Table 91 (continued). Summary of LBNL High-Resolution U Isotopic Results for Samples Collected In 2015

Sample Location	Date Collected	Total U (µg/L)[a]	Percent Natural	Percent Anthropogenic	Previous Number of Sample Events	Average Natural Percentage of Past Samples
SPIN	6/16/15	78	50.19	49.81	3	57.23
79502	5/27/15	16	97.24	2.76	1	96.81
P210189	5/28/15	43	60.13	39.87	1	92.3
WALPOC	3/26/15-4/7/15	16.1	77.50	22.50	24	78.12
WALPOC	4/17/15-4/20/15	10.6	74.88	25.13		
WALPOC	5/18/15-5/26/15	7.12	68.64	31.37		
WALPOC	6/8/15-6/12/15	5.88	68.70	31.29		
GS10	5/19/15-5/26/15	8.92	69.11	30.89	21	66.9
GS33	5/18/15-6/5/15	2.3	99.04	0.96	0	N/A
GS33	3/9/15-4/1/15	7.36	99.12	0.87		
GS13	5/18/15-5/26/15	5.24	53.07	46.93	5	72.63
SW093	5/18/15-5/26/15	5.71	47.28	52.72	4	87.00

Notes: LBNL is tasked with providing isotopic data and associated interpretation, not total uranium data. Samples representing an extended (multi-day) period of time are flow-paced composites, whereas those listing a single date are grab samples. Percent natural data are as reported by LBNL, and percent anthropogenic is sum of enriched and depleted percentages reported by LBNL; total may differ slightly from 100 percent. Previous samples collected from some locations may represent pre-closure conditions. Average natural percentages provided incorporate all high-resolution uranium data for the given location prior to the samples summarized in this table (including duplicates, and results generated by LANL as well as LBNL). Refer to previous reports for data for samples collected in earlier years.
[a] Total uranium content as reported for split submitted to contract laboratory.

Abbreviations:
N/A = No previous data available

3.2 Ecological Monitoring at the Rocky Flats Site

3.2.1 Introduction

The Ecology group conducts ecological monitoring of the Site's ecological resources to ensure regulatory compliance and to preserve, protect, and manage those resources. Ecological monitoring is an integral aspect of determining whether the management objectives and goals for the natural resources at the Site are being achieved. This report summarizes the results of the vegetation, revegetation, wetland, and wildlife monitoring conducted at the Site during 2015. It also includes a brief summary of the monitoring conducted for Preble's meadow jumping mouse (*Zapus hudsonius preblei*; Preble's mouse) mitigation activities; however, the details of that monitoring effort are summarized in a separate regulatory report provided to USFWS.

At an elevation of approximately 6,000 feet, the Site contains a unique ecotonal mixture of mountain and prairie plant species resulting from the topography of the area and its proximity to the mountain front. The POU, the area surrounding the COU (the general area where the former IA was once located), is one of the largest remaining undeveloped tracts of its kind along the Colorado Piedmont. A number of plant communities present in the COU and POU have been identified as increasingly rare and unique by the Colorado Natural Heritage Program

(CNHP 1994, 1995). These communities include the xeric tallgrass prairie, tall upland shrubland, wetlands, and Great Plains riparian woodland communities. Small inclusions of a number of other increasingly rare plant communities are also found on the Site. Many of these communities support populations of increasingly rare animals as well, including the federally protected Preble's mouse, and other uncommon species such as the grasshopper sparrow (*Ammodramus savannarum*), loggerhead shrike (*Lanius ludovicianus*), Merriam's shrew (*Sorex merriami*), black-crowned night heron (*Nycticorax nycticorax*), hops blue butterfly (*Celastrina* spp.), and Arogos skipper (*Atrytone arogos*).

During 2007, transfer of portions of the POU was made to USFWS to create the Rocky Flats National Wildlife Refuge. As a result, the total acreage managed by LM is now approximately 1,308 acres in the COU. A summary of the ecological monitoring highlights from the 2015 field season is provided in the following sections. Full, detailed summaries, methodology, and analyses for each field monitoring effort are presented as stand-alone reports on the Ecology DVD included with this report.

3.2.2 Vegetation Monitoring

Vegetation monitoring reported here is conducted at the Site to provide information necessary for management of the natural resources. The objectives of the vegetation surveys in 2015 were to:

- Identify new plant species not previously found at the Site.
- Identify and document infestations of selected noxious weeds at the Site to assist with the planning of noxious weed control activities.
- Document and track herbicide applications in 2015.
- Document where revegetation activities were conducted in 2015.
- Conduct photomonitoring for visual documentation of changes in vegetation establishment at the Site.
- Document the establishment and survival rates of shrubs and trees that were planted as part of habitat enhancement projects.
- Document the establishment of volunteer-collected forbs in forb "nurseries."

The methods for these activities may be found in the full vegetation monitoring report on the Ecology DVD included with this report.

3.2.3 Site Flora

The complete list of plant species known to occur or that have been recorded at the Site is available on the Ecology DVD. The Site species list includes the complete flora of both the COU and the POU. The vascular flora count of the Site consists of 638 species of plants. In 2015, no new records of vascular plant species were reported for the Site flora. No new species of noxious weeds were observed at the Site during 2015.

3.2.4 Weed Mapping and Weed Control

Figure 247 and Figure 248 show the 2015 weed distribution maps for diffuse knapweed (*Centaurea diffusa*) and Dalmatian toadflax (*Linaria dalmatica*), respectively. Species were mapped in the revegetation areas (approximately 575 acres) within the COU. Diffuse knapweed was observed on approximately 74 acres (49 acres of scattered-density, 24 acres of low-density, and 1 acre of medium-density) in 2015. Dalmatian toadflax was observed on approximately 86 acres in 2015 (65 acres of scattered-density and 21 acres of low-density). Figure 249 shows the locations of Scotch thistle (*Onopordum acanthium*), which was fortuitously mapped during the early summer.

Herbicide applications were made in the spring and fall of 2015. Approximately 194 acres were broadcast sprayed by a subcontractor in the spring of 2015, and approximately 145 additional acres were treated in the fall (Figure 250). Spot spraying of selected weed species was conducted by LM contractor personnel throughout the growing season (Figure 251). The compounds used at each location and the rate of application are shown in the figures. Within the spot-spraying locations, herbicides were applied to individual plants, not broadcast sprayed. (Note: Multiple herbicides are listed at some locations. Depending on site-specific characteristics [such as target weed species], the locations of water bodies, soil types, and the professional judgment of the herbicide applicator, different herbicides were used within different locations to provide the control needed.)

3.2.5 Revegetation Activities

3.2.5.1 Interseeding/Revegetation Activities

During 2015, interseeding and revegetation activities were conducted to increase vegetation cover or diversity at several locations (Table 92 and Figure 252). Approximately 10 acres were interseeded or revegetated in 2015. Shrubs were planted as part of the habitat enhancement projects (discussed below).

Table 92. 2015 Revegetation Location Summary

Project Name	Seeding/ Installation Date	Acres	Seed Mix[a] or Plants Installed	Seeding/Planting Method
ETPTS Project	1/29/2015	0.5	Hillside	Broadcast and harrowed
903 Hillside and SID	8/20/2015	1.8	Hillside and Wetland	Hand broadcast - Interseeding w/ woodstraw and turf reinforcement mat
OLF Project	9/22/2015	5.4	Hillside	Compost, broadcast, and harrowed
OLF Soil Locations	4/1/2015 to 10/20/2015	2.0	Xeric	Compost, broadcast, and harrowed
Habitat Enhancement Location 2015	6/4/2015	0.3	Rhus aromatica, Juniperus scopulorum, Atriplex canescens	5-gallon potted plants installed
	Total	10.0		

[a] Seed mixes are listed in the *Rocky Flats, Colorado, Site Revegetation Plan* (DOE 2009b).

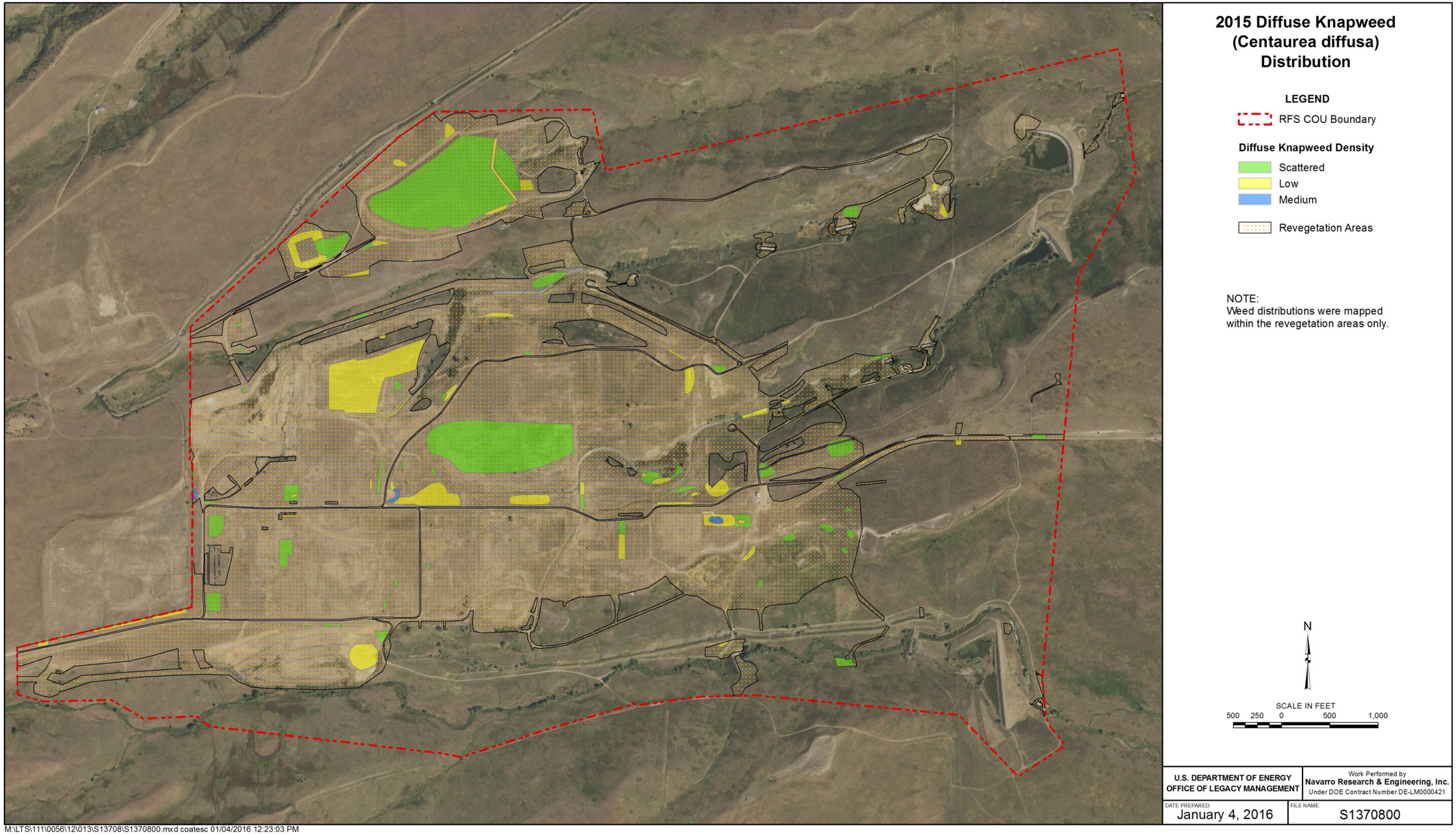

Figure 247. 2015 Diffuse Knapweed (Centaurea diffusa) Distribution

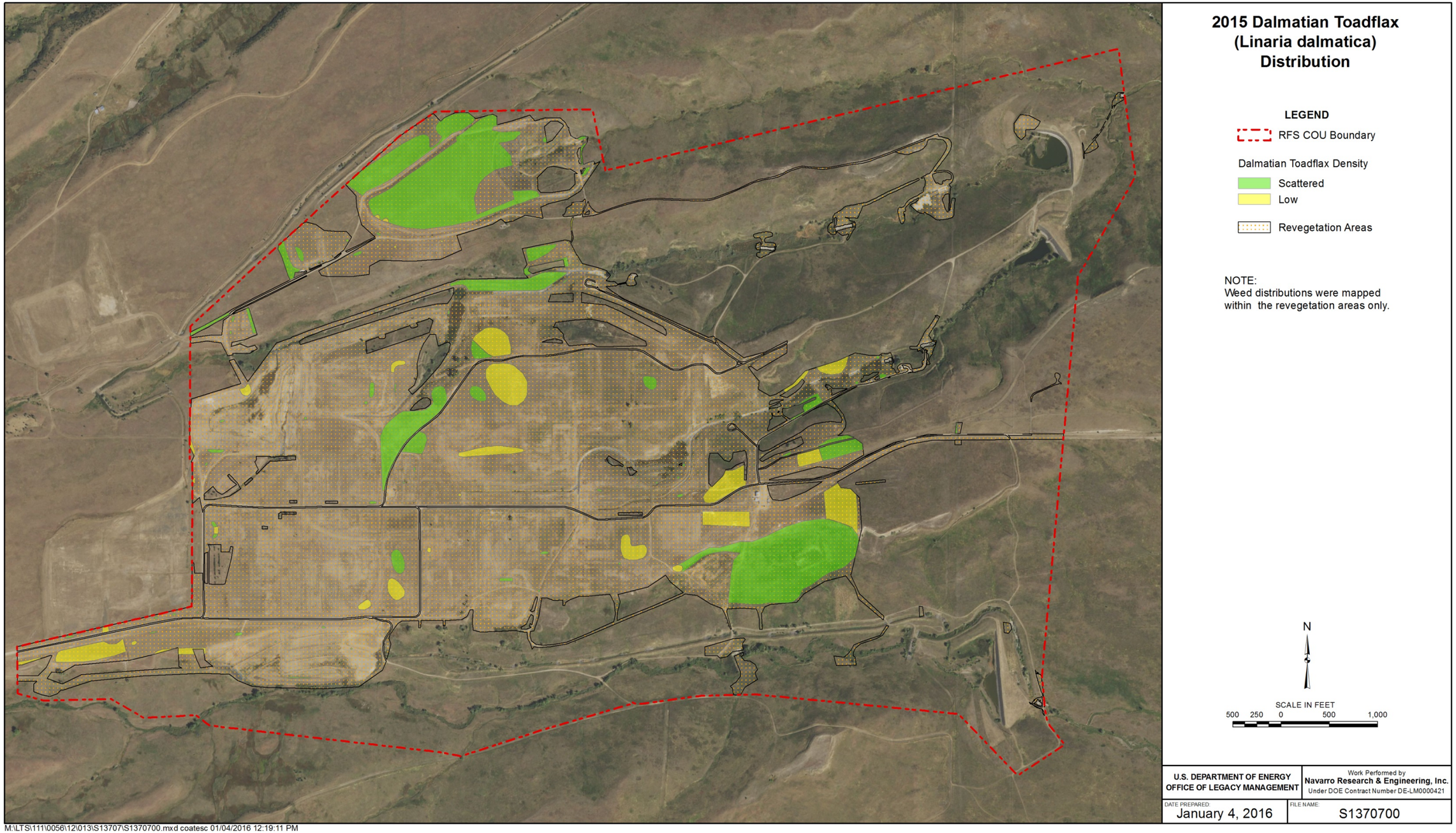

Figure 248. 2015 Dalmatian Toadflax (Linaria dalmatica) Distribution

Figure 249. 2015 Miscellaneous Weed Species Locations

Figure 250. Rocky Flats Site Herbicide Application Locations 2015

Figure 251. Rocky Flats Site 2015 Spot Spray Herbicide Application Locations

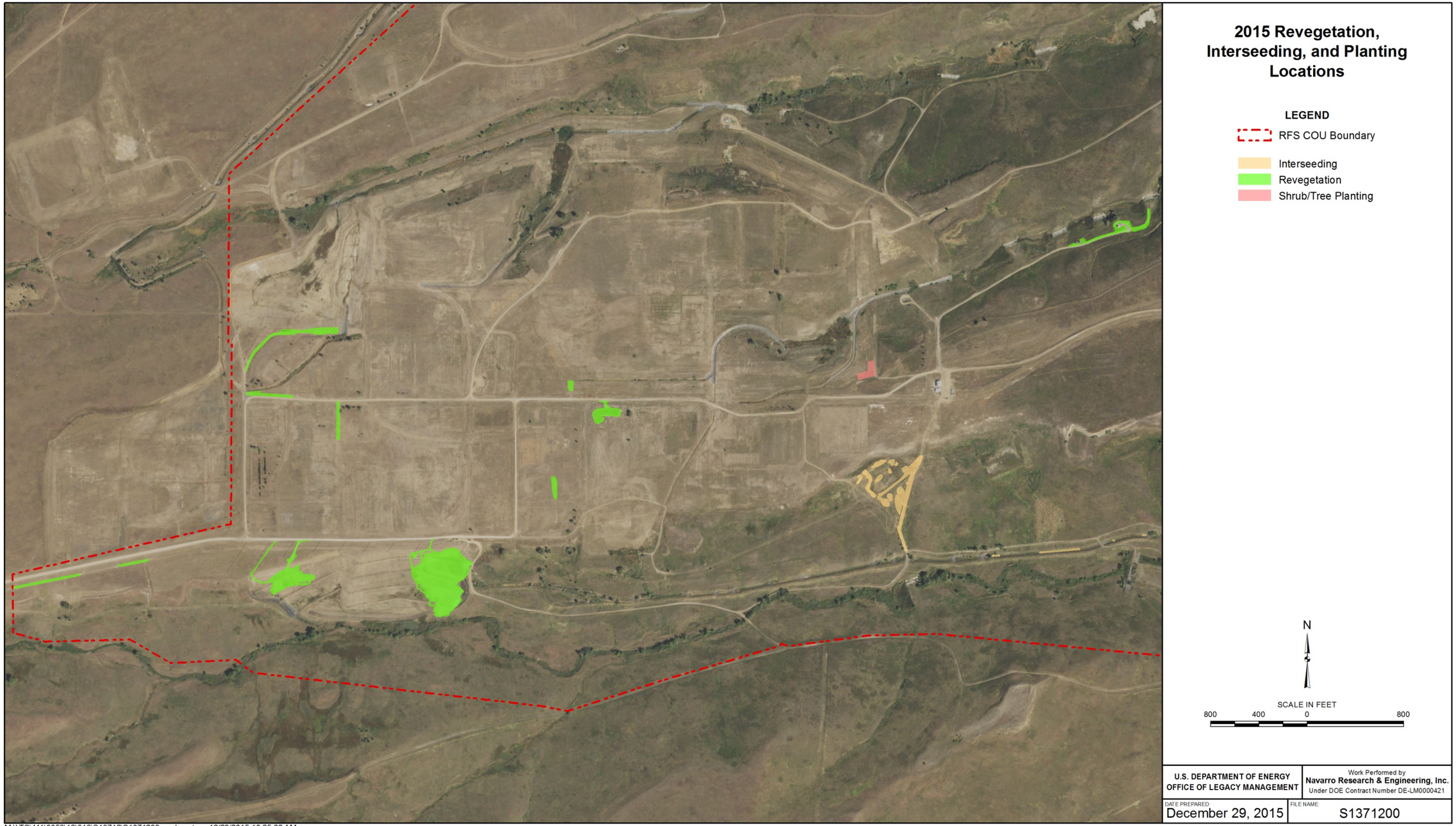

Figure 252. 2015 Revegetation, Interseeding, and Planting Locations

3.2.5.2 Habitat Enhancement Project Evaluations

In 2012 (SPPTS Habitat Enhancement Location), 2013 (Solar Ponds Habitat Enhancement Location), 2014 (MSPTS Habitat Enhancement Location), and 2015 (Burn Pit Habitat Enhancement Location), projects were implemented to enhance onsite habitat for wildlife and to increase vegetation diversity (Figure 253). In spring 2012, five different shrub and tree species were planted on a hillside in the north-central COU south of the Solar Ponds Plume Treatment System. The species included buffaloberry (*Shepherdia argentea*), fourwing saltbush (*Atriplex canescens*), coyote willow (*Salix exigua*), chokecherry (*Prunus virginiana*), and plains cottonwood (*Populus deltoides*). These plants were irrigated for only the first growing season using a gravity-fed irrigation system. During 2012 and 2013, several plains cottonwood and chokecherry plants were repeatedly browsed (some to the ground) by mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*). To protect these species from future browse damage, welded-wire fencing attached to three T-posts was installed around each of the remaining plants in the fall of 2013. As of fall 2015, 100 percent of the buffaloberry were still alive. Fifty percent of the chokecherry, 33 percent of the fourwing saltbush, and 17 percent of the coyote willow and plains cottonwood were still alive in 2015.

In spring 2013, 72 buffaloberry and 72 fourwing saltbush were planted near the location of the former Solar Ponds in the COU. These two species were selected based on the lessons learned from the 2012 habitat enhancement project. They were watered weekly through the first growing season. As of fall 2015, 6 of 72 (approximately 8 percent) buffaloberry and 17 of 72 (approximately 24 percent) fourwing saltbush plants were still alive.

In spring 2014, 50 fourwing saltbush, 50 skunkbush (*Rhus aromatica*), and 30 Rocky Mountain juniper (*Juniperus scopulorum*) were planted on a hillside south of the MSPTS. The plants were irrigated throughout the growing season in 2014. As of fall 2015, 28 of 50 fourwing saltbush (approximately 56 percent), 42 of 50 skunkbush (approximately 84 percent), and 27 of 30 Rocky Mountain juniper (90 percent) were still alive.

In spring 2015, 15 fourwing saltbush, 15 skunkbush, and 15 Rocky Mountain juniper were planted northeast of the storage shed/laydown yard on a north-facing slope. They were irrigated throughout the first growing season. Due to the above-average rainfall received in May and early June 2015, the Rocky Mountain juniper trees were water-logged and dying before they were planted. As a result, they were all dead before the end of the summer. As of fall 2015, there was 100 percent survival of both the fourwing saltbush and skunkbush.

The limiting factor restricting the number of plants that can be planted each year has been water. The availability of water and size of the potted plants has determined how many plants could be planted each year. In 2012 and 2014, 1-quart- and 1-gallon-size potted plants were used. In 2013, 10-cubic-inch pots were used. In 2015, only 5-gallon-size pots were available. On the basis of the plantings conducted thus far, the larger pots seem to have the greater survival rates. The 10-cubic-inch potted plants were so small that they were easily overcome by competition from surrounding plants, even with weed barrier and mowing. The larger and taller plants seem better able to compete for light and resources. In 2015, glyphosate (Rodeo) was applied around the base of the one row of the Rocky Mountain junipers (from the 2014 plantings) to compare whether mowing or herbicide can better reduce competition from the surrounding grasses. The herbicide was very effective and will be used in the future, in addition to the weed barrier materials and mulch.

Monitoring will done to continue to document the long-term survival rates of the different species at each of these locations to help determine which species are best adapted for various soils and slopes.

3.2.5.3 Volunteer Seed Collections/Forb Nursery Evaluations

For the past several years, the Jefferson County Nature Association has sponsored volunteer seed-picking days to provide local ecotype seed and local species, which are not available commercially, for inclusion in the revegetation efforts at the Site and other nearby projects. Sixteen forb nurseries have been established in the COU (Figure 254). Four were established in 2010 (F1, F2, F3, and F4), four in 2011 (F9, F11, F12, and F13), and eight in 2013 (F5, F6, F7, F8, F10, F14, GF1, and GF2). The forb nursery areas are locations where the forb seed was interseeded into a delineated "patch" that is not broadcast sprayed with herbicides. Spot spraying may be conducted to control individual plants as needed. As the forbs establish in these areas, the seed from these plants is expected to spread downwind and further increase the forb diversity in the revegetation areas. In 2015, approximately 56 pounds of graminoid seed and 12.5 pounds of forb seed were collected by volunteers from surrounding native lands and given to DOE for revegetation activities in the COU.

Table 93 summarizes the data collected from 2010 through 2015. Rows highlighted in yellow are those species that were most likely to be in the volunteer-collected forb seed. Prior to 2013, presence and absence data were collected at the nurseries that were established in 2010, but no abundance data were associated with many species. If no abundance data were collected for a specific species, this is indicated by an "ND" in the table.

Using only the volunteer-collected forb species (yellow rows), data were evaluated in three categories based on the year(s) of seeding, 2010/2012, 2011 and 2011/2013, and 2013. The second year shown for some years indicates that additional seed was sown into those areas that year. Interestingly, regardless of when the seeding took place, three species that were generally common in both the forb nurseries and reference areas over the different years of monitoring were Porter's aster (*Aster porter)* and two species of golden aster (*Chrysopsis fulcrata* and *Chrysopsis villosa*). These species are easily wind-dispersed and establish quite readily. Many of the other species tended to not be present in the forb nursery the first couple of years after seeding. Then suddenly in the third or fourth year they germinate and begin to increase in abundance. At some of these locations, once they appear in the forb nursery, within a year or two, they often start to show up in the adjacent references areas (initially at a lower abundance).

The presence of these species in the forb nurseries suggests that hand-collected native forb seed can be put out and will germinate when the conditions are conducive, although it may take several years to see results. These data speak to the success of this method of forb establishment. While hand collection is labor-intensive, it is a simple method for establishing local genotypic forbs that are not commercially available or in situations where it is not economical to purchase seed. At the Rocky Flats Site, along the Front Range of Colorado, it is apparent that simply sowing forb seeds into an already-established grassland community will eventually add a desirable forb component to the plant community.

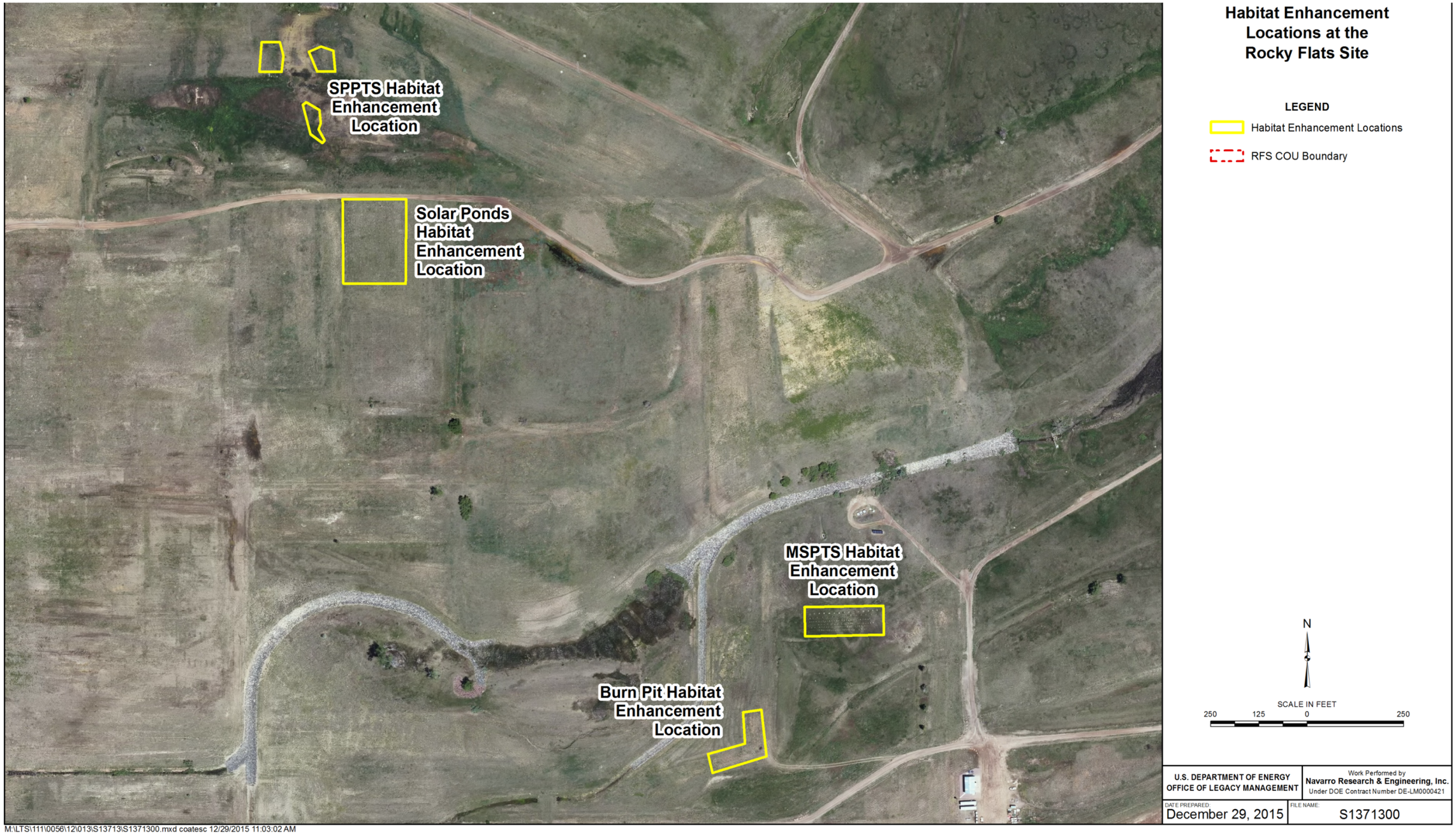

Figure 253. Habitat Enhancement Locations at the Rocky Flats Site

Figure 254. Forb Nursery Monitoring Locations 2015

Table 93. Forb Nursery Abundance Summary 2010–2015

					F1									F2									F3								F4									F5						F6									F7						F8						F9					
		Year Forbs Seeded			2010/2012									2010/2012									2010/2012								2010/2012									2013						2013									2013						2013						2011/2013					
	Nursery (N) or Reference (Ref) Area				N	N	N	N	REF	N	REF	N	REF	N	N	N	N	REF	N	REF	N	REF	N	N	N	REF	N	REF	N	REF	N	N	N	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF-1	REF-2	N	REF-1	REF-2	N	REF-1	REF-2	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF
Scientific Name	Speccode	Growth Form	Native	Noxious Weed	2010	2011	2012	2013		2014		2015		2010	2011	2012	2013		2014		2015		2011	2012	2013		2014		2015		2010	2011	2012	2013		2014		2015		2013		2014		2015		2013			2014			2015			2013		2014		2015		2013		2014		2015		2013		2014		2015	
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	F	Y														R		R																		R																																	
Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	F	N			ND	ND			I	A	A	A			ND				R	I	I	ND	ND					R	R		ND	ND							R			A	I	A	A				R	R		R	I				R	R	I	I			R			R						R
Amaranthus retroflexus L.	AMRE1	F	Y																								R																																													
Ambrosia artemisiifolia L.	AMAR1	F	Y					R			R																										R			R	R		I			R		R	R	R	R																	R					
Ambrosia psilostachya DC.	AMPS1	F	Y											R										ND	R		I												R		R	R	I	I	R	I	I							R			I									R										R	
Antennaria parvifolia Nutt.	ANPA1	F	Y																	R		R																																																			
Antennaria sp.	ANT1																R																																																									
Artemisia campestris L. ssp. caudata (Michx.) Hall & Clem.	ARCA1	F	Y								R						R	I	I		A	R	A	R		R			I		R			R	R	I		A		A				I		I														R		I											R		I		I	R
Artemisia dracunculus L.	ARDR1	F	Y															I																		I							R																																
Artemisia frigida Willd.	ARFR1	F	Y								R		R						R				I				R		I		R				R	I		A		I																																	
Artemisia ludoviciana Nutt. var. ludoviciana	ARLU1	F	Y								R		I						R		I		R						I		I				R					R										R				R																	R		R		R	R
Asclepias speciosa Torr.	ASSP1	F	Y																	R				R																				R		I	R			R			R																		
Asclepias viridiflora Raf.	ASVI1	F	Y																																		R		R																																				
Aster falcatus Lindl.	ASFA1	F	Y								R											R																																																					
Aster fendleri A. Gray	ASFE1	F	Y																		R																																R																								
Aster laevis L. var. geyeri A. Gray	ASLA1	F	Y																						R																																																		
Aster porteri Gray	ASPO1	F	Y				R	I	R	A	I	I	R		I	I	A	R	A	I	A	I			R		I		R				R	I	R	A	R	I	R	A	A	A	A	A	A	A	A	A	A	A	A	I	A	A	I		R		I	I							I	R	I	R	I	R
Carduus nutans L. ssp. macrolepis (Peterm.) Kazmi	CANU1	F	N	X								R											ND	ND																																															
Carex interior Bailey	CAIN1	G	Y													R			R																																																					
Castilleja integra A. Gray	CAIN2	F	Y																					R																																																		R
Centaurea diffusa Lam.	CEDI1	F	N	X			ND	R	R	R	I	I	A		ND	ND	I	R	R	I	A	A	ND	ND	A	R	A	I	A	I		ND	A	A	A	A	A	A	A	I	I	I	I	A	A	R	R		R	R	I	I	I	I	R	R	R	R	R	R	R				R		I	I	I	A	A	A
Chenopodium album L.	CHAL1	F	N									R																																																															
Chenopodium botrys L.	CHBO1	F	N																											R																																												
Chenopodium fremontii S. Wats.	CHFR1	F	Y																								R																																													
Chrysopsis fulcrata Greene	CHFU1	F	Y			R	R	A	R	A	R	I			I	A	A		A		A	R	R	R	A		A		R			R	R	A	I	A	R	A	R	A	A	A	A		R	I	I	I	A	A	A	A		I	R	R	A	R	A	A	R		I		R	R	A	R	I		A	R
Chrysopsis villosa Pursh.	CHVI1	F	Y		R	R	R	I		I		A	R	R	I	R	A	R	I	R		I	R	R		R		R		R	I	R	A	A	A	A	A	A	A		R	R	R	A	A	A	R	I	I	A	I	A	A		I		R		I	R					R		R		I	R		R
Cichorium intybus L.	CIIN1	F	N	X																	R																											R																											
Cirsium arvense (L.) Scop.	CIAR1	F	N	X																R		R		R																																													R		
Convolvulus arvensis L.	COAR1	F	N	X		ND	ND	R	R	I	I	I							R					ND	ND	R				R			ND	ND	I		R			R	R	R	R		R																										I		
Conyza canadensis (L.) Cronq.	COCA1	F	Y								R	I	A							I		R					R	R	R	R								R	R				I	R					I		I	I	A	A			R	R	R	R	R			R	A	A				R	R	
Dalea candida Michx. ex Willd. var. oligophylla (Torr.) Shinners.	DACA1	F	Y																																		R		R	R																																	
Dalea purpurea Vent	DAPU1	F	Y								R							R			R		R													R				I																																	
Descurainia pinnata (Walt.) Britt.	DEPI1	F	Y																																																													I							
Dyssodia papposa (Vent) Hitchc.	DYPA1	F	N					R			R									R												ND			R		R					R			I	R	I	A	I	R		R															R	R	R		
Erigeron divergens T. & G.	ERDI1	F	Y													R					R	I																	R								R							R	R	R					A	I													R
Erigeron flagellaris A. Gray	ERFL1	F	Y																																											R																													
Erigeron strigosus Muhl. ex Willd.	ERST1	F	Y									R								R								R															R					R	R		R						I				R										
Eriogonum alatum Torr.	ERAL1	F	Y															R		R		R																		R																																	
Erodium cicutarium (L.) L'Her.	ERCI1	F	N	X		ND	ND	R	A	R	A												ND	ND	I	R	I	R													R	I																									R								
Euphorbia serpyllifolia Pers.	EUSE1	F	Y			ND			I	R	I				ND													I	I													R																I	I			R								R	R	R			
Gaillardia aristata Pursh.	GAAR1	F	Y				R			R						R	R		R		I				R													R																															R				R	
Gnaphalium chilense Spreng.	GNCH1	F	Y																																																				R																			
Grindelia squarrosa (Pursh.) Dun.	GRSQ1	F	Y			ND	A	I	R	R	I	A	A		ND	A	A	R	I	R	A	A	ND	ND	I		I	I	A	A		ND	A	A	R	I	R	I	I	I	R	I	R	A	A	I	I	I	I	I	I	A	A	A	R		R	I	I	I			I	R	R		A	I	A	I	A	A
Gutierrezia sarothrae (Pursh.) Britt. & Rusby	GUSA1	F	Y				R	R		R		R			R		R		R		R												ND	R	I	R	I	I	I	R			R																															
Hackelia floribunda (Lehm.) I. M. Johnst.	HAFL1	F	Y																																													R	R																									
Helianthus annuus L.	HEAN1	F	Y						R				R											ND				R		R										R	R	R				R																			R	I		I	I	I	I	I	I	R	R	R
Helianthus pumilus Nutt.	HEPU1	F	Y															R																																																							
Helianthus rigidus (Cass.) Desf. ssp. subrhomboideus (Rydb.) Heiser	HERI1	F	Y																																																																				R			
Hypericum perforatum L.	HYPE1	F	N	X								R							R	R	R	R	R	R																					R		I							R	R	R																	
Kochia scoparia (L.) Schrad.	KOSC1	F	N				ND																		ND	ND	I	I	R	I													R	R	R				I		R			R			R	R					A	R	A		A						
Kuhnia eupatorioides L.	KUEU1	F	Y																																																																						
Lactuca serriola L.	LASE1	F	N					ND			I	I	I	I			ND			R	I	R	I	ND	ND			R	R	R	R						R		R	R	R		I	I	R	R		R		I	I	I	R	R	R			R			R			I	I	A	A		R	R	R	I	I
Lappula redowskii (Hornem.) Greene	LARE1	F	Y																																																				R																			
Liatris punctata Hook.	LIPU1	F	Y					I	R	I		I						R		I	R	A	R					I		R		R	R	R	I	I	A	A	I	R	R		R	R	R		R			R		R				R	R	I	R		R									R		I	R
Linaria dalmatica (L.) Mill.	LIDA1	F	N	X									I			ND	R	R	R		R	R	ND	ND	I		I		I	R			ND	R	I	R	I	I	I				R		R			R		R	R	R	R	I						R												
Marrubium vulgare L.	MAVU1	F	N							R		R		R										ND																																																		
Medicago lupulina L.	MELU1	F	N								R						ND	ND			R	R	R	R											ND	ND											R								R								R												R				R
Melilotus alba Medic.	MEAL1	F	N								I				R					R	R	R	A	A													R		I	R	R	R					R			R	A	R	I	R	A	I			R	I	A	I							R	R		I	A	R
Melilotus officinalis (L.) Pall.	MEOF1	F	N					R	R	A	I	R	I		ND		I	I	I	I	A	A					I				R			ND	I	I		I	I	R		R	I		I	I	I	R	I	A	A	A	R	R		I	I	A	A	A	A		I		I		R	I	R	A	R	R	I
Oenothera villosa Thunb. ssp. strigosa (Rydb.) Dietrich & Raven	OEVI1	F	Y																R	R				ND			I	R	R																				R	R	R	R	R	R				R		R				R					I	R	I	R		
Paronychia jamesii T. & G.	PAJA1	F	Y								R												R																				R		R																																
Plantago lanceolata L.	PLLA1	F	N					ND	R	I	R	R	I				ND		R		R	R	R	ND	ND	I	R			R				ND	R	R	R		R		I	I	A	A	A	A	I	A	A	I	A	I	I	A	A														R			R	R
Plantago major L.	PLMA1	F	N																																																																						
Plantago patagonica Jacq.	PLPA1	F	Y																																																																						
Polygonum arenastrum Jord. ex Bor.	POAR1	F	N																										R																																												
Psoralea tenuiflora Pursh.	PSTE1	F	Y																		R		R		R										ND						R																																		
Ratibida columnifera (Nutt.) Woot. & Standl.	RACO1	F	Y																																								R	R										R																					
Rumex crispus L.	RUCR1	F	N																																																																						
Rumex maritimus L.	RUMA1	F	Y									R		R																																																										
Rumex salicifolius Weinm. ssp. triangulivalvis Danser	RUME1	F	Y								R																																																															
Salsola iberica Senn. & Pau.	SAIB1	F	N																																										R																					I	R									
Scorzonera laciniata L.	SCLA1	F	N					ND																	ND																																										R					
Senecio spartioides T. & G.	SESP1	F	Y																		R	R	R													R	R		I		R										R		R	R	R	R	I		R	R		R	R	I	R			I		R							
Silene antirrhina L.	SIAN1	F	Y																																																																						
Sisymbrium altissimum L.	SIAL1	F	N																					ND	ND		R																																					I									
Solanum sp.	SOL1																																																													R									
Solidago missouriensis Nutt.	SOMI1	F	Y																		R		R		R																																																	
Solidago mollis Bart.	SOMO1	F	Y					R		I		I						A		A		A					R											I		I														R																		R		I	R
Solidago rigida L.	SORI1	F	Y					R		R		R										I																														R		R																			
Sonchus arvensis L. ssp. arvensis L.	SOAR1	F	N	X																																							R																												
Spergularia media (L.) Presl.	SPME1	F	Y																																																																						
Symphoricarpos occidentalis Hook.	SYOC1	S	Y																																																																						
Taraxacum officinale Weber	TAOF1	F	N					ND	R		R															R							ND	ND			R														R			R												R	R									R		
Tragopogon dubius Scop.	TRDU1	F	N										R	R	R			ND			R		R	I	ND	ND	R			R	R	R			ND			R		R	R	R	R	R	R	R	R	R	R	R	R	R		R	R	R	R	R		R		R				R	R	I	I					R	R
Unknown Species	UNKN																																																						R																	
Verbascum blattaria L.	VEBL1	F	N	X																			ND	ND			R		R			ND																						R	R																				
Verbascum thapsus L.	VETH1	F	N	X								R	R	R			ND	R	R	R	R	R	I	ND	ND	A	I	A	I	I	I		ND	A	I	A	R	A	A	I		R	R	R	R	R			R	R	R	I	R	I			R		R	R	R			R	R	R	R			R		R	R
Verbena bracteata Lag. & Rodr.	VEBR1	F	Y								I							R																										R									R																					
Xanthium strumarium L.	XAST1	F	Y																																																										R	R			I	R						

Dates across the top of the table (2010-2015) represent the year the monitoring was conducted.

Yellow rows represent the species most likely to have been in the volunteer-collected forb seed.

Table 93 (continued). Forb Nursery Abundance Summary 2010–2015

					F10						F11						F12						F13						F14						GF1						GF2					
		Year Forbs Seeded			2013						2011						2011						2011						2013						2013						2013					
	Nursery (N) or Reference (Ref) Area				N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF	N	REF
Scientific Name	Speccode	Growth Form	Native	Noxious Weed	2013		2014		2015		2013		2014		2015		2013		2014		2015		2013		2014		2015		2013		2014		2015		2013		2014		2015		2013		2014		2015	
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	ACMI1	F	Y														I		I			I						R								R		R				I		I		
Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	F	N				R						I	R	I				R	R	I	A			R		R	R			R	R	R			R	I	I	I			R	R	I	A
Amaranthus retroflexus L.	AMRE1	F	Y																																											
Ambrosia artemisiifolia L.	AMAR1	F	Y								R	R		R									R												R		R									
Ambrosia psilostachya DC.	AMPS1	F	Y										R			R												R											R							
Antennaria parvifolia Nutt.	ANPA1	F	Y																																											
Antennaria sp.	ANT1																																													
Artemisia campestris L. ssp. caudata (Michx.) Hall & Clem.	ARCA1	F	Y				R		I								R		I		R	R								I		I				R		R		R		I		I	R
Artemisia dracunculus L.	ARDR1	F	Y																																R											
Artemisia frigida Willd.	ARFR1	F	Y												R					R																							R			
Artemisia ludoviciana Nutt. var. ludoviciana	ARLU1	F	Y										R		I										R		R									R		I							
Asclepias speciosa Torr.	ASSP1	F	Y				R		R	R	R				R		R	R	R		R	R																			R				R
Asclepias viridiflora Raf.	ASVI1	F	Y																																											
Aster falcatus Lindl.	ASFA1	F	Y						R								R								R		I				R				R						R				
Aster fendleri A. Gray	ASFE1	F	Y																																											
Aster laevis L. var. geyeri A. Gray	ASLA1	F	Y				R		R																																					
Aster porteri Gray	ASPO1	F	Y		A		A		A	R			I	R			A	A	A	A	A	I	R		I		I		R	I	R	I	R	R		I	R	I		A	A	A	A	A	I
Carduus nutans L. ssp. macrolepis (Peterm.) Kazmi	CANU1	F	N	X																																										
Carex interior Bailey	CAIN1	G	Y																																											
Castilleja integra A. Gray	CAIN2	F	Y																																				R							
Centaurea diffusa Lam.	CEDI1	F	N	X		R	R	R				R	R	R			I	I	R	R	I	A	A	I	A	A	A	I	R		R	I		A	R	R	I	R	R		R	I	I	R	I	A
Chenopodium album L.	CHAL1	F	N																																											
Chenopodium botrys L.	CHBO1	F	N																																											
Chenopodium fremontii S. Wats.	CHFR1	F	Y																																											
Chrysopsis fulcrata Greene	CHFU1	F	Y				I				I	R	A	I	I		I	I	A	A	A	I	I	R	A		A				I		I		A	R	A	I	A		A	I	A	A	A	I
Chrysopsis villosa Pursh.	CHVI1	F	Y		R						I	R	I	I	R	R	A	A	A	A	A	I					R	R			R	R	R		R	R		I	R	R	I	A	I	A	A	I
Cichorium intybus L.	CIIN1	F	N	X																							R																			
Cirsium arvense (L.) Scop.	CIAR1	F	N	X			R		R	R																					R					R										
Convolvulus arvensis L.	COAR1	F	N	X																			A	A	I	I	A	A																		
Conyza canadensis (L.) Crong.	COCA1	F	Y				I	I	I	A			I	R	R			R		I		R			I	R	R	R			R	I	R	I			I	R	I			R	R	I	R	R
Dalea candida Michx. ex Willd. var. oligophylla (Torr.) Shinners.	DACA1	F	Y				R																																							
Dalea purpurea Vent	DAPU1	F	Y																																											
Descurainia pinnata (Walt.) Britt.	DEPI1	F	Y																																											
Dyssodia papposa (Vent) Hitchc.	DYPA1	F	N						R								A	I	A	R																R					I	I	I	R		
Erigeron divergens T. & G.	ERDI1	F	Y						R							R					A	I						R					R						R						I	I
Erigeron flagellaris A. Gray	ERFL1	F	Y																																											
Erigeron strigosus Muhl. ex Willd.	ERST1	F	Y										R	R			R		R	I					R												R			R		R	I			
Eriogonum alatum Torr.	ERAL1	F	Y																R		R																								R	
Erodium cicutarium (L.) L'Her.	ERCI1	F	N	X		R						R					R												R		R			R	R	R										
Euphorbia serpyllifolia Pers.	EUSE1	F	Y		I	R	R	I		R	R	R	R				R		R				I	R						R					I	R	R									
Gaillardia aristata Pursh.	GAAR1	F	Y																		R																R		R				R		R	
Gnaphalium chilense Spreng.	GNCH1	F	Y																																											
Grindelia squarrosa (Pursh.) Dun.	GRSQ1	F	Y		A	R	A	I	A	I			R	R	R	I	I	I	I	I	I	I	I	R	A	I	I	I	R	I	A	A	A	I		I	R	I	I	A	I	I	I	A	I
Gutierrezia sarothrae (Pursh.) Britt. & Rusby	GUSA1	F	Y														R																										R			
Hackelia floribunda (Lehm.) I. M. Johnst.	HAFL1	F	Y														R	R																							R					
Helianthus annuus L.	HEAN1	F	Y				I	R		R	R		R	R									A	A	I	I	R	R						R		I	R	R							
Helianthus pumilus Nutt.	HEPU1	F	Y																																											
Helianthus rigidus (Cass.) Desf. ssp. subrhomboideus (Rydb.) Heiser	HERI1	F	Y																																											
Hypericum perforatum L.	HYPE1	F	N	X											R						R																R		R							
Kochia scoparia (L.) Schrad.	KOSC1	F	N		R	I		I	R																R				R																	
Kuhnia eupatorioides L.	KUEU1	F	Y																																R		I		I							
Lactuca serriola L.	LASE1	F	N				I	I	A	A		R	A	I	I	R								R	I	R	I	I			R	R	I	A	R	R	I	I	I	R						
Lappula redowskii (Hornem.) Greene	LARE1	F	Y																																											
Liatris punctata Hook.	LIPU1	F	Y										R		R				R		R						R								R				R				R		R	
Linaria dalmatica (L.) Mill.	LIDA1	F	N	X							R	R	R	R	R	R								R	R	I	I	R							R	R		R	R	R						
Marrubium vulgare L.	MAVU1	F	N																																											
Medicago lupulina L.	MELU1	F	N												R				R	R	R								R		R						R	R					R	R		
Melilotus alba Medic.	MEAL1	F	N				R		R	R			I	R			I		A	A	A	A			I	R			R	R	A	R	I				R	R		I		A	A	A	A
Melilotus officinalis (L.) Pall.	MEOF1	F	N		R	R	I	I	R	I	R	I	A	I	R	R	A	A	A	A	A	A	I	A	A	A	A	R	R	I	A	R	A	R	I	A	I	I	R	A	A	A	A	A	A
Oenothera villosa Thunb. ssp. strigosa (Rydb.) Dietrich & Raven	OEVI1	F	Y		R	R	I		R	R			R				R	R											R		R									R	R					
Paronychia jamesii T. & G.	PAJA1	F	Y																																											
Plantago lanceolata L.	PLLA1	F	N				R		R								I	I	I	I	I	I											R							I	I	I	I	I	I
Plantago major L.	PLMA1	F	N							R																																				
Plantago patagonica Jacq.	PLPA1	F	Y													R																							R							
Polygonum arenastrum Jord. ex Bor.	POAR1	F	N																																											
Psoralea tenuiflora Pursh.	PSTE1	F	Y																																											
Ratibida columnifera (Nutt.) Woot. & Standl.	RACO1	F	Y																																									R		
Rumex crispus L.	RUCR1	F	N					R																																						
Rumex maritimus L.	RUMA1	F	Y																																											
Rumex salicifolius Weinm. ssp. triangulivalvis Danser	RUME1	F	Y																																											
Salsola iberica Senn. & Pau.	SAIB1	F	N																																R											
Scorzonera laciniata L.	SCLA1	F	N																																											
Senecio spartioides T. & G.	SESP1	F	Y						R				R		R		R		R	R	R														R		I		I		R			R		
Silene antirrhina L.	SIAN1	F	Y																R																											
Sisymbrium altissimum L.	SIAL1	F	N																																											
Solanum sp.	SOL1																																													
Solidago missouriensis Nutt.	SOMI1	F	Y																																											
Solidago mollis Bart.	SOMO1	F	Y						I								R		R	I	R				R		R						R				R		R		R		R	I	I
Solidago rigida L.	SORI1	F	Y																						R		R																R		R	
Sonchus arvensis L. ssp. uliginosus (bieb.) Nyman	SOAR2	F	N	X																															R		R									
Spergularia media (L.) Presl.	SPME1	F	Y			R		I		I																																				
Symphoricarpos occidentalis Hook.	SYOC1	S	Y																								R																			
Taraxacum officinale Weber	TAOF1	F	N		R	R	R	R									R														R						R									
Tragopogon dubius Scop.	TRDU1	F	N						R				R			R			R	R		R	I	I	R	R	I	A		R		R	R	A			R		R	R				R		R
Unknown Species	UNKN																																													
Verbascum blattaria L.	VEBL1	F	N	X									R								R																									
Verbascum thapsus L.	VETH1	F	N	X	R	R	R	R	R	R		R	I	I	R	R		R	R	I	R	R	R	R	I	R	I	R		R	R	I		I	R	R	I	I		R		R		I	R	R
Verbena bracteata Lag. & Rodr.	VEBR1	F	Y		R		R					I	R	I	R								R				R								R	I	R	I								
Xanthium strumarium L.	XAST1	F	Y				R		I	R																								R												

Dates across the top of the table (2010-2015) represent the year the monitoring was conducted.

Yellow rows represent the species most likely to have been in the volunteer-collected forb seed.

Interestingly, many of the volunteer-collected species that have established in the forb nurseries are in the composite (Asteraceae) plant family and/or they are species that flower and set seed in late summer and early fall. Since the volunteer seed collection typically occurs from early September through November, this is not unexpected. If spring or midsummer forbs are desired in the revegetation areas, seed collection would need to be done at other times of the year to collect those species when they have set seed.

3.2.6 Revegetation Monitoring

Revegetation monitoring is conducted to determine if new revegetation locations have met (or are establishing to the point where they will meet) success criteria. However, as part of the long-term stewardship of the Site, the various revegetation locations (which have already met the success criteria) are also monitored every few years to evaluate the long-term sustainability of the vegetation and the potential successional changes in plant community composition. Each of the locations monitored in 2015 had previously met the success criteria. As part of the long-term stewardship of the Site, revegetation locations are monitored every few years to evaluate the long-term sustainability of the vegetation and the potential successional changes in plant community composition. Eleven revegetation units selected in their monitoring rotation were sampled in 2015 (Figure 255). A total of 240 quadrats were sampled in 2015.The methods are not presented here but may be found in the full revegetation report on the Ecology DVD included with this report.

The success criteria, as stated in the *Rocky Flats, Colorado, Site Revegetation Plan* (Revegetation Plan; DOE 2009b), are as follows:

- A minimum of 50 percent of the seeded native species will be present at the revegetation site.
- The revegetation site will have a minimum of 70 percent total ground cover that comprises litter cover, current-year live vegetation basal cover, and rock cover.
- The revegetation site will have a minimum of 30 percent relative foliar cover of live desired species (seeded or nonseeded native species). Relative cover is defined as the percentage of cover of a given species divided by the total amount of vegetation cover present.
  Example: Species A has 20 percent absolute cover, and total vegetation cover (all individual species cover values summed) is 80 percent:

$$\text{Relative cover of Species A} = (20 \div 80) \times 100 = 25 \text{ percent}$$

- No single species will contribute more than 45 percent of the relative foliar cover (except in areas where dominance by a single species is appropriate for long-term wildlife and habitat management objectives).

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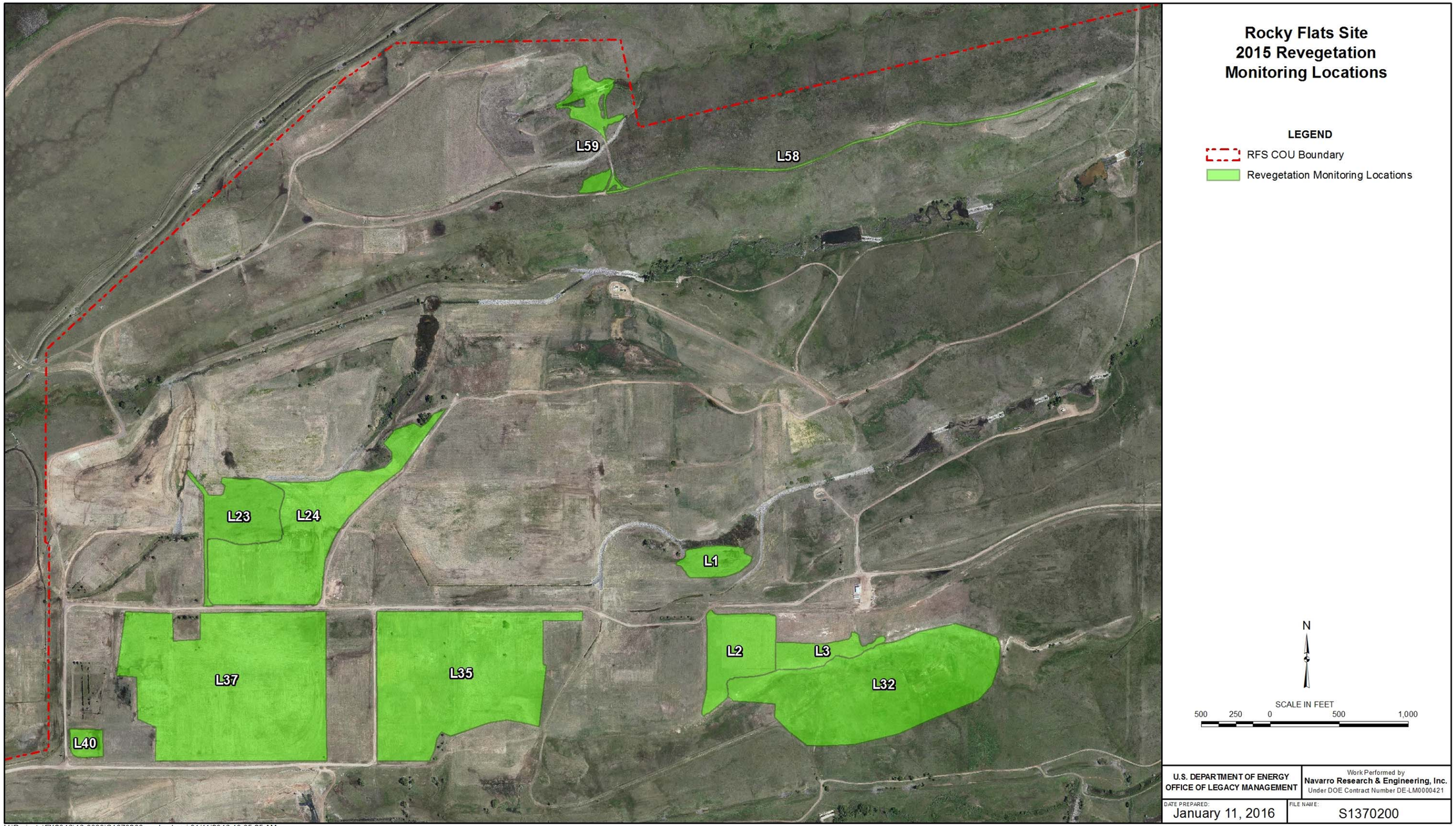

Figure 255. Rocky Flats Site 2015 Revegetation Monitoring Locations

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Table 94 shows the species richness (total number of seeded and unseeded species), a list of species seeded (checkmarks), and the seeded species found growing at each revegetation location in 2015. Species richness ranged from a low of 15 species in unit L2 to a high of 46 species in unit L32. Table 94 lists the species present at each revegetation location. Eleven different seeded graminoid species had become established and were growing at some locations in 2015. These included slender wheatgrass (*Agropyron caninum* = *Agropyron trachycaulum*), western wheatgrass (*Agropyron smithii*), big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), sideoats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), June grass (*Koeleria pyramidata*), Indian grass (*Sorghastrum nutans*), sand dropseed (*Sporobolus cryptandrus*), and green needlegrass (*Stipa viridula*). Four species were established at all 11 locations monitored in 2015: western wheatgrass, sideoats grama, blue grama, and buffalograss.

Table 94. Species Seeded By Location and 2015 Total Species Richness Summary

Location	L1	L2	L3	L23	L24	L32	L35	L37	L40	L58	L59
Scientific Name											
Agropyron caninum	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Agropyron dasystachum	✓					✓					✓
Agropyron smithii	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Andropogon gerardii		✓	✓	✓	✓		✓	✓	✓	✓	
Andropogon scoparius		✓	✓	✓	✓		✓	✓	✓	✓	
Bouteloua curtipendula	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bouteloua gracilis	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Buchloe dactyloides	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Koleria pyrimidata		✓	✓	✓	✓		✓	✓	✓	✓	
Sorghastrum nutans		✓	✓	✓	✓		✓	✓	✓	✓	
Sporobolus cryptandrus		✓	✓	✓	✓		✓	✓	✓	✓	
Stipa viridula	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total # Species Seeded	7	11	11	11	11	7	11	11	11	11	7
# Present in 2015	6	8	10	8	10	6	10	10	8	9	6
% Seeded Species Present in 2015	86	73	91	73	91	86	91	91	73	82	86
Total Species Richness in 2015	27	15	21	27	39	46	26	33	19	27	31

Yellow shaded cells mean those species were present in 2015.
Green shaded cells mean the success criteria of >50% of seeded species was met in 2015.

In addition to the desirable seeded native species, several noxious weeds were also found at the locations monitored in 2015. These included musk thistle (*Carduus nutans*), diffuse knapweed, Canada thistle (*Cirsium arvense*), bindweed (*Convolvulus arvensis*), filaree (*Erodium cicutarium*), St. Johns-wort (*Hypericum perforatum*), Dalmatian toadflax, field sow thistle (*Sonchus arvensis* ssp. *uliginosus*), common mullein (*Verbascum thapsus*), jointed goatgrass (*Aegilops cylindrica*), downy brome (*Bromus tectorum*), and Russian olive (*Elaeagnus angustifolia*). Total mean absolute foliar cover of noxious weeds at the various locations ranged from 0.4 percent to 4.5 percent (Table 95). Weeds will continue to be managed as needed to reduce noxious weed populations in the revegetation areas and to enable the desired seeded species to become established and compete with the weeds.

The first success criterion in the Revegetation Plan states that at least 50 percent of the seeded species must be present in an area for it to be considered successful. In 2015, all 11 locations (100 percent) met this criterion (Table 94).

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Table 95. Revegetation Locations Foliar Cover Summary 2015

						L1		L2		L3		L23		L24		L32		L35		L37		L40		L58		L59	
Scientific Name	Speccode	Growth Form	Native	Cool/Warm Season	Noxious Weed	Absolute Cover (%)	Relative Cover (%)	Absolute Cover (%)	Relative Cover (%)	Absolute Cover (%)	Relative Cover (%)	Absolute Cover (%)	Relative Cover (%)	Absolute Cover (%)	Relative Cover (%)	Absolute Cover (%)	Relative Cover (%)	Absolute Cover (%)	Relative Cover (%)	Absolute Cover (%)	Relative Cover (%)	Absolute Cover (%)	Relative Cover (%)	Absolute Cover (%)	Relative Cover (%)	Absolute Cover (%)	Relative Cover (%)
Alyssum minus (L.) Rothmaler var. micranthus (C. A. Mey.) Dudley	ALMI1	F	N									0.1	0.2	1.9	3.1	0.2	0.2	0.9	1.5	1.1	2.1	1.0	1.4			0.3	0.4
Carduus nutans L. ssp. macrolepis (Peterm.) Kazmi	CANU1	F	N		X									0.1	0.1												
Centaurea diffusa Lam.	CEDI1	F	N		X	0.4	0.6	0.1	0.2	0.5	0.8			0.1	0.1	0.3	0.5			0.1	0.2					2.3	3.5
Cirsium arvense (L.) Scop.	CIAR1	F	N		X											0.1	0.1									0.9	1.3
Convolvulus arvensis L.	COAR1	F	N		X	2.1	3.6	0.3	0.4	0.3	0.5			0.1	0.1	0.8	1.1	0.1	0.1	0.1	0.2			0.1	0.2	0.3	0.4
Dyssodia papposa (Vent) Hitchc.	DYPA1	F	N											0.1	0.1												
Erodium cicutarium (L.) L'Her.	ERCI1	F	N		X													0.2	0.3	0.1	0.2	0.5	0.7				
Hypericum perforatum L.	HYPE1	F	N		X									0.1	0.1	0.1	0.1										
Kochia scoparia (L.) Schrad.	KOSC1	F	N											0.2	0.3			0.1	0.1					0.1	0.2		
Lactuca serriola L.	LASE1	F	N			0.9	1.5					2.3	3.4	0.7	1.1	0.8	1.0	0.7	1.1			0.5	0.7			1.0	1.5
Lepidium campestre (L.) R. Br.	LECA1	F	N																							0.1	0.2
Linaria dalmatica (L.) Mill.	LIDA1	F	N		X					0.5	0.8					0.3	0.5							0.1	0.2		
Melilotus alba Medic.	MEAL1	F	N											2.7	4.3	3.7	5.0										
Melilotus officinalis (L.) Pall.	MEOF1	F	N			1.1	1.9	0.1	0.2	2.2	3.6	2.3	3.4	1.1	1.7	3.4	4.7	0.3	0.4	1.2	2.2			1.9	3.0	4.0	6.2
Plantago lanceolata L.	PLLA1	F	N			0.9	1.5			0.3	0.5			0.8	1.2	0.5	0.7			1.0	1.9	1.5	2.1			0.1	0.2
Sonchus arvensis L. ssp. uliginosus (Bieb.) Nyman	SOAR2	F	N		X	0.1	0.2									0.1	0.1									0.3	0.4
Taraxacum officinale Weber	TAOF1	F	N			0.1	0.2					0.3	0.4			0.1	0.1									0.1	0.2
Tragopogon dubius Scop.	TRDU1	F	N			1.3	2.1	0.5	0.9	0.3	0.5			0.6	0.9			0.3	0.4	0.2	0.3	0.5	0.7			0.3	0.4
Verbascum thapsus L.	VETH1	F	N		X	1.0	1.7					0.1	0.2	0.3	0.5	1.0	1.4							0.4	0.6		
Ambrosia psilostachya DC.	AMPS1	F	Y													0.7	0.9			0.1	0.2					1.4	2.1
Artemisia dracunculus L.	ARDR1	F	Y													0.5	0.7										
Astragalus flexuosus (Hook.) G. Don	ASFL1	F	Y													0.1	0.1										
Aster porteri Gray	ASPO1	F	Y									0.3	0.4	0.1	0.1			0.1	0.1	0.8	1.4	1.0	1.4				
Asclepias pumila (Gray) Vail	ASPU1	F	Y													0.1	0.1										
Asclepias speciosa Torr.	ASSP1	F	Y									0.1	0.2							0.1	0.2					0.1	0.2
Chrysopsis fulcrata Greene	CHFU1	F	Y																	0.1	0.2	0.5	0.7	0.1	0.2		
Chrysopsis villosa Pursh.	CHVI1	F	Y							1.7	2.7			0.1	0.1	1.1	1.5	0.1	0.1	1.0	1.9	1.0	1.4	0.3	0.4	0.1	0.2
Conyza canadensis (L.) Cronq.	COCA1	F	Y			0.1	0.2					0.6	1.0	0.2	0.3	0.3	0.3									1.0	1.5
Erigeron strigosus Muhl. ex Willd.	ERST1	F	Y											0.1	0.1	0.1	0.1										
Euphorbia serpyllifolia Pers.	EUSE1	F	Y									0.1	0.2	0.2	0.3	0.1	0.1							0.1	0.2		
Grindelia squarrosa (Pursh.) Dun.	GRSQ1	F	Y					0.5	0.9	0.5	0.8	0.9	1.3	0.4	0.7	1.2	1.6	0.4	0.7	0.3	0.5			0.3	0.4	0.1	0.2
Gutierrezia sarothrae (Pursh.) Britt. & Rusby	GUSA1	F	Y																	0.1	0.2						
Helianthus annuus L.	HEAN1	F	Y					0.1	0.2							0.1	0.1							0.3	0.4		
Lippia cuneifolia (Torr.) Steud.	LICU1	F	Y													0.1	0.1										
Linum perenne L. var. lewisii (Pursh.) Eat. & Wright	LIPE1	F	Y													0.1	0.1										
Mirabilis linearis (Pursh.) Heimerl	MILI1	F	Y													0.1	0.1										
Plantago patagonica Jacq.	PLPA1	F	Y											0.1	0.1												
Psoralea tenuiflora Pursh.	PSTE1	F	Y													1.2	1.6	0.1	0.1					0.1	0.2		
Ratibida columnifera (Nutt.) Woot. & Standl.	RACO1	F	Y													0.6	0.8										
Senecio spartioides T. & G.	SESP1	F	Y			0.1	0.2																				
Aegilops cylindrica Host	AECY1	G	N	C	X															0.1	0.2			0.6	1.0		
Agropyron cristatum (L.) Gaertn.	AGCR1	G	N	C																						0.9	1.3
Agropyron intermedium (Host) Beauv.	AGIN1	G	N	C																				0.1	0.2	12.8	19.7
Bromus inermis Leyss. ssp. inermis	BRIN1	G	N	C		6.5	11.0	3.3	5.7	2.2	3.6	2.9	4.4	1.3	2.2	26.4	36.2	0.8	1.3	0.5	1.0			0.6	1.0	1.9	2.9
Bromus japonicus Thunb. ex Murr.	BRJA1	G	N	C		0.4	0.6					0.9	1.3	0.3	0.5	1.1	1.5	0.2	0.3	0.2	0.3					2.8	4.2
Bromus tectorum L.	BRTE1	G	N	C	X	0.1	0.2			0.2	0.3	3.9	5.9	1.1	1.7			0.7	1.1	0.9	1.8	1.0	1.4	1.5	2.4	0.1	0.2
Festuca pratensis Huds.	FEPR1	G	N	C								1.9	2.9	1.1	1.7							3.0	4.3				
Lolium perenne L. var. aristatum Willd.	LOPE1	G	N	C										0.5	0.8												
Poa compressa L.	POCO1	G	N	C		0.3	0.4			0.2	0.3			0.1	0.1	0.1	0.1			0.4	0.8						
Poa pratensis L.	POPR1	G	N	C								1.8	2.7			0.5	0.7			0.1	0.2						
Setaria viridis (L.) Beauv.	SEVI1	G	N	W								0.3	0.4	0.8	1.3			0.1	0.1	0.1	0.2						
Agropyron caninum (L.) Beauv. ssp. majus (Vasey) C. L. Hitchc.	AGCA1	G	Y	C		3.9	6.5	0.1	0.2	0.2	0.3	9.0	13.8	0.7	1.1	0.5	0.7	2.6	4.3	0.2	0.3			1.1	1.8	5.1	7.9
Agropyron smithii Rydb.	AGSM1	G	Y	C		28.8	48.5	25.6	44.8	13.8	22.7	24.4	37.4	7.7	12.4	10.6	14.5	21.6	36.3	6.5	12.5	9.0	12.8	7.0	11.0	17.9	27.6
Aristida purpurea Nutt. var. robusta (Merrill) A. Holmgren & N. Holmgr	ARLO1	G	Y	C																1.3	2.4			0.8	1.2		
Elymus canadensis L.	ELCA1	G	Y	C								0.8	1.1														
Festuca ovina L. var. rydbergii St. Yves	FEOV1	G	Y	C														0.2	0.3	0.8	1.4	3.0	4.3				
Hordeum jubatum L.	HOJU1	G	Y	C								0.6	1.0	0.1	0.1									0.1	0.2		
Juncus dudleyi Wieg.	JUDU1	G	Y	C												0.5	0.7										
Koeleria pyramidata (Lam.) Beauv.	KOPY1	G	Y	C						0.2	0.3	0.1	0.2	0.6	0.9					0.2	0.3						
Stipa comata Trin. & Rupr.	STCO1	G	Y	C																				0.9	1.4		
Stipa viridula Trin.	STVI1	G	Y	C		2.4	4.0	0.9	1.5	1.7	2.7					0.2	0.2	0.5	0.8							2.5	3.9
Andropogon gerardii Vitman	ANGE1	G	Y	W				1.8	3.1	2.3	3.8			2.8	4.6	0.1	0.1	0.3	0.6	3.6	6.9	3.0	4.3	4.8	7.5	0.8	1.2
Andropogon scoparius Michx.	ANSC1	G	Y	W		0.1	0.2	3.6	6.3	4.3	7.1	0.8	1.1	3.8	6.0	0.6	0.8	1.1	1.8	8.9	17.2	6.5	9.2	6.0	9.5		
Bouteloua curtipendula (Michx.) Torr.	BOCU1	G	Y	W		1.8	3.0	9.6	16.8	15.7	25.7	1.6	2.5	8.0	12.9	7.8	10.7	8.0	13.5	5.6	10.8	11.0	15.6	16.6	26.2	2.6	4.0
Bouteloua gracilis (H. B. K.) Lag ex Griffiths	BOGR1	G	Y	W		1.4	2.3	2.4	4.1	2.3	3.8	8.5	13.0	12.4	20.0	1.0	1.4	12.5	21.0	6.0	11.6	4.0	5.7	5.9	9.3	0.1	0.2
Buchloe dactyloides (Nutt.) Engelm.	BUDA1	G	Y	W		2.1	3.6	8.4	14.6	11.5	18.9	0.1	0.2	7.2	11.6	4.4	6.1	4.3	7.2	8.5	16.4	14.0	19.9	11.4	17.9	4.3	6.6
Juncus torreyi Cov.	JUTO1	G	Y	W												0.5	0.7										
Panicum virgatum L.	PAVI1	G	Y	W		0.4	0.6									0.5	0.7									0.1	0.2
Sorghastrum nutans (L.) Nash	SONU1	G	Y	W										0.3	0.4			0.1	0.1	1.2	2.2	6.0	8.5	1.1	1.8		
Sporobolus cryptandrus (Torr.) A. Gray	SPCR1	G	Y	W		0.8	1.3			0.2	0.3	0.8	1.1	2.3	3.8	0.2	0.2	3.6	6.0	1.1	2.1	3.5	5.0	1.1	1.8		
Spartina pectinata Link	SPPE1	G	Y	W		1.5	2.5																				
Rosa arkansana Porter	ROAR1	S	Y																							0.8	1.2
Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	S	Y																							0.1	0.2
Symphoricarpos occidentalis Hook.	SYOC1	S	Y			0.1	0.2																				
Yucca glauca Nutt.	YUGL1	S	Y													0.5	0.7										
Elaeagnus angustifolia L.	ELAN1	T	N		X	0.8	1.3																				
Moss sp.	MOSS	M	NA											1.3	2.2												
Unknown Species	UNKN		NA									0.1	0.2			0.1	0.1										
Total Foliar Cover						59.3	100.0	57.3	100.0	61.0	100.0	65.3	100.0	62.0	100.0	72.9	100.0	59.4	100.0	51.9	100.0	70.5	100.0	63.4	100.0	64.9	100.0
Total Forb Cover						8.1	13.7	1.6	2.8	6.3	10.4	7.0	10.7	9.7	15.6	17.4	23.9	3.1	5.2	6.0	11.6	6.5	9.2	3.8	5.9	12.3	18.9
Total Non-Native Forb Cover						7.9	13.3	1.0	1.7	4.2	6.8	5.0	7.7	8.6	13.8	11.3	15.5	2.4	4.1	3.7	7.1	4.0	5.7	2.6	4.1	9.5	14.6
Total Native Forb Cover						0.3	0.4	0.6	1.1	2.2	3.6	2.0	3.1	1.1	1.7	6.1	8.3	0.7	1.1	2.3	4.5	2.5	3.5	1.1	1.8	2.8	4.2
Total Graminoid Cover						50.3	84.8	55.6	97.2	54.7	89.6	58.1	89.1	51.0	82.3	54.9	75.3	56.3	94.8	45.9	88.4	64.0	90.8	59.6	94.1	51.8	79.8
Total Non-Native Graminoid Cover						7.3	12.2	3.3	5.7	2.5	4.1	11.5	17.6	5.2	8.5	28.1	38.5	1.7	2.8	2.3	4.3	4.0	5.7	2.9	4.5	18.4	28.3
Total Native Graminoid Cover						43.0	72.6	52.4	91.5	52.2	85.5	46.6	71.5	45.8	73.8	26.8	36.8	54.7	92.0	43.7	84.1	60.0	85.1	56.8	89.5	33.4	51.4
Total Herbaceous Cover						58.4	98.5	57.3	100.0	61.0	100.0	65.1	99.8	60.7	97.8	72.3	99.2	59.4	100.0	51.9	100.0	70.5	100.0	63.4	100.0	64.0	98.7
Total Herbaceous Native Cover						43.3	73.0	53.0	92.6	54.3	89.1	48.6	74.5	46.8	75.5	32.9	45.1	55.3	93.1	46.0	88.6	62.5	88.7	57.9	91.3	36.1	55.7
Total Herbaceous Non-Native Cover						15.1	25.5	4.3	7.4	6.7	10.9	16.5	25.3	13.8	22.3	39.4	54.1	4.1	6.9	5.9	11.4	8.0	11.3	5.5	8.7	27.9	43.0
Total Warm-Season Graminoid Cover						8.0	13.5	25.8	45.0	36.3	59.6	12.0	18.4	37.6	60.6	15.1	20.7	29.9	50.4	34.9	67.3	48.0	68.1	46.9	74.0	7.9	12.1
Total Cool-Season Graminoid Cover						42.3	71.3	29.9	52.2	18.3	30.1	46.1	70.7	13.4	21.6	39.8	54.6	26.4	44.5	11.0	21.2	16.0	22.7	12.8	20.1	43.9	67.6
Total Noxious Weed Cover						4.5	7.6	0.4	0.7	1.5	2.5	4.0	6.1	1.8	2.8	2.8	3.8	0.9	1.5	1.3	2.4	1.5	2.1	2.8	4.3	3.8	5.8
Total Moss Cover						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Shrub Cover						0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.3
Total Tree Cover						0.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Native Cover						43.4	73.2	53.0	92.6	54.3	89.1	48.6	74.5	46.8	75.5	33.4	45.8	55.3	93.1	46.0	88.6	62.5	88.7	57.9	91.3	37.0	57.0

Absolute Cover = The percentage of the number of hits on a species out of the total number of hits possible.

Relative Cover = The percentage of the number of hits on a species out of the total number of vegetation hits.

Native Categories: Y = Native, N = Non-Native, NA = Not Available

Growth Form Categories: F = Forb, G = Graminoid, M = Moss, S = Shrub, T = Tree

Cool/Warm Season Categories: C = Cool-Season Graminoid, W = Warm-Season Graminoid

Noxious Weed Category: X = Noxious Weed (listed on October 2013 Colorado State Noxious Weed List)

Yellow shaded cells indicate success criteria were met in 2015.

Green shaded cells indicate this species provided greater than 45 percent of the relative cover in 2015.

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Ground cover protection from rock, litter, and current-year live vegetation varied from approximately 77 percent to over 100 percent at the revegetation locations in 2015 (Table 96). The occasional values over 100 percent are the result of the class system used for estimating cover, which uses the midpoint of the cover class for analysis. The second success criterion in the Revegetation Plan states that a minimum of 70 percent total ground cover comprising litter cover, current-year live vegetation basal cover, and rock cover is to be present to help prevent erosion. All 11 locations met this criterion in 2015 (Table 96).

Table 96. Basal Cover Summary at Revegetation Locations 2015

Location	Basal Vegetation Cover (%)	Litter Cover (%)	Rock Cover (%)	Total Ground Cover (%)*
L1	2.5	66.6	14.8	83.9
L2	6.3	54.4	19.3	79.9
L3	7.5	38.0	31.8	77.3
L23	3.1	70.0	14.0	87.1
L24	8.8	49.5	42.1	100.3
L32	3.8	71.3	11.0	86.0
L35	7.1	54.7	36.2	97.9
L37	6.3	42.8	48.8	97.8
L40	7.5	52.0	43.0	102.5
L58	6.9	45.0	47.1	99.0
L59	2.5	58.4	15.1	76.0
Mean	5.6	54.8	29.4	89.8

Notes:
* Numbers greater than 100 are an artifact of the sampling method using a cover class system and midpoints for analysis. The Total Ground Cover value is the sum of the Basal Vegetation Cover, Litter Cover, and Rock Cover. Shaded yellow cells indicate that the success criteria of >70% total ground cover were met in 2015.

The third success criterion states that a minimum of 30 percent relative cover of desired species must be present, and the fourth criterion states that no single species should constitute more than 45 percent of the total relative cover. The shaded row in Table 95, titled "Total Native Cover," shows that the total desired species cover meets the third success criterion at all locations in 2015. One of the 11 monitored locations (9 percent) had a single species that constituted greater than 45 percent of the relative cover in 2015 (Table 95). This single location was dominated by western wheatgrass (one of the seeded native species).

To evaluate potential successional change and trajectories in plant community composition, a comparison of past monitoring data was made with the 2015 data for each location (Table 97). Some locations have no data for a specific year because no monitoring was conducted at those locations in that year.

Changes in species richness from 2008 to 2015 varied by location. Of the 11 locations, 6 showed an increase in species richness (ranging from 1 to 12 species), 4 showed declines (ranging from a

loss of 2 to 7 species), and 1 did not change. Species richness can change due to a variety of reasons. The timing of precipitation events can often influence the vegetation in a given year, sometimes causing a flush of germination from the seed bank. At new revegetation locations, declines are typically due to a decrease in weedy species, with two primary causes. Initially most revegetation locations tend to have a flush of weedy species at the beginning of a project. As the seeded perennial graminoids begin to establish, some of the early successional weedy species are outcompeted and disappear from the area. An additional factor is the application of herbicides to remove the weedy competition and allow the seeded native graminoid species a better chance to establish. The percentage of seeded species that are present has increased at 9 of the 11 locations since monitoring began at each location, while it has remained the same at 2 locations.

Total absolute foliar cover has increased at 9 of 11 locations from the first year of monitoring to 2015. This means the abundance of vegetation has continued to increase across these areas, providing additional soil protection and reducing the potential for surface erosion. The decline in absolute foliar cover at two locations in 2015 may have been due to the fact that both areas were sprayed with herbicides to control noxious weeds in 2015. The total relative native foliar cover increased at 10 of 11 locations with 10 of 11 locations having greater than 50 percent relative native cover. These two measures suggest that a "native" prairie is establishing and the cover is not merely weedy vegetation.

Table 97 also lists the species that contributed more than 5 percent relative cover at each location from 2008 through 2015 (where data are available). Initially most of the locations were dominated by weedy species such as kochia (*Kochia scoparia*), yellow and white sweet clover (*Melilotus officinalis*, *Melilotus alba*), Russian thistle (*Salsola iberica*), and diffuse knapweed. Slender wheatgrass and western wheatgrass, which are seeded native, cool-season species, were present initially as well. However, over time, the weedy species have largely disappeared as western wheatgrass and other native warm-season species like blue grama, side-oats grama, buffalograss, big bluestem, little bluestem, sand dropseed, and Indian grass have established and increased in cover, becoming the dominant species in the plant communities. Slender wheatgrass, which is a short-lived, native perennial, has largely disappeared from the areas as the long-lived western wheatgrass has increased. The mix of both cool-season and warm-season native graminoids is desirable for long-term sustainability.

Smooth brome (*Bromus inermis*), which is an undesirable cool-season, non-native species, continued to provide greater than 5 percent relative cover at three locations. This species tends to be very aggressive and can outcompete many seeded native species under certain conditions. Future monitoring will determine whether or not smooth brome is continuing to increase. While an increase of smooth brome is not desirable, it may be unavoidable without a large sustained input of time, money, and management resources.

Table 98 shows which monitoring locations passed or failed specific success criteria in 2015. Regarding the use of the success criteria, the Revegetation Plan states:

> Success criteria and monitoring are an important component of a revegetation project... *These success criteria are provided as initial guidance; however, common sense combined with scientific data must be applied to final evaluations to determine whether further management actions are required.* (Emphasis added)

Table 97. Evaluation of Successional Changes in Plant Community Composition at Revegetation Locations

	Year	L1	L2	L3	L23	L24	L32	L35	L37	L40	L58	L59
Species Richness (# of species)	2008	27	22	24	15	28	45	28	24	15	ND	ND
	2009	24	10	10	13	27	38	28	43	16	ND	ND
	2010	14	24	19	21	ND	ND	ND	ND	11	ND	ND
	2011	18	19	21	16	27	49	25	33	18	ND	ND
	2012	ND	ND	ND	ND	ND	24	ND	ND	ND	ND	ND
	2013	ND	ND	ND	ND	ND	37	ND	ND	ND	24	33
	2014	ND	ND	ND	ND	ND	39	ND	ND	ND	28	40
	2015	27	15	21	27	39	46	26	33	19	27	31
Percent Seeded Species Present	2008	71	45	64	18	64	86	73	73	36	ND	ND
	2009	71	36	36	18	64	86	91	82	27	ND	ND
	2010	71	100	64	45	ND	ND	ND	ND	45	ND	ND
	2011	86	64	73	64	91	86	82	91	45	ND	ND
	2012	ND	ND	ND	ND	ND	86	ND	ND	ND	ND	ND
	2013	ND	ND	ND	ND	ND	86	ND	ND	ND	73	86
	2014	ND	ND	ND	ND	ND	71	ND	ND	ND	82	86
	2015	86	73	91	73	91	86	91	91	73	82	86
Total Absolute Foliar Cover (Percent)	2008	28.6	35.3	29.0	26.1	57.0	44.5	74.8	61.8	64.0	ND	ND
	2009	70.5	34.5	33.3	62.3	60.7	71.1	54.8	46.8	78.5	ND	ND
	2010	48.4	40.9	39.0	56.8	ND	ND	ND	ND	37.0	ND	ND
	2011	57.8	52.5	43.3	60.4	49.4	76.1	51.7	44.1	62.0	ND	ND
	2012	ND	ND	ND	ND	ND	63.3	ND	ND	ND	ND	ND
	2013	ND	ND	ND	ND	ND	64.7	ND	ND	ND	27.3	40.8
	2014	ND	ND	ND	ND	ND	85.3	ND	ND	ND	69.8	72.1
	2015	59.3	57.3	61.0	65.3	62.0	72.9	59.4	51.9	70.5	63.4	64.9
Total Relative Native Foliar Cover (Percent)	2008	28.8	25.5	29.3	23.9	75.0	50.2	75.7	76.4	78.9	ND	ND
	2009	34.8	58.3	65.5	51.8	79.3	53.6	81.8	54.8	61.8	ND	ND
	2010	84.2	87.5	75.6	66.1	ND	ND	ND	ND	86.5	ND	ND
	2011	79.4	94.8	71.2	93.4	93.3	58.9	95.8	90.5	83.9	ND	ND
	2012	ND	ND	ND	ND	ND	71.8	ND	ND	ND	ND	ND
	2013	ND	ND	ND	ND	ND	68.9	ND	ND	ND	82.1	50.9
	2014	ND	ND	ND	ND	ND	56.4	ND	ND	ND	85.8	47.7
	2015	73	92.6	89.1	74.5	75.5	45.1	93.1	88.6	88.7	91.3	55.7
Total Absolute Ground Cover * (Basal Veg, Litter, Rock) (Percent)	2008	53.4	82.5	95.7	33.3	64.2	84.6	67.1	69.1	79.5	ND	ND
	2009	37.0	40.1	44.8	47.3	86.8	88.3	93.9	81.8	110.5	ND	ND
	2010	62.8	61.6	55.5	83.0	ND	ND	ND	ND	100.5	ND	ND
	2011	74.3	76.5	74.3	83.1	96	90.3	89.7	90.2	95.5	ND	ND
	2012	ND	ND	ND	ND	ND	94.4	ND	ND	ND	ND	ND
	2013	ND	ND	ND	ND	ND	92.1	ND	ND	ND	84.8	85.5
	2014	ND	ND	ND	ND	ND	87.8	ND	ND	ND	99.1	77.4
	2015	83.9	79.9	77.3	87.1	100.3	86.0	97.9	97.8	102.5	99.0	76.0

Table 97 (continued). Evaluation of Successional Changes in Plant Community Composition at Revegetation Locations

	Year	L1	L2	L3	L23	L24	L32	L35	L37	L40	L58	L59
Species with 5 percent or greater relative foliar cover	2008	Kochia scoparia (27.9%) Melilotus officinalis (23.1%) Agropyron caninum (14.8%) Salsola iberica (9.2%) Agropyron smithii (6.1%)	Kochia scoparia (48.9%) Agropyron caninum (14.2%) Salsola iberica (12.1%) Agropyron smithii (6.7%)	Kochia scoparia (19.5%) Centaurea diffusa (12.6%) Salsola iberica (17.8%) Agropyron caninum (11.5%) Melilotus alba (9.8%) Agropyron smithii (8.0%)	Kochia scoparia (51.2%) Agropyron caninum (13.9%) Agropyron smithii (8.6%) Lactuca serriola (8.1%) Salsola iberica (7.7%)	Agropyron caninum (50.5%) Agropyron smithii (17.7%) Erodium cicutarium (6.1%) Kochia scoparia (5.6%) Centaurea diffusa (5.6%)	Centaurea diffusa (13.5%) Agropyron caninum (11.2%) Agropyron smithii (10.7%) Buchloe dactyloides (9.6%) Bromus inermis (9.4%) Bromus tectorum (6.0%) Bouteloua curtipendula (5.8%)	Agropyron smithii (33.9%) Agropyron caninum (28.7%) Melilotus officinalis (6.5%) Bouteloua curtipendula (5.6%)	Agropyron caninum (31.6%) Agropyron smithii (27.6%) Buchloe dactyloides (9.1%) Kochia scoparia (6.4%)	Agropyron caninum (48.4%) Agropyron smithii (26.6%) Poa compressa (9.4%) Plantago lanceolata (5.5%)	ND	ND
	2009	Melilotus officinalis (44.0%) Agropyron smithii (17.0%) Agropyron caninum (15.6%) Kochia scoparia (13.5%)	Agropyron smithii (34.4%) Kochia scoparia (30.1%) Agropyron caninum (16.7%) Buchloe dactyloides (6.9%) Bromus inermis (5.1%) Bromus tectorum (5.1%)	Agropyron caninum (40.0%) Agropyron smithii (21.0%) Kochia scoparia (21.0%) Convolvulus arvensis (6.5%)	Agropyron caninum (36.3%) Kochia scoparia (32.9%) Agropyron smithii (13.5%) Lactuca serriola (5.8%)	Agropyron smithii (33.2%) Agropyron caninum (21.6%) Kochia scoparia (7.4%) Buchloe dactyloides (5.9%)	Bromus inermis (28.8%) Agropyron smithii (14.0%) Bouteloua curtipendula (13.2%) Kochia scoparia (5.7%) Buchloe dactyloides (5.0%)	Agropyron smithii (42.1%) Agropyron caninum (17.8)% Bouteloua curtipendula (10.0%) Bouteloua gracilis (7.9%)	Agropyron caninum (18.1)% Agropyron smithii (12.8%) Buchloe dactyloides (8.7%) Agropyron cristatum (6.8%) Centaurea diffusa (6.2%) Bromus tectorum (5.9%) Alyssum minus (5.0%)	Agropyron smithii (28.7%) Agropyron caninum (21.0%) Plantago lanceolata (17.8%) Kochia scoparia (9.6%)	ND	ND
	2010	Agropyron smithii (42.1%) Agropyron caninum (39.3%) Bromus inermis (8.3%) Kochia scoparia (5.9%)	Agropyron smithii (40.1%) Agropyron caninum (32.7%) Buchloe dactyloides (7.3%)	Agropyron caninum (33.8%) Agropyron smithii (18.8%) Buchloe dactyloides (12.0%) Bromus inermis (8.5%) Convolvulus arvensis (7.7%) Bouteloua curitipendula (5.1%)	Agropyron caninum (32.4%) Agropyron smithii (27.8%) Bromus tectorum (17.8%) Lactuca serriola (6.8%) Kochia scoparia (5.5%)	ND	ND	ND	ND	Buchloe dactyloides (56.8%) Agropyron smithii (9.5%) Andropogon scoparius (8.1%) Agropyron caninum (5.4%) Plantago lanceolata (5.4%)	ND	ND
	2011	Agropyron smithii (55.8%) Bromus inermis (17.7%) Agropyron caninum (10.4%)	Agropyron smithii (54.3%) Agropyron caninum (16.4%) Stipa viridula (12.6%) Buchloe dactyloides (5.0%)	Agropyron smithii (27.7%) Agropyron caninum (16.2%) Buchloe dactyloides (13.5%) Bromus inermis (13.8%) Convolvulus arvensis (8.5%) Bouteloua curitipendula (6.9%)	Agropyron caninum (46.4%) Agropyron smithii (43.5%)	Agropyron smithii (60%) Agropyron caninum (9.3%) Buchloe dactyloides (7.8%) Bouteloua gracilis (6.6%) Bouteloua curtipendula (5.2%)	Bromus inermis (26.2%) Bouteloua curitipendula (14.9%) Buchloe dactyloides (7.1%) Panicum virgatum (6.8%)	Agropyron smithii (60.3%) Bouteloua curtipendula (13.2%) Bouteloua gracilis (6.3%) Agropyron caninum (5.0)%	Agropyron smithii (34.0%) Buchloe dactyloides (20.6%) Agropyron caninum (13.8)% Bouteloua gracilis (5.9%)	Agropyron smithii (50.0%) Agropyron caninum (12.1%) Buchloe dactyloides (10.5%) Plantago lanceolata (6.5%)	ND	ND
	2012	ND	ND	ND	ND	ND	Bouteloua curtipendula (32.8%) Bromus inermis (21.9%) Agrypyron smithii (9.4%) Bouteloua gracilis (8.8%) Buchloe dactyloides (7.9%)	ND	ND	ND	ND	ND
	2013	ND	ND	ND	ND	ND	Bouteloua curtipendula (29.4%) Bromus inermis (24.2%) Agropyron smithii (10.3%) Buchloe dactyloides (8.5%) Stipa viridula (5.7%)	ND	ND	ND	Bouteloua gracilis (19.3%) Buchloe dactyloides (17.9%) Agropyron caninum (14.7%) Bouteloua curtipendula (11.5%) Kochia scoparia (8.7%) Agropyron smithii (6.4%)	Agropyron caninum (19.3%) Agropyron intermedium (17.5%) Agropyron smithii (12.6%) Buchloe dactyloides (8.6%) Bromus tectorum (7.7%) Bromus inermis (5.2%)
	2014	ND	ND	ND	ND	ND	Bromus inermis (21.8%) Bouteloua curtipendula (17.5%) Agropyron smithii (15.3%) Melilotus officinalis (9.2%) Buchloe dactyloides (6.0%) Melilotus alba (5.7%)	ND	ND	ND	Buchloe dactyloides (31.4%) Bouteloua curtipendula (18.3%) Agropyron caninum (8.4%) Bouteloua gracilis (7.7%) Andropogon gerardii (5.7%)	Agropyron smithii (24.1%) Agropyron intermedium (23.9%) Bromus inermis (8.0%) Cirsium arvense (6.9%) Grindelia squarrosa (5.9%) Melilotus officinalis (5.0%)
	2015	Agropyron smithii (48.5%) Bromus inermis (11.0%) Agropyron caninum (6.5%)	Agropyron smithii (44.8%) Bouteloua curtipendula (16.8%) Buchloe dactyloides (14.6%) Andropogon scoparius (6.3%) Bromus inermis (5.7%)	Bouteloua curtipendula (25.7%) Agropyron smithii (22.7%) Buchloe dactyloides (18.9%) Andropogon scoparius (7.1%)	Agropyron smithii (37.4%) Agropyron caninum (13.8%) Bouteloua gracilis (13.0%) Bromus tectorum (5.9%)	Bouteloua gracilis (20.0%) Bouteloua curtipendula (12.9%) Agropyron smithii (12.4%) Buchloe dactyloides (11.6%) Andropogon scoparius (6.0%)	Bromus inermis (36.2%) Agropyron smithii (14.5%) Bouteloua curtipendula (10.7%) Buchloe dactyloides (6.1%) Melilotus alba (5.0%)	Agropyron smithii (36.3%) Bouteloua gracilis (21.0%) Bouteloua curtipendula (13.5%) Buchloe dactyloides (7.2%) Sporobolus cryptandrus (6.0%)	Andropogon scoparius (17.2%) Buchloe dactyloides (16.4%) Agropyron smithii (12.5%) Bouteloua gracilis (11.6%) Bouteloua curtipendula (10.8%) Andropogon gerardii (6.9%)	Buchloe dactyloides (19.9%) Bouteloua curtipendula (15.6%) Agropyron smithii (12.8%) Andropogon scoparius (9.2) Sorghastrum nutans (8.5%) Bouteloua gracilis (5.7%) Sporobolus cryptandrus (5.0%)	Bouteloua curtipendula (26.2%) Buchloe dactyloides (17.9%) Agropyron smithii (11.0%) Andropogon scoparius (9.5%) Bouteloua gracilis (9.3%) Andropogon gerardii (7.5%)	Agropyron smithii (27.6%) Agropyron intermedium (19.7%) Agropyron caninum (7.9%) Buchloe dactyloides (6.6%) Melilotus officinalis (6.2%)

Notes:

* Values greater than 100 percent are a result of the monitoring protocol that uses the midpoints of the cover class system for analysis.

ND = No Data collected at this location for this year.

Table 98. Success Criteria Evaluation Summary 2015

Location	>30% Relative Cover of Desired Species	>70% Total Ground Cover (Litter, Rock, and Basal Veg Cover)	50% or More of Seeded Species Present	No Single Species With >45% Relative Foliar Cover	PASS/FAIL
L1	PASS	PASS	PASS	PASS	PASS
L2	PASS	PASS	PASS	PASS	PASS
L3	PASS	PASS	PASS	PASS	PASS
L23	PASS	PASS	PASS	PASS	PASS
L24	PASS	PASS	PASS	PASS	PASS
L32	PASS	PASS	PASS	PASS	PASS
L35	PASS	PASS	PASS	PASS	PASS
L37	PASS	PASS	PASS	PASS	PASS
L40	PASS	PASS	PASS	PASS	PASS
L58	PASS	PASS	PASS	PASS	PASS
L59	PASS	PASS	PASS	PASS	PASS
% Passing					

PASS = Considered to have passed based on discussion in report text.

The Revegetation Plan's success criterion regarding dominance by a single species states that "no single species will contribute more than 45 percent of the relative foliar cover (*except in areas where dominance by a single species is appropriate for long-term wildlife and habitat management objectives*)." (Emphasis added)

At the location that failed this last criterion, western wheatgrass provided greater than 45 percent total relative cover. As discussed in previous annual reports, western wheatgrass is a desirable native species that often comprises greater than 45 percent cover on the native undisturbed grasslands in the Rocky Flats area. Another native species, needle-and-thread grass (*Stipa comata*), also is known to have greater than 45 percent cover at some locations at the Site. Because it is not uncommon for some of the native graminoid species to dominate the foliar cover at some locations, it is unlikely that the dominance of western wheatgrass at these revegetation areas will be detrimental to long-term wildlife and habitat management.

On the basis of 2015 monitoring results, no further management actions (apart from normal weed control activities) will be taken at any of the locations. In addition, abundant ground cover is present at each location, thus minimizing the potential for soil erosion. In general, the vegetation has become well-established and should be sustainable in the long term.

3.2.7 Photopoint Monitoring Results

Photomonitoring results are presented on the Ecology DVD included with this report.

3.2.8 Wildlife Monitoring

During 2015, wildlife surveys at the Site consisted of observing black-tailed prairie dogs (*Cynomys ludovicianus*), monitoring bird nesting boxes, and locating active raptor nests. A summary of the survey results are presented here, while more-detailed information on the wildlife monitoring is presented on the Ecology DVD included with this report.

3.2.8.1 Prairie Dog Monitoring

Figure 256 shows the locations of former and current prairie dog towns in the COU and on the adjacent POU property. In 2009, the prairie dogs throughout the COU and POU were killed by an outbreak of plague that began in the colonies east of the POU on the adjacent Westminster Hills Open Space dog park. Plague is an infectious disease caused by *Yersinia pestis*, a bacterium found in fleas. The fleas pass on the bacterium to wild rodents. Prairie dogs are susceptible to plague, and colonies can be wiped out by plague every few years. Observations of the former towns in the southern portion of the Site during 2015 revealed that no prairie dog towns were active within the COU. However, two small towns in the POU north of the A-4 pond (northern towns shown on Figure 256) had prairie dogs present this year. The maximum number of individuals recorded at each of these towns varied throughout the year, but approximately 24 individuals were observed in the northernmost town in April, while approximately 17 individuals were observed at the town closer to the COU fence in April. Two burrowing owls (*Athene cunicularia*) were observed in the latter town in April 2015.

Three observations of prairie dogs within the COU were made in late spring 2015. Two were observed running down the main roads in the center of the COU, and the other was in the talons of a great horned owl (*Bubo virginianus*) northeast of the C-2 pond. The prairie dogs typically travel beyond their existing towns in search of other potential burrow locations in the late spring and early summer. No evidence of burrowing or other prairie dogs was found in the COU during the remainder of 2015. Fortuitous monitoring will continue throughout 2016 to determine whether prairie dogs are in the COU.

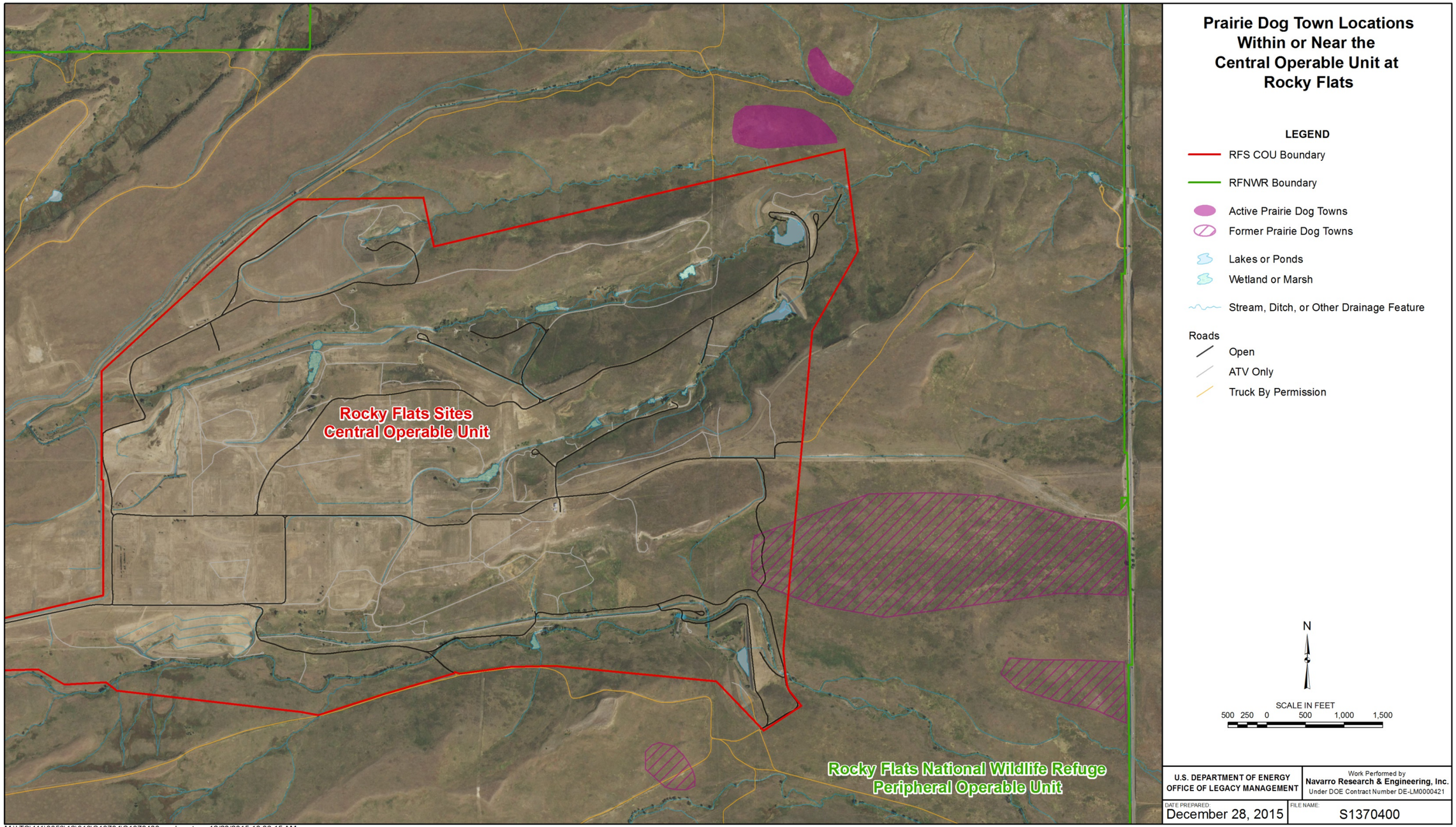

Figure 256. Prairie Dog Town Locations Within or Near the Central Operable Unit at Rocky Flats

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3.2.8.2 Nest Box Monitoring

Figure 257 shows the locations of the nest boxes in the COU at Rocky Flats. Table 99 summarizes the nest box observations made on May 12 and June 25–29, 2015. Fourteen of 21 nest boxes showed evidence of nesting activity in 2015. The species of birds observed using the nest boxes in 2015 included tree swallows (*Tachycineta bicolor*) and house wrens (*Troglodytes aedon*).

Table 99. Nest Box Summary 2015

Nest Box Number	Active Nest Yes/No	Species	Comments
1	N		Box partially full of twigs. Probably from a house wren.
2	N		Box full of twigs. Probably from a house wren.
3	N		Box full of twigs. Probably from a house wren.
5	Y	Tree Swallow	Bird sitting in nest box hole with head sticking out. Assumed active.
6	Y	Tree Swallow	Bird flew out on approach to box. Assumed active.
7	N		Box full of twigs. Probably from a house wren.
8	Y	Tree Swallow	One bird observed entering the nest box. Pair of birds flying around nest on approach to nest. Assumed active.
9	Y	Tree Swallow	One bird observed entering the nest box. Pair of birds flying around nest on approach to nest. Box full of nesting materials. Assumed active.
10	Y	Tree Swallow	One bird observed in box. Other bird flying around gathering and bringing food to the box entrance. Assumed active.
11	Y	House Wren	Box full of twigs. Wren sitting on nearby branch and bird poop was present on entrance to the box. Assumed active.
12	Y	Tree Swallow	Swallow sitting outside entrance hole on the box. Assumed active.
13	N		
14	N		
15	Y	Tree Swallow	One bird sitting with head out of the entrance hole. The other bird was sitting on a branch next to the hole. Assumed active.
16	Y	House Wren	Box full of twigs. Lots of bird poop outside the entrance to the box. Similar to #11. Assumed active.
17	Y	House Wren	Box full of twigs. Lots of bird poop outside the entrance to the box. Similar to #11. Assumed active.
18	Y	Tree Swallow	Both birds flying food to the nest box and entering or feeding young at the entrance hole.
19	Y	Tree Swallow	Bird feeding baby birds at entrance hole. Flying out and getting more food and feeding young again.
20	N		
21	Y	Tree Swallow	Bird sitting inside nest box with head out of the entrance hole. Assumed active.
22	Y	Tree Swallow	Bird flew to box and entered entrance hole. Then came out and caught insects to take to the nest box. Assumed active.

Notes: Nest box number 4 was destroyed when the tree it was installed on fell over several years ago.

3.2.8.3 Raptor Nesting Observations

In 2015, an active red-tailed hawk (*Buteo jamaicensis*) nest was observed in a cottonwood tree along the stream in Woman Creek within the COU (Figure 258). It is unknown whether any young fledged. Two Swainson's hawks (*Buteo swainsoni*) were observed trying to build a nest adjacent to the main road in a ponderosa pine tree in the west-central part of the COU (Figure 258). However, this nest never appeared to become active.

3.2.8.4 Game Camera Video

In fall 2015, the game camera was installed on a fencepost south of the Original Landfill in an area where elk (*Cervus canadensis*) often cross over the fence. A video of a large bull elk was captured with the camera on the evening of November 17, 2015. The video can be observed on the Ecology DVD by clicking on the link entitled, "Bull Elk Video" under the Game Camera Video section.

3.2.9 Preble's Meadow Jumping Mouse Mitigation Monitoring

The Preble's meadow jumping mouse is a federally listed threatened species under the Endangered Species Act (ESA) that lives in most of the stream drainages at the Site. Prior to Site closure, DOE conducted an ESA Section 7 consultation with USFWS on a Programmatic Biological Assessment (PBA) that addressed closure and post-closure activities that could have a potential impact on the Preble's mouse. The resulting Biological Opinion gave approval for the activities listed in the PBA. Mitigation was required for impacts to Preble's mouse habitat. As part of the mitigation process, monitoring of the mitigation efforts and reporting was also required. In 2015, vegetation monitoring and photopoint monitoring was conducted at various Preble's mouse mitigation locations in the COU. The results were summarized in an annual report that is due to USFWS by December 1 each year. One location met all the success criteria in 2015 and therefore concurrence was requested and received from the USFWS that no further monitoring is required at this locations. At those locations where the success criteria have not been met, monitoring will continue in 2016. Although the 2015 results are not discussed in this annual report, they are available in a separate 2015 report on Preble's meadow jumping mouse mitigation monitoring (DOE 2015a).

3.2.10 Wetland Monitoring

Projects that impact wetlands at Rocky Flats are required to mitigate for wetland impacts. Using the 1994 Rocky Flats wetlands map or more recent wetland delineations, potential impacts to wetlands are minimized during project design. Final wetland impacts that cannot be avoided are calculated after project completion and in situ wetland mitigation is designed and implemented.

Wetland mitigation monitoring is conducted to ensure the successful establishment of mitigation wetlands at the Site. Monitoring of mitigation wetlands begins as each project is completed, and for the first several years after initial wetland establishment, interim monitoring—consisting of qualitative and semiquantitative assessments of each of the wetland mitigation sites—is conducted. In addition, the wetlands are mapped annually, and noxious weeds are monitored and managed if necessary. About the fifth year after project completion, the mitigation wetlands are mapped and delineated following the current U.S. Army Corps of Engineers wetland delineation procedure.

Final wetland delineations and interim monitoring were conducted at several locations onsite in 2015. The monitored locations are shown in Figure 259. Figure 260 through Figure 263 show close-up views of the areas. The figures show only wetlands monitored in 2015 and whether or not they met wetland criteria in 2015. The monitored wetland locations in the figures below include GIS numbers; for example, Figure 260 includes the numeral "100," which is GIS #100. The GIS numbers are included in the data summary tables that are discussed later in the report. Background information for each wetland area and methodology are not described here but can be found in the more detailed wetland report found on the Ecology DVD.

Figure 257. Rocky Flats Site Nest Box Locations

Figure 258. Raptor Nest Locations, Central Operable Unit, Rocky Flats Site 2015

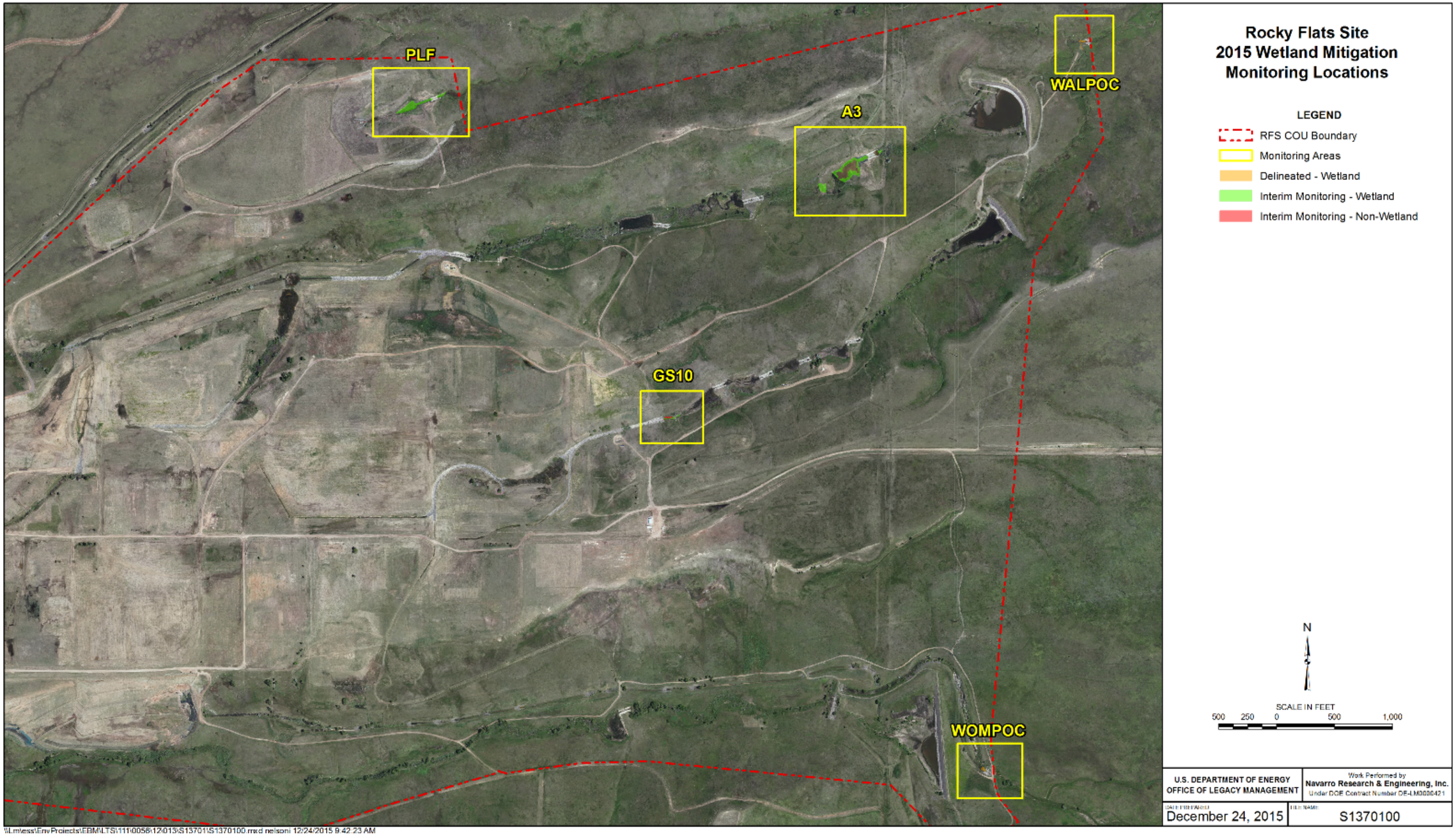

Figure 259. Rocky Flats Site 2015 Wetland Mitigation Monitoring Locations

Figure 260. Rocky Flats Site 2015 Wetland Mitigation Monitoring Locations: A-3 Dam Breach Area

Figure 261. Rocky Flats Site 2015 Wetland Mitigation Monitoring Locations: PLF Area

Rocky Flats Site
2015 Wetland Mitigation
Monitoring Locations
POC Flumes

LEGEND

Delineated 2015 - Wetland

RFS COU Boundary

Numbers represent GIS#'s found in the report and tables.

N

SCALE IN FEET

500 250 0 500 1,000

U.S. DEPARTMENT OF ENERGY OFFICE OF LEGACY MANAGEMENT	Work Performed by Navarro Research & Engineering, Inc. Under DOE Contract Number DE-LM0000421
DATE PREPARED: December 28, 2015	FILE NAME: S1370000

M:\LTS\111\0056\12\013\S13700\S1370000.mxd coatesc 12/28/2015 9:45:17 AM

Figure 262. Rocky Flats Site 2015 Wetland Mitigation Monitoring Locations: POC Flumes

Figure 263. Rocky Flats Site 2015 Wetland Mitigation Monitoring Locations: GS10

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3.2.10.1 Woody Plant Species

Table 100 lists the number of woody plants of different species found at each monitored location in 2015. At most locations where the originally installed plants survived the first year (typically coyote willow), plants have begun to spread and fill in the surrounding areas. Where clumps of willows had intact root systems after project disturbance, plants have come up and continued to spread. At many locations, volunteers of false indigo (*Amorpha fruticosa*), coyote willow, peachleaf willow (*Salix amygdaloides*), plains cottonwood, snowberry (*Symphoricarpos occidentalis*), Arkansas rose (*Rosa arkansana*), and narrowleaf cottonwood (*Populus angustifolia*) seedlings have come in on their own. The seed source was most likely nearby established plants or seed brought in by wildlife. Cottonwoods and willows require an open, scoured area for seedlings to germinate and survive; areas of open, bare ground that were available after wetland projects were completed created ideal germination conditions for these species.

Table 100. 2015 Woody Plant Summary at Wetland Mitigation Locations

Location	GIS #	Coyote Willow (SAEX1)	Peach Leaf Willow (SAAM1)	False Indigo (Lead Plant) (AMFR1)	Snowberry (SYOC1)	Arkansas Rose (ROAR1)	Narrowleaf Cottonwood (POAN1)	Cottonwood (PODE1)
WALPOC Wetland - A	94	TN						
WALPOC Wetland - B	95					3		
WOMPOC Wetland - A	96	6	6	4				3
WOMPOC Wetland - B	97			12			1	
A-3 Wetland - A	98a	TN						
A-3 Wetland - B	99	20						
A-3 Wetland - C	100	TN						
A-3 Wetland - D	98b	24						
PLF Wetland - A	101	TN						1
PLF Wetland - B	102	17	5					6
GS10-A	103a	35						
GS10-B	104	12						
GS10-C	103b	TN			1			

Notes: TN = too numerous to count

3.2.10.2 Noxious Weed Species

Weed species recorded in 2015 at the various mitigation wetlands included Canada thistle, common mullein, and sowthistle. These species are listed on the Colorado Noxious Weed list (8 CCR 1206-2). The weed surveys for each wetland are available on the Ecology DVD under the appropriate wetland link. Weed control activities in the mitigation wetlands are conducted as part of the normal natural resource management operations at the Site.

3.2.10.3 Climate Information

The average yearly precipitation received at the Site from 1992 to 2011 is 15.67 inches (based on data from the National Renewable Energy Laboratory [NREL] NWTC M2 Tower and former Rocky Flats Meteorological Tower). In 2012, the precipitation data from the NREL facility became inconsistent and were no longer found to be accurate due to missing data after storm events. Data from Boulder, Colorado, north of the Rocky Flats Site, are now used as an

approximate measure of Site precipitation (USDC 2016). On the basis of a comparison of precipitation data from the Rocky Flats Site and Boulder locations from 1992 through 2011, the Site received an average of approximately 5 inches of rainfall per year less than Boulder, but rainfall patterns are generally the same. In 2015, Boulder received 26.92 inches of precipitation with the largest amounts coming in April (4.5 inches) and May (7.82 inches). The average annual precipitation in Boulder from 1894 through 2015 is 19.11 inches. Thus, Boulder and presumably the Site received above normal precipitation for 2015. In fact, the total average annual precipitation had already been received by July in 2015 in Boulder.

3.2.10.4 Wetland Monitoring Data

Table 101 summarizes early growing-season water-level observations at the various wetlands for 2015. These data were collected from April 13 through June 24, 2015. In general, hydrologic conditions have been suitable for continued wetland establishment at each of the wetlands monitored in 2015 (with the exception of GS10-C). The specific hydrologic data for each wetland when it was monitored in 2015 can be found on each wetland's Wetland Determination Data Form on the Ecology DVD.

Table 102 summarizes the species richness and cover data collected in 2015 that were used to determine whether hydrophytic vegetation was present at each wetland. The yellow cells in the table represent the dominant species as determined by the 50/20 rule at each location. The orange cells represent locations where the total herbaceous, shrub, or tree cover, within each respective vegetation layer, was less than 5 percent and, therefore, below the threshold to be considered a separate vegetated layer.

The bottom of Table 102 summarizes the hydrophytic vegetation, hydric soils, and wetland hydrology results at the 13 locations monitored in 2015. Green cells represent locations where all wetland indicator criteria (hydrophytic vegetation, wetland hydrology, and hydric soils) were met, and pink cells represent locations where one or more wetland indicator criteria were not met. Final wetland delineations were conducted at the WALPOC (GIS #94 and #95) and WOMPOC (GIS #96 and #97) wetland locations, each of which met all three wetland criteria. At the remaining 9 locations where interim monitoring was conducted, all but one location (GS10-C; GIS #103b) met all three wetland criteria. Table 103 summarizes the areal extent (in acres) of each of the interim monitored wetlands in 2015. The total potential wetland acreage is approximately 0.67 acre as of 2015. Wetland Determination Data Forms, Wetland Qualitative Revegetation Evaluation Forms, and weed surveys for each monitored wetland area are available through links on the Ecology DVD. Time-series photo monitoring for the wetlands is also available through the "2015 Wetland Monitoring Photopoint Photos" link on the Ecology DVD.

Table 101. 2015 Wetland Water Levels Data Summary

		4/13/2015		4/20/2015		4/28/2015		5/5/2015		5/11/2015	
Location	**GIS #**	**Water Depth (in.)**	**Saturated at Surface**	**Water Depth (in.)**	**Saturated at Surface**	**Water Depth (in.)**	**Saturated at Surface**	**Water Depth (in.)**	**Saturated at Surface**	**Water Depth (in.)**	**Saturated at Surface**
WALPOC Wetland - A	94	0-4	Y	0-8	Y	0-8	Y	0-9	Y	0-14	Y
WALPOC Wetland - B	95	0-6	Y	0-10	Y	0-11	Y	0-10	Y	0-15	Y
WOMPOC Wetland - A	96	0-5	Y	0-6	Y	0-9	Y	0-10	Y	0-20	Y
WOMPOC Wetland - B	97	0-28	Y	0-24	Y	0-30	Y	0-36	Y	0-28	Y
A-3 Wetland - A	98a	0-8	Y	0-9	Y	0-10	Y	0-11	Y	0-11	Y
A-3 Wetland - B	99	0-36	Y	0-40	Y	0-40	Y	0-40	Y	0-42	Y
A-3 Wetland - C	100	0-2	Y	0-5	Y	0-5	Y	0-6	Y	0-6	Y
A-3 Wetland - D	98b	0-2	Y	0-3	Y	0-4	Y	0-5	Y	0-5	Y
PLF Wetland - A	101	0-6	Y	0-7	Y	0-8	Y	0-8	Y	0-9	Y
PLF Wetland - B	102	0-24	Y	0-25	Y	0-28	Y	0-26	Y	0-27	Y
GS10-A	103a	0-6	Y	0-6	Y	0-8	Y	0-8	Y	0-9	Y
GS10-B	104	0-6	Y	0-6	Y	0-8	Y	0-8	Y	0-8	Y
GS10-C	103b	0	N	0	N	0	N	0	N	0	N

		5/21/2015		5/26/2015		6/4/2015		6/8/2015		6/15/2015		6/24/2015	
Location	**GIS #**	**Water Depth (in.)**	**Saturated at Surface**	**Water Depth (in.)**	**Saturated at Surface**	**Water Depth (in.)**	**Saturated at Surface**	**Water Depth (in.)**	**Saturated at Surface**	**Water Depth (in.)**	**Saturated at Surface**	**Water Depth (in.)**	**Saturated at Surface**
WALPOC Wetland - A	94	0-12	Y	0-8	Y	0-6	Y	0-10	Y	0-7	Y	0-6	Y
WALPOC Wetland - B	95	0-12	Y	0-10	Y	0-6	Y	0-10	Y	0-8	Y	0-6	Y
WOMPOC Wetland - A	96	0-18	Y	0-14	Y	0-4	Y	0-8	Y	0-7	Y	0-4	Y
WOMPOC Wetland - B	97	0-36	Y	0-28	Y	0-30	Y	0-36	Y	0-28	Y	0-30	Y
A-3 Wetland - A	98a	0-10	Y	0-10	Y	0-8	Y	0-9	Y	0-8	Y	0-8	Y
A-3 Wetland - B	99	0-43	Y	0-41	Y	0-40	Y	0-40	Y	0-40	Y	0-38	Y
A-3 Wetland - C	100	0-5	Y	0-7	Y	0-3	Y	0-6	Y	0-3	Y	0-2	Y
A-3 Wetland - D	98b	0-4	Y	0-4	Y	0-2	Y	0-3	Y	0-2	Y	0-2	Y
PLF Wetland - A	101	0-7	Y	0-7	Y	0-7	Y	0-7	Y	0-7	Y	0-7	Y
PLF Wetland - B	102	0-28	Y	0-28	Y	0-25	Y	0-28	Y	0-24	Y	0-24	Y
GS10-A	103a	0-11	Y	0-8	Y	0-10	Y	0-10	Y	0-7	Y	0-7	Y
GS10-B	104	0-12	Y	0-8	Y	0-6	Y	0-10	Y	0-7	Y	0-7	Y
GS10-C	103b	0	N	0	N	0	N	0	N	0	N	0	N

Notes:
GIS #98b and GIS #103b water levels are estimated because these areas were split out during the wetland monitoring activities, which were conducted later in the summer.
In. = inches

Table 102. 2015 Wetland Vegetation Data Summary

Herbaceous Cover					A-3 Wetlands				GS10			PLF		WALPOC		WOMPOC	
				GIS#	98a	99	100	98b	103a	104	103b	101	102	94	95	96	97
Scientific Name	Speccode	Growth Form	Noxious Weed	Wetland Indicator	A3-A	A3-B	A3-C	A3-D	GS10-A	GS10-B	GS10-C	PLF-A	PLF-B	WALPOC-A	WALPOC-B	WOMPOC-A	WOMPOC-B
Alisma triviale Pursh	ALTR1	F		OBL			0.25									0.25	
Ambrosia psilostachya DC.	AMPS1	F		FACU	0.25												
Barbarea vulgaris R. Br.	BAVU1	F		FAC		1											
Cirsium arvense (L.) Scop.	CIAR1	F	X	FAC	0.25	0.25	0.25		0.25		0.25	0.25			0.25	0.25	
Conyza canadensis (L.) Cronq.	COCA1	F		XX	0.25						0.25	0.25					0.25
Cynoglossum officinale L.	CYOF1	F	X	FACU							0.25						
Epilobium ciliatum Raf. ssp. glandulosum (Lehm.) Hock & Raven	EPCI1	F		FACW			0.25					0.25	0.25				
Hypericum perforatum L.	HYPE1	F	X	FACU							0.25						
Lactuca serriola L.	LASE1	F		FACU							0.25						
Lepidium campestre (L.) R. Br.	LECA1	F		XX									0.25				
Lycopus americanus Muhl. ex Barton	LYAM1	F		OBL								0.25					
Mentha arvensis L.	MEAR1	F		FACW							0.25	0.25	0.25			0.25	
Oenothera villosa Thunb. ssp. strigosa (Rydb.) Dietrich & Raven	OEVI1	F		FAC							0.25	0.25					
Plantago major L.	PLMA1	F		FAC	0.25												
Potamogeton natans L.	PONA1	F		OBL								1	0.25				
Rumex crispus L.	RUCR1	F		FAC	0.25		0.25				0.25		0.25	0.25		2	0.25
Rumex maritimus L.	RUMA1	F		FACW												0.25	
Sonchus arvensis L. ssp. uliginosus (Bieb.) Nyman	SOAR2	F	X	FACU								0.25					
Veronica anagallis-aquatica L.	VEAN1	F		OBL		0.25			2			0.25		0.25		25	
Verbascum thapsus L.	VETH1	F	X	FACU							0.25						
Xanthium strumarium L.	XAST1	F		FAC	0.25		2										
Agropyron caninum (L.) Beauv. ssp. majus (Vasey) C. L. Hitchc.	AGCA1	G		FAC			0.25		3	5	3			1			0.25
Agropyron repens (L.) Beauv.	AGRE1	G	X	FAC	0.25												
Agrostis stolonifera L.	AGST1	G		FAC					0.25			0.25	0.25	8		2	4
Bromus inermis Leyss. ssp. inermis	BRIN1	G		FAC	0.25						15						
Carex nebrascensis Dew.	CANE1	G		OBL	0.25							1	0.25	1			
Echinochloa crus-galli (L.) Beauv.	ECCR1	G		FAC	0.25	2	1							1			0.25
Eleocharis macrostachya Britt.	ELMA1	G		OBL	15		3		1	4		2	1	30		15	
Festuca pratensis Huds.	FEPR1	G		XX					0.25						0.25		
Hordeum jubatum L.	HOJU1	G		FAC	2	4	20					0.25		25			
Juncus balticus Willd.	JUBA1	G		FACW					0.25			0.25	10		8		
Juncus torreyi Cov.	JUTO1	G		FACW					1			15	10			3	
Panicum virgatum L.	PAVI1	G		FACW	0.25							0.25	1				
Poa compressa L.	POCO1	G		FACU	0.25		0.25								2		0.25
Polypogon monspeliensis (L.) Desf.	POMO1	G		FACW	1	22	35	65	40	50		0.25	0.25	0.25		0.25	8
Poa pratensis L.	POPR1	G		FAC											0.25		
Scirpus acutus Muhl.	SCAC1	G		OBL	1	1	0.25		14			35	25			2	
Scirpus maritimus L. var. paludosus (A. Nels.) Kukenth.	SCMA1	G		OBL	20		7					4	8	2			
Scirpus pallidus (Britt.) Fern	SCPA1	G		OBL												1	
Scirpus pungens Vahl	SCPU1	G		OBL									0.25				
Typha angustifolia L.	TYAN1	G		OBL	45	0.25	2		5	6		25	32	0.25		30	
Total Herbaceous Foliar Cover					87.00	30.75	71.75	65.00	67.00	65.00	20.25	86.25	89.25	69.00	10.75	81.25	13.25
50/20 Rule: 50% of Total Cover					43.50	15.38	35.88	32.50	33.50	32.50	10.13	43.13	44.63	34.50	5.38	40.63	6.63
50/20 Rule: 20% of Total Cover					17.40	6.15	14.35	13.00	13.40	13.00	4.05	17.25	17.85	13.80	2.15	16.25	2.65
Total Noxious Weed Cover					0.50	0.25	0.25	0.00	0.25	0.00	1.00	0.50	0.00	0.00	0.25	0.25	0.00

Values in the table represent absolute foliar cover.

Shrub/Sapling Cover					A-3 Wetlands				GS10			PLF		WALPOC		WOMPOC	
				GIS#	98a	99	100	98b	103a	104	103b	101	102	94	95	96	97
Scientific Name	Speccode	Growth Form	Noxious Weed	Wetland Indicator	A3-A	A3-B	A3-C	A3-D	GS10-A	GS10-B	GS10-C	PLF-A	PLF-B	WALPOC-A	WALPOC-B	WOMPOC-A	WOMPOC-B
Amorpha fruticosa L.	AMFR1	S		FACW												1	50
Populus angustifolia James	POAN3	S		FACW													2
Populus deltoides Marsh. ssp. monilifera (Ait.) Eckenw.	PODE1	S		FAC								0.25	0.25			0.25	
Rosa arkansana Porter	ROAR1	S		FACU											0.25		
Salix amygdaloides Anderss.	SAAM1	S		FACW									0.25			0.25	
Salix exigua Nutt. ssp. interior (Rowlee) Cronq.	SAEX1	S		FACW	25	15	20		8	7	85	7	0.25	15		0.25	
Symphoricarpos occidentalis Hook.	SYOC1	S		FAC							0.25						
Total Shrub/Sapling Foliar Cover					25.00	15.00	20.00	0.00	8.00	7.00	85.25	7.25	0.75	15.00	0.25	1.75	52.00
50/20 Rule: 50% of Total Cover					12.50	7.50	10.00	0.00	4.00	3.50	42.63	3.63	0.38	7.50	0.13	0.88	26.00
50/20 Rule: 20% of Total Cover					5.00	3.00	4.00	0.00	1.60	1.40	17.05	1.45	0.15	3.00	0.05	0.35	10.40
Total Noxious Weed Cover					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Values in the table represent absolute foliar cover.

Tree Cover					A-3 Wetlands				GS10			PLF		WALPOC		WOMPOC	
				GIS#	98a	99	100	98b	103a	104	103b	101	102	94	95	96	97
Scientific Name	Speccode	Growth Form	Noxious Weed	Wetland Indicator	A3-A	A3-B	A3-C	A3-D	GS10-A	GS10-B	GS10-C	PLF-A	PLF-B	WALPOC-A	WALPOC-B	WOMPOC-A	WOMPOC-B
Populus angustifolia James	POAN3	T		FACW													25
Total Tree Foliar Cover					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00
50/20 Rule: 50% of Total Cover					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.50
50/20 Rule: 20% of Total Cover					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
Total Noxious Weed Cover					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Values in the table represent absolute foliar cover.

Hydrophytic Vegetation Indicator 1: Dominance Test					A-3 Wetlands				GS10			PLF		WALPOC		WOMPOC	
				GIS #	98a	99	100	98b	103a	104	103b	101	102	94	95	96	97
Wetland Indicator				Wetland Indicator	A3-A	A3-B	A3-C	A3-D	GS10-A	GS10-B	GS10-C	PLF-A	PLF-B	WALPOC-A	WALPOC-B	WOMPOC-A	WOMPOC-B
Obligate Species				OBL	2				1			2	2	1		2	
Facultative Wet Species				FACW	1	2	2	1	2	2	1	1		1	1		2
Facultative Species				FAC			1				1			1			1
Facultative Upland Species				FACU													
Upland Species (includes all species not listed as OBL, FACW, FAC, & FACU)				UPL													
# Dominant Species That Are OBL, FACW, or FAC					3	2	3	1	3	2	2	3	2	3	1	2	3
Total # Dominant Species Across All Strata					3	2	3	1	3	2	2	3	2	3	1	2	3
% of Dominant Species That Are OBL, FACW, or FAC					100	100	100	100	100	100	100	100	100	100	100	100	100

Values in the table represent the number of dominant species in each category.

					A-3 Wetlands				GS10			PLF		WALPOC		WOMPOC	
				GIS #	98a	99	100	98b	103a	104	103b	101	102	94	95	96	97
Wetland Determination					A3-A	A3-B	A3-C	A3-D	GS10-A	GS10-B	GS10-C	PLF-A	PLF-B	WALPOC-A	WALPOC-B	WOMPOC-A	WOMPOC-B
Hydophytic Vegetation Present? Y/N					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hdyric Soils Present? Y/N*					Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Wetland Hydrology Indicators Present? Y/N					Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Is the Sampled Area a Wetland? Y/N					Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y

	Dominant Species based on 50/20 rule from the Western Mountains, Valleys, and Coast Region Regional Supplement - May 2010.
	Total Absolute Vegetation Cover less than 5 percent.
	Passed Test
	Failed Test
*	Mitigation area - interim monitoring conducted in 2015. No soil pits dug in 2015. Soils considered hydric if both hydrophytic vegetation and wetland hydrology present.

Table 103. Areal Extent of Interim Monitored Wetlands in 2015

Location	GIS#	Acres	Delineated in 2015	Wetland Y/N
Non-CERCLA Mitigation Interim Monitoring				
A3-A	98a	0.2529	N	Y
A3-B	99	0.0096	N	Y
A3-C	100	0.0891	N	Y
A3-D	98b	0.0514	N	Y
PLF-A	101	0.2189	N	Y
PLF-B	102	0.0277	N	Y
	Total Potential Wetland	0.6497		
CERCLA Mitigation Interim Monitoring				
GS10-A	103a	0.0203	N	Y
GS10-B	104	0.0030	N	Y
GS10-C	103b	0.0099	N	N
	Total Potential Wetland	0.0233		
	Total Non-Wetland	0.0099		
	Grand Total Potential Wetland	0.6730		
	Grand Total Non-Wetland	0.0099		

3.2.10.5 Wetland Delineations

Wetland mitigation at the Site is being done on a sitewide basis, rather than project by project, unless it can be completely done in situ (such as at the PLF and A-3 project areas), due to the difficulty of reestablishing wetlands where specific project activities have often highly altered the vegetation, hydrology, and soils. The overall goal is no net loss of wetlands at the Site. The mitigation ratio at the Site is conducted at a 1:1 ratio for comparable plant communities (Claggett 2005). A mitigation ratio of no greater than 1:1 is also important to satisfy the Colorado Division of Water Resources requirements, which require water rights for in situ mitigation greater than 1:1.

The *Annual Report of Site Surveillance and Maintenance Activities at the Rocky Flats, Colorado, Site, Calendar Year 2013* (DOE 2014b) closed out the pre-closure and selected post-closure wetland impacts and mitigation monitoring, along with the *Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan* (DOE 2006b). That report included an accounting for the impacted and compensatory mitigation acreages.

Impacts to wetlands at the Site, during and since Site closure, have been classified as either CERCLA-related or non-CERCLA related and tracked separately. Table 104 lists the wetland impacts from recent CERCLA-related or non-CERCLA-related projects for which mitigation monitoring has been ongoing. The total debit from both categories of impacts combined as of the end of 2015 is approximately −0.45 acre.

Final wetland delineations were made in 2015 for the WALPOC (GIS #94 and #95) and WOMPOC (GIS #96 and #97) wetland locations (Figure 262), each of which met all three wetland criteria. A total of 0.0531 acre of wetland credit was achieved from both of these locations combined (Table 105). This credit is also shown as a credit in Table 104 for the Point of Compliance Flume Project (the project that each of these flumes were part of), leaving a debit balance of approximately −0.40 acre. As the other wetland mitigation locations continue to establish, this debit should disappear over the next few years.

Table 104. Current Wetland Impacts From CERCLA Related and Non-CERCLA Related Projects at Rocky Flats

CERCLA On-going Projects

Project Description	Actual Wetland Acres Disturbed (Debits)	Mitigation Wetland Acres (Credit)	Balance
Point of Compliance Flume Project	-0.1279	0.0531	-0.0748
GS10 Flume Project	-0.0409	In Process	-0.0409
OLF Project	-0.0451	In Process	-0.0451
Total	-0.2139	0.0531	-0.1608

Ongoing USACE Permitted Projects

Project	NWP #	Permit #	Permit Date	Specified Compensatory Mitigation	Mitigation Acres Required in NWP (Debits)	Actual Wetland Acres Disturbed	Mitigation Credit	Balance
PLF/A-3 Dam Breach	43	NOW-2011-2455-DEN	11/18/2011	Yes	0.24	-0.1703	In Process	-0.2400
				Total	0.24	-0.1703	0	-0.2400

Table 105. 2015 Wetland Mitigation Credit at the Rocky Flats Site

Delineation Year	Location	GIS#	Acres	Wetland Y/N
CERCLA Mitigation Credit				
2015	WALPOC-A	94	0.0286	Y
2015	WALPOC-B	95	0.0003	Y
2015	WOMPOC-A	96	0.0216	Y
2015	WOMPOC-B	97	0.0025	Y
		Total	0.0531	

3.2.11 Summary

The Ecology Program at the Site conducts monitoring of the ecological resources to ensure regulatory compliance and to preserve, protect, and manage those resources. Proactive management of the natural resources is critical to the long-term sustainability of the ecosystems at the Site. Noxious weeds continue to be a priority, as does the revegetation of the COU. Data from 2015 documented the continuing establishment of vegetation at revegetation locations. Noxious weed control activities and additional habitat management activities were conducted during 2015 to improve and enhance the vegetation at the Site. Preble's mouse mitigation monitoring continued to document the establishment of Preble's habitat at several locations. Wetland mitigation was closed out at two locations and interim monitoring documented the establishment of additional wetland mitigation for ongoing projects. Overall, the monitoring results continue to provide useful information for management activities. Full, detailed reports and analyses for each field monitoring effort are presented as stand-alone reports on the Ecology DVD included with this report.

3.3 Data Management

3.3.1 Water Data

Data from samples submitted to an analytical laboratory are received in both hard copy and electronic data deliverable formats. The electronic data are loaded into an Oracle-based relational database. The environmental monitoring data are accessible using the SEEPro (Site Environmental Evaluation for Projects) application. The hard-copy analytical reports are archived in the records library in Grand Junction, Colorado, along with the original field data forms and other relevant hard-copy forms or documents containing project data. Well construction and lithology logs are maintained for previously drilled wells and are produced for all new wells drilled. These logs are archived in the records library and can also be accessed electronically via the SEEPro database and GEMS (Geospatial Environmental Mapping System).

SEEPro uses Oracle software for data management and Microsoft Access for data retrieval and display. It compiles water quality, air quality, field parameter, sample-tracking, sample location, and water-level data for groundwater, surface water, boreholes, soils, and sediment samples. Field parameter data include such information as sample location, sample date, pH, turbidity, conductivity, and temperature. Chemical information (Chemical Abstracts Service registry numbers, analytical results, and detection limits) is also included. Data managers follow specific procedures for verification of database information received from subcontractors or verification