

2013 Vegetation Surveys

Introduction

Vegetation surveys are conducted at the Rocky Flats Site (Site) to provide information necessary for managing the natural resources. The Site comprises the Central Operable Unit (COU) and Peripheral Operable Unit (POU) (Figure 1). The objectives of the vegetation surveys in 2013 were to:

- Identify 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 activities.
- Document and track herbicide applications in 2013.
- Document where revegetation activities were conducted in 2013.
- Conduct photomonitoring for visual documentation of changes in vegetation establishment at the Site.
- Document the establishment and survival rates of shrubs/trees that were planted as part of habitat enhancement projects.
- Document the establishment of volunteer-collected forbs in forb “nurseries.”

This section pertains to general vegetation surveys. Revegetation monitoring to evaluate revegetation success across the Site is reported in the revegetation section of the annual report.

Methods

Weed Mapping

Mapping for selected weed species in the COU is a means of identifying high-priority treatment areas, monitoring the distribution of specific noxious weed species, discovering new weed species, and tracking the effectiveness of weed control. Weed mapping in the COU in 2013 was conducted both on foot and from a vehicle; binoculars were also used. Weed mapping was conducted when species were flowering or when they were most visible. The species mapped throughout the COU in 2013 included diffuse knapweed (*Centaurea diffusa*) and Dalmatian toadflax (*Linaria dalmatica*). Fortuitous observations of other noxious weed species were recorded in field notebooks.

For species mapped throughout the COU, infestation areas were classified into general density categories of high, medium, low, and scattered, based on a subjective interpretation of the extent, visual density, need for control, and aggressive nature of the species. The high-density category indicated that an area was dominated by a nearly solid infestation or a very high cover of the species. The medium-density category was used where the infestation provided less cover and was less homogeneous. The low-density category was used where individuals of the species were present in fewer numbers and were not visually dominating the landscape but were beginning to establish a foothold in the plant community and needed control. The scattered-density category indicated a sporadic occurrence of the species. The noxious weed populations and distributions were hand-drawn in the field and should not be interpreted as a precise outline of the distribution

of these species. Attempts were made to visit the entire Site, but some infestations may have been missed. Fortuitous observations were not classified into density categories.

Herbicide Applications and Revegetation Activities

Licensed subcontractors applied herbicides at the Site in accordance with applicable laws, including the 2011 U.S. Environmental Protection Agency Pesticide General Permit. Maps of herbicide applications and revegetation activities were prepared to show where herbicides were applied and where interseeding/revegetation activities took place during 2013. Maps were prepared in the Geographic Information System and were based on hand-drawn field maps.

Habitat Enhancement and Forb Nursery Evaluations

Counts of surviving shrubs and trees were made at the habitat enhancement locations that were planted in 2012 and 2013.

Qualitative observations were made of the 16 forb nurseries and adjacent “unseeded” reference locations in early fall 2013 to evaluate the establishment of forbs in the nurseries. The reference area was an area adjacent to and of approximately the same size as the forb nursery. Each area was traversed and a list of all the forb species occurring within each location was generated. The abundance of each species was categorized as rare (R), infrequent (I), or abundant/common (A).

Photographic Documentation

Photographs were taken at selected permanent photo points during summer 2013 to document and evaluate changes resulting from climatic changes, natural resource management, or human activity. Photographs were compared to those taken previously. The time-series photographs of the past several years can be viewed on the Ecology DVD.

Results and Discussion

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 of the Site consists of 637 species of plants. In 2013, one new record of a vascular plant species was reported for the Site flora. *Brassica napus*, an agricultural plant commonly known as rape (the source of rapeseed oil, or canola oil), was collected near the west boundary fence in a revegetation area in the POU. The following taxonomic name will be used at the Site for the new plant species record¹:

Family	Scientific Name	Speccode	Common Name
Brassicaceae	<i>Brassica napus</i> L.	BRNA1	Rape

¹ 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.

Voucher specimens of the species will be deposited at the University of Colorado Herbarium in Boulder, Colorado. No new species of noxious weeds were observed at the Site during 2013.

Weed Mapping and Weed Control

Figures 2 and 3 show the 2013 weed distribution maps for diffuse knapweed and Dalmatian toadflax, respectively. Table 1 shows the estimated total acreage and acreage-by-density categories for each species, based on the mapping data from 2007 through 2013. The total area of the COU is approximately 1,308 acres. In 2013, diffuse knapweed was observed on approximately 78 acres at various levels of infestation, the lowest amount observed since mapping began in the COU in 2007. Dalmatian toadflax was mapped on approximately 110 acres in 2013, the second lowest amount recorded since 2007. A variety of reasons may account for the reduced abundance of these two noxious weeds. Past herbicide applications certainly have reduced their abundance at the Site. Additionally, biocontrol insects have been released onsite for both species and are known to have spread across the Site, helping to reduce and keep populations lower. In 2013, the dry conditions experienced at the Site from fall 2012 through spring 2013 have probably also contributed to the lower abundance. Observations in spring 2013 revealed very few diffuse knapweed rosettes at the Site. Annual fluctuations in the abundance of many grassland species are not uncommon, as populations respond to changes in temperature, precipitation amounts, timing of precipitation, and other environmental factors.

For the first time in over a decade, no herbicide applications were made in spring 2013. Reconnaissance efforts during late winter/early spring in the COU revealed no areas that required chemical control efforts. In the fall, approximately 62 acres were treated with herbicides at the Site via ground application (Figure 4), with most of this along the gravel roads. Table 2 lists the target species, treatment (herbicides) used, application rates, acreage treated, and approximate timing of the application during the year. (**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 professional judgment of the licensed herbicide applicator, different herbicides were used within that location to provide the control needed.)

Hand control and weed-whacking were also used to control some small patches of Scotch thistle (*Onopordum acanthium*) and whitetop (*Cardaria draba*) in 2013.

A test to evaluate the effectiveness of mechanical control on common mullein (*Verbascum thapsus*) was conducted by mowing and cutting off flower stalks at some small patches in the COU. Reexamination of the patches after a few weeks showed the plants had regrown new flower stalks (often multiple flower stalks per plant where previously there had been one) at the point where the stem had been cut off. These stalks were removed; but resprouted again. Therefore, without continued mechanical control throughout the growing season, mechanical control is not very effective on this species and requires considerable labor. However, at one location (Location 1 on Figure 4), the removal of the flower stalks provided clear access to the rosettes for chemical control that was applied to these plants later in the summer. The combination of mowing plus herbicide applications seems to have been very effective at this location. Mowing and removing the flower stalk may weaken the plant (because it has expended a lot of energy to produce the flower stalk), making it more susceptible to the herbicide application. This could be an effective technique in a situation where chemical control cannot be or was not applied in the early spring when only rosettes are present.

Biocontrol insects continue to be used at the Site. In 2013, 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.

Revegetation Activities

Interseeding/Revegetation Activities

During 2013, interseeding and revegetation activities were conducted to increase vegetation cover or diversity at several locations (Table 3 and Figure 5). An old mining road in the D-2A mine parcel on the western edge of the POU was revegetated in preparation for transfer of the mine parcel to the Rocky Flats National Wildlife Refuge (Figure 6). At three other locations (B371 Revegetation Area, East Trenches Revegetation Area, and Mound Revegetation Area) compost was disced to add organic matter to the soil. Other areas were interseeded to increase vegetation cover.

Habitat Enhancement Project Evaluations

In 2012 and 2013, projects were begun to enhance onsite habitat for wildlife and to increase vegetation diversity. In spring 2012, five different shrub and tree species were planted on a hillside in the north-central COU. 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 (2012) using a gravity-fed irrigation system. Although several plains cottonwood and chokecherry plants had been repeatedly browsed (some to the ground) by mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*), all plants were alive in fall 2012. As of fall 2013, all of the chokecherry, buffaloberry, and fourwing saltbush were still alive. One coyote willow and three plains cottonwood trees died in 2013. The death of the coyote willow was likely due to a lack of water, while the plains cottonwoods died from continued browsing by mule deer and elk. To protect the remaining chokecherry and plains cottonwood plants from future browse damage, welded-wire fencing attached to three t-posts was installed around each of the remaining chokecherry and plains cottonwood plants in the fall of 2013.

In spring 2013, 72 buffaloberry and 72 fourwing saltbush were planted near the location of the former Solar Ponds in the COU as a habitat enhancement project. 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 2013, 33 of 72 (approximately 46 percent) buffaloberry and 57 of 72 (approximately 79 percent) fourwing saltbush plants were still alive. Some of the loss of buffaloberry plants can be attributed to a heavy frost in the late spring. Initial damage was noted to the buffaloberry after the frost occurred, and many of the small plants never recovered. The fourwing saltbush plants were more tolerant of the frost. No browse damage was noted on any of the plants. Survival monitoring will continue at both of these locations for the next several years.

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 7). 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 treated with herbicides. 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 2013, approximately 6 pounds of graminoid seed and 5 pounds of forb seed were collected by volunteers. The graminoid seed was interseeded on the hillsides at FC-1 (Figure 5). The forb seed was interseeded into the forb “nursery” locations that were established in early 2013 (Figure 5).

Table 4 summarizes the data collected in 2013. Rows highlighted in yellow are those species that were most likely to be in the volunteer-collected forb seed. Prior to 2013, presence/absence data was collected at the nurseries that were established in 2010, but no abundance data was associated with many species. If no abundance data were collected for a specific species, this is indicated by an “ND” in the table.

Evaluation of the data reveals a succession of native forb establishment over time. For this evaluation species classified as “infrequent” or “abundant/common” are included and those classified as “rare” are not included. In the nurseries planted in early 2013, Porter’s aster (*Aster porteri*), hairy false golden aster (*Chrysopsis villosa*), and rockyscree false goldenaster (*Chrysopsis fulcrata*), established readily in the first year. At the nurseries planted in 2011, these three species were the only infrequent or abundant species present after three growing seasons. It should be noted that at several 2013 locations and at one 2011 location (F12), these species were also present in the reference locations in similar abundance. This suggests that the seeds of these species which are easily wind-dispersed, blew in from the seeded areas or were already present.

At the locations seeded in 2010, several more native forb species have become established. Porter’s aster, golden aster, western sagewort (*Artemisia campestris*), silky wormwood (*Artemisia dracunculus*), silver sage (*Artemisia frigida*), snakeweed (*Gutierrezia sarothrae*), blazing star (*Liatris punctata*), and soft goldenrod (*Solidago mollis*) have all become established and are doing well. In the reference areas at these locations, the abundance of these species is mostly rare, if they occur at all. This suggests that the seeding has influenced the abundance of these species at these locations and, although it may take several years before the some of these species appear, seeding is effective.

Interestingly all of the volunteer-collected species are in the composite (Asteraceae) plant family and they 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 mid-summer 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.

Summary

Managing natural resources at the Site involved various tools in 2013, including weed control and revegetation activities. The threat from noxious weeds continues to be a concern at the Site, and weed control in both the revegetation areas and the natural areas remains a high priority within the COU. However, due to good weed control and dry environmental conditions, noxious weeds were less abundant in 2013 compared to previous years. Approximately 62 acres in the COU were treated with herbicides in 2013 to control noxious weeds and improve the quality of

the plant communities. Interseeding was conducted at several locations to continue to increase the vegetation cover and stand density. A shrub planting (habitat enhancement) project was conducted in 2013 to attempt to increase vegetation diversity at the Site. Photomonitoring continued to document the establishment of vegetation at the revegetation locations. Evaluation of the forb nurseries documented successful establishment of several volunteer-collected forb species. Vegetation establishment has been good and, with proactive management, should be self-sustaining in the long term.

References

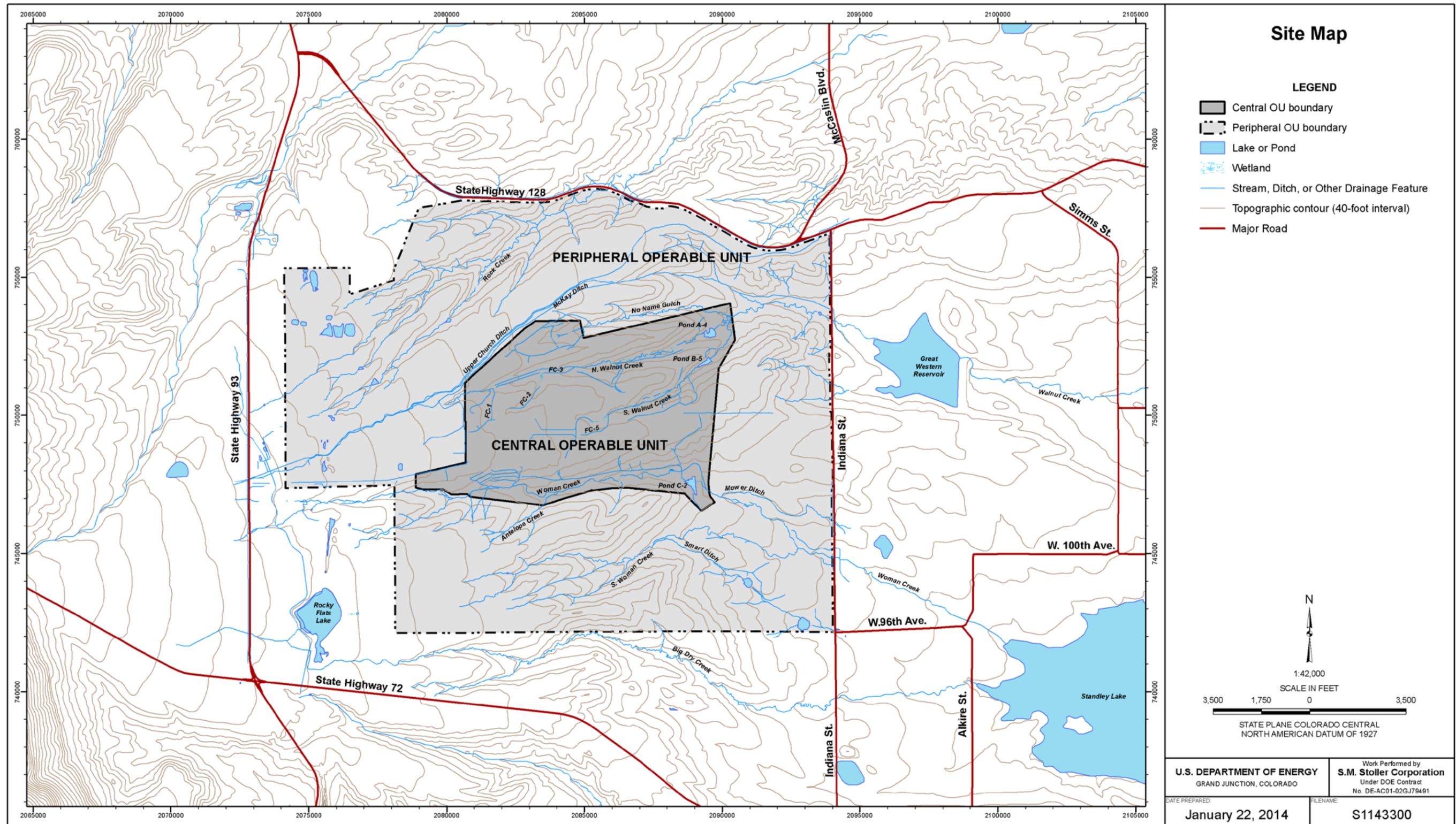
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Weber, W.A., 1976. *Rocky Mountain Flora, Colorado*, Associated University Press, Boulder, Colorado.

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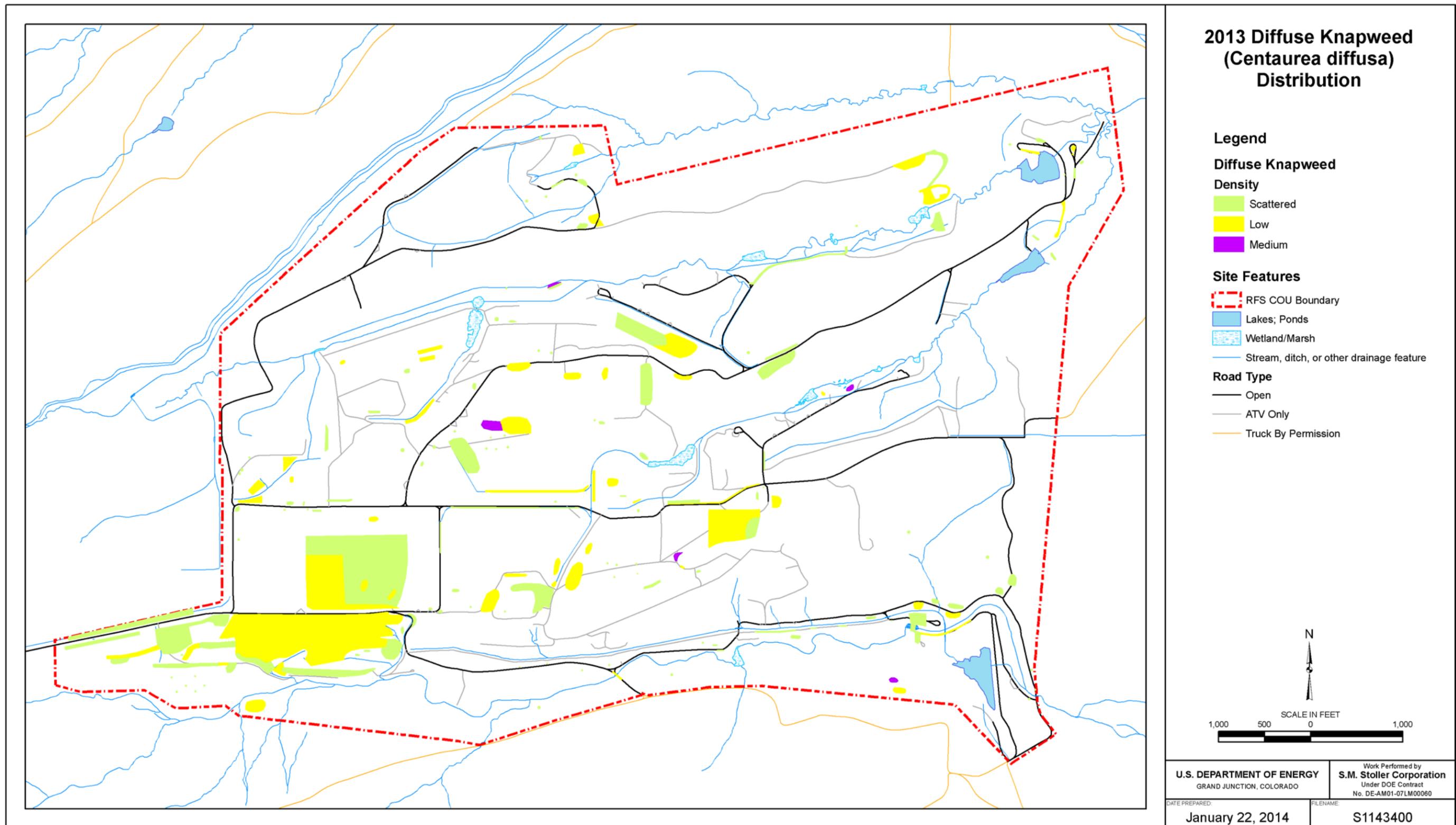
Weber, W.A., and R.C. Wittmann, 1992. *Catalog of the Colorado Flora: A Biodiversity Baseline*, University Press of Colorado, Niwot, Colorado.

Weber, W.A., and R.C. Wittmann, 2001. *Colorado Flora: Western Slope*, 3rd edition, University Press of Colorado, Niwot, Colorado.



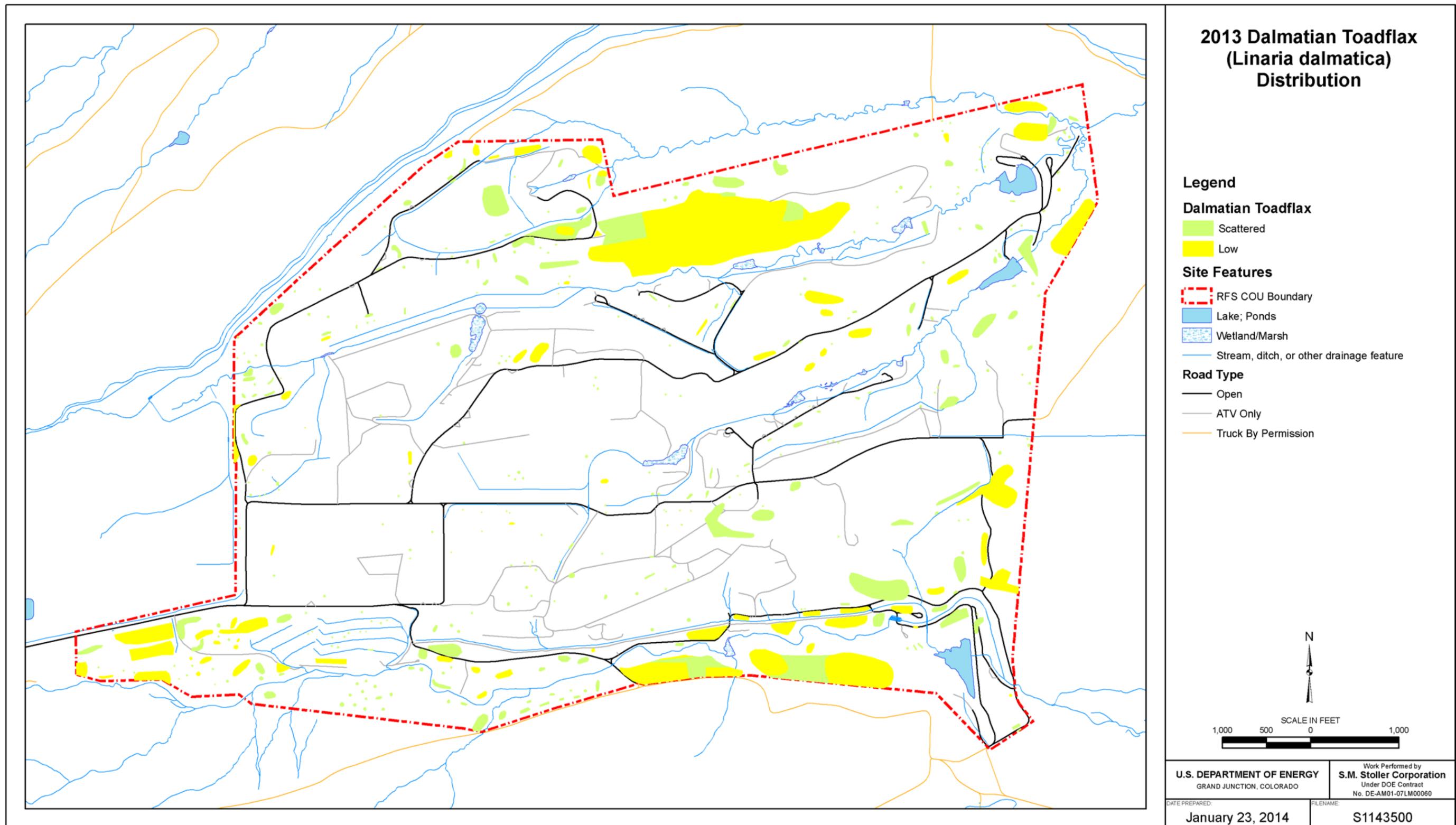
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Figure 1. Site Map



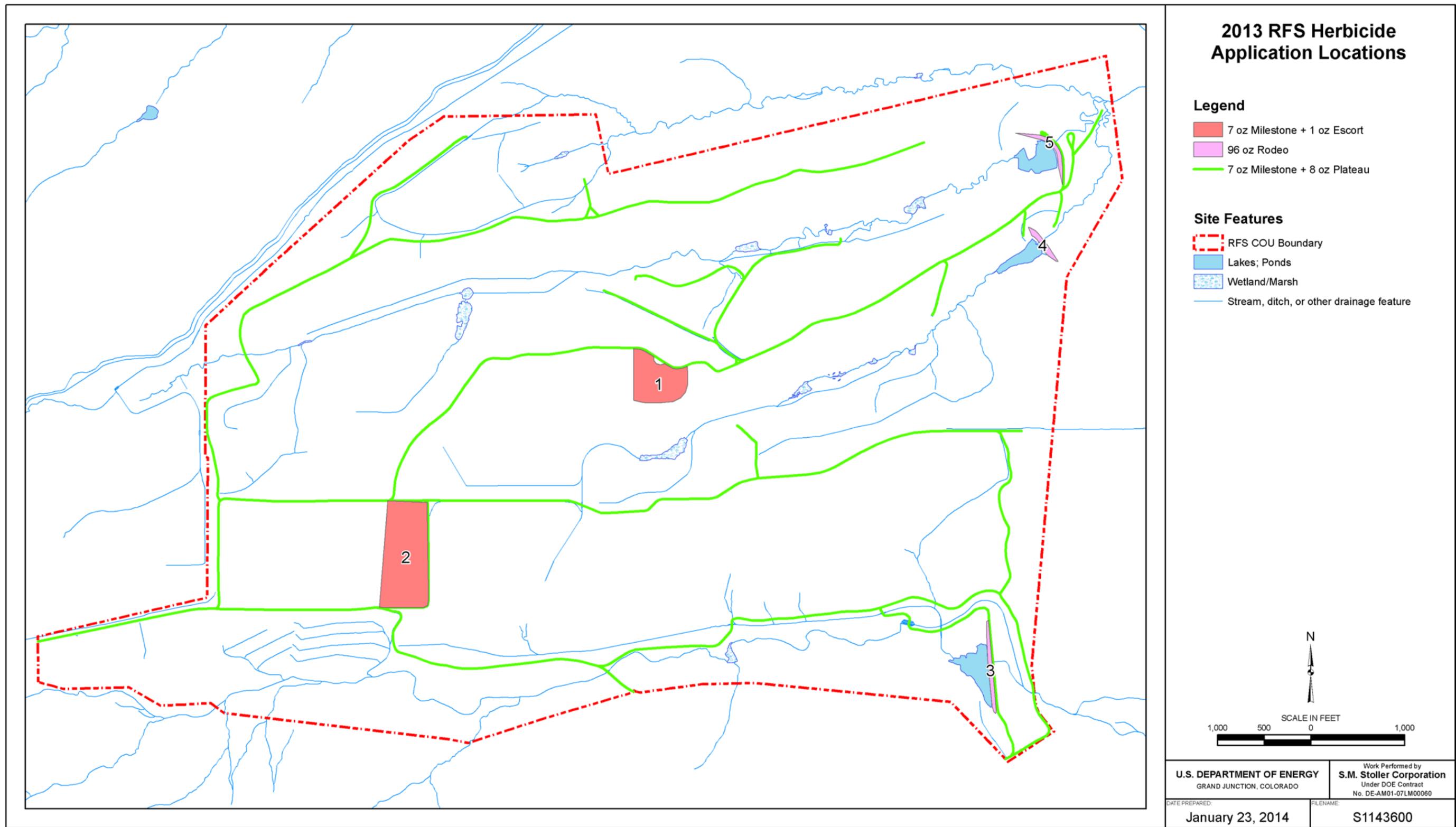
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Figure 2. 2013 Diffuse Knapweed (*Centaurea diffusa*) Distribution



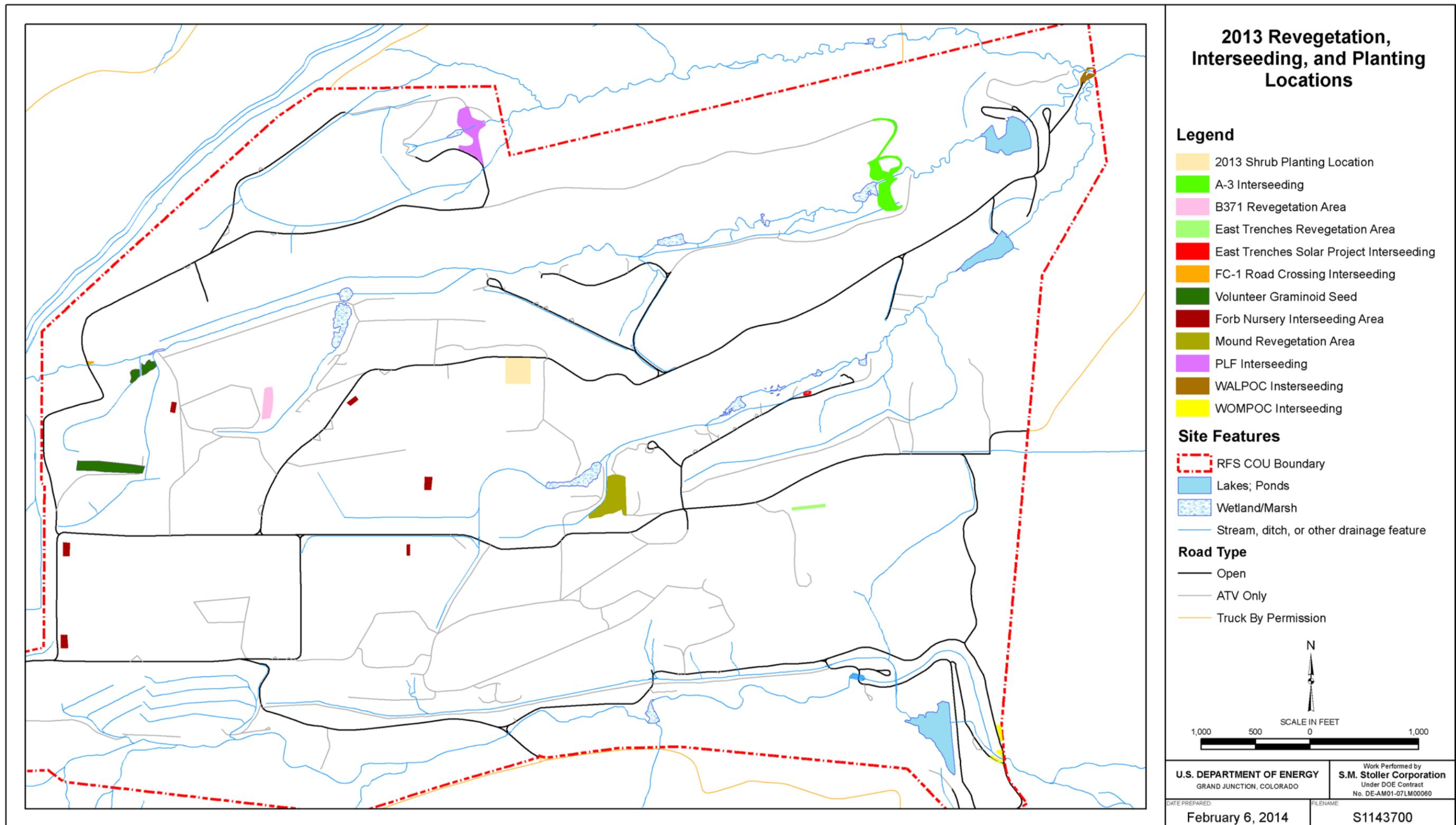
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Figure 3. 2013 Dalmatian Toadflax (*Linaria dalmatica*) Distribution



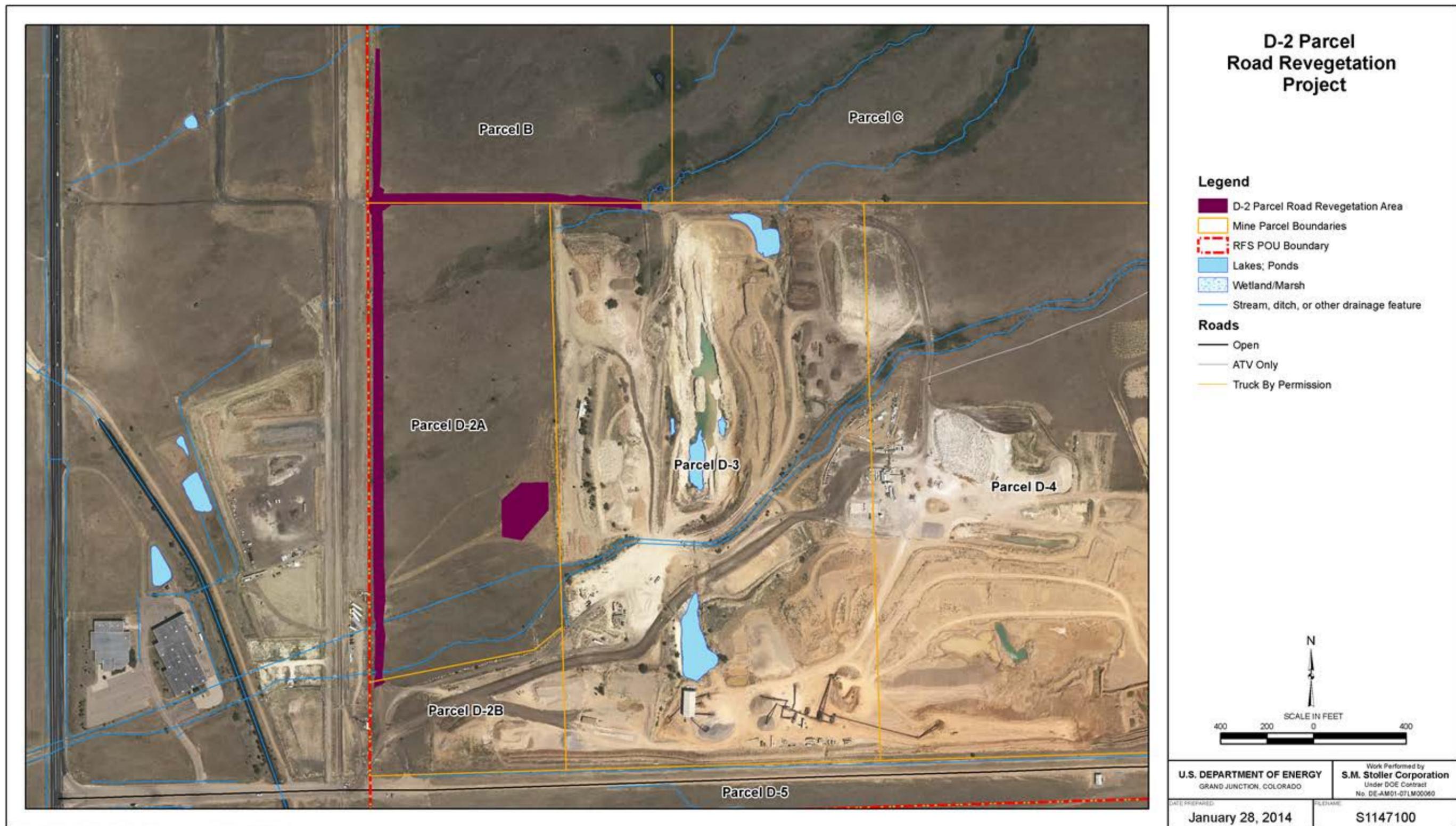
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Figure 4. 2013 RFS Herbicide Application Locations



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Figure 5. 2013 Revegetation, Interseeding, and Planting Locations



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Figure 6. D-2 Parcel Road Revegetation Project

Forb Nursery Monitoring Locations 2013

Legend

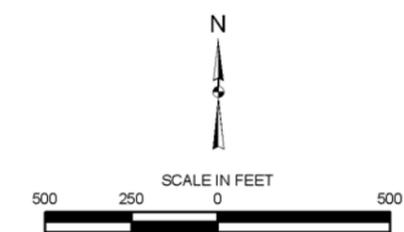
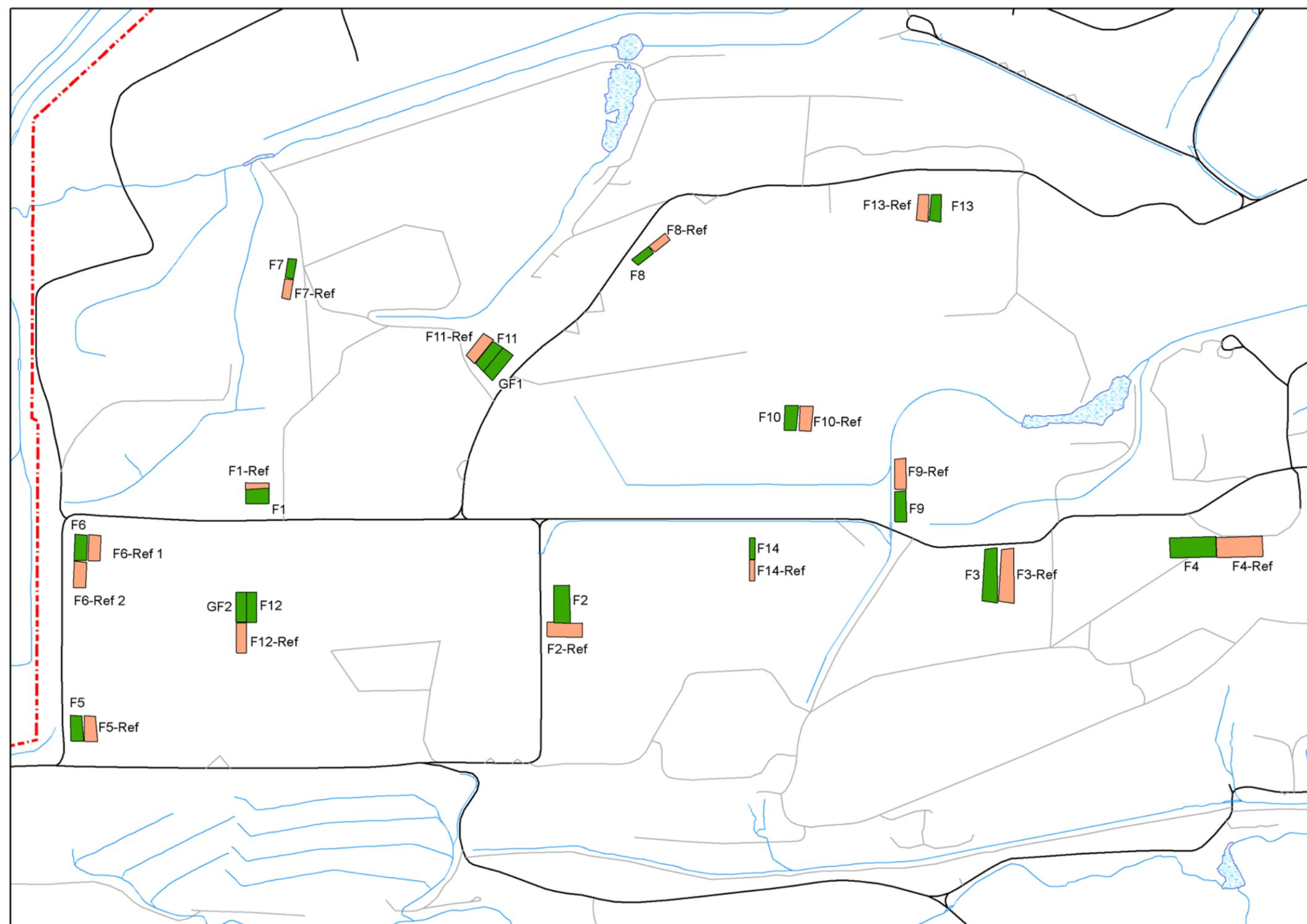
- Forb Nursery
- Forb Nursery Reference Area

Site Features

- RFS COU Boundary
- Lakes; Ponds
- Wetland/Marsh
- Stream, ditch, or other drainage feature

Road Type

- Open
- ATV Only
- Truck By Permission



U.S. DEPARTMENT OF ENERGY GRAND JUNCTION, COLORADO	Work Performed by S.M. Stoller Corporation Under DOE Contract No. DE-AM01-07LM00060
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Figure 7. Forb Nursery Monitoring Locations 2013

Table 1. COU Noxious Weed Acreage Summary (2007-2013)

Species	Density (acres)				Total	% of Total COU
	High	Medium	Low	Scattered		
Diffuse knapweed						
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
2012	0.0	7.6	109.1	56.4	173.1	13
2013	0.0	0.8	41.1	36.0	77.9	6
Dalmatian toadflax						
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
2012	0.0	2.8	53.8	58.9	115.5	9
2013	0	0	75.3	35.1	110.4	8

The total acreage of the COU is 1308 acres.

Table 2. FY2013 Herbicide Application Summary

Location	Target Species*	Treatment** (Rate/Acre)	Actual Acreage Treated***	Time of Year Treated
1	CEDI1, VETH1, DACA1	7 oz Milestone + 1 oz Escort	5.60	Fall 2013
2	CEDI1, VETH1	7 oz Milestone + 1 oz Escort	12.00	Fall 2013
3	Total Kill	96 oz Rodeo	0.84	Fall 2013
4	Total Kill	96 oz Rodeo	0.54	Fall 2013
5	Total Kill	96 oz Rodeo	0.67	Fall 2013
All Roads	BRTE1, AECY1, CEDI1	7 oz Milestone + 8 oz Plateau	42.00	Fall 2013
		Annual Total Acreage Treated	61.65	

* Species Codes: AECY1 = Jointed Goatgrass, BRTE1 = Downy Brome, CEDI1 = Diffuse Knapweed, DACA1 = Wild Carrot, VETH1 = Common Mullein

** Depending on location specific environmental conditions and which target species were present, one or more of the listed herbicides were mixed together and used in that area.

*** Acreages based on billing statements, not GIS footprints on map.

Table 3. 2013 Revegetation Location Summary

Project Name	Seeding/Installation Date	Acres	Seed Mix* Or Plants Installed	Seeding/Planting Method
2013 Shrub Planting	4/4/2013	1.2	Four-wing Saltbush, Buffaloberry	10 cu. in. plants, Hand Installed
A-3 Interseeding	11/14/2013	1.8	Mesic seed mix	Hand Broadcasting
B371 Revegetation Area	6/6/2013	0.5	Mesic seed mix	Compost added, ATV Broadcasting and Harrowed
D-2 Parcel Road Revegetation Area	4/8/2013	4.7	Xeric seed mix	Sustane Fertilizer, Broadcast seeding and Harrowed
East Trenches Revegetation Area	6/6/2013	0.2	Xeric seed mix	Compost added, ATV Broadcasting and Harrowed
East Trenches Solar Project Interseeding	10/17/2013	0.04	Mesic seed mix	Hand Broadcasting
FC-1 Road Crossing Interseeding	12/19/2013	0.03	Mesic seed mix	Hand Broadcasting
Volunteer Graminoid Seed	11/27/2013	1.6	Volunteer collected seed	Hand Broadcasting
Forb Nurseries	12/18/2013	0.7	Volunteer collected seed	Hand Broadcasting
Mound Revegetation Area	6/6/2013	1.7	Mesic seed mix	Compost added, ATV Broadcasting and Harrowed
PLF Interseeding	11/14/2013	1.3	Mesic seed mix, coyote willow stake installation	Hand Broadcasting and Planting of Willow stakes
WALPOC Interseeding	10/17/2013	0.2	Mesic seed mix	Hand Broadcasting
WOMPOC Interseeding	11/26/2013	0.2	Mesic seed mix	Hand Broadcasting
	Total	14.2		

*Seed mixes are listed in the Rocky Flats, Colorado, Site Revegetation Plan, January 2009.

