

## 3.2 Ecological Monitoring

### 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 ecological monitoring that was conducted at the Site during 2011. It includes a brief summary of the monitoring conducted for Preble's meadow jumping mouse (*Zapus hudsonius preblei*; Preble's mouse) mitigation and wetland mitigation activities; however, the details of those monitoring efforts are summarized in separate regulatory reports provided to the appropriate agencies.

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 sp.*), 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 and 484 acres in the POU. A summary of the highlights from the 2011 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. Objectives of the vegetation monitoring in 2011 were to:

- Identify any new plant species not found at the Site previously.
- Identify and document infestations of selected noxious weeds at the Site to assist with the planning of noxious weed control applications.
- Document and track herbicide applications in 2011.

- Document where revegetation activities were conducted in 2011.
- Conduct photomonitoring for visual documentation of changes in vegetation establishment at the Site.

### 3.2.2.1 Site Flora

The complete list of plant species known to be at the Site at the end of 2011 is available on the ecology DVD. The Site species list includes the complete flora of both the COU and the POU. The vascular flora of the Site consists of 633 species of plants. One new record of vascular plant species for the Site flora is reported. Honey locust (*Gleditsia triacanthos*), an ornamental tree, was collected from the former Building 850 area in the COU. The following taxonomic name will be used at the Site for the new plant species record<sup>21</sup>:

Family	Scientific Name	Speccode	Common Name
Caesalpinaceae	<i>Gleditsia triacanthos</i> L.	GLTR1	Honey locust

Voucher specimens of the species will be deposited at the University of Colorado Herbarium in Boulder, Colorado.

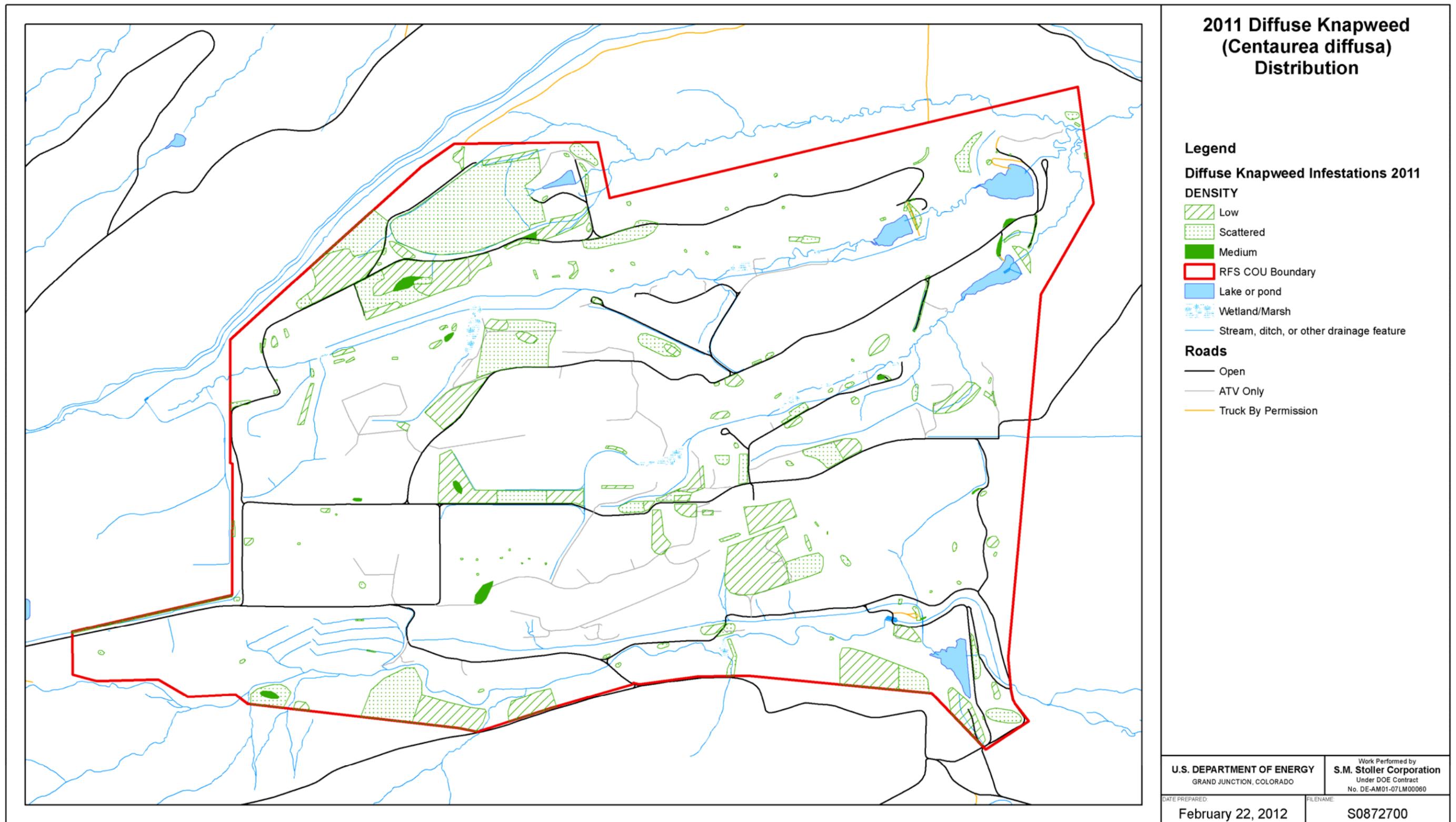
### 3.2.2.2 Weed Mapping and Weed Control

Figure 266 and Figure 267 show the 2011 weed distribution maps for diffuse knapweed and Dalmatian toadflax, respectively. Table 104 shows the estimated total acreage and acreage-by-density categories for each species, based on the mapping data from 2007 through 2011. The total area of the COU is approximately 1,308 acres. In 2011, diffuse knapweed was observed on approximately 158 acres at various levels of infestation. Dalmatian toadflax was mapped on approximately 49 acres in 2011. Both species have shown a steady decrease in acreage since 2009. Annual fluctuations in the abundance of many grassland species are not uncommon as they respond to changes in temperature, precipitation amounts, timing of precipitation, and other environmental factors. Some areas have also been treated with herbicides.

Additional species that were mapped based on fortuitous observations in 2011 included Scotch thistle, leafy spurge, whitetop, Russian olive, salt cedar/tamarix, and jointed goatgrass. Figure 268 shows the locations of these species as mapped in 2011. No acreages are provided for these species since the polygons simply show the general location of the infestations.

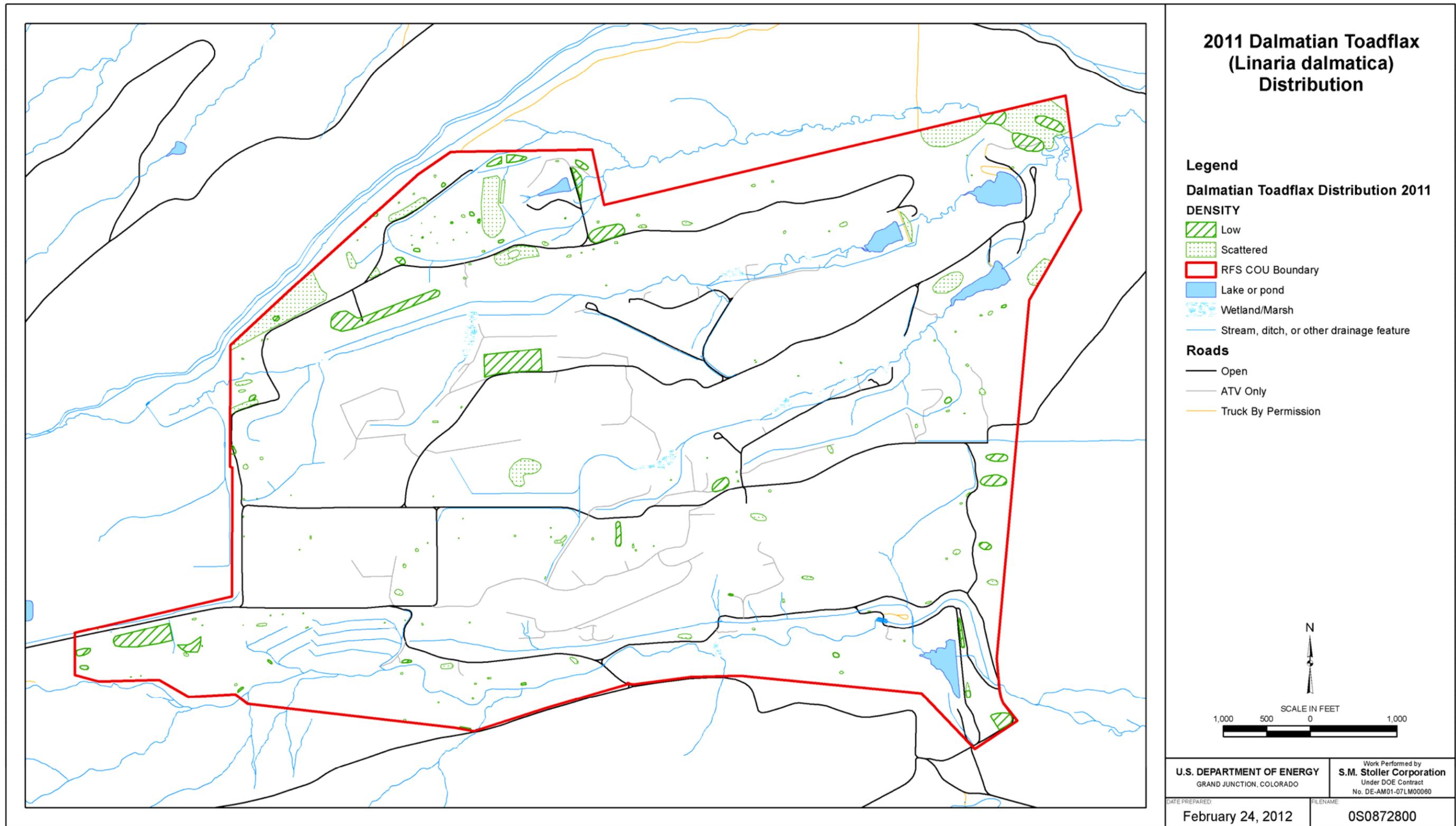
During 2011, approximately 300 acres were treated with herbicides at the Site via ground application (Figure 269). Table 105 lists the target species, herbicides used, application rates and the approximate timing of the application during the year. (**Note:** Multiple herbicides are listed at some locations. This does not mean that each herbicide was used across that entire location. Rather, depending on site-specific characteristics such as target weed species, the locations of water bodies, soil types, and the professional judgment of the licensed herbicide applicator, different herbicides were used within that location to provide the control needed.)

<sup>21</sup> Nomenclature follows GPFA (1986), Weber (1976), Weber (1990), Weber and Wittmann (1992), and Weber and Wittmann (2001), in that order of determination. Species were verified at the University of Colorado Herbarium in Boulder, Colorado.



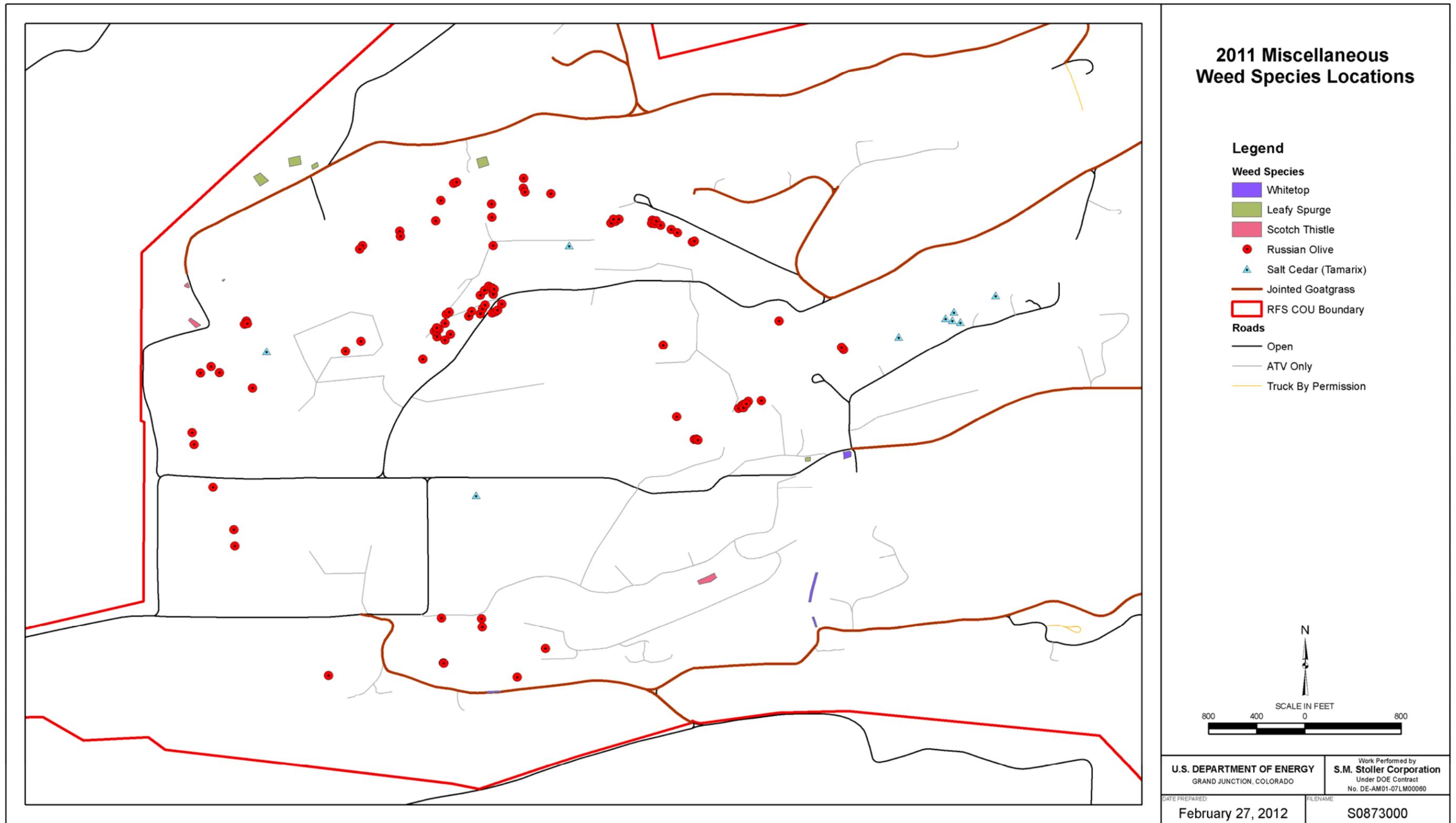
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Figure 266. 2011 Diffuse Knapweed (Centaurea diffusa) Distribution at Rocky Flats



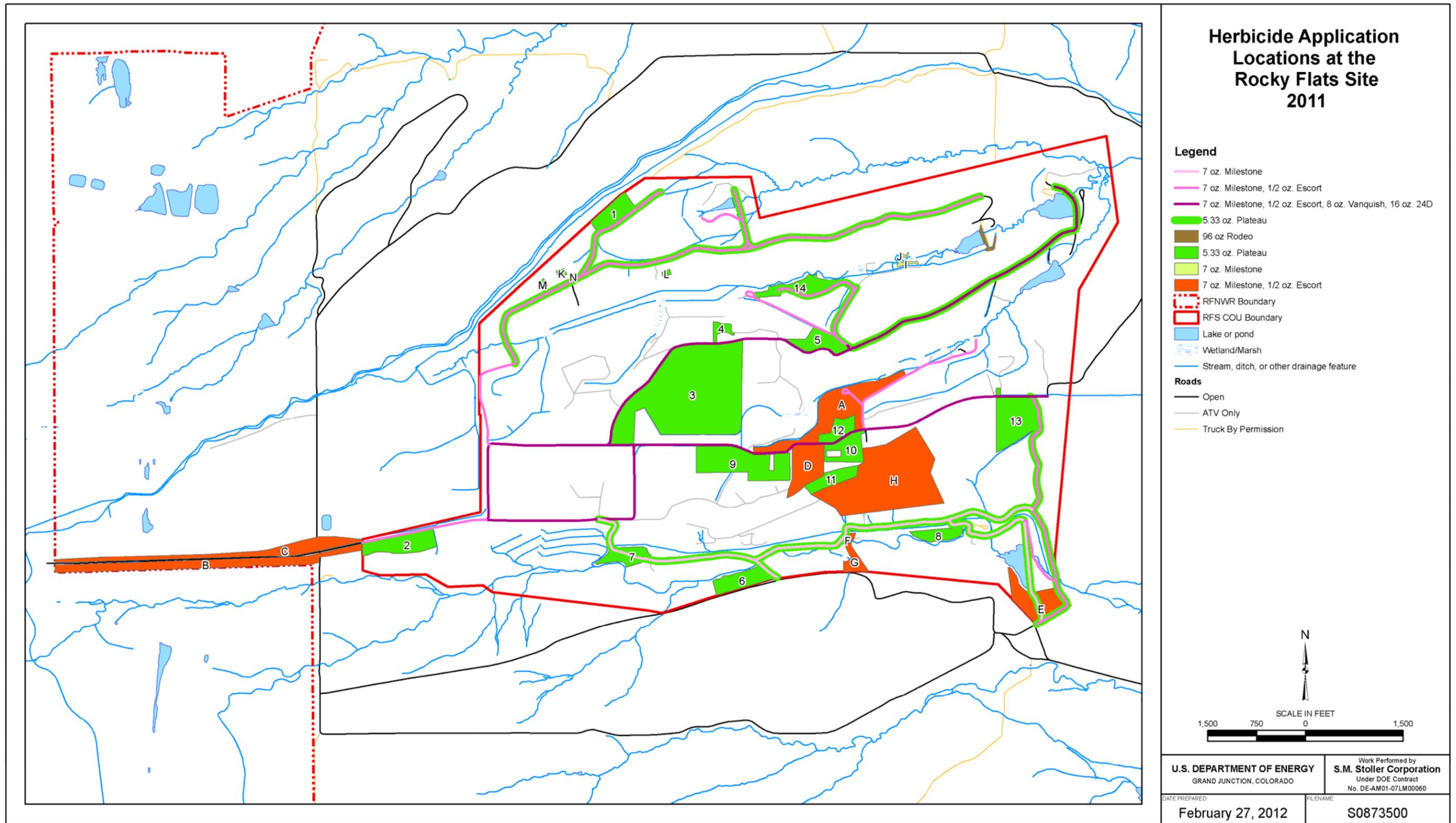
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Figure 267. 2011 Dalmation Toadflax (Linaria dalmatica) Distribution at Rocky Flats



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Figure 268. 2011 Miscellaneous Weed Species Locations at Rocky Flats



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Figure 269. 2011 Herbicide Application Locations at the Rocky Flats Site

Table 104. COU Noxious Weed Acreage Summary (2007–2011)

Species	Density (acres)				Total	% of Total COU
	High	Medium	Low	Scattered		
<b>Diffuse knapweed</b>						
2007	2.2	41.2	248.8	167.7	459.9	35
2008	1.8	20.6	110.0	147.5	279.9	21
2009	1.6	44.6	231.2	147.5	424.9	32
2010	0.1	10.6	155.0	64.3	230.1	18
2011	0.0	2.8	77.1	77.7	157.6	12
<b>Dalmatian toadflax</b>						
2007	77.1	51.0	0.0	109.0	237.1	18
2008	0	0	54.3	151.8	206.1	16
2009	2.1	16.8	56.5	386.7	462.1	35
2010	0.0	2.1	64.2	101.4	167.7	13
2011	0.0	0.0	19.9	29.0	48.9	4

Table 105. FY 2011 Herbicide Application Summary

Location	Target Species <sup>a</sup>	Treatment <sup>b</sup> (Rate/Acre)	Actual Acreage Treated <sup>c</sup>	Time of Year Treated
1	CEDI1	7 oz. Milestone, 1/2 oz. Escort	4.4	Spring 2011
2	CEDI1, VETH1	7 oz. Milestone, 1/2 oz. Escort	6.6	Spring 2011
3	CEDI1, VETH1	7 oz. Milestone, 1/2 oz. Escort	53.0	Spring 2011
4	CEDI1	7 oz. Milestone, 1/2 oz. Escort	1.5	Spring 2011
5	CEDI1, DACA1	7 oz. Milestone, 1/2 oz. Escort	4.5	Spring 2011
6	CEDI1, VETH1, LIDA1	7 oz. Milestone, 1/2 oz. Escort	4.8	Spring 2011
7	CEDI1	7 oz. Milestone, 1/2 oz. Escort	3.9	Spring 2011
8	CEDI1, CACH1, VETH1	7 oz. Milestone, 1/2 oz. Escort	2.8	Spring 2011
9	CEDI1	7 oz. Milestone, 1/2 oz. Escort	14.5	Spring 2011
10	CEDI1, DACA1	7 oz. Milestone, 1/2 oz. Escort	4.5	Spring 2011
11	CEDI1	7 oz. Milestone, 1/2 oz. Escort	4.5	Spring 2011
12	CEDI1, VETH1, COAR1	7 oz. Milestone, 1/2 oz. Escort	3.0	Spring 2011
13	CEDI1, VETH1	7 oz. Milestone, 1/2 oz. Escort	10.5	Spring 2011
14	CEDI1, HEMA1, CIAR1, VETH1	7 oz. Milestone, 1/2 oz. Escort	4.7	Spring 2011
Spring Roads	CEDI1, MEOF1, CADR1, CIAR1, VETH1	7 oz. Milestone, 1/2 oz. Escort, 8 oz. Vanquish, 16 oz. 2,4D	50.7	Spring 2011
Riprap Dam Faces	Total Kill	96 oz. Rodeo	0.6	Spring 2011
A	CEDI1, VETH1, CIAR1	7 oz. Milestone, 1/2 oz. Escort	15.0	Fall 2011
B	CEDI1, VETH1	7 oz. Milestone, 1/2 oz. Escort	13.5	Fall 2011
C	CEDI1, VETH1	7 oz. Milestone, 1/2 oz. Escort	11.0	Fall 2011
D	CEDI1, VETH1, CIAR1	7 oz. Milestone, 1/2 oz. Escort	7.0	Fall 2011
E	CEDI1, VETH1	7 oz. Milestone, 1/2 oz. Escort	8.0	Fall 2011
F	CEDI1, VETH1, CIAR1	7 oz. Milestone, 1/2 oz. Escort	0.6	Fall 2011
G	CEDI1, VETH1, CIAR1	7 oz. Milestone, 1/2 oz. Escort	2.5	Fall 2011
H	CEDI1, VETH1, CIAR1	7 oz. Milestone, 1/2 oz. Escort	34.0	Fall 2011
I	CIAR1	7 oz. Milestone	0.4	Fall 2011
J	CIAR1	7 oz. Milestone	0.2	Fall 2011
K	EUUR1	5.33 oz. Plateau	0.1	Fall 2011
L	EUUR1	5.33 oz. Plateau	0.1	Fall 2011
M	EUUR1	5.33 oz. Plateau	0.1	Fall 2011
N	EUUR1	5.33 oz. Plateau	0.1	Fall 2011
O	EUUR1	5.33 oz. Plateau	0.1	Fall 2011
Fall Roads	AECY1	5.33 oz. Plateau	32.6	Fall 2011
		Total Area Treated in 2011	299.9	

<sup>a</sup> Species Codes: CACH1 = Tall Mustard, CADR1 = Whitetop, CEDI1 = Diffuse knapweed, CIAR1 = Canada thistle, COAR1 = Field Bindweed, DACA1 = Wild Carrot, EUUR1 = Leafy Spurge, HEMA1 = Dame's Rocket, LIDA1 = Dalmatian Toadflax, MEOF1 = Yellow Sweetclover, VETH1 = Common Mullein

<sup>b</sup> Depending on location specific environmental conditions and which target species were present, one of more of the listed herbicides were mixed together and used in that area.

<sup>c</sup> Acreages based on billing statements, not original GPS locations provided to subcontractor.

Leafy spurge, a state-listed noxious weed, was documented for the first time at the Site in 2007. Those populations have been sprayed to control and eradicate the species. In 2011, another small isolated population was found over ½ mile from the original population. This patch was also sprayed to prevent its spread. Hand control and weed-whacking were also used to control some small patches of Scotch thistle, tall mustard, salt cedar, and whitetop in 2011. No new species of noxious weeds were observed at the Site during 2011.

Biocontrol insects continue to be used at the Site. In 2011, no additional releases of biocontrol insects were made since most of the biocontrols released in the past have now largely spread across the Site. Collections and transplants from other established populations of various biocontrols at the site may be conducted if needed. Additional biocontrol insects for different weed species may be released as they become available.

In 2011, EPA promulgated its *Final National Pollutant Discharge Elimination System (NPDES) Pesticide General Permit (PGP) for Point Source Discharges From the Application of Pesticides*, 76 FR 68750-68756, November 7, 2011. In response to a 2009 U.S. Court of Appeals ruling (*National Cotton Council, et al. v. EPA*), the ruling which became effective on October 31, 2011, requires NPDES permits for herbicide applications resulting in discharges in or near “waters of the U.S.” The ruling will have an impact on herbicide applications at some DOE Legacy Management sites, although details regarding how the permit requirements may be implemented are still being addressed.

### **3.2.2.3    *Revegetation Activities in 2010***

During winter, spring, and fall 2011, interseeding was conducted to increase vegetation cover on approximately 36 acres at the Site (Figure 270). The seed was either broadcast by hand or using an all-terrain-vehicle broadcast seeder. Table 106 lists the activities at each location.

For the past several years the Jefferson County Nature Association has been sponsoring volunteer seed-picking days to provide local ecotype seed and species that are not available commercially for inclusion in the revegetation efforts at the Rocky Flats Site and other nearby revegetation projects. In 2011, approximately 9 pounds of forb seed and 32 pounds of graminoid seed was collected by volunteers and interseeded at various locations within the COU. The forb seed was interseeded into the forb “nursery” areas that were established in 2009.

Table 106. 2011 Revegetation Location Summary

Location	Seeding Date	Approximate Acreage	Seed Mix <sup>a</sup>	Seeding Method
1	9/28/2011	5.5	Mesic seed mix + PAV11/ Volunteer collected seed	Broadcast seeded
2	9/28/2011	6.4	Mesic seed mix + PAV11	Broadcast seeded
3	2/22/2011	6.3	Xeric seed mix	Broadcast seeded
4	2/22/2011	1.9	Xeric seed mix	Broadcast seeded
5	2/22/2011	0.2	Xeric seed mix	Broadcast seeded
6	2/22/2011	0.3	Mesic seed mix + PAV11	Broadcast seeded
7	2/22/2011	0.4	Xeric seed mix	Broadcast seeded
8	5/5/2011	1.9	Mesic seed mix + PAV11	Broadcast seeded
9	2/22/2011	1.3	Xeric seed mix	Broadcast seeded
10	11/30/2011	0.7	Mesic seed mix + PAV11	Broadcast seeded
11	11/24/2011	0.9	Mesic seed mix + PAV11	Broadcast seeded
12	11/25/2011	1.6	Mesic seed mix + PAV11	Broadcast seeded
13	5/17/2011	0.0	Mesic seed mix	Broadcast seeded
14	5/17/2011	0.0	Mesic seed mix	Broadcast seeded
15	5/17/2011	0.0	Mesic seed mix	Broadcast seeded
16	5/17/2011	0.0	Mesic seed mix	Broadcast seeded
17	11/30/2011	0.9	Mesic seed mix + PAV11	Broadcast seeded
18	11/29/2011	0.1	Mesic seed mix + PAV11	Broadcast seeded
19	11/29/2011	0.1	Mesic seed mix + PAV11	Broadcast seeded
20	11/29/2011	0.1	Mesic seed mix + PAV11	Broadcast seeded
21	11/29/2011	0.0	Mesic seed mix + PAV11	Broadcast seeded
22	11/29/2011	0.0	Mesic seed mix + PAV11	Broadcast seeded
23	9/23/2011	0.0	Mesic seed mix + PAV11/ Wetland mix	Broadcast seeded
24	9/23/2011	0.2	Mesic seed mix + PAV11/ Wetland mix	Broadcast seeded
25	9/23/2011	0.2	Mesic seed mix + PAV11	Broadcast seeded
26	9/23/2011	0.2	Mesic seed mix + PAV11/ Wetland mix	Broadcast seeded
27	9/23/2011	0.1	Mesic seed mix + PAV11/ Wetland mix	Broadcast seeded
28	9/23/2011	0.0	Mesic seed mix + PAV11	Broadcast seeded
29	9/28/2011	6.3	Mesic seed mix + PAV11	Broadcast seeded
	Total Acres	36.0		

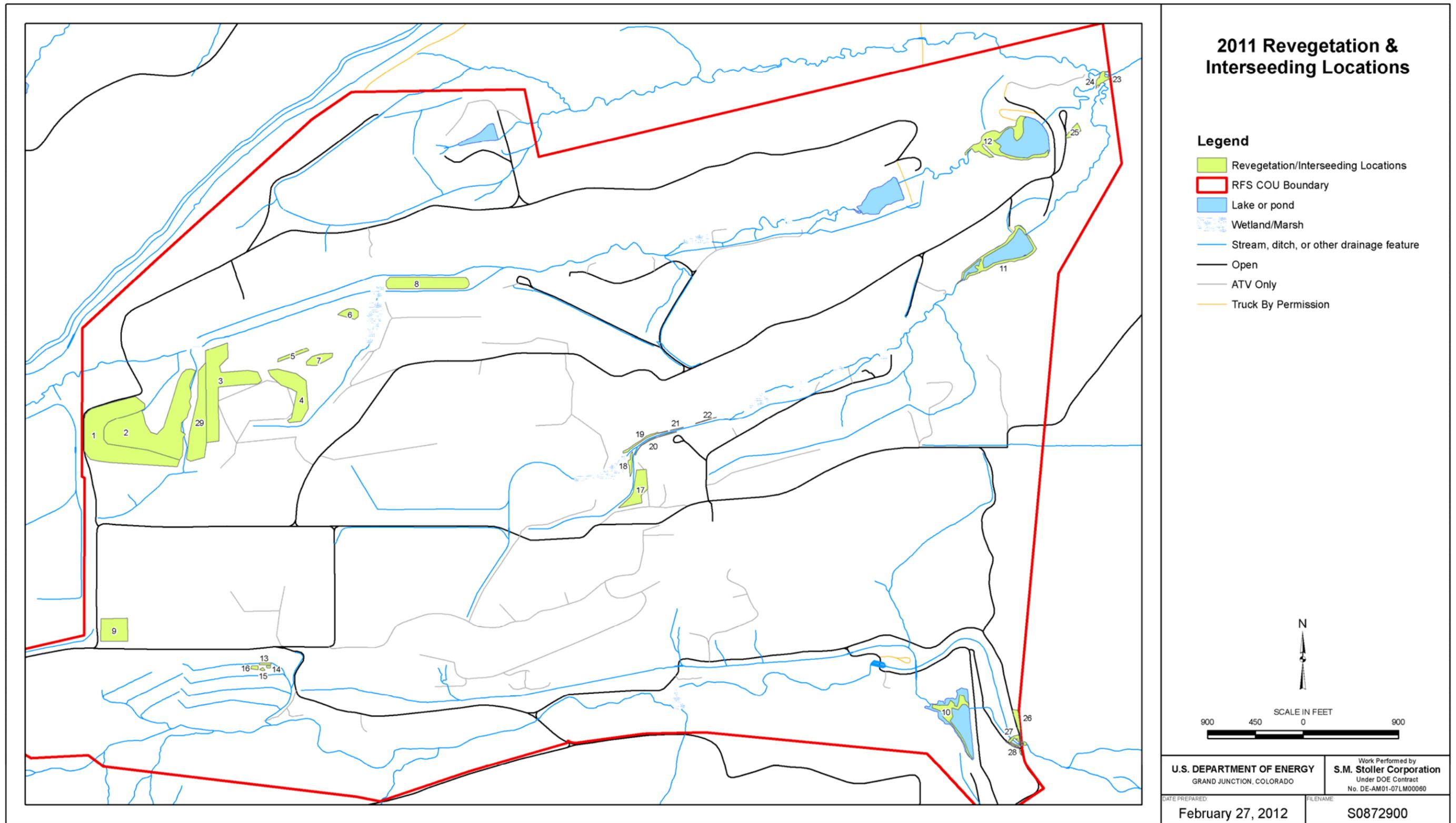
<sup>a</sup> Seed mixes are listed in the Rocky Flats, Colorado, Site Revegetation Plan, January 2009.

This can be found at: [http://www.lm.doe.gov/Rocky\\_Flats/SOG.aspx](http://www.lm.doe.gov/Rocky_Flats/SOG.aspx)

PAV11 = Panicum virgatum (switchgrass)

### 3.2.2.4 Revegetation Monitoring

As part of the cleanup and closure of the Site, the buildings, roads, and other infrastructure in the IA were removed. Approximately 650 acres were disturbed during cleanup activities, which were completed in fall 2005. Revegetation of the disturbed areas was conducted to prevent erosion and sedimentation of the Site streams and to meet water quality standards. Reestablishment of native plant species is also desirable to benefit wildlife and provide desirable vegetation and ground cover adjacent to the Rocky Flats National Wildlife Refuge. As part of the revegetation process, monitoring is conducted to determine whether success criteria, as stated in the *Rocky Flats, Colorado, Site Revegetation Plan* (Revegetation Plan) (DOE 2009b) are being met as well as to determine whether management of these revegetation areas is needed.



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Figure 270. 2011 Revegetation and Interseeding Locations

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The success criteria as stated in the Revegetation Plan are as follows:

- 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. Relative cover =  $(20/80) \times 100 = 25\%$ .
- 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.
- A minimum of 50 percent of the seeded native species will be present at the revegetation site.
- 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).

This report section summarizes the revegetation monitoring results for data collected during 2011. The objective of the revegetation monitoring in 2011 was to assess the success of the revegetation efforts. The methods and the large data summary tables are not presented here but may be found in the full report on the Ecology DVD included with this report.

Fourteen revegetation units were sampled in 2011 (Figure 271<sup>22</sup>). Of these, nine units had yet to meet success criteria (L1, L2, L3, L21, L23, L40, L55, L56, L57), and five others that were previously successful (L24, L25, L32, L35, L37) were monitored again to evaluate long-term sustainability of the vegetation and the potential successional changes in plant community composition. The 2011 monitoring efforts' results for the locations that had never before met success criteria (listed as Previously Non-Successful in the tables) and for the locations that had (listed as Previously Successful in the tables) are discussed separately.

### ***Previously Non-Successful Locations***

This section discusses the results of the nine previously non-successful locations. Species richness in 2011 ranged from a low of 16 species in units L23 and L57, to a high of 38 species in unit L55 (the "L" is not shown for each location in Figure 6). The wide range in the number of species present is attributable to a number of factors, including how long ago the area was revegetated, the size of the location, the number of quadrats sampled in the location, the degree of disturbance in the area prior to revegetation, and the management actions (e.g., weed control) that have been conducted in the area. Twelve different seeded graminoid species had become established and were growing at some locations in 2011. 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*), junegrass (*Koeleria pyramidata*), switchgrass (*Panicum virgatum*), Indian grass (*Sorghastrum nutans*), sand dropseed (*Sporobolus cryptandrus*), and green needlegrass (*Stipa viridula*). Four species were established at all nine locations in 2011 including slender wheatgrass, western wheatgrass, sideoats grama, and buffalograss. Several noxious weeds were also found at these

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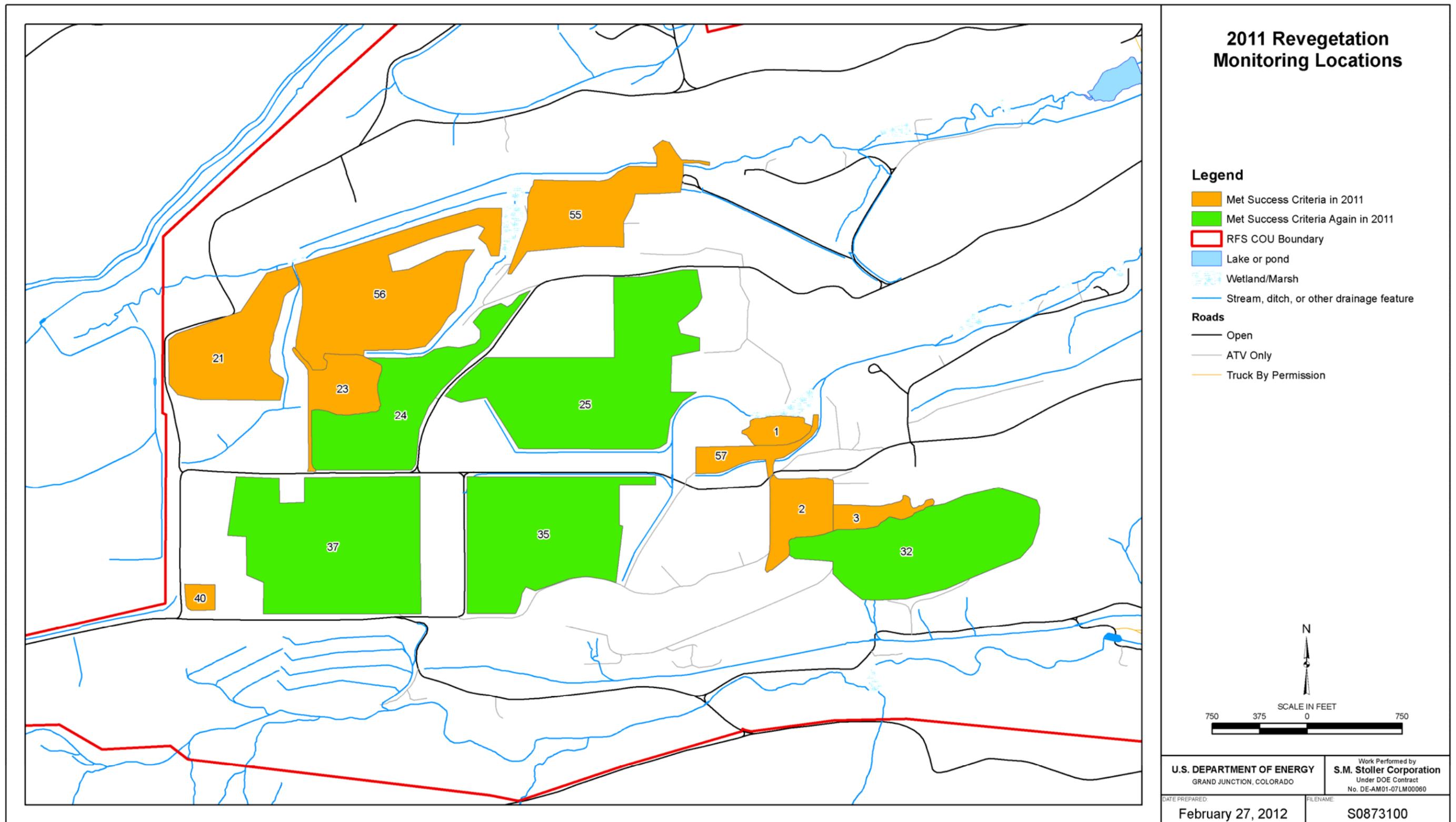
<sup>22</sup> Although the text refers to the revegetation units with a prefix of "L," (e.g., L1), the revegetation unit numbers are shown on Figure 1 without the "L".

locations. These included downy brome (*Bromus tectorum*), filaree (*Erodium cicutarium*), diffuse knapweed (*Centaurea diffusa*), Canada thistle (*Cirsium arvense*), chicory (*Cichorium intybus*), bindweed (*Convolvulus arvensis*), redstem filaree (*Erodium cicutarium*), field sow thistle (*Sonchus arvensis*), moth mullein (*Verbascum blattaria*), and common mullein (*Verbascum thapsus*). Weeds will continue to be managed as needed to keep noxious weed populations down in the revegetation areas and enable the desired seeded species to become established more quickly and compete with the weeds.

Slightly different seed mixes were used at the revegetation locations depending on the year they were seeded and the slope position. 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. Eight of nine locations (89 percent) had 50 percent or more seeded species present in 2011 based solely on the quadrat monitoring data. Only location L40, failed to meet this criterion based on quadrat monitoring data. However, only five quadrats were sampled at this location. As discussed in previous annual reports, the monitoring method may contribute to the lack of seeded species present, because the measure is based solely on the species list generated from the quadrat sampling. Given the small size of the total area measured on the ground through the quadrat method, it is possible that more of the seeded species are present at the revegetation locations but are simply outside the “footprint” of the randomly located quadrats in 2011. Therefore in December 2011, the location was traversed on foot to determine if other species were present. Based on this survey, four more seeded species were observed growing in the revegetation area, in addition to those found only within the quadrats. The additional species included big bluestem, sideoats grama, Indian grass, and sand dropseed. Based on this extra evaluation L40 has met this success criterion (82 percent).

Ground cover protection from rock, litter, and current-year live vegetation varied from 74 percent to over 100 percent at the revegetation locations in 2011. The occasional values over 100 percent are the result of the class system used for estimating cover, which estimates cover values into a range and uses the midpoint of the cover class for analysis. 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 nine locations (100 percent) met this criterion in 2011.

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. Total relative vegetation cover of desired (native) species was greater than 30 percent at 100 percent (9) of the locations monitored in 2011. Seven of the nine revegetation locations (78 percent) had a single species that constituted greater than 45 percent of the relative cover in 2011. Five of these locations were dominated by western wheatgrass, one of the seeded native species and the other two locations were dominated by slender wheatgrass. All 7 locations failed to meet all four success criteria solely because they each had a single species that covered greater than 45 percent of the area.



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Figure 271. 2011 Revegetation Monitoring Locations

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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].

Additionally, the Revegetation Plan's success criterion regarding dominance by a single species states that "[n]o 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].

Western wheatgrass and slender wheatgrass are desirable native species. At locations that fail only this last criterion, and otherwise have a good stand of vegetation, several questions are worth considering:

- Is the dominance of these areas by a single species (with greater than 45 percent relative foliar cover) detrimental to long-term wildlife and habitat management?
- Is the dominance by these species likely to change in the future?
- Is there any other reason not to pass these locations in 2011, just because they failed this last criterion?

As discussed in previous years, one way to answer the first question is to evaluate the dominance of relative foliar cover of native species on the undisturbed native grassland areas of the Site. Do native species account for greater than 45 percent of the cover at some locations on the native grasslands? Monitoring in 2009 at two reference locations in native grassland used for Preble's meadow jumping mouse mitigation monitoring (Original Landfill [OLF] and A-Ponds reference areas) showed that western wheatgrass provided, respectively, 54 and 59 percent relative foliar cover. At TR06, a xeric grassland monitoring location at the Site, data collected over multiple years showed that needle-and-thread grass (*Stipa comata*), a native grassland species, consistently provided greater than 45 percent relative foliar cover. 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 or slender wheatgrass at these revegetation areas will be detrimental to long-term wildlife and habitat management.

Relative foliar cover of different species and overall vegetation cover also fluctuate in response to environmental conditions, such as temperature and the amount and timing of precipitation. Data for western wheatgrass at TR02 and TR04 (both mesic grassland monitoring locations) and the OLF revegetation area, for needle-and-thread grass at TR06 and TR11 (mesic grassland monitoring locations), and for overall foliar cover at TR02, have also shown large annual shifts in relative foliar cover. Annual fluctuations in species cover are common on the undisturbed grasslands in response to changing environmental conditions. Therefore although these monitored locations were dominated by species with greater than 45 percent cover in 2011, this may change over time as environmental conditions change. Given the evidence that dominance by a single species occurs on the native prairie, and annual fluctuations in foliar cover are common, there is no practical reason these locations cannot be considered to have passed all four criteria in 2011. David Buckner, an ecologist under contract with EPA, conducted revegetation monitoring for EPA at Rocky Flats in 2009, 2010, and 2011. He noted similar conditions in the

revegetation areas they sampled and has no concerns for areas with greater than 45 percent cover by a single species. In the 2010 report, he states, “The single sample showed that western wheatgrass comprised half of the cover, and though slightly in excess of the 45 percent DOE criterion, it is not likely that this represents a problem situation. Many native stands on finer-textured soils ‘naturally’ have as much western wheatgrass as is present here, or more” (EPA 2010a). Therefore all these locations are considered to have passed this criterion based on this reasoning.

In summary, all nine of the previously non-successful revegetation locations monitored in 2011 (100 percent; approximately 74 acres) have met all four criteria in 2011 (Table 107) (some for the specific reasons described above). These areas have established good stands of vegetation that should be sustainable in the future. At this point all of the original revegetation locations have met success criteria. A few newer locations are still in the process of establishing sustainable stands of vegetation, but should meet the success criteria in the next few years.

Table 107. Success Criteria Evaluation Summary 2011

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	FAIL	PASS
L2	PASS	PASS	PASS	FAIL	PASS
L3	PASS	PASS	PASS	PASS	PASS
L21	PASS	PASS	PASS	PASS	PASS
L23	PASS	PASS	PASS	FAIL	PASS
L24	PASS	PASS	PASS	FAIL	PASS
L25	PASS	PASS	PASS	PASS	PASS
L32	PASS	PASS	PASS	PASS	PASS
L35	PASS	PASS	PASS	FAIL	PASS
L37	PASS	PASS	PASS	PASS	PASS
L40	PASS	PASS	FAIL	FAIL	PASS
L55	PASS	PASS	PASS	FAIL	PASS
L56	PASS	PASS	PASS	FAIL	PASS
L57	PASS	PASS	PASS	FAIL	PASS
% Passing	100	100	100	100	100
Yellow shaded cells indicate all success criteria were met in 2011.					
Blue shaded cells indicate all success criteria would be met in 2011 if >45% cover of a single species was removed as criteria.					
For reasons outlined in the text, these areas are considered to have passed as of 2011.					
Green shaded cells indicate the success criteria was met when a survey was conducted for seeded species outside the quadrat boundaries for reasons outlined in the text.					

### *Previously Successful Locations*

Five locations that met success criteria previously (L24, L25, L32, L35, L37) were monitored in 2011 to evaluate long-term sustainability of the vegetation and the successional changes in plant community composition.

Table 108 shows a comparison of the 2008, 2009 and 2011 summary data for total species richness (number of species) found at each revegetation location, percent of seeded species present, total absolute foliar cover, total relative native foliar cover, total absolute ground cover, and the list of species with five percent or more of total relative foliar cover at each location. Changes in species richness from 2008 to 2011 varied by location. The greatest decline in species richness occurred at locations L25 and L37 from 2009 to 2011. At both locations, most of the decline in species richness was from a loss of forb species that resulted from the broadleaf herbicide that was used for weed control at these locations. Location L32 saw a large increase in richness from 2009 to 2011 from both forbs and graminoids. Some of this may be attributable to the lack of herbicide applications at this location. The last time this area was sprayed was in 2009, so the effect of the application may have worn off by 2011, thus resulting in an increase of species richness. The other two locations L24 and L35 showed little change in species richness over the years. The percentage of seeded species present has generally increased or remained the same at all locations except L35 where Indian grass, a species present in 2009 was not observed (within the quadrats) in 2011. Most likely it was present in the revegetation area, but was just not captured within the quadrats evaluated for this monitoring. The 2011 values continue to meet the success criterion for the percentage of seeded species.

Annual variation in total foliar cover can vary considerably in response to herbicide applications or environmental factors. Herbicide applications at revegetation locations are targeted primarily at noxious forb species. With the loss of forb cover, declines in overall foliar cover the following year are not uncommon. Over time, some loss would be made up by increases in graminoid cover. Foliar cover responses to other environmental factors (i.e., spatial and temporal distribution of precipitation) are also common. Past vegetation monitoring studies on the grasslands at the Site have shown that total foliar cover can fluctuate up to 20 percent or more annually (K-H 2001).

At each location, total native foliar cover was greater in 2011 than in 2008. All locations were well above the success criterion of 30 percent. Total ground cover (composed of basal vegetation cover, litter cover, and rock cover) also increased at all locations from 2008 to 2011. All locations continued to remain well above the success criterion of 70 percent. At two locations, L24 and L35, western wheatgrass provided approximately 60 percent of the relative foliar cover. This exceeds the 45 percent relative foliar cover for a single species success criterion; however, as discussed in the previous section of the report, it is not uncommon for native species on the undisturbed native grassland areas to provide more than 45 percent of the relative foliar cover. Also, given the annual variability in cover by individual species, an abundance of this species is not a problem. Therefore, each of these areas continues to meet the success criterion.

The seeded native species continue to increase in dominance at each of these revegetation locations. Table 108 shows the species that provided more than 5 percent cover at each location during 2008, 2009, and 2011. The early dominance by the native, short-lived, cool-season, perennial, slender wheatgrass has begun to give way to an increase in western wheatgrass

(a long-lived, native, cool-season species) and warm-season, native perennials such as blue grama and sideoats grama. This mix of cool-season and warm-season graminoids is desirable for long-term sustainability. Western wheatgrass is the dominant species at each of the locations except L32, where smooth brome, a nonnative perennial grass dominant before the revegetation activities, has reestablished. Early successional weedy species such as kochia (*Kochia scoparia*), filaree, and alyssum (*Alyssum minus*) have all but disappeared as the native species have increased across the revegetation locations. Cover of diffuse knapweed, a noxious weed, and yellow sweet clover (*Melilotus officinalis*), a common nonnative forb species seeded at the Site years ago, have been reduced in cover primarily through herbicide applications. Downy brome only remained a problem at location L25 in 2011 and will hopefully decrease as the perennial desirable grasses further establish and crowd it out.

In general, the successional trajectory of the revegetation areas is on track and should result in long-term sustainable native grassland communities in the COU. Continued proactive management of weeds using an integrated vegetation management program will aid in that process.

### **3.2.2.5 EPA Revegetation Assessments**

In 2009, 2010, and 2011, EPA conducted their own revegetation monitoring to assess the status of the revegetation efforts at the Rocky Flats Site. The EPA reports for each year are available on the Ecology DVD included with this report.

### **3.2.2.6 Photomonitoring Results**

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

## **3.2.3 Wildlife Monitoring**

During 2011, wildlife surveys at the Site consisted of observing black-tailed prairie dogs (*Cynomys ludovicianus*), monitoring mountain bluebird (*Sialia currucoides*) boxes, and observing active raptor nests. More-detailed information for the wildlife monitoring is presented in the Ecology DVD included with this report.

### **3.2.3.1 Prairie Dog Monitoring**

Figure 272 shows the locations of former prairie dog towns in the COU and on the adjacent POU property as of 2008. 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 (Jefferson County 2009). Plague is an infectious disease caused by *Yersinia pestis*, a bacterium found in fleas that pass on the bacterium to wild rodents by biting them. Prairie dogs are susceptible to plague, and it is not uncommon for colonies to be wiped out by plague every few years. Observations of the former towns in the COU and adjacent POU during 2011 revealed that no prairie dog towns were active within the COU and the small town north of the A-4 pond (northern town shown on Figure 272) had three or four individuals present.

Table 108. Revegetation Summary Data for Previously Successful Areas (L24–L37)

		Location				
		L24	L25	L32	L35	L37
Species Richness	2008	28	31	45	28	24
	2009	27	38	38	28	43
	2011	27	30	49	25	33
Percent Seeded Species Present	2008	64	73	86	73	73
	2009	64	82	86	91	82
	2011	91	100	86	82	91
Total Absolute Foliar Cover	2008	57.0	49.8	76.5	74.8	61.8
	2009	60.7	45.3	71.1	54.8	46.8
	2011	49.4	48.8	76.1	51.7	44.1
Total Relative Native Foliar Cover	2008	75.0	72.7	50.2	75.7	76.4
	2009	79.3	78.1	53.6	81.8	54.8
	2011	93.3	74.9	58.9	95.8	90.5
Total Absolute Ground Cover (Basal Veg, Litter, Rock)	2008	64.2	61.4	84.6	67.1	69.1
	2009	86.8	87.8	88.3	93.9	81.8
	2011	96	101.8 <sup>a</sup>	90.3	89.7	90.2
Species with greater than 5 percent relative foliar cover	2008	Slender wheatgrass (50.5%) Western wheatgrass (17.7%) Filaree (6.1%) Kochia (5.6%) Diffuse knapweed (5.6%)	Slender wheatgrass (36.7%) Western wheatgrass (23.9%) Kochia (7.4%) Blue grama (7.1%) Alyssum (6.1%)	Diffuse knapweed (13.5%) Slender wheatgrass (11.2%) Western wheatgrass (10.7%) Buffalograss (9.6%) Smooth brome (9.4%) Downy Brome (6.0%) Sideoats grama (5.8%)	Western wheatgrass (33.9%) Slender wheatgrass (28.7%) Yellow sweet clover (6.5%) Sideoats grama (5.6%)	Slender wheatgrass (31.6%) Western wheatgrass (27.6%) Buffalograss (9.1%) Kochia (6.4%)
	2009	Western wheatgrass (33.2%) Slender wheatgrass (21.6%) Kochia (7.4%) Buffalograss (5.9%)	Western wheatgrass (25.4%) Slender wheatgrass (19.5%) Buffalograss (11.6%) Yellow sweet clover (6.3%)	Smooth brome (28.8%) Western wheatgrass (14.0%) Sideoats grama (13.2%) Kochia (5.7%) Buffalograss (5.0%)	Western wheatgrass (42.1%) Slender wheatgrass (17.8%) Sideoats grama (10.0%) Blue grama (7.9%)	Slender wheatgrass (18.1%) Western wheatgrass (12.8%) Buffalograss (8.7%) Crested wheatgrass (6.8%) Diffuse knapweed (6.2%) Downy Brome (5.9%) Alyssum (5.0%)
	2011	Western wheatgrass (60%) Slender wheatgrass (9.3%) Buffalograss (7.8%) Blue grama (6.6%) Sideoats grama (5.2%)	Western wheatgrass (25.1%) Buffalograss (20.3%) Slender wheatgrass (18.3%) Downy Brome (8.2%) Diffuse knapweed (5.5%)	Smooth brome (26.2%) Sideoats grama (14.9%) Buffalograss (7.1%) Switchgrass (6.8%)	Western wheatgrass (60.3%) Sideoats grama (13.2%) Blue grama (6.3%) Slender wheatgrass (5.0%)	Western wheatgrass (34.0%) Buffalograss (20.6%) Slender wheatgrass (13.8%) Blue grama (5.9%)

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

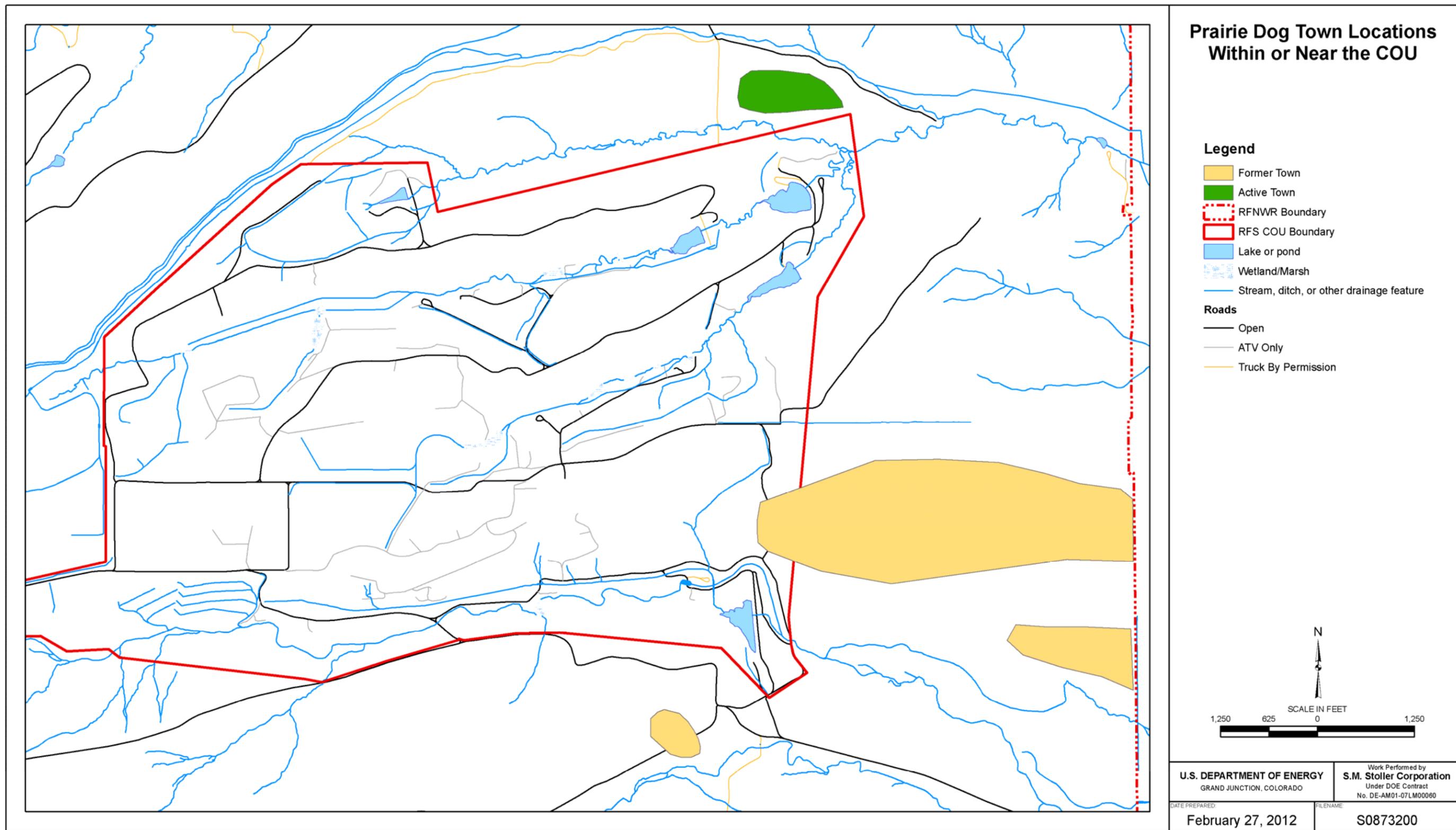


Figure 272. Prairie Dog Town Locations Within or Near the COU

No individual prairie dogs were observed roaming along the roads at the Site in 2011. The prairie dogs typically travel beyond their existing towns in search of other potential burrow locations in the late spring and early summer. With the exception of the sightings at the town north of the A-4 pond, inspectors have observed no signs of the prairie dogs' return throughout the remainder of the year across the COU and at the previously occupied prairie dog towns. Fortuitous monitoring of these locations will continue throughout 2012 to determine whether the prairie dogs have returned.

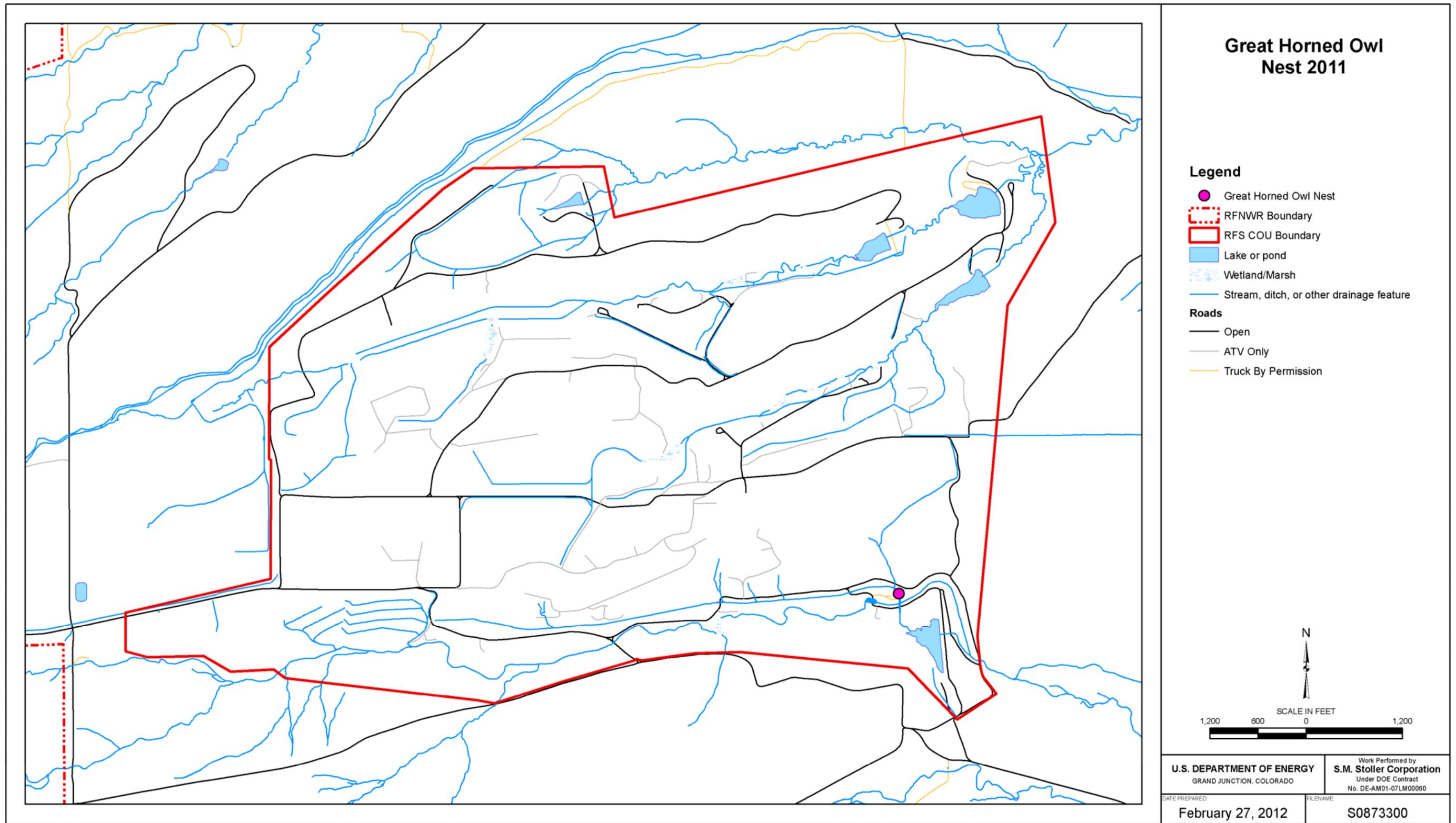
### **3.2.3.2 Mountain Bluebird Nest Box Monitoring**

Only three of the eight functioning nest boxes (one was destroyed when the tree fell over), showed evidence of nesting activity in 2011. Tree swallows (*Tachycineta bicolor*) were using the three active nest boxes. No mountain bluebirds were observed nesting in any of the nest boxes in 2011.

### **3.2.3.3 Raptor Nesting Observations**

In 2011, only one active raptor nest was observed within the COU. Figure 273 shows the location of a great horned owl (*Bubo virginianus*) nest in Woman Creek. The owl nest was approximately 380 feet from where it was located in 2010. The tree was in the South Interceptor Ditch, and when inspectors approached the tree from the east, the nest was actually below eye level when they stood on the bank. Three young owls fledged from the nest (Figure 274).

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Figure 273. Great Horned Owl Nest 2011

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Figure 274. Great Horned Owlets in Woman Creek Nest in 2011

### 3.2.4 Regulatory Mitigation Monitoring Summary

#### 3.2.4.1 *Preble's Meadow Jumping Mouse Mitigation Monitoring*

The Preble's meadow jumping mouse is a federally listed threatened species under the Endangered Species Act that lives in most of the stream drainages at the Site. Prior to site closure, DOE conducted 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 2011, vegetation monitoring and photopoint monitoring was conducted at various Preble's mouse mitigation locations in the COU. Several areas met success criteria and concurrence was requested from USFWS that no further monitoring of these areas was required. The results were

summarized in an annual report that is due to USFWS by December 1 each year. Although the 2011 results are not discussed in this annual report, they are available in the *2011 U.S. Fish and Wildlife Biological Opinion Reports for the Rocky Flats Site* (DOE 2011g).

#### **3.2.4.2 Wetland Mitigation Monitoring**

During the cleanup and closure of the Site, approximately 7.8 acres of wetlands were disturbed. In order to maintain a “no net loss” of wetlands at the Site, several mitigation wetlands were constructed to create or reestablish 7.8 acres of wetlands. Additionally new seeps and wet areas have developed at several locations throughout the COU where wetlands are developing naturally. DOE also paid for the Standley Lake Wetland Mitigation Bank that could be used if in situ wetland mitigation did not provide the total number of needed acres onsite. The *Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan* (DOE 2006b) provides guidance for monitoring the mitigation wetlands and reporting. During 2011, a total of 30 potential wetland locations were monitored. Of these, 29 had all three wetland indicators present. The 2011 results are not presented here, but are found in the *Rocky Flats, Colorado, Site, 2011 Annual Wetland Mitigation Monitoring Report* (DOE 2012b). This report is due to EPA by March 1 each year.

#### **3.2.5 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 top priority, as does the revegetation of the COU. Data from 2011 documented the continuing establishment of vegetation at revegetation locations; several met success criteria. Noxious weed control activities and additional revegetation activities were conducted during 2011 to improve and enhance the vegetation at the Site. 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 Site Environmental Evaluation for Projects (SEEPro) 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 the 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,