of ground cover for each rooted species within the confines of the plot frame is documented for each plot-frame measurement. The total vegetation can exceed 100% with this method due to species overlapping when plot measurements are taken in densely vegetated areas. Depending on the size of the restoration site, a number of plot-frame measurements were collected and analyzed to estimate canopy cover for each species present. Frequency was represented as the percentage of occurrences a species was observed within the given 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%. 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. Species that were observed within a revegetated area but were not counted in a plot frame were recorded as occurrences and denoted as an "X" in the tables. Frequency of occurrence and canopy cover measurements were taken between April 1 and May 16, 2019. Listed Washington State noxious weed species identified within the monitoring areas are identified in the site monitoring result tables with their state class designation (e.g., A, B, or C). Washington State noxious weed classes are defined as:

> *"Noxious weed" is the traditional, legal term for invasive, non-native plants that are so aggressive they harm ecosystems or disrupt agricultural production. These plants crowd out the native species that fish and wildlife depend on. Washington State separates noxious weeds into three classifications. Class A noxious weeds are usually newcomers to Washington, and are generally rare. The goal is to completely eradicate them before they gain a foothold. Class B noxious weeds are widespread in some areas of the state, but limited or absent in other parts of the state. The goal is to prevent them from spreading into new areas, and to contain or reduce their population in already infested areas. Class C Noxious weeds are often widespread, or are of special interest to the agricultural industry.* (NWCB 2017).

Ground cover type was factored into the vegetative cover calculation for each site. The measurement "Unavailable Space" used the Daubenmire method to calculate the percentage of each site where vegetation was unable to grow. An example of this would be a large boulder or area with large rocks or concrete pads within the revegetation area. The amount of space considered unavailable is subtracted from 100% to represent the available growing space. Vegetative cover is then divided by the available growing space to represent the actual vegetative cover in a revegetation site. For example, if a site had 5% unavailable space and 20% vegetative cover, the adjusted vegetative cover to represent plants growing in the available growing space would be:

$$\frac{\%\ vegetative\ cover}{\%\ available\ growing\ space} * 100\% = \frac{20\%}{95\%} * 100\% = \mathbf{21}\%$$

Changes in native and invasive cover are reported based on the unadjusted vegetative cover data from 2018 to 2019, as data collected in 2018 was not adjusted to represent available growing space.

Plant identifications in the 2019 monitoring efforts use the current nomenclature from the United States Department of Agriculture (USDA) PLANTS Database (USDA 2019). Appendix A of this report lists the current scientific and common names from the USDA database along with synonyms possibly used in previous revegetation monitoring reports from *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973) and/or *Vascular Plants of the Hanford Site* (Sackschewsky and Downs 2001).

As of December 2020, the Hanford Site Revegetation Monitoring Reports for FY 2016, 2017, 2018, and 2019 are available online at https://www.hanford.gov/page.cfm/EcologicalMonitoring.

# 3.0 MONITORING RESULTS

This section describes the revegetation site data collected during the FY 2020 revegetation monitoring efforts. Shrub density data from FY 2020 and canopy cover data from FY 2019 are reported for the applicable sites.

## 3.1 100-B/C AREA SITES

Two sites were monitored for shrub survival in the 100-B/C Area in FY 2020: 100-B-35 and 116-B/C Misc. In a typical revegetation monitoring year, 100-C-7 and 116-C-5 would also be monitored, but these two sites are only monitored using plot frames and thus were not monitored in FY 2020. Monitoring results for 100-C-7 and 116-C-5 are not provided in this report and can be found in the *Hanford Site Revegetation Monitoring Report for FY 2019*. Monitoring will resume for 100-C-7 and 116-C-5 in FY 2021.

The 100-B-35 and 116-B/C Misc. sites were remediated to meet the objectives for interim closure as established in DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, (100 Area RDR/RAWP) and in the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 10-DR-2, 100-FR-1, 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* (Interim Action ROD) (EPA 1999).

The 100-B-35 site was revegetated in FY 2016. Revegetation efforts at 100-B-35 entailed broadcast seeding at approximately 15 lbs/ac with a mixture of native grasses including Sandberg bluegrass (*Poa secunda*), Indian ricegrass (*Achnatherum hymenoides*), bluebunch wheatgrass (*Pseudoroegneria spicata*), squirreltail (*Elymus elymoides*), needle-and-thread grass (*Hesperostipa comata*), and prairie junegrass (*Koeleria macrantha*) topped with a straw mulch that was crimped into the soil surface. Shrub species including big sagebrush (*Artemisia tridentata*), antelope bitterbrush (*Purshia tridentata*), and spiny hopsage (*Grayia spinosa*) were transplanted on the sites at approximately 500 to 650 plants/ac with a mix of approximately 75% sagebrush, 15% bitterbrush, and 10% spiny hopsage.

The 116-B/C-Misc. site was initially revegetated in FY 2007. Additional shrub plantings were recommended at this site in FY 2018, these additional plantings were completed in FY 2019 and FY 2020. An additional 250 sagebrush (*Artemisia tridentata*) per acre were planted at this site in FY 2019. An additional 50 bitterbrush (*Purshia tridentata*), 50 hopsage (*Grayia spinosa*), and 100 forbs per acre were planted in the 100-B/C-Misc. site in FY 2020.

### 3.1.1 100-B-35 Site (Electrical Substation)

The 100-B-35 site (Figure 2) was revegetated in FY 2016 and monitoring for the site was first conducted in 2016. The substrate for the site consists predominantly of cobbles with varying amounts of sandy loam. Shrub survival monitoring conducted in 2020 represents fifth-year monitoring for this site.

The shrub monitoring transect at 100-B-35 was established in 2016. Fifth-year monitoring results show a shrub density of 263 plants/ac, above the shrub density success criteria of 240 plants/ac. Shrub survival was 94.2% of that observed in 2019.

Canopy cover data for the site was most recently collected in April 2019. Canopy cover for the site was 31.2% with native cover representing 17.8% and invasive cover representing 13.4% (Table 3). This represents an increase of 7.2% in native cover and an increase of 2.1% in invasive cover from 2018. Native cover was dominated by Sandberg's bluegrass (*Poa secunda*) with 8.4% cover and bluebunch wheatgrass (*Pseudoroegneria spicata*) with 3.7% cover. Cheatgrass (*Bromus tectorum*) was the dominant species at the site with a coverage of 6.8%. Twelve native species were recorded at this site. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was observed on the site and had less than 1% cover.

This site is meeting success criteria for shrub density but as of fourth-year monitoring was not meeting success criteria for canopy cover. From 2018 to 2019, canopy cover increased by 7.2% at this site, indicating a positive trend in canopy cover. It is expected that canopy cover will continue to increase at 100-B-35. Though fifth-year monitoring would typically be the last year of revegetation monitoring, it is recommended that this site be monitored for canopy cover in FY 2021 to determine if the native cover is continuing to increase.

**Table 3. Percent Canopy Cover and Frequency of Occurrence at the 100-B-35 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achnatherum hymenoides* (Indian ricegrass) | 0.8 | 32.0 |
| *Artemisia tridentata* (big sagebrush) | 2.8 | 16.0 |
| *Bromus tectorum* (cheatgrass) [a] | 6.8 | 100.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | 0.7 | 8.0 |
| *Chorispora tenella* (crossflower) [a] | X | X |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | X | X |
| *Descurcainia pinnata* (western tansymustard) | 0.2 | 8.0 |
| *Draba verna* (spring draba) [a] | 0.5 | 20.0 |
| *Elymus elymoides* (squirreltail) | 0.1 | 4.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.2 | 8.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | X | X |
| *Erodium cicutarium* (redstem stork's bill) [a] | 0.1 | 4.0 |
| *Grayia spinosa* (spiny hopsage) | 0.2 | 8.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.7 | 28.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.4 | 16.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.3 | 12.0 |
| *Melilotus officinalis* (sweet clover) [a] | X | X |
| *Poa bulbosa* (bulbous bluegrass) [a] | X | X |
| *Poa secunda* (Sandberg bluegrass) | 8.4 | 96.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 3.7 | 68.0 |

**Table 3. Percent Canopy Cover and Frequency of Occurrence at the 100-B-35 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Salsola kali* (Russian thistle) [a] | 1.6 | 64.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 1.7 | 68.0 |
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| Crust | 0.6 | 4.0 |
| Soil | 3.3 | 56.0 |
| Litter | 18.9 | 100.0 |
| Rock/Cobble | 71.1 | 100.0 |
| Unavailable Space | 6.4 | 60.0 |
| **Total Canopy Cover %** | **31.2** | |
| **Native Cover %** | **17.8** | |
| Invasive Cover % | 13.4 | |
| Unadjusted Canopy Cover | 29.2 | |
| Unadjusted Native % Cover | 16.7 | |
| Change in Native Cover from 2018 | 7.2 | |
| Unadjusted Invasive % Cover | 12.5 | |
| Change in Invasive % Cover from 2018 | 2.1 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 2. The 100-B-35 Site in 2020.**

### 3.1.2 116-B/C-Misc. Site (Multiple WIDS Sites)

This site encompasses multiple Waste Information Data System (WIDS) sites in the northern 100-B/C Area. WIDS sites included in the 116-B/C Misc. site were the 116-B-11 site, the 116-C-5 site, the 100-C-6 site, the 100-B-8 site, and the 100-B-7 site. The majority of this area was revegetated in FY 2007 with a small section of the northern portion revegetated in FY 2000. The substrate at this site is a high amount of cobble and rock mixed with loam (Figure 3).

No initial monitoring data is available for these sites after they were planted in 2007. The representative site for this area and planting year is the 100-C-9 site. The 100-C-9 had native cover of 18.4% and invasive cover of 21.4% in 2010 monitoring. In FY 2018, supplemental planting was recommended at the 116-B/C-Misc. site to add shrub and forb plugs to the area. Over FY 2019 and FY 2020, the 116-B/C-Misc. site was planted with 250 sagebrush, 50 bitterbrush, 50 hopsage, and 100 forbs per acre.

A transect was established for this site in October 2020. First-year monitoring results show a shrub density of 393 shrubs/ac, which includes existing sagebrush recruits present on the transect. This is above the success criteria of 240 plants/ac.

Canopy cover data for the site was collected in April 2019. Data was collected from 50 plot frames. Canopy cover for the site was 41.6%, with 25.6% native cover and 16.0% invasive cover (Table 4). This represents an increase of 3.6% in native cover and of 8.3% in invasive cover from 2018. The dominant native species was snow buckwheat (*Eriogonum niveum*) with 7.1% cover followed by Sandberg's bluegrass (*Poa secunda*) with 6.3% cover. The dominant invasive species was cheatgrass (*Bromus tectorum*) with 8.6% cover. Eleven native species were recorded at this site, five of which were native forbs. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was observed at this site at less than 1% cover and was detected in 20% of plot frames.

It is recommended that monitoring continues for a total of 5 years at this site to determine shrub survival and to evaluate the effectiveness of the supplemental planting effort.

**Table 4. Percent Canopy Cover and Frequency of Occurrence at the 116-B/C Miscellaneous Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | X | X |
| *Artemisia tridentata* (big sagebrush) | 5.6 | 16.0 |
| *Artemisia tridentata* (big sagebrush) (recruits) | X | X |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.1 | 2.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 8.6 | 100.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | 0.8 | 20.0 |
| *Descurcania pinnata* (western tansymustard) | X | X |
| *Draba verna* (spring draba) [(a)] | 1.2 | 46.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 4.2 | 30.0 |
| *Erigeron pumilus* (shaggy fleabane) | 0.2 | 8.0 |

**Table 4. Percent Canopy Cover and Frequency of Occurrence at the 116-B/C Miscellaneous Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Eriogonum niveum* (snow buckwheat) | 7.1 | 52.0 |
| *Erodium cicutarium* (redstem stork's bill) [a] | 1.2 | 26.0 |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.8 | 72.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.3 | 12.0 |
| *Poa bulbosa* (bulbous bluegrass) [a] | X | X |
| *Poa secunda* (Sandberg bluegrass) | 6.3 | 82.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.9 | 8.0 |
| *Ranunculus testiculatus* (burr buttercup) [a] | 0.1 | 2.0 |
| *Salsola kali* (Russian thistle) [a] | 0.9 | 36.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.4 | 16.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Tragopogon dubius* (yellow salsify) [a] | 0.1 | 4.0 |
| Crust | 11.6 | 92.0 |
| Soil | 7.6 | 88.0 |
| Litter | 12.8 | 100.0 |
| Rock/Cobble | 64.2 | 100.0 |
| Unavailable Space | 3.7 | 60.0 |
| **Total Canopy Cover %** | **41.6** | |
| **Native Cover %** | **25.6** | |
| Invasive Cover % | 16.0 | |
| Unadjusted Canopy Cover | 39.3 | |
| Unadjusted Native % Cover | 24.2 | |
| Change in Native Cover from 2018 | 3.6 | |
| Unadjusted Invasive % Cover | 15.2 | |
| Change in Invasive % Cover from 2018 | 8.3 | |

[a] Invasive species

[b] Washington State Classified Noxious Weed (class)

X = present but not counted in plot frames

**Figure 3. The 116-B/C- Misc. Site in 2020.**

## 3.2 100-K AREA SITES

Three sites in the 100-K area were monitored for shrub survival in 2020: 100-K-95, 100-K-CTA, and 128-K-2-SSA. Low native species cover and shrub survival measurements in 2017 monitoring led to the 100-K-95, 100-K-CTA, and the 128-K-2 SSA sites being recommended for additional revegetation actions. The 100-K-95 and 100-K-CTA sites were both redone in FY 2019 with the FY 2019 Revegetation Seed Mix listed in Appendix B. The 128-K-2-SSA site had forb seedlings added in FY 2019. Additional shrub and forb plugs were added at all three sites in FY 2020, as is summarized in the following sections.

### 3.2.1 100-K-95 Site (100-K Tar Dump)

The 100-K-95 site was originally revegetated in FY 2014. Fourth-year monitoring in 2017 showed a shrub density of 89 plants/ac due to a large die off of shrubs after the first year (2014 to 2015). The 2017 canopy cover measurements show 69.1% coverage with only 5.2% being native species. Big sagebrush (*Artemisia tridentata*) was the dominant native species at the time of 2017 monitoring, cheatgrass (*Bromus tectorum*) had a coverage of 55.4%.

The 100-K-95 site was redone in FY 2019. This site was broadcast seeded with shrub, forb, and grass species (Table 5). Care was taken to avoid crushing mature sagebrush plants during this process. This site was also planted with sagebrush, bitterbrush (*Purshia tridentata*), and hopsage (*Grayia spinosa*) seedlings at a rate of 400, 100, and 100 plants per acre, respectively. In FY 2020, an additional 100 forb plugs per acre were planted at the site. Figure 4 shows the 100-K-95 site in 2020.

**Table 5. Species Seeded at the 100-K-95 Site in FY 2019.**

| Species | Detected in 2019? | Pounds per Acre |
|---|---|---|
| Gray Rabbitbrush (*Ericameria nauseosa*) | Yes | 0.14 |
| Green Rabbitbrush (*Chrysothamnus viscidiflorus*) | No | 0.14 |
| Blue Mountain Buckwheat (*Eriogonum strictum*) | No | 0.14 |
| Snow Buckwheat (*Eriogonum niveum*) | Yes | 0.18 |
| Munro's globemallow (*Sphaeralcea munroana*) | Yes | 0.18 |
| Carey's balsamroot (*Balsamorhiza careyana*) | No | 0.18 |
| Crouching milkvetch (*Astragalus succumbens*) | No | 0.18 |
| Cushion fleabane (*Erigeron poliospernus*) | Erigeron sp. | 0.16 |
| Threadleaf fleabane (*Erigeron filifolius*) | Erigeron sp. | 0.16 |
| Hoary falseyarrow (*Chaenactis douglasii*) | Yes | 0.16 |
| Sandberg's bluegrass (*Poa secunda*) | Yes | 9.8 |
| Needle-and-thread grass (*Hesperostipa comata*) | Yes | 7.0 |
| Indian ricegrass (*Oryzopsis hymenoides*) | Yes | 5.6 |
| Bottlebrush squirreltail (*Elymus elymoides*) | Yes | 5.6 |

Canopy cover monitoring was performed at the 100-K-95 site in April 2019. Total canopy cover was 38.1%, with 7.6% native and 30.5% invasive cover (Table 6). Native cover had increased by 2.4% since 2017 monitoring. Seventeen native species were recorded growing at this site, nine of which were seeded during 2019 revegetation efforts. This is an increase from the 11 native species detected during 2017 monitoring. The dominant native species were unidentified young bunchgrasses, which had a coverage of 2.3%. Big sagebrush remaining from the initial revegetation had a coverage of 1.5%. The dominant invasive species remains cheatgrass, which had a coverage of 22.5%. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was observed on the site but was not detected during canopy cover monitoring.

Second-year shrub transect monitoring was conducted in November 2020. One 100-m (328.08-ft) transect was established during the revegetation process in order to track shrub planting density and quality. Shrubs planted in FY 2014 and 2019 were both recorded on this transect during first-year monitoring and shrub density was 368 plants/ac. Considering only the shrubs that had been planted in 2019, shrub density was 295 plants/ac, which is above success criteria. This measure decreased slightly in 2020 when shrub density was 247 plants/ac of shrubs that had been planted in 2019. Monitoring in 2020 detected over 200 sagebrush recruits on the transect. It is suspected that the disturbance from seeding efforts in 2019 may have resulted in an influx of sagebrush seedlings.

**Table 6. Percent Canopy Cover and Frequency of Occurrence at the 100-K-95 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achnatherum hymenoides* (Indian ricegrass) | 1.2 | 8.0 |
| *Artemisia tridentata* (big sagebrush) | 1.5 | 4.0 |

**Table 6. Percent Canopy Cover and Frequency of Occurrence at the 100-K-95 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Artemisia tridentata* (planted) | 0.3 | 12.0 |
| *Bromus tectorum* (cheatgrass) [a] | 22.5 | 92.0 |
| Bunchgrass sp. (multiple) | 2.3 | 52.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | X | X |
| *Chaenactis douglasii* (Douglas' dustymaiden) | X | X |
| *Draba verna* (spring draba) [a] | 2.6 | 64.0 |
| *Elymus elymoides* (squirreltail) | 0.1 | 4.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 4.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.0 | 0.0 |
| *Erigeron* (sp.) | X | X |
| *Eriogonum niveum* (snow buckwheat) | X | X |
| *Grayia spinosa* (planted) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 0.1 | 4.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 4.0 | 80.0 |
| *Lactuca serriola* (prickly lettuce) [a] | X | X |
| *Lomatium gormanii* (Gorman's biscuitroot) | 0.1 | 4.0 |
| *Matricaria chamomilla* (wild chamomile) [a] | X | X |
| *Microsteris gracilis* (slender phlox) | 1.0 | 40.0 |
| *Poa secunda* (Sandberg bluegrass) | 0.9 | 16.0 |
| *Purshia tridentata* (planted) | X | X |
| *Salsola kali* (Russian thistle) [a] | 0.8 | 32.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.6 | 24.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| Crust | 0.2 | 8.0 |
| Soil | 28.1 | 72.0 |
| Litter | 69.3 | 100.0 |
| Rock/Cobble | 0.8 | 32.0 |
| Unavailable Space [c] | 0.0 | 0.0 |
| **Total canopy cover** (excludes crust/soil/litter) | **38.1** | |
| **Total Native % Cover** | **7.6** | |
| Total Invasive % Cover | 30.5 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
[c] Not measured at this site
X = present but not counted in plot frames

**Figure 4. The 100-K-95 Site in 2020, Showing Both the Original Sagebrush and the Newly Planted Sagebrush.**

### 3.2.2 100-K-CTA Site (Container Transfer Area)

The 100-K-CTA site was originally revegetated in FY 2015. Due to a lack of shrubs that established on the site during initial monitoring in 2016, no shrub transect was established for this site. The 2017 canopy cover monitoring found 38.4% coverage, with 7.6% native cover and 30.8% invasive cover. Additional revegetation efforts were recommended to increase native species cover and to improve the shrub establishment on the site. The substrate at this site is mostly loam with large cobbles interspersed throughout (Figure 5).

The 100-K-CTA site was redone in FY 2019. This site was broadcast seeded with shrub, forb, and grass species from the FY 2019 Revegetation Seed Mix (Appendix B). Care was taken to avoid crushing mature sagebrush plants during this process. This site was also planted with sagebrush, bitterbrush (*Purshia tridentata*), and hopsage (*Grayia spinosa*) seedlings in FY 2019 at a rate of 400, 100, and 13 plants per acre, respectively. Additional seedlings added at this site in FY 2020 included forbs at a rate of 100 plants per acre and hopsage at a rate of 87 plants per acre. Table 7 displays the detection rate for species seeded at the 100-K-CTA site in 2019.

**Table 7. Species seeded at the 100-K-CTA Site in 2019. (2 Pages)**

| Species | Detected in 2019? | Pounds per Acre |
|---|---|---|
| Gray Rabbitbrush (*Ericameria nauseosa*) | Yes | 0.14 |
| Green Rabbitbrush (*Chrysothamnus viscidiflorus*) | No | 0.14 |
| Blue Mountain Buckwheat (*Eriogonum strictum*) | No | 0.14 |
| Snow Buckwheat (*Eriogonum niveum*) | Yes | 0.18 |
| Munro's globemallow (*Sphaeralcea munroana*) | Yes | 0.18 |

**Table 7. Species seeded at the 100-K-CTA Site in 2019. (2 Pages)**

| Species | Detected in 2019? | Pounds per Acre |
|---|---|---|
| Carey's balsamroot (*Balsamorhiza careyana*) | No | 0.18 |
| Crouching milkvetch (*Astragalus succumbens*) | Yes | 0.18 |
| Cushion fleabane (*Erigeron poliospernus*) | No | 0.16 |
| Threadleaf fleabane (*Erigeron filifolius*) | No | 0.16 |
| Hoary falseyarrow (*Chaenactis douglasii*) | Yes | 0.16 |
| Sandberg's bluegrass (*Poa secunda*) | Yes | 9.8 |
| Needle-and-thread grass (*Hesperostipa comata*) | Yes | 7.0 |
| Indian ricegrass (*Oryzopsis hymenoides*) | Yes | 5.6 |
| Bottlebrush squirreltail (*Elymus elymoides*) | Yes | 5.6 |

Canopy cover monitoring was performed at the 100-K-CTA Site in 2019. Total canopy cover was 29.6%, with 10.4% native and 19.2% invasive cover (Table 8). Native cover had increased by 2.8% since 2017 monitoring. Nineteen native species were recorded growing at this site, nine of which were seeded during 2019 revegetation efforts. This is an increase of 11 native species detected at the site since 2017 monitoring, where only 8 were found. The dominant native species was needle-and-thread grass (*Hesperostipa comata*), which had a coverage of 3.0%, followed by big sagebrush from the original planting with a cover of 2.5%. The dominant invasive species remains cheatgrass (*Bromus tectorum*), which had a coverage of 8.4%.

Second-year shrub transect monitoring was conducted in October 2020. Two 100-m transects were established in order to track shrub planting density and quality. Only newly planted shrubs were recorded, shrubs planted in FY 2014 were not recorded on this transect. Shrub density was 306 plants/ac, which is above success criteria and is an improvement on the pre-redo shrub success. Transect monitoring showed 89.2% survival from 2019 to 2020. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was observed on the site at a coverage of less than 1%.

**Table 8. Percent Canopy Cover and Frequency of Occurrence at the 100-K-CTA Site in 2019. (3 Pages)**

| Species | East Area | | West Area | | Entire Site | |
|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| *Achillea millefollium* (common yarrow) | X | X | 0.6 | 4 | 0.6 | 4.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | X | X | X | X | X | X |
| *Artemisia tridentata* (big sagebrush) (existing) | 1.7 | 8.0 | 3.4 | 4.0 | 2.5 | 6.0 |
| *Artemisia tridentata* (big sagebrush) (transplants) | 0.5 | 18.0 | 0.4 | 16.0 | 0.4 | 17.0 |
| *Astragalus purshii* (woollypod milkvetch) | 0.1 | 4.0 | - | - | 0.1 | 4.0 |
| *Astragalus succumbens* (crouching milkvetch) | X | X | X | X | X | X |

**Table 8. Percent Canopy Cover and Frequency of Occurrence at the 100-K-CTA Site in 2019. (3 Pages)**

| Species | East Area | | West Area | | Entire Site | |
|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| *Bromus tectorum* (cheatgrass) [a] | 7.1 | 96 | 9.6 | 100.0 | 8.4 | 98.0 |
| *Bunchgrass sp.* (multiple) | 0.1 | 4.0 | 0.4 | 15.0 | 0.2 | 9.5 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | 0.4 | 4.0 | 0.9 | 16.0 | 0.6 | 10.0 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | 0.1 | 4.0 | 0.1 | 5.0 | 0.1 | 4.5 |
| *Chenopodium leptophyllym* (narrowleaf goosefoot) | X | X | X | X | X | X |
| *Draba verna* (spring draba) [a] | 1.5 | 60.0 | 2.1 | 75.0 | 1.8 | 67.5 |
| *Elymus elymoides* (squirreltail) | X | X | X | X | X | X |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.2 | 8.0 | 0.2 | 6.5 | 0.2 | 7.3 |
| *Ericameria nauseosa* (rubber rabbitbrush) | - | - | 0.1 | 5.0 | 0.1 | 5.0 |
| *Eriogonum niveum* (snow buckwheat) | X | X | X | X | X | X |
| *Grayia spinosa* (spiny hopsage) (transplants) | X | X | - | - | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 2.9 | 54.0 | 3.1 | 60.0 | 3.0 | 57.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 2.1 | 64.0 | 1.7 | 68.5 | 1.9 | 66.3 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.7 | 26.0 | 1.1 | 32.5 | 0.9 | 29.3 |
| *Poa secunda* (Sandberg bluegrass) | 1.7 | 28.0 | 2.7 | 34.0 | 2.2 | 31.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 1.3 | 22 | 0.5 | 9.5 | 0.9 | 15.8 |
| *Purshia tridentata* (antelope bitterbrush) | 0.2 | 8.0 | - | - | 0.2 | 8.0 |
| *Ranunculus testiculatus* (burr buttercup) [a] | - | - | 0.1 | 4.0 | 0.1 | 4.0 |
| *Salsola kali* (Russian thistle) [a] | 2.9 | 74.0 | 2.4 | 76.0 | 2.6 | 75.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 2.5 | 58.0 | 2.0 | 45.5 | 2.2 | 51.8 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X | X | X | X | X |
| Crust | 1.8 | 30.0 | 3.6 | 60.0 | 2.7 | 45.0 |
| Soil | 2.9 | 46.0 | 17.3 | 75.0 | 10.1 | 60.5 |
| Litter | 52.2 | 100.0 | 50.1 | 97.5 | 51.2 | 98.8 |
| Rock/Cobble | 30.6 | 88.0 | 14.9 | 85.0 | 22.7 | 86.5 |
| Unavailable Space | 2.4 | 26.0 | 5.0 | 34.0 | 3.7 | 30.0 |
| **Total Canopy Cover** | 26.1 | | 33.0 | | **29.5** | |
| **Native % Cover** | 8.7 | | 12.0 | | **10.3** | |
| Invasive % Cover | 17.4 | | 21.0 | | 19.2 | |
| Unadjusted canopy cover | 25.5 | | 31.4 | | 28.4 | |
| Unadjusted Native % Cover | 8.5 | | 11.4 | | 9.9 | |
| Unadjusted Invasive % Cover | 17.0 | | 19.9 | | 18.5 | |

[a] Invasive species

[b] Washington State Classified Noxious Weed (class)

- = species not observed on site

X = present but not counted in plot frames

**Figure 5. The 100-K-CTA site after being redone in 2020.**

### 3.2.3 128-K-2 Site (Burn Pit and Soil Staging Area)

The 128-K-2 Burn Pit and the 128-K-2 Soil Staging Area were monitored as one site due to their close proximity, similarity in age, and the supplemental planting that occurred at this site (Figure 6). Both sites were planted in FY 2013 and have a substrate that is sandy loam with varying amounts of cobble. The 2017 monitoring at the 128-K-2 Burn Pit site showed a decrease in native cover from the previous year. Total canopy cover was 35.8%, with 11.1% native cover. Eight native species were recorded at the site. The 2017 monitoring at the 128-K-2 Soil Staging Area also showed a decrease in native cover from the previous year; canopy cover was 55.7% with 14.1% native cover. Only six native species were recorded at this site in 2017. When combined, these sites averaged 12.6% native cover and had nine native species detected. Additional revegetation actions were recommended for both of these areas. In FY 2019, these sites were planted with 7-in.$^3$ forb plugs in an effort to increase native species cover and diversity. A total of 675 globemallow (*Sphaeralcea munroana*), 725 snow buckwheat (*Erigeron niveum*), and 100 cushion fleabane (*Erigeron poliospermus*) were planted at this site. Planting forb plugs is a new effort and the plug survival will be tracked closely to determine the cost-benefit of this process compared to seeding forbs. Canopy cover monitoring and transect monitoring were initiated at this site in 2019.

First-year canopy cover monitoring occurred at the 128-K-2 site in 2019 (Table 9). Canopy cover totaled 44.7%, with 27.3% native and 17.4% invasive cover. Various bunchgrasses accounted for the increase in native cover including Sandberg's bluegrass (*Poa secunda*, 8.8% cover), needle-and-thread grass (*Hesperostipa comata*, 5.0% cover), and bluebunch wheatgrass (*Pseudoroegneria spicata*, 4.4% cover). Native cover has increased by 13.2% since 2017. Cheatgrass (*Bromus tectorum*) was the dominant invasive species with 9.6% cover. Forb plugs

planted during FY 2019 accounted for an increase in native species cover by 1% and are expected to continue to grow, produce seed, and expand their populations. Multiple planted forbs were seen flowering and producing seed at this site. Ten native species were recorded at this site. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was observed on the site at a coverage of less than 1%.

One transect was established in the portion of the 128-K-2 site previously referred to as the Burn Pit. Forbs planted in 2019 and sagebrush from the original 2013 planting were recorded on this transect. Second-year transect monitoring occurred at this site in October 2020. A total of 61.9% of the sagebrush on the transect had seed, suggesting the sagebrush will continue to seed and reproduce on the site. Many sagebrush recruits were recorded on the transect, suggesting the sagebrush seed is successfully germinating and expanding its population. Including recruits, sagebrush had a density of 425 plants/ac, well above success levels and an increase from 2019. Only one cushion fleabane was detected on the transect in 2019 and it was not found in 2020. A total of 61% of the globemallow plants were in bloom in 2020 and monitoring results show that 56% of the plants were surviving from the initial planting. A total of 28% of the snow buckwheat plants were in bloom, with 65% surviving from the initial planting. Planted forbs had a density of 174 plants/ac.

As of second-year monitoring, the high proportion of flowering forbs and the high survival rate suggests that forb planting at this site was a success and has resulted in the forbs establishing and re-seeding. Sagebrush cover is successful and increasing at this site; monitoring for sagebrush density may end. It is recommended that transect monitoring continue for forb species and that canopy cover monitoring continue to determine if the forb planting has a significant effect on total native cover.

**Table 9. Percent Canopy Cover and Frequency of Occurrence at the 128-K-2 Site in 2019.**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.4 | 2.9 |
| *Amaranthus albus* (white pigweed) [a] | X | X |
| *Artemisia tridentata* (big sagebrush) | 4.9 | 17.1 |
| *Artemisia tridentata* (recruits) | 1.4 | 11.4 |
| *Bromus tectorum* (cheatgrass) [a] | 9.6 | 94.3 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | 0.3 | 11.4 |
| *Chenopodium leptophyllym* (narrowleaf goosefoot) | X | X |
| *Draba verna* (spring draba) [a] | 3.8 | 94.3 |
| *Ericameria nauseosa* (rubber rabbitbrush) | X | X |
| *Erigeron poliospermus* (cushion fleabane) | X | X |
| *Eriogonum niveum* (snow buckwheat) | 0.8 | 17.1 |
| *Hesperostipa comata* (needle-and-thread grass) | 5.0 | 48.6 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.3 | 51.4 |
| *Poa secunda* (Sandberg bluegrass) | 8.8 | 85.7 |

| | | |
|---|---|---|
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 4.4 | 22.9 |
| *Salsola kali* (Russian thistle) [a] | 1.2 | 48.6 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.1 | 5.7 |
| *Sphaeralcea munroana* (Munro's globemallow) | 0.2 | 8.6 |
| *Tragopogon dubius* (yellow salsify) [a] | 0.1 | 2.9 |
| Crust | 11.4 | 65.7 |
| Soil | 17.9 | 71.4 |
| Litter | 25.9 | 100.0 |
| Rock/Cobble | 31.1 | 88.6 |
| Unavailable Space | 5.5 | 65.7 |
| **Total Canopy Cover** | **44.7** | |
| **Native % Cover** | **27.3** | |
| Invasive % Cover | 17.4 | |
| Unadjusted Canopy Cover | 42.2 | |
| Unadjusted Native % Cover | 25.8 | |
| Change in Native % Cover from 2017 [c] | 13.2 | |
| Unadjusted Invasive % Cover | 16.4 | |
| Change in Invasive % Cover from 2017 [c] | -16.8 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
[c] Average from 128-K-2-SSA and 128-K-2 Burn Pit
X = present but not counted in plot frames

**Figure 6. The 128-K-2 Soil Staging Area in 2020.**

## 3.3 100-N AREA SITES

Seven sites were monitored in the 100-N Area: 130-N-1:1, 100-N-96, 100-N-83, 100-N-CTA, 100-N-61:1, 100-N-South, and 124-N-10. The 100-N-83 site was revegetated in FY 2017. The other six sites in the 100-N Area monitored in October 2020 had been recommended for additional revegetation actions after FY 2019 monitoring found that representative sites were not going to meet success levels. These sites had additional revegetation actions performed in early FY 2020. The 100-N-South and 100-N-96 sites were re-seeded and had shrub and forb plugs planted in FY 2020. The 130-N-1:1, 100-N-CTA, 100-N-61:1, and 124-N-10 sites had supplemental shrub and forb plugs planted in FY 2020. The 100-N-83 site was monitored for the fourth year in 2020, while the other six sites were monitored for the first year since supplemental planting.

All sites were initially remediated to meet the objectives for interim closure as established in the 100-N Area RDR/RAWP (DOE/RL-2005-93) and in the Interim Action ROD (EPA 2000a, 2000b). The 100-N-96 site had additional revegetation guidelines as stated in the *Memorandum of Agreement (MOA) Between the U.S. Department of Energy, Richland Operations Office and the Washington State Historic Office, and the Advisory Council on Historic Preservation Regarding the Remediation of the 100-N-96 Waste Site* (DOE-RL et al. 2014). Sites 100-N-83 and 100-N-CTA had additional revegetation guidelines as stated in the *Memorandum of Agreement (MOA) Between the U.S. Department of Energy, Richland Operations Office and the Washington State Department of Archaeology and Historic Preservation Regarding Removal and Remedial Actions, Demobilization and Area Revegetation for the 100-N Area of the Hanford Site* (DOE-RL et al. 2015a). Initial revegetation efforts entailed broadcast seeding at approximately 15 lb/ac with a mixture of native grasses including Sandberg's bluegrass (*Poa secunda*), Indian ricegrass (*Achnatherum hymenoides*), bluebunch wheatgrass (*Pseudoroegneria spicata*), squirreltail (*Elymus elymoides*), needle-and-thread grass (*Hesperostipa comata*), and prairie junegrass (*Koeleria macrantha*) topped with a straw mulch that was crimped into the soil surface. Shrub species (including big sagebrush [*Artemisia tridentata*], antelope bitterbrush [*Purshia tridentata*], and spiny hopsage [*Grayia spinosa*]) were transplanted on the sites at approximately 500 to 650 plants/ac with a mix of approximately 75% sagebrush, 15% bitterbrush, and 10% spiny hopsage, with the exception of site 100-N-96. The 100-N-96 site received varying planting ratios ranging from 60 to 75% big sagebrush, 5 to 15% antelope bitterbrush, 10 to 30% spiny hopsage, and approximately 1% (cumulatively) of rubber rabbitbrush (*Ericameria nauseosa*) and yellow rabbitbrush (*Chrysothamnus viscidiflorus*). Additional revegetation efforts performed in FY 2020 are summarized for each site.

### 3.3.1 130-N-1:1 Site (183-N Northeastern Backwash Discharge Pond)

The 130-N-1:1 site (Figure 7) was initially revegetated in FY 2015 and monitoring was first conducted for the site in 2015. The substrate for the site is characterized predominantly by cobbles with some loamy sand in the south area (Area 1) and predominantly sandy loam in the north area (Area 2) with increased amounts of cobbles in the south portion of this area. Additional shrub and forb plugs were added in this site in FY 2020; sagebrush (*Artemisia tridentata*) was planted at a rate of 300 plants/ac, and bitterbrush (*Purshia tridentata*), hopsage (*Grayia spinosa*), and forbs were each planted at a rate of 50 plants/ac. Forbs planted included Munro's globemallow (*Sphaeralcea munroana*) and snowy buckwheat (*Erigeron niveum*).

First-year transect monitoring for supplemental planting for the site was conducted in October 2020. Two transects had been established for this site in 2015, one in the sandy loam area and one in the cobble area. The 2020 results show an average shrub density of 322 plants/ac for the site overall. This is an increase from the pre-supplemental planting density of 239 plants/ac that was reported in 2019 and indicates that supplemental planting has improved this site to successful levels. Planted forbs were also recorded on the transects and were detected at an average density of 34 forbs/ac.

Canopy cover data for the site was collected in April 2019. Data was collected from 25 plot frames in each of the two areas. Canopy cover for the site overall was 37.4%, with 22.5% native cover and 14.9% invasive cover (Table 10). This represents an increase of 10.4% in native cover and decrease of 9.5% in invasive cover from 2018. Sandberg's bluegrass (*Poa secunda*) and bluebunch wheatgrass (*Pseudoroegneria spicata*) were the dominant native species with 7.6% cover and 6.9% cover, respectively. Cheatgrass (*Bromus tectorum*) is the dominant invasive species with 7.9% cover. Fifteen native species were identified at this site in 2019. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was recorded at 1% cover occurring in 4% of the plot frames.

The additional shrub plantings at the 130-N-1:1 site have brought the site above success levels. Continued monitoring for shrub survival will indicate if the site will be successful in the long term. The supplemental forb and shrub plantings are expected to increase native canopy cover to successful levels in the coming years. No additional action apart from continued monitoring is recommended at this site.

**Table 10. Percent Canopy Cover and Frequency of Occurrence at the 130-N-1:1 Site in 2019. (2 Pages)**

| Species | Area 1 (cobble) | | Area 2 (loamy sand) | | Entire Site | |
|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| *Achillea millefollium* (common yarrow) | 0.6 | 4.0 | X | X | 0.3 | 2.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.6 | 24.0 | 2.8 | 52.0 | 1.7 | 38.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | X | X | 0.2 | 8.0 | 0.1 | 4.0 |
| *Artemisia tridentata* (big sagebrush) | 1.5 | 4.0 | 0.8 | 12.0 | 1.2 | 8.0 |
| *Artemisia tridentata* (recruits) | 0.9 | 16.0 | X | X | 0.5 | 8.0 |
| *Bromus tectorum* (cheatgrass) [a] | 6.0 | 100.0 | 9.8 | 100.0 | 7.9 | 100.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | 0.2 | 8.0 | X | X | 0.1 | 4.0 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | X | X | - | - | X | X |
| *Draba verna* (spring draba) [a] | 1.5 | 60.0 | 2.1 | 64.0 | 1.8 | 62.0 |
| *Elymus elymoides* (squirreltail) | 0.9 | 16.0 | 2.0 | 20.0 | 1.5 | 18.0 |

**Table 10. Percent Canopy Cover and Frequency of Occurrence at the 130-N-1:1 Site in 2019. (2 Pages)**

| Species | Area 1 (cobble) | | Area 2 (loamy sand) | | Entire Site | |
|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 4.0 | 0.1 | 4.0 | 0.1 | 4.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | - | - | 0.1 | 4.0 | 0.1 | 2.0 |
| *Erigeron pumilus* (shaggy fleabane) | X | X | - | - | X | X |
| *Erodium cicutarium* (redstem stork's bill) [a] | - | - | 0.1 | 4.0 | 0.1 | 2.0 |
| *Hesperostipa comata* (needle-and-thread grass) | 0.3 | 12.0 | 0.2 | 8.0 | 0.3 | 10.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.0 | 40.0 | 2.2 | 68.0 | 1.6 | 54.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.4 | 16.0 | 0.8 | 32.0 | 0.6 | 24.0 |
| *Lamium amplexicaule* (henbit deadnettle) [a] | 0.2 | 8.0 | - | - | 0.1 | 4.0 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X | X | X | X | X |
| *Melilotus officinalis* (sweetclover) [a] | 0.1 | 4.0 | - | - | 0.1 | 2.0 |
| *Microsteris gracilis* (slender phlox) | - | - | 0.1 | 4.0 | 0.1 | 2.0 |
| *Poa secunda* (Sandberg bluegrass) | 6.2 | 88.0 | 8.9 | 96.0 | 7.6 | 92.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 9.1 | 72.0 | 4.7 | 36.0 | 6.9 | 54.0 |
| *Salsola kali* (Russian thistle) [a] | 0.9 | 36.0 | 0.8 | 32.0 | 0.9 | 34.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.4 | 16.0 | - | - | 0.2 | 8.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | - | - | X | X | X | X |
| *Tragopogon dubius* (yellow salsify) [a] | X | X | - | - | X | X |
| Crust | 1.3 | 12.0 | 1.7 | 48.0 | 1.5 | 30.0 |
| Soil | 12.9 | 60.0 | 21.5 | 96.0 | 17.2 | 78.0 |
| Litter | 15.9 | 96.0 | 21.4 | 92.0 | 18.7 | 94.0 |
| Rock/Cobble | 45.7 | 100.0 | 25.1 | 100.0 | 35.4 | 100.0 |
| Unavailable Space | 13.2 | 100.0 | 8.7 | 92.0 | 11.0 | 96.0 |
| **Total Canopy Cover** | **35.6** | | **39.1** | | **37.4** | |
| **Total Native % Cover** | **23.3** | | **21.8** | | **22.5** | |
| Total Invasive % Cover | 12.3 | | 17.3 | | 14.9 | |
| Unadjusted canopy cover | 30.9 | | 35.7 | | 33.3 | |
| Unadjusted Native % Cover | 20.2 | | 19.9 | | 20.1 | |
| Change in Native % Cover from 2018 | 8.0 | | 12.7 | | 10.4 | |
| Unadjusted Invasive % Cover | 10.7 | | 15.8 | | 13.3 | |
| Change in Invasive % Cover from 2018 | 2.0 | | -20.9 | | -9.5 | |

[a] = Invasive species
[b] = Washington State Classified Noxious Weed (class)
X = present but not counted in plots
- = species not found

**Figure 7. The Cobble Section of the 130-N-1:1 Site in 2020.**

### 3.3.2 100-N-96 Site (Military Camp Disposal Pits)

The 100-N-96 site was initially revegetated in FY 2016 and monitoring was first conducted for the site in 2016. The substrate for the site is characterized by loamy sand with varying amounts of gravel. In keeping with the *Memorandum of Agreement (MOA) Between the U.S. Department of Energy, Richland Operations Office and the Washington State Historic Office, and the Advisory Council on Historic Preservation Regarding the Remediation of the 100-N-96 Waste Site* (DOE-RL et al. 2014), seeds from several native forbs were collected from the Hanford Site and broadcast on the site along with the standard native grass seed mix. Rubber rabbitbrush (*Ericameria nauseos*a) and yellow rabbitbrush (*Chrysothamnus viscidiflorus*) were also planted on this site along with the standard mix of big sagebrush, antelope bitterbrush, and spiny hopsage. The 2019 monitoring found this site was trending below success criteria and additional revegetation actions were recommended. The 100-N-96 site was re-seeded using ATV broadcast seeders to minimally disturb the existing soil and vegetation. It was re-seeded using the FY 2020 re-work seed mix (Table 1) and planted with shrubs and forbs. Sagebrush (*Artemisia tridentata*) was planted at a rate of 400 shrubs/ac, bitterbrush (*Purshia tridentata*) and hopsage (*Grayia spinosa*) were planted at a rate of 100 plants/ac, and forbs were planted at a rate of 200 plants/ac.

A 75-m (246-ft) shrub monitoring transect with approximately 3-m (9.8-ft) offsets was established for the site in 2016. This same transect was used during FY 2020 monitoring, which occurred in October 2020. First-year supplemental planting monitoring results show a shrub density of 297 shrubs/ac, which is an increase over the pre-supplemental shrub density of 140 plants/ac that was recorded in 2019. Snow buckwheat survival is being tracked on this transect; 11% of the snow buckwheat on this transect were in bloom in 2020.

Canopy cover data for the site was collected in April 2019. Canopy cover for the site was 50.7%, with native cover representing 19.3% and invasive cover representing 31.4% (Table 11). This represents an increase of 9.7% in native cover and an increase of 1.2% in invasive cover from 2018. The dominant native species was Sandberg's bluegrass (*Poa secunda*), with 11.9% cover followed by common yarrow (*Achillea millefollium*) with 2.1% cover. Cheatgrass (*Bromus tectorum*) was the dominant species for the site overall with 19.9% cover. Nine native species were detected during 2019 monitoring. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was observed on the site with less than 1% cover and was detected in 4% of plot frames.

The FY 2020 supplemental planting has brought the 100-N-96 shrub density to successful levels. It cannot be determined at this time if the re-seeding increased native cover at the 100-N-96 site, as canopy cover measurements were not performed in 2020. It is recommended that this site continue to be monitored to determine if the shrub density success will be long-term and to determine if re-seeding helped increase native cover.

**Table 11. Percent Canopy Cover and Frequency of Occurrence at the 100-N-96 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 2.1 | 8.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.6 | 4.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.9 | 16.0 |
| *Artemisia tridentata* (big sagebrush) | 1.8 | 12.0 |
| *Bromus tectorum* (cheatgrass) [a] | 19.9 | 100.0 |
| *Centaurea diffusa* (diffuse knapweed) [b] | 0.6 | 4.0 |
| *Draba verna* (spring draba) [a] | 5.4 | 96.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.1 | 4.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.9 | 76.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.3 | 12.0 |
| *Machaeranthera canescens* (hoary tansymustard) | 0.1 | 4.0 |
| *Poa secunda* (Sandberg bluegrass) | 11.9 | 84.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 1.7 | 28.0 |
| *Salsola kali* (Russian thistle) [a] | 1.1 | 44.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 1.4 | 56.0 |
| *Triticum sp.* (wheat) [a] | 0.6 | 4.0 |
| *Microsteris gracilis* (slender phlox) | 0.3 | 12.0 |
| Mushroom sp. | 0.1 | 4.0 |
| *Erodium cicutarium* (redstem stork's bill) [a] | 0.7 | 8.0 |
| Crust | 6.6 | 84.0 |
| Soil | 39.7 | 92.0 |
| Litter | 25.1 | 92.0 |
| Rock/Cobble | 12.9 | 40.0 |
| Unavailable Space | 0.6 | 24.0 |
| **Total Canopy Cover** | **50.7** | |

**Table 11. Percent Canopy Cover and Frequency of Occurrence at the 100-N-96 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| **Native % Cover** | **19.3** | |
| Invasive % Cover | 31.4 | |
| Unadjusted canopy cover | 50.4 | |
| Unadjusted Native % Cover | 19.2 | |
| Change in Native % Cover from 2018 | 9.7 | |
| Unadjusted Invasive % Cover | 31.2 | |
| Change in Invasive % Cover from 2018 | 1.2 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)

### 3.3.3 100-N-83 Site (Cleaned Contamination Area)

The 100-N-83 site (Figure 8) was revegetated in FY 2017 and monitoring was first conducted for the site in 2017. The substrate for the site is mainly sandy loam with varying amounts of gravel and cobble. In keeping with the *Memorandum of Agreement (MOA) Between the U.S. Department of Energy, Richland Operations Office and the Washington State Department of Archaeology and Historic Preservation Regarding Removal and Remedial Actions, Demobilization and Area Revegetation for the 100-N Area of the Hanford Site* (DOE-RL et al. 2015a), seeds from several native forbs were collected from the Hanford Site and broadcast on the site along with the standard native grass seed mix.

Forb species seeded at the 100-N-CTA included coyote tobacco (*Nicotiana attenuata*), Munro's globemallow (*Sphaeralcea munroana*), longleaf phlox (*Phlox longifolia*), slender phlox (*Microsteris gracilis*), Carey's balsamroot (*Balsamorhiza careyana*), desert parsley (*Lomatium sp.*), common yarrow (*Achillea millefolium*), mariposa lily (*Calochortus macrocarpus*), upland larkspur (*Delphinium nuttallianum*), shaggy fleabane (*Erigeron pumilis*), white-stemmed blazingstar (*Mentzelia albicaulis*), woollypod milkvetch (*Astragalus purshii*), Douglas' dustymaiden (*Chaenactis douglasii*), and yellowbell (*Fritillaria pudica*). The rates at which these species were seeded and the viability of the seed planted is unknown. Native grass seed was broadcast seeded at an average of approximately 18 lb/ac and was composed of Sandberg's bluegrass (*Poa secunda*), bluebunch wheatgrass (*Pseudoroegneria spicata*), needle-and-thread grass (*Hesperostipa comata*), Indian Ricegrass (*Achnatherum hymenoides*), bottlebrush squirreltail (*Elymus elymoides*), Idaho fescue (*Festuca idahoensis*), thickspike wheatgrass (*Elymus lanceolatus*), and sand dropseed (*Sporobolus cryptandrus*). All of these grasses (except thickspike wheatgrass, Idaho fescue, and sand dropseed) were recorded at the site in 2019.

Two 100-m (328-ft) shrub monitoring transects were monitored for the site in November 2020 for fourth-year monitoring: Transect 1 in the lower (south) portion of the site and Transect 2 in the upper (north) portion of the site. Big sagebrush (*Artemisia tridentata*), spiny hopsage (*Grayia spinosa*), and antelope bitterbrush (*Purshia tridentata*) were recorded along both transects. The shrub density for the lower area was 291 plants/ac and the density for the upper

area was 235 plants/ac; this equates to about 261 plants/ac for the site overall, above the success criteria of 240 plants/ac.

Canopy cover data for the site was collected in April 2019. Canopy cover for the site was 53.3% (Table 12). Native cover for the site was 12.5%, an increase of 5.4% from the year previous. Invasive cover increased by 7.9% since 2018 monitoring. Fifteen native species were recorded for the site. Bluebunch wheatgrass (*Pseudoroegneria spicata*) is the dominant native species at this site with 3.5% cover. Cheatgrass (*Bromus tectorum*) is the dominant invasive species for the site overall with 30.5% cover, and increased by 7.2% since 2018. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, had a cover of less than 1% and occurred in 6% of the plot frames. Rush skeletonweed (*Chondrilla juncea*), a Washington State Class B noxious weed, was present on the site with less than 1% cover and was recorded in 2% of the plot frames.

Additional revegetation actions are not recommended for this site at this time. Fifth-year canopy cover monitoring in FY 2021 will indicate if native cover is increasing and will help determine if additional seeding is needed.

**Table 12. Percent Canopy Cover and Frequency of Occurrence at the 100-N-83 Site in 2019. (2 Pages)**

| Species | Lower Area | | Upper Area | | Entire Site | |
|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| *Achillea millefollium* (common yarrow) | 0.6 | 4.0 | 0.6 | 4.0 | 0.6 | 4.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | - | - | X | X | X | X |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | - | - | 2.6 | 44.0 | 1.3 | 22.0 |
| *Artemisia tridentata* (big sagebrush) | 3.1 | 24.0 | 1.3 | 12.0 | 2.2 | 18.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 28.0 | 100.0 | 33.0 | 100.0 | 30.5 | 100.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | 0.7 | 8.0 | 0.1 | 4.0 | 0.4 | 6.0 |
| *Chondrilla juncea* (rush skeletonweed) (B) [(b)] | 0.1 | 4.0 | - | - | 0.1 | 2.0 |
| *Chorispora tenella* (crossflower) [(a)] | 0.1 | 4.0 | - | - | 0.1 | 2.0 |
| *Draba verna* (spring draba) [(a)] | 1.1 | 44.0 | 1.2 | 48.0 | 1.2 | 46.0 |
| *Elymus elymoides* (squirreltail) | 0.1 | 4.0 | 0.2 | 8.0 | 0.2 | 6.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.5 | 20.0 | X | X | 0.3 | 10.0 |
| *Ericamerua nauseosa* (rubber rabbitbrush) | 0.1 | 4.0 | X | X | 0.1 | 2.0 |
| *Erodium cicutarium* (redstem stork's bill) [(a)] | 0.1 | 4.0 | - | - | 0.1 | 2.0 |
| *Grayia spinosa* (spiny hopsage) | - | - | 0.1 | 4.0 | 0.1 | 2.0 |
| *Hesperostipa comata* (needle-and-thread grass) | 0.1 | 4.0 | - | - | 0.1 | 2.0 |
| *Holosteum umbellatum* (jagged chickweed) [(a)] | 0.9 | 36.0 | 2.2 | 48.0 | 1.6 | 42.0 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 3.1 | 84.0 | 0.2 | 8.0 | 1.7 | 46.0 |
| *Lomatium macrocarpum* (bigseed desertparsley) | - | - | X | X | X | X |

**Table 12. Percent Canopy Cover and Frequency of Occurrence at the 100-N-83 Site in 2019. (2 Pages)**

| Species | Lower Area | | Upper Area | | Entire Site | |
|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| *Machaeranthera canescens* (hoary tansyaster) | X | X | - | - | X | X |
| *Microsteris gracilis* (slender phlox) | 0.3 | 12.0 | 0.4 | 16.0 | 0.4 | 14.0 |
| *Poa secunda* (Sandberg bluegrass) | 3.7 | 68.0 | 2.3 | 52.0 | 3.0 | 60.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 5.0 | 44.0 | 2.0 | 40.0 | 3.5 | 42.0 |
| *Salsola kali* (Russian thistle) [a] | 0.5 | 20.0 | 0.7 | 28.0 | 0.6 | 24.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.1 | 4.0 | 2.5 | 60.0 | 1.3 | 32.0 |
| *Triticum sp.* (wheat) [a] | 0.1 | 4.0 | X | X | 0.1 | 2.0 |
| Crust | 0.0 | 0.0 | 0.1 | 4.0 | 0.1 | 2.0 |
| Soil | 4.9 | 64.0 | 20.3 | 68.0 | 12.6 | 66.0 |
| Litter | 28.1 | 96.0 | 55.1 | 100.0 | 41.6 | 98.0 |
| Rock/Cobble | 32.4 | 96.0 | 11.4 | 68.0 | 21.9 | 82.0 |
| Unavailable Space | 12.3 | 84.0 | 4.4 | 56.0 | 8.4 | 70.0 |
| **Total Canopy Cover** | 55.1 | | 51.7 | | **53.3** | |
| **Native % Cover** | 15.4 | | 9.9 | | **12.5** | |
| Invasive % Cover | 39.7 | | 41.7 | | 40.8 | |
| Unadjusted canopy cover | 48.3 | | 49.4 | | 48.9 | |
| Unadjusted Native % Cover | 13.5 | | 9.5 | | 11.5 | |
| Change in Native % Cover from 2018 | 8.3 | | 2.5 | | 5.4 | |
| Unadjusted Invasive % Cover | 34.8 | | 39.9 | | 37.4 | |
| Change in Invasive % Cover from 2018 | 13.3 | | 2.6 | | 7.9 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames
- = species not observed

**Figure 8. The 100-N-83 Site in 2020.**

### 3.3.4 100-N-CTA Site (Container Transfer Area)

The 100-N-CTA site (Figure 9) was initially revegetated in FY 2017 and monitoring was first conducted for the site in 2017. The substrate for the site is characterized by loamy sand with varying amounts of cobbles and boulders. In keeping with the *Memorandum of Agreement (MOA) Between the U.S. Department of Energy, Richland Operations Office and the Washington State Department of Archaeology and Historic Preservation Regarding Removal and Remedial Actions, Demobilization and Area Revegetation for the 100-N Area of the Hanford Site* (DOE-RL et al. 2015a), seeds from several native forbs were collected from the Hanford Site and were hand seeded on the site.

Forb species seeded at the 100-N-CTA included coyote tobacco (*Nicotiana attenuata*), Munro's globemallow (*Sphaeralcea munroana*), longleaf phlox (*Phlox longifolia*), slender phlox (*Microsteris gracilis*), Carey's balsamroot (*Balsamorhiza careyana*), desert parsley (*Lomatium sp.*), common yarrow (*Achillea millefolium*), mariposa lily (*Calochortus macrocarpus*), upland larkspur (*Delphinium nuttallianum*), shaggy fleabane (*Erigeron pumilis*), white-stemmed blazingstar (*Mentzelia albicaulis*), woollypod milkvetch (*Astragalus purshii*), Douglas' dustymaiden (*Chaenactis douglasii*), and yellowbell (*Fritillaria pudica*). The rates at which these species were seeded and the viability of the seed planted is unknown. Native grass seed was broadcast seeded at an average of approximately 18 lb/ac and was composed of Sandberg's bluegrass (*Poa secunda*), bluebunch wheatgrass (*Pseudoroegneria spicata*), needle-and-thread grass (*Hesperostipa comata*), Indian ricegrass (*Achnatherum hymenoides*), bottlebrush squirreltail (*Elymus elymoides*), Idaho fescue (*Festuca idahoensis*), thickspike wheatgrass (*Elymus lanceolatus*), and sand dropseed (*Sporobolus cryptandrus*).

This site was recommended for supplemental planting after 2019 monitoring showed the site was not meeting success criteria for shrub density. The 100-N-CTA site has a separate upper and lower area, with the upper area to the north and the lower area to the south. The upper area received 400 sagebrush (*Artemisia tridentata*), 100 hopsage (*Grayia spinosa*), 100 bitterbrush (*Purshia tridentata*), and 100 forbs per acre. The lower area was planted with 300 sagebrush, 50 hopsage, 50 bitterbrush, and 100 forbs per acre.

Two 100-m (328-ft) shrub monitoring transects were established in 2017; Transect 1 in the lower (south) portion of the site and Transect 2 in the upper (north) portion of the site. Both of these transects were monitored for shrub survival in October 2020. The shrub density for the lower area was 356 plants/ac, an increase from the pre-supplemental density. The shrub density for the upper area was 117 plants/ac. Though this was a significant increase from the pre-supplemental planting density of 28 plants/ac, it was not sufficient to increase the upper portion of the site to successful levels. The 100-N-CTA site had an average shrub density of 237 plants/ac, just below the success criteria of 240 plants/ac.
Canopy cover data for the site was collected in April 2019. Canopy cover varied between the two areas (lower and upper) with 41.7% cover recorded for the lower area and 36.8% for the upper area; the average canopy cover for the site overall was 39.2% (Table 13). Native cover for the site averaged 23.2%, with 29.4% recorded for the lower area and 17.2% recorded for the upper area. Native vegetation cover increased by 10.7% since 2018 and 13 native species were recorded for the site. Sandberg's bluegrass was the dominant native species with a cover of 14.1%. Cheatgrass (*Bromus tectorum*) was the dominant invasive species with a cover of 6.5%. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was observed in less than 1% of the plots.

Supplemental planting at this site significantly increased shrub density levels, but not enough to bring this site to a successful shrub density. The lower portion of the 100-N-CTA site has successful shrub density. Additional plug plantings are recommended for the upper portion of the site.

**Table 13. Percent Canopy Cover and Frequency of Occurrence at the 100 N CTA Site in 2019. (2 Pages)**

| Species | Lower Area | | Upper Area | | Entire Site | |
|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| *Achillea millefollium* (common yarrow) | X | X | 0.1 | 4.0 | 0.1 | 2.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 1.1 | 24.0 | 0.1 | 4.0 | 0.6 | 14.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | X | X | 0.1 | 4.0 | 0.1 | 2.0 |
| *Artemisia tridentata* (big sagebrush) | 0.8 | 12.0 | X | X | 0.4 | 6.0 |
| *Bromus tectorum* (cheatgrass) [a] | 3.0 | 100.0 | 9.9 | 88.0 | 6.5 | 94.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | 0.7 | 8.0 | 0.1 | 4.0 | 0.4 | 6.0 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | - | - | X | X | X | X |

**Table 13. Percent Canopy Cover and Frequency of Occurrence at the 100 N CTA Site in 2019. (2 Pages)**

| | | | | | | |
|---|---|---|---|---|---|---|
| *Draba verna* (spring draba) [a] | 0.7 | 28.0 | 2.0 | 40.0 | 1.4 | 34.0 |
| *Descurcania pinnata* (western tansymustard) | 0.2 | 8.0 | 0.4 | 16.0 | 0.3 | 12.0 |
| *Elymus elymoides* (squirreltail) | 0.9 | 16.0 | 0.3 | 12.0 | 0.6 | 14.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.2 | 8.0 | 0.1 | 4.0 | 0.1 | 6.0 |
| *Hesperostipa comata* (needle-and-thread grass) | 0.9 | 16.0 | - | - | 0.5 | 8.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.6 | 24.0 | 1.1 | 44.0 | 0.9 | 34.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 2.1 | 64.0 | 0.7 | 28.0 | 1.4 | 46.0 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X | - | - | X | X |
| *Poa secunda* (Sandberg bluegrass) | 13.2 | 100.0 | 14.9 | 88.0 | 14.1 | 94.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 10.4 | 52.0 | 0.7 | 8.0 | 5.6 | 30.0 |
| *Salsola kali* (Russian thistle) [a] | 3.1 | 84.0 | 2.8 | 92.0 | 3.0 | 88.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 1.5 | 40.0 | 2.4 | 56.0 | 2.0 | 48.0 |
| *Sporobolus cryptandrus* (sand dropseed) | 0.1 | 4.0 | - | - | 0.1 | 2.0 |
| *Triticum sp.* (wheat) [a] | X | X | - | - | X | X |
| Crust | 0.8 | 12.0 | 1.5 | 20.0 | 1.2 | 16.0 |
| Soil | 17.7 | 92.0 | 29.5 | 88.0 | 23.6 | 90.0 |
| Litter | 24.1 | 100.0 | 18.3 | 80.0 | 21.2 | 90.0 |
| Rock/Cobble | 21.5 | 92.0 | 24.5 | 88.0 | 23.0 | 90.0 |
| Unavailable Space | 5.3 | 56.0 | 3.1 | 64.0 | 4.2 | 60.0 |
| **Total Canopy Cover** | 41.7 | | 36.8 | | **39.2** | |
| **Native % Cover** | 29.4 | | 17.2 | | **23.2** | |
| Invasive % Cover | 12.4 | | 19.6 | | 16.0 | |
| Unadjusted canopy cover | 39.5 | | 35.7 | | 37.6 | |
| Unadjusted Native % Cover | 27.8 | | 16.7 | | 22.2 | |
| Change in Native % Cover from 2018 | 13.5 | | 8.0 | | 10.7 | |
| Unadjusted Invasive % Cover | 11.7 | | 19.0 | | 15.4 | |
| Change in Invasive % Cover from 2018 | -3.5 | | 4.7 | | 0.6 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames
- = species not observed

**Figure 9. The 100-N Container Transfer Area Site in 2020.**

### 3.3.5 100-N-61:1 (Underground Pipelines)

The 100-N-61:1 site (Figure 10) was initially revegetated in FY 2015. Monitoring for this site was not conducted until June 2018, when the site was 3 years old. The substrate for the site is characterized predominantly by cobbles and backfill material. No shrub transect was established for this site, as first-year monitoring did not occur until June 2018. The 2018 monitoring determined that additional shrub plantings were needed to bring the 100-N-61:1 site to successful levels. In FY 2020, the site was supplemented with 300 sagebrush (*Artemisia tridentata*), 50 bitterbrush (*Purshia tridentata*), 50 hopsage (*Grayia spinosa*), and 100 forbs per acre.

Two transects were established for the 100-N-61:1 site in 2020 after supplemental planting to monitor shrub survival and density. Shrubs on this transect were distinguished as 'new' or 'existing'. Data from the two transects were averaged to show the average shrub density per site. Existing shrubs on the transect had a density of 206 plants/ac, supplemental shrubs increased the shrub density at this site to 376 plants/ac, increasing it to successful levels.

Canopy cover data for the site was collected in April 2019. Data was collected from 50 plot frames, 25 in the eastern area and 25 in the backfilled area to the northwest of N Reactor. Canopy cover data for the two areas were fairly similar. Canopy cover for the site overall was 35.9%, with 18.9% native cover and 17% invasive cover (Table 14). Native cover increased by 7.9% and invasive cover increased by 6.0% from 2018. The dominant native species for this site was Sandberg's bluegrass (*Poa secunda*) with 7.5% cover followed by bluebunch wheatgrass (*Pseudoroegneria spicata*) with 6.6% cover. The dominant invasive species was cheatgrass (*Bromus tectorum*) with 8.4% cover and occurrence in 100% of the plot frames.

The supplemental planting increased shrub density to successful levels at the 100-N-61:1 site. Continued monitoring will determine if canopy cover is trending positively and will reach successful levels.

**Table 14. Percent Canopy Cover and Frequency of Occurrence at the 100-N-61:1 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefolium* (common yarrow) | X | X |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.3 | 12.0 |
| *Artemisia tridentata* (big sagebrush) | 2.2 | 16.0 |
| *Bromus tectorum* (cheatgrass) [a] | 8.4 | 100.0 |
| *Centaurea diffusa* (diffuse knapweed) [b] | 1.5 | 18.0 |
| *Chorispora tenella* (crossflower) [a] | 0.1 | 4.0 |
| *Descurcania pinnata* (western tansymustard) | 0.8 | 32.0 |
| *Draba verna* (spring draba) [a] | 1.3 | 50.0 |
| *Elymus elymoides* (squirreltail) | X | X |
| *Epilobium brachycarpum* (tall annual willowherb) | X | 4.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | X | 12.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.3 | 52.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 1.1 | 44.0 |
| *Lamium amplexicaule* (henbit deadnettle) [a] | 1.6 | 42.0 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X |
| *Poa secunda* (Sandberg bluegrass) | 7.5 | 90.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 6.6 | 62.0 |
| *Salsola kali* (Russian thistle) [a] | X | 24.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.4 | 16.0 |
| *Tragopogon dubius* (yellow salsify) [a] | X | 0.0 |
| Crust | 1.4 | 26.0 |
| Soil | 0.8 | 12.0 |
| Litter | 12.9 | 66.0 |
| Rock/Cobble | 58.2 | 100.0 |
| Unavailable Space | 8.5 | 92.0 |
| **Total Canopy Cover** | **35.9** | |
| **Native % Cover** | **18.9** | |
| Invasive % Cover | 17.0 | |
| Unadjusted canopy cover | 32.9 | |
| Unadjusted Native % Cover | 17.3 | |
| Change in Native % Cover from 2018 | 7.9 | |
| Unadjusted Invasive % Cover | 15.6 | |
| Change in Invasive % Cover from 2018 | 6.0 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 10. Section of the 100-N-61:1 Site in 2020.**

### 3.3.6 124-N-10 Site (Sewage Lagoon)

The 124-N-10 site was initially revegetated in FY 2015. Monitoring was not conducted for this site, it was represented by the 130-N-1:1 site. A site visit in FY 2019 found sparse shrubs at the site and recommended supplemental planting of shrubs and forbs in order to bring the site to successful shrub density levels. In FY 2020, the 124-N-10 site was supplemented with 300 sagebrush (*Artemisia tridentata*), 50 bitterbrush (*Purshia tridentata*), 50 hopsage (*Grayia spinosa*), and 100 forbs per acre (Figure 11).

First-year monitoring was initiated in October 2020. One transect was established at this site to measure density and survival for both the supplemental and existing shrubs at the site. Pre-supplementation, shrubs had a density of 97 plants/ac. Supplemental planting increased shrub density to 202 plants/ac. Despite doubling the shrub density, supplemental planting was not sufficient to increase the site to successful levels. A total of 20% of the sagebrush was in bloom and producing seed at the time of monitoring, suggesting the sagebrush population may increase in the coming years.

Canopy cover monitoring was not performed in FY 2020 and no historic canopy cover data exists for this site.

It is recommended that monitoring continue at this site. If shrub density decreases in second-year monitoring, it is recommended that additional shrubs be added to this site to bring it to successful shrub density levels. Alternatively, if sagebrush seedlings are found during transect monitoring it will suggest that the sagebrush are reproducing and may naturally increase up to successful levels.

**Figure 11. The 124-N-10 Site in 2020.**

### 3.3.7 100-N-84:9 (Raw Water Pipelines)

The 100-N-84:9 site, referred to as the 100-N-South site in revegetation paperwork from FY 2020, was originally revegetated in FY 2015. This site was not monitored and was represented by the 130-N-1:1 site. A field visit in 2019 noted few shrubs in the area and that the canopy was heavily dominated by cheatgrass (*Bromus tectorum*). The site was recommended for a full re-work, which was performed in FY 2020. The 100-N-84:9 site was re-seeded with the FY 2020 re-work seed mix (Table 1) and planted with 400 sagebrush (*Artemisia tridentata*), 100 hopsage (*Grayia spinosa*), 100 bitterbrush *(Purshia tridentata*), and 200 forbs per acre (Figure 12).

First-year shrub survival monitoring was performed in FY 2020. One transect was established and monitored in October 2020. Monitoring results show a shrub density of 210 plants/ac. No existing shrubs were recorded on the transect, suggesting a previous shrub density of 0 plants/ha. Re-work and subsequent planting increased shrub density, but not to levels that are considered successful.

Canopy cover monitoring was not performed in FY 2020 and historic canopy cover data does not exist for this site. Canopy cover will be monitored in FY 2021 to evaluate the effectiveness of re-seeding this site. Additional actions will be recommended after multiple years of monitoring demonstrate a need for increased sagebrush or seeding.

**Figure 12. The 100-N-84:9 Site in 2020.**

## 3.4 100-D AREA SITES

Five sites were monitored for post-revegetation monitoring in the 100-D Area: 128-D-2, 628-3, 100-D-100, 100-D Trailer Village, and 600-30. These sites were remediated to meet the objectives for interim closure as established in the 100 Area RDR/RAWP (DOE/RL-96-17) and in the Interim Action ROD (EPA 1999).

Revegetation efforts at the 100-D-100 and 100-D Trailer Village sites entailed broadcast seeding or hydroseeding with a mixture of native grasses including Sandberg's bluegrass (*Poa secunda*), Indian ricegrass (*Achnatherum hymenoides*), bluebunch wheatgrass (*Pseudoroegneria spicata*), squirreltail (*Elymus elymoides*), needle-and-thread grass (*Hesperostipa comata*), and prairie junegrass (*Koeleria macrantha*) at approximately 15 lbs/ac. Broadcast seeding areas were topped with a straw mulch that was crimped into the soil surface. Areas with steep slopes were seeded by hydroseeding vs. broadcast seeding followed by mulch application. Shrub species (including big sagebrush [*Artemisia tridentata*], antelope bitterbrush [*Purshia tridentata*], and spiny hopsage [*Grayia spinosa*]) were transplanted on the sites at approximately 500 to 650 plants/ac with a mix of approximately 75% sagebrush, 15% bitterbrush, and 10% spiny hopsage (with the exception of site 100-D-100). Sites planted in FY 2016 (100-D-100) received varying planting ratios ranging from 60 to 75% big sagebrush, 5 to 15% antelope bitterbrush, 10 to 30% spiny hopsage, and approximately 1% (cumulatively) rubber rabbitbrush (*Ericameria nauseosa*) and yellow rabbitbrush (*Chrysothamnus viscidiflorus*).

The 128-D-2, 628-3, and 600-30 sites were planted in FY 2011 and determined to not be meeting success criteria. Additional revegetation actions took place at the 128-D-2 and 628-3 sites in

FY 2019. The inner area of the 628-3 site was planted with forb and shrub plugs, and the outer area of 628-3 and the 128-D-2 site were reseeded and planted with the FY 2019 seed mix (Appendix B). The 600-30 site had additional revegetation actions taken in FY 2020 including ATV seeding with the FY 2020 re-work seed mix (Table 1) and planting forb and shrub plugs.

### 3.4.1 100-D-100 Site (Process Sewer, Unplanned Release 183-DR Railroad Tracks)

The 100-D-100 site (Figure 13) was revegetated in FY 2016 and monitoring was first conducted for the site in 2016. Fifth-year monitoring for shrub survival was conducted in 2020. This is a larger site that was divided into three areas (north, central, and south) for monitoring purposes with one established transect in each area and data collected from 25 plot frames in each area. Substrates at the site are predominantly loamy sands with large amounts of cobble.

Three shrub monitoring transects were established for the site in 2016. Fifth-year shrub survival monitoring was conducted in November 2020. The results show a shrub density of 341 plants/ac for the site overall, well above the success criteria of 240 plants/ac. The survival rates of all planted shrubs at this site are high compared to other sites, with 91% of shrubs surviving from the initial planting in 2016.

Canopy cover data for the site was collected in April 2019. Average canopy cover for the site was 25.9%, with native cover representing 13.6% and invasive cover representing 12.3% (Table 15). This represents an increase of 5.1% in native cover and of 3.9% in invasive cover from 2018. The dominant native species were Sandberg bluegrass (*Poa secunda*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and big sagebrush with 5.1%, 3.0%, and 1.8% cover, respectively. Cheatgrass (*Bromus tectorum*) was the dominant invasive species for the site with 4.1% cover. Twenty native species were observed at this site in 2019. Considering the high shrub survival percentage of 95.3% from the first year, the lack of substantial cover by invasive species, and the high diversity of native species, no additional revegetation efforts are suggested at this time. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was observed on the site at less than 1% cover.

It is recommended that canopy cover monitoring be performed in FY 2021 for this site. Results from FY 2021 canopy cover monitoring will help determine if native canopy cover is increasing, which will advise if any additional revegetation actions need to occur. The shrub density is successful at this site, no supplemental plantings are recommended.

**Table 15. Percent Canopy Cover and Frequency of Occurrence at the 100-D-100 Site in 2019. (2 Pages)**

| Species | Area 1 (North) | | Area 2 (Central) | | Area 3 (South) | | Entire Site | |
|---|---|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| *Achillea millefolium* (common yarrow) | X | X | - | - | X | X | X | X |
| *Achnatherum hymenoides* (Indian ricegrass) | - | - | 0.2 | 8.0 | 0.4 | 16.0 | 0.2 | 8.0 |
| *Artemisia tridentata* (big sagebrush) | 2.7 | 12.0 | 1.3 | 12.0 | 1.4 | 16.0 | 1.8 | 13.3 |
| *Artemisia tridentata* (big sagebrush) (recruits) | X | X | - | - | - | - | X | X |
| *Astragalus caricinus* (buckwheat milkvetch) | X | X | - | - | - | - | X | X |
| *Bromus tectorum* (cheatgrass) [a] | 6.0 | 100.0 | 3.2 | 88.0 | 3.0 | 100.0 | 4.1 | 96.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | - | - | 0.6 | 4.0 | 0.2 | 8.0 | 0.3 | 4.0 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | 0.1 | 4.0 | - | - | X | X | 0.03 | 1.3 |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | - | - | - | - | X | X | X | X |
| *Descurcania pinnata* (western tansymustard) | 1.0 | 40.0 | 0.7 | 28.0 | 1.2 | 48.0 | 1.0 | 38.7 |
| *Draba verna* (spring draba) [a] | 1.7 | 68.0 | 0.9 | 36.0 | 0.7 | 28.0 | 1.1 | 44.0 |
| *Elymus elymoides* (squirreltail) | 0.3 | 12.0 | 0.2 | 8.0 | 0.1 | 4.0 | 0.2 | 8.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.3 | 12.0 | 0.4 | 16.0 | 0.4 | 16.0 | 0.4 | 14.7 |
| *Ericameria nauseosa* (rubber rabbitbrush) | X | X | X | X | 0.7 | 8.0 | 0.2 | 2.7 |
| *Erigeron filifolius* (threadleaf fleabane) | X | X | - | - | - | - | X | X |
| *Eriogonum niveum* (snow buckwheat) | X | X | - | - | - | - | X | X |
| *Erodium cicutarium* (redstem stork's bill) [a] | X | X | - | - | - | - | X | X |
| *Grayia spinosa* (spiny hopsage) | X | X | X | X | 0.2 | 8.0 | 0.1 | 2.7 |
| *Hesperostipa comata* (needle-and-thread grass) | - | - | - | - | 0.1 | 4.0 | 0.03 | 1.3 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.6 | 64.0 | 1.1 | 24.0 | 1.1 | 44.0 | 1.3 | 44.0 |
| *Koeleria macrantha* (prairie junegrass) | - | - | - | - | 0.2 | 8.0 | 0.1 | 2.7 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.9 | 36.0 | 0.6 | 24.0 | 0.4 | 16.0 | 0.6 | 25.3 |
| *Lamium amplexicaule* (henbit deadnettle) [a] | - | - | X | X | 0.1 | 4.0 | 0.03 | 1.3 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X | - | - | 0.1 | 4.0 | 0.03 | 1.3 |
| *Medicago sativa* (alfalfa) [a] | X | X | - | - | - | - | X | X |
| *Melilotus officinalis* (sweet clover) [a] | 1.2 | 8.0 | X | X | 0.6 | 4.0 | 0.6 | 4.0 |
| *Poa bulbosa* (bulbous bluegrass) [a] | 0.2 | 8.0 | X | X | - | - | 0.1 | 2.7 |
| *Poa secunda* (Sandberg bluegrass) | 4.3 | 92.0 | 5.7 | 92.0 | 5.2 | 88.0 | 5.1 | 90.7 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 3.9 | 56.0 | 3.8 | 72.0 | 1.4 | 36.0 | 3.0 | 54.7 |
| *Purshia triedntata* (antelope bitterbrush) | 1.5 | 4.0 | 0.6 | 4.0 | X | X | 0.7 | 2.7 |
| *Salsola kali* (Russian thistle) [a] | 2.4 | 96.0 | 1.7 | 68.0 | 2.3 | 92.0 | 2.1 | 85.3 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 1.0 | 40.0 | 1.6 | 64.0 | 1.0 | 40.0 | 1.2 | 48.0 |
| *Tragopogon dubius* (yellow salsify) [a] | X | X | 0.2 | 8.0 | 0.6 | 4.0 | 0.3 | 4.0 |
| *Vulpia microstachys* (desert fescue) | X | X | - | - | - | - | X | X |
| Crust | 0.1 | 4.0 | 0.1 | 4.0 | 0.8 | 12.0 | 0.3 | 6.7 |

**Table 15. Percent Canopy Cover and Frequency of Occurrence at the 100-D-100 Site in 2019. (2 Pages)**

| Species | Area 1 (North) | | Area 2 (Central) | | Area 3 (South) | | Entire Site | |
|---|---|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| Soil | 23.1 | 100.0 | 36.2 | 80.0 | 31.6 | 88.0 | 30.3 | 89.3 |
| Litter | 14.4 | 100.0 | 16 | 100.0 | 16.0 | 100.0 | 15.5 | 100.0 |
| Rock/Cobble | 61.9 | 100.0 | 47.5 | 100.0 | 51.9 | 100.0 | 53.8 | 100.0 |
| Unavailable Space | 7.2 | 88.0 | 4.6 | 64.0 | 5.6 | 64.0 | 5.8 | 72.0 |
| **Total canopy cover** | 31.4 | | 23.9 | | 22.7 | | **25.9** | |
| **Total Native % Cover** | 15.2 | | 13.5 | | 12.1 | | **13.6** | |
| Total Invasive % Cover | 16.2 | | 10.4 | | 10.6 | | 12.3 | |
| Unadjusted canopy cover | 29.1 | | 22.8 | | 21.4 | | 24.4 | |
| Unadjusted Native % Cover | 14.1 | | 12.9 | | 11.4 | | 12.8 | |
| Change in Native % Cover from 2018 | | | | | | | 5.1 | |
| Unadjusted Invasive % Cover | 15.0 | | 9.9 | | 10.0 | | 11.6 | |
| Change in Invasive % Cover from 2018 | | | | | | | 3.9 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames
- = species not observed on site

**Figure 13. The 100-D-100 Site in 2020.**

### 3.4.2 100-D Trailer Village Site

The 100-D Trailer Village site (Figure 14) was revegetated in FY 2017 and monitoring was first conducted for the site in 2017. The substrate for the site is characterized predominantly by loamy sand with some scattered patches of gravel.

A 100-m (328-ft) shrub monitoring transect was established in 2017 and third-year monitoring was completed for the site in October 2020. The results show a shrub density of 150 plants/ac, which falls below the success criteria of 240 plants/ac. None of the spiny hopsage (*Grayia spinosa*) or antelope bitterbrush (*Purshia tridentata*) plants initially recorded survived past 2018. Only 31% of the sagebrush (*Artemisia tridentata*) initially planted survived to third-year monitoring. Of the surviving sagebrush, 97% were in bloom and producing seed, suggesting the sagebrush density at the site may increase with sagebrush recruits in the coming years.

Canopy cover data for the site was collected in April 2019. Total canopy cover for the site was 41.0%, with 20.1% native cover and 20.9% invasive cover (Table 16). Total invasive cover decreased by 3.1% since 2018 and total native cover increased by 16.2%. Total invasive cover has decreased by approximately 20% since 2017, largely due to a decrease in Russian thistle (*Salsola kali*) cover from 31.8% in 2017 to 2.5% in 2019. This may explain the large increase in native cover this year, as more growing space became available and there was less competition from invasive species. Sandberg's bluegrass (*Poa secunda*) was the most abundant species with 13.5% cover. Fifteen native species were detected on the site in 2019. Cheatgrass (*Bromus tectorum*) was the dominant invasive species with 12.6% cover. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was recorded on the site with less than 1% cover occurring in 20% of the plot frames.

Additional shrub plantings are recommended at this site to bring shrub density to success levels. Continued tracking of canopy cover data is recommended to determine site trends.

**Table 16. Percent Canopy Cover and Frequency of Occurrence at the 100-D Trailer Village Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefolium* (common yarrow) | X | X |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.6 | 24.0 |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | X | X |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 1.7 | 28.0 |
| *Artemisia tridentata* (big sagebrush) | 2.4 | 16.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 12.6 | 100.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | X | X |
| *Chorispora tenella* (crossflower) [(a)] | 0.3 | 12.0 |
| *Descurcania pinnata* (western tansymustard) | 0.3 | 12.0 |
| *Draba verna* (spring draba) [(a)] | 0.4 | 16.0 |
| *Elymus elymoides* (squirreltail) | 0.1 | 4.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 4.0 |

**Table 16. Percent Canopy Cover and Frequency of Occurrence at the 100-D Trailer Village Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Hesperostipa comata* (needle-and-thread grass) | X | X |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.8 | 32.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.4 | 16.0 |
| *Machaeranthera canescens* (hoary tansymustard) | X | X |
| *Phlox longifolia* (longleaf phlox) | X | X |
| *Poa bulbosa* (bulbous bluegrass) [a] | 0.2 | 8.0 |
| *Poa secunda* (Sandberg bluegrass) | 13.5 | 96.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 1.4 | 16.0 |
| *Purshia tridentata* (antelope bitterbrush) | X | X |
| *Ranunculus testiculatus* (burr buttercup) [a] | 0.1 | 4.0 |
| *Salsola kali* (Russian thistle) [a] | 2.5 | 80.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 3.6 | 84.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| Crust | 0.0 | 0.0 |
| Soil | 70.4 | 100.0 |
| Litter | 24.0 | 100.0 |
| Rock/Cobble | 7.9 | 88.0 |
| Unavailable Space | 0.0 | 0.0 |
| **Total canopy cover** (excludes crust/soil/litter) | **41.0** | |
| **Total Native % Cover** | **20.1** | |
| Change in Native % Cover from 2018 | 16.2 | |
| Total Invasive % Cover | 20.9 | |
| Change in Invasive % Cover from 2018 | -3.1 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 14. The 100-D Trailer Village Site in 2020, Showing the Low Shrub Density Northern Section and the Higher Shrub Density Southern Section.**

### 3.4.3 128-D-2 Site (Burn Pit)

The 128-D-2 site was originally planted in FY 2011 and was not monitored. A field visit in 2018 determined that the site was not successful and needed additional revegetation actions. Two sections of the 128-D-2 site were re-worked in FY 2019 with the goal of increasing native species cover and shrub density. Both sections, referred to as East and West, were reseeded with the FY 2019 Seed Mix (Table 1) and planted with big sagebrush (*Artemisia tridentata*), Munro's globemallow (*Sphaeralcea munroana*), and snow buckwheat (*Eriogonum niveum*) at a rate of 400 shrubs per acre and 225 forbs per acre. In FY 2020, additional hopsage (*Grayia spinosa*) and bitterbrush (*Purshia tridentata*) was planted at the site, each at a rate of 100 plants per acre. First-year monitoring for this site occurred in FY 2019.

The 128-D-2 site is split into two sections, the West section and the East section. Both sections have sandy soil (Figure 15). One transect was established in each section of the 128-D-2 site. The western transect was monitored for second-year monitoring in October 2020 and had 409 shrubs/ac and 20 forbs/ac. Sagebrush had 66% survival from initial planting. Munro's globemallow was the only forb recorded on this transect, and had a relatively low survival rate of 29% at this site. No Munro's globemallow plants had evidence of blooming. The eastern transect was monitored in October 2020 and had 134 shrubs/ac and 69 forbs/ac. Sagebrush survival from first-year to second-year monitoring was only 33% for this transect. Munro's globemallow and snow buckwheat were recorded on this transect, with 75% of Munro's globemallow and 55% of snow buckwheat plants having evidence of blooming at the time of monitoring. A total of 19% of sagebrush plants were in bloom and producing seed. When considering both transects, the 128-D-2 site had an average shrub density of 272 shrubs/ac, which is above success levels.

Canopy cover measurements for both sections were taken in April 2019. The western section had 19.0% canopy cover, with 9.9% native cover and 9.0% invasive cover (Table 17). Young bunchgrasses (listed as Bunchgrass sp.) made up the majority of the native cover with 5.2% coverage. Cheatgrass (*Bromus tectorum*) was the dominant invasive species with 2.4% coverage. Twenty native species were detected in the western section. The eastern section was more successful with 29.5% total cover; the section was made up of 15.0% native and 14.5% invasive cover (Table 18). Sandberg's bluegrass (*Poa secunda*) had the highest native cover at 5.9%. Russian thistle (*Salsola kali*) had the highest invasive cover at 4.1%. Twenty-seven native species were detected in the eastern section. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was present in both sections with a 1.3% cover and 52.0% occurrence in the western section and 0.5% cover and 8.0% occurrence in the eastern section.

No additional actions beyond continued monitoring are recommended for the 128-D-2 site.

**Table 17. Percent Canopy Cover and Frequency of Occurrence at the 128-D-2 West Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefolium* (common yarrow) | 0.8 | 32.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.1 | 4.0 |
| *Artemisia tridentata* (big sagebrush) | 0.1 | 4.0 |
| *Artemisia tridentata* (recruits) | 0.3 | 12.0 |
| *Astragalus purshii* (woollypod milkvetch) | 0.5 | 20.0 |
| *Astragalus sclerocarpus* (stalked-pod milkvetch) | X | X |
| *Astragalus succumbens* (crouching milkvetch) | X | X |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.5 | 20.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 2.4 | 76.0 |
| Bunchgrass sp. (multiple) | 5.2 | 88.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | 1.3 | 52.0 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | X | X |
| *Draba verna* (spring draba) [(a)] | 2.3 | 52.0 |
| *Elymus elymoides* (squirreltail) | 0.2 | 8.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.6 | 24.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | X | X |
| *Erigeron filifolius* (threadleaf fleabane) | 0.1 | 4.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.2 | 8.0 |
| *Festuca sp.* (fescue) | X | X |
| *Holosteum umbellatum* (jagged chickweed) [(a)] | 0.1 | 4.0 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 0.8 | 32.0 |
| *Leptodactylon pungens* (prickly phlox) | X | X |
| *Lupinus pusillus* (low lupine) | 0.1 | 4.0 |
| *Melilotus officinalis* (sweet clover) [(a)] | X | X |
| *Poa secunda* (Sandberg bluegrass) | 1.0 | 20.0 |

**Table 17. Percent Canopy Cover and Frequency of Occurrence at the 128-D-2 West Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.1 | 4.0 |
| *Ranunculus testiculatus* (burr buttercup) [(a)] | 0.2 | 8.0 |
| *Salsola kali* (Russian thistle) [(a)] | 1.8 | 72.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [(a)] | 0.1 | 4.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | 0.1 | 4.0 |
| Crust | 10.9 | 88.0 |
| Soil | 55.7 | 100.0 |
| Litter | 30.7 | 100.0 |
| Rock/Cobble | 3.3 | 56.0 |
| Unavailable Space | 0.3 | 12.0 |
| **Total Canopy Cover** | **19.0** | |
| **Total Native % Cover** | **9.9** | |
| Total Invasive % Cover | 9.0 | |
| Unadjusted canopy cover | 18.9 | |
| Unadjusted Native % Cover | 9.9 | |
| Unadjusted Invasive % Cover | 9.0 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Table 18. Percent Canopy Cover and Frequency of Occurrence at the 128-D-2 East Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefolium* (common yarrow) | 0.2 | 6.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.1 | 4.0 |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 1.3 | 32.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.1 | 4.0 |
| *Artemisia tridentata* (big sagebrush) | 0.1 | 4.0 |
| *Artemisia tridentata* (transplants) | 0.3 | 10.0 |
| *Astragalus purshii* (woollypod milkvetch) | 0.4 | 14.0 |
| *Astragalus succumbens* (crouching milkvetch) | X | X |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.6 | 22.0 |
| *Bromus tectorum*[a] (cheatgrass) | 3.1 | 92.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | 0.5 | 8.0 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | 0.2 | 6.0 |
| *Chorispora tenella* (crossflower) [(a)] | 0.1 | 4.0 |
| *Coldenia nuttallii* (desert mat) | 0.2 | 8.0 |
| *Descurcania pinnata* (western tansymustard) | X | X |
| *Cryptantha circumscissa* (matted cryptantha) | X | X |

**Table 18. Percent Canopy Cover and Frequency of Occurrence at the 128-D-2 East Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Draba verna* (spring draba) [a] | 2.3 | 50.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 4.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.3 | 12.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.5 | 20.0 |
| *Eriogonum niveum* (transplant) | 0.2 | 8.0 |
| *Erodium cicutarium* (redstem stork's bill) [a] | X | X |
| *Festuca sp.* (fescue) | 0.1 | 4.0 |
| *Hesperostipa comata* (needle-and-thread grass) | 0.5 | 8.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.7 | 26.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.4 | 16.0 |
| *Leptodactylon pungens* (prickly phlox) | X | X |
| *Lupinus pusillus* (low lupine) | X | X |
| *Microsteris gracilis* (slender phlox) | 0.3 | 10.0 |
| *Oenothera pallida* (pale-evening primrose) | 0.1 | 4.0 |
| *Phacelia linearis* (threadleaf phacelia) | X | X |
| *Poa bulbosa* (bulbous bluegrass) [a] | 3.8 | 52.0 |
| *Poa secunda* (Sandberg bluegrass) | 5.9 | 70.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.5 | 18.0 |
| *Purshia tridentata* (antelope bitterbrush) | X | X |
| *Ranunculus testiculatus* (burr buttercup) [a] | 0.4 | 16.0 |
| *Salsola kali* (Russian thistle) [a] | 4.1 | 96.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 2.2 | 58.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | 0.4 | 4.0 |
| *Sphaeralcea munroana* (transplants) | 0.2 | 8.0 |
| *Sporobolus cryptandrus* (sand dropseed) | X | X |
| *Tragopogon dubius* (yellow salsify) [a] | 0.1 | 4.0 |
| Crust | 1.0 | 18.0 |
| Soil | 41.2 | 96.0 |
| Litter | 55.8 | 100.0 |
| Rock/Cobble | 0.7 | 28.0 |
| Unavailable Space | 0.0 | 0.0 |
| **Total canopy cover** (excludes ground cover) | **29.5** | |
| **Total Native % Cover** | **15.0** | |
| Total Invasive % Cover | 14.5 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 15. The 128-D-2 Site in 2020. Top: The Western Section of the 128-D-2 Site in 2020. Bottom: The Eastern Section of the 128-D-2 Site in 2020.**

### 3.4.4 628-3 Site (Burn Pit)

The 628-3 site was planted in FY 2011 and additional revegetation actions took place in FY 2019 and FY 2020 (Figure 16). This site was split into two areas for revegetation actions– the inner area and the outer area. The 628-3 inner area has significantly different substrate than the outer

area, with sandier soil and a higher amount of cobble mixed in. The 628-3 outer area substrate is sandy loam with low amounts of cobble. The 628-3 inner area was planted with Munro's globemallow (*Sphaeralcea munroana*) and snow buckwheat (*Eriogonum niveum*) plugs in FY 2019 at a rate of 200 forbs per acre. The 628-3 outer area was re-worked and reseeded with the FY 2019 Seed Mix (Appendix B), then planted with big sagebrush (*Artemisia tridentata*) plugs at a rate of 400 plants per acre. In FY 2020, the outer area was planted with bitterbrush (*Purshia tridentata*) and hopsage (*Grayia spinosa*) at a rate of 100 plants per acre each, along with forbs at a rate of 100 plants per acre.

One transect was established in the outer area of the 628-3 site to track survival of the planted shrubs. Second-year monitoring occurred at this transect in October 2020. Second-year transect monitoring shows a shrub density of 121 plants/ac, which is below success criteria. Only 35% of sagebrush survived from first-year to second-year monitoring.

Canopy cover for the 628-3 inner area was measured in April 2019 (Table 19). Canopy cover totaled 34.3%, with 21.7% native cover and 12.6% invasive cover. Sagebrush had a coverage of 12.4% and Sandberg's bluegrass (*Poa secunda*) had a coverage of 5.6%. The dominant invasive species was diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, with 4.7% cover and occurrence in 48% of the plot frames. Canopy cover for the 628-3 outer area was measured in April 2019 (Table 25). Canopy cover totaled 28.4%, with 6.6% native cover and 21.8% invasive cover. The dominant native species was slender phlox (*Microsteris gracilis*) with a cover of 1.4% followed by Sandberg's bluegrass with a cover of 1.1%. The dominant invasive species was cheatgrass (*Bromus tectorum*) with 6.9% cover. As a whole, 25 species were recorded at the 628-3 site. Average canopy cover was 31.4%, with 14.2% native and 17.2% invasive cover. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was detected at this site with 3.0% cover and occurrence in 30% of the plot frames. Treatment of diffuse knapweed is highly recommended at this site.

Additional supplemental planting is recommended at this site if third-year monitoring shows continued decreases in shrub density. It is also recommended that a second transect be established in the 628-3 inner area to better represent the site as a whole.

**Table 19. Percent Canopy Cover and Frequency of Occurrence at the 628-3 Site in 2019. (3 Pages).**

| Species | Outer Area | | Inner Area | | Entire Site | |
|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| *Achillea millefolium* (common yarrow) | X | X | X | X | X | X |
| *Achnatherum hymenoides* (Indian ricegrass) | - | - | X | X | X | X |
| *Agoseris heterophylla* (false mountain dandelion) | 0.4 | 16.0 | - | - | 0.4 | 16.0 |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | - | - | 0.8 | 32.0 | 0.8 | 32.0 |

**Table 19. Percent Canopy Cover and Frequency of Occurrence at the 628-3 Site in 2019. (3 Pages).**

| Species | Outer Area | | Inner Area | | Entire Site | |
|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | X | X | X | X | X | X |
| *Artemisia tridentata* (big sagebrush) | X | X | 11.9 | 36.0 | 11.9 | 36.0 |
| *Artemisia tridentata* (recruits) | - | - | 0.5 | 20.0 | 0.5 | 20.0 |
| *Artemisia tridentata* (transplants) | 0.2 | 8.0 | - | - | 0.2 | 8.0 |
| *Astragalus caricinus* (buckwheat milkvetch) | - | - | X | X | X | X |
| *Astragalus purshii* (woollypod milkvetch) | 0.1 | 4.0 | - | - | 0.1 | 4.0 |
| *Astragalus succumbens* (crouching milkvetch) | X | X | - | - | X | X |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.4 | 16.0 | - | - | 0.4 | 16.0 |
| *Bromus tectorum* (cheatgrass) [a] | 6.9 | 96.0 | 2.1 | 84.0 | 4.5 | 90.0 |
| *Calochortus macrocarpus* (sagebrush mariposa lily) | X | X | - | - | X | X |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | 1.3 | 12.0 | 4.7 | 48.0 | 3.0 | 30.0 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | 0.2 | 8.0 | - | - | 0.2 | 8.0 |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | - | - | X | X | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.3 | 12.0 | 0.2 | 8.0 | 0.3 | 10.0 |
| *Draba verna* (spring draba) [a] | 2.1 | 84.0 | 0.5 | 20.0 | 1.3 | 52.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 4.0 | 0.1 | 4.0 | 0.1 | 4.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | - | - | 0.1 | 4.0 | 0.1 | 4.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.5 | 20.0 | 0.1 | 4.0 | 0.3 | 12.0 |
| *Erodium cicutarium* (redstem stork's bill) [a] | 0.6 | 4.0 | 0.2 | 8.0 | 0.4 | 6.0 |
| *Grayia spinosa* (spiny hopsage) | - | - | 0.4 | 16.0 | 0.4 | 16.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.7 | 68.0 | 0.5 | 20.0 | 1.1 | 44.0 |
| *Lactuca serriola* (prickly lettuce) [a] | X | X | 0.4 | 16.0 | 0.4 | 16.0 |
| *Lepidium perfoliatum* (clasping pepperweed) [a] | 0.3 | 12.0 | - | - | 0.3 | 12.0 |
| *Lupinus pusillus* (low lupine) | - | - | 0.3 | 12.0 | 0.3 | 12.0 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X | - | - | X | X |
| *Melilotus officinalis* (sweet clover) [a] | 0.1 | 4.0 | 0.2 | 8.0 | 0.2 | 6.0 |
| *Microsteris gracilis* (slender phlox) | 1.4 | 56.0 | 0.5 | 20.0 | 1.0 | 38.0 |
| *Plantago patagonica* (woolly plantain) | 1.0 | 20.0 | 0.6 | 24.0 | 0.8 | 22.0 |
| *Poa bulbosa* (bulbous bluegrass) [a] | 2.5 | 60.0 | X | X | 2.5 | 60.0 |
| *Poa secunda* (Sandberg bluegrass) | 1.1 | 44.0 | 5.6 | 84.0 | 3.4 | 64.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.7 | 28.0 | 0.1 | 4.0 | 0.4 | 16.0 |
| *Ranunculus testiculatus* (burr buttercup) [a] | 1.0 | 20.0 | 0.2 | 8.0 | 0.6 | 14.0 |
| *Salsola kali* (Russian thistle) [a] | 3.4 | 96.0 | 2.1 | 84.0 | 2.8 | 90.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 1.7 | 68.0 | 1.6 | 64.0 | 1.7 | 66.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | 0.2 | 8.0 | 0.3 | 12.0 | 0.3 | 10.0 |
| Crust | 0.1 | 4.0 | 26.5 | 84.0 | 13.3 | 44.0 |

**Table 19. Percent Canopy Cover and Frequency of Occurrence at the 628-3 Site in 2019. (3 Pages).**

| Species | Outer Area | | Inner Area | | Entire Site | |
|---|---|---|---|---|---|---|
| | % Cover | % Frequency of Occurrence | % Cover | % Frequency of Occurrence | Average % Cover | Average % Frequency of Occurrence |
| Soil | 48.5 | 96.0 | 45.9 | 100.0 | 47.2 | 98.0 |
| Litter | 40.0 | 100.0 | 14.1 | 100.0 | 27.1 | 100.0 |
| Rock/Cobble | 7.0 | 80.0 | 5.1 | 84.0 | 6.1 | 82.0 |
| Unavailable Space | 0.7 | 8.0 | 0.9 | 16.0 | 0.8 | 12.0 |
| **Total Canopy Cover** | 28.4 | | 34.3 | | **31.4** | |
| **Total Native % Cover** | 6.6 | | 21.7 | | **14.2** | |
| Total Invasive % Cover | 21.8 | | 12.6 | | 17.2 | |
| Unadjusted canopy cover | 28.2 | | 34.0 | | 31.1 | |
| Unadjusted Native % Cover | 6.6 | | 21.5 | | 14.1 | |
| Unadjusted Invasive % Cover | 21.6 | | 12.5 | | 17.1 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames
- = species not observed on site

**Figure 16. The Outer Area of the 628-3 Site in 2020.**

### 3.4.5 600-30 Site (Construction Lay-Down Area)

The 600-30 site was initially revegetated in FY 2011 and was monitored for 5 years following completion. Fifth-year monitoring found that native cover was below success levels and additional revegetation actions were recommended for the site. The 600-30 site was seeded in FY 2020 with the FY 2020 Seed Mix (Table 1) via an ATV broadcast seeder in order to reduce impact to the existing native vegetation at the site. The site was also planted in FY 2020 with 400 sagebrush (*Artemisia tridentata*), 100 bitterbrush (*Purshia tridentata*), 100 hopsage (*Grayia spinosa*), and 200 forbs per acre (Figure 17).

One transect was established at the 600-30 site in 2020. This transect was monitored for both existing shrubs and shrubs planted in FY 2020. Monitoring results show a shrub density of 360 plants/ac, above success criteria of 240 plants/ac. A total of 23% of the shrubs on the transect were in bloom, all of which were existing shrubs. Existing shrubs made up 206 plants/ac and planted shrubs brought this number up to success criteria, adding 154 plants/ac.

Monitoring of the supplemental planning effort at the 600-30 site shows that supplemental shrubs brought this site to successful shrub density levels. Continued monitoring will show if supplemental planting and seeding had a positive impact in native canopy cover at this site.

**Figure 17. The 600-30 Site in 2020.**

## 3.5 100-H AREA SITES

Two sites were monitored in the 100-H Area: 100-H-28:2 and 600-385. Two other sites in the 100-H Area, 100-H-24 and 116-H-1, were scheduled for canopy cover monitoring in FY 2020 but this work was not able to be performed. Monitoring at those sites will resume in FY 2021.

The 100-H-28:2 was revegetated in FY 2016 and the 600-385 site in FY 2017. These sites were remediated to meet the objectives for interim closure as established in the 100 Area RDR/RAWP (DOE/RL-96-17) and in the Interim Action ROD (EPA 1999). The 600-385 site had additional revegetation guidelines as stated in the *Memorandum of Agreement (MOA) Between the U.S. Department of Energy, Richland Operations Office, the Washington Department of Archaeology and Historic Preservation, and the Advisory Council on Historic Preservation Regarding the Remediation of Waste Site 600-385, and Removal of Miscellaneous Restoration Items SG4DH-169 and SG4DH-207 in the 100-D and 100-H Intermediary Area of the Hanford Site, Benton County, Washington (HCR#2011-100-083)* (DOE-RL et al. 2015b).

Revegetation efforts entailed broadcast seeding with a mixture of native grasses (including Sandberg's bluegrass [*Poa secunda*], Indian ricegrass [*Achnatherum hymenoides*], bluebunch wheatgrass [*Pseudoroegneria spicata*], squirreltail [*Elymus elymoides*], needle-and-thread grass [*Hesperostipa comata*], and prairie junegrass [*Koeleria macrantha*]) at approximately 15 lbs/ac. Broadcast seeding areas were topped with a straw mulch that was crimped into the soil surface. Shrub species (including big sagebrush [*Artemisia tridentata*], antelope bitterbrush [*Purshia tridentata*], and spiny hopsage [*Grayia spinosa*]) were transplanted on the sites at approximately 500 to 650 plants/ac with a mix of approximately 75% sagebrush, 15% bitterbrush, and 10% spiny hopsage. Sites planted in FY 2016 (100-H-28:2) received varying planting ratios ranging from 60 to 75% big sagebrush, 5 to 15% antelope bitterbrush, 10 to 30% spiny hopsage, and approximately 1% (cumulatively) of rubber rabbitbrush (*Ericameria nauseosa*) and yellow rabbitbrush (*Chrysothamnus viscidiflorus*).

### 3.5.1 100-H-28:2 Site (Process Sewer Area)

The 100-H-28:2 site (Figure 18) was revegetated in FY 2016 and monitoring was first conducted for the site in 2016. This is a larger site that was divided into two areas (north and south) for monitoring purposes with one established transect in each area. Substrates at the site are predominantly gravel and cobbles with varying amounts of loamy sand.

Two shrub monitoring transects were established for the site in 2016. In FY 2016 and FY 2017, these transects were monitored by recording plants only 3 m (9.8 ft) on either side of the tape. Fifth-year monitoring for the site was conducted in November 2020; the results show an average shrub density of 198 plants/ac, below the success criteria of 240 plants/ac. Both transects had relatively similar shrub density, with Transect 1 having a shrub density of 460 shrubs/ha (186 shrubs/ac) and Transect 2 having a shrub density of 210 shrubs/ac. Both Transect 1 and Transect 2 had high survival from the initial planting, with 88% survival on each transect. It appears neither was planted at a rate that would allow it to reach success criteria.

Canopy cover data for the site was collected in April 2019. Average canopy cover for the site was 35.1%, with native cover representing 22.9% and invasive cover representing 12.2% (Table 20). This represents an increase of 9.2% in native cover and an increase of 3.8% in invasive cover from 2018. The dominant native species was bluebunch wheatgrass (*Pseudoroegneria spicata*) with 10.1% cover followed by Sandberg's bluegrass (*Poa secunda*) with 8.8% cover. Cheatgrass (*Bromus tectorum*) was the dominant invasive species for the site with 5.3% cover. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was recorded on the site with less than 1% cover occurring in 22% of the plot frames.

This site has a good ratio of native to invasive species and native species cover is increasing. Additional revegetation efforts to increase shrub density should be considered for this site. It is recommended that canopy cover be monitored in FY 2021 to account for fifth-year monitoring and that additional plugs be planted in FY 2022.

**Table 20. Percent Canopy Cover and Frequency of Occurrence at the 100-H-28:2 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | X | X |
| *Artemisia tridentata* (big sagebrush) | 1.0 | 8 |
| *Bromus tectorum* (cheatgrass) [(a)] | 5.3 | 100 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | 0.8 | 22 |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.1 | 4 |
| *Draba verna* (spring draba) [(a)] | 1.3 | 50 |
| *Elaeagnus angustifolia* (Russian olive) [(a)] | X | X |
| *Elymus elymoides* (squirreltail) | 0.1 | 2 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.3 | 12 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.4 | 4 |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 1.0 | 18 |
| *Holosteum umbellatum* (jagged chickweed) [(a)] | 0.9 | 36 |
| *Koeleria macrantha* (prairie junegrass) | 0.2 | 6 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 0.6 | 24 |
| *Lamium amplexicaule* (henbit deadnettle) [(a)] | 0.1 | 2 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X |
| *Melilotus officinalis* (sweetclover) [(a)] | X | X |
| *Poa secunda* (Sandberg bluegrass) | 8.8 | 100 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 10.1 | 86 |
| *Purshia triedntata* (antelope bitterbrush) | X | X |
| *Salsola kali* (Russian thistle) [(a)] | 2.4 | 96 |
| *Sisymbrium altissimum* (tall tumblemustard) [(a)] | 0.3 | 12 |
| *Sphaeralcea munroana* (Munro's globemallow) | 0.1 | 2 |
| *Tragopogon dubius* (yellow salsify) [(a)] | 0.1 | 2 |
| *Verbascum thapsus* (common mullein) [(a)] | X | X |
| Crust | 1 | 10 |
| Soil | 16.2 | 94 |
| Litter | 20.05 | 76 |
| Rock/Cobble | 32.4 | 100 |
| Unavailable Space | 5.25 | 80 |
| **Total Canopy Cover** | **35.1** | |
| **Total Native % Cover** | **22.9** | |

**Table 20. Percent Canopy Cover and Frequency of Occurrence at the 100-H-28:2 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| Total Invasive % Cover | 12.2 | |
| Unadjusted canopy cover | 33.3 | |
| Unadjusted Native % Cover | 21.7 | |
| Change in Native % Cover from 2018 | 9.2 | |
| Unadjusted Invasive % Cover | 11.6 | |
| Change in Invasive % Cover from 2018 | 3.8 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 18. The 100-H-28:2 Site in 2020.**

### 3.5.2 600-385 Site (Dump Site)

The 600-385 site (Figure 19) was revegetated in FY 2017 and monitoring was first conducted for the site in 2017. The substrate for the site is characterized by loamy sand with varying amounts of gravel. In keeping with the *Memorandum of Agreement (MOA) Between the U.S. Department of Energy, Richland Operations Office, the Washington Department of Archaeology and Historic Preservation, and the Advisory Council on Historic Preservation Regarding the Remediation of Waste Site 600-385, and Removal of Miscellaneous Restoration Items SG4DH-169 and SG4DH-207 in the 100-D and 100-H Intermediary Area of the Hanford Site, Benton County, Washington (HCRC#2011-100-083)* (DOE-RL et al. 2015b), seeds from several native forbs were collected from the Hanford Site and broadcast on the site along with the standard native

grass seed mix. Second-year revegetation monitoring found that the 600-385 site was not meeting success criteria for shrub density and supplemental plantings were recommended for this site. In FY 2020, this site was planted with sagebrush (*Artemisia tridentata*) at a rate of 300 plants per acre, bitterbrush (*Purshia tridentata*) and hopsage (*Grayia spinosa*) each at a rate of 50 plants per acre, and forbs at a rate of 100 plants per acre.

One 100-m (328-ft) shrub monitoring transect was established in 2017. Fourth-year monitoring took place on this transect in September 2020. The results show a density of 227 shrubs/ac. If monitoring had occurred in spring 2020, shrub density immediately after plug planting would have likely been higher and above success levels. The monitoring results suggest that there was relatively high die-off of supplemental plants after their first summer. A toal of 43% of sagebrush on the transect were in bloom and producing seed, so the shrubs may begin to naturally recruit and expand their population in future years.

Canopy cover data for the site was collected in May 2019. Data was collected from 25 plot frames. Canopy cover for the site overall was 38.5% with 27.8% native cover and 10.8% invasive cover (Table 21). Native cover increased by 6.6% since 2018 and invasive cover decreased by 8.7% from 2018. The dominant native species was Sandberg's bluegrass (*Poa secunda*) with 13.5% cover followed by bluebunch wheatgrass (*Pseudoroegneria spicata*) with 5.1% cover. Fifteen native species were detected at this site in 2019. Cheatgrass (*Bromus tectorum*) was the dominant invasive species at this site with 5.5% cover. Kochia (*Bassia scoparia*) and diffuse knapweed (*Centaurea diffusa*), both Washington State Class B noxious weeds, were recorded at this site at levels less than 1% coverage.

Additional monitoring will help determine if sagebrush is naturally reproducing at this site. This will help decision makers determine if additional plug plantings are needed.

**Table 21. Percent Canopy Cover and Frequency of Occurrence at the 600-385 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.1 | 4.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.1 | 4.0 |
| *Artemisia tridentata* (big sagebrush) | 0.2 | 8.0 |
| *Bassia scoparia* (kochia) (B) [(b)] | 0.3 | 12.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 5.5 | 100.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | 0.1 | 4.0 |
| *Chorispora tenella* (crossflower) [(a)] | X | X |
| *Descurcania pinnata* (western tansymustard) | 1.2 | 28.0 |
| *Draba verna* (spring draba) [(a)] | 0.4 | 16.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.3 | 12.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 4.9 | 40.0 |
| *Erodium cicutarium* (redstem stork's bill) [(a)] | 0.7 | 8.0 |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 0.3 | 12.0 |

**Table 21. Percent Canopy Cover and Frequency of Occurrence at the 600-385 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.7 | 28.0 |
| *Hordeum leporinum* (hare barley) [a] | X | X |
| *Lactuca serriola* (prickly lettuce) [a] | 0.4 | 16.0 |
| *Lepidium perfoliatum* (clasping pepperweed) [a] | 0.3 | 12.0 |
| *Leymus cinereus* (basin wildrye) | X | X |
| *Lupinus wyethii* (Wyeth's lupine) | X | X |
| *Melilotus officinalis* (sweet clover) [a] | X | X |
| *Phlox longifolia* (longleaf phlox) | 0.1 | 4.0 |
| *Poa bulbosa* (bulbous bluegrass) [a] | 0.1 | 4.0 |
| *Poa secunda* (Sandberg bluegrass) | 13.5 | 96.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 5.1 | 64.0 |
| *Salsola kali* (Russian thistle) [a] | 1.0 | 40.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.5 | 20.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| Crust | 3.1 | 28.0 |
| Soil | 27.2 | 92.0 |
| Litter | 35.9 | 100.0 |
| Rock/Cobble | 1.6 | 44.0 |
| Unavailable Space | 7.1 | 64.0 |
| **Total Canopy Cover** | **38.5** | |
| **Total Native % Cover** | **27.8** | |
| Total Invasive % Cover | 10.8 | |
| Unadjusted canopy cover | 35.8 | |
| Unadjusted Native % Cover | 25.8 | |
| Change in Native % Cover from 2018 | 6.6 | |
| Unadjusted Invasive % Cover | 10.0 | |
| Change in Invasive % Cover from 2018 | -8.7 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 19. The 600-385 Site in 2019.**

## 3.6 100-F AREA SITES

Nine sites were monitored in the 100-F Area: 118-F-6 SSA, 100-F-47, 100-F-CTA, 100-F-57, 100-F-26, 118-F-1, 118-F-3, 118-F-5, and the 100-F Trailer Village. The 100-F-47 and 100-F-48 sites were revegetated in FY 2012 and monitoring was first conducted in FY 2016. The 100-F-47 and 100-F-48 sites had additional shrubs planted in FY 2018 in order to increase the shrub coverage and 100-F-47 was monitored as a representative site. The eight other sites were determined to need additional revegetation actions due to failing shrub and/or native plant coverage and were all re-done in FY 2018. The original planting of 118-F-1, 100-F-26, and 118-F-5 took place in FY 2008, the original planting of 118-F-6 SSA took place in FY 2009, and the original planting of 100-F-47 and 100-F-CTA occurred in FY 2012. Initial revegetation efforts at all these sites entailed broadcast seeding at approximately 15 lbs/ac with a mixture of native grasses including Sandberg's bluegrass (*Poa secunda*), Indian ricegrass (*Achnatherum hymenoides*), bluebunch wheatgrass (*Pseudoroegneria spicata*), squirreltail (*Elymus elymoides*), needle-and-thread grass (*Hesperostipa comata*), and prairie junegrass (*Koeleria macrantha*) topped with a straw mulch that was crimped into the soil surface. Shrub species including big sagebrush (*Artemisia tridentata*), antelope bitterbrush (*Purshia tridentata*), and spiny hopsage (*Grayia spinosa*) were transplanted on the sites at approximately 500 to 650 plants/ac with a mix of approximately 75% sagebrush, 15% bitterbrush, and 10% spiny hopsage. The 2017 monitoring of these sites showed higher invasive cover than native cover and low shrub coverage.

In FY 2018, additional revegetation actions at the 100-F Area involved both supplemental plantings of shrubs and the complete re-working of failing revegetation sites. All of the sites monitored and included in this report were completely re-done. Revegetation efforts at these

sites included seeding approximately 15 lbs/ac pure live seed of a mixture of native grasses including Sandberg bluegrass, Indian ricegrass, bluebunch wheatgrass, squirreltail, and needle-and-thread grass. Gray rabbitbrush (*Ericameria nauseosa*), snow buckwheat (*Eriogonum niveum*), Blue Mountain buckwheat (*Eriogonum strictum*), Munro's globemallow (*Sphaeralcea munroana*), Douglas' dustymaiden (*Chaenactis douglasii*), Carey's balsamroot (*Balsamorhiza careyana*), and sharpleaf penstemon (*Penstemon acuminatus*) were seeded as a mix at a rate of 1.1 lb/ac. Big sagebrush, antelope bitterbrush, and spiny hopsage were planted at a target rate of 600 plants/ac at a mix of 67%, 16%, and 16%, respectively.

Three different revegetation treatments were used on the sites that were completely redone. The 118-F-1 and 118-F-6 seeding used an imprinter rather than a broadcast seeder, and these sites were not covered with straw mulch. The 100-F-CTA, the 100-F Trailer Village, and 118-F-5 were imprinted and covered with straw mulch. The 100-F-57, 100-F-26, and 118-F-3 used the typical method of broadcast seeding and covered with straw mulch.

### 3.6.1 100-F-47 Site (151-F Substation)

The 100-F-47 site (Figure 20) was originally revegetated in FY 2012 and monitoring was first conducted for the site in 2016. After finding low shrub density, additional supplemental revegetation actions were taken in FY 2018. Sagebrush, bitterbrush, and hopsage were planted at this site at a rate of approximately 350 plants/ac, 100 plants/ac, and 100 plants/ac, respectively. The substrate for the site is primarily gravel and cobble backfill with varying amounts of loamy sand.

A shrub monitoring transect was established for the site after supplemental planting in FY 2018 and was first monitored in 2018. Third-year monitoring of the supplemental plantings occurred in FY 2020. Shrubs planted in 2018 had a density of 166 plants/ac, with 79% of the planted sagebrush surviving from 2019 to 2020. When including the original sagebrush planted in FY 2012, shrub density at this site increases to 397 plants/ac. Sagebrush seedlings on the transect were not measured in 2020 as there were over 200 recruits found. Though a large number of recruits will be outcompeted and die, they currently bring the shrub density at 100-F-47 to over 1,206 plants/ac.

Canopy cover data was not collected for this site in 2018, data collected in 2019 will be compared to 2017 pre-supplementation data. Second-year canopy cover monitoring showed 42.5% total cover, with 23.1% native cover and 19.4% invasive cover (Table 22). This represents an increase of 10.0% in native cover and of 5.3% in invasive cover since 2017. The dominant native species is Sandberg's bluegrass (*Poa secunda*) with 6.3% cover followed by sagebrush with 4.8% cover. Eighteen native species were detected at this site. The dominant invasive species is cheatgrass (*Bromus tectorum*) with 10.3% cover. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was present on the site with 2.3% cover and occurrence in 52% of the plot frames.

The supplemental planting appears to have been successful, as native cover is nearing 25% success levels and shrub density is successful. One additional year of canopy cover monitoring is recommended for this site to determine if it meets success criteria. Shrub transect monitoring is no longer required due to the high density of shrub cover at this site.

**Table 22. Percent Canopy Cover and Frequency of Occurrence at the 100-F-47 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.2 | 8.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | X | X |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 0.2 | 8.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.1 | 4.0 |
| *Artemisia tridentata* (big sagebrush) | 4.8 | 20.0 |
| *Artemisia tridentata* (recruits) | 0.7 | 28.0 |
| *Astragalus succumbens* (crouching milkvetch) | X | X |
| *Bromus tectorum* (cheatgrass) [a] | 10.3 | 100.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | 2.3 | 52.0 |
| *Descurcania pinnata* (western tansymustard) | 0.3 | 12.0 |
| *Draba verna* (spring draba) [a] | 0.8 | 32.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.9 | 36.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 1.9 | 20.0 |
| *Erodium cicutarium* (redstem stork's bill) [a] | 0.3 | 12.0 |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 0.2 | 8.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.0 | 40.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.5 | 20.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.1 | 4.0 |
| *Plantago patagonica* (woolly plantain) | 0.2 | 8.0 |
| *Poa bulbosa* (bulbous bluegrass) [a] | 0.2 | 8.0 |
| *Poa secunda* (Sandberg bluegrass) | 6.3 | 92.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 3.7 | 48.0 |
| *Salsola kali* (Russian thistle) [a] | 2.0 | 80.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | X | X |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Sporobolus cryptandrus* (sand dropseed) | 0.1 | 4.0 |
| *Vulpia microstachys* (desert fescue) | 1.1 | 44.0 |
| Crust | 0.4 | 16.0 |
| Soil | 9.5 | 64.0 |
| Litter | 28.0 | 92.0 |
| Rock/Cobble | 21.3 | 92.0 |
| Unavailable Space | 10.1 | 92.0 |
| **Total Canopy Cover** | **42.5** | |
| **Total Native % Cover** | **23.1** | |
| Total Invasive % Cover | 19.4 | |
| Unadjusted canopy cover | 38.2 | |
| Unadjusted Native % Cover | 20.8 | |
| Change in Native % Cover from 2017 [c] | 10.0 | |
| Unadjusted Invasive % Cover | 17.4 | |
| Change in Invasive % Cover from 2017 [c] | 5.3 | |

**Table 22. Percent Canopy Cover and Frequency of Occurrence at the 100-F-47 Site in 2019. (2 Pages)**

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
[c] was not monitored in 2018
X = present but not counted in plot frames

**Figure 20. The 100-F-47 Site in 2020.**

### 3.6.2 118-F-1 Site (Burial Ground)

The 118-F-1 site was originally revegetated in FY 2009 and was not monitored; however, 118-F-6 acts as a representative site, suggesting 118-F-1 also failed to meet success criteria after the original planting. The 118-F-1 and 118-F-6 sites were revegetated in FY 2018 using an imprinter seeder and no straw mulch (Figure 21). The substrate for this site is predominantly sand with some gravel and cobbles. Vegetative coverage is patchy with areas of dense cheatgrass and areas of bare sand.

One transect was established on this site in May 2018. Third-year monitoring results show a shrub density of 263 plants/ac, putting this site above the success criteria of 240 plants/ac. Shrub survival for sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*), and hopsage (*Grayia spinosa*) averaged 40% from the first year.

Canopy cover at this site was measured with 25 plots in May 2019 (Table 23). Canopy cover totaled 31.7% with 9.5% native cover and 22.2% invasive cover. This represents an increase of 0.4% in native cover and 1.9% in invasive cover. Russian thistle (*Salsola kali*), the dominant invasive species in 2018, dropped from 9.4% coverage to 1.7% coverage in 2019. Cheatgrass

(*Bromus tectorum*) increased from 5.8% to 13.1%. The dominant native species was Sandberg's bluegrass (*Poa secunda*) with 2.2% coverage. Nineteen native species were found at this site, an increase of seven species from 2018 monitoring. Of the six forbs that were seeded at this site, four were found growing at this site in 2019. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was present on the site with 2.3% cover and occurrence in 52% of the plot frames.

More time is needed to determine the success of this site but the high diversity of native plants observed and increasing native cover is a positive indicator. The shrub cover is successful but will need to maintain high survival in the coming years to remain successful long-term.

**Table 23. Percent Canopy Cover and Frequency of Occurrence at the 118-F-1 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.1 | 4.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.1 | 4.0 |
| *Artemisia tridentata* (big sagebrush) | 1.2 | 8.0 |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.1 | 4.0 |
| *Bromus tectorum* (cheatgrass) [a] | 13.1 | 100.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | 0.2 | 8.0 |
| *Chaenactis douglasii* (Douglas' dusty maiden) | 0.7 | 8.0 |
| *Cryptantha circumscissa* (cushion cryptantha) | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.7 | 28.0 |
| *Draba verna* (spring draba) [a] | 0.4 | 16.0 |
| *Elymus elymoides* (squirreltail) | X | X |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.6 | 24.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 1.1 | 24.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.1 | 4.0 |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Holosteum umbellatum* (jagged chickweed) [a] | 2.7 | 68.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.1 | 4.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.1 | 4.0 |
| *Melilotus officinalis* (sweet clover) [a] | X | X |
| *Phacelia sp.* (phacelia) | X | X |
| *Poa bulbosa* (bulbous bluegrass) [a] | 0.8 | 32.0 |
| *Poa secunda* (Sandberg bluegrass) | 2.2 | 68.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 1.4 | 36.0 |
| *Purshia tridentata* (antelope bitterbrush) | X | X |
| *Salsola kali* (Russian thistle) [a] | 1.7 | 68.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.9 | 36.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Sporobolus cryptandrus* (sand dropseed) | 0.1 | 4.0 |
| *Tragopogon dubius* (yellow salsify) [a] | X | X |

**Table 23. Percent Canopy Cover and Frequency of Occurrence at the 118-F-1 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| Crust | 4.2 | 68.0 |
| Soil | 43.6 | 100.0 |
| Litter | 6.4 | 96.0 |
| Rock/Cobble | 24.0 | 100.0 |
| Unavailable Space | 10.4 | 96.0 |
| **Total Canopy Cover** | **31.7** | |
| **Total Native % Cover** | **9.5** | |
| Total Invasive % Cover | 22.2 | |
| Unadjusted canopy cover | 28.4 | |
| Unadjusted Native % Cover | 8.5 | |
| Change in Native % Cover from 2018 | 0.4 | |
| Unadjusted Invasive % Cover | 19.9 | |
| Change in Invasive % Cover from 2018 | 1.9 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 21. The 118-F-1 Site in 2020.**

### 3.6.3 118-F-6 Site (Soil Staging Area)

The 118-F-6 Soil Staging Area site (Figure 22) was revegetated in FY 2009 and monitoring was first conducted for the site in 2016. The substrate for the site is a loamy sand with varying

amounts of gravel and cobbles. No shrub transect was established for the site in 2016 due to the scarcity of shrubs observed on the site. In 2018 this site was revegetated with an imprint seeder and no straw mulch.

In 2017, 7 years after this site was originally planted, 118-F-6 had little to no shrub cover and a canopy cover of 18.7% with 14.2% invasive and 4.5% native. In May 2018, after this site was redone, one transect was set up to measure shrub cover. Third-year monitoring took place in October 2020. The results show a shrub cover of 174 plants/ac below the success criteria of 240 plants/ac. Sagebrush (*Artemisia tridentata*) survival in 2020 was 34%, hopsage (*Grayia spinosa*) survival was 12%, and bitterbrush (*Purshia tridentata*) survival was 17%. It is unknown why survival rates were abnormally low at this site.

Canopy cover data for this site was collected in May 2019 (Table 24). Data was collected from a total of 25 plot frames. Canopy cover for the site was 37.3%, with 6.3% native cover and 31.6% invasive cover. This represents a 0.7% decrease in native cover and a 1.7% increase in invasive cover since 2018. The high invasive cover is mainly made up cheatgrass (*Bromus tectorum*, 13.2% cover). The highest native coverage was from bluebunch wheatgrass (*Pseudoroegneria spicata*) with 1.7% cover. Twenty-two native grasses and forbs were identified at this site, an increase of six from 2018 monitoring. Prior to additional revegetation action, only five native grass and forb species were identified at this site. Of the six forbs that were seeded at this site, four were found growing at this site in 2019. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was observed at this site but was not detected in any plot frames.

The 118-F-6 site has significantly higher native plant diversity and cover than it did before additional revegetation actions. Though shrub cover did not meet success levels, shrub cover is higher than the site was prior to supplementation. Additional actions such as supplemental planting or seeding with shrub seed are recommended at this site to bring it to successful shrub density levels.

**Table 24. Percent Canopy Cover and Frequency of Occurrence at the 118-F-6 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | X | X |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.1 | 4.0 |
| *Agoseris heterophylla* (false mountain dandelion) | 0.1 | 4.0 |
| *Artemisia tridentata* (big sagebrush) | 0.9 | 16.0 |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.1 | 4.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 13.2 | 100.0 |
| *Bunchgrasses sp.* (multiple) | 0.1 | 4.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | X | X |
| *Chaenactis douglasii* (Douglas' dusty maiden) | 0.1 | 4.0 |
| *Chondrilla juncea* (rush skeletonweed) (B) [(b)] | X | X |

**Table 24. Percent Canopy Cover and Frequency of Occurrence at the 118-F-6 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Cryptantha circumscissa* (cushion cryptantha) | 0.2 | 8.0 |
| *Descurcania pinnata* (western tansymustard) | 0.5 | 20.0 |
| *Draba verna* (spring draba) [(a)] | 1.1 | 44.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.4 | 16.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.1 | 4.0 |
| *Erigeron sp.* (fleabane) | X | X |
| *Eriogonum niveum* (snow buckwheat) | X | X |
| *Erodium cicutarium* (redstem stork's bill) [(a)] | 2.8 | 16.0 |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 0.1 | 4.0 |
| *Holosteum umbellatum* (jagged chickweed) [(a)] | 4.8 | 92.0 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 0.1 | 4.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.2 | 8.0 |
| *Microsteris gracilis* (slender phlox) | 0.3 | 12.0 |
| *Poa bulbosa* (bulbous bluegrass) [(a)] | 2.8 | 32.0 |
| *Poa secunda* (Sandberg bluegrass) | 0.7 | 28.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 1.7 | 28.0 |
| *Purshia tridentata* (antelope bitterbrush) | 0.1 | 4.0 |
| *Ranunculus testiculatus* (burr buttercup) [(a)] | 0.2 | 8.0 |
| *Salsola kali* (Russian thistle) [(a)] | 1.5 | 60.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [(a)] | 2.2 | 48.0 |
| *Sporobolus cryptandrus* (sand dropseed) | X | X |
| Crust | 7.0 | 88.0 |
| Soil | 34.0 | 100.0 |
| Litter | 15.5 | 100.0 |
| Rock/Cobble | 18.8 | 96.0 |
| Unavailable Space | 9.2 | 76.0 |
| **Total Canopy Cover** | **37.9** | |
| **Total Native % Cover** | **6.3** | |
| Total Invasive % Cover | 31.6 | |
| Unadjusted canopy cover | 34.4 | |
| Unadjusted Native % Cover | 5.7 | |
| Change in Native % Cover from 2018 | -0.7 | |
| Unadjusted Invasive % Cover | 28.7 | |
| Change in Invasive % Cover from 2018 | 1.7 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 22. The 118-F-6 Soil Staging Area Site in 2020.**

### 3.6.4 100-F-CTA Site (Container Transfer Area)

The 100-F-CTA site (Figure 23) was revegetated in FY 2012 and monitoring was first conducted for the site in 2016. This site met success criteria in 2017 monitoring with 259 plants/ac. Native canopy cover at this site was not successful in 2017, with 9.6% native cover and 12.3% invasive cover. Due to the low native cover and patchy shrub cover at this site, it was redone in FY 2018. This site was imprinted and covered with a straw mulch, care was taken to avoid running machinery over existing patches of shrubs. The substrate for the site is primarily gravel and cobble backfill with varying amounts of loamy sand.

A shrub monitoring transect was established for the site after the completion of revegetation activities in 2018; this transect was monitored for third-year monitoring in October 2020. The 2020 results show a shrub density of 273 plants/ac, meeting the success criteria of 240 plants/ac. This is an increase from 2019 shrub density, and the increase appears to be due to natural recruitment of sagebrush at the site. A total of 40% of the sagebrush (*Artemisia tridentata*) recorded on the transect was in bloom and seeding in 2020, suggesting the site will continue to recruit.

Canopy cover data for the site was collected in May 2019. Data was collected from a total of 25 plot frames. Canopy cover for the site was 30.9% with native cover representing 8.0% and invasive cover representing 22.9% (Table 25). This represents an increase of 0.5% in native cover and of 9.2% in invasive cover from 2018. The dominant native species was Sandberg's bluegrass (*Poa secunda*) with 4.4% cover. The dominant invasive species was cheatgrass (*Bromus tectorum*) with 16.4%. Cheatgrass cover has increased by 12.5% since 2018. Sixteen native grass and forb species were identified at this site, five more than in 2018 monitoring; prior

to the additional revegetation actions only six native grass and forb species were found at this site. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was present on the site with 1.9% cover and occurrence in 16% of the plot frames.

The 100-F-CTA site has significantly higher native plant diversity than it did before additional revegetation actions. In 2019, native plant cover is not as high as it was before additional revegetation actions but native plant cover is expected to increase. Shrub cover has improved over the last year and is now at successful levels due to successful sagebrush recruitment.

**Table 25. Percent Canopy Cover and Frequency of Occurrence at the 100-F-CTA Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achnatherum hymenoides* (Indian ricegrass) | 0.1 | 4.0 |
| *Artemisia tridentata* (big sagebrush) | 0.8 | 12.0 |
| *Artemisia tridentata* (recruits) | 0.2 | 8.0 |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.1 | 4.0 |
| *Bromus tectorum* (cheatgrass) [a] | 16.4 | 92.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | 1.9 | 16.0 |
| *Chaenactis douglasii* (Douglas' dusty maiden) | X | X |
| *Dalea ornata* (prairie clover) | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.1 | 4.0 |
| *Draba verna* (spring draba) [a] | X | X |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.2 | 8.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.1 | 4.0 |
| *Erodium cicutarium* (redstem stork's bill) [a] | 0.1 | 4.0 |
| *Festuca sp.* (fescue) | X | X |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.0 | 40.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.1 | 4.0 |
| *Lepidium perfoliatum* (clasping pepperweed) [a] | 0.1 | 4.0 |
| *Oenothera pallida* (pale-evening primrose) | X | X |
| *Poa bulbosa* (bulbous bluegrass) [a] | X | X |
| *Poa secunda* (Sandberg bluegrass) | 4.4 | 80.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 1.4 | 56.0 |
| *Purshia tridentata* (antelope bitterbrush) | 0.1 | 4.0 |
| *Salsola kali* (Russian thistle) [a] | 2.0 | 80.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.7 | 28.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Vulpia microstachys* (desert fescue) | 0.3 | 12.0 |
| Crust | 0.7 | 8.0 |
| Soil | 14.2 | 84.0 |
| Litter | 42.3 | 92.0 |
| Rock/Cobble | 15.6 | 88.0 |
| Unavailable Space | 2.5 | 40.0 |
| **Total Canopy Cover** | **30.9** | |

**Table 25. Percent Canopy Cover and Frequency of Occurrence at the 100-F-CTA Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| **Total Native % Cover** | **8.0** | |
| Total Invasive % Cover | 22.9 | |
| Unadjusted canopy cover | 30.1 | |
| Unadjusted Native % Cover | 7.8 | |
| Change in Native % Cover from 2018 | 0.5 | |
| Unadjusted Invasive % Cover | 22.3 | |
| Change in Invasive % Cover from 2018 | 9.2 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 23. The 100-F-CTA Site in 2020.**

### 3.6.5 100-F Trailer Village Site

The 100-F Trailer Village site was revegetated in FY 2018 using an imprinter seeder and straw mulch (Figure 24). The 100-F Trailer Village site was originally revegetated in FY 2013 and was not monitored but the 100-F-CTA site acts as a representative site, suggesting the 100-F Trailer Village would also benefit from additional revegetation activities. The substrate for this site is predominantly loamy sand with gravel.

A shrub monitoring transect was established for the site after the completion of revegetation activities in 2018; this transect was monitored for third-year monitoring in October 2020. The

2020 results show a shrub density of 206 plants/ac, below the success criteria of 240 plants/ac. A total of 9% of the surviving sagebrush was in bloom and producing seed. Shrub survival at this site was 30.7% from the initial planting. Similar to the 100-F-CTA site, it is unknown why shrub survival is so low at this site.

Canopy cover at this site was measured with 25 plots in May 2019 (Table 26). Canopy cover totaled 28.0% with 6.6% native cover and 21.4% invasive cover. This represents an increase of 1.8% in native cover and of 4.9% in invasive cover. The dominant native species was Sandberg's bluegrass (*Poa secunda*) with 3.0% cover. The dominant invasive plant was cheatgrass (*Bromus tectorum*) with a coverage totaling 14.5%. Eighteen species of native forbs and grasses were identified at this site, eight more than in 2018. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was present on the site but did not occur in any of the plot frames.

The 100-F Trailer Village site has significantly higher native plant diversity than the representative site did before additional revegetation actions. Native plant cover is not as high as it was at the representative site before additional revegetation actions but native plant cover is expected to increase. Shrub cover has dropped below success levels in 2020 but planted sagebrush is beginning to produce seed. The 100-F-CTA site has seen increases in shrub density due to seeding sagebrush, and this may occur at the 100-F Trailer Village Site. Continued monitoring is recommended, and if increases in shrub cover are not observed, additional revegetation actions may be required.

**Table 26. Percent Canopy Cover and Frequency of Occurrence at the 100-F Trailer Village Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | X | X |
| *Achnatherum hymenoides* (Indian ricegrass) | X | X |
| *Artemisia tridentata* (big sagebrush) | 0.6 | 4.0 |
| *Artemisia tridentata* (recruits) | X | X |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.1 | 4.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 14.5 | 92.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | X | X |
| *Chaenactis douglasii* (Douglas' dusty maiden) | 0.1 | 4.0 |
| *Chorispora tenella* (crossflower) [(a)] | 0.1 | 4.0 |
| *Dalea ornata (* prairie clover) | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.4 | 16.0 |
| *Draba verna* (spring draba) [(a)] | 0.7 | 28.0 |
| *Elymus elymoides* (squirreltail) | X | X |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.8 | 32.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.2 | 8.0 |
| *Eriogonum niveum* (snow buckwheat) | X | X |
| *Grayia spinosa* (spiny hopsage) | X | X |

**Table 26. Percent Canopy Cover and Frequency of Occurrence at the 100-F Trailer Village Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.6 | 64.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.3 | 12.0 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X |
| *Melilotus officinalis* (sweet clover) [a] | X | X |
| *Poa secunda* (Sandberg bluegrass) | 3.0 | 80.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 1.0 | 40.0 |
| *Purshia tridentata* (antelope bitterbrush) | 0.1 | 4.0 |
| *Ranunculus testiculatus* (burr buttercup) [a] | 1.0 | 20.0 |
| *Salsola kali* (Russian thistle) [a] | 2.4 | 76.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.7 | 28.0 |
| *Vulpia microstachys* (desert fescue) | 0.3 | 12.0 |
| Crust | 0.0 | 0.0 |
| Soil | 23.2 | 88.0 |
| Litter | 41.9 | 100.0 |
| Rock/Cobble | 14.8 | 88.0 |
| Unavailable Space | 0.5 | 20.0 |
| **Total Canopy Cover** | **28.0** | |
| **Total Native % Cover** | **6.6** | |
| Total Invasive % Cover | 21.4 | |
| Unadjusted canopy cover | 27.9 | |
| Unadjusted Native % Cover | 6.6 | |
| Change in Native % Cover from 2018 | 1.8 | |
| Unadjusted Invasive % Cover | 21.3 | |
| Change in Invasive % Cover from 2018 | 4.9 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 24. The 100-F Trailer Village in 2020.**

### 3.6.6 118-F-5 Site (Sawdust Pit)

The 118-F-5 site was revegetated in FY 2018 using an imprinter seeder and straw mulch (Figure 25). The 118-F-5 site was originally revegetated in FY 2008 and was not monitored. The 2017 evaluations recommended additional revegetation actions to increase shrubs and native plant cover at this site. The substrate for this site is predominantly sandy loam with heavy cobble changing to sandy loam with some gravel. The northwestern third of the site had especially high rates of cobble.

Two transects established on this site were monitored for the third time in October 2020. Monitoring results show an average shrub density of 73 plants/ac, putting this site well below the success criteria of 240 plants/ac. Transect 1, located in the cobble area, had a survival rate of 34%, while Transect 2 in the sandy loam area had a survival rate of only 9%. There are established stands of mature sagebrush at this site producing seed, additionally, 32% of the sagebrush on Transect 1 were in bloom. Shrub density is expected to increase due to the seed production at this site, but with the low shrub density levels in third-year monitoring, the shrub density is not expected to rise to successful levels before the end of fifth-year monitoring.

Canopy cover at this site was measured with 50 plots in June 2018 (Table 27). Canopy cover totaled 41.1%, with 9.2% native cover and 32.2% invasive cover. This represents an increase of 5.1% in native cover and an increase of 22.8% in invasive cover. The dominant native species was Sandberg's bluegrass (*Poa secunda*) with a coverage totaling 3.8%. The dominant invasive plant was cheatgrass (*Bromus tectorum*) with a coverage totaling 27.9%. Cheatgrass coverage has increased by over 20% at this site in the last year. Thirty species of native forbs and grasses were identified at this site. Diffuse knapweed (*Centaurea diffusa*) and rush skeleton weed (*Chondrilla juncea*), both Washington State Class B noxious weeds, were present on the site but were not detected in plot frames.

Native cover is increasing at this site and there are a high number of native plant species, but cheatgrass levels have been notably increasing since the planting in FY 2018. Shrub density is well below successful levels; however, this site has a few significant sagebrush seed sources that may increase shrub density in the future. Further monitoring and evaluation is required before additional steps are taken to revegetate this site. Transect 1 and 2 are located in close proximity at this site and may not be the best representation of sagebrush density at the site as a whole. Relocating Transect 2 is recommended.

**Table 27. Percent Canopy Cover and Frequency of Occurrence at the 118-F-5 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.4 | 6 |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 0.1 | 2 |
| *Achnatherum hymenoides* (Indian ricegrass) | X | X |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.6 | 22 |
| *Artemisia tridentata* (big sagebrush) | X | X |
| *Balsamorhiza careyana* (Carey's balsamroot) | X | X |
| *Bromus tectorum* (cheatgrass) [a] | 27.9 | 98 |
| Bunchgrass sp. (multiple) | 0.1 | 2 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | X | X |
| *Ceratocephala testiculata* (bur buttercup) [a] | 0.1 | 4 |
| *Chaenactis douglasii* (Douglas' dusty maiden) | X | X |
| *Chondrilla juncea* (rush skeletonweed) (B) [b] | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.4 | 14 |
| *Draba verna* (spring draba) [a] | 1.0 | 40 |
| *Elymus elymoides* (squirreltail) | 0.1 | 4 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 4 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.5 | 8 |
| *Erigeron poliospermus* (cushion fleabane) | X | X |
| *Erigeron pumilus* (shaggy fleabane) | X | X |
| *Eriogonum niveum* (snow buckwheat) | X | X |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | X | X |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.6 | 24 |
| *Koeleria macrantha* (prairie junegrass) | X | X |
| *Lactuca serriola* (prickly lettuce) [a] | 0.1 | 2 |
| *Machaeranthera canescens* (hoary tansyaster) | 1.1 | 12 |
| *Microsteris gracilis* (slender phlox) | 0.3 | 12 |
| *Opuntia polyacantha* (plains pricklypear) | X | X |

**Table 27. Percent Canopy Cover and Frequency of Occurrence at the 118-F-5 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Plantago patagonica* (woolly plantain) | 0.2 | 6 |
| *Poa bulbosa* (bulbous bluegrass) [a] | 1.5 | 28 |
| *Poa secunda* (Sandberg bluegrass) | 3.8 | 56 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.4 | 14 |
| *Purshia tridentata* (antelope bitterbrush) | X | X |
| *Salsola kali* (Russian thistle) [a] | 0.7 | 26 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.1 | 4 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Sporobolus cryptandrus* (sand dropseed) | X | X |
| *Triteleia grandiflora* (Douglas' clusterlily) | X | X |
| *Triticum sp.* (wheat) [a] | X | X |
| *Vulpia microstachys* (desert fescue) | 1.4 | 56 |
| Crust | 0.6 | 4 |
| Soil | 22.5 | 94 |
| Litter | 45.5 | 100 |
| Rock/Cobble | 11.1 | 64.0 |
| Unavailable Space | 1.2 | 46.0 |
| **Total Canopy Cover** | **41.4** | |
| **Total Native % Cover** | **9.2** | |
| Total Invasive % Cover | 32.2 | |
| Unadjusted canopy cover | 41.0 | |
| Unadjusted Native % Cover | 9.1 | |
| Change in Native % Cover from 2018 | 5.1 | |
| Unadjusted Invasive % Cover | 31.9 | |
| Change in Invasive % Cover from 2018 | 22.8 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 25. The 118-F-5 Site in 2020, Showing High Amounts of Cheatgrass.**

### 3.6.7 100-F-57 Site (190-F Water Pump House Debris)

The 100-F-57 site was originally revegetated in FY 2009 and was not monitored. The 2017 evaluations recommended additional revegetation actions to increase shrubs and native plant cover at this site. The 100-F-57 site was revegetated in FY 2018 using a broadcast seeder and straw mulch (Figure 26). The substrate for this site is predominantly loamy sand with high amounts of cobble, scattered asphalt patches, and some debris.

One transect was established on this site after FY 2018 revegetation actions. Third-year monitoring results show an average shrub density of 1,596 plants/ha (646 plants/ac), high above the success criteria of 600 plants/ha (240 plants/ac). Shrubs had an average survival rate of 49% and 5% of the sagebrush on the transect was in bloom.

Canopy cover at this site was measured with 25 plots in May 2019 (Table 28). Canopy cover totaled 42.5%, with 7.8% native cover and 34.7% invasive cover. This represents a decrease in native cover of 3.1% and an increase in invasive cover of 17%. The dominant native species was bluebunch wheatgrass (*Pseudoroegneria spicata*) with 2.1% cover. The dominant invasive plant was cheatgrass (*Bromus tectorum*) with a coverage totaling 27.8%, representing an 18.6% increase from 2018 monitoring. Twenty-four species of native forbs and grasses were identified at this site. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was present on the site but was not detected in any plot frames.

Shrub density monitoring in FY 2020 found that the 100-F-57 site is well over success criteria for shrub density. Continued monitoring of canopy cover is needed to determine if native cover is increasing since re-seeding activities at this site. No additional actions are recommended at this time.

**Table 28. Percent Canopy Cover and Frequency of Occurrence at the 100-F-57 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.8 | 12.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.3 | 12.0 |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 0.1 | 4.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | X | X |
| *Artemisia tridentata* (big sagebrush) | 0.3 | 12.0 |
| *Astragalus succumbens* (crouching milkvetch) | X | X |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.1 | 4.0 |
| *Bromus tectorum* (cheatgrass) [a] | 27.8 | 100.0 |
| Bunchgrass sp. (multiple) | 0.1 | 4.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [b] | X | X |
| *Ceratocephala testiculata* (bur buttercup) [a] | 0.5 | 20.0 |
| *Chaenactis douglasii* (Douglas' dusty maiden) | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.6 | 24.0 |
| *Draba verna* (spring draba) [a] | 1.2 | 48.0 |
| *Elymus elymoides* (squirreltail) | X | X |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.4 | 16.0 |
| *Eriogonum niveum* (snow buckwheat) | X | X |
| *Erodium cicutarium* (redstem stork's bill) [a] | 0.1 | 4.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.4 | 56.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.2 | 8.0 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X |
| *Melilotus officinalis* (sweetclover) [a] | X | X |
| *Penstemon sp.* (beardtongue) | X | X |
| *Poa bulbosa* (bulbous bluegrass) [a] | 0.4 | 16.0 |
| *Poa secunda* (Sandberg bluegrass) | 1.7 | 68.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 2.1 | 64.0 |
| *Purshia tridentata* (antelope bitterbrush) | X | X |
| *Salsola kali* (Russian thistle) [a] | 1.3 | 52.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.3 | 12.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Sporobolus cryptandrus* (sand dropseed) | X | X |
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| *Triticum sp.* (wheat) [a] | X | X |
| *Vulpia microstachys* (desert fescue) | 1.0 | 40.0 |
| Crust | 0.0 | 0.0 |
| Soil | 17.6 | 72.0 |
| Litter | 46.2 | 100.0 |
| Rock/Cobble | 7.0 | 64.0 |
| Unavailable Space | 4.2 | 68.0 |

**Table 28. Percent Canopy Cover and Frequency of Occurrence at the 100-F-57 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| **Total Canopy Cover** | **42.5** | |
| **Total Native % Cover** | **7.8** | |
| Total Invasive % Cover | 34.7 | |
| Unadjusted canopy cover | 40.7 | |
| Unadjusted Native % Cover | 7.5 | |
| Change in Native % Cover from 2018 | -3.1 | |
| Unadjusted Invasive % Cover | 33.2 | |
| Change in Invasive % Cover from 2018 | 17.0 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 26. The 100-F-57 Site in 2020.**

### 3.6.8 100-F-26 Site (Water Treatment Facility Pipelines)

The 100-F-26 site was originally revegetated in FY 2009 and was not monitored. The 2017 evaluations recommended additional revegetation actions to increase shrubs and native plant cover at this site. The 100-F-26 site was revegetated in FY 2018 using a broadcast seeder and straw mulch (Figure 27). The substrate for this site is predominantly loamy sand with some gravel and cobbles.

One transect was established on this site after FY 2018 planting and this transect was monitored for a third year in October 2020. Monitoring results show an average shrub density of 257 plants/ac, putting this site above the success criteria of 240 plants/ac. Shrubs had a 57% survival rate post-planting. A total of 44% of sagebrush (*Artemisia tridentata*) at this site was in bloom and producing seed at the time of monitoring, suggesting the shrub density at this site will continue to increase.

This site is relatively small, and canopy cover was measured with 12 plot frames in May 2019 (Table 29). Canopy cover totaled 71.5%, with 8.3% native cover and 63.1% invasive cover. This represents a 4.3% increase in native cover and a 19.3% increase in invasive cover. The dominant native species was Sandberg's bluegrass (*Poa secunda*) with 4.2% cover. The dominant invasive species was cheatgrass (*Bromus tectorum*) with a coverage totaling 56.0%. Fourteen species of native forbs and grasses were identified at this site. No Washington State Noxious Weeds were identified at this site.

Shrub density at this site is successful and a high proportion of blooming sagebrush suggests that shrub density at this site will continue to increase. The 2019 monitoring found that invasive cover was high at this site. Continued canopy cover monitoring is necessary to determine if native canopy cover is increasing.

**Table 29. Percent Canopy Cover and Frequency of Occurrence at the 100-F-26 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | X | X |
| *Artemisia tridentata* (big sagebrush) | 1.3 | 8.3 |
| *Bromus tectorum* (cheatgrass) [(a)] | 56.0 | 100.0 |
| *Chaenactis douglasii* (Douglas' dusty maiden) | X | X |
| *Draba verna* (spring draba) [(a)] | 0.4 | 16.7 |
| *Elymus elymoides* (squirreltail) | X | X |
| *Eriogonum niveum* (snow buckwheat) | X | X |
| *Festuca sp.* (fescue) | X | X |
| *Holosteum umbellatum* (jagged chickweed) [(a)] | 1.3 | 50.0 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 0.4 | 16.7 |
| *Poa secunda* (Sandberg bluegrass) | 4.2 | 83.3 |
| *Purshia tridentata* (antelope bitterbrush) | X | X |
| *Salsola kali* (Russian thistle) [(a)] | X | X |
| *Sisymbrium altissimum* (tall tumblemustard) [(a)] | 0.2 | 8.3 |
| *Vulpia microstachys* (desert fescue) | 1.3 | 50.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Poa bulbosa* (bulbous bluegrass) [(a)] | 4.8 | 33.3 |
| *Lomatium macrocarpum* (bigseed desertparsley) | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.2 | 8.3 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.2 | 8.3 |
| *Hesperostipa comata* (needle-and-thread grass) | 1.3 | 8.3 |

**Table 29. Percent Canopy Cover and Frequency of Occurrence at the 100-F-26 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| Crust | 0.0 | 0.0 |
| Soil | 14.4 | 58.3 |
| Litter | 84.6 | 100.0 |
| Rock/Cobble | 0.0 | 0.0 |
| Unavailable Space | 0.0 | 0.0 |
| **Total Canopy Cover** | **71.5** | |
| **Total Native % Cover** | 8.3 | |
| Change in Native % Cover from 2018 | 4.3 | |
| Total Invasive % Cover | 63.1 | |
| Change in Invasive % Cover from 2018 | 19.3 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 27. The 100-F-26 Site in 2020 Showing High Levels of Cheatgrass Cover, View Facing West.**

### 3.6.9 118-F-3 Site (Burial Ground)

The 118-F-3 site was originally revegetated in FY 2008 and was not monitored. The 2017 evaluations recommended additional revegetation actions to increase shrubs and native plant cover at this site. The 118-F-3 site was revegetated in FY 2018 using a broadcast seeder and

straw mulch (Figure 28). The substrate for this site is predominantly sandy with areas of cobbles and boulders.

One transect was established on this site after planting in FY 2018 and third-year monitoring at this site was conducted in October 2020. Monitoring results show an average shrub density of 166 plants/ac, putting this site below the success criteria of 240 plants/ac. The shrub density at this site has not changed since 2019 monitoring. Shrubs had a 32% survival rate post-planting. Notably, 36% of sagebrush (*Artemisia tridentata*) plants were in bloom at this site. Additionally, mature sagebrush plants with seed were present in the area, suggesting this site has multiple seed sources that may increase shrub density in the future.

Canopy cover at this site was measured with 25 plots in May 2019 (Table 30). Canopy cover totaled 30.5%, with 13.0% native cover and 17.5% invasive cover. This represents an increase of 6.2% in native cover and a decrease of 3.2% in invasive cover. The dominant native species was Sandberg's bluegrass (*Poa secunda*) with 3.7% cover. The dominant invasive plant was cheatgrass (*Bromus tectorum*) with a coverage of 8.3%. Sixteen species of native forbs and grasses were identified at this site, five more than were detected in 2018. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was present on the site and had 1% cover and occurred in 4% of the plot frames.

The 118-F-3 site saw a significant die-off in shrubs from 2018 to 2019 that brought shrub density below success levels. Survival from 2019 to 2020 was 100%, suggesting shrub density at this site has somewhat stabilized since the initial die-off. Native cover and diversity did increase significantly at this site from 2018 to 2019, and cheatgrass is at a relatively low level compared to the other 100-F sites planted in 2018. Further monitoring and evaluation is required before additional steps are taken to revegetate this site. Future monitoring should note if sagebrush is recruiting on the site.

**Table 30. Percent Canopy Cover and Frequency of Occurrence at the 118-F-3 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.1 | 4.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | X | X |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | X | X |
| *Artemisia tridentata* (big sagebrush) | 0.8 | 12.0 |
| *Balsamorhiza careyana* (Carey's balsamroot) | X | X |
| *Bromus tectorum* (cheatgrass) [(a)] | 8.3 | 96.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | 0.6 | 4.0 |
| *Chaenactis douglasii* (Douglas' dusty maiden) | 0.1 | 4.0 |
| *Descurcania pinnata* (western tansymustard) | 0.2 | 8.0 |
| *Draba verna* (spring draba) [(a)] | 1.0 | 40.0 |
| *Elymus elymoides* (squirreltail) | X | X |
| *Ericameria nauseosa* (rubber rabbitbrush) | 3.4 | 36.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.2 | 8.0 |

**Table 30. Percent Canopy Cover and Frequency of Occurrence at the 118-F-3 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Hesperostipa comata* (needle-and-thread grass) | X | X |
| *Holosteum umbellatum* (jagged chickweed) [a] | 2.9 | 76.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.2 | 8.0 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X |
| *Poa bulbosa* (bulbous bluegrass) [a] | 1.1 | 24.0 |
| *Poa secunda* (Sandberg bluegrass) | 3.7 | 68.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 3.6 | 64.0 |
| *Purshia tridentata* (antelope bitterbrush) | X | X |
| *Salsola kali* (Russian thistle) [a] | 1.8 | 52.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.4 | 16.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| *Triticum sp.* (wheat) [a] | X | X |
| Crust | 0.5 | 20.0 |
| Soil | 23.5 | 92.0 |
| Litter | 43.4 | 100.0 |
| Rock/Cobble | 17.8 | 92.0 |
| Unavailable Space | 7.0 | 64.0 |
| **Total Canopy Cover** | **30.5** | |
| **Total Native % Cover** | **13.0** | |
| Total Invasive % Cover | 17.5 | |
| Unadjusted canopy cover | 28.4 | |
| Unadjusted Native % Cover | 12.1 | |
| Change in Native % Cover from 2018 | 6.2 | |
| Unadjusted Invasive % Cover | 16.3 | |
| Change in Invasive % Cover from 2018 | -3.2 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 28. The 118-F-3 Site in 2020.**

## 3.7 100-IU-2 AND 100-IU-6 AREA SITES

Seven sites were monitored in the 100-IU-2/100-IU-6 Area: 600-301, 600-370, 600-356, 600-358, 600-100, 600-120, and C9L3. All of these sites, with the exception of C9L3, had additional revegetation actions performed in FY 2019 after the FY 2018 report recommended additional actions at these sites. All of the sites worked on in FY 2019 were supplemented with additional shrubs and forbs with the exception of the 600-356 and 600-301 sites, which were completely re-worked. The C9L3 site was revegetated in FY 2020 with the FY 2020 Seed mix (Table 2) and first-year monitoring occurred at this site in 2020.

Original revegetation efforts at all sites that had additional revegetation actions performed in FY 2019 entailed broadcast seeding with a mixture of native grasses (including Sandberg bluegrass [*Poa secunda*], Indian ricegrass [*Achnatherum hymenoides*], bluebunch wheatgrass [*Pseudoroegneria spicata*], squirreltail [*Elymus elymoides*], needle-and-thread grass [*Hesperostipa comata*], and prairie junegrass [*Koeleria macrantha*]) at approximately 15 lbs/ac. Broadcast seeding areas were topped with a straw mulch that was crimped into the soil surface. Shrub species (including big sagebrush [*Artemisia tridentata*], antelope bitterbrush [*Purshia tridentata*], and spiny hopsage [*Grayia spinosa*]) were transplanted on the sites at approximately 500 to 650 plants/ac with a mix of approximately 75% sagebrush, 15% bitterbrush, and 10% spiny hopsage. Site 600-358 had a varied ratio of transplanted shrubs with 60 to 70% big sagebrush, 5 to 15% antelope bitterbrush, 10 to 30% spiny hopsage, and approximately 1% (cumulatively) rubber rabbitbrush (*Ericameria nauseosa*) and yellow rabbitbrush (*Chrysothamnus viscidiflorus*).

### 3.7.1 600-301 Site (White Bluffs Sanitary Sewer Pipelines)

The 600-301 site (Figure 29) was revegetated in FY 2014 and monitoring was first conducted for the site in 2014. Additional revegetation actions were recommended after fifth-year monitoring in 2018 where shrub density was only 20 plants/ha (8 plants/ac) and native cover was not successful at 13.2%. In FY 2019, this site was completely redone and seeded with the FY 2019 Seed Mix (Appendix B). In FY 2019, the site was planted with sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*), and hopsage (*Grayia spinosa*) at a rate of 400, 50, and 22 plants per acre, respectively. Additional hopsage and bitterbrush at a rate of 50 plants/ac were added in FY 2020, along with 100 forbs per acre. Over 2 years, the 600-301 site was supplemented with 400 sagebrush, 100 bitterbrush, 72 hopsage, and 100 forbs per acre. The substrate for the site is characterized by sand and loamy sand with a small amount of intermixed cobbles.

Second-year shrub transect monitoring occurred in October 2020. The results show a shrub density of 77 plants/ac below success criteria of 240 plant/ac. This marks a large decrease from 2019, with only 16% of shrubs surviving from FY 2019 to FY 2020. No shrubs were blooming at the 600-301 site.

Canopy cover data for the site was collected in April 2019. Data was collected from 25 plot frames. Canopy cover for the site was 40.7%, with 17.9% native cover and 22.8% invasive cover (Table 31). This represents an increase of 4.7% in native cover and decrease of 9.9% in invasive cover from 2018. The dominant native species was Sandberg's bluegrass (*Poa secunda*) with 13.1% cover. Cheatgrass (*Bromus tectorum*) was the dominant invasive species for the site with 8.2% cover, a decrease from 21.1% cover in 2018. Nineteen native species were recorded at the 600-301 site. Diffuse knapweed (*Centaurea diffusa*), a Washington State Class B noxious weed, was present on the site but was not detected in any plot frames.

Shrubs at the 600-301 site had an extremely low survival rate from first to second-year monitoring. Though shrub density at this site is above pre-supplementation levels, it is below success levels. Continued monitoring is necessary to determine if shrub die-off continues at this site or if shrub density stabilizes.

**Table 31. Percent Canopy Cover and Frequency of Occurrence at the 600-301 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | X | X |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.7 | 8.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.8 | 12.0 |
| *Artemisia tridentata* (big sagebrush) (transplant) | 0.1 | 4.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 8.2 | 96.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | X | X |
| *Chaenactis douglasii* (Douglas' dustymaiden) | 0.3 | 12.0 |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.5 | 20.0 |
| *Digitaria sp.* (crabgrass) [(a)] | 0.5 | 20.0 |

**Table 31. Percent Canopy Cover and Frequency of Occurrence at the 600-301 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Draba verna* (spring draba) [a] | 2.3 | 72.0 |
| *Elymus elymoides* (squirreltail) | 0.2 | 8.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.3 | 12.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.6 | 4.0 |
| *Erodium cicutarium* (redstem stork's bill) [a] | 2.5 | 24.0 |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 0.6 | 24.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.8 | 32.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.6 | 24.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.2 | 8.0 |
| *Poa secunda* (Sandberg bluegrass) | 13.1 | 100.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.1 | 4.0 |
| *Purshia tridentata* (antelope bitterbrush) (transplant) | X | X |
| *Salsola kali* (Russian thistle) [a] | 4.4 | 96.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 3.5 | 40.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | 0.2 | 8.0 |
| *Sporobolus cryptandrus* (sand dropseed) | 0.1 | 4.0 |
| *Vulpia microstachys* (desert fescue) | 0.1 | 4.0 |
| Crust | 0.2 | 8.0 |
| Soil | 34.0 | 84.0 |
| Litter | 54.2 | 100.0 |
| Rock/Cobble | 6.5 | 32.0 |
| Unavailable Space | 0.0 | 0.0 |
| **Total canopy cover** (excludes crust/soil/litter) | **40.7** | |
| **Total Native % Cover** | **17.9** | |
| Change in Native % Cover from 2018 | 4.7 | |
| Total Invasive % Cover | 22.8 | |
| Change in Invasive % Cover from 2018 | -9.9 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 29. The 600-301 Site in 2020.**

### 3.7.2 600-356 Site (Dump Area)

The 600-356 site (Figure 30) was revegetated in FY 2015 and monitoring was first conducted for the site in 2015. Additional revegetation actions were recommended after fourth-year monitoring in 2018 where shrub density was 0 plants/ha (0 plants/ac) after all shrubs on the transect died and native cover was not successful at 7.5%. In FY 2019, this site was completely redone and seeded with the FY 2019 Seed Mix (Appendix B). The 600-356 site was planted in FY 2019 with sagebrush (*Artemisia tridentata*) at a rate of 400 plants/ac, and bitterbrush (*Purshia tridentata*) and hopsage (*Grayia spinosa*) each at a rate of 125 plants/ac. In FY 2020, 100 forbs per acre were added to this site. The substrate for the site is predominantly cobbly sandy loam.

A new transect was established after the 2019 rework. Second-year shrub transect monitoring occurred in October 2020. The results show a shrub density of 518 plants/ac, above success criteria of 240 plant/ac. Overall shrub survival was relatively high at 84%. Shrub density has significantly improved from pre-supplementation levels, where 0 plants/ha were found at the site. Continued monitoring will reveal if these shrub density levels are stable.

Canopy cover data for the site was collected in May 2019. Data was collected from 25 plot frames. Canopy cover for the site was 36.8%, with 8.3% native cover and 29.1% invasive cover (Table 32). This represents an increase of 0.8% in native cover and decrease of 16.7% in invasive cover from 2018. The dominant native species were young bunchgrasses with 2.1% cover. Cheatgrass (*Bromus tectorum*) was the dominant invasive species for the site with 17.0% cover, a nearly 20% decrease from 2018. Twenty-two native species were recorded at the 600-356 site, a large amount for a site of that size. No listed Washington State Class B noxious weeds were observed on the site.

FY 2020 results found that shrub density at this site was successful and is expected to remain successful into the future. Continued monitoring will reveal if shrub density is stable at this site. This high shrub density is expected to increase native canopy cover levels over time. No additional actions apart from continued monitoring are recommended for the 600-356 site at this time.

**Table 32. Percent Canopy Cover and Frequency of Occurrence at the 600-356 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.6 | 4.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.6 | 4.0 |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 0.2 | 8.0 |
| *Artemisia tridentata* (big sagebrush) | 0.1 | 4.0 |
| *Astragalus succumbens* (crouching milkvetch) | 0.3 | 12.0 |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.1 | 4.0 |
| *Bromus tectorum* (cheatgrass) [a] | 17.0 | 100.0 |
| Bunchgrass sp. (multiple) | 2.1 | 64.0 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | 0.1 | 4.0 |
| *Descurcania pinnata* (western tansymustard) | 0.6 | 24.0 |
| *Draba verna* (spring draba) [a] | 2.3 | 92.0 |
| *Elymus elymoides* (squirreltail) | 0.6 | 4.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.2 | 8.0 |
| *Erigeron poliospermus* (cushion fleabane) | X | X |
| *Eriogonum niveum* (snow buckwheat) | 0.2 | 8.0 |
| *Erodium cicutarium* (redstem stork's bill) [a] | 0.8 | 32.0 |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 0.7 | 8.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.6 | 24.0 |
| *Hordeum leporinum* (hare barley) [a] | X | X |
| *Lactuca serriola* (prickly lettuce) [a] | 0.9 | 36.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.1 | 4.0 |
| *Poa bulbosa* (bulbous bluegrass) [a] | 0.9 | 16.0 |
| *Poa secunda* (Sandberg bluegrass) | 1.5 | 60.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | X | X |
| *Purshia tridentata* (antelope bitterbrush) | X | X |
| *Salsola kali* (Russian thistle) [a] | 4.0 | 80.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 2.5 | 40.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| *Vulpia microstachys* (desert fescue) | 0.3 | 12.0 |
| Crust | 0.0 | 0.0 |
| Soil | 23.7 | 84.0 |
| Litter | 53.2 | 100.0 |

**Table 32. Percent Canopy Cover and Frequency of Occurrence at the 600-356 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| Rock/Cobble | 7.9 | 68.0 |
| Unavailable Space | 0.4 | 16.0 |
| **Total Canopy Cover** | **36.8** | |
| **Total Native % Cover** | **8.3** | |
| Total Invasive % Cover | 29.1 | |
| Unadjusted canopy cover | 36.7 | |
| Unadjusted Native % Cover | 8.3 | |
| Change in Native % Cover from 2018 | 0.8 | |
| Unadjusted Invasive % Cover | 29.0 | |
| Change in Invasive % Cover from 2018 | -16.7 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 30. The 600-356 Site in 2020.**

### 3.7.3 600-370 Site (Dump Area)

The 600-370 site (Figure 31) was revegetated in FY 2014 and monitoring was first conducted for the site in 2014. In FY 2019, shrub and forb plugs were planted at the 600-370 site. In FY 2019, forbs (Munro's globemallow [*Sphaeralcea munroana*] and snow buckwheat [*Eriogonum niveum*]) were planted at a rate of 124 plants/ac, and bitterbrush (*Purshia tridentata*) and

hopsage (*Grayia spinosa*) were planted at a rate of 50 plants/ac. In FY 2020, the site was planted with sagebrush at a rate of 300 plants/ac. The substrate for the site is characterized by sand with varied amounts of cobbles and small boulders. Black sand is common in the western portion of the site.

The same transect that was used for routine 5-year monitoring was used for a seventh year in order to measure the plugs planted in FY 2019 and FY 2020. Only the plugs planted in FY 2019 and FY 2020 were monitored on this transect in October 2020. Fifth-year monitoring of this transect in 2018 showed a shrub density of 312 plants/ac. FY 2020 monitoring found that additional shrub plugs resulted in an increase of 40 shrubs/ac, bringing the total shrub density up to 352 shrubs/ac. Supplemental shrubs had a survival rate of 44% from initial planting to 2020 monitoring. Forbs were also monitored on this transect. Additional forb plugs resulted in an increase of 93 forbs/ac. A total of 36% of the forbs had evidence of blooming the previous summer when monitored in fall 2020, suggesting forb populations will expand. Snow buckwheat had a survival of 67% from initial monitoring and Munro's globemallow had a survival of 50%.

Canopy cover data for the site was collected in April 2019. Data was collected from 25 plot frames. Canopy cover for the site was 36.3%, with 9.3% native cover and 26.8% invasive cover (Table 33). This represents a decrease of 2.3% in native cover and an increase of 5.7% in invasive cover from 2018. The dominant native species was big sagebrush (*Artemisia tridentata*) with 2.7% cover. Nineteen native species were observed at this site in 2019. Cheatgrass (*Bromus tectorum*) was the dominant species for the site overall with 16.1% cover. No listed Washington State Class B noxious weeds were observed on the site.

Monitoring in 2020 showed that the 600-370 site is successfully over shrub density levels. Supplemental planting has increased shrub diversity at this site and has introduced a seeding source population for forbs. Supplemental planting at this site is a success and is expected to increase native canopy cover over time. Additional canopy cover monitoring is recommended for this site to determine if native cover is increasing. Continued monitoring of transplanted forbs and shrubs is recommended to track the long-term effectiveness of supplemental planting.

**Table 33. Percent Canopy Cover and Frequency of Occurrence at the 600-370 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achnatherum hymenoides* (Indian ricegrass) | 0.1 | 4.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.1 | 4.0 |
| *Artemisia tridentata* (big sagebrush) | 2.7 | 12.0 |
| *Brassica sp.* (mustard) [(a)] | 0.2 | 8.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 16.1 | 100.0 |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | X | X |
| *Draba verna* (spring draba) [(a)] | 4.8 | 72.0 |
| *Elymus elymoides* (squirreltail) | 0.2 | 8.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 2.1 | 24.0 |

**Table 33. Percent Canopy Cover and Frequency of Occurrence at the 600-370 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Eriogonum niveum* (snow buckwheat) | 0.8 | 12.0 |
| *Eriogonum vimineum* (wickerstem buckwheat) | 0.6 | 4.0 |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 0.1 | 4.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 3.2 | 88.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.3 | 12.0 |
| *Lamium amplexicaule* (henbit deadnettle) [a] | 0.1 | 4.0 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X |
| *Microsteris gracilis* (slender phlox) | 1.0 | 40.0 |
| *Oenothera pallida* (pale evening primrose) | 0.1 | 4.0 |
| *Poa secunda* (Sandberg bluegrass) | 1.0 | 40.0 |
| *Psoralidium lanceolatum* (lemon scurfpea) | X | X |
| *Purshia tridentata* (antelope bitterbrush) | 0.1 | 4.0 |
| *Salsola kali* (Russian thistle) [a] | 0.3 | 12.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.6 | 24.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | 0.1 | 4.0 |
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| *Vulpia microstachys* (desert fescue) | X | X |
| Crust | 5.7 | 52.0 |
| Soil | 43.3 | 100.0 |
| Litter | 22.2 | 88.0 |
| Rock/Cobble | 5.9 | 40.0 |
| Unavailable Space | 4.6 | 28.0 |
| **Total Canopy Cover** | **36.3** | |
| **Total Native % Cover** | **9.4** | |
| Total Invasive % Cover | 26.8 | |
| Unadjusted canopy cover | 34.6 | |
| Unadjusted Native % Cover | 9.0 | |
| Change in Native % Cover from 2018 | -2.2 | |
| Unadjusted Invasive % Cover | 25.6 | |
| Change in Invasive % Cover from 2018 | 5.7 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 31. The 600-370 Site in 2020, Showing Both the Cobble-Heavy and the Sand Area.**

### 3.7.4 600-358 Site (Gable Mountain Fringe Dump Area)

The 600-358 site (Figure 32) was revegetated in FY 2016 and monitoring was first conducted for the site in 2016. In addition to the standard native grass seed mix that was broadcast over the site, seeds from several native forbs were collected from the Hanford Site and hand seeded on the site. This site is surrounded by mature native vegetation that should promote natural recovery of the site. Third-year monitoring in 2018 identified a need for additional revegetation actions in order for this site to be successful. The 2018 monitoring found a shrub density of 163 plants/ac, with native canopy cover of 9.0% and invasive cover of 4.0%. Sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*) and hopsage (*Grayia spinosa*) were planted at this site in FY 2019 at a rate of 400, 50, and 50 plants/ac, respectively. In FY 2020, 100 forbs per acre and 50 bitterbrush per acre were planted at the 600-358 site. The substrate for the site is characterized by loamy sand with some gravel through the revegetated roadway and predominantly cobble with varying amounts of loamy sand in the dump area at the north end of the roadway. This site burned in the Gable Mountain Fire in June 2020. The upper cobble area was significantly less effected than the roadway leading to the site where there was more than 90% shrub mortality.

One 100-m (328-ft) and one 65-m (213-ft) shrub monitoring transects were established at this site in 2016, one on the southern and one on the northern portion of the site. Fifth-year shrub monitoring was conducted at this site in November 2020. Only Transect 2 (Northern Transect) was monitored, as Transect 1 had few surviving shrubs from the fire. Transect 2 had a shrub density of 293 plants/ac, above success criteria. A total of 13% of sagebrush at Transect 2 was in bloom and producing seed at the time of monitoring. Shrub density on Transect 1 was presumed to be well below success levels considering there were only a few plants left surviving on the roadway.

Canopy cover data for the site was collected in April 2018. Data was collected from 25 plot frames. Canopy cover for the site overall was 32.3%, with 14.9% native cover and 17.4% invasive cover (Table 34). Native cover increased by 5.9% since 2018 and invasive cover has increased by 13.3% since 2018. Fourteen native species were identified at this site in 2019. The dominant native species was Sandberg's bluegrass (*Poa secunda*) with 7.4% cover followed by bluebunch wheatgrass (*Pseudoroegneria spicata*) with 5.5% cover. Cheatgrass (*Bromus tectorum*) was the dominant invasive species for the site with 11.7% cover. No listed Washington State Class B noxious weeds were observed on the site. Though vegetation on the roadway of this site has burned and was not present at the time of monitoring, vegetation in the upper area was relatively unaffected by the fire.

Supplemental revegetation actions were successful at this site. The upper area of this site has successful shrub density and is expected to remain successful. The roadway area burned in the Gable Mountain Fire. The Gable Mountain Fire area will be seeded in FY 2021 with native grass seed and potentially sagebrush seed, but the amount of sagebrush seed included in the seed mix is not expected to be sufficient to bring the roadway area up to successful shrub density levels. Additional actions are recommended in the roadway area to bring shrub density back up to pre-fire levels.

**Table 34. Percent Canopy Cover and Frequency of Occurrence at the 600-358 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | X | X |
| *Artemisia tridentata* (big sagebrush) | X | X |
| *Artemisia tridentata* (big sagebrush) (planted) | 0.2 | 8.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 11.7 | 100.0 |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.2 | 8.0 |
| *Draba verna* (spring draba) [(a)] | 3.2 | 88.0 |
| *Elymus elymoides* (squirreltail) | 0.1 | 4.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.2 | 8.0 |
| *Eriogonum niveum* (snow buckwheat) | X | X |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 0.1 | 4.0 |
| *Holosteum umbellatum* (jagged chickweed) [(a)] | 1.0 | 40.0 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 0.2 | 8.0 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X |
| *Melilotus officinalis* (sweet clover) [(a)] | X | X |
| *Microsteris gracilis* (slender phlox) | 1.2 | 48.0 |
| *Poa secunda* (Sandberg bluegrass) | 7.4 | 96.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 5.5 | 40.0 |
| *Purshia triedntata* (antelope bitterbrush) | X | X |
| *Salsola kali* (Russian thistle) [(a)] | 0.6 | 24.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [(a)] | 0.6 | 24.0 |

**Table 34. Percent Canopy Cover and Frequency of Occurrence at the 600-358 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| Crust | 4.3 | 32.0 |
| Soil | 46.7 | 84.0 |
| Litter | 23.1 | 96.0 |
| Rock/Cobble | 15.6 | 36.0 |
| Unavailable Space | 0.3 | 12.0 |
| **Total Canopy Cover** | **32.3** | |
| **Total Native % Cover** | **14.9** | |
| Total Invasive % Cover | 17.4 | |
| Unadjusted canopy cover | 32.2 | |
| Unadjusted Native % Cover | 14.9 | |
| Change in Native % Cover from 2018 | 5.9 | |
| Unadjusted Invasive % Cover | 17.3 | |
| Change in Invasive % Cover from 2018 | 13.3 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 32. The 600-358 Site in 2020. Left: The Upper Portion of the Site that was Less Affected by the Fire. Right: The Roadway Portion of the Site that was Heavily Burned in the Fire.**

### 3.7.5 600-100 Site (White Bluffs Landfill)

The 600-100 site (Figure 33) was first revegetated in FY 2012 and supplemental plants were added in FY 2019 and FY 2020. This site was planted with forbs (snow buckwheat [*Eriogonum niveum*] and shaggy fleabane [*Erigeron pumilus*]) at a rate of 210 plants/ac, sagebrush (*Artemisia tridentata*) at a rate of 300 plants/ac, and bitterbrush (*Purshia tridentata*) at a rate of 50 plants/ac. In FY 2020, this site was planted with bitterbrush and hopsage (*Grayia spinosa*) each at a rate of 50 plants/ac. This site consists of deep, well-drained sandy soils.

One new transect was established at this site in 2019; second-year monitoring occurred at this transect in November 2020. Snow buckwheat was measured on this transect at 84 forbs/ac and has had a survival rate of 64% from the initial planting. A total of 33% of snow buckwheat plants had evidence of blooming during 2020 monitoring. Established shrubs and recruits had a density of 206 shrubs/ac, below success levels. Planting sagebrush and bitterbrush increased shrub density to 283 shrubs/ac, bringing the site above success levels. Shrub survival from initial planting totaled 69%. Half of the sagebrush recorded on the transect were in bloom or producing seed at the time of monitoring.

Canopy cover data for this site was collected in April 2019. Average canopy cover for the site overall was 28.7%, with 13.8% native cover and 14.6% invasive cover (Table 35). This represents a decrease of 4.5% in native cover and of 2.1% in invasive cover from 2015 monitoring. The dominant native species was Sandberg bluegrass (*Poa secunda*) with 10.4% cover. Eighteen native species were detected at this site. Cheatgrass (*Bromus tectorum*) was the dominant invasive species with 6.0% cover. Diffuse knapweed (*Centaurea diffusa*), Washington State Class B noxious weeds, was observed on this site at less than 1% cover.

Supplemental plantings have pushed this site into successful shrub density levels. As the supplemental plants establish and mature, native canopy cover is expected to increase. Additionally, as sagebrush and snow buckwheat produce seed their populations are expected to expand. Continued monitoring is necessary to track the progress of this site, notably for canopy cover changes and for long-term shrub survival.

**Table 35. Percent Canopy Cover and Frequency of Occurrence at the 600-100 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.3 | 12.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | X | X |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 1.0 | 20.0 |
| *Artemisia tridentata* (big sagebrush) | 0.1 | 4.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 6.0 | 84.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | 0.7 | 28.0 |
| *Ceratocephala testiculata*[a] (bur buttercup) | 0.1 | 4.0 |
| *Cryptantha circumscissa* (matted cryptantha) | 0.2 | 8.0 |
| *Descurcania pinnata* (western tansymustard) | X | X |
| *Draba verna* (spring draba) [(a)] | 1.1 | 44.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | X | X |
| *Erigeron poliospermus* (cushion fleabane) | 1.0 | 40.0 |
| *Eriogonum vimineum* (wickerstem buckwheat) | X | X |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | X | X |
| *Holosteum umbellatum* (jagged chickweed) [(a)] | 3.0 | 60.0 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 0.8 | 32.0 |
| *Lepidium perfoliatum* (clasping pepperweed) [(a)] | X | X |
| *Machaeranthera canescens* (hoary tansyaster) | 0.3 | 12.0 |
| *Microsteris gracilis* (slender phlox) | 0.3 | 12.0 |
| *Oenothera pallida* (pale-evening primrose) | 0.2 | 8.0 |
| *Poa secunda* (Sandberg bluegrass) | 10.4 | 88.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | X | X |
| *Purshia tridentata* (antelope bitterbrush) | 0.2 | 8.0 |
| *Salsola kali* (Russian thistle) [(a)] | 1.4 | 56.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [(a)] | 1.6 | 44.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |

**Table 35. Percent Canopy Cover and Frequency of Occurrence at the 600-100 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| Crust | 4.9 | 24.0 |
| Soil | 71.4 | 100.0 |
| Litter | 11.9 | 52.0 |
| Rock/Cobble | 1.6 | 24.0 |
| Unavailable Space | 0 | 0.0 |
| **Total canopy cover** (excludes crust/soil/litter) | **28.7** | |
| **Total Native % Cover** | 13.8 | |
| Change in Native % Cover from 2015 | -4.5 | |
| Total Invasive % Cover | 14.6 | |
| Change in Invasive % Cover from 2015 | -2.1 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 33. The 600-100 Site in 2020.**

### 3.7.6 600-120 Site (Burn Pit)

The 600-120 site (Figure 34) was first revegetated in FY 2011. No monitoring data is available for this site prior to FY 2019 monitoring. A 2018 survey found that though the southern part of the site had good sagebrush (*Artemisia tridentata*) and Indian ricegrass (*Oryzopsis hymenoides*) cover, the rest of the site had patchy native plant cover. In FY 2019, this site was planted with

sagebrush (*Artemisia tridentata*) at a rate of 300 plants/ac and bitterbrush (*Purshia tridentata*) plugs at a rate of 75 plants/ac. In FY 2020, this site was planted with forbs at a rate of 100 plants/ac, bitterbrush at a rate of 200 plants/ac, and hopsage (*Grayia spinosa*) at a rate of 50 plants/ac. This site consists of deep, well-drained sandy soils.

One new transect was established at this site in 2019 in the section of the 600-120 site that was lacking shrubs. This transect was monitored for second-year monitoring in October 2020. Both newly planted shrubs and shrubs from the FY 2011 planting were recorded on this transect. Established shrubs and recruits had a density of 44 shrubs/ac, well below success levels. Planting supplementary shrubs increased shrub density to 206 shrubs/ac. A total of 79% of shrubs had survived since initial planting and 18% of sagebrush were in bloom. This transect is representative of an area of the 600-120 site with less existing shrubs. When considering shrub density of the entire site, it is expected that this site would have successful shrub density.

Canopy cover data for this site was collected in April 2019. Average canopy cover for the site overall was 34.4%, with 21.6% native cover and 12.8% invasive cover (Table 36). The dominant native species was Sandberg bluegrass (*Poa secunda*) with 15.1% cover. Seventeen native species were detected at this site. Cheatgrass (*Bromus tectorum*) was the dominant invasive species with 6.8% cover. Diffuse knapweed (*Centaurea diffusa*) and rush skeletonweed (*Chondrilla juncea*), both Washington State Class B noxious weeds, were observed on this site.

Supplemental plantings have significantly improved shrub density levels at this site. As shrubs continue to grow and reproduce, shrub density and native canopy cover are both expected to increase. FY 2021 monitoring should include estimating shrub density considering the successful portion of the 600-120 site. Continued monitoring is necessary to track the progress of this site.

**Table 36. Percent Canopy Cover and Frequency of Occurrence at the 600-120 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | X | X |
| *Achnatherum hymenoides* (Indian ricegrass) | 4.2 | 32.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.1 | 4.0 |
| *Artemisia tridentata* (big sagebrush) | 9.6 | 24.0 |
| *Artemisia tridentata* (planted) | 0.2 | 8.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 6.8 | 96.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | 1.5 | 60.0 |
| *Chondrilla juncea* (rush skeletonweed) (B) [(b)] | X | X |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | X | X |
| *Descurcania pinnata* (western tansymustard) | X | X |
| *Draba verna* (spring draba) [(a)] | 0.7 | 28.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 1 | 40.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | X | X |
| *Erigeron filifolius* (threadleaf fleabane) | X | X |

**Table 36. Percent Canopy Cover and Frequency of Occurrence at the 600-120 Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | X | X |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.5 | 20.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.9 | 36.0 |
| *Lepidium perfoliatum* (clasping pepperweed) [a] | X | X |
| *Machaeranthera canescens* (hoary tansyaster) | 0.2 | 8.0 |
| *Microsteris gracilis* (slender phlox) | 0.4 | 16.0 |
| *Oenothera pallida* (pale-evening primrose) | 0.3 | 12.0 |
| *Poa secunda* (Sandberg bluegrass) | 15.1 | 100.0 |
| *Purshia tridentata* (antelope bitterbrush) | 0.1 | 4.0 |
| *Salsola kali* (Russian thistle) [a] | 1 | 40.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 1.4 | 36.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| Crust | 2.8 | 36.0 |
| Soil | 55.5 | 96.0 |
| Litter | 39.9 | 92.0 |
| Rock/Cobble | 0.2 | 8.0 |
| Unavailable Space | 0 | 0.0 |
| **Total canopy cover** (excludes crust/soil/litter) | **34.4** | |
| **Total Native % Cover** | **21.6** | |
| Change in Native % Cover from 2018 | 8.4 | |
| Total Invasive % Cover | 12.8 | |
| Change in Invasive % Cover from 2018 | -19.9 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 34. The 600-120 Site in 2020.**

### 3.7.7 C9-L3 Site (Electrical Access Road)

The C9-L3 site was originally an access road under a power line. After the power line was removed, the access road was revegetated in accordance with the *Site Specific Revegetation Plan for Project C9-L3: Power Line from 100-H Area to Hanford Town Site* (MSA 2019). In FY 2020 the site was seeded with the C9-L3 Seed Mix (Table 2) and planted with sagebrush (*Artemisia tridentata*) at a rate of 400 plants/ac, and bitterbrush (*Purshia tridentata*) and hopsage (*Grayia spinosa*) in varying sections of the line at a rate of 200 plants/ac each. First-year monitoring occurred in October 2020 (Figure 35).

Four 100-m transects were established at this site to measure shrub survival and density. Typically, the first-year monitoring would occur only a few months after the initial planting and before the summer die-off that many first-year sites experience. In 2020, monitoring could not occur until after the summer; therefore, accurate measures of initial planting rates and density could not be obtained. First-year monitoring found shrub density at the C9-L3 to be 126 plants/ac, well below successful shrub density. The percentage of shrubs that died post-planting is unknown but is assumed to be approximately 80% since the site was planted with 600 plants/ac. The cause of this high mortality rate is unknown. This site is bordered by mature sagebrush, many of which were in bloom and producing seed at the time of monitoring.

Canopy cover measurements were not taken at the C9-L3 site and will be taken for the first time in FY 2021. Anecdotal observations suggest native canopy cover is below 25%, as would be expected in a first-year site.

Additional shrub plantings are recommended at the C9-L3 site and are currently planned for FY 2021 revegetation efforts.

**Figure 35. The C9-L3 Site in 2020.**

## 3.8 300 AREA SITES

One site in the 300 Area, the 618-10 site, was monitored for routine fifth-year monitoring in 2020. 300-North A-D and 618-2&3 were originally on the schedule for FY 2020 monitoring, but neither site has shrub transects; the monitoring was delayed until FY 2021. The 300-288:2 site was revegetated in FY 2017 and was scheduled for fourth-year monitoring in 2020; this monitoring was delayed as additional plugs were being planted at the site in FY 2021. These sites were remediated to meet the objectives for interim closure as established in the 300 Area RDR/RAWP (DOE/RL-2001-47 and DOE/RL-2014-13-ADD1) and in the Interim Action ROD (EPA 1999).

Revegetation efforts at the 618-10 site involved five different seed mixes that were applied at various rates per acre. Seeded species and rates are included in Appendix C and are available in *Site Specific Revegetation Plans for 618-10, 316-4, 600-96, 600-63, and 600-276* (CH2MHILL 2018). The site was planted with sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*), snow buckwheat (*Eriogonum niveum*), and green rabbitbrush (*Chrysothamnus viscidiflorus*).

### 3.8.1 618-10 Site (Burial Ground)

The 618-10 site was revegetated in FY 2019. This site is approximately 127 ac and was split into four areas during the initial revegetation. Soil substrate varies from sandy loam to gravely sand, seed mix varied depending on the substrate. See Appendix C for a description of seed mix and rates for the different areas. Forty-two native species were seeded at 618-10 and sagebrush

(*Artemisia tridentata*), bitterbrush (*Purshia tridentata*), snow buckwheat (*Eriogonum niveum*), and green rabbitbrush (*Chrysothamnus viscidiflorus*) plugs were planted. In addition to seeding and hand planting shrubs, six "Forb Islands" were established. These islands were hand seeded with forb species in an effort to establish forb populations that could expand into the rest of the revegetation site.

Second-year transect monitoring occurred at the 618-10 site in October and November 2020. Three transects were established in Area 1, 4 transects were established in Area 2, 2 transects were established in Area 3, and 1 transect was established in Area 4 for a total of 10 transects established at the 618-10 site. Sagebrush and bitterbrush were recorded on these transects to measure total shrub density, and snow buckwheat was recorded to track forb survival. Area 1 had a combined shrub density of 298 shrubs/ac, Area 2 had a combined shrub density of 368 shrubs/ac, Area 3 had a combined shrub density of 247 shrubs/ac, and Area 4 had a shrub density of 275 shrubs/ac. The 618-10 site had a combined total of 297 shrubs/ac, above success levels.

First-year plot monitoring occurred at the 618-10 site in May 2019. Three sets of 25 plot frames were taken in Area 1, four sets of 25 plot frames were taken in Area 2, two sets of 25 plot frames were taken in Area 3, and one set of 25 plot frames were taken in Area 4. In addition to these plots, 10 plot frames were taken within 50 m of the center of each forb island site, totaling 60 additional forb island plots. A total of 310 plot frames were measured at the 618-10 site. Plot monitoring data is reported by area due to the size of this site.

Area 1 (Figure 36) has 23.3% canopy cover, made up of 10.3% native cover and 12.9% invasive cover (Table 37). Twenty-nine native species were detected at Area 1. The dominant species in this area was Russian thistle (*Salsola kali*) with 5.7% cover, and the most abundant native species was Indian Ricegrass (*Achnatherum hymenoides*) with 1.7% cover.

Area 2 (Figure 37) has 17.1% canopy cover, made up of 7.5% native cover and 9.6% invasive cover (Table 38). Thirty-two native species were detected at Area 2. The dominant species in this area was Russian thistle with 3.2% cover followed by young bunchgrasses with 3.0% cover.

Area 3 (Figure 38) has 22.6% canopy cover, made up of 9.0% native cover and 13.7% invasive cover (Table 39). Thirty-six native species were detected at Area 3. The dominant species in this area was Russian thistle with 6.0% cover followed by young bunchgrasses with 2.8% cover.

Area 4 (Figure 39) has 29.5% canopy cover, made up of 11.6% native cover and 17.9% invasive cover (Table 40). Twenty native species were detected at Area 4. The dominant invasive species in this area was cheatgrass (*Bromus tectorum*) with 5.3% cover and the dominant native species in this area was bur ragweed (*Ambrosia acanthicarpa*) with 5.3% cover.

The 618-10 site as a whole averaged 23.1% canopy cover, made up of 9.6% native cover and 13.5% invasive cover in 2019.

Forb islands were also last monitored in 2019. The six forb islands were grouped by soil type with three islands in sandy loam soils and three islands in gravely sand soils. Canopy cover

within 50 m (164 ft) of the sandy loam forb islands averaged 16.6%, with 8.8% native cover and 7.8% invasive cover (Table 41). Twenty-six native species were detected in this area. Of the 16 forbs hand seeded in this area, 11 were germinating in 2019. Russian thistle dominated this area with 4.8% cover followed by young bunchgrasses with 2.3% cover. Canopy cover within 50 m of the gravely sand forb islands averaged 20.9%, with 9.8% native cover and 11.2% invasive cover (Table 42). Twenty-seven native species were detected in this area. Of the 14 forbs hand seeded in this area, 7 were germinating in 2019. Russian thistle dominated this area with 3.8% cover followed by bur ragweed with 3.3% cover.

Continued monitoring of this site is necessary to track plant establishment and growth as the site matures. Second-year shrub monitoring results are positive as shrubs are above success criteria.

**Table 37. Percent Canopy Cover and Frequency of Occurrence at 618-10 Area 1 in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.1 | 4.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 1.7 | 66.7 |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 1.5 | 38.7 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | X | X |
| *Artemisia tridentata* (big sagebrush) (transplants) | 0.4 | 16.0 |
| *Brassica sp.* (mustard) [a] | 0.5 | 20.0 |
| *Bromus tectorum* (cheatgrass) [a] | 1.0 | 41.3 |
| Bunchgrass species (multiple) | 0.3 | 13.3 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | X | X |
| *Chondrilla juncea* (rush skeletonweed) (B) [b] | 1.2 | 8.0 |
| *Cryptantha circumscissa* (matted cryptantha) | X | X |
| *Cymopterus terebinthinus* (turpentine springparsley) | 1.5 | 4.0 |
| *Dalea ornata* (western prairie clover) | 0.1 | 4.0 |
| *Descurcania pinnata* (western tansymustard) | 1.2 | 28.0 |
| *Draba verna* (spring draba) [a] | 0.3 | 10.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.3 | 16.0 |
| *Gilia sinuata* (shy gilia) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 0.3 | 12.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.4 | 14.7 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.1 | 4.0 |
| *Microsteris gracilis* (slender phlox) | X | X |
| *Nama densum* (purple mat) | X | X |
| *Oenothera pallida* (pale-evening primrose) | X | X |
| *Penstemon acuminatus* (sharpleaf penstemon) | 0.1 | 4.0 |
| *Phacelia hastata* (whiteleaf phacelia) | 0.1 | 4.0 |
| *Phlox longifolia* (longleaf phlox) | X | X |
| *Plantago patagonica* (woolly plantain) | X | X |
| *Poa secunda* (Sandberg bluegrass) | 0.6 | 17.3 |

**Table 37. Percent Canopy Cover and Frequency of Occurrence at 618-10 Area 1 in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.3 | 10.7 |
| *Psoralidium lanceolatum* (lemon scurfpea) | 0.7 | 6.0 |
| *Purshia tridentata* (antelope bitterbrush) | 0.3 | 13.3 |
| *Rumex venosus* (winged dock) | 0.6 | 5.3 |
| *Salsola kali* (Russian thistle) [a] | 5.7 | 100.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 1.5 | 53.3 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| *Triticum aestivum* (common wheat) [a] | X | X |
| *Triticum sp.* (wheat) [a] | 0.5 | 20.0 |
| *Triticum x elymus trachycaulus* (Regreen) [a] | 1.8 | 58.7 |
| Crust | 0.0 | 0.0 |
| Soil | 64.7 | 98.7 |
| Litter | 28.0 | 100.0 |
| Rock/Cobble | 5.2 | 70.7 |
| Unavailable Space | 0.9 | 24.0 |
| **Total Canopy Cover** | **23.3** | |
| **Total Native % Cover** | **10.3** | |
| Total Invasive % Cover | 12.9 | |
| Unadjusted canopy cover | 23.0 | |
| Unadjusted Native % Cover | 10.2 | |
| Unadjusted Invasive % Cover | 12.8 | |

[a] = Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plots

**Figure 36. Area 1 of the 618-10 Site in 2020.**

**Table 38. Percent Canopy Cover and Frequency of Occurrence at 618-10 Area 2 in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.1 | 2.0 |
| *Amaranthus albus* (white pigweed) [a] | 0.4 | 16.0 |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 1.2 | 34.0 |
| *Artemisia tridentata* (big sagebrush) | 0.2 | 9.0 |
| *Artemisia tridentata* (recruits) | 0.1 | 4.0 |
| *Astragalus caricinus* (buckwheat milkvetch) | X | X |
| *Astragalus purshii* (woollypod milkvetch) | X | X |
| *Astragalus sclerocarpus* (stalked-pod milkvetch) | X | X |
| *Balsamorhiza careyana* (Carey's balsamroot) | X | X |
| *Bromus tectorum* (cheatgrass) [a] | 2.5 | 38.0 |
| *Bunchgrass* sp. (multiple) | 3.0 | 86.7 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | X | X |
| *Chenopodium leptophyllym* (narrowleaf goosefoot) | X | X |
| *Chondrilla juncea* (rush skeletonweed) (B) [b] | X | X |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | X | X |
| *Coldenia nuttallii* (desert mat) | 0.1 | 4.0 |
| *Cryptantha circumscissa* (matted cryptantha) | X | X |
| *Cymopterus terebinthinus* (turpentine springparsley) | 0.1 | 4.0 |
| *Dalea ornata* (western prairie clover) | X | X |

**Table 38. Percent Canopy Cover and Frequency of Occurrence at 618-10 Area 2 in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Descurcania pinnata* (western tansymustard) | 0.1 | 4.0 |
| *Draba verna* (spring draba) [(a)] | 1.0 | 10.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.1 | 4.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.3 | 12.0 |
| *Eriogonum vimineum* (wickerstem buckwheat) | 0.1 | 4.0 |
| *Erysimum asperum* (rough wallflower) | 0.1 | 4.0 |
| *Hesperostipa comata* (needle-and-thread grass) | 0.5 | 20.0 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 0.3 | 10.0 |
| *Machaeranthera canescens* (hoary tansyaster) | X | X |
| *Medicago sativa* (alfalfa) [(a)] | 0.1 | 4.0 |
| *Melilotus officinalis* (sweet clover) [(a)] | X | X |
| *Mentzelia albicaulis* (whitestem stickleaf) | 0.1 | 4.0 |
| *Nicotiana acuminata* (coyote tobacco) | X | X |
| *Oenothera pallida* (pale-evening primrose) | 0.1 | 4.0 |
| *Penstemon acuminatus* (sharpleaf penstemon) | 0.1 | 4.0 |
| *Phacelia hastata* (whiteleaf phacelia) | 0.2 | 8.0 |
| *Poa secunda* (Sandberg bluegrass) | 0.6 | 17.0 |
| *Purshia tridentata* (antelope bitterbrush) | 0.3 | 12.0 |
| *Rumex venosus* (winged dock) | X | X |
| *Salsola kali* (Russian thistle) [(a)] | 3.2 | 87.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [(a)] | 0.9 | 29.0 |
| *Tragopogon dubius* (yellow salsify) [(a)] | X | X |
| *Triticum x elymus trachycaulus* (Regreen) [(a)] | 0.6 | 22.0 |
| *Triticum sp.* (wheat) [(a)] | 0.8 | 32.0 |
| *Vulpia microstachys* (desert fescue) | 0.1 | 1.3 |
| Crust | 0.0 | 0.0 |
| Soil | 62.6 | 100.0 |
| Litter | 33.3 | 100.0 |
| Rock/Cobble | 2.2 | 34.0 |
| Unavailable Space | 0.3 | 5.0 |
| **Total Canopy Cover** | **17.1** | |
| **Total Native % Cover** | **7.5** | |
| Total Invasive % Cover | 9.6 | |
| Unadjusted canopy cover | 17.0 | |
| Unadjusted Native % Cover | 7.5 | |
| Unadjusted Invasive % Cover | 9.6 | |

[a] = Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plots

**Figure 37. Area 2 of the 618-10 Site in 2020.**

**Table 39. Percent Canopy Cover and Frequency of Occurrence at 618-10 Area 3 in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.3 | 12.0 |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 1.3 | 42.0 |
| *Artemisia tridentata* (big sagebrush) | 0.2 | 6.0 |
| *Astragalus caricinus* (buckwheat milkvetch) | X | X |
| *Astragalus purshii* (woollypod milkvetch) | X | X |
| *Balsamorhiza careyana* (Carey's balsamroot) | X | X |
| *Bromus tectorum* (cheatgrass) [a] | 1.8 | 30.0 |
| *Bunchgrass* sp. (multiple) | 2.8 | 90.0 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | X | X |
| *Chenopodium leptophyllym* (narrowleaf goosefoot) | X | X |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | X | X |
| *Coldenia nuttallii* (desert mat) | 0.2 | 6.0 |
| *Cryptantha circumscissa* (matted cryptantha) | 0.2 | 6.0 |
| *Cymopterus terebinthinus* (desert parsley) | X | X |
| *Dalea ornata* (western prairie clover) | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.5 | 20.0 |
| *Draba verna* (spring draba) [a] | 0.4 | 14.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 4.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.1 | 4.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.7 | 18.0 |

**Table 39. Percent Canopy Cover and Frequency of Occurrence at 618-10 Area 3 in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Eriogonum vimineum* (wickerstem buckwheat) | X | X |
| *Erodium cicutarium* (redstem stork's bill) [a] | X | X |
| *Erysimum capitatum* (rough wallflower) | X | X |
| *Gilia sinuata* (shy gilia) | 0.1 | 4.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.1 | 4.0 |
| *Hordeum leporinum* (hare barley) [a] | X | X |
| *Lactuca serriola* (prickly lettuce) [a] | 0.2 | 8.0 |
| *Lamium amplexicaule* (henbit deadnettle) [a] | 0.9 | 24.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.1 | 4.0 |
| *Medicago sativa* (alfalfa) [a] | X | X |
| *Melilotus officinalis* (sweet clover) [a] | X | X |
| *Mentzelia albicaulis* (whitestem stickleaf) | 0.2 | 8.0 |
| *Nama densum* (purple mat) | X | X |
| *Nicotiana acuminata* (coyote tobacco) | 0.1 | 4.0 |
| *Oenothera pallida* (pale-evening primrose) | X | X |
| *Penstemon acuminatus* (sharpleaf penstemon) | X | X |
| *Phacelia hastata* (whiteleaf phacelia) | 0.2 | 8.0 |
| *Plantago patagonica* (woolly plantain) | X | X |
| *Poa secunda* (Sandberg bluegrass) | 1.7 | 68.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.1 | 4.0 |
| *Psoralidium lanceolatum* (dune scurfpea) | X | X |
| *Purshia tridentata* (antelope bitterbrush) | 0.3 | 10.0 |
| *Ranunculus testiculatus* (burr buttercup) [a] | X | X |
| *Rumex venosus* (winged dock) | X | X |
| *Salsola kali* (Russian thistle) [a] | 6.0 | 98.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 1.5 | 38.0 |
| *Triticum aestivum* (common wheat) [a] | 0.6 | 24.0 |
| *Triticum x elymus trachycaulus* (Regreen) [a] | 2.4 | 46.0 |
| Crust | 0.0 | 0.0 |
| Soil | 66.1 | 98.0 |
| Litter | 27.1 | 100.0 |
| Rock/Cobble | 2.1 | 26.0 |
| Unavailable Space | 0.0 | 0.0 |
| **Total canopy cover** (excludes ground cover) | **22.6** | |
| Total Native % Cover | **9.0** | |
| Total Invasive % Cover | 13.7 | |

[a] = Invasive species
X = present but not counted in plots

**Figure 38. Area 3 of the 618-10 Site in 2020.**

**Table 40. Percent Canopy Cover and Frequency of Occurrence at 618-10 Area 4 in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.2 | 8.0 |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.5 | 20.0 |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 5.3 | 92.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | X | X |
| *Artemisia tridentata* (big sagebrush) | 0.3 | 12.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 6.2 | 88.0 |
| Bunchgrass species (multiple) | 0.3 | 12.0 |
| *Centaurea diffusa* (diffuse knapweed) (B) [(b)] | X | X |
| *Chenopodium leptophyllym* (narrowleaf goosefoot) | X | X |
| *Chondrilla juncea* (rush skeletonweed) (B) [(b)] | 0.3 | 12.0 |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | 0.1 | 4.0 |
| *Coldenia nuttallii* (desert mat) | 0.1 | 4.0 |
| *Cryptantha circumscissa* (matted cryptantha) | 1.3 | 52.0 |
| *Draba verna* (spring draba) [(a)] | 4.4 | 96.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 4.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | X | X |
| *Eriogonum niveum* (snow buckwheat) | 0.1 | 4.0 |
| *Eriogonum* sp. (buckwheat sp.) | 0.1 | 4.0 |
| *Filago arvensis* (field fluffweed) [(a)] | 0.4 | 16.0 |
| *Hesperostipa comata* (needle-and-thread grass) | 0.6 | 24.0 |

**Table 40. Percent Canopy Cover and Frequency of Occurrence at 618-10 Area 4 in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Holosteum umbellatum* (jagged chickweed) [a] | 1.0 | 40.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.4 | 16.0 |
| *Lamium amplexicaule* (henbit deadnettle) [a] | 0.1 | 4.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.2 | 8.0 |
| *Poa secunda* (Sandberg bluegrass) | 1.7 | 48.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.1 | 4.0 |
| *Purshia tridentata* (antelope bitterbrush) | X | X |
| *Ranunculus testiculatus* (burr buttercup) [a] | 0.3 | 12.0 |
| *Salsola kali* (Russian thistle) [a] | 1.9 | 76.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 1.1 | 44.0 |
| *Tragopogon dubius* (yellow salsify) [a] | 0.1 | 4.0 |
| *Triticum aestivum* (common wheat) [a] | 0.2 | 8.0 |
| *Triticum x elymus trachycaulus* (Regreen) [a] | 1.3 | 32.0 |
| *Vulpia microstachys* (desert fescue) | 0.5 | 20.0 |
| Crust | 0.0 | 0.0 |
| Soil | 60.3 | 96.0 |
| Litter | 31.1 | 100.0 |
| Rock/Cobble | 4.9 | 76.0 |
| Unavailable Space | 1.0 | 20.0 |
| **Total Canopy Cover** | **29.5** | |
| **Total Native % Cover** | **11.6** | |
| Total Invasive % Cover | 17.9 | |
| Unadjusted canopy cover | 29.2 | |
| Unadjusted Native % Cover | 11.5 | |
| Unadjusted Invasive % Cover | 17.7 | |

[a] = Invasive species
[b] = Washington State Classified Noxious Weed (class)
X = present but not counted in plots

**Figure 39. Area 4 of the 618-10 Site in 2020.**

**Table 41. Percent Canopy Cover and Frequency of Occurrence at 618-10 Sandy Loam Forb Islands in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence | Hand Seeded? |
|---|---|---|---|
| *Abronia mellifera* (white sand verbena) | X | X | Yes |
| *Achillea millefollium* (common yarrow) | 0.1 | 3.3 | |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 0.8 | 30.0 | |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | X | X | |
| *Artemisia tridentata* (big sagebrush) | 0.1 | 3.3 | |
| *Astragalus caricinus* (buckwheat milkvetch) | X | X | Yes |
| *Astragalus purshii* (woollypod milkvetch) | 0.1 | 3.3 | Yes |
| *Astragalus sclerocarpus* (stalked-pod milkvetch) | X | X | Yes |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.6 | 23.3 | Yes |
| *Bromus tectorum* (cheatgrass) [(a)] | 0.7 | 26.7 | |
| *Bunchgrass sp.* (multiple) | 2.3 | 73.3 | |
| *Chaenactis douglasii* (Douglas' dustymaiden) | 0.7 | 26.7 | Yes |
| *Chrysothamnus viscidiflorus* (yellow rabbitbrush) | X | X | |
| *Coldenia nuttallii* (desert mat) | X | X | |
| *Cymopterus terebinthinus* (turpentine springparsley) | 0.4 | 16.7 | Yes |
| *Dalea ornata* (western prairie clover) | X | X | Yes |
| *Descurcania pinnata* (western tansymustard) | 0.4 | 16.7 | |
| *Eriogonum niveum* (snow buckwheat) | 0.2 | 6.7 | |
| *Erysimum asperum* (rough wallflower) | 0.7 | 26.7 | Yes |
| *Hordeum leporinum* (hare barley) [(a)] | X | X | |

**Table 41. Percent Canopy Cover and Frequency of Occurrence at 618-10 Sandy Loam Forb Islands in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence | Hand Seeded? |
|---|---|---|---|
| *Lactuca serriola* (prickly lettuce) [a] | 0.3 | 10.0 | |
| *Machaeranthera canescens* (hoary tansyaster) | 0.1 | 3.3 | |
| *Nicotiana acuminata* (coyote tobacco) | X | X | |
| *Penstemon acuminatus* (sharpleaf penstemon) | 0.4 | 16.7 | Yes |
| *Phacelia hastata* (whiteleaf phacelia) | 0.1 | 3.3 | |
| *Poa secunda* (Sandberg bluegrass) | 1.8 | 56.7 | |
| *Purshia tridentata* (antelope bitterbrush) | 0.1 | 3.3 | |
| *Rumex venosus* (winged dock) | 0.1 | 3.3 | Yes |
| *Salsola kali* (Russian thistle) [a] | 4.8 | 96.7 | |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.8 | 33.3 | |
| *Tragopogon dubius* (yellow salsify) [a] | 0.1 | 3.3 | |
| *Triticum aestivum* (common wheat) [a] | 0.6 | 23.3 | |
| *Triticum x elymus trachycaulus* (Regreen) [a] | 0.6 | 23.3 | |
| Crust | 0.0 | 0.0 | |
| Soil | 66.7 | 100.0 | |
| Litter | 33.3 | 100.0 | |
| Rock/Cobble | 0.0 | 0.0 | |
| Unavailable Space | 0.0 | 0.0 | |
| **Total canopy cover** (excludes ground cover) | **16.6** | | |
| Total Native % Cover | **8.8** | | |
| Total Invasive % Cover | 7.8 | | |

[a] = Invasive species
X = present but not counted in plots

**Table 42. Percent Canopy Cover and Frequency of Occurrence at 618-10 Gravelly Sand Forb Islands in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence | Hand Seeded? |
|---|---|---|---|
| *Achillea millefollium* (common yarrow) | 0.2 | 6.7 | |
| *Ambrosia acanthicarpa* (flatspine bur ragweed) | 3.3 | 46.7 | |
| *Astragalus caricinus* (buckwheat milkvetch) | 0.2 | 6.7 | |
| *Bromus tectorum* (cheatgrass) [a] | 1.8 | 40.0 | |
| *Bunchgrass* sp. (multiple) | 1.4 | 56.7 | |
| *Chaenactis douglasii* (Douglas' dustymaiden) | 0.1 | 3.3 | |
| *Cryptantha circumscissa* (matted cryptantha) | 0.9 | 36.7 | Yes |
| *Dalea ornata* (western prairie clover) | X | X | |
| *Descurcania pinnata* (western tansymustard) | X | X | |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 3.3 | |

**Table 42. Percent Canopy Cover and Frequency of Occurrence at 618-10 Gravelly Sand Forb Islands in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence | Hand Seeded? |
|---|---|---|---|
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.1 | 3.3 | |
| *Erigeron sp.* (fleabane) | 0.1 | 3.3 | Yes |
| *Eriogonum niveum* (snow buckwheat) | 0.1 | 3.3 | |
| *Eriogonum vimineum* (wickerstem buckwheat) | X | X | |
| *Filago arvensis* (field fluffweed) [a] | 0.3 | 10.0 | |
| *Gilia sinuata* (shy gilia) | 0.1 | 3.3 | |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.3 | 13.3 | |
| *Hordeum leporinum* (hare barley) [a] | X | X | |
| *Kochia scoparia* (kochia) [a] | 0.1 | 3.3 | |
| *Lactuca serriola* (prickly lettuce) [a] | 0.1 | 3.3 | |
| *Machaeranthera canescens* (hoary tansyaster) | 0.7 | 26.7 | Yes |
| *Nama densum* (purple mat) | X | X | |
| *Nicotiana acuminata* (coyote tobacco) | 0.1 | 3.3 | Yes |
| *Oenothera pallida* (pale-evening primrose) | X | X | |
| *Penstemon acuminatus* (sharpleaf penstemon) | 0.3 | 10.0 | |
| *Phacelia hastata* (whiteleaf phacelia) | 0.8 | 30.0 | Yes |
| *Phlox longifolia* (longleaf phlox) | 0.2 | 6.7 | Yes |
| *Plantago patagonica* (woolly plantain) | 0.3 | 13.3 | Yes |
| *Poa bulbosa* (bulbous bluegrass) [a] | 0.1 | 3.3 | |
| *Poa secunda* (Sandberg bluegrass) | 0.7 | 26.7 | |
| *Psoralidium lanceolatum* (dune scurfpea) | X | X | |
| *Rumex venosus* (winged dock) | 0.1 | 3.3 | |
| *Salsola kali* (Russian thistle) [a] | 3.8 | 53.3 | |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 2.3 | 56.7 | |
| *Tragopogon dubius* (yellow salsify) [a] | 1.4 | 23.3 | |
| *Triticum aestivum* (common wheat) [a] | 0.1 | 3.3 | |
| *Triticum x elymus trachycaulus* (Regreen) [a] | 0.9 | 36.7 | |
| *Vulpia microstachys* (desert fescue) | 0.3 | 13.3 | |
| Crust | 0.0 | 0.0 | |
| Soil | 53.3 | 100.0 | |
| Litter | 32.5 | 100.0 | |
| Rock/Cobble | 4.0 | 43.3 | |
| Unavailable Space | 0.0 | 0.0 | |
| **Total canopy cover** (excludes ground cover) | **20.9** | | |
| Total Native % Cover | **9.8** | | |
| Total Invasive % Cover | 11.2 | | |

[a] = Invasive species
X = present but not counted in plots

## 3.9 200 AREA SITES

Five revegetation projects in the 200 Areas were monitored in FY 2020: L-840, L-525, L-419, L-853/854, and L-894. The L-840 and L-525 sites were revegetated in FY 2017, the L-419 site was revegetated in FY 2018, and the L-853/854 and L-894 sites were revegetated in FY 2019.

In FY 2017, an export water line was installed and the disturbed areas revegetated. For revegetation and monitoring purposes the area was divided into two sites, the 200-West (L-840) Export Water Pipeline site and the 200-East (L-525) Export Water Pipeline site. Per the *Site-Specific Revegetation Plan for the Export Water Pipeline* (L-840) and the *Site-Specific Revegetation Plan for the Export Water Pipeline* (L-525) (MSA 2016 and MSA 2017a), revegetation efforts entailed broadcast seeding with a mixture of native grasses including Sandberg bluegrass (*Poa secunda*), Indian ricegrass (*Achnatherum hymenoides*), and needle-and-thread grass (*Hesperostipa comata*) at approximately 9.75 lbs/ac combined with a native forb mix of a minimum of four species at approximately 0.4 lbs/ac. Broadcast seeding areas were topped with a straw mulch that was crimped into the soil surface. Shrub species including big sagebrush (*Artemisia tridentata*), antelope bitterbrush (*Purshia tridentata*), and spiny hopsage (*Grayia spinosa*) were transplanted on the sites at approximately 600 plants/ac with a mix of approximately 66% sagebrush, 17% bitterbrush, and 17% spiny hopsage.

In FY 2018, an export water line was installed between the 2901-Y Valve House and the 282-E Inlet Valve House in the 200-East Area. The L-419 pipeline is approximately 3.73 km (2.37 mi) in length and is close and parallel to the L-525 Export Water Pipeline. Per the *Site-Specific Revegetation Plan for the Export Water Pipeline* (L-419) (MSA 2017b), revegetation efforts entailed broadcast seeding with a mixture of native grasses including Sandberg bluegrass (*Poa secunda*), Indian ricegrass (*Achnatherum hymenoides*), and needle-and-thread grass (*Hesperostipa comata*) at approximately 15.5 lb/ac. Native forb seed was also broadcasted across the site including Munro's globemallow (*Sphaeralcea munroana*), Carey's balsamroot (*Balsamorhiza careyana*), shaggy fleabane (*Erigeron pumilis*), slender hawksbeard (*Crepis atribarba*), snow buckwheat (*Eriogonum niveum*), and Douglas' Dustymaiden (*Chaenactis douglasii*) at a rate of 1.88 lb/ac. Shrub species (including big sagebrush [*Artemisia tridentata*], antelope bitterbrush [*Purshia tridentata*], and spiny hopsage [*Grayia spinosa*]) were transplanted on the sites at approximately 600 plants/ac with a mix of approximately 66% sagebrush, 17% bitterbrush, and 17% spiny hopsage.

In FY 2019, the L-853/854 export water line was revegetated. This site was broadcast seeded with a mixture of native grasses including Sandberg bluegrass (*Poa secunda*) and needle-and-thread grass (*Hesperostipa comata*) at a rate of 3.7 lb/ac and 3 lb/ac, respectively, along with cushion fleabane (*Erigeron poliospermus*), Munro's globemallow, and slender hawksbeard at a rate of 0.2 lb/ac. Shrub species including big sagebrush (*Artemisia tridentata*), antelope bitterbrush (*Purshia tridentata*), and spiny hopsage (*Grayia spinosa*) were transplanted on the sites at approximately 600 plants/ac with a mix of approximately 66% sagebrush, 17% bitterbrush, and 17% spiny hopsage.

The L-894 export water line was also revegetated in FY 2019 following the *Site Specific Revegetation Plan for Project L-894* (MSA 2017c). The site was broadcast seeded with a mixture of native grasses including Sandberg bluegrass (*Poa secunda*), Indian ricegrass (*Achnatherum hymenoides*), and needle-and-thread grass (*Hesperostipa comata*) at a rate of approximately 9.0 lb/ac. Forb species seeded included Mariposa lily (*Calochortus macrocarpus*), western prairie clover (*Dalea ornata*), desert parsley (*Cymopterus terebinthinus*), hoary tansyaster (*Machaeranthera canescens*), and slender hawksbeard. Pale evening primrose (*Oenothera pallida*) was also included in the seed mix but rock primrose (*Oenothera caespitosa*) was incorrectly substituted by the vendor. Forbs were seeded at a rate of 0.46 lb/ac. Shrub species (including big sagebrush [*Artemisia tridentata*] and spiny hopsage [*Grayia spinosa*]) were transplanted on the sites at approximately 600 plants/ac with a mix of approximately 66% sagebrush and 33% spiny hopsage.

### 3.9.1 200-West (L-840) Export Water Pipeline Site

The 200-West (L-840) Export Water Pipeline site (Figure 42) was revegetated in FY 2017 and monitoring was first conducted for the site in 2017. This is a larger site that was divided into 5 areas for monitoring purposes with data collected from 20 plot frames in each area and 1 transect at the southwest end of the site. That transect was retired in 2018 due to being converted to an industrial use area. A new transect was established in 2019. Substrates for the site are sandy loams to loamy sands with varied amounts of gravel and cobble.

One transect was established in FY 2019 to estimate shrub density at the L-840 site. This transect counted sagebrush (*Artemisia tridentata*) that were planted in FY 2017, as well as recruits from the soil and surrounding areas. There were a large number of recruits throughout the L-840 site. The 2020 monitoring of this transect found 2,438 shrubs/ac, well above shrub density requirements. Many of the shrubs counted were recruits and will naturally thin out in the coming years, but it is expected that this site will remain above success levels.

Canopy cover data for the site was collected in April 2019. Average canopy cover for the site overall was 53.5% with native cover representing 24.8% and invasive cover representing 28.7% (Table 43). Native cover increased by 14.2% since 2018 and invasive cover decreased by 0.7% since 2018. Sandberg's bluegrass (*Poa secunda*) was the dominant native species for the site with 11.0% cover. Cheatgrass (*Bromus tectorum*) was the dominant invasive species for the site with 13.0% cover. Since 2017 monitoring, Russian thistle (*Salsola kali*) cover has decreased from 32.3% to 2.8%. Twenty-three native species were identified at this site in 2019 (Table 43).

Fourth-year shrub density monitoring at this site shows highly successful sagebrush density. The 2019 monitoring shows native cover quickly approaching success levels. No further action apart from continued monitoring is recommended at this site.

**Table 43. Percent Canopy Cover and Frequency of Occurrence at the 200-West L-840 Waterline Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achnatherum hymenoides* (Indian ricegrass) | 1.1 | 20.0 |
| *Agropyron cristatum* (crested wheatgrass) [a] | X | X |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.1 | 5.0 |
| *Artemisia tridentata* (big sagebrush) | 3.6 | 45.0 |
| *Astragalus succumbens* (crouching milkvetch) | 1.1 | 7.5 |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.1 | 5.0 |
| *Bromus tectorum* (cheatgrass) [a] | 13.0 | 100.0 |
| *Calochortus macrocarpus* (sagebrush mariposa lily) | 0.1 | 5.0 |
| *Chorispora tenella* (crossflower) [a] | 0.1 | 5.0 |
| *Crepis atribarba* (slender hawksbeard) | X | X |
| *Descurcania pinnata* (western tansymustard) | 0.6 | 24.0 |
| *Draba verna* (spring draba) [a] | 0.4 | 15.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 5.0 |
| *Erigeron pumilus* (shaggy fleabane) | 0.8 | 5.0 |
| *Eriogonum niveum* (snow buckwheat) | 2.8 | 32.5 |
| Fescue sp. (unknown) | 0.1 | 5.0 |
| *Grayia spinosa* (spiny hopsage) | 0.8 | 5.0 |
| *Hesperostipa comata* (needle-and-thread grass) | 0.4 | 17.5 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.8 | 30.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.7 | 28.0 |
| *Lupinus pusillus* (low lupine) | 0.1 | 5.0 |
| Lupinus sp. (lupine sp.) | 0.1 | 5.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.3 | 10.0 |
| *Microsteris gracilis* (slender phlox) | 0.1 | 5.0 |
| *Phlox speciosa* (showy phlox) | 0.1 | 5.0 |
| *Poa bulbosa* (bulbous bluegrass) [a] | 0.9 | 36.7 |
| *Poa secunda* (Sandberg bluegrass) | 11.0 | 95.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.4 | 16.7 |
| *Rumex venosus* (winged dock) | X | X |
| *Salsola kali* (Russian thistle) [a] | 2.8 | 73.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 2.8 | 43.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | 0.8 | 6.7 |
| *Tragopogon dubius* (yellow salsify) [a] | 7.3 | 95.0 |
| Crust | 0.1 | 4.0 |
| Soil | 54.6 | 99.0 |
| Litter | 41.3 | 100.0 |
| Rock/Cobble | 4.3 | 83.0 |
| Unavailable Space | 0.2 | 9.0 |
| **Total Canopy Cover** | **53.5** | |
| **Total Native % Cover** | **24.8** | |
| Total Invasive % Cover | 28.7 | |
| Unadjusted canopy cover | 53.4 | |

**Table 43. Percent Canopy Cover and Frequency of Occurrence at the 200-West L-840 Waterline Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| Unadjusted Native % Cover | 24.8 | |
| Change in Native % Cover from 2018 | 14.2 | |
| Unadjusted Invasive % Cover | 28.7 | |
| Change in Invasive % Cover from 2018 | -0.7 | |

[a] Invasive species
X = present but not counted in plot frames

**Figure 40. The 200-West (L-840) Export Water Pipeline Site in 2020.**

### 3.9.2 200-East (L-525) Export Water Pipeline Site

The 200-East (L-525) Export Water Pipeline site (Figure 43) was revegetated in FY 2017 and monitoring was first conducted for the site in 2017. This is a larger site that was divided into 5 areas for monitoring purposes with data collected from 20 plot frames in each area and 1 transect at the northwest end of the site. Substrates for the site are sandy loams to loamy sands with varied amounts of gravel and cobbles.

A 100-m (328-ft) shrub monitoring transect with a 4-m (13.1-ft) and 3-m (9.84-ft) offset was established for the site in 2017. The 2018 second-year monitoring revealed extremely low survival on this transect (1%), so a new transect was established in 2019 to determine if low survival was common throughout the line. Fourth-year monitoring of Transect 1 and second-year monitoring of Transect 2 were conducted in November 2020. Shrub density at Transect 1

was 64 plants/ac, below success criteria of 240 plants/ac. A total of 36% of the sagebrush (*Artemisia tridentata*) at Transect 1 were in bloom and producing seed at the time of monitoring. Transect 2 had a density of 81 plants/ac, below success criteria, and 79% of plants on this transect were in bloom. Average shrub density at L-525 was 73 plants/ac. The similar low shrub density at Transect 2 suggests that low shrub survival post-planting occurred throughout the entire L-525 site. There was complete shrub survival from the 2019 to 2020 season, suggesting that all of the die-offs occurred between 2017 and 2018.

Canopy cover data for the site was collected in April 2019. Average canopy cover for the site overall was 37.3%, with native cover representing 15.5% and invasive cover representing 21.8% (Table 44). Native cover had increased by 6.6% and invasive cover had increased by 9.3% at this site since 2018 monitoring. Sandberg's bluegrass (*Poa secunda*) was the dominant native species with 10.8% of the native cover. Twenty-three native species were recorded at this site, and this site has a high diversity of forb species. Cheatgrass (*Bromus tectorum*) was the dominant invasive species for the site with 14.7% cover, an increase of about 10% from 2018.

This site is surrounded by mature stands of sagebrush and has a large proportion of planted sagebrush producing seed. The L-840 site, planted with the same methods and at the same time as the L-525 site, has a high number of sagebrush recruits. Before additional revegetation actions are taken to increase shrub density, sagebrush recruits at this site should be closely monitored to see if the surrounding sagebrush stands can successfully seed the area. The high native diversity and success of forbs at this site suggests native canopy cover will continue to increase at this site.

**Table 44. Percent Canopy Cover and Frequency of Occurrence at the 200-West L-525 Waterline Site in 2019. (2 Pages)**

| Species | Entire Site | |
|---|---|---|
| | % Cover | % Frequency of Occurrence |
| *Achnatherum hymenoides* (Indian ricegrass) | 0.7 | 12.0 |
| *Agropyron cristatum* (crested wheatgrass) [a] | X | X |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.1 | 2.0 |
| *Artemisia tridentata* (big sagebrush) | 0.4 | 4.0 |
| *Artemisia tridentata* (recruits) | 0.03 | 1.0 |
| *Astragalus caricinus* (buckwheat milkvetch) | X | X |
| *Astragalus succumbens* (crouching milkvetch) | X | X |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.4 | 7.0 |
| *Bromus tectorum* (cheatgrass) [a] | 14.7 | 100.0 |
| Bunchgrasses sp. (multiple) | 0.03 | 1.0 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | 0.1 | 2.0 |
| *Chorispora tenella* (crossflower) [a] | X | X |
| *Crepis atribarba* (slender hawksbeard) | X | X |
| *Descurainia pinnata* (western tansymustard) | X | X |
| *Draba verna* (spring draba) [a] | 0.1 | 4.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 2.0 |

**Table 44. Percent Canopy Cover and Frequency of Occurrence at the 200-West L-525 Waterline Site in 2019. (2 Pages)**

| Species | Entire Site | |
|---|---|---|
| | % Cover | % Frequency of Occurrence |
| *Erigeron pumilus* (shaggy fleabane) | 0.1 | 5.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.7 | 9.0 |
| *Grayia spinosa* (spiny hopsage) | X | X |
| *Hesperostipa comata* (needle-and-thread grass) | 0.8 | 8.0 |
| *Holosteum umbellatum* (jagged chickweed) [a] | 0.1 | 3.0 |
| *Lactuca serriola* (prickly lettuce) [a] | 0.9 | 37.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.1 | 2.0 |
| *Microsteris gracilis* (slender phlox) | 0.1 | 3.0 |
| *Poa bulbosa* (bulbous bluegrass) [a] | 0.03 | 1.0 |
| *Poa secunda* (Sandberg bluegrass) | 10.8 | 88.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.5 | 8.0 |
| *Salsola kali* (Russian thistle) [a] | 3.8 | 87.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 2.0 | 45.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | 0.6 | 5.0 |
| *Sporobolus cryptandrus* (sand dropseed) | 0.03 | 1.0 |
| *Tragopogon dubius* (yellow salsify) [a] | X | X |
| *Triticum sp.* (wheat) [a] | 0.03 | 1.0 |
| *Vulpia microstachys* (desert fescue) | 0.1 | 2.0 |
| Crust | 0.0 | 1.0 |
| Soil | 36.9 | 95.0 |
| Litter | 40.0 | 100.0 |
| Rock/Cobble | 9.7 | 50.0 |
| Unavailable Space | 0.7 | 17.0 |
| **Total Canopy Cover** | **37.3** | |
| **Total Native % Cover** | **15.5** | |
| Total Invasive % Cover | 21.8 | |
| Unadjusted canopy cover | 37.1 | |
| Unadjusted Native % Cover | 15.4 | |
| Change in Native % Cover from 2018 | 6.6 | |
| Unadjusted Invasive % Cover | 21.6 | |
| Change in Invasive % Cover from 2018 | 9.3 | |

[a] Invasive species

X = present but not counted in plot frames

**Figure 41. The 200-East (L-525) Export Water Pipeline Site in 2020.**

### 3.9.3 200-East (L-419) Export Water Pipeline Site

The 200-East (L-419) Export Water Pipeline site (Figure 44) was revegetated in FY 2018 and monitoring was first conducted for the site in 2018. This is a larger site that was divided into 5 areas for monitoring purposes with data collected from 20 plot frames in each area and 3 transects spaced along the site. Loamy sand is the predominant substrate at this site.

Three 100-m (328-ft) shrub monitoring transects with 5-m (16.4-ft) offsets to each side were established for the site in 2018. Low shrub survival was recorded from 2018 to 2019. Third-year monitoring was conducted at this site in October 2020. Using data from these three transects, an overall shrub density of 167 plants/ac was recorded for the site, below success criteria of 240 plants/ac. Shrub survival averaged 22.6% from the initial planting but was high between 2019 and 2020. In 2020, 59% of sagebrush (*Artemisia tridentata*) on the transect was in bloom and producing seed at the time of monitoring.

Canopy cover data for the site was collected in May 2019. Average canopy cover for the site overall was 32.4%, with native cover representing 6.4% and invasive cover representing 26.0% (Table 45). Native cover has increased by 3.5% and invasive cover has increased by 2.7% since 2018. Eighteen native species were identified at this site in 2019. The dominant species at this site was cheatgrass (*Bromus tectorum*) with 16.1% cover. Russian thistle levels have decreased at this site from 20% to 4% from 2018 to 2019. The dominant native species at this site was Sandberg's bluegrass (*Poa secunda*) with 1.7% cover.

The 2019 canopy cover monitoring shows increasing canopy cover and a relatively high level of native species. Third-year shrub monitoring shows that shrub density is below success levels but 59% of sagebrush on the transect was producing seed. Continued monitoring of shrub density

and close tracking of sagebrush recruits is necessary for this site to determine if sagebrush will reach successful shrub density levels.

**Table 45. Percent Canopy Cover and Frequency of Occurrence at the 200-East L-419 Waterline Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achnatherum hymenoides* (Indian ricegrass) | 0.5 | 20.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.1 | 5.0 |
| *Artemisia tridentata* (big sagebrush) | 1.0 | 15.0 |
| *Balsamorhiza careyana* (Carey's balsamroot) | 0.1 | 5.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 16.1 | 100.0 |
| *Bunchgrasses sp.* (multiple) | 0.2 | 8.3 |
| *Chaenactis douglasii* (Douglas' dustymaiden) | 0.1 | 5.0 |
| *Descurcania pinnata* (western tansymustard) | 0.5 | 21.3 |
| *Draba verna* (spring draba) [(a)] | 0.4 | 8.8 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.3 | 10.0 |
| *Erigeron pumilus* (shaggy fleabane) | 0.3 | 10.0 |
| *Eriogonum niveum* (snow buckwheat) | 0.4 | 17.0 |
| *Grayia spinosa* (spiny hopsage) | 0.1 | 5.0 |
| *Hesperostipa comata* (needle-and-thread grass) | 0.1 | 5.0 |
| *Holosteum umbellatum* (jagged chickweed) [(a)] | 0.2 | 7.5 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 1.4 | 54.0 |
| *Microsteris gracilis* (slender phlox) | 0.1 | 5.0 |
| *Oenothera pallida* (pale-evening primrose) | 0.8 | 5.0 |
| *Poa bulbosa* (bulbous bluegrass) [(a)] | 0.8 | 5.0 |
| *Poa secunda* (Sandberg bluegrass) | 1.7 | 41.0 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.3 | 13.0 |
| *Salsola kali* (Russian thistle) [(a)] | 4.0 | 86.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [(a)] | 2.9 | 66.0 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Triticum sp.*[a] (wheat) | 0.1 | 5.0 |
| Crust | 0.0 | 0.0 |
| Soil | 36.9 | 93.0 |
| Litter | 50.7 | 100.0 |
| Rock/Cobble | 6.7 | 78.0 |
| Unavailable Space | 1.7 | 26.0 |
| **Total Canopy Cover** | **32.4** | |
| **Total Native % Cover** | **6.4** | |
| Total Invasive % Cover | 26.0 | |
| Unadjusted canopy cover | 31.9 | |
| Unadjusted Native % Cover | 6.3 | |
| Change in Native % Cover from 2018 | 3.5 | |
| Unadjusted Invasive % Cover | 25.6 | |
| Change in Invasive % Cover from 2018 | 2.7 | |

**Table 45. Percent Canopy Cover and Frequency of Occurrence at the 200-East L-419 Waterline Site in 2019. (2 Pages)**

[a] Invasive species
X = present but not counted in plot frames

**Figure 42. The Export Water Pipeline Site (L-419) in 2020.**

### 3.9.4 200-East (L-853/L-854) Export Water Pipeline Site

The 200-East (L-853/L-854) Export Water Pipeline site (Figure 45) was revegetated in FY 2019 and monitoring was first conducted for the site in 2019. This is a larger site that was divided into 5 areas for monitoring purposes with data collected from 25 plot frames in each area and 3 transects spaced along the site. Substrate at this site is predominately loam with varying amounts of cobble.

Three 100-m (328-ft) shrub monitoring transects with 5-m (16.4-ft) offsets to each side were established for the site in 2019. Second-year monitoring was conducted at this site in October 2020. Using data from these three transects, an overall shrub density of 231 plants/ac was recorded for the site, below success criteria of 240 plants/ac. Shrub survival from initial planting was 51.2%.

Canopy cover data for the site was collected in May 2019. Average canopy cover for the site overall was 27.0%, with native cover representing 6.1% and invasive cover representing 20.9% (Table 46). Eighteen native species were identified at this site in 2019. The dominant species at this site was Russian thistle (*Salsola kali*) with 7.9% cover. The dominant native species at this site was Sandberg's bluegrass (*Poa secunda*) with 2.3% cover.

Continued monitoring is necessary to track the progress of this site. Shrub density is not at successful levels. FY 2021 monitoring should ensure that transects are representative of the shrub density at the site. Native canopy cover is expected to increase in future monitoring efforts.

**Table 46. Percent Canopy Cover and Frequency of Occurrence at the L-853/854 Waterline Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.7 | 15.2 |
| *Artemisia tridentata* (big sagebrush) | 0.1 | 5.6 |
| *Artemisia tridentata* (recruits) | 0.3 | 13.3 |
| *Bromus tectorum* (cheatgrass) [(a)] | 3.7 | 86.4 |
| *Bunchgrass* sp. (multiple) | 1.0 | 39.2 |
| *Chenopodium leptophyllym* (narrowleaf goosefoot) | 0.1 | 4.0 |
| *Chorispora tenella* (crossflower) [(a)] | X | X |
| *Crepis atribarba* (slender hawksbeard) | 0.1 | 3.2 |
| *Descurcania pinnata* (western tansymustard) | 0.2 | 8.0 |
| *Draba verna* (spring draba) [(a)] | 1.1 | 39.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.2 | 6.0 |
| *Ericameria nauseosa* (rubber rabbitbrush) | 0.3 | 12.0 |
| *Erigeron poliospermus (*cushion fleabane) | 0.02 | 0.8 |
| *Erigeron pumilus* (shaggy fleabane) | 0.02 | 0.8 |
| *Grayia spinosa* (spiny hopsage) | 0.1 | 2.7 |
| *Holosteum umbellatum* (jagged chickweed) [(a)] | 0.6 | 23.0 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 1.1 | 39.2 |
| *Lamium amplexicaule* (henbit deadnettle) [(a)] | 0.1 | 4.0 |
| *Machaeranthera canescens* (hoary tansyaster) | 0.02 | 0.8 |
| *Poa bulbosa* (bulbous bluegrass) [(a)] | X | X |
| *Poa secunda* (Sandberg's bluegrass) | 2.3 | 80.8 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.6 | 24.0 |
| *Purshia tridentata* (antelope bitterbrush) | 0.1 | 2.0 |
| *Ranunculus testiculatus*(burr buttercup) [(a)] | 0.2 | 9.0 |
| *Salsola kali* (Russian thistle) [(a)] | 7.9 | 88.0 |
| *Sisymbrium altissimum* (tall tumblemustard) [(a)] | 5.9 | 83.2 |
| *Triticum sp.* (wheat) [(a)] | 0.3 | 6.0 |
| *Vulpia microstachys* (desert fescue) | X | X |
| Crust | 0.0 | 0.0 |
| Soil | 46.9 | 96.8 |
| Litter | 38.5 | 98.4 |
| Rock/Cobble | 4.0 | 44.8 |
| Unavailable Space | 0.6 | 15.2 |
| **Total Canopy Cover** | **27.0** | |
| **Total Native % Cover** | **6.1** | |

**Table 46. Percent Canopy Cover and Frequency of Occurrence at the L-853/854 Waterline Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| Total Invasive % Cover | 20.9 | |
| Unadjusted canopy cover | 26.8 | |
| Unadjusted Native % Cover | 6.1 | |
| Unadjusted Invasive % Cover | 20.7 | |

[a] Invasive species
X = present but not counted in plot frames

**Figure 43. The L-853/L-854 Site in 2020, Showing the Sagebrush Cheatgrass Community to the North.**

### 3.9.5 200-East (L-894) Export Water Pipeline Site

The 200-East (L-894) Export Water Pipeline site (Figure 46) was revegetated in FY 2019 and monitoring was first conducted for the site in 2019. This is a larger site that was divided into 5 areas for monitoring purposes with data collected from 25 plot frames in each area and 3 transects spaced along the site. Substrate at this site is predominately loam with varying amounts of cobble.

Three 100-m (328-ft) shrub monitoring transects with 5-m (16.4-ft) offsets to each side were established for the site in 2019. Second-year monitoring was conducted at this site in November 2020. Using data from these three transects, an overall shrub density of 590 plants/ac was recorded for the site, above success criteria of 240 plants/ac.

Canopy cover data for the site was collected in April 2019. Average canopy cover for the site overall was 11.1%, with native cover representing 5.2% and invasive cover representing 5.9% (Table 47). Twenty-one native species were identified at this site in 2019. The dominant species at this site were young bunchgrasses with 2.6% cover. The dominant invasive species at this site was cheatgrass (*Bromus tectorum*) with 1.8% cover. Kochia (*Bassia scoparia*), a Washington State Class B noxious weed, was detected at this site at less than 1% cover and occurred in 4% of plot frames.

Continued monitoring is necessary to track the progress of this site. Second-year shrub density monitoring shows successful shrub density levels. Canopy cover data shows high native diversity and native cover is expected to increase in the coming years.

**Table 47. Percent Canopy Cover and Frequency of Occurrence at the L-894 Waterline Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Achnatherum hymenoides* (Indian ricegrass) | 0.2 | 8.0 |
| *Amsinckia lycopsoides* (tarweed fiddleneck) | 0.3 | 11.2 |
| *Artemisia tridentata* (big sagebrush) | 0.2 | 9.6 |
| *Artemisia tridentata* (recruit) | 0.1 | 4.8 |
| *Astragalus* sp. (milkvetch sp.) | 0.1 | 0.8 |
| *Balsamorhiza careyana* (Carey's balsamroot) | X | X |
| *Bassia scoparia* (kochia) (B) [(b)] | 0.1 | 68.0 |
| *Bromus tectorum* (cheatgrass) [(a)] | 2.6 | 90.4 |
| *Bunchgrasses* (multiple) | 0.1 | 4.0 |
| *Calochortus macrocarpus* (sagebrush mariposa lily) | 0.2 | 7.2 |
| *Chenopodium leptophyllym* (narrowleaf goosefoot) | X | X |
| *Chorispora tenella* (crossflower) [(a)] | X | X |
| *Comandra umbellata* (bastard toadflax) | 0.1 | 4.8 |
| *Crepis atribarba* (slender hawksbeard) | 0.0 | 0.8 |
| *Cymopterus terebinthinus* (turpentine springparsley) | 0.1 | 7.2 |
| *Descurcania pinnata* (western tansymustard) | 0.3 | 10.4 |
| *Draba verna* (spring draba) [(a)] | 0.2 | 8.0 |
| *Epilobium brachycarpum* (tall annual willowherb) | 0.1 | 5.6 |
| *Grayia spinosa* (spiny hopsage) | 0.1 | 4.0 |
| *Holosteum umbellatum* (jagged chickweed) [(a)] | 0.0 | 0.8 |
| *Lactuca serriola* (prickly lettuce) [(a)] | 1.7 | 44.8 |
| *Lamium amplexicaule* (henbit deadnettle) [(a)] | X | X |
| *Machaeranthera canescens* (hoary tansyaster) | 0.6 | 23.2 |
| *Microsteris gracilis* (slender phlox) | 0.1 | 2.4 |
| *Oenothera caespitosa* (rockrose) | 0.1 | 0.8 |
| *Poa bulbosa* (bulbous bluegrass) [(a)] | 0.1 | 0.8 |
| *Poa secunda* (Sandberg's bluegrass) | 2.4 | 72.8 |
| *Pseudoroegneria spicata* (bluebunch wheatgrass) | 0.1 | 2.4 |

**Table 47. Percent Canopy Cover and Frequency of Occurrence at the L-894 Waterline Site in 2019. (2 Pages)**

| Species | % Cover | % Frequency of Occurrence |
|---|---|---|
| *Purshia tridentata* (antelope bitterbrush) | X | X |
| *Rumex crispus* (curly dock) [a] | X | X |
| *Salsola kali* (Russian thistle) [a] | 1.1 | 43.2 |
| *Sisymbrium altissimum* (tall tumblemustard) [a] | 0.1 | 0.8 |
| *Sphaeralcea munroana* (Munro's globemallow) | X | X |
| *Triticum sp.* (wheat) [a] | X | X |
| Crust | 0.0 | 0.0 |
| Soil | 49.4 | 97.6 |
| Litter | 43.8 | 100.0 |
| Rock/Cobble | 1.3 | 43.2 |
| Unavailable Space | 0.3 | 6.4 |
| **Total Canopy Cover** | **11.1** | |
| **Total Native % Cover** | **5.2** | |
| Total Invasive % Cover | 5.9 | |
| Unadjusted canopy cover | 11.1 | |
| Unadjusted Native % Cover | 5.2 | |
| Unadjusted Invasive % Cover | 5.9 | |

[a] Invasive species
[b] Washington State Classified Noxious Weed (class)
X = present but not counted in plot frames

**Figure 44. The L-894 Site in 2020 Showing High Native Grass Cover.**

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# 4.0 DISCUSSION

Revegetation of remediated and disturbed sites on the Hanford Site is performed to support the U.S. Department of Energy, Richland Operations Office's goal of meeting cleanup and revegetation requirements mandated in the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*. Revegetation and monitoring activities of remediated and disturbed sites on the Hanford Site are conducted in accordance with the *Hanford Site Revegetation Manual* (DOE/RL-2011-116), area specific revegetation plans (DOE/RL-96-17, Appendix H; DOE/RL-2005-93, Appendix G; DOE/RL-2001-47, Appendix C), as well as other area and/or site-specific guidance such as Mitigation Action Plans and Memorandums of Agreement.

Landscapes within semi-arid climates take decades or even centuries to reestablish naturally to functional and sustainable ecosystems after disturbances. The Hanford Site presents many challenges to revegetation efforts due to its complex shrub-steppe ecosystem, decades of natural and anthropogenic disturbances, widespread invasive species (e.g., cheatgrass, *Bromus tectorum* and Russian thistle, *Salsola kali*), and limited fill material that often has a high percentage of rock (gravel and cobbles). It is also important to realize that habitats within a landscape may differ significantly from one another. Not all plants grow in the same soil or climatic conditions. A prescription that is successful for one site may not work for another. Factors such as substrate, moisture, adjacent topography and species composition, prescribed species and application rates, seasonal timing for planting, annual precipitation, and proper planting and seeding techniques all influence the success of a particular revegetation site.

MSA is responsible for monitoring and evaluating Hanford Site revegetation sites previously restored by the RCCC and CHPRC within areas that have transitioned to MSA, and for monitoring restoration areas associated with Site reliability projects implemented by MSA. MSA's goal through revegetation monitoring is to ensure the success of the restoration process. As described in this report, this is accomplished by conducting annual monitoring of representative revegetated sites to provide quantitative data (shrub density and canopy cover percentages) that can be used to evaluate trends, individual site success or failure, and provide insight regarding the effectiveness of different planting strategies for different conditions. Sites that are not meeting the prescribed success criteria are evaluated to determine if additional revegetation efforts need to be implemented to achieve success.

A total of 40 revegetated sites were monitored during routine 5-year monitoring by MSA in 2020. Table 48 summarizes the actions performed at each site, along with the current shrub density and future recommendations. Twenty-nine of the 40 monitored sites had some kind of additional revegetation action performed after the original revegetation, ranging from supplemental planting of shrubs to completely re-working the site. The remaining 12 revegetation sites had no additional revegetation actions and were monitored with routine 5-year monitoring. For each site monitored, these data were evaluated against the success criteria of 600 plants/ha (240 plants/ac) for native shrub density and 25% native cover (shrubs, grasses, forbs combined).

All 40 sites monitored in 2020 had shrub transects to measure shrub density. Twenty-five of the 40 monitored sites are currently meeting the shrub density success criteria of over 600 plants/ha (240 plants/ac). Five sites that had unsuccessful shrub density in 2019 had successful shrub density in 2020 due to supplemental planting that occurred in winter of 2020 (116-C-5, 130-N-1:1, 100-N-96, 100-N-61:1, 600-30). Four sites that were planted in winter of 2020 had increased shrub density but were still below the shrub density success criteria of over 600 plants/ha (240 plants/ac) (100-N-CTA, 124-N-10, 100-N-84:9, 600-120). Four sites monitored in 2020 changed status from successful to unsuccessful due to low shrub survival (628-3, 100-F Trailer Village, 600-301, L-853/854). Seven sites were unsuccessful in both 2019 and 2020 and did not receive additional plants in winter 2020 (100-D Trailer Village, 100-H-28:2, 118-F-6, 118-F-5, 118-F-3, L-525, L-419). Additional revegetation actions are recommended depending on the current status of the site, if it has had additional actions before, and on the presence of blooming sagebrush at the site.

Sagebrush that were planted in 2019 had an average survival of 66% from first to second-year monitoring (2019 monitoring to 2020 monitoring). Past revegetation monitoring has noted that first to second-year monitoring is when the lowest shrub survival is seen. This may be due to high survival during the first few months of planting leading up to first-year monitoring, then low survival following the summer drought. Because 2020 monitoring occurred in the fall of 2020, sagebrush planted in 2019 had withstood two summer droughts by the time of 2020 monitoring. This may have made the 66% survival rate artificially lower than what the first to second-year survival would typically be. Additionally, the timing of fall monitoring may make sagebrush that was planted in 2020 and will be monitored for the second year in 2021 have artificially high survival from 2020 to 2021. This would be because the "baseline" survival for those plants actually reflects the survival after the first summer, rather than before as is typical. First to second-year survival will be monitored in all future planting years in order to identify years with abnormally high or low survival rates.

Because no monitoring occurred immediately after planting for shrubs and forbs planted in winter 2020, analyzing the first-year survival accurately is not possible. A site where this is demonstrated is the C9-L3 site. This site was planted at a rate of 600 shrubs per acre, yet 2020 first-year monitoring found an average of 126 plants/ac at this site. The C9-L3 site was planted in a distinct diamond pattern. This made it clear at the time of planting that there was low survival, as the majority of plants in the diamond pattern were missing. Due to the delayed monitoring, that low survival was not accounted for in the data.

Snow buckwheat (*Eriogonum niveum*) and Munro's globemallow (*Sphaeralcea munroana*) were planted as 4-in.$^3$ plugs in select revegetation sites in 2019. The survival of these forbs was tracked closely to determine if planting forbs was an effective way to add a forb component to revegetation sites. Snow buckwheat that was planted in 2019 had an average survival from planting of 67% in 2020 monitoring. Additionally, an average of 54% of snow buckwheat plants had evidence of blooming in 2020. Munro's globemallow that was planted in 2019 had an average survival from planting of 48% in 2020. Additionally, an average of 34% of Munro's globemallow plants had evidence of blooming in 2020. Snow buckwheat was the more reliable forb of the two, with a higher survival and blooming rate than Munro's globemallow. But both forbs were successful at adding a forb component back to the revegetation sites and have since

acted as seed sources in the areas. Based on current monitoring data, planting these two species of forb is an effective way to return the forb component to revegetation areas.

Revegetation efforts in 2019 and 2020 used 10-in.$^3$ shrub plugs for first-time restoration and supplemental planting. Past efforts had most often used 4-in.$^3$ shrub plugs for sagebrush and hopsage, while using 10-in.$^3$ plugs for bitterbrush. In 2019 and 2020, 10-in.$^3$ plugs were used for all shrub species as the plugs had larger and more developed root structures, which were hypothesized to increase survival. An analysis of 4-in.$^3$ sagebrush plugs shows an average survival from planting of 93% in the first year, 53% in the second year, and 43% in the third year. The analysis of 10-in.$^3$ sagebrush plugs could only capture first and second year survival from planting, and found an average survival of 92% from the first year and 62% from the second year. Data collection on long-term benefits of planting 10-in.$^3$ sagebrush plugs is ongoing. The data currently supports planting 10-in.$^3$ plugs in revegetation areas to achieve the highest survival.

Native canopy cover measurements in this report are from 2019 monitoring and are discussed in the *Hanford Site Revegetation Monitoring Report for Fiscal Year 2019*.

Continued monitoring of revegetation sites is essential to determine the success of those sites and to identify the most effective methods of revegetation. New revegetation methods, such as planting 10-in.$^3$ sagebrush plugs and adding forb plugs to revegetation sites, have proven effective at improving revegetation areas. Continued innovation and tracking of the methods employed at revegetation sites will allow site managers to improve revegetation methods and the success of sites in the years to come.

**Table 48. 2020 Revegetation Monitoring Summary. (4 Pages)**

| Site | Year Planted | Monitoring Year | Shrub Density (goal greater than 240 plants/ac) | 2019 Shrub Density Success | 2020 Shrub Density Success | Recommendations/ Notes |
|---|---|---|---|---|---|---|
| **B/C Area Sites** | | | | | | |
| 100-B-35 | FY 2016 | 5 | 263 | Successful | Successful | Monitor canopy cover in FY 2021. |
| 116-B/C-Misc. | FY 2007<br>FY 2019 (R)<br>FY 2020 (S) | 1 | 393 | Unknown | Successful | Continue to monitor. |
| **K Area Sites** | | | | | | |
| 100-K-95 | FY 2014<br>FY 2019 (R)<br>FY 2020 (S) | 2 | 247 | Successful | Successful | Continue to monitor. |
| 100-K-CTA | FY 2015<br>FY 2019 (R)<br>FY 2020 (S) | 2 | 306 | Successful | Successful | Continue to monitor. |

**Table 48. 2020 Revegetation Monitoring Summary. (4 Pages)**

| Site | Year Planted | Monitoring Year | Shrub Density (goal greater than 240 plants/ac) | 2019 Shrub Density Success | 2020 Shrub Density Success | Recommendations/ Notes |
|---|---|---|---|---|---|---|
| 128-K-2 Soil Staging Area | FY 2013<br>FY 2019 (R)<br>FY 2020 (S) | 2 | 425 | Successful | Successful | Continue to monitor forb survival on transect. Sagebrush monitoring complete. |
| **N Area Sites** | | | | | | |
| 130-N-1:1 | FY 2015<br>FY 2020 (S) | 6 | 322 | Unsuccessful | Successful | Continue to monitor. |
| 100-N-96 | FY 2016<br>FY 2020 (A) | 5 | 297 | Unsuccessful | Successful | Continue to monitor. |
| 100-N-83 | FY 2017 | 4 | 261 | Successful | Successful | Continue to monitor. |
| 100-N CTA | FY 2017<br>FY 2020 (S) | 4 | 237 | Unsuccessful | Unsuccessful | Additional plug plantings in the northern portion are recommended. |
| 100-N-61:1 | FY 2015<br>FY 2020 (S) | 3 | 376 | Unsuccessful | Successful | Continue to monitor. |
| 124-N-10 | FY 2020<br>FY 2020 (S) | 1 | 202 | Unsuccessful | Unsuccessful | Continue to monitor. |
| 100-N-84:9 | FY 2015<br>FY 2020 (R) | 1 | 210 | Unsuccessful | Unsuccessful | Continue to monitor. |
| **D Area Sites** | | | | | | |
| 100-D-100 | FY 2016 | 5 | 341 | Successful | Successful | One additional year of canopy cover monitoring. |
| 100-D Trailer Village | FY 2017 | 4 | 150 | Unsuccessful | Unsuccessful | Supplemental planting recommended. |
| 128-D-2 | FY 2011<br>FY 2019 (R)<br>FY 2020 (S) | 2 | 272 | Successful | Successful | Continue to monitor. |
| 628-3 | FY 2011<br>FY 2019 (R)<br>FY 2020 (S) | 2 | 121 | Successful | Unsuccessful | Continue to monitor. |
| 600-30 | FY 2011<br>FY 2020 (A) | 1 | 360 | Unsuccessful | Successful | Continue to monitor. |
| **H Area Sites** | | | | | | |
| 100-H-28:2 | FY 2016 | 5 | 198 | Unsuccessful | Unsuccessful | Supplemental planting recommended. |

**Table 48. 2020 Revegetation Monitoring Summary. (4 Pages)**

| Site | Year Planted | Monitoring Year | Shrub Density (goal greater than 240 plants/ac) | 2019 Shrub Density Success | 2020 Shrub Density Success | Recommendations/ Notes |
|---|---|---|---|---|---|---|
| 600-385 | FY 2017<br>FY 2020 (S) | 4 | 227 | Unsuccessful | Unsuccessful | Continue to monitor. |
| **F Area Sites** | | | | | | |
| 100-F-47 | FY 2012<br>FY 2018 (R) | 3 | 397 | Successful | Successful | Continue to monitor canopy cover. |
| 118-F-1 | FY 2008<br>FY 2018 (R) | 3 | 263 | Successful | Successful | Continue to monitor. |
| 118-F-6 | FY 2009<br>FY 2018 (R) | 3 | 174 | Unsuccessful | Unsuccessful | Additional actions recommended. |
| 100-F-CTA | FY 2012<br>FY 2018 (R) | 3 | 273 | Unsuccessful | Successful | Continue to monitor. |
| 100-F Trailer Village | FY 2013<br>FY 2018 (R) | 3 | 206 | Successful | Unsuccessful | Continue to monitor. |
| 118-F-5 | FY 2008<br>FY 2018 (R) | 3 | 73 | Unsuccessful | Unsuccessful | Continue to monitor. Relocate Transect 2. |
| 100-F-57 | FY 2009<br>FY 2018 (R) | 3 | 646 | Successful | Successful | Continue to monitor. |
| 100-F-26 | FY 2008<br>FY 2018 (R) | 3 | 257 | Successful | Successful | Continue to monitor. |
| 118-F-3 | FY 2008<br>FY 2018 (R) | 3 | 166 | Unsuccessful | Unsuccessful | Continue to monitor. |
| **600 Area Sites** | | | | | | |
| 600-301 | FY 2014<br>FY 2019 (R)<br>FY 2020 (S) | 2 | 77 | Successful | Unsuccessful | Continue to monitor. |
| 600-356 | FY 2015<br>FY 2019 (R)<br>FY 2020 (S) | 2 | 518 | Successful | Successful | Continue to monitor. |
| 600-370 | FY 2014<br>FY 2019 (S)<br>FY 2020 (S) | 7 | 352 | Successful | Successful | Continue to monitor. |

**Table 48. 2020 Revegetation Monitoring Summary. (4 Pages)**

| Site | Year Planted | Monitoring Year | Shrub Density (goal greater than 240 plants/ac) | 2019 Shrub Density Success | 2020 Shrub Density Success | Recommendations/ Notes |
|---|---|---|---|---|---|---|
| 600-358 | FY 2016<br>FY 2019 (S)<br>FY 2020 (S) | 5 | 293 (Transect 2) | Successful | Successful (Transect 2) | Continue to monitor. Additional revegetation actions recommended for Transect 1. |
| 600-100 | FY 2012<br>FY 2019 (S)<br>FY 2020 (S) | 9 | 283 | Successful | Successful | Continue to monitor. |
| 600-120 | FY 2012<br>FY 2019 (S)<br>FY 2020 (S) | 9 | 206 | Unsuccessful | Unsuccessful | Continue to monitor. |
| C9L3 | FY 2020 | 1 | 126 | N/A | Unsuccessful | Supplemental planted recommended. |
| **300 Area Sites** | | | | | | |
| 618-10 | FY 2019 | 2 | 297 | Successful | Successful | Continue to monitor. |
| **200 Area Sites** | | | | | | |
| L-840 | FY 2017 | 4 | 2,438 | Successful | Successful | Continue to monitor. |
| L-525 | FY 2017 | 4 | 73 | Unsuccessful | Unsuccessful | Continue to monitor. Consider additional supplemental revegetation activities. |
| L-419 | FY 2018 | 3 | 167 | Unsuccessful | Unsuccessful | Continue to monitor. Consider additional supplemental revegetation activities. |
| L-853 / L-854 | FY 2019 | 2 | 231 | Successful | Unsuccessful | Continue to monitor. |
| L-894 | FY 2019 | 2 | 590 | Successful | Successful | Continue to monitor. |

A = Seeded via ATV
R = Revegetation Work Redone
S = Supplemental Planting
FY = Fiscal Year
N/A = Not Applicable

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# APPENDIX A

# 2019 REVEGETATION MONITORING TAXONOMY LIST

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# APPENDIX A

# 2019 REVEGETATION MONITORING TAXONOMY LIST

| **Current Scientific Name** (USDA Plants Database) | **Synonyms** (from Hitchcock & Cronquist and/or Sackschewsky and Downs) | **Common Name** (USDA database) | **Native** (N) **or Introduced** (a) | **Washington State Noxious Weed Class** (A, B, or C) |
|---|---|---|---|---|
| *Abronia mellifera* | | white sand verbena | N | |
| *Achillea millefollium* | | common yarrow | N | |
| *Achnatherum hymenoides* | *Oryzopsis hymenoides* | Indian ricegrass | N | |
| *Agoseris sp.* | | agoseris | N | |
| *Agoseris heterophylla* | | false mountain dandelion | N | |
| *Agropyron cristatum*[a] | | crested wheatgrass | a | |
| *Agropyron dasystachyum* | | thickspike wheatgrass | N | |
| *Aliciella leptomeria* | *Gilia leptomeria* | sand gilia | N | |
| *Allium ascaloncum*[a] | | wild onion | a | |
| Amaranthus albus | | white pigweed | a | |
| *Ambrosia acanthicarpa* | | flatspine bur ragweed | N | |
| *Amsinckia lycopsoides* | *Benthamia lycopsoides* | tarweed fiddleneck | N | |
| *Artemisia biennis* | | biennial wormwood | N | |
| *Artemisia tridentata* | | big sagebrush | N | |
| *Astragalus caricinus* | | buckwheat milkvetch | N | |
| *Astragalus purshii* | | woollypod milkvetch | N | |
| *Astragalus sclerocarpus* | | stalked-pod milkvetch | N | |
| *Astragalus succumbens* | | crouching milkvetch | N | |
| *Balsamorhiza careyana* | | Carey's balsamroot | N | |
| *Bassia scoparia* | | kochia | a | B |
| *Brassica sp.*[a] | | mustard | a | |
| *Bromus arvensis*[a] | *Bromus japonicus* | field brome | a | |
| *Bromus tectorum*[a] | | cheatgrass | a | |
| *Calochortus macrocarpus* | | sagebrush mariposa lily | N | |
| *Carex sp.* | | sedge | N | |
| *Centaurea diffusa*[b] | | diffuse knapweed (B) | a | B |
| *Ceratocephala testiculata*[a] | *Ranunculus testiculatus* | bur buttercup | a | |
| *Chaenactis douglasii* | | Douglas' dustymaiden | N | |
| *Chenopodium album* | | lambsquarters | N | |
| *Chenopodium leptophyllym* | *Chenopodium album* | narrowleaf goosefoot | N | |

| **Current Scientific Name** (USDA Plants Database) | **Synonyms** (from Hitchcock & Cronquist and/or Sackschewsky and Downs) | **Common Name** (USDA database) | **Native** (N) **or Introduced** (a) | **Washington State Noxious Weed Class** (A, B, or C) |
|---|---|---|---|---|
| *Chondrilla juncea*[b] | | rush skeletonweed | a | B |
| *Chorispora tenella*[a] | | crossflower | a | |
| *Chrysothamnus viscidiflorus* | | yellow rabbitbrush | N | |
| *Cirsium arvense*[b] | | Canada thistle | a | C |
| *Coldenia nuttallii* | | desert mat | N | |
| *Comandra umbellata* | | bastard toadflax | N | |
| *Convolvulus arvensis*[b] | | field bindweed | a | C |
| *Coreopsis sp.* | | tickseed | N | |
| *Coreopsis tinctoria* | *Coreopsis atkinsoniana* | golden tickseed | N | |
| *Cornus sericea* | *Cornus stolonifera* | redosier dogwood | N | |
| *Crepis atribarba* | | slender hawksbeard | N | |
| *Cryptantha circumscissa* | | matted cryptantha | N | |
| *Cymopterus terebinthinus* | | turpentine springparsley | N | |
| *Dalea ornata* | *Petalostemon ornatum* | western prairie clover | N | |
| *Descurcania pinnata* | | western tansymustard | N | |
| *Digitaris sp.*[a] | | crabgrass | a | |
| *Digitaris sanguinalis* | | hairy crabgrass | a | |
| *Draba verna*[a] | | spring draba | a | |
| *Elaeagnus angustifolia*[a] | | Russian olive | a | |
| *Elymus elymoides* | *Sitanion hystrix* | squirreltail | N | |
| *Elymus repens* | | quackgrass | a | |
| *Epilobium brachycarpum* | *Epilobium paniculatum* | tall annual willowherb | N | |
| *Ericameria nauseosa* | *Chrysothamnus nauseosus* | rubber rabbitbrush | N | |
| *Erigeron filifolius* | | threadleaf fleabane | N | |
| *Erigeron poliospermus* | | cushion fleabane | N | |
| *Erigeron pumilus* | | shaggy fleabane | N | |
| *Eriogonum niveum* | | snow buckwheat | N | |
| *Eriogonum vimineum* | *Eriogonum baileyi* | wickerstem buckwheat | N | |
| *Erodium cicutarium*[a] | | redstemstork's bill | a | |
| *Erysimum asperum* | *Cheirinia aspera* | western wallflower | N | |
| *Filago arvensis*[a] | | field fluffweed | a | |
| *Galium aparine* | | stickywilly | N | |
| *Gilia sinuata* | | shy gilia | N | |

| **Current Scientific Name** (USDA Plants Database) | **Synonyms** (from Hitchcock & Cronquist and/or Sackschewsky and Downs) | **Common Name** (USDA database) | **Native** (N) **or Introduced** (a) | **Washington State Noxious Weed Class** (A, B, or C) |
|---|---|---|---|---|
| *Grayia spinosa* | *Atriplex spinosa* | spiny hopsage | N | |
| *Helianthella uniflora* | | oneflower helianthella | N | |
| *Hesperostipa comata* | *Stipa comata* | needle and thread grass | N | |
| *Holodiscus discolor* | | oceanspray | N | |
| *Holosteum umbellatum*[a] | | jagged chickweed | a | |
| *Hordeum leporinum*[a] | | hare barley | a | |
| *Hypericum perforatum*[b] | | common St. Johnswort | a | C |
| *Kochia scoparia* | | kochia | a | |
| *Koeleria macrantha* | | prairie Junegrass | N | |
| *Lactuca serriola*[a] | | prickly lettuce | a | |
| *Lamium amplexicaule*[a] | | henbit deadnettle | a | |
| *Layia glandulosa* | | white daisy tidy tips | N | |
| *Lepidium latifolium*[a] | *Cardaria latifolia* | broadleaved pepperweed | a | B |
| *Lepidium perfoliatum*[a] | | clasping pepperweed | a | |
| *Leptodactylon pungens* | | prickly phlox | N | |
| *Leymus cinereus* | | basin wildrye | N | |
| *Linaria dalmatica* | | dalmatian toadflax | a | B |
| *Linum lewisii* | | prairie flax | N | |
| *Lomatium grayi* | | Gray's biscuitroot | N | |
| *Lomatium gormanii* | | Gorman's biscuitroot | N | |
| *Lomatium macrocarpum* | | bigseed desertparsley | N | |
| *Lomatium sp.* | | desertparsley | N | |
| *Lupinus pusillus* | | low lupine | N | |
| *Lupinus wyethii* | | Wyeth's lupine | N | |
| *Lycium barbarum*[a] | | matrimony vine | a | |
| *Machaeranthera canescens* | | hoary tansyaster | N | |
| *Malva neglecta*[a] | | common mallow | a | |
| *Matricaria recutita*[a] | | wild chamomile | a | |
| *Medicago sativa*[a] | | alfalfa | a | |
| *Melilotus officinalis*[a] | *Melilotus alba* | sweet clover | a | |
| *Mentzelia albicaulis* | | whitestem stickleaf | N | |
| *Microsteris gracilis* | | slender phlox | N | |
| *Morus alba*[a] | | white mulberry | a | |
| *Nama densum* | | purple mat | N | |

| **Current Scientific Name** (USDA Plants Database) | **Synonyms** (from Hitchcock & Cronquist and/or Sackschewsky and Downs) | **Common Name** (USDA database) | **Native** (N) **or Introduced** (a) | **Washington State Noxious Weed Class** (A, B, or C) |
|---|---|---|---|---|
| *Nicotiana attenuata* | | coyote tobacco | N | |
| *Oenothera caspitosa* | | rockrose | N | |
| *Oenothera pallida* | | pale-evening primrose | N | |
| *Opuntia polyacantha* | | plains pricklypear | N | |
| *Penstemon acuminatus* | | sharpleaf penstemon | N | |
| *Phacelia hastata* | | whiteleaf phacelia | N | |
| *Phacelia linearis* | | threadleaf phacelia | N | |
| *Phalaris arundinacea*[b] | | reed canarygrass | a | C |
| *Phlox longifolia* | | longleaf phlox | N | |
| *Phlox speciosa* | | showy phlox | N | |
| *Phragmites australis*[b] | | common reed | a | B |
| *Plantago lanceolata*[a] | | narrowleaf plantain | a | |
| *Plantago patagonica* | | woolly plantain | N | |
| *Poa bulbosa*[a] | | bulbous bluegrass | a | |
| *Poa secunda* | *Poa sandbergii* | Sandberg bluegrass | N | |
| *Polygonum aviculare*[a] | | prostrate knotweed | a | |
| *Polygonum convolvulus*[a] | | black bindweed | a | |
| *Polygonum persicaria* | | spotted ladys thumb | a | |
| *Polypogon monspeliensis*[a] | | annual rabbitsfoot grass | a | |
| *Populus balsamifera* | *Populus trichocarpa* | black cottonwood | N | |
| *Prunus virginiana* | | chokechery | N | |
| *Pseudoroegneria spicata* | *Agropyron spicatum* | bluebunch wheatgrass | N | |
| *Psoralidium lanceolatum* | *Psoralea lanceolata* | dune scurfpea | N | |
| *Purshia tridentata* | | antelope bitterbrush | N | |
| *Ranunculus testiculatus*[a] | | burr buttercup | a | |
| *Raphanus raphanistrum*[a] | | wild radish | a | |
| *Ribes aureum* | | golden currant | N | |
| *Rosa woodsii* | | Woods' rose | N | |
| *Rumex crispus* | | curly dock | a | |
| *Rumex venosus* | | windged dock | N | |
| *Salix amygdaloides* | | peachleaf willow | N | |
| *Salix exigua* | | narrowleaf willow | N | |
| *Salsola kali*[a] | | Russian thistle | a | |
| *Salvia dorii* | | grayball sage | N | |
| *Sanguisorba minor*[a] | *Poterium sanguisorba* | small burnet | a | |

| **Current Scientific Name** (USDA Plants Database) | **Synonyms** (from Hitchcock & Cronquist and/or Sackschewsky and Downs) | **Common Name** (USDA database) | **Native** (N) **or Introduced** (a) | **Washington State Noxious Weed Class** (A, B, or C) |
|---|---|---|---|---|
| *Sisymbrium altissimum*[a] | | tall tumblemustard | a | |
| *Sphaeralcea munroana* | | Munro's globemallow | N | |
| *Sporobolus cryptandrus* | | sand dropseed | N | |
| *Tamarix ramosissima*[b] | | saltcedar | a | B |
| *Tragopogon dubius*[a] | | yellow salsify | a | |
| *Triteleia grandiflora* | *Brodiaea douglasii* | Douglas' clusterlily | N | |
| *Triticum aestivum*[a] | | common wheat | a | |
| *Triticum sp.*[a] | | wheat | a | |
| *Triticum x elymus trachycaulus*[a] | | Regreen | a | |
| *Ulmus pumila*[a] | | Siberian elm | a | |
| *Verbascum thapsus*[a] | | common mullein | a | |
| *Verbena bracteata* | | bigbract verbena | N | |
| *Vicia sp.* | | vetch | N | |
| *Vulpia microstachys* | *Festuca microstachys* | desert fescue | N | |

Hitchcock, C. L., and A. Cronquist, 1973, *Flora of the Pacific Northwest*, University of Washington Press, Seattle, Washington.

Sachschewsky, M. R., and J. L. Downs, 2001, *Vascular Plants of the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington.

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# APPENDIX B

# 2019 RE-WORK SITE SPECIES LIST AND SEEDING RATES

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# APPENDIX B

# 2019 RE-WORK SITE SPECIES LIST AND SEEDING RATES

**FY 2019 Seed Mix Used at Re-Worked Sites.**

| Species | Pounds Pure Live Seed per Acre |
|---|---|
| Gray rabbitbrush (*Ericameria nauseosa*) | 0.14 |
| Green rabbitbrush (*Chrysothamnus viscidiflorus*) | 0.14 |
| Blue Mountain buckwheat (*Eriogonum strictum*) | 0.14 |
| Snow buckwheat (*Eriogonum niveum*) | 0.18 |
| Munro's globemallow (*Sphaeralcea munroana*) | 0.18 |
| Carey's balsamroot (*Balsamorhiza careyana*) | 0.18 |
| Crouching milkvetch (*Astragalus succumbens*) | 0.18 |
| Cushion fleabane (*Erigeron poliospernus*) | 0.16 |
| Threadleaf fleabane (*Erigeron filifolius*) | 0.16 |
| Hoary falseyarrow (*Chaenactis douglasii*) | 0.16 |
| Sandberg's bluegrass (*Poa secunda*) | 9.8 |
| Needle-and-thread grass (*Hesperostipa comata*) | 7.0 |
| Indian ricegrass (*Oryzopsis hymenoides*) | 5.6 |
| Bottlebrush squirreltail (*Elymus elymoides*) | 5.6 |

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# APPENDIX C

# 618-10 SPECIES LIST AND SEEDING RATES

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# APPENDIX C

# 618-10 SPECIES LIST AND SEEDING RATES

Total Seed Applied to Site

| Species | Applied On Site (lbs) | |
|---|---|---|
| *Artemisia tridentata* (Big sagebrush) | 29.7 | |
| *Chrysothamnus nauseosa* (Gray rabbitbrush) | 11.1 | Shrub Species |
| *Chrysothamnus viscidiflorus* (Green rabbitbrush) | 12.7 | |
| *Erigonum nivium* (Snow buckwheat) | 22.1 | |
| *Purshia tridentata* (Antelope bitterbrush) | 26 | |
| *Hesperostipa comata* (Needle-and-thread grass) | 433.2 | |
| *Koeleria macrantha* (Prairie junegrass) | 30.9 | Grass Species |
| *Poa secunda* (Sandberg's bluegrass) | 479 | |
| *Sporobolus cryptandrus* (Sand dropseed) | 26 | |
| *Triticum x elymus trachycaulus* (Regreen) | 1722.7 | |
| *Abronia mellifera* (White sand verbena) | 0.03 | |
| *Achillea millefolium* (Yarrow) | 2.5 | Forb & Legume Species |
| *Arenaria franklinii* (Franklin's sandwort) | 0.2 | |
| *Astragalus caricinus* (Buckwheat milkvetch) | 0.27 | |
| *Astragalus purshii* (Woolly pod milkvetch) | 0.58 | |
| *Astragalus succumbens* (Crouching milkvetch) | 0.16 | |
| *Astragalus sclerocarpus* (Stalked-pod milkvetch) | 4.3 | |
| *Balsamorhiza careyana* (Carey's balsamroot) | 2.87 | |
| *Calochortus macrocarpus* (Mariposa lily) | 0.24 | |
| *Chaenactis douglasii* (Hoary false-yarrow) | 0.27 | |
| *Crepis atribarba* (Slender hawksbeard) | 0.14 | |
| *Criptantha circumscissa* (Matted cryptantha) | 0.07 | |
| *Erigeron filifolius* (Threadleaf fleabane) | 0.05 | |
| *Erigeron poliospermus* (Cushion fleabane) | 0.08 | |
| *Erigeron pumilus* (Shaggy fleabane) | 0.09 | |
| *Erysimum asperum* (Rough wallflower) | 0.21 | |
| *Frittellaria pudica* (Yellowbell) | 0.01 | |
| *Hymenopappus filifolius* (Columbia cutleaf) | 0.03 | |
| *Machaeranthera canescens* (Hoary aster) | 2.6 | |
| *Nicotiana attenuata* (Coyote tobacco) | 1.4 | |
| *Oenothera pallida* (Pale eveningprimrose) | 2.9 | |
| *Oryzopsis hymenoides* (Indian ricegrass) | 399.7 | |
| *Penstemon accuminatus* (Sand beardtongue) | 3 | |
| *Petalostemon ornatum* (Western prairie clover) | 5.3 | |
| *Phacelia hastata* (Whiteleaf scorpionweed) | 1.5 | |
| *Phacelia linearis* (Threadleaf scorpionweed) | 0.01 | |
| *Phlox longifolia* (Long-leaf phlox) | 0.05 | |
| *Plantago patagonica* (Indian wheat) | 0.24 | |
| *Psoralea lanceolata* (Dune scurf-pea) | 0.16 | |
| *Pterexia terebinthina* (Turpentine springparsley) | 2.18 | |
| *Rumex venosus* (Winged dock) | 1.25 | |
| *Sphaeralcea munroana* (Munro's globemallow) | 2.8 | |
| Rice Hulls | 1985.1 | Broadcast Medium |
| **Total** | **5213.71** | |

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