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Fiscal Year 2014 Vegetation Assessment

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November 2014

The INL is a U.S. Department of Energy National Laboratory
operated by Battelle Energy Alliance

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ABSTRACT

This report summarizes the Fiscal Year 2014 Revegetation Assessment by Battelle Energy Alliance, LLC. This assessment was conducted to document revegetation efforts at Idaho National Laboratory to ensure that disturbed vegetation and soil at various locations are being restored. This report provides the following information for each site being monitored by the Idaho National Laboratory Environmental Support and Services:

- Summary of each site
- Assessment of vegetation status and site stabilization at each location
- Actions and Resolutions for each site.

Five disturbed sites were evaluated for this assessment. Four sites are recommended to be removed from the annual assessment, and one is recommended for continued evaluation. New sites are also identified for future monitoring as part of the annual assessment.

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ACRONYMS

ACOE	Army Corp of Engineers
BEA	Battelle Energy Alliance, LLC
CGP	General Permit for Storm Water Discharge from Construction Activities
DOE-ID	U.S. Department of Energy Idaho Operations Office
EPA	U.S. Environmental Protection Agency
ESRP	Eastern Snake River Plain
GI	Geomorphic Investigations
GSS	Gonzales-Stoller Surveillance, LLC
ICP	Idaho Cleanup Project
INL	Idaho National Laboratory
ISU	Idaho State University
IWP	Industrial Waste Pond
MFC	Materials and Fuels Complex
NSTR	National Security Test Range
RRTR	Radiological Response Training Range
RWMC	Radioactive Waste Management Complex
USGS	United States Geological Survey
VAM	vesicular-arbuscular mycorrhizae
VZRP	Vadose Zone Research Park

Fiscal Year 2014 Revegetation Assessment

1. Introduction

Revegetation of disturbed sites at the Idaho National Laboratory (INL) Site is required to comply with some aspects of both federal (7 USC 2814) and state (IDAPA 02.06.22) noxious weed control laws. Revegetation is identified as a method for prevention and/or control of noxious weeds. Executive Order 13112, Invasive Species, also specifies revegetation as a control measure to limit the spread of invasive species. In addition, revegetation may be required by project specific environmental checklists that require projects to complete and verify successful revegetation of disturbed soils.

Battelle Energy Alliance, LLC (BEA) complies with the National Pollutant Discharge Elimination System (40 CFR 122) General Permit for Storm Water Discharges from Construction Activities (CGP) issued by the U.S. Environmental Protection Agency (EPA) in 2012. New projects, disturbing one or more acres of land, require coverage under the 2012 CGP. A Notice of Intent for coverage under the new CGP must be submitted to the EPA at least 14 calendar days prior to earth disturbing activities. The INL Site currently uses the INL Site Storm Water Corridor to determine when a construction activity has the potential to impact "waters of the United States" under the CGP requirements. The INL Storm Water Corridor is defined "as an area that has a reasonable potential to discharge storm water to the Big Lost River."

On May 7, 2008, a letter (Stenzel 2008) was submitted to the U. S. Army Corps of Engineers (ACOE) requesting the ACOE to perform a Jurisdictional Determination concerning the applicability of Section 404 of the Clean Water Act and Sections 9 and 10 of the Rivers and Harbors Act of 1899 for the Big Lost River, Little Lost River, and Birch Creek. The ACOE responded with a letter dated May 26, 2009 (Brochu 2009) that stated "Due to the workload and priorities we are unable to complete your request. If you propose a specific project which may affect wetlands, playas, streams, creeks, or other waters such as the Big Lost River, Little Lost River or Birch Creek we shall reinitiate your request." Therefore, until a specific project is initiated and ACOE performs the Jurisdictional Determination or BEA submits another request, BEA will continue to comply with the CGP requirements.

For the 2012 Revegetation Assessment, two sites were located within the INL Storm Water Corridor. These sites are the Geomorphic Investigations for Flood Bounds (GI) and the Vadose Zone Research Park (VZRP). Notices of termination were submitted to the Storm Water Processing Center on June 19, 2012 to cancel coverage for the GI and VZRP. The U.S. Environmental Protection Agency (EPA) terminated coverage for the VZRP and GI under the EPA's Stormwater Construction General Permit on July 16, 2012 and November 28, 2012 respectively.

Given the long recovery periods for disturbance in sagebrush steppe ecosystems, the 2012 Revegetation Assessment further recommended that the disturbed areas of the GI Project and the VZRP be visually evaluated every three to five years until they appear to be reaching the INL criteria for final stabilization, and that BEA continue to explore and evaluate technologies and relevant scientific information regarding the eradication of cheatgrass (*Bromus tectorum*) that may assist these areas in achieving 70% cover of native perennial background vegetation. Therefore, these sites are not included in this assessment.

However, in 2014 five sites not in the INL Storm Water Corridor were evaluated for revegetation success. These included the Large-scale Infiltration Basin, Materials and Fuels Complex (MFC) Industrial Waste Pond, MFC New Sewage Lagoons Site, MFC Soil Pile Area, and National Security Test Range (NSTR) Project.

As recommended in the 2012 Revegetation Assessment, visual observation was used to assess the revegetation success at sites included in this report. Digital camera sampling was not performed in 2014.

1.1 Purpose

The purpose of this report is to comply with Contract Data Requirements List item number F.24 by providing this revegetation assessment to the Department of Energy, Idaho Operations Office (DOE-ID).

1.2 Organization

This report is organized by individual site and provides the following information:

- A historical background summary of each site
- An assessment of background vegetation
- An assessment of the revegetation effort and site stabilization status
- Actions and Resolutions for the site.

2. Background

Revegetation efforts for replanting and rebuilding the soil on disturbed land are an ongoing practice at the INL Site, and an annual report of these activities is submitted in accordance with BEA's contract with the DOE-ID. Revegetation sites being assessed for final stabilization in fiscal year 2014 are listed in Table 1.

Table 1. Sites included in the 2014 revegetation assessment.

Site Name
Large-scale Infiltration Basin
Materials and Fuels Complex Industrial Waste Pond
Materials and Fuels Complex Soil Pile
Materials and Fuels Complex New Sewage Lagoons
National Security Test Range Project Power Pole 179

Disturbed areas at the INL are usually considered to have reached final stabilization when vegetation within the disturbed area has reached 70% cover of native, perennial background vegetation. Anderson and Shumar (1989) found that total vascular plant cover at the INL was 25%, and the remainder was bare ground, litter, rocks, etc.

The location of the INL in the Eastern Snake River Plain (ESRP), including altitude, latitude, and intermountain setting, affects the climate of the Site. Air masses crossing the ESRP have first crossed a mountain barrier and precipitated a large percentage of inherent moisture. Therefore, annual rainfall at the INL is light, and the region is classified as arid to semi-arid (Clawson et. al. 1989).

Vegetation at the INL typically consists of a shrub over story with a perennial grass and forb understory. Wyoming big sagebrush (*Artemisia tridentata* subspecies *wyomingensis*) is the most common shrub. Basin big sagebrush (*Artemisia tridentata* subspecies *tridentata*) is dominant or co-dominant with Wyoming big sagebrush on sites having deep soils or accumulations of sand on the surface. Communities dominated by big sagebrush occupy most of the central portions of the INL and most areas included in this assessment. Green rabbitbrush (*Chrysothamnus viscidiflorus*) is the next most abundant shrub in many of these communities. Other common shrubs include gray rabbitbrush (*Ericameria nauseosus*), winterfat (*Krascheninnikovia lanata*), spiny hopsage (*Grayia spinosa*), prickly phlox (*Leptodactylon pungens*), broom snakeweed (*Gutierrezia sarothrae*), and horse-brush (*Tetradymia canescens*).

The most common native grasses found within sagebrush communities across the INL and in the assessment areas include thickspiked wheatgrass (*Elymus lanceolatus*), bottlebrush squirreltail (*Elymus elymoides*), Indian rice grass (*Achnatherum hymenoides*), needle-and-thread grass (*Hesperostipa comata*), and Sandberg bluegrass (*Poa secunda*). Great Basin wildrye (*Leymus cinerus*) and western wheatgrass (*Pascopyrum smithii*) can also be found in localized patches. Bluebunch wheatgrass (*Pseudoroegneria spicata*) is rare at the lowest elevations but is common at slightly higher elevations to the southwest and along the eastern side of the INL; it is often the dominant grass on alluvial fans and slopes of the buttes and foothills (Anderson, et. al. 1996).

Cheatgrass, an invasive annual species, is also widespread and well established across the INL. Goodrich and Gale (1999) noted that in similar situations, cheatgrass should be recognized as a component of the potential plant community. Gonzales-Stoller Surveillance, LLC (GSS) and Idaho State University (ISU) identified the Bromus tectorum Semi-natural Herbaceous Vegetation and Sisymbrium altissmum-Bromus tectorum Semi-natural Herbaceous Vegetation classes (Shive 2011).

In addition, nearly monotypic stands of crested wheatgrass (*Agropyron cristatum*) can be found in localized areas across the INL, including several of the sites near MFC. Crested wheatgrass remains productive for more than 30 years, and stand mortality is virtually unknown, except in cases of extreme drought during critical phenological stages (Hardy BBT Limited 1989). Anderson and Marlette (1986) point out that crested wheatgrass may inhibit or preclude the re-establishment of native species on disturbed sites and may become the dominant species. GSS reported that in areas with no anthropogenic influence, crested wheatgrass was found to invade sagebrush stands and out-compete the native plant species (Shive 2011). GSS and ISU identified a crested wheat vegetation class at the INL as "Agropyron cristatum (Agropyron desertorum) Semi-natural Herbaceous Vegetation" (Shive 2011).

Big sagebrush is the climax species on most of its range (Eddleman and Doescher 1978, Jensen at. al. 1988). While seedling establishment may begin immediately following a disturbance, it usually takes a decade or more before big sagebrush dominates a site (Welch and Criddle 2003), though some researchers argue 25-45 years is typical (Watts and Wambolt 1996, Wambolt et. al. 2001). Because roots of big sagebrush species, particularly Wyoming big sagebrush, are infected with the vesicular-arbuscular mycorrhizae (VAM) *Glomus microcarpus* and *Gigaspora* spp. (Bethlenfalvay and Dakessian 1984; Doerr, et. al. 1971; Hurley and Wicklow-Howard 1986) and VAM associated with Wyoming big sagebrush are killed by heating or chemical alteration of the soil, VAM, and thus sagebrush, take several years to recolonize after soil-altering disturbance (Wicklow-Howard 1989).

Absence of VAM probably inhibits Wyoming big sagebrush establishment on disturbed soils. For example, 2.5 years after restoration work, VAM had not yet colonized a coal-mined site in south-central Wyoming even though stockpiled topsoil was replaced. When VAM-infected and noninfected Wyoming big sagebrush seedlings were transplanted on the site, there was no significant difference in growth between the 2 groups: both showed poor establishment. However, in the greenhouse, biomass gain of the infected group was significantly greater (about 1.5 times more, $p=0.05$) compared to the uninfected group. This suggests that on the disturbed site, VAM were unable to survive anywhere but inside Wyoming big sagebrush roots, and establishment of VAM and host Wyoming big sagebrush probably will not occur until the chemistry of lower soil horizons changes with succession (Stahl et. al. 1988).

None of the subspecies of big sagebrush resprout after fire or other disturbance, and prior to re-establishment, big sagebrush communities are mostly populated with associated grasses (Sheehy and Winward 1981). As expected, shrub cover on disturbed sites across the INL is usually much lower than that found on undisturbed sites, and grasses associated with big sagebrush communities account for most of the perennial vegetation found on disturbed sites included in this assessment.

3. Site Revegetation Assessment Summary

The State of Idaho Department of Environmental Quality's "Catalog of Stormwater Best Management Practices for Idaho Cities and Counties" notes that construction activities should maintain and preserve the vegetative canopy. In addition, Minnesota Pollution Control Agency and Environmental Protection Agency Region V developed stormwater guidance for small construction operators to use canopy cover when determining compliance with the 70% final stabilization requirement. Based on this information, canopy cover is sometimes used to determine final stabilization of revegetation sites at the INL.

Canopy cover is the area of the ground surface spanned by the canopy of the plant, and is used because it determines the underlying plant community. A high percentage of plant cover generally increases the soil infiltration rate, thereby reducing runoff and soil erosion. Plant cover also reduces wind erosion.

In addition, GDE-8525, "INL Revegetation Guide" notes that revegetation is expensive and should only be implemented when necessary. Kotanen (1996) states revegetation should be constrained by the abundance and types of plants available at the site. The necessity of revegetation should be based upon this advantage. Natural revegetation may be necessary where quick groundcover is needed to mitigate soil erosion or when desired plants at the site are inadequate to meet land use objectives.

4. Large Scale Infiltration Basin

The Large Scale Infiltration Basin is a Long Term Stewardship site located about 0.9 miles south of the Radioactive Waste Management Complex (RWMC) (Figure 1). The *Weed Control and Revegetation Report for Fiscal Year 2006* (ICP January 2007) recommended that the site be monitored until the disturbed area meets 70% cover of background. The site is now part of the Radiological Response Training Range (RRTR). Vehicle traffic is allowed on the disturbed area as part of training exercises, and vehicle tracks were observed within the basin. Figure 2 is an overview of the area.

4.1 Site Background Conditions

The Large Scale Infiltration Basin is located within a sagebrush steppe community. Wyoming big sagebrush is dominant on undisturbed sites in this area, although other species of big sagebrush also occur. Plant species observed throughout the background include: tapertip hawksbeard (*Crepis acuminata*), cushion buckwheat (*Eriogonum ovalifolium)*, bluebunch wheatgrass, Indian rice grass, needle and thread grass, bottlebrush squirrel tail, green rabbitbrush, and Hood's phlox (*Phlox hoodii*).

4.2 Site Assessment

Vegetation appears to be uniformly distributed throughout the disturbed area. However, a few small bare areas do exist. Mean perennial cover of the disturbed area at the Large Scale Infiltration Basin site was 62.1% in 2012.

Activities associated with the RRTR did not appear to be impacting revegetation at the site in 2013 or 2014. Due to lower than normal precipitation in the fall of 2012 and the spring of 2013 and the long recovery times associated with disturbance in arid sagebrush steppe environments, it is unlikely that canopy cover at the Large Scale Infiltration Basin increased to the level recommended for final stabilization within a single growing season. Therefore, the location was visually observed to confirm the site had not changed significantly.

Native species appear to be establishing well at the Large Scale Infiltration Basin. Squirreltail, sagebrush, and grey and green rabbitbrush are established around the rim. Crested wheatgrass and cheatgrass as well as native wheatgrasses and Indian rice grass were also observed. Sagebrush, crested

wheatgrass, mixed wheatgrasses, bottlebrush squirreltail, foxtail barley (*Hordeum jubatum*), and both grey and green rabbitbrush with some cheatgrass have established within the interior of the basin. Annual and nonnative species within the disturbed area include halogeton (*Halogeton glomeratus*), desert alyssum (*Alyssum desertorum*), and cheatgrass. Soil erosion was not observed at this location.

4.3 Actions and Resolutions

The disturbed area at the Large Scale Infiltration Basin is close to meeting 70% percent cover of background vegetation. Visual observations of the area revealed no signs of drifting, rilling, pedestalling or other signs of soil erosion at the sight, and noxious weeds are rare and have not impeded growth of native vegetation. It is recommended that the site be dropped from the yearly vegetation assessment, but that the facility owner reports weed infestations to Facility and Site Services for weed control activities.

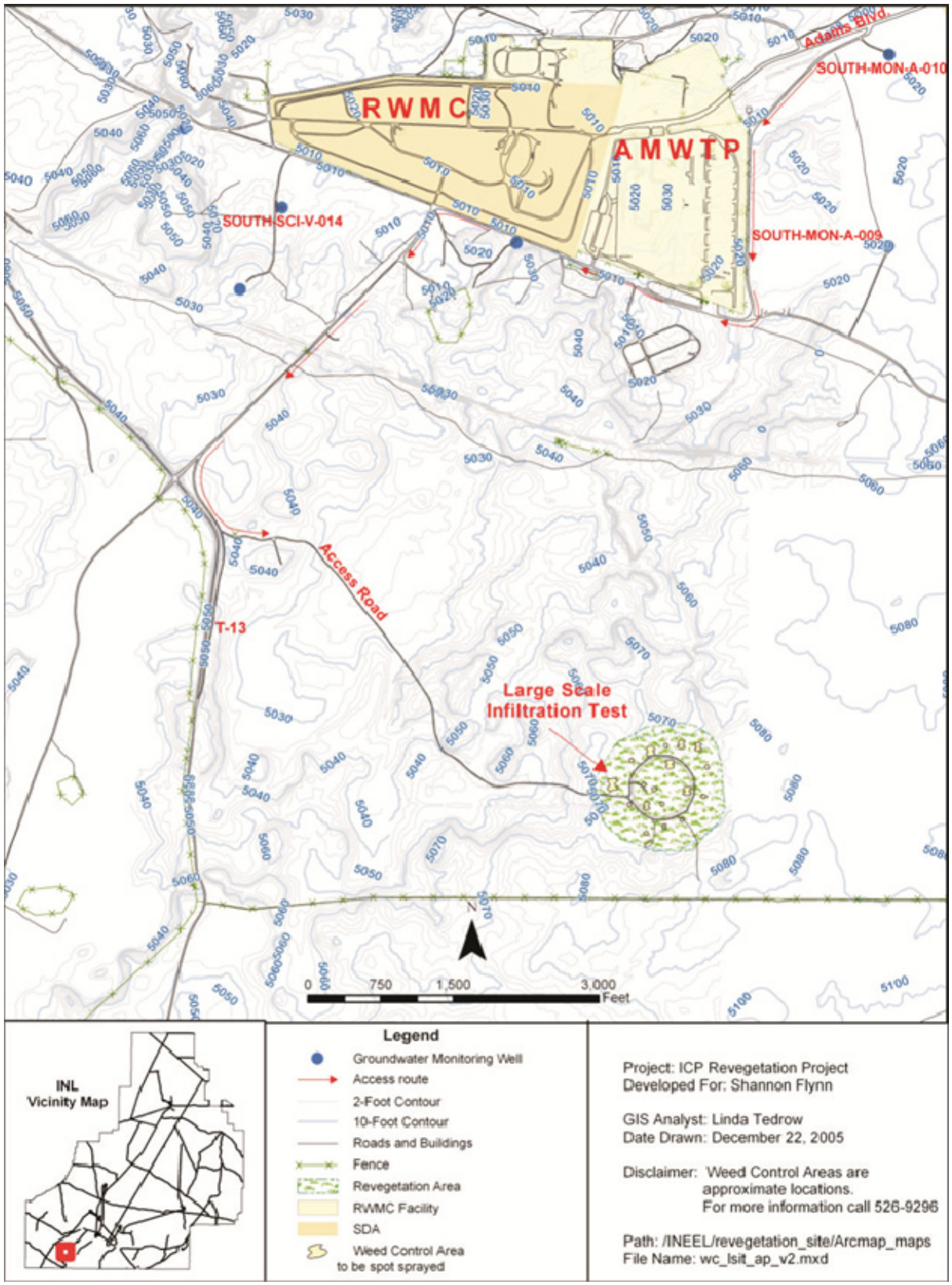

Figure 1. Map of the Large Scale Infiltration Basin.

Figure 2. Revegetation at the Large Scale Infiltration Basin

5. Materials and Fuels Complex Industrial Waste Pond

The MFC Industrial Waste Pond (IWP) is located just outside the western facility fence at MFC. Contaminated soil was excavated from the MFC IWP and the area was recontoured prior to being reseeded in 2004 with the seed mix found in Table 2.

Table 2. MFC Industrial Waste Pond seed mixture

Species Name	Common Name
Achnatherum hymenoides	Indian rice grass
Elymus lanceolatus (including ssp. Lanceolatus)	Thick spiked and streambank wheatgrass
Pseudoroegneria spicata	Bluebunch wheatgrass
Sphaeralcea munroana	White-stemmed globe-mallow
Hedysarum boreale	Northern sweetvetch
Artemisia tridentata ssp. wyomingensis	Wyoming big sagebrush
Chrysothamnus viscidiflorus	Green rabbitbrush

5.1 Site Background Conditions

Background vegetation near the MFC IWP consists mainly of a crested wheatgrass monoculture. Bottlebrush squirreltail, thickspike wheatgrass, and sagebrush are scattered throughout the area. Cheatgrass is present, but is not as prevalent as at other areas on the INL. Crested wheatgrass is persistent and allows little establishment of native species, especially in arid areas (Allen and Jackson 1992). It is expected that the disturbed areas of the MFC IWP will eventually revert primarily to crested wheatgrass.

5.2 Site Assessment

Conditions have changed little since 2012. The southern end of the MFC IWP has a good perennial vegetative cover. Species present include Wyoming big sagebrush, green rabbitbrush, crested wheat grass, and globemallow. Several young sagebrush plants were observed. This small area may be close to reaching the 70% criteria.

Canada thistle is present in the area surrounding the MFC IWP and ranges from sparse to thick depending on the location. Cheatgrass is present towards the southern end and becomes very thick at the northern end of the MFC IWP. Crested wheatgrass appears to be increasing throughout the area based on the number of young plants observed. This is expected since crested wheatgrass is prevalent in the area surrounding MFC. Kochia was present in bare areas. As in previous years, Russian knapweed (*Rhaponticum repens*) is present along the eastern side of the IWP.

5.3 Actions and Resolutions

Crested wheatgrass and Wyoming big sagebrush appear to be increasing in certain areas of the revegetation site. A visual evaluation was performed in 2014, and site conditions are similar to what has been observed in previous years.

The revegetation effort at this site was not successful. Because this site is located near MFC, the time that has elapsed since the last revegetation effort, and it is likely that eventual plant cover will consist of crested wheatgrass, further revegetation efforts at the IWP are not recommended. However, the area should continue to be monitored and sprayed for noxious weeds. This location will no longer be included in the yearly revegetation assessment.

6. MFC New Sewage Lagoons Site

New sewage lagoons were constructed during 2011-2012 north of MFC, adjacent to the old sewage lagoons. The new lagoons are approximately 14 total acres in size and 20-30 total acres were disturbed during construction and relocation of a security road. Table 3 shows the seed mix used at the sewage lagoons.

Table 3. MFC New Sewage Lagoons Site seed mixture

Species	Rate of Application (pounds per acre pure live seed)
Indian Rice Grass “Rimrock”	2
Thickspiked wheatgrass “Bannock”	2
Bottlebrush Squirreltail	2
Silverleaf Lupine	1

6.1 Site Background Conditions

Background vegetation near the MFC New Sewage Lagoons Site consists almost entirely of crested wheatgrass, with thickspiked wheatgrass, bottlebrush squirreltail, and sagebrush scattered throughout. It is likely that the disturbed areas will eventually revert back to a crested wheatgrass monoculture.

6.2 Site Assessment

The MFC New Sewage Lagoons Site was visually observed in 2014. As in 2013, Kochia was the predominant species occupying the site with a few patches of cheatgrass also observed. Supplemental water was not provided to the reseeded area, and it does not appear that seed sprouting from the revegetation effort occurred. Bare ground in the disturbed area is extensive. Revegetation was attempted via hydroseeding after construction of the new lagoons. It was noted in the 2013 revegetation assessment that the revegetation attempt was unsuccessful, and it was recommended that the area be reseeded. As of 2014, reseeding had not occurred.

6.3 Actions and Resolutions

As previously stated, the New Sewage Lagoon Site was recommended for reseeding in 2013. As of 2014, reseeding has not occurred and this issue will be entered into Labway for appropriate action to be identified and implemented by facility personnel. The area will continue to be monitored annually until revegetation establishment has occurred.

7. MFC Soil Pile

A soil pile was located on the south side of the road that runs east and west along the southern barrier of MFC. In late October 2010, the soil pile was removed to grade. In the 2010 Annual Revegetation Assessment, it was suggested that the area be revegetated using an appropriate seed mix, and hydroseeding of the area was performed in 2012. The same seed mix was used at the MFC Soil Pile as at the MFC New Sewage Lagoons Site (Table 4).

7.1 Site Background Conditions

Background vegetation near the MFC Soil Pile Project is located within an area consisting almost entirely of crested wheatgrass. Thickspiked wheatgrass, bottlebrush squirreltail, and sagebrush are scattered throughout. Cheatgrass, halogeton, and kochia are also present. It is expected that the disturbed areas of the Soil Pile location will eventually revert back to a crested wheatgrass monoculture.

7.2 Site Assessment

The MFC Soil Pile location was visually observed in 2014. Kochia remains the dominant species in the few locations that vegetation has become established. Reseeding efforts did not cover the entire disturbed area, and supplemental water was not supplied to the seeded area. As with the MFC New Sewage Lagoons, seeding was not successful. The few plants establishing in the area besides kochia include non-natives such as halogeton, cheatgrass, and a few crested wheatgrass plants. As in 2013, even these species are sparse.

7.3 Actions and Resolutions

Without the addition of supplemental water, it is unlikely that revegetation efforts at the soil pile location would be successful. In addition, providing supplemental water to the location is likely to be cost prohibitive given the small size of disturbance. In addition, it is highly likely the disturbed area will eventually revert to a crested wheatgrass monoculture. Given the area's proximity to MFC and a road, it

is recommended that the site be included in the noxious weed program to control weed establishment until the site naturally revegetates.

8. National Security Test Range Project

On September 9, 2008, a survey of sites disturbed by the NSTR project along the T-25 road was performed by NSTR personnel and the S. M. Stoller Corporation (Saupe 2009). All sites along the T-25 have been dropped from the annual revegetation survey except the area near power pole 179.

Table 4 shows the seed mix recommended by the S. M. Stoller Corporation for reseeding the seven disturbed sites. Disturbed sites were seeded late fall 2008.

Table 4. Recommended seed mixture for T-25 road disturbed sites.

Species	Rate of Application (pounds per acre pure live seed)
Indian Rice Grass "Rimrock"	2
Thickspiked wheatgrass "Bannock"	2
Bottlebrush Squirreltail	2
Green Rabbitbrush	1

8.1 Site Background Conditions

The NSTR Project is located within a sagebrush steppe community. Wyoming big sagebrush is dominant on undisturbed sites in this area, although other species of big sagebrush are co-dominant. Needle and Thread grass and Indian rice grass are the dominant grasses. Other plant species observed throughout the background include: tapertip hawksbeard, cushion buckwheat, shaggy fleabane, green rabbitbrush, and Hood's phlox.

All sites along the T-25 road associated with the NSTR project achieved final stabilization prior to the 2014 revegetation assessment except the area near power pole 179. In 2011, mean perennial cover at the location was 33.9% of background.

8.2 Site Assessment

8.2.1 North of Power pole 179

A visual assessment of the site was conducted in 2014. As in previous assessments, tumble mustard and skeleton weed were observed. Native grasses including Indian rice grass, needle and thread grass, thickspike wheatgrass, and bottlebrush squirreltail are establishing. Green rabbitbrush is the most common re-establishing shrub.

Heavy gravel at the southern end of the disturbed area is still impeding regrowth of the vegetation, but the area did not appear to have received vehicle traffic as has been noted in previous years.

8.3 Actions and Resolutions

It is recommended the disturbed area north of power pole 179 be monitored for noxious weed control by the facility owner, and the area be removed from the Annual Revegetation Assessment.

Figure 3. Revegetation at Power Pole 179.

9. Conclusion

The following areas will be removed from the annual revegetation assessment:

- Large Scale Infiltration Basin
- Materials and Fuels Complex Industrial Waste Pond
- MFC Soil Pile
- National Security Test Range Project

In addition, the following projects in 2014 had environmental checklists that identified soil and vegetation disturbance as possible impacts associated with the approved actions:

- INL-14-018 “United States Geological Survey (USGS) Geotechnical Drilling for USGS-142 and USGS-143”
- INL-14-049 “Replace Submersible Pump in Monitoring Wells ANL-MON-12 and ANL-MON-A-13
- INL-14-070 “Wireless Test Bed Fiber Optic Cable to Gate 1 and EBR-I Cell Sites.”

Locations associated with these projects will be added to the 2015 Revegetation Assessment. The purpose of adding these locations to the annual assessment is to determine if revegetation is warranted at newly disturbed locations. It is a final recommendation of this assessment that future assessments evaluate environmental checklists for projects that have the potential to disturb vegetation and that those locations be included in future annual revegetation assessments.

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