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**2002 Annual Vegetation Management
Plan for the Rocky Flats
Environmental Technology Site**



ADMIN RECORD

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**2002 Annual Vegetation Management Plan for the Rocky Flats
Environmental Technology Site**

Kaiser-Hill, LLC
Rocky Flats Environmental Technology Site
Golden, Colorado 80402-0464

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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 for preservation of the natural resources in the Buffer Zone while complying with applicable regulations and allowing Site closure to proceed unimpeded. The program incorporates an integrated ecosystem approach to natural resource management utilizing as many management techniques as possible, within the guidelines and special limitations that exist at a Superfund site. 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. 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 2002.

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 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 past 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.

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 disturbed portions of the developed area.

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. Nor does it restore natural processes that are important to improve the health and vigor of the native species so that they can better compete with invasive exotic species. 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) calls for an annual weed control plan for each fiscal year, and the Vegetation Management Environmental Assessment (DOE 1999) required development of a Vegetation Management Plan to provide a vegetation management program that goes beyond only weed eradication goals. This document serves that purpose for 2002; 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.

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. Most noxious weeds invade ecosystems because of disturbance, degradation, or changes in the natural system that alters resource availability thus making the community more prone to invasions (Davis et al. 2000). Long-term control of these noxious weeds will ultimately depend on restoring the natural processes (i.e., fire, grazing) that originally kept the ecosystem healthy. However, weed control is a critical component of an integrated management approach because it focuses efforts directly on the undesired species. 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

During the winter of 2001-2002, 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. Ranking was conducted using the Alien Plants Ranking System (APRS; Version 5.0) developed by Ron Hiebert of the National Park Service 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."

Although 36 species of state listed noxious weeds are known to occur at the Site (Table 2), only those on the Colorado top ten noxious weed species prioritized for control (Table 3) and others considered a specific problem at the Site were ranked for control at this time.

This was done to simplify the ranking effort and due to the fact that many of the other state listed species, although occurring on the Site, are only found at isolated disturbed locations. Many of these latter species are also not aggressive, invasive species (under current conditions at the Site), and are not presently having a significant impact on the native plant communities at the Site. In the future the other listed species may be included in the ranking as necessary. The results of the analysis for each species are shown in alphabetical order in Table 4. 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 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 also begun to invade the surrounding native prairie at several locations, creeping in from the roadside edges where it originated.

In order to determine how, when, and where to expend limited resources for noxious weed control it is important to prioritize the species. Table 5 lists the prioritized weed species at the Site. Species were priority one or two on the basis of the above ranking system results, their need for control on the Site, and the difficulty of control. Note the table contains the state listed noxious weed species as well as a few others not listed by the state but which are considered problems at the Site. For some of the latter category species, the control of these species at this time is prudent because their current limited infestation levels are conducive for eradication of the species from the Site. Not all of these species listed in Table 5 are slated for specific control during 2002, however they may be included in control efforts directed towards other species.

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

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

* Noxious weeds as listed by the State of Colorado Noxious Weed Act (2001).

+ Additional species considered a noxious weed at the Site.

Table 3. Top 10 Prioritized Noxious Weed Species for the State of Colorado

*Canada thistle (<i>Cirsium arvense</i>)
*Dalmatian toadflax (<i>Linaria dalmatica</i>)
*Diffuse knapweed (<i>Centaurea diffusa</i>)
*Field bindweed (<i>Convolvulus arvensis</i>)
*Hoary cress (<i>Cardaria draba</i>)
*Houndstongue (<i>Cynoglossum officinale</i>)
Leafy spurge (<i>Euphorbia esula</i>)
*Musk thistle (<i>Carduus nutans</i>)
*Russian knapweed (<i>Centaurea repens</i>)
*Yellow toadflax (<i>Linaria vulgaris</i>)

List is in alphabetical order.

* Species known to occur at Rocky Flats Environmental Technology Site.

All priority one species are slated for some specific control efforts in 2002, while priority two species are not slated for specific control. However, priority two species may be indirectly affected by treatments directed at priority one species. Diffuse knapweed and Russian knapweed remain priority one species as in the past. Diffuse knapweed continues as a priority one threat 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. Additionally, annual weed mapping has shown it is present across large portions of the Site and it is important to contain its spread before it completely infests the Site. Control efforts over the past several years have reduced the overall abundance of diffuse knapweed at the Site, however, it continues to slowly return due to the seedbank and emigration of seed from

Table 4. Alien Plants Ranking System Results for Selected Noxious Weeds at Rocky Flats Environmental Technology Site

Species	Impact	Pest	Control
Annual rye	44	52	31
Blue mustard	16	38	48
Bouncingbet	24	52	61
Bull thistle	22	57	36
Canada thistle	69	78	73
Chicory	24	52	56
Common mullein	31	49	63
Dalmatian toadflax	45	65	63
Dame's rocket	33	60	59
Diffuse knapweed	82	78	72
Field bindweed	29	52	60
Hoary cress	16	46	41
Houndstongue	22	51	59
Jointed goatgrass	18	52	41
Musk thistle	33	63	56
Russian knapweed	47	79	59
Scotch thistle	31	57	43
St. John's-wort	33	70	43
Yellow toadflax	29	56	52

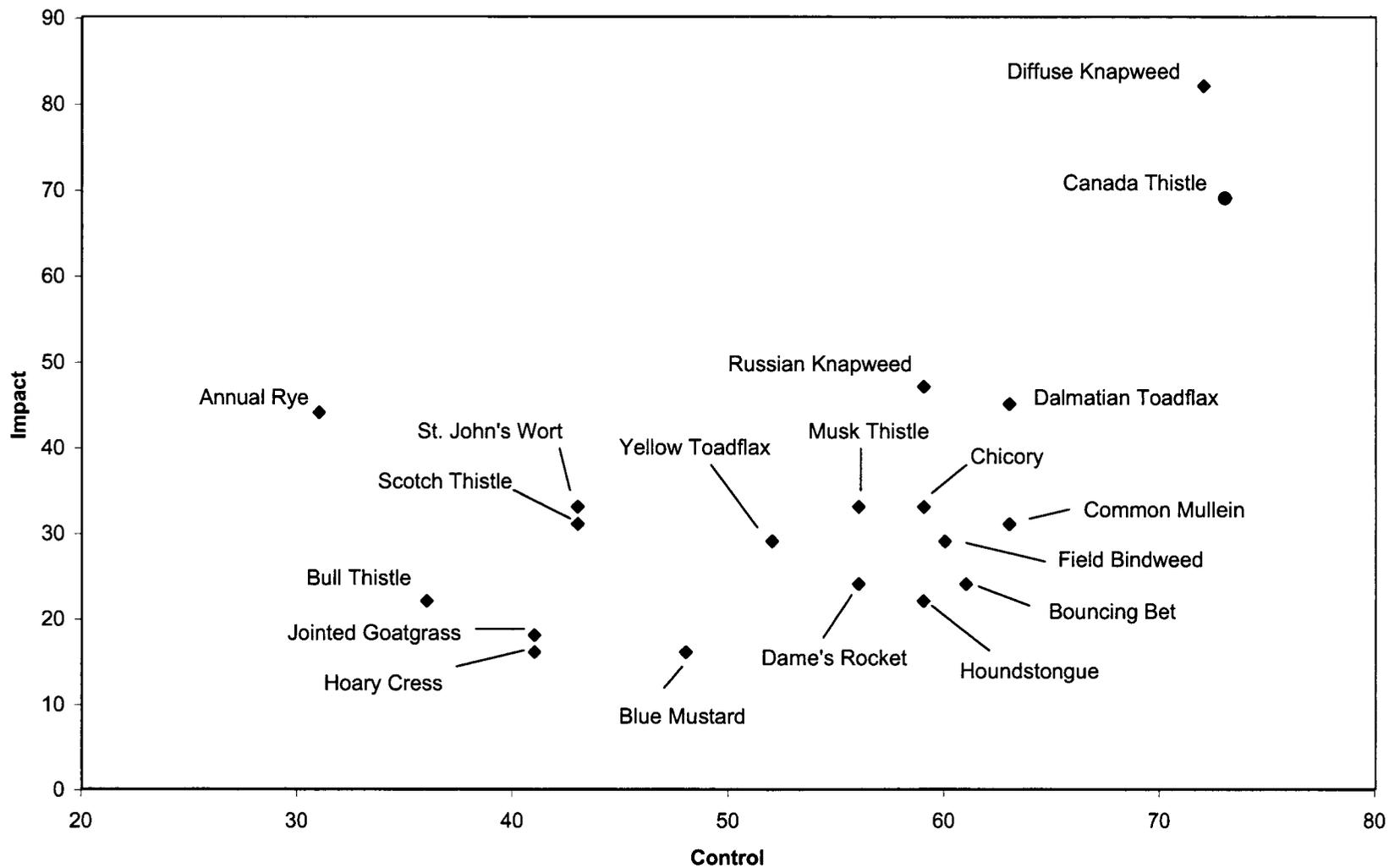
List is in alphabetical order. Scores are based on answers to questions in Alien Plant Ranking System. Impact refers to the significance or impact of a species based on your site's characteristics. Pest refers to the innate ability of a plant species to be a pest. Control refers to the difficulty of controlling the species. Ranking scores range from 0 = low or easier to control to 100 = high or difficult to control.

Table 5. 2002 List of Noxious Weeds Prioritized for Control at Rocky Flats Environmental Technology Site

Priority 1 Species	Priority 2 Species
+Annual Rye (<i>Secale cereale</i>)	*Blue mustard (<i>Chorispora tenella</i>)
+Bird's-foot trefoil (<i>Lotus corniculatus</i>)	*Bull thistle (<i>Cirsium vulgare</i>)
*Bouncing bet (<i>Saponaria officinalis</i>)	*Chicory (<i>Cichorium intybus</i>)
*Canada thistle (<i>Cirsium arvense</i>)	*Common burdock (<i>Arctium minus</i>)
*Common mullein (<i>Verbascum thapsus</i>)	*Downy brome (<i>Bromus tectorum</i>)
*Common St. Johnswort (<i>Hypericum perforatum</i>)	*Flixweed (<i>Descurainia sophia</i>)
+Crown vetch (<i>Coronilla varia</i>)	*Green foxtail (<i>Setaria viridis</i>)
*Dalmatian toadflax (<i>Linaria dalmatica</i>)	*Houndstongue (<i>Cynoglossum officinale</i>)
*Dame's rocket (<i>Hesperis matronalis</i>)	*Kochia (<i>Kochia scoparia</i>)
*Diffuse knapweed (<i>Centaurea diffusa</i>)	*Mayweed chamomile (<i>Anthemis cotula</i>)
*Field bindweed (<i>Convolvulus arvensis</i>)	*Moth Mullein (<i>Verbascum blattaria</i>)
*Hoary cress (<i>Cardaria draba</i>)	*Oxeye daisy (<i>Chrysanthemum leucanthemum</i>)
*Jointed goatgrass (<i>Aegilops cylindrica</i>)	*Perennial Sowthistle (<i>Sonchus arvensis</i>)
+Lens-padded hoary cress (<i>Cardaria chalapensis</i>)	*Poison hemlock (<i>Conium maculatum</i>)
*Musk thistle (<i>Carduus nutans</i>)	*Puncturevine (<i>Tribulus terrestris</i>)
+Russian olive (<i>Elaeagnus angustifolia</i>)	*Quackgrass (<i>Elytrigia repens</i>)
*Russian knapweed (<i>Centaurea repens</i>)	*Redstem filaree (<i>Erodium cicutarium</i>)
*Scotch thistle (<i>Onopordum acanthium</i>)	*Russian thistle (<i>Salsola iberica</i>)
+Texas blueweed (<i>Helianthus ciliaris</i>)	*Saltcedar (<i>Tamarix ramosissima</i>)
*Yellow toadflax (<i>Linaria vulgaris</i>)	*Shepardspurse (<i>Capsella bursa-pastoris</i>)
	*Wild Oats (<i>Avena fatua</i>)

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

Figure 1. Alien Plants Ranking System Results For Selected Noxious Weeds At The Site.



off-site. Thus control efforts remain high for this species. Russian knapweed is a high priority because of its similarly aggressive nature, but also because it currently occupies only about one acre, making control and eradication possible at this point. Several other species such as bouncing bet, crown vetch, Dame's rocket, lens-padded hoary cress, and Scotch thistle, have also been moved into the priority one category due to their limited occurrence at the Site and the potential for complete eradication if control efforts are implemented immediately. Successful control efforts have been conducted on several of these species over the past few years and eradication is a realistic goal. Annual rye was moved to priority one status because it continues to invade at several grassland locations across the Site and needs immediate control due to the speed at which it is invading. Other priority one species slated for control in 2002 include Canada thistle, Dalmatian toadflax, musk thistle, common mullein, common St. John's-wort, bird's-foot trefoil, hoary cress, field bindweed, Texas blueweed, Russian olive, jointed goatgrass, and yellow toadflax.

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 2002

The following control methods (Table 6) are proposed for selected priority one species at the Site during 2002. No specific control is slated for priority two species during 2002.

Table 6. Control Measures for Selected Species

Diffuse Knapweed	<ul style="list-style-type: none">• Mowing along main access roads and Buffer Zone fire break roads will be continued to help control the diffuse knapweed present in these areas.• Ground and aerial application of Tordon 22K[®] and Transline[®] herbicides will continue at selected locations in the Buffer Zone. Spot control will be conducted within previously treated aerial herbicide application locations to minimize the rate of diffuse knapweed return to these locations.• Additional biocontrol insects will be requested from the Colorado Department of Agriculture Insectary at Palisade, Colorado, for release at the Site. These insects will be released at areas where other forms of control are impractical (i.e. riparian corridors) in order to try and control infestations at these locations. These areas will then also serve as nurseries, for increasing biocontrol populations that can later be introduced to other locations at the Site.• Monitoring and mapping of control efforts will continue to evaluate the effectiveness of control techniques.
Russian Knapweed	<ul style="list-style-type: none">• 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.
Annual Rye	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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, Bouncing bet, Crown Vetch, Lens Padded Hoary Cress	<ul style="list-style-type: none">• Hand pulling, sickles, and spot herbicide treatments with Roundup will be used to control the few small infestations at the Site.
Dalmatian Toadflax	<ul style="list-style-type: none">• Since 1999, nearly 3,500 acres of the Buffer Zone have been treated with Tordon22K[®] and Transline[®]. The Tordon22K[®] applications have had some effect on setting this species back, reducing flowering (and thus potentially seed set), and reducing abundance. Monitoring of these effects on Dalmatian toadflax will continue in 2002.• Ground and aerial herbicide applications of Tordon22K[®] will be used to help control infestations of this species that are in the target infestations of diffuse knapweed. This will be part of a multi-species control effort.• Monitoring will be conducted at the locations where the biocontrol insect, <i>Mecinus janthinus</i>, was released in 2001, to determine whether the insects established and are having any impacts.• Test plots may be established to evaluate the impacts of different herbicide combinations on Dalmatian toadflax.• As feasible, Dalmatian toadflax will be mapped during 2002.

Canada Thistle	<ul style="list-style-type: none"> • In 2000, 200 individuals of the biocontrol fly, <i>Urophora cardui</i>, were released at 2 locations in Rock Creek. These sites will be revisited to determine if the flies survived and if any damage (galls) is present on the Canada thistle plants in the area of their release. In 2001, a defoliating beetle, <i>Cassida rubiginosa</i>, was released at another location in Rock Creek. This site will be evaluated for any impacts. Additional releases of both biocontrol insects will be made if insects can be obtained from the Colorado Department of Agriculture. • Limited herbicide applications and/or mowing may be used on infestations far enough from wetlands to avoid adverse impacts.
Russian Olive	<ul style="list-style-type: none"> • 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. • Whenever possible, demolition actions will include removal of any Russian olive trees.
Field Bindweed	<ul style="list-style-type: none"> • Monitoring will be conducted at the locations where the biocontrol insect, <i>Aceria malherbae</i>, was released in 2001, to determine whether the insects established and are having any impacts. As population establishment allows, <i>A. malherbae</i> will be transplanted to new locations as well.
Bird's-Foot Trefoil, Hoary Cress, Texas Blueweed, and Yellow Toadflax	<ul style="list-style-type: none"> • Spot herbicide applications of Roundup® will be made to eradicate the isolated patches of these species in the Buffer Zone at the Site. Monitoring will be conducted to evaluate control efforts for these species where control was begun in 2001.
Jointed Goatgrass	<ul style="list-style-type: none"> • Mowing and grading will be timed to attempt to prevent seed set of this species along the Buffer Zone roads where it occurs. • Herbicide applications may be used at some locations to assist in control of the species.
Musk Thistle and Common Mullein	<ul style="list-style-type: none"> • Ground and aerial herbicide applications will be used to assist in controlling several infestations of these species that are in the target infestations of diffuse knapweed. This will be part of a multi-species control effort. • The musk thistle biocontrol insect, <i>Rhinocyllus conicus</i>, will be evaluated at several infestations to ensure that populations continue to be present at the Site. • Where the biocontrol insect, <i>Trichosiromia horridus</i>, for musk thistle control was released in 2001, monitoring will be conducted to determine whether the species established and whether any impacts can be observed.
Common St. John's-wort	<ul style="list-style-type: none"> • Foliage feeding beetles, <i>Chrysolina quadrigemina</i>, 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. • Spot herbicide applications may be used to control some populations of this species.

Biological Weed Controls (Insects)

Biological control agents (i.e., insects) are being used on the Site to assist in the control of musk thistle, St. John's-wort, Dalmatian toadflax, Canada thistle, field bindweed, and diffuse knapweed. The insects have been provided to the Site by the Colorado Department of Agriculture (CDA), and the U.S. Fish and Wildlife Service (USFWS)

through an agreement with Texas A&M University, to target specific weed infestations. Table 7 lists the biological controls that have been released at the Site.

Table 7. Biological Control Agents Released at the Site

Target Species	Beneficial Organism	Effect
Diffuse knapweed (<i>Centaurea diffusa</i>)	<i>Urophora quadrifasciata</i>	Attacks knapweed flowers, producing galls that reduce seed production.
	<i>Urophora affinis</i>	Attacks knapweed flowers, producing galls that reduce seed production.
	<i>Sphenoptera jugoslavica</i>	Beetle larvae bore into root crown and upper roots of knapweed, retarding plant development and stunting growth.
	<i>Larinus minutus</i>	A seedhead weevil.
Musk thistle (<i>Carduus nutans</i>)	<i>Cyphocleonus achates</i>	A root boring weevil.
	<i>Rhinocyllus conicus</i>	A weevil that eats the seeds in the musk flower heads.
	<i>Trichosirocalus horridus</i>	Weevil that attacks the crown of musk thistle, thus killing the apical meristem and reducing the potential of the plant to flower.
Canada thistle (<i>Cirsium arvense</i>)	<i>Urophora carduii</i>	A gall fly.
	<i>Cassida rubiginosa</i>	A defoliating beetle.
St. Johns-wort (<i>Hypericum perforatum</i>)	<i>Chrysolina quadrigemina</i>	A foliage-feeding beetle.
Dalmatian toadflax (<i>Linaria dalmatica</i>)	<i>Calophasia lunula</i>	Larvae of this moth feed on the leaves and flowers of the plant.
	<i>Mecinus janthinus</i>	A stem mining beetle.
Field Bindweed (<i>Convolvulus arvensis</i>)	<i>Aceria malherbae</i>	A gall mite.

It is recommended that cooperative efforts with these groups 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 will be continued to keep abreast of any new findings and techniques.

Additional requests for biocontrol insects to be released at the Site in 2002 from the Colorado Department of Agriculture Insectary at Palisade, Colorado. These insects will be released at locations where other forms of control are impractical (i.e., riparian areas) and to complement other forms of weed control being used at the Site. Release locations will then also serve as nurseries for increasing biocontrol populations on Site, which can later be introduced to other locations at the Site. Monitoring of 2001 release locations will be conducted to evaluate establishment and impacts on the noxious weed populations.

Chemical Weed Controls

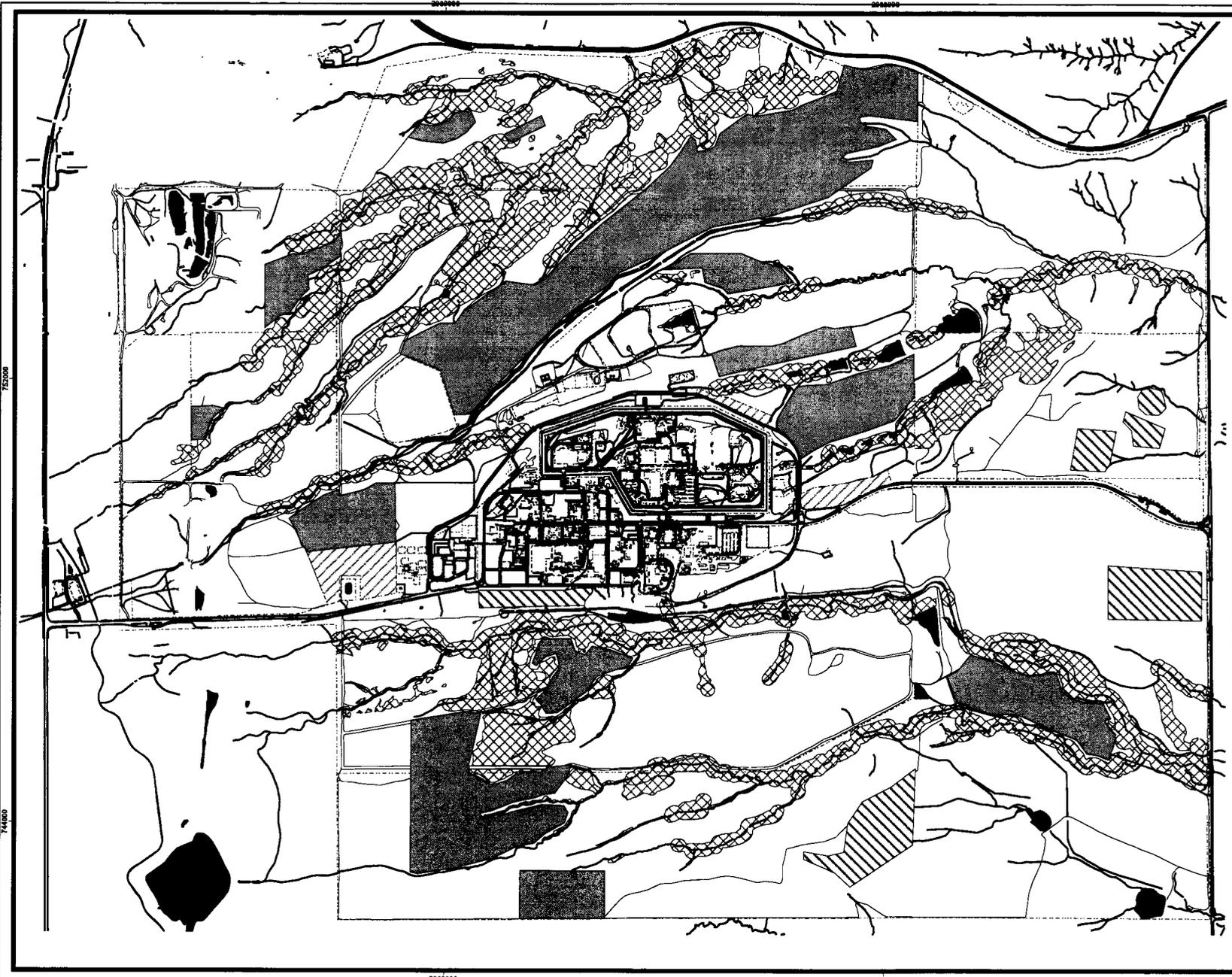
The Ecology Group maintains a list of herbicides approved for use on the Site (Table 8). Herbicides *not* on the current list *may not* be used until they are approved. Many of these chemicals are restricted use herbicides, and must be applied only by a licensed (certified) applicator. Such restricted 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, herbicide labels, and recommendations from experts (Beck 1992, Beck, 1996a, Beck 1996b, Beck, 1997a, Beck, 1997b, CNAP, 2000).

Table 8. Approved Herbicides for Use at Rocky Flats (Last updated 10/18/01)

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

Knapweed Treatment

Diffuse knapweed infestations on the Site remain significant enough that continued application of herbicides (Tordon 22K[®] and Transline[®]) to portions of the Buffer Zone during 2002 is planned. Monitoring results of past applications have shown large decreases in the amounts of diffuse knapweed present in treated areas. The large



2002 Ground and Aerial Herbicide Application Locations

Figure 2

Legend

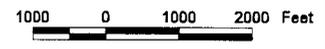
-  Transline Aerial Application Locations
-  Tordon Aerial Application Locations
-  Transline Ground Application Locations
-  Telar Ground Application Locations
-  PMJM Protection Areas

Standard Legend

-  Buildings
-  Lakes and Ponds
-  Landfill
-  Streams and Ditches
-  Fences
-  Paved Roads
-  Dirt Roads
-  Contours (20 ft.)

Data Source Base Features:
 Buildings, fences, topography, roads and other structures from 1984 aerial imagery data supplied by ES&D RSL, Las Vegas. Digitized from base orthorectified 1:50,000 photography derived from digital elevation model (DEM) data by Mountain Viewers (MVI) using 2000 Arc 700 and LATRICE to process the DEM data to create 1-foot contours. The DEM data was supplied by the Nevada State Geology Lab, Las Vegas, NV, 1988 Aerial Photograph at 10 meter resolution. The DEM post-processing performed by MVI, Winter 1997.

Data Source Ecology Features:
 Location data provided by Exponent, 1511 Colfax Group P.O. Carson North 893-66-6476



State Plane Coordinate Projection
 Colorado Central Zone
 Datum: NAD27

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

Prepared by: For:

Exponent  Kaiser-Hill Company, L.L.C.

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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 to blow away), and dramatically improved the condition of the grassland. Data from these past efforts while showing good initial control of the diffuse knapweed have also underscored the need for continued spot control in the years following large-scale operations. During 2002, spot control efforts will continue to, maintain diffuse knapweed at lower levels at these locations, thus increasing the effectiveness of the large-scale operations longer term.

During 2002, the K-H Ecology Group will develop maps, prescribed herbicides, and application rates for herbicide application by vehicle-mounted equipment and backpack spraying in the Buffer Zone. Figure 2 shows locations planned for ground application of herbicides at the Site during 2002. A total of approximately 48 acres are slated for ground application of herbicides in 2002.

In addition, aerial herbicide application plans will be developed for the continuation of aerial herbicide applications across larger weed infested areas at the Site. Aerial application of herbicides to the Site will be conducted under stringent guidelines (Flight Safety Plan, safety screens, and Integrated Work Control Package [IWCP guidance]). Areas slated for aerial application in 2002 are shown in Figure 2. Approximately 840 acres are proposed to receive aerial herbicide application in 2002. Appendix B contains the current guidelines for aerial application of herbicides on the Site.

Figure 2 shows where broadcast herbicides will be used over all management areas in 2002, 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. 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 wildlife to the dilute compound would not risk mortality or other adverse responses. 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. 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 by broadcast methods, several target species are often treated together (e.g., diffuse knapweed, musk thistle, common mullein, and Dalmatian toadflax). However, application of other herbicides or other management techniques may be necessary for species that are not affected by the broadcast herbicide treatments.

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.

An example of this is the Russian knapweed population that was discovered on Site during 1998, which will be treated again with herbicides during 2002 to reduce the stand and keep it from spreading. The timing of application will be conducted prior to flowering of the species.

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 (using Roundup[®]) will be continued for small infestations of noxious weeds where this type of control method is suitable and effective. These methods have been used on the Site in recent years and will be continued in 2002 for the infestations of Scotch thistle, dame's rocket, bouncing bet, bird's-foot trefoil, hoary cress, Texas blueweed, Russian olive, yellow toadflax, 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 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 are being 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 9. Preventative Actions for Weed Control

Weed-free Materials	<ul style="list-style-type: none">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	<ul style="list-style-type: none">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. Use of native species will be required in all cases, except when specific written prior approval has been obtained from the K-H Ecology Group.
Sterile Mulch	<ul style="list-style-type: none">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	<ul style="list-style-type: none">Weed control and reseedling 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	<ul style="list-style-type: none">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	<ul style="list-style-type: none">A list of species prohibited for use in revegetation seed mixtures is maintained by the K-H Ecology Group, and updated annually or as required. See next page for list.

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 2002, 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 2002 as a mechanical method of vegetation control along the unpaved roads. Grading maintains unvegetated firebreaks that 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 continue to be reduced and spread back out over the road surface, 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 2002.

Mowing

Roadside Mowing

In addition to the road grading in 2002, 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 areas 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 2002. 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 (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 will also be conducted and timed to reduce seed set of jointed goatgrass along certain Buffer Zone firebreak roads.

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, 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 and Grazing

The use of prescribed burns and grazing on Site 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. Weed control strategies that focus solely on the weed species and not on enhancing conditions for desired native species will provide only limited success. If desired native species are not able to fill in the openings created in the native plant communities after target weed species are eliminated, then often other undesirable weeds come in and take their place instead. The tools available for resource management at the Site are currently limited by Site policies. This is especially true with regard to grassland resource management where the natural processes of grazing and fire are essential for prairie health. Currently grazing is not permitted at the Site and prescribed burns are on hold. A 48-acre test burn conducted on the xeric tallgrass prairie in the south Buffer Zone in spring 1999 showed positive results.

For any planned prescribed burns in the future, specific burn prescription plans 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. Combined with the herbicide treatments and other weed control measures, the use of fire should help to reduce the weed problem at the Site while improving the vigor and competitiveness of native species, thus improving the overall health and condition of the plant communities at the Site.

All prescribed burn plans will detail every aspect of the burn prescription. All Site and state regulations governing prescribed burns will be followed. (Colorado State regulations prohibit 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). All proper permits will be obtained, and all logistical details coordinated with onsite and offsite agencies, organizations, and the public. 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

Strides have been made in recent years at the Site to implement an integrated, ecosystem management program for natural resource management. During 2002 several techniques will be employed to restore, improve, and preserve the increasingly rare plant communities that provide habitat for imperiled plant and animal species at the Site. If some of the areas slated for control are not completed during 2002, they will be added to the list for 2003.

References

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- NFPA 1997. 1997 Urban-Wildland Interface Code. National Fire Protection Association.
- USC. 1973. Migratory Bird Treaty Act. U.S. Congress, 16USC. 703 et.seq. as amended.

Appendix A

AERIAL HERBICIDE APPLICATION PLAN FOR FY2000

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 apply 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

Application areas are shown on Figure 2. The application rate for areas slated for treatment with Transline® and Tordon22K® shall not 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.

Appendix B

**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 state 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.