

2015 Vegetation Surveys

Introduction

Vegetation surveys are conducted at the Rocky Flats Site (Site) to provide information necessary for managing the natural resources. The Site consists of the Central Operable Unit (COU), which comprises the lands retained by the U.S. Department of Energy Office of Legacy Management (LM), and the Peripheral Operable Unit (POU), most of which was transferred to the U.S. Fish and Wildlife Service to become the Rocky Flats National Wildlife Refuge (Figure 1). 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.”

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 2015 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 in the revegetation areas within the COU in 2015 included diffuse knapweed (*Centaurea diffusa*) and Dalmatian toadflax (*Linaria dalmatica*). Fortuitous observations of other noxious weed species were recorded in field notebooks or field maps.

Diffuse knapweed and Dalmatian toadflax 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 to control the species, 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 need to be controlled. 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 each of the various revegetation areas at the Site, but some infestations may have been missed. Fortuitous observations were not classified into density categories.

Herbicide Applications and Revegetation Activities

Licensed subcontractors and LM contractor personnel 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 or revegetation activities took place during 2015. 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, 2013, 2014, and 2015.

Qualitative observations were made of the 16 forb nurseries and adjacent “unseeded” reference locations in fall 2015 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 2015 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 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.

Weed Mapping and Weed Control

Figures 2 and 3 show the 2015 weed distribution maps for diffuse knapweed and Dalmatian toadflax, respectively. Species were mapped in the revegetation areas within the COU (approximately 575 acres). 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 4 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 5). Spot spraying of selected weed species was conducted by LM contractor personnel throughout the growing season (Figure 6). 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 professional judgment of the herbicide applicator, different herbicides were used within different locations to provide the control needed.)

Biocontrol insects continue to be used at the Site. In 2015, 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 2015, interseeding and revegetation activities were conducted to increase vegetation cover or diversity at several locations (Table 1 and Figure 7). Approximately 10 acres were interseeded or revegetated in 2015. Shrubs were planted as part of the habitat enhancement projects (discussed below).

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 8). 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 (approximately 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 more 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 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.

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 9). 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 2 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.

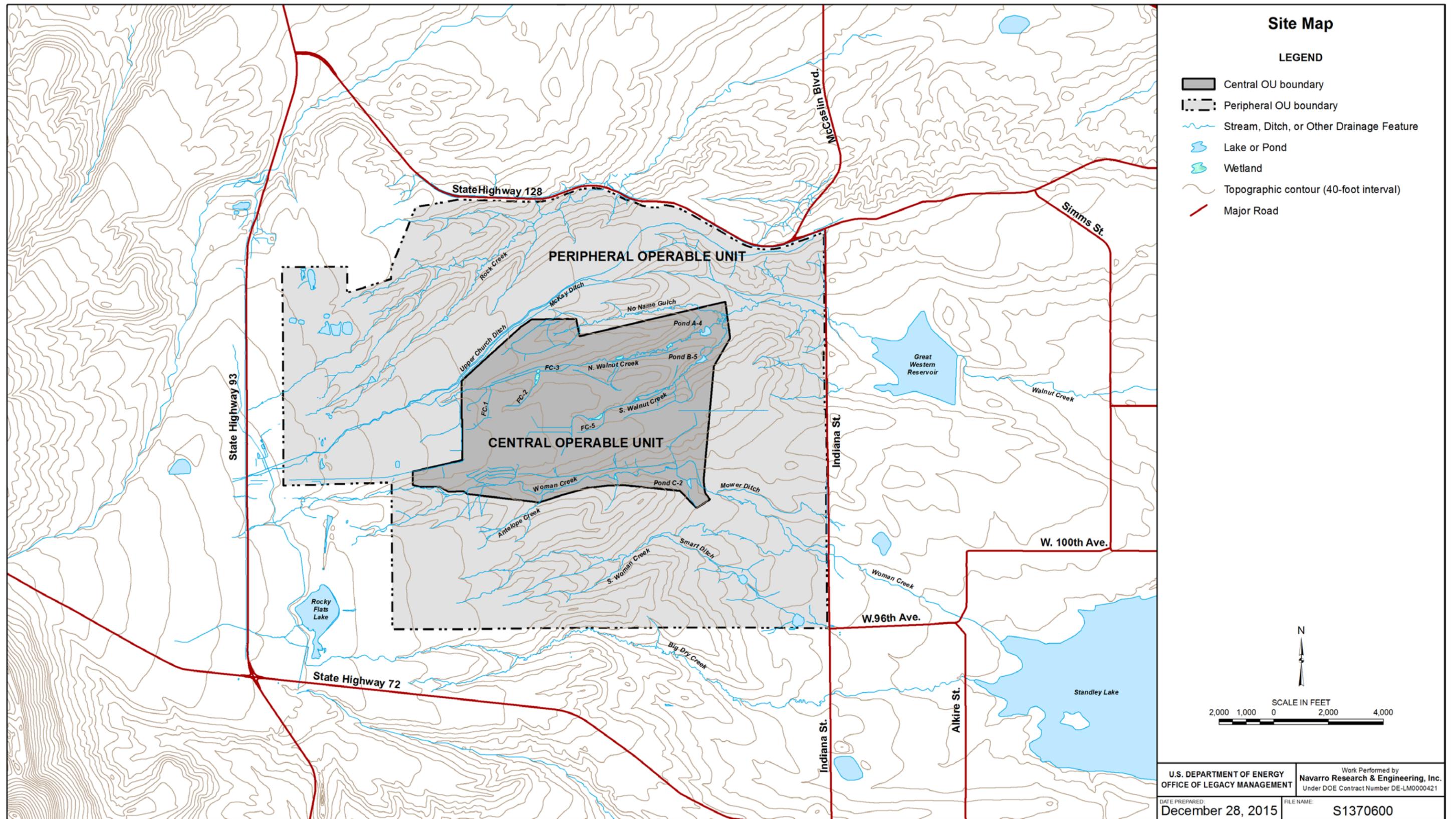
Using only the volunteer-collected forb species (yellow rows), data were evaluated in three categories based on the year(s) of seeding, 2010/2012, 2011 and 2011/2013, and 2013. The second year shown for some years indicates that additional seed was sown into those areas that year. Interestingly, regardless 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 reference 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.

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.

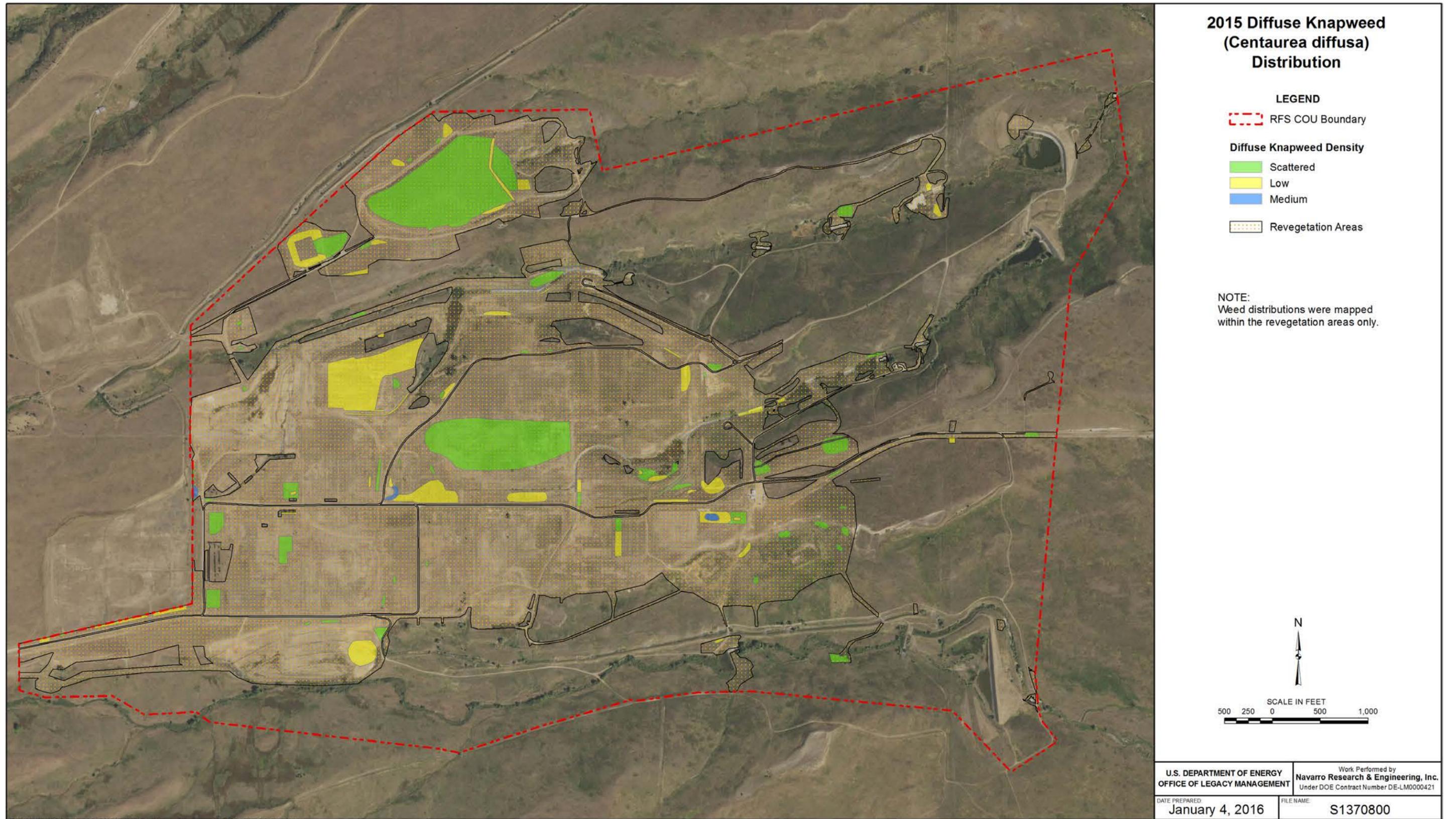
Summary

Managing natural resources at the Site involved various tools in 2015, 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. Approximately 340 acres in the COU were treated with herbicides in 2015 to control noxious weeds and improve the quality of the plant communities. Interseeding and revegetation activities were conducted at several locations to continue to increase the vegetation cover and stand density. A habitat enhancement project was conducted in 2015 to attempt to increase shrub and tree diversity at the Site. The establishment of vegetation at the revegetation locations continued to be documented through photomonitoring. Successful establishment of several volunteer-collected forb species was documented through the evaluation of the forb nurseries. Vegetation establishment has been good and, with proactive management, should be self-sustaining in the long term.



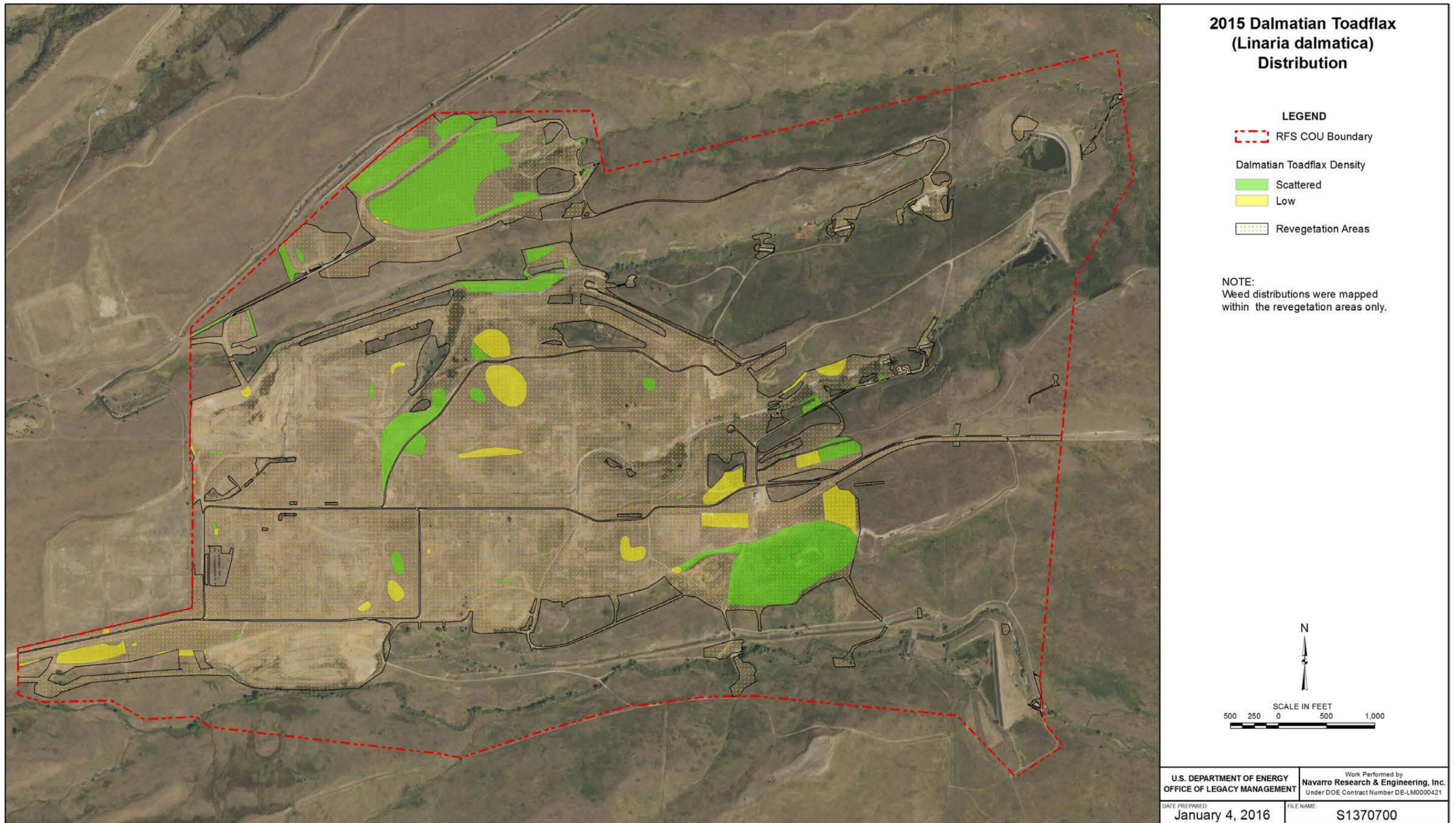
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Figure 1. Site Map



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Figure 2. 2015 Diffuse Knapweed (*Centaurea diffusa*) Distribution



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Figure 3. 2015 Dalmatian toadflax (*Linaria dalmatica*) Distribution



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Figure 4. 2015 Miscellaneous Weed Species Locations

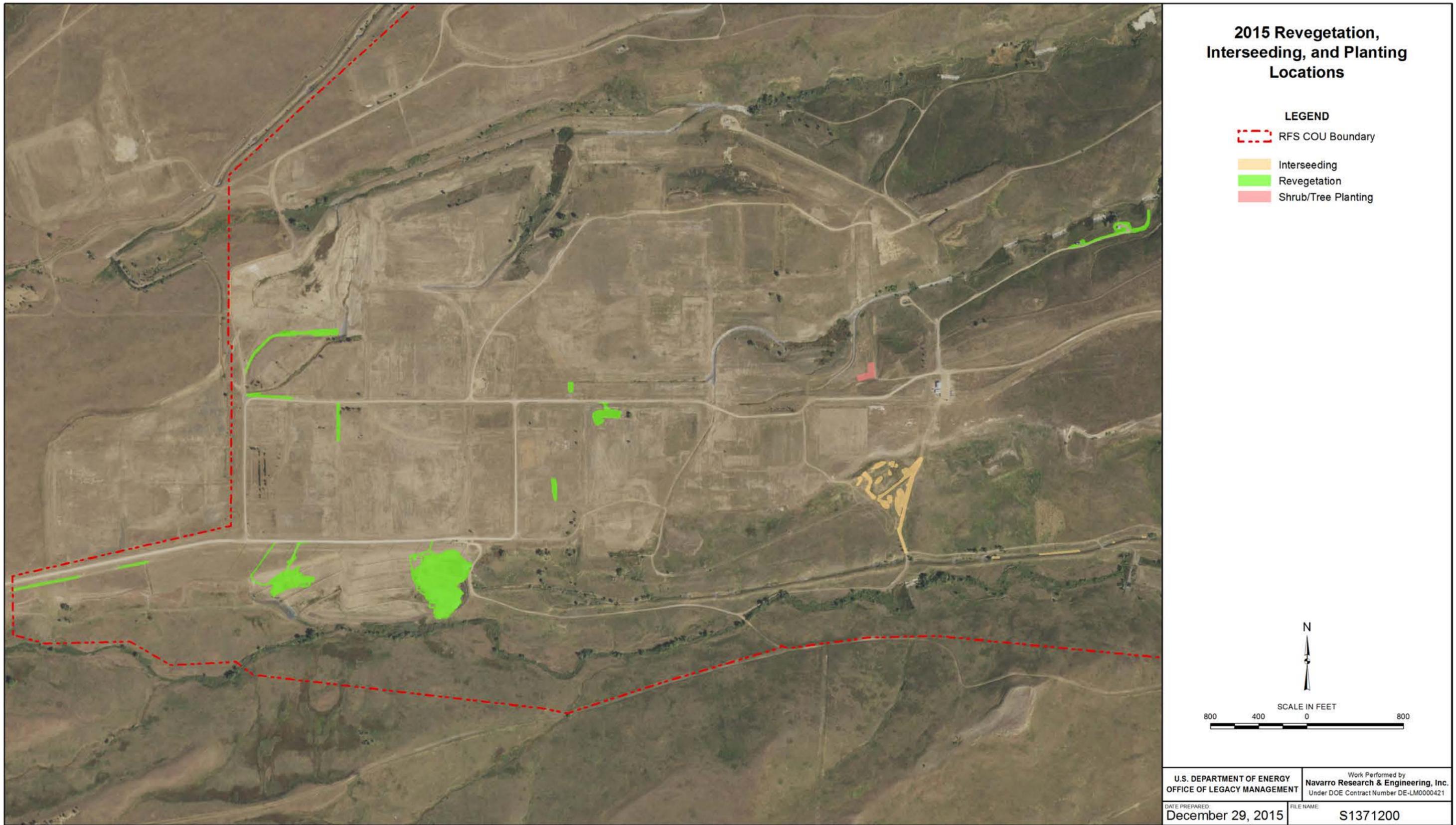


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Figure 5. Rocky Flats Site Herbicide Application Locations 2015

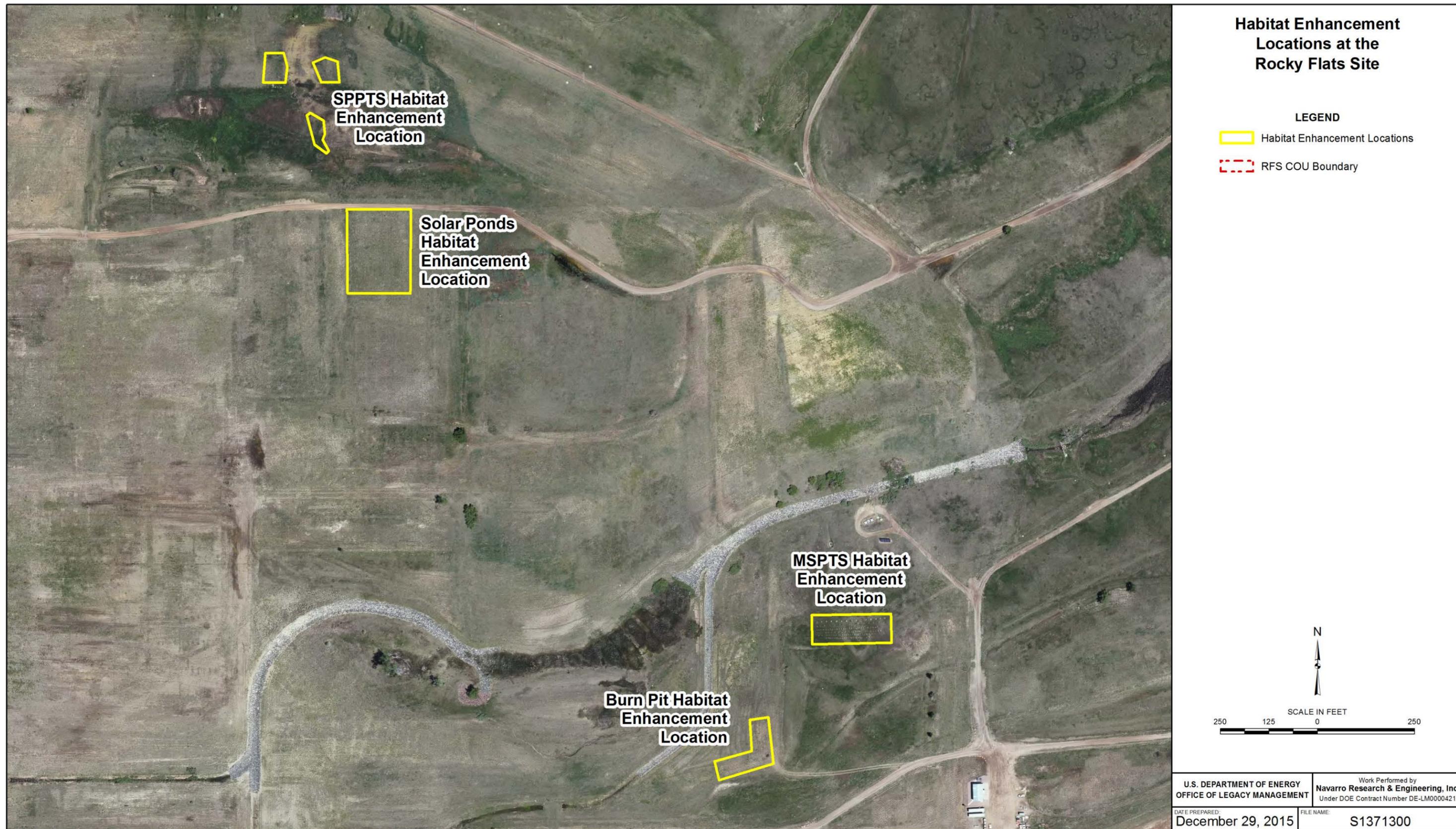


Figure 6. Rocky Flats Site 2015 Spot Spray Herbicide Application Locations



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Figure 7. 2015 Revegetation, Interseeding, and Planting Locations



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Figure 8. Habitat Enhancement Locations at the Rocky Flats Site



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Figure 9. Forb Nursery Monitoring Locations 2015

Table 1. 2015 Revegetation Location Summary

Project Name	Seeding/Installation Date	Acres	Seed Mix* 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	Handbroadcast - Interseeding w/ woodstraw and TRM
OLF Project	9/22/2015	5.4	Hillside	Compost, Broadcast, and Harrowed
OLF Soil Locations	4/1/2015; 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 planted installed
	Total	10.0		

