ECOLOGY

2001 Annual Vegetation Management Plan for the Rocky Flats Environmental Technology Site

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Revision 1

CONTENTS

	Page
LIST OF TABLES	iii
LIST OF FIGURES	iv
ACRONYMS AND ABBREVIATIONS	v
INTRODUCTION	1
WEED CONTROL STRATEGY	3
WEED CONTROL PROGRAM	3
WEED RANKING SYSTEM AND CONTROL PRIORITIZATION	3
IDENTIFICATION OF SPECIES-SPECIFIC WEED CONTROL FOR FY2001	7
BIOLOGICAL WEED CONTROLS (INSECTS)	9
CHEMICAL WEED CONTROLS	10
SPOT WEED CONTROL	13
GENERAL VEGETATION MANAGEMENT	14
ADMINISTRATIVE AND CULTURAL WEED MANAGEMENT ACTIONS	14
RECLAMATION AND REVEGETATION	15
PHYSICAL OR MECHANICAL VEGETATION CONTROL	15
PRESCRIBED BURNING	18
CONCLUSIONS	19
REFERENCES	20
FIGURES	
APPENDIX A – Aerial herbicide application plan for FY2001	
APPENDIX B – Guidelines for Temporary Revegetation of [Insert Project Name/Location]	

LIST OF TABLES

Table 1 Weed control methods for the Site

Table 2 Noxious weeds occurring at the Site

Table 3 Alien plants ranking results for selected noxious weeds

Table 4 Prioritized noxious weed list for the Site

Table 5 Control measures for Priority 1 and Priority 2 species

Table 6 Biological control agents for use at the Site

Table 7 Approved herbicides for use at the Site

Table 8 Preventative Actions for Weed Control

LIST OF FIGURES

Figure 1 Alien Plants Ranking System results for selected noxious weeds at Rocky Flats Environmental Technology Site

Figure 2 FY 2001 road grading and mowing operations for weed control

Figure 3 Potential prescribed burn locations in PMJM habitat protection areas

Figure 4 FY2001 ground herbicide application locations (broadcast)

Figure 5 FY2001 aerial herbicide application locations (broadcast)

ACRONYMS AND ABBREVIATIONS

APRS	Alien Plant Ranking System
CAQCC	Colorado Air Quality Control Commission
CDA	Colorado Department of Agriculture
DOE	Department of Energy
IWCP	Integrated Work Control Package
K-H	Kaiser-Hill Company, L.L.C.
PIDAS	Perimeter Intrusion Detection Assessment System
NFPA	National Fire Protection Association
RFCSS	Rocky Flats Closure Site Services
RFFD	Rocky Flats Fire Department
RFFO	Rocky Flats Field Office
Site	Rocky Flats Environmental Technology Site

Introduction

The vegetation management goal at Rocky Flats Environmental Technology Site (Site) is to exercise good stewardship to preserve the natural resources in the Buffer Zone while complying with applicable regulations. The program is designed to control excessive vegetation that can increase wildfire hazards, to control present and future infestations of noxious weeds (DOE 1998), and to enhance the native plant communities by reducing dead plant litter while recycling nutrients. This Annual Vegetation Management Plan provides an integrated framework for managing vegetation, providing wildfire protection, protecting the natural resources of the Site Buffer Zone, and perpetuating native plant communities during FY2001.

Some vegetation management actions serve dual purposes of controlling the spread of invasive weeds while reducing the accumulation of fuels that can carry uncontrolled wildfires across the Site and into improved areas. Invasions of non-native vegetation at the Site are degrading existing habitat quality in the undeveloped areas, reducing the coverage of the Site's high-value vegetation communities, and adversely affecting the conservation of Buffer Zone resources. The invasion of these noxious weeds into the developed Industrial Area has also increased debris accumulation around structures and transformers where it increases the potential of fire in these areas. By controlling excessive weed growth, and mowing all vegetation around buildings and structures in the developed areas, fuel accumulation is reduced, and the sitewide noxious weed control effort enhanced. These vegetation control efforts implemented within the Industrial area also reduce the secondary seed source from noxious weeds that grow in unused disturbed portions of the developed area.

The spread of some noxious weed species into the Industrial Area has increased the buildup of fuel along fences and against buildings (accumulation of tumbleweeds), which unchecked provides bridge areas where urban interface wildfires could attack structures and cause property damage. There are additional accumulations along line fences in the Buffer Zone. The long-term suppression of wildfires, combined with the recent prohibition of prescribed burning at the Site (including cessation of burning of accumulated vegetation debris out of fences), has allowed a heavy accumulation of fine fuels. This has increased the risk of uncontrolled wildfires, and control problems at urban/wildland interface areas.

Simply applying herbicides to noxious weeds in the Buffer Zone does not fully address the problem of vegetation debris accumulating to levels that increase the risk of rapid spread of wildfire. To address problems other than noxious weed control, additional vegetation management actions are incorporated into this Plan.

The Integrated Weed Control Strategy (K-H 1997) for the Site calls for an annual weed control plan for each fiscal year. The Vegetation Management Environmental

Assessment (DOE 1999) called for development of a Vegetation Management Plan that addresses an expanded vegetation management program that includes actions other than weed eradication. This document serves that purpose for FY2001, as it targets the major weed control efforts at species presenting the greatest threat to native plant communities, while outlining other vegetation management actions that contribute to personnel safety, aesthetics, and wildfire prevention and/or risk reduction. With a moratorium in effect for Department of Energy (DOE) facilities, prescribed burning was deferred for 2001, therefore grassland management through application of prescribed fire will not occur during this fiscal year.

Although no single weed control effort or strategy will completely remedy the noxious weed problems at the Site, this plan seeks to integrate various techniques to provide effective weed control and enhanced wildfire protection, while minimizing environmental damage and optimizing the use of available resources. Some vegetation management actions are important from the standpoint of reduction of biomass that would otherwise provide fuel for wildfires; others are more important from a resource management perspective. Implementation of these actions will involve a joint effort between the Kaiser-Hill Company, LLC (K-H) Ecology Group and Rocky Flats Closure Site Services (RFCSS) Roads and Grounds personnel. While this plan concentrates primarily on weed control actions in the Buffer Zone, it also provides guidance for vegetation management in the developed Industrial Area.

Weed Control Strategy

Weed Control Program

Vegetation management at the Site includes integration of the noxious weed control efforts with other means of vegetation control necessary for health and safety, resource, conservation, fire safety, wildfire control, security, and traffic safety purposes. The weed control component of this program is discussed first because it is the largest-scale component, and the most complex. Weed control substantially reduces the large amounts of moveable fuels (tumbleweeds), while providing the mechanism by which healthy vegetation communities are maintained. Well managed native vegetation communities can provide one of the best means for controlling the spread of wildfires. The weed control measures in this plan are listed in the order they should be considered from an integrated weed management viewpoint, starting with the least toxic, non-chemical measures. Table 1 lists the weed and vegetation control methods currently in use at the Site.

Table 1. Weed Control Methods for the Site

Treatment Option	Control Method
Administrative Controls	Administrative policies and procedures
Cultural Controls	Reclamation and revegetation requirements
Physical or Mechanical Controls	Grading
	Mowing
	Prescribed Burns
	Hand-pulling
Biological Controls	Insects
Chemical Controls	Herbicide application

Weed Ranking System and Control Prioritization

Weed Ranking System for Weed Control Planning

In recent years, weed ranking by risk and control difficulty has become a valuable tool for prioritizing weed species for control. After review of FY2000 monitoring results, noxious weeds (legally listed as "state noxious weeds" by the State of Colorado) that are known to occur at the Site were prioritized for control in FY2001. Ranking was conducted using the Alien Plants Ranking System (APRS; Version 5.0) developed by Ron Hiebert of the National Park System and Jim Stubbendieck of the University of Nebraska. The software, available free on the internet (http://www.ripon.edu/faculty/beresk/aliens), is described by the developers as:

"…a computer program which allows the user to compare the impacts, current and potential, of nonnative plant species on a particular land area or site, and to consider the feasibility and urgency of taking control measures against particular exotic species. APRS is a tool to help managers evaluate the threats posed by nonindigenous plants. A data file for the site consists of a DataSheet for each alien species. The DataSheet has 23 questions which must be answered with reference to how the plant behaves on this particular site. These questions assess the ecological impacts of the species and its potential to become a pest. Following a thorough plant inventory, the data file for the site may be created by answering the questions for each alien species. This information is then processed to create graphs and reports indicating how each species ranks according to its level of impact, ease of control, and the urgency of management efforts."

Weed Ranking Results for the Site

Although 32 species of state listed noxious weeds are known to occur at the Site (Table 2), only those on the Colorado "top ten" weed species are list are Priority 1 for control. Others considered problems specific to the Site were also ranked Priority 1 for control. This was done to simplify the ranking effort, and was in part due to the fact that many of the other state listed species, although occurring on the Site, are only found in isolated disturbed areas. Many of these latter species are not such aggressive, invasive species, and are having a less significant impact on the native plant communities. In the future the other listed species may be included in the Site Priority 1 ranking as necessary.

Table 2. Noxious Weeds Occurring at Rocky Flats Environmental Technology Site

+Annual Rye (*Secale cereale*)	***Jointed goatgrass (*Aegilops cylindrica*)**
*Blue mustard (*Chorispora tenella*)	*Kochia (*Kochia scoparia*)
*Bouncing bet (*Saponaria officinalis*)	*Longspine sandbur (*Cenchrus longispinus*)
*Bull thistle (*Cirsium vulgare*)	*Mayweed chamomile (*Anthemis cotula*)
***Canada thistle (*Cirsium arvense*)**	***Musk thistle (*Carduus nutans*)**
*Chicory (*Cichorium intybus*)	*Oxeye daisy (*Chrysanthemum leucanthemum*)
*Common burdock (*Arctium minus*)	*Poison hemlock (*Conium maculatum*)
*Common mullein (*Verbascum thapsus*)	*Puncturevine (*Tribulus terrestris*)
*Common St. Johnswort (*Hypericum perforatum*)	*Quackgrass (*Elytrigia repens*)
*Dalmatian toadflax (*Linaria dalmatica*)	*Redstem filaree (*Erodium cicutarium*)
*Dame's rocket (*Hesperis matronalis*)	***Russian knapweed (*Centaurea repens*)**
***Diffuse knapweed (*Centaurea diffusa*)**	+Russian olive (*Elaeagnus angustifolia*)
*Downy brome (*Bromus tectorum*)	*Russian thistle (*Salsola iberica*)
***Field bindweed (*Convolvulus arvensis*)**	*Saltcedar (*Tamarix ramosissima*)
*Flixweed (*Descurainia sophia*)	*Scotch thistle (*Onopordum acanthium*)
*Green foxtail (*Setaria viridis*)	***Yellow toadflax (*Linaria vulgaris*)**
***Hoary cress (*Cardaria draba*)**	
*Houndstongue (*Cynoglossum officinale*)	

* Noxious weeds as listed by the State of Colorado Noxious Weed Act.
\+ Additional species considered a noxious weed at the Site.
*** Species listed in bold font are Priority 1 for treatment at the Site.**

The results of the analysis are shown ranked in descending order of impact to native plant communities (Table 3). Figure 1 graphically compares the species on the basis of their impact on the plant community versus their difficulty of control. The species with the greatest potential to impact the native plant communities, and with the greatest difficulty of control are diffuse knapweed, Canada thistle, Russian knapweed, and Dalmatian toadflax. The aggressive nature, and ability of these species to dominate and replace the native plant communities, makes control of these species especially urgent. Annual rye, another species having an impact, but easier to control, is of concern at the Site because it has begun to invade the surrounding native prairie, at several locations, creeping in from the roadside edges where it originated.

Table 3. Alien Plants Ranking Results for Selected Noxious Weeds

Species	Impact	Control Difficulty	Pest Rank
Diffuse Knapweed	82	72	78
Canada Thistle	69	73	78
Russian Knapweed	47	59	79
*Dalmatian Toadflax	45	63	65
Annual Rye	44	31	52
Chicory	33	59	60
Musk Thistle	33	56	63
St. John's Wort	33	43	70
Common Mullein	31	63	49
Scotch Thistle	31	43	57
Field Bindweed	29	60	52
Bouncing Bet	24	61	52
Dame's Rocket	24	56	52
Bull Thistle	22	36	57
Jointed Goatgrass	18	41	52
Hoary Cress	16	41	46

*At present there are no known effective controls for this species that will not significantly damage native communities.

Weed Prioritization for Control

In order to determine how, when, and where to expend limited Site resources for noxious weed control it is important to prioritize the species. The full priority list is presented in Table 4 below. Priorities 1, 2, or 3 were assigned on the basis of the ranking results, their need for control on the Site, and their difficulty of control. The list includes state listed noxious weed species, as well as a few others considered problems at the Site. Not all of these species are slated for specific control efforts during FY2001, however.

Table 4. Prioritized Noxious Weed List for Rocky Flats Environmental Technology Site

Priority 1 Species	**Priority 2 Species**
*Canada thistle (*Cirsium arvense*)	+Annual Rye (*Secale cereale*)
*Diffuse knapweed (*Centaurea diffusa*)	*Bouncing bet (*Saponaria officinalis*)
*Russian knapweed (*Centaurea repens*)	*Common mullein (*Verbascum thapsus*)
	*Common St. Johnswort (*Hypericum perforatum*)
	*Dame's rocket (*Hesperis matronalis*)
	*Musk thistle (*Carduus nutans*)
	+Russian olive (*Elaeagnus angustifolia*)
	*Scotch thistle (*Onopordum acanthium*)
Priority 3 Species	
*Blue mustard (*Chorispora tenella*)	*Kochia (*Kochia scoparia*)
*Bull thistle (*Cirsium vulgare*)	*Longspine sandbur (*Cenchrus longispinus*)
*Chicory (*Cichorium intybus*)	*Mayweed chamomile (*Anthemis cotula*)
*Common burdock (*Arctium minus*)	*Oxeye daisy (*Chrysanthemum leucanthemum*)
*Dalmatian toadflax (*Linaria dalmatica*)	*Poison hemlock (*Conium maculatum*)
*Downy brome (*Bromus tectorum*)	*Puncturevine (*Tribulus terrestris*)
*Field bindweed (*Convolvulus arvensis*)	*Quackgrass (*Elytrigia repens*)
*Flixweed (*Descurainia sophia*)	*Redstem filaree (*Erodium cicutarium*)
*Green foxtail (*Setaria viridis*)	*Russian thistle (*Salsola iberica*)
*Hoary cress (*Cardaria draba*)	*Saltcedar (*Tamarix ramosissima*)
*Houndstongue (*Cynoglossum officinale*)	*Yellow toadflax (*Linaria vulgaris*)
*Jointed goatgrass (*Aegilops cylindrica*)	

* Noxious weeds as listed by the State of Colorado Noxious Weed Act.
\+ Additional species considered a noxious weed at the Site.

In general, the prioritization of species slated for control in FY2001 remains much the same as in FY2000. The Priority 1 species are diffuse knapweed, Russian knapweed, and Canada thistle. Diffuse knapweed is the greatest threat to native plants because of the aggressive, invasive character of the plant and its ability to invade and dominate undisturbed native plant communities at the Site. Diffuse knapweed is also the major contributor of windblown fuel that accumulates in fences, against buildings, and in other sheltered areas. Other species that are sedentary (e.g., Canada thistle and Russian knapweed) only contribute to the fuel loads where they are rooted.

Additionally, annual weed mapping has shown that diffuse knapweed is present across large portions of the Site. It is important to contain the spread of this species before it completely infests the Site. Russian knapweed is of high priority because of its similarly aggressive nature. It currently occupies only about one acre, making control and eradication possible at this point. Canada thistle is currently found throughout most of the wetland and riparian areas on the Site. Its similarly aggressive nature, continuing expansion, and difficulty of control make it of high priority as well. The fact that it occurs in wet areas makes effective control difficult because mowing and herbicides cannot be used effectively in many of these areas. Some drier locations will allow mowing, which combined with herbicide application, could begin to provide effective control over time at these locations.

Priority 2 species slated for control in FY2001 are annual rye, Scotch thistle, dame's rocket, Russian olive, musk thistle, common mullein, common St. John's-wort, and bouncing bet. These species have been selected because the infestations are currently restricted to small isolated patches that can be more easily controlled than many of the other species shown in Table 4; or they are in areas that will be treated as part of the herbicide applications for diffuse knapweed. For the species with small infestations, it is important to begin control of these immediately to keep them small and hopefully completely eradicate them from the Site.

The Priority 3 species are currently not slated for any specific control measures during FY2001. Dalmatian toadflax, although one of the species most in need of control at the Site because of its impact to the native plant communities, is a considerable challenge because it is extremely difficult to control. Currently no effective management scheme exists for its control at the scale the problem exists on the Site. Based on small plot trials on the Site, certain herbicides such as Tordon 22K or Telar *can* effectively control and kill the species, but *only* at application rates that eliminate all the other forbs in the plant community. Because one of the goals of this plan is to preserve and enhance native plant communities, this would be counterproductive to the overall goal. Mechanical control, which to be effective requires tillage, is not an option because it, too, would be destructive to the prairie. Effective biological controls for Dalmatian toadflax are presently unavailable. Broadcast Tordon 22K treatment has shown some effect in depressing flowering, and impacting vigor of the species, but treatment concentrations cannot be increased without negative impacts on desirable native species. No specific control effort is slated for this species in FY2001.

Treatment priority for any of Priority 3 species could change in the future as some of the higher priority species are brought under control. While some of the Priority 3 species (e.g., Russian thistle, which also contributes tumbleweeds to the moveable fuel sources) may be impacted by control efforts directed at other target species, but no specific efforts will be directed at them in FY2001.

Noxious weed species may be added to the lists maintained under this program at any time, depending upon the adoption of noxious weed list revisions by state or local regulatory agencies. Should a problem species appear at the Site, the new species will be added to the Site’s list of target species without prior notice, and immediate eradication efforts may begin.

Identification of Species-Specific Weed Control for FY2001

The following control methods (Table 5) are proposed for priority one and priority two species at the Site during FY2001. No specific control is slated for priority three species during FY2001.

Table 5. Control Measures for Priority 1 and Priority 2 Species

Diffuse Knapweed	• Mowing along main access roads and selected Buffer Zone roads will be continued to help control the diffuse knapweed in these areas. • Ground and aerial application of Tordon 22K and Transline herbicides will continue at selected locations. Spot control will be conducted in previously treated aerial herbicide application locations to minimize the rate of diffuse knapweed return. • Additional biocontrol insects will be obtained from the CDA Insectary at Palisade, Colorado. Insect releases will be in areas were other forms of control are impractical (i.e., riparian corridors). These areas will serve as nurseries, for further Site releases.
Russian Knapweed	• Ground herbicide applications, to control the small infestation (~ 1 acre) of Russian knapweed found at the Site, will continue. • Continued reseeding with native perennial grasses to reestablish a native cover.
Canada Thistle	• Mowing, combined with application of the herbicide Transline, will be conducted at a few selected locations to begin control of infestations of Canada thistle at the Site. • Evaluate the 2000 release locations the biocontrol fly, *Urophora cardui*, at 2 locations in Rock Creek. These sites will be inspected to determine fly survival and to observe any damage (galls) present on the Canada thistle plants. If flies are abundant, relocation of some of the flies to other Site locations may be attempted.
Annual Rye	• Mowing will be used in the xeric tallgrass prairie to prevent seed-set in a large infestation of annual rye along a firebreak road in the north Buffer Zone. • At several locations in the southeast Buffer Zone where there are smaller infestations, sickles will be used to prevent seed-set.
Scotch Thistle	• Hand pulling, hand cutting, and spot herbicide treatments with Roundup will be used to control the few small infestations remaining at several locations in the Buffer Zone. • Broadcast herbicide application in the Operable Unit 5 area.
Dame's Rocket	• Hand pulling, sickles, and spot herbicide treatments with Roundup will be used to control the small infestations west of the A-series ponds in the Buffer Zone.
Bouncing bet	• Hand pulling, sickles, and spot herbicide treatments with Roundup will be used to control the few small infestations at the Site.
Russian Olive	• The isolated trees occurring on Site will continue to be cut down and the trunks treated with Roundup to prevent regeneration. • Alternatively, trees may be girdled and Roundup sprayed into the girdled area.
Musk Thistle and Common Mullein	• Ground and aerial herbicide applications will be used to control several infestations of these species as part of the larger spray effort to control diffuse knapweed. • Musk thistle control insects will be evaluated at some infestations to ensure that populations continue to be present at the Site.
Common St. John's-wort	• Foliage feeding beetles, *Chrysolina quadrigemina*, that were transferred in 2000 to St. John's-wort infestations east of the Lindsay Ranch, in Rock Creek, from other areas on the Site will be evaluated. Additional insects will be collected and released as needed for the problem on this hillside.

Biological Weed Controls (Insects)

Biological control agents (i.e., insects) are being used on the Site to assist in the control of musk thistle (*Carduus nutans*), St. John's-wort (*Hypericum perforatum*), Dalmatian toadflax (*Linaria dalmatica*), Canada thistle, and diffuse knapweed. The insects have been provided to the Site by the Colorado Department of Agriculture (CDA) to target specific weed infestations.

The cooperative efforts with the CDA will continue with regard to the release of biological control agents for weed control at the Site. Additional releases of insects and other biological control agents for the above-listed and other species could increase the effectiveness of the weed control efforts while potentially reducing costs. Communication with local researchers who are evaluating the use of biocontrols on nearby Open Space properties should be continued to keep abreast of any new findings and techniques. Table 6 lists the biological controls currently available for weed control at the Site. Those that have been released or observed on the Site are in bold.

During FY2001, additional biocontrol insects for diffuse knapweed will be requested from the CDA Insectary at Palisade, Colorado, for release at the Site. These insects will be released at locations where other forms of control are impractical (i.e., riparian areas), in order to try and control infestations at these locations. These areas will then also serve as nurseries, for increasing biocontrol populations on Site, which can later be introduced to other locations at the Site.

During FY2000, 200 individuals of the biocontrol fly, *Urophora cardui*, were released at two locations in Rock Creek. These sites will be evaluated to determine if the flies survived, and if any damage (galling) is present on the Canada thistle plants in the area where the flies were released. These flies were already present in other Rock Creek locations in 2001, indicating that the species may have already migrated in from other release sites. The U.S. Fish and Wildlife Service may also provide some biological control insects to the Site.

Musk thistle control flower head weevils, *Rhinocyllus conicus,* will be monitored at several locations to ensure that populations continue to be present at the Site. Evaluation will also be made of the foliage feeding beetles, *Chrysolina quadrigemina*, that were released on St. John's-wort infestations east of the Lindsay Ranch in Rock Creek in 2000. As needed, additional insects will be collected elsewhere on the Site and released to augment the existing population help control the problem on this hillside.

Table 6. Biological Control Agents for Use at the Site

Target Species	Beneficial Organism	Effect
Diffuse knapweed (*Centaurea diffusa*)	*Urophora affinis* and **Urophora quadrifasciata**	Attacks knapweed flowers, producing galls that reduce seed production.
	Sphenoptera jugoslavica	Beetle larvae bore into root crown and upper roots of knapweed, retarding plant development and stunting growth.
	Bangasternus fausti	Adults lay eggs in knapweed flowers. Larvae feed within flower receptacle, destroying seeds.
Musk thistle (*Carduus nutans*)	**Rhinocyllus conicus**	A weevil that eats the seeds in the musk flower heads.
	Trichosirocalus horridus	Weevil that attacks the crown of musk thistle, thus killing the apical meristem and reducing the potential of the plant to flower.
	Cassida rubiginosa	Leaf-eating beetle that eats the musk thistle leaves.
Canada thistle (*Cirsium arvense*)	*Ceutorhynchus litura*	A leaf- and stem-mining weevil.
	Urophora carduii	A gall fly.
St. Johns-wort (*Hypericum perforatum*)	*Agrilus hyperici*	A flower-feeding weevil.
	Chrysolina quadrigemina	A foliage-feeding beetle.
	Zeuxidiplosis giardi	A gall-forming fly.
Russian thistle (*Salsola iberica*)	*Coleophora klimeschiella*	Foliage-feeding, case-bearing moth.
	Coleophora parthenica	Stem-boring moth.
Puncturevine (*Tribulus terrestris*)	*Microlarinus lareynii*	Seed-feeding weevil.
	Microlarinus lypriformis	Stem-boring weevil.
Dalmatian toadflax (*Linaria dalmatica*)	**Calophasia lunula**	Larvae of this moth feed on the leaves and flowers of the plant.

Species listed in **bold** have been released or observed on the Site.

Chemical Weed Controls

The Ecology Group maintains a list of herbicides approved for use on the Site. Herbicides *not* on the current list *may not* be used until they are approved. Many of these chemicals are restricted use herbicides, and must be applied only by a licensed (certified) applicator. Such restricted use herbicides may not be applied onsite by unlicensed applicators. Unrestricted use herbicides, such as Roundup, may however, be applied by unlicensed applicators. Herbicides cannot be stored or maintained onsite, empty containers may not be washed onsite, and used containers must be removed by the

applicator at the end of the work shift. Disposal is strictly the responsibility of the applicator. The selected herbicides and application rates are based on the best available information and recommendations from experts (Beck 1992, Beck, 1996a, Beck 1996b, Beck, 1997a, Beck, 1997b, CNAP, 2000).

Table 7. Approved Herbicides for Use at Rocky Flats (Last updated 01/19/01)

Herbicide Name	Active Ingredient
Arsenal	Imazapyr
Banvel	Dicamba
Buctril	Bromoxynil
Escort	Metsulfuron
Gallery	Isoxaben
Karmex	Diuron
Oust	Sulfometuron
Plateau	Imidazolinone
Rodeo	Glyphosphate
Roundup	Glyphosphate
Surflan	Oryzalin
Telar	Chlorsulfuron
Transline	Clopyralid
Tordon 22K	Picloram

Knapweed Treatment

Diffuse knapweed infestations on the Site are so serious that continued application of herbicides (Tordon 22K and Transline) to portions of the Buffer Zone during FY2001 is planned. During FY1997 and FY1998 combined, more than 536 acres of prairie in the Buffer Zone were treated with herbicides using vehicle-mounted equipment. Results of monitoring have shown large decreases in the amounts of diffuse knapweed present in treated areas. The large reduction in the abundance of reproducing adult plants in these areas has reduced annual seed production, reduced the likelihood of the spread of the infestation from these areas (due to no adult plants being available for wind dispersal), and dramatically improved the appearance of the grassland. During FY1999 and FY2000, both ground application and aerial application (by helicopter) of herbicides was used to treat more than 2,500 acres infested with diffuse knapweed and other weed species. Data from these past efforts while, showing good initial control of the diffuse knapweed, have also underscored the need for continued spot control at the locations in the years following large-scale operations. During FY2001, efforts will be made to do more spot control to maintain diffuse knapweed at lower levels in these locations, thus increasing the longer term effectiveness of the large-scale operations.

The K-H Ecology Group will provide guidance in the form of maps, prescribed herbicides, and application rates to RFCSS (the group responsible for the herbicide application) for herbicide application by vehicle-mounted equipment and backpack spraying in the Buffer Zone. Figure 2 shows recommended locations for ground

application of herbicides at the Site during FY2001. A total of approximately 436 acres are slated for ground application of herbicides in FY2001.

In addition to ground application, aerial herbicide application plans have been developed and will be provided to RFCSS guidance for the continuation of aerial herbicide applications across large portions of weed infested areas at the Site. Aerial application of herbicides to the Site will be conducted under stringent guidelines (flight plan and Integrated Work Control Package [IWCP]). Areas slated for aerial application in FY2001 are shown in Figure 3. Approximately 1020 acres are proposed to receive aerial herbicide application in FY2001. Appendix A contains the current guidelines for aerial application of herbicides on the Site.

Figures 2 and 3 show where broadcast herbicides will be used over all management areas in FY2001, including where it will encroach near Preble's meadow jumping mouse (*Zapus hudsonius preblei*) protection areas. This particular species is of interest because of its standing as a threatened species, protected under the Endangered Species Act. The impacts to the mouse, and its habitat, were evaluated during development of the herbicide application plans, and it was determined that because of several factors, there will be no adverse effect on the mouse as a result of herbicide application. Most importantly, the use of selective herbicides is expected to improve the overall habitat condition for this species at the Site. Large-scale herbicide application is planned to occur while the mouse is in hibernation (prior to mid-May), and therefore not at risk from physical harm. Herbicides that will be used have been selected on the basis of their lack of adverse effect on species other than target species, so even direct exposure of the mice to the dilute compound would not risk mortality or other adverse responses. Because the herbicides are selective, only certain broadleaf plants will be affected, leaving sufficient vegetation cover to protect the mouse. It is hoped that by improving the condition of marginal habitat, the viable habitat for the mouse can be increased.

Aerial herbicide application will be limited to a distance not closer than 100 feet to riparian vegetation. Drift cards will be used to monitor wind-induced drift of herbicides near woody vegetation and other sensitive areas. Broadcast ground herbicide application will not be conducted closer than 30 feet to appropriate Preble's mouse habitat. Individual plants within the 30-foot buffer, as well as within appropriate habitat, may be treated with spot herbicide application, or hand cutting. To control the potential for wind drift of herbicides, aerial and ground application will be subject to wind speed restrictions in accordance with manufacturer's instructions.

Herbicide Applications for Other Target Weed Species

In many cases where herbicides are applied to control diffuse knapweed, no additional effort is required for other target weed species because these non-target species are also affected by the herbicides used for knapweed control. However, application of other species-specific herbicides may be necessary for species that are not affected by the knapweed treatment.

Herbicide application for some of the less aggressive target species will be limited mostly to road shoulders, roadsides, disturbed areas, storage yards, and areas adjacent to or in the Industrial Area. In some cases, where ecological conditions allow, populations of these species within the native plant communities may be spot treated with herbicides. The goal of such applications will be to reduce or eliminate small populations that might otherwise expand aggressively, and/or to improve the quality of the native communities. This application strategy will be employed as needed throughout the growing season.

A Russian knapweed population that was discovered on Site during FY1998 will be treated again with herbicide during FY2001 to reduce the stand and keep it from spreading further. Application will be conducted prior to flowering of the species. Some Canada thistle infestations will be treated by mowing, paired with herbicides application, for better control.

Spot Weed Control

Spot weed control consists primarily of hand pulling, using sling blades or sickles, and spot spraying or wicking of individual plants. Spot control will be continued for small infestations of noxious weeds where this type of control method is suitable and effective. These methods were used on the Site in FY1999 and FY2000, and will be continued in FY2001 for the infestations of Scotch thistle, dame's rocket, bouncing bet, and some of the smaller isolated patches of annual rye. Continued evaluation of the effectiveness of these measures will be conducted. The use of this method over the past two years has shown excellent control and reduction in the size of the infestations of Scotch thistle on the Site and should eliminate this species from the Site in the next few years if continued. Annual rye infestations have been reduced by mowing or cutting at the time of flower production. Russian olive, an exotic tree, which has caused substantial degradation of the much of the riparian habitat along the Front Range of Colorado, also occurs on the Site at a few locations. Hand cutting of the few individual trees on the Site, combined with an herbicide applied to the cut stem, should eliminate many of the individuals of this species from the Site. As demolition projects progress, these projects will be requested to eliminate this species from their work areas as well.

General Vegetation Management

Administrative and Cultural Weed Management Actions

Administrative and cultural weed management actions are incorporated into this Plan with the intention of preventing the introduction and spread of weeds at the Site. In the near future, as decommissioning and demolition of buildings in the Industrial Area occurs, a large amount of area will be subject to disturbance and subsequent revegetation. These areas must be protected from invasive weeds, and properly treated to encourage successful establishment of native vegetation cover. The preventative actions incorporated into this Vegetation Management Plan include:

Table 8. Preventative Actions for Weed Control

Weed-free Materials	• All revegetation and reclamation projects at the Site will use weed-free topsoil, seed, and mulch sources. Seed mixes will be composed of appropriate native species for the locations.
Approved Seed Mixtures Only	• All seed mixtures for Site reclamation and revegetation projects must be approved by the K-H Ecology Group. All seed mixtures to be used on Site will be inspected, prior to planting, by a qualified ecologist to ensure that the proper seed mixture was obtained.
Sterile Mulch	• All straw used for mulch on the Site will be weed-free and free of crop seed heads (i.e., threshed straw).
Followup Weed Control	• Weed control and reseeding should be a part of all revegetation and reclamation efforts for a minimum of two years after their initiation (i.e., three years in total). Budgets for all projects requiring revegetation should include funding for these efforts. The K-H Ecology Group will be the point of contact for information concerning these issues.
Immediate Eradication of New Species	• Any new noxious weed species found on the Site will be controlled immediately to reduce their population and prevent their future increase.
Prohibition of Undesirable Species	• A list of species prohibited for use in regevetation seed mixtures is maintained by the K-H Ecology Group, and updated annually or as required.

Reclamation and Revegetation

Reclamation and revegetation of the closed roads, roadside edges, and noxious weed-infested areas in the Buffer Zone would help reduce future weed control costs. Revegetation of such areas speeds the natural process of succession and helps to move these areas beyond the early successional stage that encourages weed growth. Reseeding or transplanting native species into these areas encourages them to return to native plant communities more quickly, allowing the desirable species to better compete with the weeds. Currently, all projects that disturb soil are required to reclaim and revegetate their project areas. As budget and time permit during FY2001, other disturbed and/or low-quality areas in the Buffer Zone will be reclaimed in order to restore native vegetation and to assist with weed control. Revegetation guidelines for establishing temporary vegetation cover for interim stabilization needs in the Industrial Area only (until the Final Site Reconfiguration Project) are found in Appendix B. All other revegetation projects will be custom designed by the K-H Ecology Group as the need arises.

Species Prohibited in Revegetation Mixtures

The following graminoid species shall not be used in seed mixtures for reclamation and revegetation projects on Site:

- Annual rye grass *Secale cereale*
- Bulbous bluegrass *Poa bulbosa*
- Crested wheatgrass *Agropyron desertorum* or *Agropyron cristatum*
- Intermediate wheatgrass *Agropyron intermedium*
- Johnsongrass *Sorghum halepense*
- Orchardgrass *Dactylis glomerata*
- Quackgrass *Agropyron repens*
- Sheep fescue *Festuca ovina*
- Smooth brome *Bromus inermis*
- Timothy *Phleum pratense*
- Wild proso millet *Panicum milaceum*

Physical or Mechanical Vegetation Control

Grading

Grading of Buffer Zone roads will be continued in FY2001 as a mechanical method of weed control along the unpaved roads. Grading maintains unvegetated firebreaks that also serve as access roads into the Buffer Zone for fire fighting equipment. To prevent unnecessary disturbance of native prairie, and to limit the size of the seedbed for noxious weeds, graded widths are maintained as specified under this plan. Grading will not widen the existing roads. If budget and manpower are available, designated roads will be graded at least twice per growing season, with specific times for grading determined by the K-H Ecology Group and work performed by Buildings and Grounds personnel, to

ensure the greatest effectiveness on roadside weeds and fuel control. At some locations, as possible, the large rock rows on both sides of the road will be reduced and spread back out over the road surface, in order to allow the mowing equipment better access for mowing the roadside edge. The rock row grading will not widen the road and the rocks from the rows should be spread near the road edge, leaving a smooth travel surface down the center of the roads. Figure 4 shows approximately 18 miles of roads to be graded during FY2001.

Mowing

Roadside Mowing

In addition to the roadside grading in FY2001, roadsides along certain Buffer Zone roads, and along all Site access roads, will be mowed to keep the weeds cut back. There are several purposes for mowing roadsides. Properly timed, mowing can stress weeds and impact seed-set of these undesirable plants, which aids in the control of noxious weeds. For practical travel safety reasons, keeping roadside vegetation cut low in some areas is also needed. Mowing road edges increases visibility of wildlife crossing rights-of-way and can help reduce collisions between wildlife and cars, as well as providing better visibility at intersections. Reduction of roadside vegetation height also reduces the available fuel at the margins of the firebreak and paved roads, functionally enhancing their ability to impede the spread of wildfires, and aiding firefighters in extinguishing fires in these lower-fuel buffer areas. Mowing can be done along any of the roads slated for grading, if grading is not possible in these areas. The East and West Access Roads will be mowed a minimum of 25 feet from the edges of pavement to maintain a fire protection perimeter, in accordance with National Fire Protection Association (NFPA; 1997) code, for these egress routes. Figure 4 shows the Buffer Zone roads slated for mowing during FY2001. In addition to the Buffer Zone and Access roads, all roadsides within the Industrial Area will be mowed, as practicable, out to a minimum of 25 feet from pavement.

Mowing for Building and Structure Protection

Mowing is generally conducted for aesthetic purposes in certain highly visible locations such as lawns around buildings and in common areas. In addition to aesthetic enhancement, mowing in these areas reduces fuel height, thereby reducing the potential for a wildfire to spread rapidly into buildings and other improvements. Shorter vegetation also enhances pedestrian safety in such areas by increasing visibility of uneven ground surface features, and poisonous snakes. Lawns and other vegetation surrounding buildings and structures at the Site will be mowed to maintain a height of no greater than 4 inches out to a minimum of 50 feet (as practicable) from the buildings or structures requiring protection. Mowing shall occur as needed, or as requested by the Rocky Flats Fire Department (RFFD), to maintain this fire protection perimeter in conformance to NFPA code (NFPA 1997) and RFFD procedures.

Special Mowing for Weed Control

In addition to mowing along roads, mowing will be used at some off-road Buffer Zone locations for control of annual rye (*Secale cereale*) and Canada Thistle (*Cirsium arvense*; Figure 4). The annual rye locations will be mowed during flower production (but before seed set) to eliminate the annual production of seed. Application of this methodology for the next few years should eventually eliminate the annual rye from these locations by preventing annual seed production and exhausting the seed bank. Mowing (combined with chemical control) will also be conducted at some Canada thistle infestations during FY2001 to evaluate the potential of this method for controlling Canada thistle populations on the Site. Mowing is planned at least twice during the growing season.

Special Vegetation Control for Transformers

To prevent the buildup of vegetation fuels in transformer areas, all vegetation must be eliminated from the fencing and enclosed areas around transformers. The safest, most practical means of vegetation management in these areas is the application of a total-kill herbicide. Areas within transformer enclosures, including the fencing itself, shall be maintained in a vegetation-free condition. Approved total-kill herbicides shall be applied as needed, or as requested by the RFFD to prevent accumulation of any vegetation in these areas in conformance with NFPA code (NFPA 1997) and RFFD procedures. Should there be no enclosure fence, an area that will provide a 15-foot fire protection perimeter around the installation shall be kept vegetation-free by the use of mowing and herbicides as required.

Vegetation Management for Security Purposes

In some areas vegetation must be managed to ensure that security needs are achieved. Vegetation will be maintained at a height no greater than 4 inches overall in all Security perimeter areas. Where no vegetation at all can be allowed to grow in the Perimeter Intrusion Detection Assessment System (PIDAS) around the Protected Area, total-kill herbicides will be applied as needed to curtail any plant growth. Within the boundaries of the abandoned PIDAS (once the conversion is complete), broadleaf weed herbicide will be applied to control noxious weed growth until such time as the former PIDAS is finally reclaimed and revegetated. Mowing and removal of vegetation from security perimeters will be done as needed, or as requested by the Site Security force.

Wildfire Risk Reduction Actions

In addition to the fuel reduction actions already discussed, weeds and debris that have accumulated in fences will be removed as needed. This removal may include physical removal and disposal of accumulated debris in appropriate waste containers, or once prescribed burning is again allowed on Site, by burning such debris out of fences in situ. This removal shall occur as needed (weather conditions heavily influence the rate of accumulation) or as requested by the RFFD, for conformance with NFPA code (NFPA 1997) and RFFD procedures. Vegetation debris *shall not* be tossed loose, or disposed of *anywhere* except in appropriate waste containers destined for offsite landfill disposal.

Prescribed Burning

The Rocky Flats Field Office (RFFO) postponed prescribed burning in spring 2001, but submitted a proposed multi-year burn rotation plan to the Colorado Air Quality Control Commission (CAQCC) in June 2000. The Proposed Prescribed Burn Annual Rotation Plan for the Rocky Flats Environmental Technology Site (DOE 2000) describes an 11-year rotation plan that will reduce fuel loads and improve prairie condition while protecting natural resources at the Site. Areas that will eventually be treated with prescribed burning are shown on Figure 5. Specific burn units and the planned rotation schedule are discussed in detail in the rotation plan (DOE 2000).

The use of prescribed burns on grasslands is highly recommended as a management tool to help control weeds, reduce plant litter, recycle nutrients, and improve the health and vigor of the native plant communities. Because prescribed burning is the most efficient means to reduce fuel buildup in such areas, DOE plans to pursue a prescribed burning program once the agency-wide moratorium has been lifted. A 48-acre test burn conducted on the xeric tallgrass prairie in the south Buffer Zone in spring 1999 showed positive results from both the fuel reduction standpoint and the prairie management standpoint.

Figure 5 shows where prescribed fire will be used over all management areas in the foreseeable future, including where it will encroach into Preble's meadow jumping mouse (*Zapus hudsonius preblei*) protection areas. This particular species is of interest because of its standing as a threatened species, protected under the Endangered Species Act. The impacts to the mouse, and its habitat, were evaluated during development of the proposed prescribed burn areas, and it was determined that because of several factors, there will be no adverse effect on the mouse as a result of prescribed burning. Most importantly, the use of prescribed fire is expected to improve the overall habitat condition for this species at the Site. Prescribed burning is planned to occur while the mouse is in hibernation, and therefore not at risk from physical harm. With burning timed at the start of greenup, and about a month before the mice begin to emerge from hibernation, new growth is expected to provide the requisite protective cover for the mouse by the time it emerges from hibernation. In areas where dead plant litter has been choking desirable vegetation, it is anticipated that the fire will rejuvenate the decadent vegetation and provide a nutrient boost for its growth. It is hoped that by improving the condition of marginal habitat, the viable habitat for the mouse can be increased.

For each planned prescribed burn in the future, a specific burn prescription plan will be developed, based on the specific management objectives of the burn. A properly timed prescribed burn can stress many of the undesirable weedy species in the plant communities while promoting the growth of the desired native species. Burning at appropriate intervals can limit fuel buildup such that wildfires can be more easily controlled and contained. Combined with the herbicide treatments and other weed control measures, the use of fire is expected to help reduce the weed problem, reduce the windblown fuel issue, and improve the vigor and competitiveness of native species. Thus, while periodic prescribed burning will improve the overall health and condition of

the plant communities at the Site, it will also help reduce the risk of widespread uncontrolled wildfires.

The prescribed burn plan for each burn unit will detail every aspect of the burn prescription, including safety, chain of command, public notification, contingency planning, and compliance issues. All Site and state regulations governing prescribed burns will be followed. (Colorado state regulations prohibit open burning from November 1 to March 1 because of pollution concerns [CAQCC 1995]). In addition, nesting bird mortality will also be taken into consideration (USC 1973) such that the fire will be timed to avoid undue songbird mortality. All proper permits will be obtained, and all logistical details coordinated with onsite and offsite agencies, organizations, and the public as already demonstrated by the specific communication and coordination plans used during the 2000 test burn. The effectiveness of the prescribed burns will be assessed as part of the K-H Ecology Group's ongoing monitoring of the ecological resources at the Site.

Conclusions

The use of an integrated approach for vegetation management is helping restore, improve, and preserve the increasingly rare plant communities that provide habitat for imperiled plant and animal species that occur at the Site. The previous sections outline the methods and techniques planned for FY2001. Appropriate vegetation management actions also help reduce fuel accumulation. If some of the areas slated for control are not completed during FY2001, they will be added to the list for FY2002.

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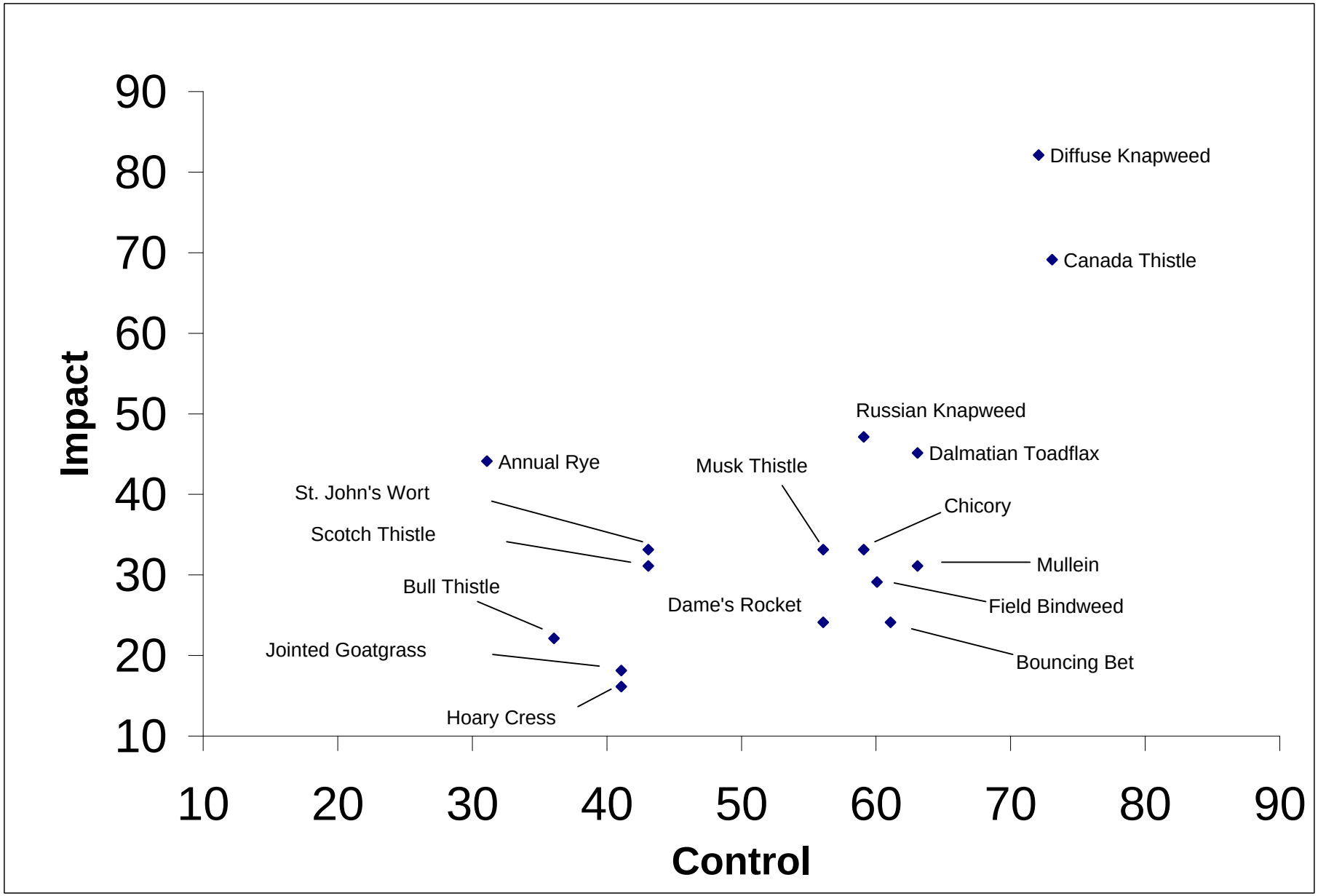
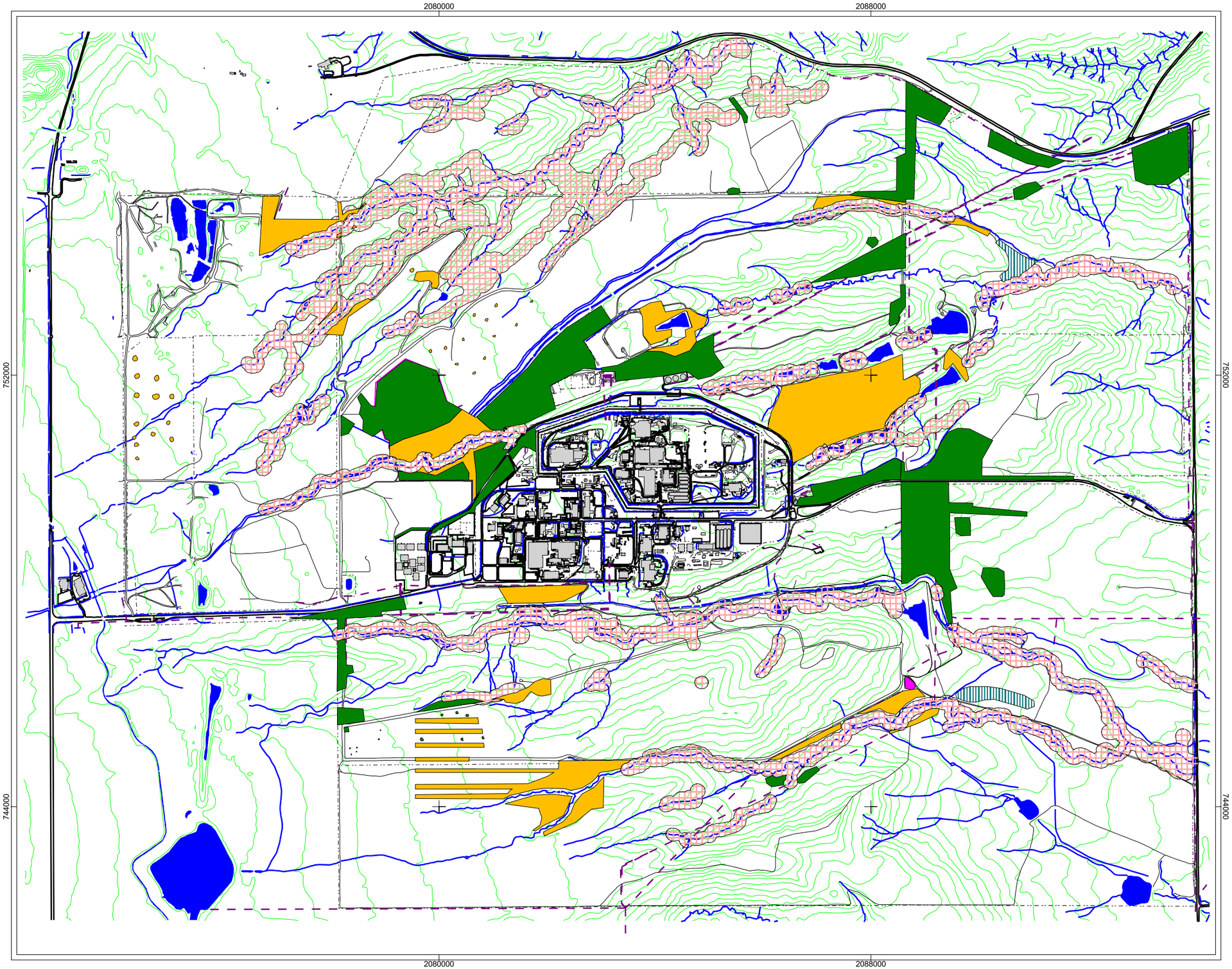


Figure 1. Alien Plants Ranking System Results for Selected Noxious Weeds at the Site

Note: This chart depicts the impact of the noxious weed versus its difficulty of control.



2001 Ground Herbicide Application Locations (Broadcast)

Figure 2

MAP LEGEND

- Tordon 22K Locations (295 acres)
- Transline Locations (123 acres)
- Telar Locations (1 acre)
- Transline/Mowing Locations (17 acres)
- Annual Rye Mowing Locations (26 acres)
- Preble's Protection Areas

Standard Features

- Buildings
- Lakes & ponds
- Landfill
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours

DATA SOURCE BASE FEATURES:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas. Digitized from the orthophotographs, 1/95
Hypsography derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~10 meter resolution. The DEM post-processing performed by MK, Winter 1997.

Data Source Ecology Features:
Spraying location data provided by Exponent.
K-H Ecology Group POC; Karan North 303-966-9876.
All locations are approximate.

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State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: Exponent®
RFETS GIS Dept. 303-966-7707

For: Kaiser-Hill Company, LLC

MAP ID: 01-0146

March 27, 2001

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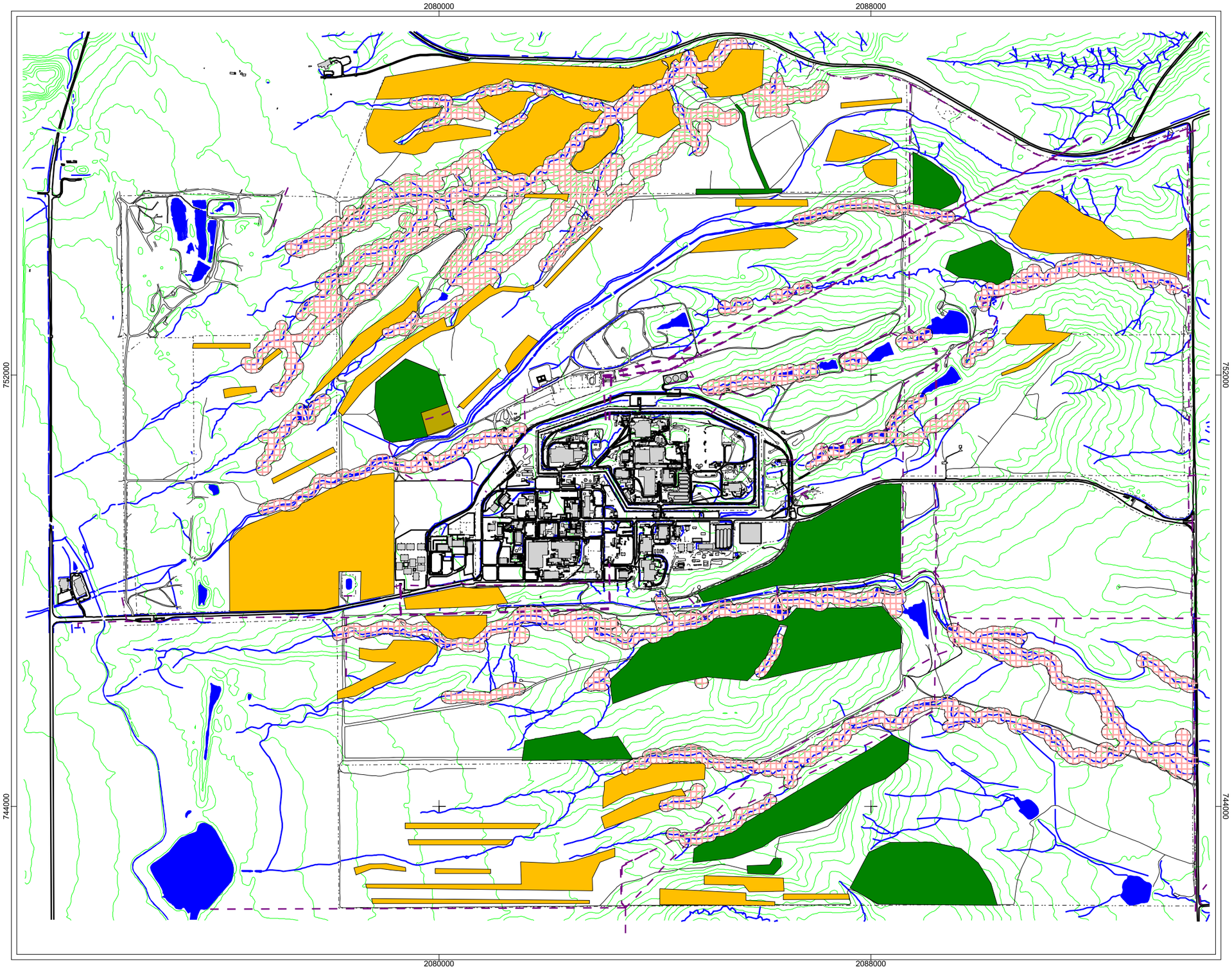

2001 Aerial Herbicide Application Locations (Broadcast)

Table 3

MAP LEGEND

- Tordon 22K Locations
- Transline Locations
- PMJM Protection Areas

Standard Features

- Buildings
- Lakes & ponds
- Landfill
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours

DATA SOURCE BASE FEATURES:
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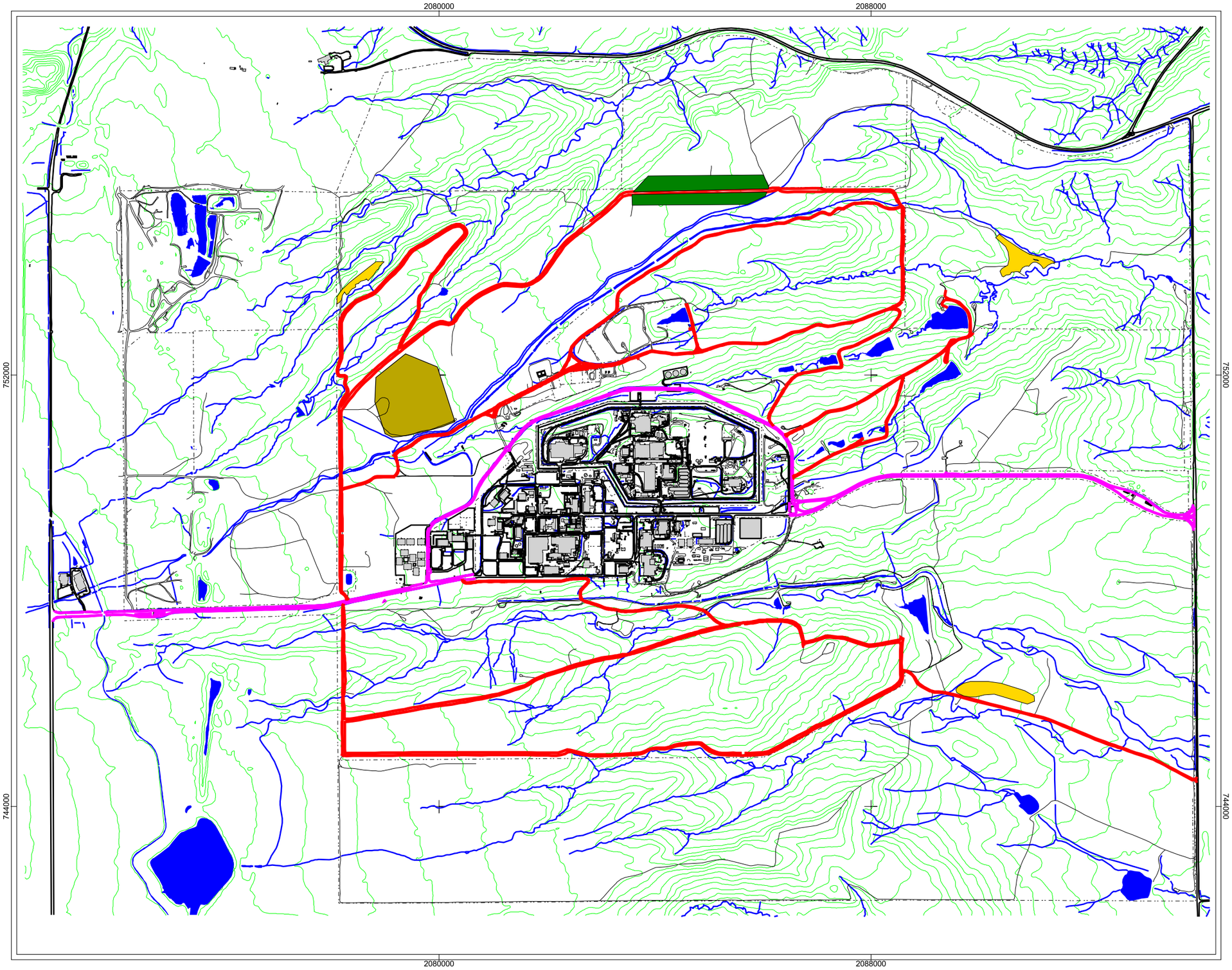

2001 Road Grading and Mowing Areas

Figure 4

MAP LEGEND

- Annual Rye Mowing Locations (26 acres)
- Canada Thistle Mowing Locations (17 acres)
- Roadside Grading and Roadside Mowing Locations
- Roadside Mowing

Standard Features

- Buildings
- Lakes & ponds
- Landfill
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours

DATA SOURCE BASE FEATURES:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
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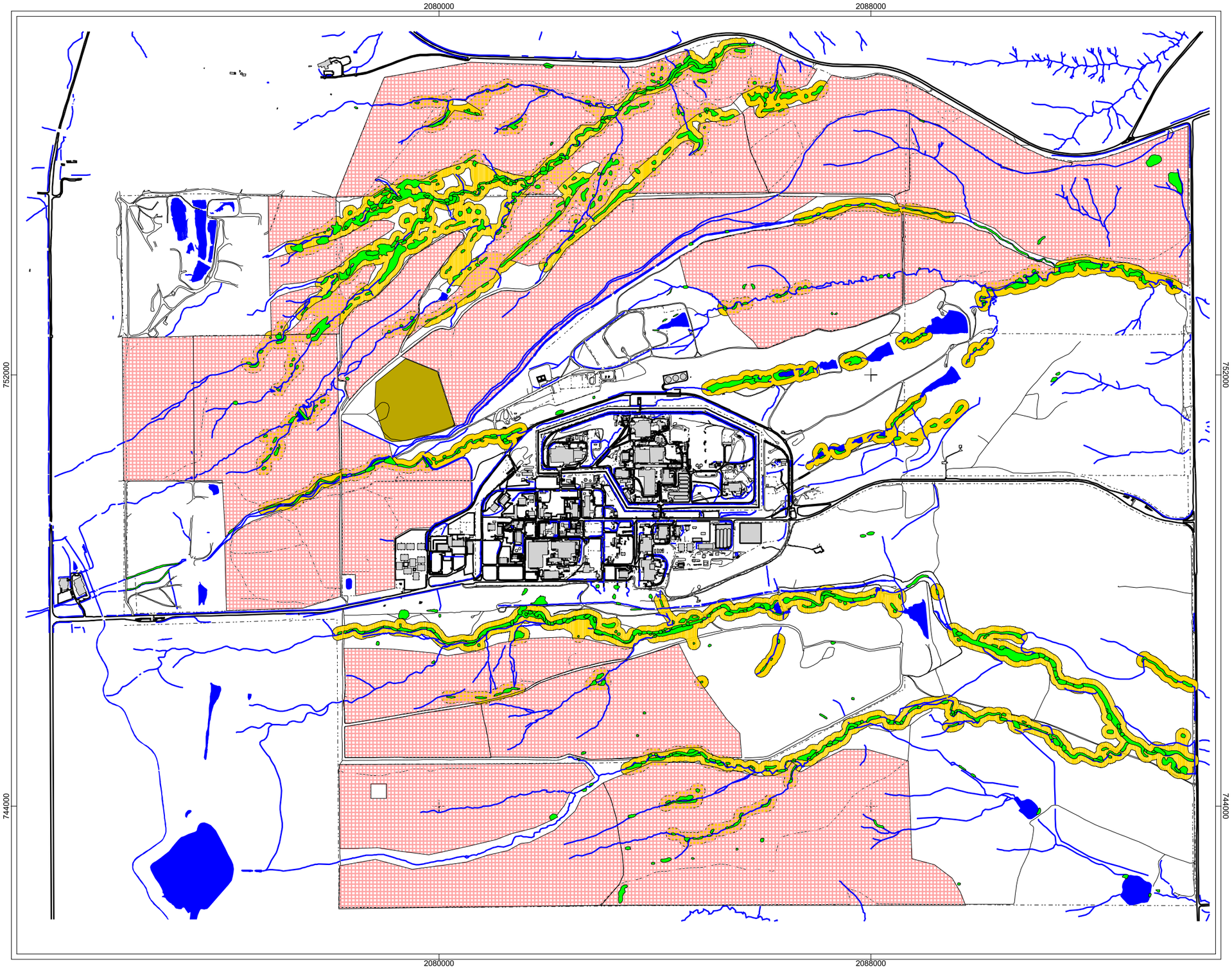

Potential Prescribed Burn Locations in PMJM Habitat Protection Areas

Figure 5

MAP LEGEND

- Potential Prescribed Burn Locations
- PMJM Protection Areas
- Woody Vegetation

Standard Features

- Buildings
- Lakes & ponds
- Landfill
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours

DATA SOURCE BASE FEATURES:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs, 1/95
Hypsography derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~10 meter resolution. The DEM post-processing performed by MK, Winter 1997.

Data Source Ecology Features:
Prescribed burn location data provided by Exponent. All locations are approximate.
K-H Ecology Group POC; Karan North 303-966-9876.

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MAP ID: 01-0146

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Appendix A

Aerial Herbicide Application Plan for 2001

AERIAL HERBICIDE APPLICATION PLAN FOR 2001

PURPOSE

The purpose of using aerial herbicide application is to allow safe herbicide application over large areas that are inaccessible to ground equipment, and to increase the cost effectiveness of the weed control effort at the Site. This document is intended to become a portion of the Integrated Work Control Package (IWCP) for this work.

LIMITATIONS

Herbicides shall be mixed and applied only in strict accordance with the manufacturer's instructions and with the approval of the Contractor's Technical Representative CTR. All required personal protection equipment (PPE) shall be used, and the Subcontractor's Health and Safety Plan shall be followed. The Subcontractor is responsible for the proper disposal of all used PPE, equipment, and empty herbicide containers. The Subcontractor is responsible for any spills caused by himself or his employees, and will comply with all applicable Federal, State, and local laws and regulations when handling and using chemicals.

The Subcontractor shall use only herbicides that have been approved for use at the Site, and only at the rates prescribed in this plan. Locations for application of herbicides, including buffer areas and set-backs from specific areas, are identified in the following section. No application shall occur over open water, including wetlands, ponds, water-filled ditches, and streams. Application of herbicides shall be terminated when wind speeds approach 15 miles per hour, or per application label directions, whichever is lesser.

The pilot shall strictly observe all no-fly areas and other flight restrictions identified in the Flight Safety Plan for Aerial Herbicide Application.

APPLICATION AREAS

Aerial application areas are shown on Figure 3 of the vegetation management plan document. Gold areas shall have Transline applied at a rate not to exceed 1 pint per acre. Green areas shall have Tordon 22K applied at a rate not to exceed 1 pint per acre. No application shall occur within 100 feet of riparian vegetation. The applicator shall accompany the CTR and subject matter experts from the Kaiser-Hill Ecology Group on a driving orientation tour before any aerial application is done. During this orientation tour, the buffer areas shall be clearly identified for the applicator, and the operator will be supplied with detail maps of the application areas, including information on acreages and specific application area boundaries.

Appendix B

Guidelines for Temporary Revegetation of [Insert Project Name/Location]

(Effective Date of this Guideline is January 11, 2001)

GUIDELINES FOR TEMPORARY REVEGETATION OF
[INSERT PROJECT NAME/LOCATION]
(Effective Date of this Guideline is January 11, 2001)

General guidelines for revegetation have been developed by the Kaiser-Hill Ecology Group based on recent experience at the Site. Customized seed mixtures for each location help ensure that appropriate species for each location are planted, and that undesirable non-endemic species are not introduced. For most revegetation areas, a mixture of native plants that will most closely emulate the surrounding plant community will be used. Project-specific revegetation guidelines for permanent revegetation are provided to most Site remediation and construction projects by Kaiser-Hill Ecology Group. The one exception is the increasing number of interim building and infrastructure decommissioning and demolition projects that will be partially completed in one phase, but not finished until the Final Site Reconfiguration Project. In these cases, temporary vegetation cover may be needed for several years, to provide soil stabilization and weed control during an interim period.

This Guideline provides instructions for establishing temporary vegetation cover for interim stabilization needs in the Industrial Area only. Table 1 gives the seed requirements for *temporary* revegetation of excavations and other areas that will be disturbed during INSERT PROJECT NAME/LOCATION. The strategy behind this guideline is to plant a short term, temporary, lower cost vegetation cover to prevent erosion and weed invasion until completion of end-state revegetation the by Final Site Reconfiguration Project. These temporary revegetation areas will be re-graded and permanently revegetated using the appropriate native plant species mixture as the last action in the Final Site Reconfiguration Project.

CAUTION: These guidelines apply only within the Industrial Area where decommissioning and demolition projects must be left temporarily in an interim state until work is concluded by the Final Site Reconfiguration Project. These guidelines are not for use in the Buffer Zone or areas that will be in their end-state configuration after the building, structure, or road has been removed. For any projects or areas other than those described above, contact the Kaiser-Hill Ecology Group for specific revegetation instructions.

Topsoil Stockpiles

DOE orders require the stripping and stockpiling of topsoil from work areas prior to the start of construction work. Any area that supports vegetation has topsoil that must be reserved (the rocky soil at the Site may appear to be poor topsoil but it is suitable for the native plants that grow at the Site). The top 18 to 24 inches of topsoil (except in the case of contaminated soils) must be removed and stockpiled in a pile that is kept separated from the remaining overburden material. Soil stockpiles should be placed such that erosion can be controlled. In the case of removal of parking areas or buildings, stockpiling topsoil may be impossible, and the project may need to import soil from another location to accomplish revegetation after the demolition phase is completed.

Surface waters must be protected from siltation due to surface water runoff from stockpiles, and from other disturbed areas in the event of runoff from precipitation. This should be accomplished by placing silt fence around topsoil and overburden stockpiles, as well as open disturbances, to intercept water-washed soils before they reach streams, ditches, or ponds. Alternatively, ditching and catchment basins may be used. Soil stockpiles at the Site must also be protected from wind-borne weed seed sources ,and wind erosion. This may be accomplished by installing snow fencing around the perimeter of a stockpile and/or by covering the stockpile with tarps or a mulch-stabilizer to temporarily stabilize the stockpile. This step is necessary to help in the sitewide noxious weed control effort and to reduce the production of fugitive dust.

Seedbed preparation

Once a disturbance has been filled and/or re-contoured, the subsoil should be ripped or scarified to a depth of 8 inches, to relieve soil compaction from heavy equipment, before topsoil placement. Topsoil should then

be placed as evenly as possible, using all reserved (or imported) soil. Care should be taken during topsoil application to avoid compaction of this layer.

If no topsoil is available, procurement of topsoil may be necessary. The amount purchased must be sufficient to allow placement of a minimum of 6 to 8 inches of topsoil over the subsoil. Because purchasing topsoil off-site often adds an unanticipated expense, all efforts should be made to reserve any available topsoil at the work site. Should importation of topsoil from another location be necessary, every effort must be made to ensure that the borrow location is weed-free. (Site ecologists can provide assistance in determining a suitable topsoil source.) The purchase of soil from a weed-free location will help prevent importation of noxious weeds to the Site, and reduce the final cost of a project.

Seed Application

Seed should be applied directly into the topsoil. Seeding may be performed using a no-till drill, or broadcast seeding, depending on slope, areal extent of the disturbance, soil conditions (much of the soil at the Site is too rocky for drill-seeding), and other site-specific factors. If the seed has been broadcast, the seeded area should be drag-chained or raked to ensure that the seed is buried prior to mulching.

Mulch Application

Certified weed-free straw mulch or various hydromulches can be used. Excelsior or coarse wood fiber mulch is also an acceptable material since wood fiber is also weed-free. Straw mulch must be of *threshed* wheat or oat straw that is free of excessive crop seed heads. Mechanical crimping of untackified mulch is normally recommended to anchor it to the soil. In large areas, on steep slopes, and where high winds are commonly experienced at the Site, mulch can be easily dislodged; in such areas hydromulching or overspraying with a tackifier is necessary.

Mulch should be applied as a separate, final step after seed placement. Application of seed within hydromulch is not an accepted practice at the Site. Only tackifiers based on vegetable-based binders are acceptable at the Site to prevent undesired chemicals from leaching into the groundwater. Tackifying agents found to be "environmentally friendly" and chemically acceptable for use at the Site are those based on guar gum, or Psyllium (*alpha plantago*). The product known by the brand name "SoilGuard" was also found to be chemically acceptable.

Hydromulch should be applied in accordance to manufacturer's specifications. Each product has different application recommendations, so application depths will vary.

Prohibitions – Certain plant species shall not be introduced to the Site in revegetation seed mixtures. See the current Vegetation Management Plan for a list of prohibited species (see Attachment 1). The use of hay for mulch is no longer allowed at the Site because of the increased potential of introducing undesirable non-native species. Bark and wood chips are not suitable, and shall not be used as mulch for revegetation areas. Reprocessed paper mulch is not acceptable at the Site. The thick clumping and persistence of the papier-mache-like product inhibits successful plant establishment. Nylon netting has been prohibited for revegetation efforts at the Site. While the netting is an efficient means of stabilizing the mulch during the high winds often experienced at the Site, the clear evidence of songbird mortality caused by this netting has led Kaiser-Hill ecologists to prohibit the use of netting. Killing songbirds is specifically prohibited by the Migratory Bird Treaty Act (MBTA), therefore, use of netting became a compliance issue.

Weed Control

Weed control on Federal lands is mandated by the Federal Noxious Weed Act, P.L. 93-629, Section 15 (USC 1975); the Colorado Weed Management Act, Section 1, Title 35, CRS, 1984, Article 5.5 (CO 1990); and the Jefferson County Undesirable Plant Management Plan (JEFFCO 1991). Penalties for violations vary, (e.g. the sate and county acts indicate that Jefferson County can enter federal property to treat noxious weeds, then

can bill the federal agency who owns the land for reasonable expenses. If revegetation efforts may be delayed, weed control on the disturbed area may become necessary. If the work area is in a target weed control area, the project may be required to fund weed control efforts at the work site for a minimum of 2 years after revegetation to ensure that new weed infestations are controlled until the revegetation is sufficient to out compete the weeds.

Table 1. SEED FOR TEMPORARY REVEGETATION

SPECIES COMMON NAME	SCIENTIFIC NAME	APPLICATION RATE (PLS lbs/ac)(1)
Canada Bluegrass	Poa compressa	18.0
Total Pure Live Seed per Acre Application(2)		18.0

(1) Pure Live Seed Pounds per Acre
(2) Recommended application rate for no-till drill. For broadcast seeding, the application rate should be doubled.

REFERENCES

USC. 1975. Federal Noxious Weed Act, as amended. Title 7, Chapter 61, Sec. 2801 et. seq., U.S. Congress. 1975.

CO, 1990. Colorado Weed Management Act, Section 1, Title 35, CRS, 1984, Article 5.5. General Assembly of State of Colorado. Denver, CO May 1990.

JEFFCO, 1991. Jefferson County Undesirable Plant Management Plan, Jefferson County Board of Commissioners. December 1991.

Attachment 1

From 2001 Annual Vegetation Management Plan for the Rocky Flats Environmental Technology Site.

The following grass species shall **not** be used in seed mixtures for reclamation and revegetation projects at Rocky Flats Environmental Technology Site:

– Annual rye grass	*Secale cereale*
– Bulbous bluegrass	*Poa bulbosa*
– Crested wheatgrass	*Agropyron desertorum* or *Agropyron cristatum*
– Intermediate wheatgrass	*Agropyron intermedium*
– Johnsongrass	*Sorghum halepense*
– Orchardgrass	*Dactylis glomerata*
– Quackgrass	*Agropyron repens*
– Sheep fescue	*Festuca ovina*
– Smooth brome	*Bromus inermis*
– Timothy	*Phleum pratense*
– Wild proso millet	*Panicum milaceum*

All seed mixtures for Site reclamation and revegetation projects must be approved by the K-H Ecology Group.