

TO: Steve Nesta, Karan North, Bob Nininger
FROM: KH-Ecology Group
DATE: May 28, 2004
SUBJECT: USE OF PART II OF THE PROGRAMMATIC BIOLOGICAL ASSESSMENT
FOR THE RFETS

The Final Programmatic Biological Assessment (PBA) Part II for the Rocky Flats Environmental Technology Site was recently approved by the U.S. Fish and Wildlife Service. This document covers selected activities that may occur at RFETS and have potential to impact the Preble's meadow jumping mouse (a federally listed threatened species) or the current Preble's mouse protection areas. On April 5, 2004, the U.S. Fish and Wildlife Service, in the Biological Opinion (BO), concurred that these activities may be conducted at RFETS. Per the requirements of the PBA Part II, project management is to receive a copy of Part II of the PBA and a copy of the BO. The PBA Part II and the USFWS BO approving the Part II of the PBA may be found on EDDIE under the Ecology Section, Current Plans and Reports section of the website. Per the requirements of the PBA this is how K-H is providing project management with a complete copy for your records. Please pass this information onto appropriate project personnel. Please note the PBA Part II states: "Project management is responsible to ensure compliance with the requirements and guidelines outlined in Part II of the PBA and BO. Project managers are responsible for following and maintaining the best management practices (BMPs) [as outlined in the PBA]."

Although concurrence has been received for the specific projects listed in the document, the K-H Ecology Group must be contacted prior to commencement of projects authorized within Part II because there are preliminary notifications to the USFWS that must be made. The K-H Ecology Group will provide assistance with project boundary delineation, revegetation information, and any additional information on the minimum best management practices required for the activities under this approval. Activities occurring in Preble's meadow jumping mouse protection areas that are not explicitly outlined in this Part II are not authorized. If you have any questions or your project plans change, please feel free to contact the K-H Ecology Group at x2231 (Jody Nelson), x3560 (Karin Kiefer), or x3687 (Andrew Rosenman). Thank you.

Jody Nelson x2231
Karin Kiefer x3560
Andrew Rosenman x3687

Thank you.

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**PROGRAMMATIC BIOLOGICAL ASSESSMENT FOR
DEPARTMENT OF ENERGY ACTIVITIES AT THE ROCKY
FLATS ENVIRONMENTAL TECHNOLOGY SITE**

**PART II: Activities that may “Adversely Affect”
threatened or endangered species.**

April 2004

**U.S. Department of Energy
Rocky Flats Field Office
Golden, Colorado**



**April 2004
Revision 7**

Classification Exemption CEX-105-01

**Prepared for
US Department of Energy
Rocky Flats Field Office
Golden, Colorado 80402-0464**

**By
Kaiser-Hill Company, LLC**



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
755 Parfet Street, Suite 361
Lakewood, Colorado 80215

April 5, 2004

IN REPLY REFER TO:
ES/CO: ES/LK-6-CO-04-F-012
Mail Stop 65412

Cliff Franklin
Department of Energy
Rocky Flats Field Office
10808 Highway 93, Unit A
Golden, Colorado 80403-8200

Dear Mr. Franklin:

In accordance with section 7 of the Endangered Species Act (Act) as amended (16 U.S.C. 1531 et seq.) and the Interagency Cooperative Regulations (50 CFR 402), this is the U.S. Fish and Wildlife Service's (Service) final biological opinion on impacts to the federally-listed Preble's meadow jumping mouse, *Zapus hudsonius preblei* (Preble's) associated with Part II of the Programmatic Biological Assessment (PBA) for the Department of Energy (DOE) at Rocky Flats Environmental Technology Site (RFETS) located in Jefferson County, Colorado. Your request for formal consultation was received October 15, 2003. The revised PBA Part II with the additional information requested and the notification letter was received on January 20, 2004.

This biological opinion is based on information provided in Part II of the PBA provided on January 20, 2004 and the accompanying maps, telephone conversations, various meetings, field investigations, and other sources of information. A complete administrative record of this consultation is on file at this office.

CONSULTATION HISTORY

DOE, Kaiser-Hill (K-H), and the Service began preliminary discussions about a PBA on June 4, 1998. Discussions about the benefits and the basic outline of contents for the PBA began on March 8, 1999. On July 12, 2000 the Service provided a letter of concurrence on a portion of the projects in the PBA- Part I containing projects with no effects, or projects that were not likely to adversely affect the Preble's mouse. The Service provided comments and requested information on the remaining projects provided by DOE in PBA-I where there was not concurrence. On August 1, 2002 the Service issued a biological opinion on the Water Measurement Flume Replacement Project (USFWS 2002) so that several deteriorated flumes could be replaced. Further discussion of the recommendations and non-concurrence activities was tabled until DOE

reinitiated consultation on the PBA on January 16, 2003. Revisions to the PBA draft were discussed by Service personnel, DOE and K-H on February 11, 20, 21, 24, and 27, 2003. Additional PBA revisions and comments for PBA-I were discussed April 29, 2003 and PBA-II comments were provided by the Service June 18, 2003.

A revised draft PBA was provided by DOE and K-H in October, 2003 for review. On December 18, 2003, the Service received a draft of Part I of the PBA incorporating the previously requested information and revisions along with a letter requesting concurrence by DOE. Part I was submitted separately to expedite the approval process of the activities addressed there while consultation continued on Part II of the PBA.

Species other than the Preble's mouse considered and determined to be not likely to be adversely affected in Part I of the PBA include:

Animals:

American burying beetle (<i>Nicrophorus americanus</i>) *	Endangered
Bald eagle (<i>Haliaeetus leucocephalus</i>)	Threatened
Black-footed ferret (<i>Mustela nigripes</i>)	Endangered
Black-tailed prairie dog (<i>Cynomys ludovicianus</i>)	Candidate
Boreal toad (<i>Bufo boreas boreas</i>)	Candidate
Canada lynx (<i>Lynx canadensis</i>)	Threatened
Eskimo curlew (<i>Numenius borealis</i>)*	Endangered
Greenback cutthroat trout (<i>Oncorhynchus clarki stomias</i>)	Threatened
Least tern (<i>Sterna antillarum</i>)*	Endangered
Mexican spotted owl (<i>Strix occidentalis lucida</i>)	Threatened
Mountain plover (<i>Charadrius montanus</i>)	Threatened
Pallid sturgeon (<i>Scaphirhynchus albus</i>)*	Threatened
Pawnee montane skipper (<i>Hesperia leonardus montana</i>)	Threatened
Piping plover (<i>Charadrius melodus</i>)*	Threatened
Whooping crane (<i>Grus americana</i>)	Endangered

Plants:

Colorado butterfly plant (<i>Gaura neomexicana</i> ssp. <i>coloradensis</i>)	Threatened
Ute ladies' tresses orchid (<i>Spiranthes diluvialis</i>)	Threatened
Western prairie fringed orchid (<i>Platanthera praeclara</i>)*	Threatened
* Platte River species	

In addition, no other species will be adversely affected by Part II activities.

BIOLOGICAL OPINION

This biological opinion is based on information regarding cumulative effects, conditions forming the environmental baseline, the status of Preble's, the importance of the project area to the survival and recovery of the species, and other sources of information as described below. The data used in this biological opinion constitute the best scientific and commercial information

currently available. This biological opinion addresses Part II of the PBA, which addresses activities that may affect and are likely to adversely affect the Preble's mouse.

DESCRIPTION OF THE PROPOSED ACTION

Project Location

The RFETS has been a nuclear industrial facility for the DOE since 1951. RFETS is located in Jefferson County approximately 5 miles southeast of Boulder and 16 miles northwest of Denver. The industrial area (IA) where manufacturing occurred covers about 400 acres of the site. The IA is surrounded by a 5,900 acre buffer zone (BZ), and Public open space lands lie to the west, north, and northwest borders. A housing development is currently located to the northeast, and another development is planned to the southeast. Several gravel mines and light industry sites are located on the western edge of the site. Approximately 750 acres of the western portion of the site are permitted for surface mining (Figure 1).

Project Site Description

Production of nuclear weapon components at RFETS stopped after the Cold War ended. In 1996, DOE, the Environmental Protection Agency (EPA), and the Colorado Department of Public Health and Environment (CDPHE) completed the Rocky Flats Cleanup Agreement (RFCA). The RFCA is the Federal Facility Compliance Agreement and Consent Order negotiated pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), and the Colorado Hazardous Waste Act (CHWA). The RFCA provides the regulatory guidance for the accelerated cleanup and site closure to be completed by the end of 2006. After the cleanup is completed and the buildings and various other manmade structures have been decommissioned and demolished, a portion of the site will become the Rocky Flats National Wildlife Refuge.

Project boundaries and project actions have been described based on the best current information available. Project descriptions are based on worst case scenarios with the largest anticipated project disturbance size and impacts to the highest quality habitat included, except where specific plans or information currently exists. Higher quality habitat is defined as all woody vegetation classifications and short marsh, tall marsh, and wet meadow wetland types. Lower quality habitat is defined as all grassland classifications, mud flats, and other disturbed community types.

Due to the accelerated cleanup schedule, it is likely that a number of these projects will be conducted concurrently. These projects are being consulted on because they are likely, but not certain to take place and are within the Preble's protection area. The protection area is designated as a 300 foot zone extending in all directions around Preble's mice telemetry points. In addition, a 100 foot zone extending around suitable Preble's habitat areas without telemetry data is also included in the protection zone (Preble's Protection Plan, Appendix A of Part I of the PBA) (Figure 2). The area of Preble's habitat at the Site is 941.23 acres.

Description of Proposed Project Actions

Monitoring Well Installations

Additional wells may need to be installed site-wide to meet regulatory requirements for monitoring water quality and possible groundwater contamination during and after closure activities. Up to ten of these wells may need to be installed within the Preble's habitat area. Typically during installation, truck-mounted drill rigs will be driven to the well location to bore the well holes. A small amount of soil (1 cubic yard) from the well boring will be spread out in the adjacent vegetation. For the monitoring well installations, 405 square feet per well will be disturbed at an estimated ten different sites. This equates to a maximum disturbance total of 4,050 square feet (0.093 acres). Of the total 0.093 acres disturbed, a total of 0.09 acres will be temporary disturbances for all ten wells. A total of 0.003 acres will be permanently disturbed for all ten wells combined. After installation, the well would need to be monitored periodically for sample collection.

Additional disturbances could result from temporary two tracks becoming established from off-road driving where no established access roads exist. No impacts to water flows or increases in sedimentation are anticipated from this activity.

Original Landfill Project

The remediation plan for this project involves removing radiological hotspots and stabilizing the hillside slopes to prevent further erosion. The cleanup of the landfill is being conducted as a CERCLA action as required by the RFCA. Heavy earthmoving equipment will be used to complete this project. Large areas of the hillside may need to be scraped off and recontoured with additional fill material. The South Interceptor Ditch (SID) would be removed as part of the cleanup activity. The project area is about 20 acres in size and could impact a total of 9.10 acres of Preble's habitat, including 2.76 acres of high quality woody riparian habitat along several hundred feet of the north edge of Woman Creek. Most of the project is located in an old landfill vegetated with smooth brome (*Bromus inermis*), intermediate wheatgrass (*Elytrigia intermedium*), and diffuse knapweed (*Centaurea diffusa*). Although this disturbance will be temporary, the remediation work is expected to take several months to complete.

Pond Remediation and Removal

The ponds included in the remediation and removal project include A-1, A-2, A-3, B-1, B-2, B-3, B-4, in Walnut Creek, as well as the C-1, C-2 ponds and associated diversion and bypass structures found near the C-2 pond in Woman Creek. The project may also require the removal of the associated underground pipelines and valve boxes that are used to transfer water from one pond to another. These pipelines are typically buried adjacent to the pond edges and run between the ponds. Characterization of pond sediments may be conducted prior to remediation activities to determine the need for remedy. Characterization involves sampling the sediments on the pond bottoms either by foot or boat, depending on water levels. Remediation activities would include removal of contaminated sediments from the pond bottoms and stream channels. Pond removal activities may include removal of the dams and spillway structures and

recontouring the stream drainage and channel. Removal may also include breaching of the dams or leaving some type of lowhead dam structure in place to maintain the wetlands behind the dams. If the dams are not removed, then dam maintenance activities would need to continue indefinitely. Heavy equipment would be required for pond remediation or removal activities.

At the C-2 pond location, the Woman Creek bypass structure and diversion ditch that diverts water from the natural stream channel around the C-2 pond may be removed. The large riprap and concrete bypass structure in the creek channel above the C-2 pond may be taken out and the natural stream channel reestablished to allow the stream to flow into C-2. The diversion ditch may be filled in and recontoured to match the natural landscape. The outlet works for C-2 pond need to be redesigned to function properly to allow for water releases from the pond. If the bypass structure and diversion ditch are not removed, repairs to the riprap drop structures in the diversion ditch will be necessary to prevent further ditch erosion. In either case, future work activity would remain within the project boundary.

In the A-series ponds, a total of 14.82 acres of current Preble's habitat could be disturbed (Figure 2). In the B-series ponds, a total of 12.59 acres of current Preble's habitat could be disturbed (Figure 2). In the C-series ponds, a total of 9.99 acres of current Preble's habitat could be disturbed (Figure 2). In the A- and B-series ponds, impacts would be temporary. In the C-series, most of the work in the C-2 pond area would create temporary disturbances. However, approximately 1.87 acres in current Preble's protection areas would be permanently lost if the bypass channel and diversion ditch are filled in. The open surface area of the ponds has been subtracted from the total disturbance calculations because open water is not considered to be Preble's habitat. If the open areas of the ponds are converted to habitat suitable for Preble's through pond removal, higher quality habitat could be increased by 2.65 net acres.

Surface Water Monitoring Equipment Removal

Most of the old surface water monitoring instrumentation housings, concrete pads, posts, and signage will probably be removed as part of cleanup and closure. Although vegetation type, and the presence of the Preble's mouse varies by individual site, all of these structures are located within Preble's habitat in the Walnut and Woman Creek drainages. Existing roads or two tracks are used to access most of the locations, however some off-road travel may prove necessary. Some shrubs may need to be clipped so monitoring equipment can be removed. Heavy equipment may be needed for removal of larger structures. A maximum of 1.0 acre of temporary disturbance is anticipated to occur.

Surface Water Permanent Flume Installations and Replacement

Surface water flumes are used to monitor water flows and to obtain automated grab samples for contaminant analyses. Although there are no current plans to add or replace permanent flumes, it is possible that one flume may need to be replaced before site closure. Permanent flumes are large concrete structures that require the use of heavy equipment and up to three months to complete construction. Total disturbance area would be 0.5 acres in size, and would be temporary in nature. Because a new flume would be replacing a structure of the same size, no additional permanent impacts will result. Two deteriorated, permanent surface water flumes were replaced during 2002/2003 under a biological opinion provided by the Service in 2002.

Surface Water Flume Removal

Temporary and permanent surface water flumes have been used to monitor water flow and for automated grab samples for contaminant analyses. Several flumes that are no longer being used will be removed, in addition to several more where use will be discontinued before site closure. Established roads already exist for most of the flumes as they have been monitored for years.

Temporary flumes are small structures (12x3 feet) that are made of a fiberglass body, plastic sheeting wings, wooden beams, and sand bag anchors. These flumes would be dismantled by hand, and a vehicle used to haul off the components. The total temporary disturbance for the removal of temporary flumes is not expected to exceed .10 acres.

Permanent flumes are large concrete structures, and will require driving heavy equipment to the flume for removal, and a roll-off container or dump truck for hauling debris off-site. The total disturbance footprint for all of the flumes would not exceed 0.45 acres in size.

North Access Road and Culvert Removal Project

The north access road and some culverts are planned for removal as part of the IA regrading plan. Except for a small portion east of the north access road, most of the culverts and the road to be removed are not in the Preble's protection area. The roads will be removed by heavy earthmoving equipment, and will include asphalt removal and ripping of the roadbed before reseeding. Areas where culverts are removed will be recontoured as a stream channel. The total disturbance to Preble's protection areas will be 1.83 acres in lower quality habitat, and 0.23 in higher quality habitat.

Approximately 12 cement culvert sections that remain from an abandoned roadbed across the Woman Creek stream bottom may be removed as part of site cleanup operations. Culvert sections would be lifted by a crane or hoist and then placed on a truck to be removed from the area. A limited amount of off-road driving in mesic grassland will be necessary for crane access and staging. Some vegetation may be trampled from foot traffic as well. Temporary disturbance to 0.40 acres for lower quality habitat and 0.20 acres of higher quality habitat is anticipated for this activity. In the long term, successful revegetation and stream realignment in this area would restore Preble's travel corridors and reduce habitat fragmentation.

Dam Maintenance and Safety Activities

Dam safety inspections are conducted periodically throughout the year. The Federal Energy Regulatory Commission and the State of Colorado have requested that all vegetation obscuring visual inspection of the outlet area and upstream slopes be removed so that seepage from low-level pipes can be monitored throughout the year. Removal will involve mowing, hand clipping, and weed whacking on the dam toes, outlet works, and both interior and exterior dam faces. Affected dams within the Preble's protection area include the A-1- A-3, C-1, and B series ponds. These areas will be accessed on foot. A total of 3.16 acres of lower quality habitat, and 0.22 acres of higher quality Preble's habitat will be permanently disturbed.

For safety reasons, additional riprap must occasionally be placed on dam faces or spillways to protect these structures and the downstream areas. Heavy equipment will be required for this work, but the equipment will remain on the dams or spillway areas and will not affect Preble's habitat.

Waste Water Treatment Plant (WWTP) Removal

The WWTP treats 150,000 gallons of site-generated non-hazardous, non-radioactive liquid, sanitary waste daily to meet National Pollutant Discharge Elimination System requirements. The waste is treated with activated sludge, tertiary clarification, sand filtration, and ultra-violet light disinfection, and then is released into South Walnut Creek through a pipeline. The treatment structure will be removed prior to site closure. Approximately one third of the WWTP lies within the Preble's habitat protection area boundary. The WWTP buildings and parking lots are not considered to be suitable Preble's habitat, however some reclaimed grassland and riparian vegetation just to the south may be disturbed in conjunction with the North Access and Culvert Removal project described previously. The WWTP removal project is expected to disturb 0.28 acres of roads, parking, and building areas (See PBA Figure 2 map.).

Platte River Water Depletions and Preble's Mouse Water Reduction Issues

Cessation of the release of Waste Water Treatment Plant (WWTP) effluent into Walnut Creek is not considered to be a depletion of the Platte River system. Further, discontinuing the purchase of water from the Denver Water Board that is currently used for sanitary needs by on-site personnel, and the removal of impervious surfaces and returning them to a more natural state also do not constitute a depletion according to current Service policy (Don Anderson, personal communication, 2004).

However, these closure activities will have an impact on Preble's mouse habitat in the Walnut Creek drainage. A Site-Wide Water Balance (SWWB) modeling study provides an estimation of changes in surface and subsurface hydrology at the Site. Results from the model indicate substantial changes in the hydrology of Walnut Creek. Walnut Creek discharges decreased for the following three reasons: (1) WWTP contributions to Walnut Creek were eliminated; (2) impervious surfaces in the Industrial Area (IA) were removed, thereby eliminating fast runoff and increasing the amount of surface water infiltration in the IA; (3) building drain discharges to IA streams were eliminated. Potential effects of these changes are discussed in the biological assessment.

Based on the SWWB (K-H 2002b), under the No Imported Water Scenario, modeled off-Site surface discharge in Walnut Creek decreased from about 800,000 m³/year to 510,000 m³/year in wet years, and from 450,000 m³/year to 190,000 m³/year in dry years. Under the Land Configuration Scenario, off-Site surface discharge in Walnut Creek decreased from approximately 800,000 m³/year to 180,000 m³/year in wet years. In dry years the modeling showed a decrease from 450,000 m³/year to 20,000 m³/year. The Land Configuration Scenario described the combined effect of no imported water in addition to reduced water from surface water flows in the IA. Overall reductions of water flow at the Site boundary in Walnut Creek are estimated to range from about 78 percent in wet years to about 96 percent in dry years.

Additionally, the study showed that in Woman Creek, surface flows exiting the Site near Indiana Street will be largely unaffected by changes resulting from site closure activities. Wet year or dry year water flows remained at about 200,000 m³/year during wet years, and at slightly below 100,000 m³/year in dry years. Upstream of the C-2 pond no changes in surface flows are expected as a result of IA cleanup and closure actions because currently no water reaches the stream from the IA due to its diversion through the South Interceptor Ditch (SID). Although runoff in the SID basin is expected to decrease as a result of changes in the IA, no discharges were predicted for Pond C-2 in any of the scenarios modeled. As a result, little change should occur in Woman Creek flows.

No changes are anticipated in the Rock Creek drainage as a result of closure activities because this watershed is isolated from the IA closure activities.

Unforeseen Projects Inside Current Preble's Protection Areas

To avoid possible work delays, there potentially could be an additional 2 acres of disturbance in Preble's habitat resulting from unforeseen project activities that would adversely affect the Preble's mouse. These activities could cause a permanent loss of habitat of 0.25 acres maximum. Any use of the two-acre allotment will be documented and the pertinent information provided to the Service.

Conservation Measures

Actions in the project description that the project proponent will implement to reduce impacts of the action or further the recovery of threatened and endangered species are known as conservation measures. As part of the proposed action, the beneficial effects of these conservation measures are taken into consideration in the jeopardy and incidental take analyses. Conservation measures are part of the proposed action and their implementation is required under the terms of this consultation. Specific conservation measures identified in the biological assessment and included in this biological opinion that will benefit threatened and endangered species are detailed in the following section.

General Measures and Best Management Practices (BMPs)

1. Identify and prioritize Preble's habitat areas that are subject to disturbance and design activities to avoid areas of higher habitat value. For example, large willow patches will be avoided, except where the project cannot be completed without impacts.
2. Reduce the impact footprint (i.e., no walking in area beyond what is necessary to accomplish the work, minimizing laydown area and equipment storage locations).
3. Conduct activities during daylight hours, when the Preble's mouse is less active, when scheduling during the hibernation season of the mouse cannot be accomplished.
4. Minimize the length of time spent in sensitive areas (getting work done as quickly as possible, and not reentering the area once work is completed).
5. Explore options with project designers to avoid and/or minimize impacts to the Preble's mouse.
6. Use established roads (i.e., paved, gravel, two-track, historically-used routes to monitoring locations) for vehicle traffic. If an established road does not exist, use the

- safest and most direct route that minimizes impacts to the habitat and has been predetermined by an entity familiar with Preble's habitat use.
7. Limit equipment entrance/exit areas to the minimum number necessary to accomplish the work.
 8. Limit vegetation disturbance through alternative actions. For example, prune trees/shrubs rather than remove trees/shrubs; cut shrub stems to allow re-growth rather than grubbing out the entire root system.
 9. Remove trash and unnecessary equipment in project areas after work is completed.
 10. Revegetate all disturbed Preble's habitat with suitable native species at 2:1 ratio in higher quality habitat, 1.5:1 in lower quality habitat, after the activity has been completed. Refer to Table 1 and the Habitat Mitigation Techniques Plan (Appendix A, Part II of the PBA).
 11. When revegetation activities cannot be completed immediately after project completion (i.e., outside optimum seeding window) use alternative erosion controls to control potential erosion and sedimentation problems. Use redundant erosion controls where appropriate.
 12. Utilize erosion controls (i.e., silt fence, erosion blankets, hay bales, mulching, tackifiers, surface roughening) on all appropriate cleanup projects to control erosion and sedimentation problems. Utilize photo or biodegradable erosion blankets that will not entangle Preble's and other wildlife. For large areas, minimize exposed surfaces. Project personnel will be responsible to monitor erosion control effectiveness and modify control techniques as needed (especially after precipitation events). Monitoring will be conducted weekly or more frequently as needed (after precipitation events). Projects will maintain and repair erosion controls through project completion.
 13. Monitoring of mitigation actions will be conducted according to the Mitigation Monitoring Plan (Appendix B of Part II of the PBA).
 14. Prevent spilled fuels, lubricants or other toxic materials from entering Preble's habitat through the use of spill containment devices.
 15. Minimize project activities in wet areas and wet conditions to avoid damage to the habitat.
 16. Use the least amount of and/or smallest equipment necessary to accomplish the work.
 17. Do not clean equipment in Preble's mouse habitat or in areas where runoff will enter Preble's mouse habitat.
 18. Staging areas will be located either outside of Preble's habitat, or within the defined project footprint.
 19. Do not use Preble's mouse habitat as borrow areas.
 20. Inspect and clean equipment of weeds/seed to prevent the spread of noxious weeds to other locations.

Activity Specific Measures

Monitoring Well Installations

1. Excavated soil from bore holes will be spread out on the surrounding area to a depth of less than 1" to avoid burying vegetation.

Original Landfill Project

1. If construction will likely occur during the hibernation period (October – April), trim back and prune woody vegetation where practicable within Preble's habitat the previous August.
2. Retain woody root systems where remedy regulation guidelines permit.
3. If the alteration of stream flows becomes necessary, or excessive sedimentation, as evidenced by visible plumes in the stream, occurs in riparian habitat outside of the project footprint, the Service will be notified, and sediment control methods will be re-evaluated. Additionally, if rills or gullies occur in graded areas, the Service will be notified, and erosion control methods will be re-evaluated.

Pond Remediation and Removal

1. If construction will likely occur during the hibernation period, trim back and prune woody vegetation where practicable within Preble's habitat the previous August.
2. Retain woody root systems where remedy regulation guidelines permit.
3. Revegetate areas of pond removal with appropriate mesic or wetland native plant species.
4. Maintain redirected stream flows when de-watering of the ponds is necessary during remediation activity.
5. Contour disturbed areas to match surrounding areas.

Surface Water Flume Removal

1. Contour disturbed areas to match surrounding areas.

North Access Road and Culvert Removal Project

1. Alleviate compaction of roadbed areas before seeding operations through ripping, plowing and or discing to a minimum depth of 24 inches to allow successful revegetation.

Additional details of proposed conservation measures are provided in the PBA Part II, Preble's Protection Plan, Revegetation Plan Revision 2, and other materials.

Status of the Species/Critical Habitat

Preble's is a small rodent in the family Zapodidae and is 1 of 12 recognized subspecies of the species *Z. hudsonius*, the meadow jumping mouse. Preble's is native only to the Rocky Mountains-Great Plains interface of eastern Colorado and southeastern Wyoming. This shy,

largely nocturnal mouse lives in moist lowlands with dense vegetation. Adult Preble's are up to 8 to 9 inches long (its tail accounts for 60 percent of its length) with hind feet adapted for jumping. Preble's hibernate underground from September to May.

Records for Preble's meadow jumping mouse define a range including Adams, Arapahoe, Boulder, Denver, Douglas, El Paso, Elbert, Jefferson, Larimer, and Weld counties in Colorado; and Albany, Laramie, Platte, Goshen, and Converse counties in Wyoming (Kruttsch 1954, Compton and Hugie 1993). Armstrong et al. (1997, p. 77) described typical Preble's meadow jumping mouse habitat as "well-developed plains riparian vegetation with relatively undisturbed grassland and a water source in close proximity." Also noted was a preference for "dense herbaceous vegetation consisting of a variety of grasses, forbs and thick shrubs." Shenk (2000) conducted radio tracking studies at three sites and document greater use of upland habitats than previously assumed.

Preble's has undergone a decline in range and populations within its remaining range have been lost. Habitat loss and fragmentation resulting from human land uses have adversely impacted Preble's populations. David Armstrong (University of Colorado, 1998) concluded that the meadow jumping mouse, in this region as elsewhere, is a habitat specialist, and that the specific habitat on which it depends is declining.

Compton and Hugie (1993, 1994) cited human activities that have adversely impacted Preble's meadow jumping mouse including: conversion of grasslands to farms; livestock grazing; water development and management practices, and, residential and commercial development. Shenk (1998) linked potential threats to ecological requirements of Preble's meadow jumping mouse and suggested that factors which impacted vegetation composition and structure, riparian hydrology, habitat structure, distribution, geomorphology, and animal community composition must be addressed in any conservation strategy.

Residential and commercial development and associated infrastructure, including highway and bridge construction, and instream alterations to implement flood control, directly removes Preble's meadow jumping mouse habitat, or reduces, alters, fragments, and isolates habitat to the point where Preble's meadow jumping mouse can no longer persist. Corn et al. (1995) proposed that a 100 meter (328 foot) buffer of unaltered habitat be established to protect the floodplain of Monument Creek from a range of human activities that might adversely affect Preble's or its habitat. Roads, trails, or other linear developments through Preble's habitat may act as barriers to movement. Shenk (1998) suggested that on a landscape scale, maintenance of acceptable dispersal corridors linking patches of Preble's habitat may be critical to its conservation.

Further information about the biology and status of the Preble's can be found in the report "Conservation Assessment and Preliminary Conservation Strategy for Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*)" (Shenk, 1998, available on request).

Environmental Baseline

Preble's mice have been captured in all of the site's major drainages: Rock, Woman, North and South Walnut Creeks. Although the habitat quality varies widely, all of the drainages contain the

dense herbaceous understory, shrubbery, and open overstory associated with Preble's habitat. Introduced and noxious plant species are also present in all of the drainages despite intense site-wide weed control efforts. Previous trapping and telemetry studies indicate that these riparian areas are extensively utilized by Preble's for feeding, nesting, breeding, dispersal, and/or hibernation. There are approximately 941.23 acres of Preble's habitat at the Site.

Preble's have been captured near the A-series ponds above the A-3 pond, B-series ponds above the B-5 pond, and adjacent to the C-series ponds above and below the C-1 pond, between the C-1 and C-2 ponds, but not below the C-2 pond or in the diversion ditch around C-2. In the pond areas, habitat consists of open water ponds surrounded by short and tall marsh habitats along pond edges, and grasslands in the surrounding upland areas. At some locations upstream and downstream of the ponds and dams themselves, coyote willow, plains cottonwood, and false indigo are commonplace. No mice have been trapped downstream from the C-2 pond, possibly due to the more xeric conditions and lack of a significant shrub vegetation layer.

The xeric tallgrass prairie, tall upland shrubland, wetland, and Great Plains riparian woodland vegetation types present on-site have been identified by the Colorado Natural Heritage program as increasingly rare and unique (Figure 3).

EFFECTS OF THE ACTION

For determination of impacts to Preble's habitat, habitat quality was defined based on the 1996 Site vegetation map that was used to produce the current Preble's protection plan map. Using the Site's Geographic Information System (GIS), project footprints and the current Preble's protection area GIS coverages were overlain to determine the amount of area specific projects might impact in Preble's habitat. With this information, the 1996 vegetation map was used to identify different plant communities and habitat types within the potentially affected Preble's habitat. Higher quality habitat is defined as all woody vegetation classifications and short marsh, tall marsh, and wet meadow wetland types. Lower quality habitat was defined to include all grassland classifications, mud flats, and other disturbed community types. Open water, riprap, concrete, roads, and structures were not considered habitat for the Preble's mouse. This information was used in the GIS effort to calculate the total number of acres of potential temporary and permanent impacts to both lower and higher quality habitat within project footprints. Any areas where additional riprap, concrete, roads, or structures are placed in the future will be considered as permanent habitat loss for Preble's.

Table 1. Anticipated effects of cleanup actions to Preble's habitat.

Project	Temporary (Acres)		Permanent (Acres)		Location/ Drainage	Total Disturbance (Acres)
	Habitat Type		Habitat Type			
	Low*	High+	Low	High		
Monitoring Well Installations	0	0.09	0	0.003	Various	0.09
Original Landfill	6.34	2.76	0	0	Woman Creek	9.1
Pond Remediation						
A Series	11.5	3.07	0	.25	Walnut Creek	14.82
B Series	10.48	1.78	0	.33	Walnut Creek	12.59
C Series	6.65	2.05	0.98	.31	Woman Creek	9.99
Ponds Total	28.63	6.9	0.98	.89		37.4
Surface Water Monitoring Equipment Removal	0	1.0	0	0	Walnut and Woman Creek	1.0
Surface Water Permanent Flume Installations/ Replacement	0	0.5	0	0	Walnut and Woman Creek	0.5
Surface Water Permanent Flume Removal	0	0.55	0	0	IA/Walnut, Rock, Woman Creek	0.55
North Access and Culvert Removal	2.23	.43	0	0	Walnut Creek	2.66
Dam Maintenance	0	0	3.16	0.22	Walnut and Woman Creek	3.38
Waste Water Treatment Plant						
Unforeseen Projects	0	1.75	0	0.25	Various	2.0
TOTAL	37.2	13.98	4.14	1.36		56.68
MITIGATION TOTAL	55.8	27.96	6.21	2.72		92.69

* Lower quality habitat is defined as all grassland classifications, mud flats, and other disturbed community types. A 1.5:1 mitigation ratio will be used in this habitat type. For determination of impacts within current Preble's protection areas, habitat quality was defined based on the 1996 site vegetation map.

+ Higher quality habitat is defined as all woody vegetation classifications and short marsh, tall marsh, and wet meadow wetland types. A 2:1 mitigation ratio will be used in this habitat type

Activities in Part II of the PBA will disturb 56.7 acres of Preble's habitat in total. This accounts for approximately 6.0 percent of total existing Preble's habitat on the Site. Of this area, 51.2 acres (5.4 percent of the existing habitat) could be temporarily affected and 5.5 acres (0.6 percent of the existing habitat) could have permanent impacts to habitat. Preble's individuals may be taken due to construction and/or restoration, enhancement, and/or revegetation efforts within their habitat. Additional take is expected to result from indirect effects due to habitat modification and destruction.

Secondary impacts of the proposed projects to Preble's may include temporary increases in noise, light, dust, stormwater runoff and sedimentation, pollution, disruption of travel corridors, and human activities related to the normal implementation of the project activities in the PBA.

The removal of the north access road, associated culverts, and buildings along with the creation of a section of new stream reaches to connect drainage areas will restore travel corridors and potentially add approximately 41 acres of suitable habitat upon subsequent revegetation.

Project sites that involve the removal of buildings, roads, riprap, and structures will be revegetated with native species, eventually resulting in an improved, more natural state for Preble's and other wildlife. Higher quality Preble's habitat will be revegetated at a 2:1 ratio of mitigation acres to potential impact acres. Lower quality areas will be revegetated based on a 1.5:1 ratio.

The final approval of acreages credited as appropriate and successful mitigation for impacts to Preble's mice will be determined by the Service.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action, including the possible development of new section of the 470 highway corridor nearby, are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Substantial development is occurring in Jefferson County. Various development projects are planned adjacent to RFETS, both upstream and downstream from the project site. While development in other areas of Jefferson County that contain Preble's habitat may undergo section 7 review, others may not. In the latter case, projects would be required to pursue Habitat Conservation Plans (HCPs) and section 10 permits where take of Preble's is likely. Jefferson County and other local jurisdictions are in the process of developing a county-wide HCP for Preble's. It is not clear how a county-wide HCP, if approved, will affect future development that may impact Preble's. However, the Service is required to conduct internal section 7 review of issuance of section 10 permits that may result from these HCPs. Future development in the area may result in a variety of direct and secondary impacts to Preble's and its habitat.

CONCLUSION

After reviewing the current status of Preble's, the environmental baseline for the action area, the effects of the proposed development and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of Preble's. Approximately 0.6 percent of existing Preble's habitat at RFETS will be permanently affected, and approximately 5.4 percent will be temporarily affected by the proposed activities.

Although the proposed projects will adversely affect Preble's and its habitat at RFETS in the short term, conservation measures and BMPs will avoid jeopardy to the species. Critical habitat was not designated in the project area, therefore none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by DOE so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The DOE has a continuing duty to regulate the activity covered by this incidental take statement. If the DOE (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

Amount or extent of take anticipated

The Service anticipates incidental take of Preble's through direct killing and by loss of food, cover, and other essential habitat elements. This take will be difficult to detect because of their small size and hibernation underground. The Service anticipates that the proposed action will result in incidental take of an undetermined number of Preble's individuals through both direct take and through habitat destruction, due to the temporary loss of 51.2 acres of Preble's habitat, and the permanent loss of 5.5 acres of Preble's habitat for a total of 56.7 acres.

In this biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of Preble's:

1. The DOE will monitor the extent of habitat impacted to ensure that it does not exceed the authorized area or the authorized take limits.
2. The DOE will require timely revegetation and enhancement of the project area, as described in the conservation measures and project descriptions, to minimize the disturbance to Preble's habitat.
3. The DOE will ensure that mitigation efforts are successful in protecting, restoring, and enhancing Preble's habitat and report on its progress.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the DOE must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are **non-discretionary**.

1. To implement Reasonable and Prudent Measure #1, the DOE shall:
 - a. Ensure that BMPs designed to minimize take are implemented and are successful, including those for revegetation and erosion control.
 - b. Ensure that Preble's habitat not designated for remedy, construction or restoration actions will be marked off with erosion barrier or other appropriate fencing to prevent inadvertent impacts to habitat outside the project footprint.
 - c. Collect geospatial data on the actual footprint of disturbance after the activity is completed.
 - d. Ensure that workers on-site will be informed about the reason for and importance of limiting disturbances and impacts to Preble's habitat outside of the fenced work areas.
2. To implement Reasonable and Prudent Measure #2, the DOE shall:
 - a. Ensure seeding is completed as soon as the planting windows/timeframe allows.
3. To implement Reasonable and Prudent Measure #3 above, the DOE shall:

- a. Conduct monitoring of restoration and enhancement efforts, which shall include photographs, geospatial data, spreadsheets, and other necessary information to determine the extent and effects of construction and the implementation and effectiveness of such efforts, until success criteria as defined in Appendix B of the PBA Part II are met. Reports of this information shall be forwarded to the Service after each growing season and prior to December 1.
 - b. Monitor habitat restoration and enhancement areas for a minimum of three growing seasons, and until such time as DOE and the Service determine that the required restoration and enhancement have met the success criteria (PBA Part II, Appendix B, Mitigation Monitoring Plan). If supplemental irrigation of habitat restoration or enhancement vegetation is provided, success shall be assessed by the Service only after at least two growing seasons without supplemental irrigation.
 - c. Ensure implementation of habitat restoration and enhancement is supervised by an entity experienced in reclamation or habitat restoration.
 - d. Continue to implement weed control efforts site-wide to prevent the further spread of noxious weeds.
4. To implement all Reasonable and Prudent Measures (#1 through #3) DOE shall:
- a. Provide advance notice to the on-site Service representative on project activities planned for the upcoming week in Preble's habitat areas.
 - b. Provide access for inspection at any time by the on-site Service representative, with the proper accommodations made for any safety requirements for the work site.
 - c. Provide notification upon initiation of disturbance resulting from project activities to the on-site Service representative.
 - d. Provide notification of final sign-off on project activities in Preble's habitat areas to the on-site Service representative.
 - e. Provide updated Preble's Mouse Mitigation Debit/Credit Spreadsheet (PBA Part II, Appendix G) information as projects and mitigation efforts are completed on a monthly basis to the on-site Service representative.
 - f. Develop an adaptive management strategy with assistance from the Service for changes on RFCA requirements and site conditions.
5. Develop an adaptive management strategy with assistance from the Service that will address the potential habitat loss due to hydrologic changes in the Walnut and Woman Creek drainages. Such a strategy will describe how habitat will be measured, how loss

will be determined, and the steps that will be taken to compensate for that habitat loss, should it occur.

6. In the unlikely event that a Preble's mouse is encountered (dead, injured, or hibernating) during construction activities, the Colorado Field Office of the Service will be contacted at (303) 275-2370 immediately.

The Service believes that no more than 56.7 acres of Preble's habitat will be adversely affected as a result of the proposed action. The reasonable and prudent measures, with their terms and conditions of implementation, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The DOE must immediately provide an explanation of the causes of the take exceedences and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service recommendations are as follows:

1. Provide Preble's habitat enhancement through the Service-facilitated negotiations on the procurement of a conservation easement on the grazing rights, and by fencing the riparian corridor and adjacent pastures for conservation grazing, (in Section 16) to enhance approximately 144 acres of riparian habitat in the headwaters of Woman Creek.
2. Remove non-terminal ponds, dams and current spillway structures in the Walnut and Woman Creek drainages, leaving some type of lowhead dam structure in place to maintain the wetlands in place behind the dams. Recontour the stream drainage and channel to a more natural alignment to mitigate the possible effects on Preble's from decreased water flow in the Walnut Creek drainage.
3. Minimize the amount of riprap used for streambed stabilization; utilize alternate methods such as check dams and lowhead structures to control water flow and erosion to create more suitable Preble's and wildlife habitat.
4. Obtain the surface mineral mining rights in Section 9 in the west spray field to maintain the integrity of headwaters of Walnut Creek and enhance suitable habitat downstream.

5. Re-seed areas currently being mowed for dam maintenance activities with lower height native species such as blue grama, and western wheatgrass that will not require frequent mowings.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If the Service can be of further assistance, please contact Amy Thornburg at (303) 966-5777.

Sincerely,


FOR Susan C. Linner
Colorado Field Supervisor

cc: Dean Rundle, USFWS
Andrew Rosenman K-H
Jody Nelson, PEG

REFERENCES CITED

Armstrong, D.M. (University of Colorado, pers. com. 1998)

Armstrong, D.M., M.E. Bakeman, A. Deans, C.A. Meaney, and T.R. Ryon. 1997. Report on habitat findings of the Preble's meadow jumping mouse. Boulder (CO); report to the U.S. Fish and Wildlife Service and Colorado Division of Wildlife. 91 pp.

Compton, S.A., and R.D. Hugie. 1993. Status report on *Zapus hudsonius preblei*, a candidate endangered subspecies. Logan (UT): Pioneer Environmental Consulting Services Inc.; under contract with the U.S. Fish and Wildlife Service. 32 pp.

Compton, S.A., and R.D. Hugie. 1994. Addendum to the status report on *Zapus hudsonius preblei*, a candidate subspecies. Logan (UT): Pioneer Environmental Services, Inc.; under contract with the U.S. Fish and Wildlife Service. 8 pp.

Corn, J.G., C.A. Pague, A.R. Ellingson, M. Sherman, T. Zwięjac, G. Kittel, and C. Fleming. 1995. Final report on the geographic extent of the Preble's meadow jumping mouse population on the United States Air Force Academy. Ft. Collins (CO): Colorado Natural Heritage Program; under contract with the United States Air Force Academy. 40 pp.

K-H. 2002b. Site-Wide Water Balance Model Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC, Golden, CO. May 2002

Krutzsch, P.H. 1954. North American jumping mice (genus *Zapus*). University of Kansas Publications, Museum of Natural History 7:349-472.

Shenk, T. 1998. Conservation assessment and preliminary conservation strategy for Preble's meadow jumping mouse (*Zapus hudsonius preblei*). Fort Collins (CO): Colorado Division of Wildlife. 38 pp.

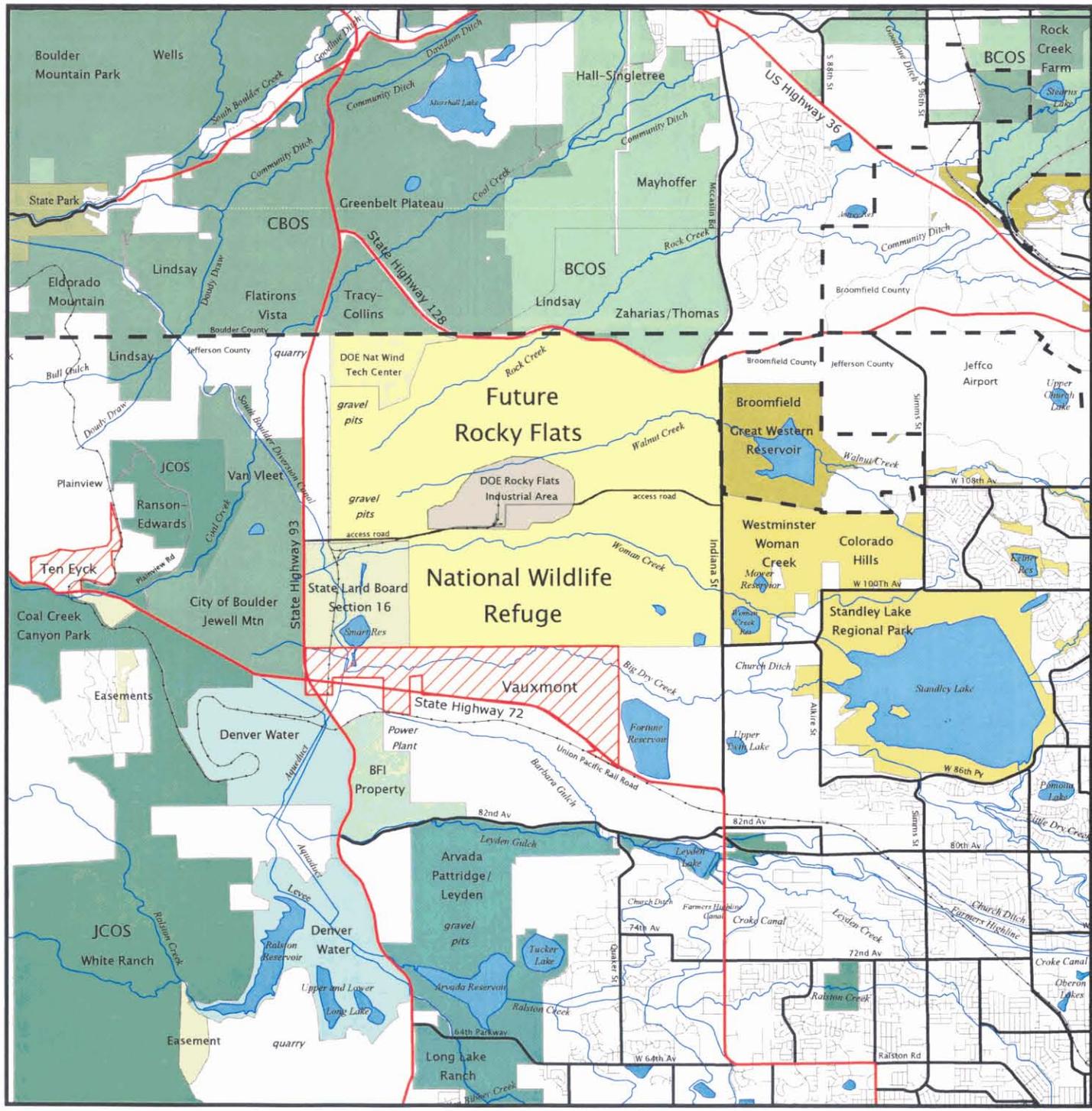
Shenk, T. 2000. Temporal and spatial variation in the demography and movement patterns of Preble's meadow jumping mouse (*Zapus hudsonius preblei*). Fort Collins (CO): Colorado Division of Wildlife. 41 pp.

USFWS. 2002. Biological Opinion for the Water Measurement Flume Replacement Project at the Rocky Flats Environmental Technology Site. US Fish and Wildlife Service, Lakewood, CO. August 1, 2002.

Figure 1

NJAG

Map of Open Space and Natural Lands



Open Space

- Rocky Flats
- Boulder County
- Jefferson County
- Arvada
- City of Boulder
- Broomfield
- Westminster

Other Open Lands

- BFI Property
- Conservation Easements
- Denver Water
- Nat Wind Tech Center
- State Land Board

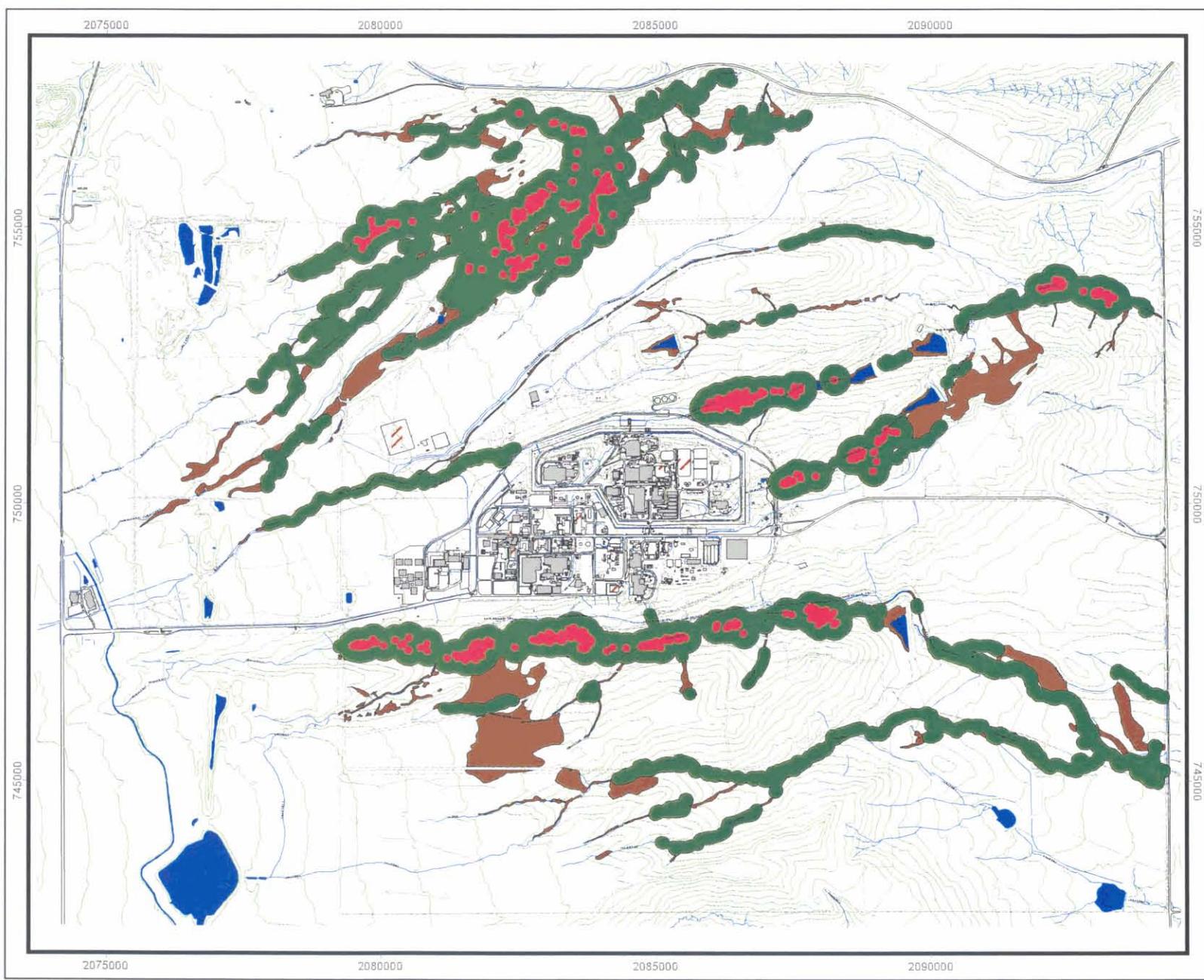
Note: Transparent colors in map may vary from those in legend.

Other Features

- Highways
- Major Roads
- Local Roads
- Rail Lines
- Streams and Gulches
- Lakes and Reservoirs
- County Boundaries
- Proposed Development



North Jeffco Area Group
 Version 1.0, April 2002
 8.5" x 11" Format
 1:84,000 Scale
 State Plane Coordinates
 Central Zone, NAD 1927
 For reference only.
 Locations are approximate.
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**Preble's Meadow Jumping Mouse
Current Protection Areas
at RFETS
December 2003**

Figure 2

Legend

- Current Preble's Protection Areas
- Contiguous Wetlands
- Preble's mouse telemetry points

Standard Features

- Buildings
- Demolished Buildings
- Lakes & ponds
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours (20 ft. intervals)

DATA SOURCE BASE FEATURES:
Buildings, fences, hydrography, roads and other structures from 1994 aerial flyover data captured by EG&G RSI, Las Vegas. Digitized from the orthophotographs, 1995.

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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: Professional Environmental Group, L.L.C.

For: Kaiser-Hill Company, LLC

RFETS GIS Dept. 303-966-7707
MAP ID: 04-0006 December 16, 2003

**Rocky Flats Environmental
Technology Site
Vegetation Map**

Figure 3

LEGEND

- Riparian Woodland
- Leadplant Riparian Shrubland
- Wet Meadow/Marsh Ecotone
- Short Upland Shrubland
- Willow Riparian Shrubland
- Annual Grass/Forb Community
- Xeric Tallgrass Prairie
- Ponderosa Woodland
- Reclaimed Mixed Grassland
- Mesic Mixed Grassland
- Savannah Shrubland
- Tall Upland Shrubland
- Short Marsh
- Xeric Needle and Thread Grass Prairie
- Short Grassland
- Disturbed and Developed Areas
- Open Water
- Riprap, Rock, and Gravel Piles
- Mudflats
- Tree Plantings
- Tall Marsh

- Standard Map Features**
- Buildings and other structures
 - Solar evaporation ponds
 - Lakes and ponds
 - Streams, ditches, or other drainage features
 - Fences and other barriers
 - Rocky Flats boundary
 - Paved roads
 - Dirt roads

DATE REVISED:
Revisions were also made to the map legend.

NOTES:
This map is a derivative of the Rocky Flats Environmental Technology Site Vegetation Map, Version 3.0, dated 10/2007. It was prepared by Rocky Mountain Remediation Services, L.L.C. for the U.S. Department of Energy. The map is intended for informational purposes only and does not constitute a warranty or representation of any kind. The user assumes all liability for any use of this map. For more information, contact Rocky Mountain Remediation Services, L.L.C. at 303.440.1000.



Scale: 1" = 200'
1 inch represents 200 feet

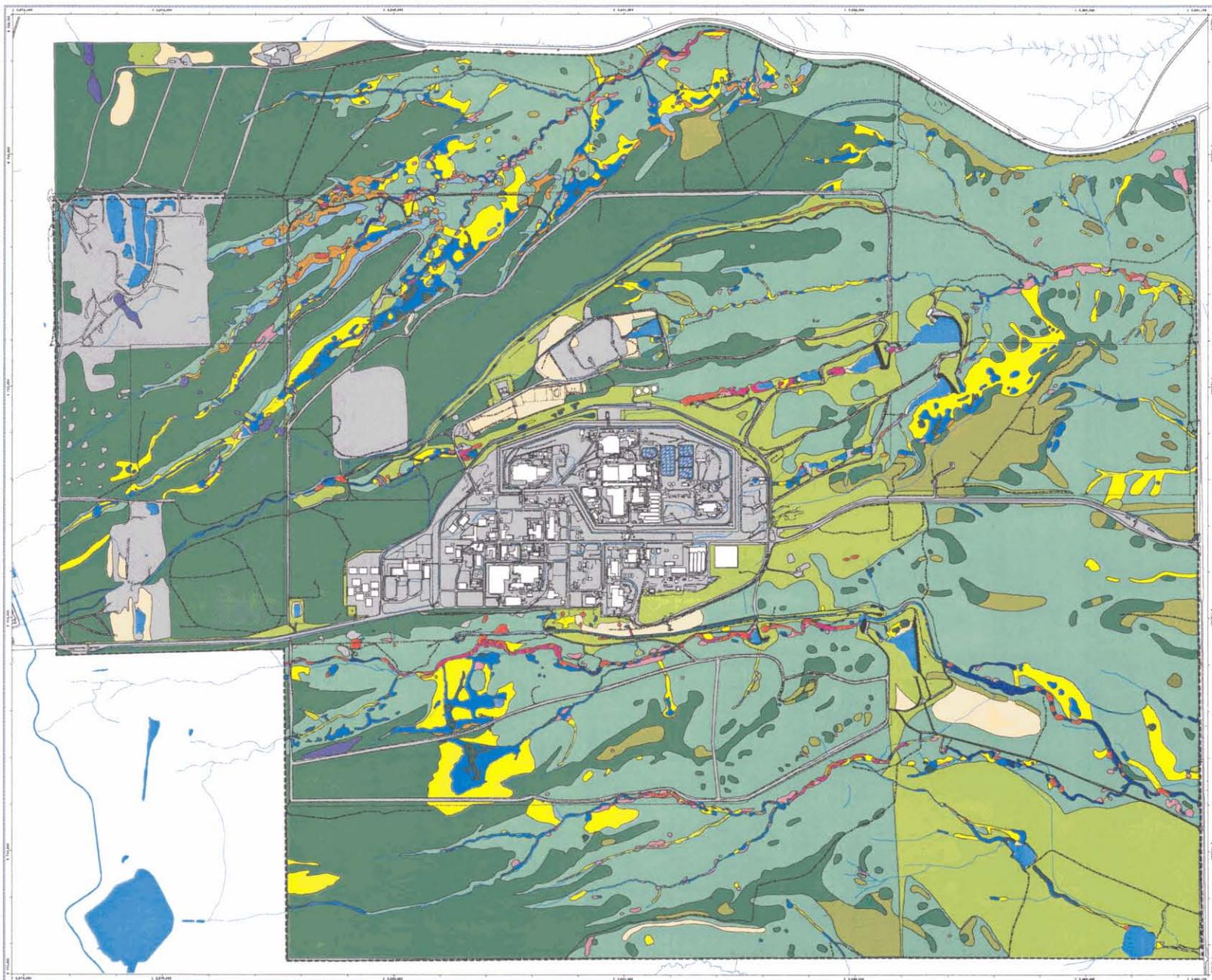
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD83

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

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Appendix A – Habitat Mitigation Techniques Plan

Appendix B – Mitigation Monitoring Plan

Appendix C – RFCA Standard Operating Protocol for Asphalt and Soil Management

Appendix D – Historical Correspondence with USFWS

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Appendix G – Preble’s Mouse Mitigation Debit/Credit Spreadsheet

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- Figure 4. Locations of surface water flumes to be removed
- Figure 5. IA Preble's mouse habitat creation
- Figure 6. Preble's Mouse Current Protection Areas at the Rocky Flats Environmental Technology Site

Acronyms and Abbreviations

AF	Acre Feet
BA	Biological Assessment
BE	Biological Evaluation
BMP	Best Management Practice
BO	Biological Opinion
BZ	Buffer Zone
CDNR	Colorado Department of Natural Resources
CDOW	Colorado Division of Wildlife
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EPA	Environmental Protection Agency
ESA	Endangered Species Act
GIS	Geographic Information System
IA	Industrial Area
IHSS	Individual Hazardous Substance Site
MOA	Memorandum of Agreement
NREL	National Renewable Energy Lab
PBA	Programmatic Biological Assessment
PPP	Preble's Protection Plan
PRCA	Platte River Cooperative Agreement
RFETS	Rocky Flats Environmental Technology Site
RFCA	Rocky Flats Cleanup Agreement
SID	South Interceptor Ditch
SOP	Standard Operating Protocol
SWWB	Site Wide Water Balance Report
USFWS	U.S. Fish and Wildlife Service
WWTP	Waste Water Treatment Plant

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1. Introduction

1.1 Purpose

The Department of Energy (DOE) developed this Programmatic Biological Assessment (PBA) for the Rocky Flats Environmental Technology Site (Site, RFETS) as part of the Section 7 consultation requirements of the Endangered Species Act of 1973, as amended (ESA). The DOE is the action agency requesting the formal consultation with the U.S. Fish and Wildlife Service (USFWS). This document is Part II of two parts of the PBA that will address the potential for Site activities to affect threatened and endangered species that are protected under the ESA. Part I of the PBA was prepared to examine impacts from routine, ongoing activities, and specific closure actions that will have either “no effect” or “may affect, but are not likely to adversely affect” listed species under consideration in this PBA. One listed species under consideration in this PBA includes the Preble’s meadow jumping mouse (Preble’s mouse, *Zapus hudsonius preblei*) and its habitat (current protection areas at the Site. Part II of the PBA addresses actions that are “likely to adversely affect” the species under consideration in this PBA or the Preble’s mouse or its habitat. The current Preble’s protection areas at the Site are defined as the areas delineated by the *Preble’s Meadow Jumping Mouse Protection Plan* for the Site (PPP; DOE 2000; see Appendix A of Part I of this PBA for the Plan and the map). This plan was required under the Memorandum of Agreement (MOA, February 26, 1999) signed between DOE, USFWS, U.S. Environmental Protection Agency (EPA), Colorado Department of Public Health and Environment (CDPH&E), and the Colorado Department of Natural Resources (CDNR). The PPP was developed based on several years of Preble’s mouse trapping, telemetry, and habitat characterization work at the Site. The PPP has been submitted several times to the USFWS for concurrence, however, the USFWS has never concurred. Although the PPP has never received formal concurrence, it has been cited and used for numerous Biological Assessments (BAs), Biological Evaluations (BEs), and Biological Opinions (BOs) for Site projects with no objections from the USFWS.

See Part I of the PBA for background and introductory information on the Site.

1.2 Assumptions

This PBA addresses all the potential activities that may occur at the Site through closure that may adversely affect threatened and endangered species, with specific emphasis on the Preble’s mouse. However, the fact that a project is listed in this document does not necessarily mean that it will take place. Only projects that are conducted will be mitigated as discussed in the PBA. Mitigation will not occur for projects that are not conducted. The objective of the PBA is to identify all potential projects for the consultation process so that no delays in project schedules will occur.

1.3 Responsibilities

To ensure compliance with the requirements of Part II of the PBA and BO the following guidelines are established:

1. Project managers for projects addressed in Part II will be given a copy of the PBA and BO and instructed on the requirements contained therein related to their projects.
2. Initial project boundaries agreed upon in the PBA will be physically delineated on the ground by Site ecologists and/or the USFWS. Flagging, plastic fencing or other means will be used by the project to delineate the project boundary. The project will be advised that all work and storage areas must be conducted and contained within this boundary.
3. Site ecologists and/or USFWS personnel will meet regularly with project personnel to discuss and ensure PBA and BO requirements are being followed. Meetings and project location visits will be documented.
4. Should projects require additional area, the USFWS will be consulted.
5. In situations, where the project does not disturb the entire area originally designated for disturbance, the area actually disturbed will be delineated and mapped, acreage calculated, and that area used to determine the actual amount of mitigation needed (if any) based on the mitigation ratios agreed on in the PBA. Within current Preble's protection areas, open water, riprap, concrete, roads, and structures are not considered Preble's habitat. Therefore if these areas are removed during the project, and revegetated, they will be considered as habitat creation. The created habitat will be delineated and mapped, acreage calculated, and that area taken as credit to offset debits. This information will be reported to the USFWS.

1.4 Species Considered In This Assessment

Based on a species list received from the USFWS the following species have been evaluated as part of this PBA. Species descriptions are presented in Appendix B of Part I of this PBA.

Animals	Legal Status
American burying beetle (<i>Nicrophorus americanus</i>)*	LE
Bald eagle (<i>Haliaeetus leucocephalus</i>)	LT
Black-footed ferret (<i>Mustela nigripes</i>)	LE
Black-tailed prairie dog (<i>Cynomys ludovicianus</i>)	C
Boreal toad (<i>Bufo boreas boreas</i>)	C
Canada lynx (<i>Lynx canadensis</i>)	LT
Eskimo curlew (<i>Numenius borealis</i>)*	LE
Greenback cutthroat trout (<i>Oncorhynchus clarki stomias</i>)	LT
Least tern (<i>Sterna antillarum</i>)*	LE
Mexican spotted owl (<i>Strix occidentalis lucida</i>)	LT
Mountain plover (<i>Charadrius montanus</i>)	PT
Pallid sturgeon (<i>Scaphirhynchus albus</i>)*	LT
Pawnee montane skipper (<i>Hesperia leonardus montana</i>)	LT
Piping plover (<i>Charadrius melodus</i>)*	LT
Preble's meadow jumping mouse (<i>Zapus hudsonius preblei</i>)	LT
Whooping crane (<i>Grus americana</i>)*	LE
Plants	
Colorado butterfly plant (<i>Gaura neomexicana coloradensis</i>)	LT
Ute ladies' -tresses (<i>Spiranthes diluvialis</i>)	LT
Western prairie fringed orchid (<i>Platanthera praeclara</i>)*	LT

* = Lower Platte River species

C = Candidate for listing

LT = Listed threatened

LE = Listed endangered

PT = Proposed threatened

2. Likely To Adversely Affect Activities

This section of Part II of the PBA outlines various Site activities that are “likely to adversely affect” listed species. Although several species are under evaluation, the activities will only likely affect the Preble’s mouse. Preble’s mouse “take”, as defined by the USFWS, would likely occur as a result of these project activities. In the USFWS Endangered Species Consultation Handbook (USFWS 1998), “take” is defined as:

“to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct. [ESA §3(19)] Harm is further defined by the FWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by FWS as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. [50 CFR §17.3]”

These project activities were deemed likely to affect or cause “take” to the Preble’s mouse because the projects described in Part II of the PBA exceed the criteria listed in Part I of the PBA that would result in a “no effect” or “may affect, but not likely to adversely affect” determination. The flowchart in Figure 1 summarizes the above criteria and allows for easier determination of project activity effects.

To minimize impacts to the Preble’s mouse, project management will utilize and maintain the following best management practices (BMPs) except where regulatory and/or health and safety requirements take precedence.

- Identify and prioritize Preble’s habitat areas that are subject to disturbance and design activities to avoid areas of higher habitat value¹. For example, large willow patches will be avoided, except where the project cannot be completed without impacts.
- Reduce the impact footprint (i.e., no excessive walking in area beyond what is necessary to accomplish the work, minimizing laydown area and equipment storage locations).
- Conduct all activities during daylight hours, when the Preble’s mouse is less active, when scheduling during the hibernation season of the mouse cannot be accomplished.
- Minimize the length of time spent in sensitive areas (getting work done as quickly as possible, not reentering area once work is completed).

¹ For determination of impacts within current Preble’s protection areas, habitat quality was defined based on the 1996 Site vegetation map. Higher quality habitat is defined as all woody vegetation classifications and short marsh, tall marsh, and wet meadow wetland types. Lower quality habitat is defined as all grassland classifications, mud flats, and other disturbed community types. Open water, riprap, concrete, roads, and structures are not considered habitat for the Preble’s mouse.

- Explore options with project designers to avoid and/or minimize impacts to the Preble's mouse.
- Use established roads (i.e. paved, gravel, two-track, historically used routes to monitoring locations) for vehicle traffic. If an established road does not exist, use the safest and most direct route that minimizes impacts to the habitat.
- Limit equipment entrance/exit areas to the minimum necessary to accomplish the work.
- Limit vegetation disturbance through alternative actions. For example, prune trees/shrubs rather than remove trees/shrubs; cut shrub stems to allow re-growth rather than grubbing out the entire root system.
- Remove trash and unnecessary equipment in project areas after work is completed.
- Revegetate disturbed Preble's habitat with native species after the activity has been completed in accordance with the Habitat Mitigation Techniques Plan (Appendix A, Part II of PBA).
- When revegetation activities cannot be completed immediately after project completion (i.e., outside optimum seeding window) use alternative erosion controls to control potential erosion and sedimentation problems. Use redundant erosion controls where appropriate.
- Use erosion controls (i.e., silt fence, erosion blankets, hay bales, mulching, tackifiers, surface roughening) to control erosion and sedimentation problems. For large areas, minimize exposed surfaces. Project personnel will be responsible to monitor erosion control effectiveness and modify control techniques as needed (especially after precipitation events). Monitoring will be conducted weekly or more frequently as needed (after precipitation events). Projects will maintain and repair erosion controls through project completion.
- Monitoring of mitigation actions will be conducted according to the Mitigation Monitoring Plan (Appendix B of Part II of the PBA)
- Prevent spilled fuels, lubricants or other toxic materials from entering Preble's habitat.
- Minimize project activities in wet areas and wet conditions to avoid damage to the habitat.
- Use the least amount of and/or smallest equipment necessary to accomplish the work.
- Do not clean equipment in Preble's mouse habitat or in areas where runoff will enter Preble's mouse habitat.
- Staging areas will be located either outside of Preble's habitat, or within the defined project footprint.
- Preble's mouse habitat will not be used as borrow areas.
- Inspect and clean equipment of weeds/seed to prevent spread of noxious weeds.

Project managers will receive a copy of Part II of the PBA and BO, and be briefed on the guidelines and requirements contained therein pertinent to their project. Project management is responsible to ensure compliance with the requirements and guidelines outlined in Part II of the PBA and BO. Project managers are responsible for following and maintaining the best management practices (BMPs).

The following table lists the projects that are likely to adversely affect the Preble's mouse and its habitat. Figure 2 shows the general locations of the projects. The table summarizes the project impacts within the current Preble's protection areas and whether the project will be conducted primarily during the hibernation period of the mouse. Replacement of open water areas with vegetated communities is considered creating habitat and offsets the overall total impact of project activities. Additional detail on each project is found following the table. Project evaluations are based on worst case scenarios, except where specific plans or information currently exists. The activities included in this section are being consulted on because they are likely to happen. Their inclusion here, however, does not constitute the fact that they will indeed occur. The timeframe for completion of all the projects listed in Part II of the PBA is December 2006.

For determination of impacts to Preble's habitat, habitat quality was defined based on the 1996 Site vegetation map that was used to produce the current Preble's protection plan map. Using the Site's GIS, project footprints and the current Preble's protection area GIS coverages were overlain to determine the amount of area specific projects might impact in Preble's habitat. With this determined, the 1996 vegetation map was used to identify the different plant communities or habitat types within the potentially impacted Preble's habitat. Higher quality habitat is defined as all woody vegetation classifications and short marsh, tall marsh, and wet meadow wetland types. Lower quality habitat is defined as all grassland classifications, mud flats, and other disturbed community types. Open water, riprap, concrete, roads, and structures are not considered habitat for the Preble's mouse. This information was used in the GIS to calculate the total number of acres of potential temporary and permanent impacts to both lower and higher quality habitat within the project footprints.

Project	Temporary (Acres)		Permanent (Acres)		Total Disturbance (Acres)
	Habitat Quality*		Habitat Quality*		
	Lower	Higher	Lower	Higher	
Monitoring Well Installations	0.00	0.09	0.00	0.003	0.093
Original Landfill Project	6.34	2.76	0.00	0.00	9.10
Pond Remediation and Removal					
A-Series	11.50	3.07	0.00	0.25	14.82
B-Series	10.48	1.78	0.00	0.33	12.59
C-Series	6.65	2.05	0.98	0.31	9.99
Total	28.63	6.90	0.98	0.89	37.40
Surface Water Monitoring Equipment Removal	0.00	1.00	0.00	0.00	1.00
Surface Water Permanent Flume Installations and Replacements	0.00	0.50	0.00	0.00	0.50
Surface Water Flume Removal	0.00	0.55	0.00	0.00	0.55
North Access Road and Culvert Removal Project	2.23	0.43	0.00	0.00	2.66
Dam Maintenance and Safety Activities	0.00	0.00	3.16	0.22	3.38
Waste Water Treatment Plant	0.00	0.00	0.00	0.00	0.00
Site Water Reduction	N/A	N/A	N/A	N/A	N/A
Unforeseen Projects	0.00	1.75	0.00	0.25	2.00
Total Disturbance	37.20	13.98	4.14	1.36	56.68

* See footnote number one for definitions of habitat quality.

3. Projects

This section describes the projects that are likely to occur through Site closure and that will adversely affect listed species (i.e. the Preble's mouse). A number of assumptions have been made to allow the development of this PBA without having detailed plans for each of the projects listed below. The assumptions are provided below.

Project boundaries have been estimated based on the best current available information. Worst case scenarios have been assumed for the following project descriptions. Should larger areas than specified in the PBA be required, additional consultation with the USFWS will be conducted. Preble's mouse data from the Site and elsewhere have been used as the best scientific information for making decisions. Acreages of disturbance to the current Preble's protection area were determined using the Site's Geographic Information System (GIS). This PBA attempts to identify all potential projects that could occur within the current Preble's protection areas. However, given the scope and scale of the closure activities, it is possible something could have been missed and that additional consultation will be required. The activities listed in this section are being consulted on because they may happen. Their listing here, however, does not obligate them to occur. But should they occur, these activities will be covered under the PBA.

3.1 Monitoring Well Installations

Monitoring wells may still need to be installed at different locations across the Site to monitor possible contaminants in the groundwater. Wells are required to be installed to meet regulatory requirements for water quality at the Site. Typically these wells are installed next to buildings and other structures that are in the process of being removed in order to monitor potential contamination during and after closure activities. These buildings and structures, and therefore the wells, are usually located within the IA, outside of Preble's habitat. Occasionally, however, wells are installed in the Buffer Zone (BZ) in the Preble's mouse current protection areas. It is estimated that prior to Site closure about ten additional monitoring wells may need to be installed that will fall within Preble's mouse habitat. Currently no definite plans or locations for wells are available.

The activities typically involved in the installation of a well are as follows. A truck-mounted drill rig is driven to the well location and used to bore the well holes. The excavated soil from the well boring (typically one cubic yard) is spread thinly throughout the work area to avoid burying vegetation. This follows the Rocky Flats Cleanup Agreement (RFCA) Standard Operating Protocol (SOP) for Asphalt and Soil Management for the Site (K-H 2001a, Appendix C of Part II of PBA). For the well installations, it is estimated that 405 square feet will be disturbed for each well. This footprint area will be used for the drill rig, the actual drilling location, and the staging area for other equipment that will be needed during the process. The excavated soil from

the well boring will be spread within this 405 square feet or scattered so thinly outside the area that little to no disturbance would be created by it. Of these 405 square feet, 13 square feet (the approximate size of the concrete pad) will be permanently disturbed. The total temporary habitat disturbance for all ten of the proposed well installations is about 3,920 square feet (or about 0.09 acres). The total permanent loss for this project is estimated to be about 130 square feet (about 0.003 acres). All impacts are calculated based on the assumption that they would occur in higher quality habitat. Best management practices will be used to minimize impact to the Preble's mouse or its habitat. Revegetation of soil disturbances will follow the revegetation plan provided in Appendix A of Part II of the PBA.

No description of Preble's habitat or quality of habitat can be provided at this time because no known locations for wells installations have been determined. As mentioned above, a small amount of permanent habitat loss will occur (13 square feet/well) with the remainder being temporary loss only. Some temporary indirect impact from noise and human presence is likely to result from the drill rig. No impacts to water flows or increased sedimentation are expected. Depending on the location of where the well must be installed, there could be off-road driving within the Preble's habitat areas. This will be minimized as much as possible. After the wells are installed, periodic monitoring will be required to collect samples for analysis. These monitoring activities will be conducted as described in Part I of the PBA. As a result, if the well is located off existing roads, a two-track road will likely be created for access to the well.

Some "take" is likely as a result of the project because of the potential to harm or harass the Preble's mouse because a drill rig will be used and other disturbance to the habitat will occur. However, the effect to the Preble's mouse will be primarily a temporary loss of habitat, if and when these wells are actually installed. Further discussion on the effects to the Preble's mouse is presented in the Analysis of Impacts section of Part II of the PBA. If more than ten wells must be installed within Preble's habitat prior to Site closure, re-initiation of consultation with the USFWS will be undertaken.

3.2 Original Landfill Project

The Original Landfill is located in the BZ south of the IA on a south-facing hill slope north of Woman Creek (Figure 2). The Original Landfill has an area extent of approximately 20 acres and includes two Individual Hazardous Substance Sites (IHSS): the Original Landfill (IHSS 115), and the Filter Backwash Pond (IHSS 196). The water treatment plant Filter Backwash Pond overlies the landfill in the western part of the Original Landfill site. In addition to the Original Landfill and Filter Backwash Pond, the site includes a number of other disturbed areas and structures, such as the South Interceptor Ditch (SID), which will be destroyed during the project activities. The SID will not be rebuilt. Cleanup of the Original Landfill is being conducted as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) action under the requirements of RFCA.

The basic plan for remediation of the Original Landfill project involves removing any radiological hotspots and stabilizing the hillside slopes to prevent further erosion. Cleanup, if conducted, will be required for regulatory purposes. The project may potentially disturb an area several hundred feet long along Woman Creek (Figure 2). The total amount of disturbance along Woman Creek will depend on the final design plan, which may or may not require some type of buttress wall at the base of the hill to stabilize the slope. The worst case scenario is outlined here for purposes of the PBA and includes the area that would potentially be disturbed by this latter activity. In the long-term, however, cleanup and stabilization of the hillside should reduce the potential for future contamination of Woman Creek and reduce the need to disturb the area again.

Most of the habitat north of the stream that may be disturbed is part of an old dump (landfill) that is largely vegetated with reclamation grasses (smooth brome [*B. inermis*] and intermediate wheatgrass [*A. intermedium*]) and noxious weeds (diffuse knapweed [*Centaurea diffusa*]). Some coyote willow (*Salix exigua*) and young plains cottonwood (*Populus deltoides*) trees are found occasionally on the hillside above the South Interceptor Ditch (SID) or in the SID itself. Plains cottonwood trees, coyote willow, and false indigo (*Amorpha fruticosa*), are found along the main channel of Woman Creek itself on the southern edge of the project area and extend upstream and downstream of the project area, undisturbed, for several hundred feet in each direction. Currently large areas on the hillside are exposed to erosion due to the steepness of the slopes. The area along the stream itself along the southern edge of the project area is known to be occupied by the Preble's mouse based on past studies in Woman Creek. The riparian corridor at this location, however, is wider than at other locations in Woman Creek because years ago, a diversion channel was dug south of the natural stream channel to divert water away from the Original Landfill to prevent undercutting of the hillside. As a result, the riparian corridor is somewhat wider and additional habitat is available on the south side of the stream at this location.

A total of 9.10 acres of current Preble's protection area may be disturbed as a result of this project. Of this acreage, 6.34 acres are lower quality habitat and 2.76 acres are higher quality habitat. The higher quality habitat includes the riparian woody vegetation area on the north edge of Woman Creek within the project area. The disturbance will all be temporary, in that after the project is completed the disturbed areas will be revegetated with native species. Heavy earthmoving equipment will be used to conduct the project. This could include such equipment as backhoes, trackhoes, dump trucks, scrapers, bulldozers, or other large pieces of earthmoving type equipment. Large areas of the hillside have the potential to be scraped off and recontoured with addition fill material. This potentially includes all the area within the project boundary (Figure 2). These activities may be required to reduce the potential for soil erosion that exists due to the steep slopes currently present on the hill. Silt fence and other best management practices will be used to keep disturbance out of the actual stream and riparian community along the stream edge. Redundant erosion controls may be used where appropriate and necessary. Project personnel will conduct weekly inspections of erosion controls (more

frequently after precipitation events) and maintain and make repairs as necessary through project completion.

The duration of this project may be several months. Although the habitat on the north side of the stream will be temporarily destroyed, suitable habitat south of the stream will remain intact and not be disturbed. Additionally several hundred feet of higher quality riparian habitat exists upstream and downstream of the project area for the Preble's mice. No effect to travel corridors should occur as a result of the project at this location. There may be some impacts from noise resulting from the heavy equipment and human presence. No alteration of stream flows or increased sedimentation is expected with appropriate and redundant use of erosion control measures. Should alteration of stream flows be needed and/or if sedimentation occurs in the riparian habitat, the USFWS will be consulted.

Once the project is completed, the area will be revegetated with native plant species following the guidance provided in the habitat mitigation techniques and monitoring plan documents provided in Appendices A and B of Part II of the PBA. It is likely to take a growing season to establish a stand of vegetation cover on the disturbed areas. Best management practices will be used to minimize impact to the Preble's mouse and/or its habitat.

"Take" is likely as a result of the project because of the potential to harm or harass the Preble's mouse. The large scale earthmoving activities using heavy earthmoving equipment have the potential to harm and harass the mouse, in addition to direct "take" of Preble's mice. Indirect effects may include noise, dust, and potentially erosion or sedimentation along the stream. Best management practices will be used to minimize these potential impacts. The largest effect to the Preble's mouse, however, will be a temporary loss of lower quality grassland on the hillside areas north of Woman Creek. Some impact to the woody riparian vegetation may occur along the north side of the stream depending how close the project must get to the stream edge. This worst case scenario assumes that all the riparian vegetation along the Woman Creek within the construction area (Figure 2) will be removed. Coyote willow and other shrubby vegetation along Woman Creek that will be disturbed during project activities will be cut at ground level prior to Preble's mouse hibernation, depending on the time of year. This will discourage the mice from hibernating within the project area. Cutting the vegetation at ground level will leave the roots in tact, and if the rootstock remains undisturbed during project activities, this will allow for immediate resprouting of the species from underground rootstock. Further discussion on the effects to the Preble's mouse is presented in the Analysis of Impacts section of Part II of the PBA.

3.3 Pond Remediation and Removal

As part of the Site cleanup and closure, several of the ponds in the A-series, B-series, and C-Series may be remediated as necessary (Figure 2). Some ponds may also be removed or modified. The ponds included in this assessment are the A-1, A-2, A-3, B-1, B-2, B-3,

B-4, C-1, C-2 ponds and associated diversion and bypass structures found near the C-2 pond in Woman Creek. In addition, as necessary, the project may remove the associated underground pipelines and valve boxes that are used to transfer water from one pond to another. These pipelines are typically buried adjacent to the pond edges and run between the ponds. Characterization of pond sediments may be conducted prior to remediation activities to characterize the need for remediation. Characterization involves sampling the sediments on the pond bottoms by foot or in a boat. Remediation activities would include removal of contaminated sediments from the pond bottoms and stream channels, and shipment to off-Site approved storage or disposal facilities. Pond removal activities may include removal of the dams and spillway structures, recontouring of the natural stream drainage and channel, and revegetation with native plant species. Removal may also include breaching of the dams or leaving some type of lowhead dam structure in place to maintain the wetlands in place behind the dams (Figure 3). Note: If the dams are not removed prior to Site closure, then dam maintenance activities will continue indefinitely.

At the C-2 pond location, the Woman Creek bypass structure and diversion ditch that routes water from the natural stream channel around the C-2 pond may be removed. The large riprap and concrete bypass structure in the creek channel above the C-2 pond may be taken out and the natural stream channel reestablished to allow the stream to flow into C-2. The diversion ditch may be filled in and recontoured to match the natural landscape. The outlet works for the C-2 pond were designed incorrectly and need repair. Currently the water from the pond must be pumped through a pipeline over the dam. In order to fix this problem, upgrades may also be made to the C-2 pond outlets works so that they are able to properly function and allow for releases of water from the pond. If the bypass structure and diversion ditch are not removed, repairs to riprap drop structures in the diversion ditch will be necessary to prevent further erosion of the ditch. In either case, however, the project will remain within the assumed project boundary. Any need to exceed this would require additional consultation with the USFWS prior to project initiation.

For the purposes of the PBA, the worst case scenario is assumed which involves the complete removal of ponds and restoration of the stream channels at the locations of all the interior ponds and associated structures listed above. The assumption is that the entire area within the proposed construction area around the ponds shown in Figure 2 will be disturbed and the current habitat converted to bare ground before revegetation would occur. Heavy equipment would be required for the pond remediation or removal activities. This may include equipment such as trackhoes, backhoes, front end loaders, dump trucks, scrapers, bulldozers, or other similar type equipment. Staging areas will be located within previously disturbed areas or outside Preble's habitat. Attempts will be made to minimize the overall extent of the disturbance footprint within the Preble's habitat. Redundant erosion controls will be used where appropriate and necessary to prevent erosion and sedimentation in the streams. Project personnel will conduct weekly inspections of erosion controls (more frequently after precipitation events) and maintain and make repairs as necessary through project completion.

In the A-series, B-series, and C-series pond areas, the ponds are surrounded typically by short and tall marsh habitats along the pond edges and grassland in the surrounding upland areas. At some locations upstream and downstream of the ponds and dams themselves, coyote willow, plains cottonwood, and false indigo are common. Preble's mice have been captured in the A-series ponds above the A-3 pond, in the B-series ponds above the B-5 pond, and in the C-series ponds above and below the C-1 pond, between the C-1 and C-2 ponds, but not below the C-2 pond or in the diversion ditch around C-2. Previous trapping and telemetry studies have documented the use of these latter areas by the Preble's mouse at the Site.

In the A-series ponds a total of 14.82 acres of current Preble's habitat could be disturbed (Figure 2). Of this approximately 0.25 acres may be lost permanently if the dams are breached (loss occurring in breach location). In the B-series ponds a total of 12.59 acres of current Preble's habitat could be disturbed (Figure 2), with approximately 0.33 acres being permanent. In the C-series ponds, a total of 9.99 acres of current Preble's habitat could be disturbed (Figure 2), with up to 1.29 acres being permanent. In the C-series, most of the work in the C-2 pond area would create temporary disturbances, however, about 1.08 acres in current Preble's protection areas would be a permanent loss because of the loss of the bypass channel (assuming the scenario where the bypass channel and diversion ditch are filled in). Note: for all calculations the surface area of the ponds has been subtracted from the total disturbance because the water surface is not suitable Preble's habitat. As a result, when these open water areas are converted to Preble's habitat, a net increase of 2.65 acres of higher quality habitat is expected. Additional discussion about the creation of Preble's habitat is found in the mitigation section of Part II of the PBA.

Removal and remediation of the ponds may completely disturb the riparian corridors at the pond locations. Although no schedule is currently available for the projects, the pond removal and remediation activities may take several months to accomplish. Best management practices will be used to minimize potential impacts to the current Preble's protection areas. Project plans would be evaluated to minimize construction footprints in Preble's habitat. However, the habitat adjacent to the ponds will likely be destroyed and taken to bare ground as part of the earthmoving and stream corridor reestablishment activities, in addition to human presence during the project. Travel corridors for the mice may be disrupted, direct "take" is possible as a result of the earthmoving activities and heavy equipment. Noise, dust, erosion, and sedimentation are potential additional indirect factors that may affect the mice in surrounding areas. Redirection of stream flows during the project are likely in order to de-water the ponds so that remediation and restoration activities can proceed. Revegetation of the disturbances will be conducted following the guidance documents found in Appendices A and B of Part II of the PBA. "Take" is likely as a result of the project because of the potential direct and indirect factors that may harm or harass the Preble's mouse. Further discussion on the effects to the Preble's mouse is presented in the Analysis of Impacts section of Part II of the PBA.

The creation of Preble's habitat is discussed further in the mitigation section of Part II of the PBA.

3.4 Surface Water Monitoring Equipment Removal

Several old surface water monitoring stations and associated equipment are scattered along the streams in Walnut Creek and Woman Creek at many locations. These structures include old monitoring instrumentation housings, concrete pads, posts, and signage. Most of these structures and equipment will likely be removed as part of the Site cleanup and closure. All these structures are located within the current Preble's protection areas. The vegetation varies depending on location. At some locations, coyote willow and other shrubs have overgrown the old equipment. At other locations, only herbaceous vegetation is present. Depending on the specific location in the drainage there may or may not be Preble's mice present, based on past trapping data. Existing roads or tracks access most of these locations. Some clipping of shrubs may be necessary to access and remove the equipment. Because some of the equipment is buried in the ground, removal will likely require some minor excavation or in some cases wooden posts may be cut off at ground level. Heavy equipment (backhoe, trackhoe, or front end loader) may be needed to remove the larger structures. Existing roads will be used as much as possible, however, some off-road travel may be necessary to access the equipment. Access routes will be minimized to prevent damage to the habitat. A maximum of one acre of temporary disturbance in the current Preble's protection areas is estimated to be potentially disturbed across the Site where this equipment is to be removed. As a conservative approach, all impacts are assumed to occur in higher quality habitat. If more than one acre will be disturbed, consultation with the USFWS will be reinitiated. Monitoring and delineation of the size of disturbances created by this project will be conducted by Site ecologists and/or USFWS personnel.

Some "take" could result from this project because of the potential to harm or harass the Preble's mouse along stream reaches where the mouse is found. Indirect effects may include noise, dust, and potential erosion or sedimentation along the stream. Disturbance to the vegetation and the need for some excavation pose the greatest potential to harm or harass the mouse. Best management practices will be used to minimize these potential impacts to the current Preble's protection areas. Project plans would be evaluated to minimize construction footprints in Preble's habitat. Revegetation of disturbances would take place after completion of the project using native plant species and following the methods outlined in Appendices A and B of Part II of the PBA.

3.5 Surface Water Permanent Flume Installations and Replacement

Surface water flumes are used at the Site to monitor water flows and for automated grab samples for contaminant analyses. The permanent flumes are large concrete structures that require the use of heavy equipment and take several weeks to complete the construction activities. (Note: temporary flume installations are discussed in Part I of the PBA). In 2002/early 2003, two permanent surface water flumes were replaced at the Site because of their deteriorated condition. These flume replacement projects were

determined to adversely impact the Preble's mouse because of the scope and scale of the project and the need for heavy equipment to complete the project. A biological assessment was written and submitted to the USFWS for approval (DOE 2002). The USFWS gave approval for the project in a biological opinion (USFWS 2002, Appendix D of Part II of the PBA).

Although currently there are no plans to add or replace permanent flumes at the Site prior to closure, if any were to be replaced the work would be conducted in the same fashion as those previously approved. For the PBA it is assumed that one additional flume may be replaced between now and closure. The total area of disturbance would be 0.5 acres. It would all be temporary disturbance since the flume footprint would be the same size as being replaced. As a conservative approach, all impacts are assumed to occur in higher quality habitat. Some "take" would be likely as a result of the project because of the potential to harm or harass the Preble's mouse along the streams since heavy equipment and excavation would be necessary. Depending on the specific location in the drainage there may or may not be Preble's mice present, based on past trapping data. Trackhoes, backhoes, or front end loaders, in addition to other types of equipment may be required to complete the work. The type and quality of habitat that could be disturbed may vary depending on the location chosen for the project. It could range from a herbaceous wetland habitat type to a woodland/shrubland area. The duration of the project could vary from one to three months depending on weather conditions. Indirect effects may include noise, dust, and potentially erosion or sedimentation along the stream. Best management practices will be used to minimize potential impacts to the current Preble's protection areas, as was done during the recent projects. Project plans would be evaluated to minimize construction footprints in Preble's habitat. Revegetation of project areas would be conducted after completion of the project using native plant species and would follow the basic guidance provided in the habitat mitigation techniques document provided in Appendix A in Part II of the PBA. Post-mitigation monitoring would be completed following the protocols provided in Appendix B in Part II of the PBA.

3.6 Surface Water Flume Removal

It may become necessary to remove some of the old surface water flumes located throughout the BZ before Site closure. These surface water flumes have been used at the Site to monitor water flows and for automated grab samples for contaminant analyses. Several flumes are no longer being used, or will be discontinued prior to Site closure. The flumes to be removed include both temporary and more permanent flumes (Figure 4). The two types differ in construction, and therefore removal of each type will be different. Both types of flumes have been monitored for years, so an established road exists next to most of them.

The temporary flumes are small structures (approximately 12x3 feet) that include a fiberglass body, plastic sheeting wings, and wooden beam and sand bag anchors. Currently ten temporary flumes are located within Preble's habitat that may be removed (Figure 4). If others are removed, the same removal methodology outlined here will be

followed. The removal of the temporary flumes involves dismantling the structure by hand and lifting the pieces into a vehicle to remove out of the area. Some trampling of the vegetation may occur with the removal of these temporary flumes. A total of 0.01 acres of temporary disturbance is expected for each flume for a grand total of 0.10 acres of disturbance. If additional temporary flumes are installed in Preble's habitat (Part I of PBA), they would be removed in the manner described here.

The permanent flumes are concrete structures that will require heavy equipment for removal. A piece of heavy equipment such as a trackhoe, backhoe, or similar type equipment may be driven to the flume and used to remove the flume and other associated structures. The structures will be lifted into a roll-off container or dump truck and hauled off-Site. The vegetation at these locations varies depending on location. Depending on the specific location in the drainage there may or may not be Preble's mice present, based on past trapping data. Disturbed areas will be contoured to match the surrounding areas. Revegetation of disturbances will be done using native plant species following the basic guidance provided in the habitat mitigation techniques document provided in Appendix A in Part II of the PBA. Indirect effects may include noise, dust, and potential erosion or sedimentation along the stream. Best management practices will be used to minimize these impacts and disturbance to the surrounding Preble's mouse habitat.

The following permanent flumes may be removed prior to closure: GS01, GS02, GS03, GS04, GS05, GS08, GS10, GS12, and SW093. It is estimated that a disturbance footprint for each flume will not exceed 2180 square feet (0.05 acres). This footprint will include any impact from heavy equipment, the roll-off, and other equipment used to remove the flumes. For all 9 permanent flumes the total acreage in the current Preble's protection areas would be about 0.45 acres. As a conservative approach, all impacts are assumed to occur in higher quality habitat.

Removal of the permanent flumes impacts the habitat less than installation of a flume because for removal a trackhoe or similar type piece of equipment will be driven to the flume, the flume will be lifted out and placed in a roll-off container for disposal. For a flume replacement or installation, additional area is necessary for equipment staging, preparation of the area to install the new flume, construction of concrete forms, pouring of the concrete, installing the new flume, and final contouring and revegetating of the project area. A flume removal disturbs a much smaller area and takes much less time compared to a flume installation or replacement. "Take" is likely as a result of the project because of the potential to harm or harass the Preble's mouse along the streams at the Site resulting from the use of heavy equipment and the excavation required for the project. Impacts would be temporary until the areas became revegetated.

3.7 North Access Road and Culvert Removal Project

As part of the IA regrading plan, the north access road and some of the culverts that occur in the IA are planned for removal. Most of the culvert removals will not be in current Preble's protection areas. However, along portions of the north access road where the

road crosses North Walnut Creek and South Walnut Creek (Figure 2), the road and culverts are planned to be removed. At these locations, only small work areas would be located in the current Preble's protection area. The area northeast of B771 contains higher quality riparian woodland/shrubland vegetation (coyote willow and plains cottonwood trees) where Preble's mice have been captured in the past. South of the 995 complex (sewage treatment plant), the habitat consists of grassland and cattails. Preble's mice have never been captured in this area (west of the North Access road). The area east of the North Access road consists of coyote willow along the stream before it enters the B-1 pond. Preble's mice have been captured in this location before. Northwest of B371, the project area along the road is largely cattails, with some coyote willow and occasional plains cottonwood trees around the perimeter. Trapping has never been conducted in this area, but it has been assumed there is a low probability of mice in this area because of the barrier to travel that was created by the north access road, large parking lots, and channelized stream.

In addition to road and culvert removal in Walnut Creek, approximately 12 old concrete culvert sections remain from a long abandoned road in the bottom of Woman Creek south of the Building 130. These may also be removed as part of the Site cleanup operations. The remaining culverts are located in the stream bottom of Woman Creek in Preble's mouse habitat. The culverts in Woman Creek would be lifted from the stream bottom using a crane or hoist of some type and placed on a truck and removed from the area. The vehicles used would access the area on a two-track road that accesses the location. A small amount of off road driving on the mesic grassland adjacent to the stream channel would be necessary to stage the crane or hoist. Other than some trampling of the vegetation and the need to walk into the shrubby vegetation where the culvert sections are located, little disturbance of the vegetation is expected. A total of 0.40 acres of lower quality habitat and 0.20 acres of higher quality habitat may be temporarily disturbed during this aspect of the project.

For the roads and culverts located in Walnut Creek, heavy earthmoving equipment (trackhoes, backhoes, front-end loaders, scrapers, or other similar type of equipment) will be used for the removal activities. Although much of the activity would be conducted from the road and shoulder areas on the roads themselves, which are not considered Preble's habitat, some disturbance would occur on either side of the road areas. Road removal is planned to include removal of the asphalt and some ripping of the roadbed prior to reseeding. Within Preble's habitat the road areas will be ripped to a depth of at least 24 inches. The areas where the culverts are removed will be recontoured as a stream channel. The total area in Preble's protection areas that may be disturbed is estimated to be about 2.06 acres, of which 1.83 acres is lower quality habitat and 0.23 acres is higher quality habitat.

Some "take" is likely as a result of the project because of the potential to harm or harass the Preble's mouse along the streams at the Site resulting from the use of heavy equipment and the excavation required for the project. Indirect effects may include noise, dust, and potential erosion or sedimentation from these areas. Impacts would be

temporary until the areas became revegetated. Best management practices will be used to minimize these impacts and disturbance to the surrounding Preble's mouse habitat. Redundant erosion controls may be used to prevent erosion and sedimentation problems in the streams. The project will conduct weekly inspections of erosion controls (more frequently after precipitation events) and maintain and make repairs as necessary through project completion. Revegetation of project areas would be conducted after completion of the project using native plant species and would follow the basic guidance provided in the habitat mitigation techniques document provided in Appendix A of Part II of the PBA. Post-mitigation monitoring would be completed following the protocols provided in Appendix B of Part II of the PBA.

The removal of the North Access Road and culverts and re-establishment of the stream channels at the stream crossings will create Preble's habitat at these locations. In addition, the removal of the North Access Road and associated culverts will restore the travel corridors for Preble's mouse movement into the upper reaches of North and South Walnut Creek, the side drainage off North Walnut Creek that goes up between Buildings 371 and 771, and a new south stream reach off North Walnut Creek that will be created in the borrow area (Figure 5). The middle location will connect the drainage east of Buildings 116 and 117 to North Walnut Creek. This project will remove barriers to Preble's mouse movement, restore previously existing travel corridors, increase wetlands acreages, add to the available suitable habitat for the Preble's mouse, and potentially increase the long-term sustainability of Preble's mouse populations in Walnut Creek at the Site. These areas will be reseeded with native plant species following the guidelines outlined in Appendix A of Part II of the PBA. The creation of Preble's habitat is discussed further in the mitigation section of Part II of the PBA.

3.8 Dam Maintenance and Safety Activities

Part I of the PBA lists several vegetation management activities required for dam maintenance and safety at the Site. These activities are required for dam safety inspections which are conducted throughout the year. The dam maintenance activities listed in Part I of the PBA have already been consulted on, and follow the guidance provided in the BE entitled *Vegetation Management on Water Control Structures and Related Actions in Preble's Mouse Habitat* (DOE 2001; Part I, Appendix C) and USFWS concurrence letter (concurrence letter dated, November 27, 2001; Part I, Appendix C).

Recent inspections, however, have revealed the need for more frequent inspections of the dams and inspection reports have stated that "...all vegetation obscuring visual inspection of the outlet area should be permanently removed," (Federal Energy Regulatory Commission [FERC] report, August 23, 2002; Appendix E of Part II of the PBA). Independent engineers inspecting the dams per State of Colorado requirements have written findings that state "Willows on the upstream slope of B-1 [pond] prevented complete observation. These willows should be cleared immediately so the upstream slope can be re-inspected," (Wright Water Engineers dam inspection report, September 10, 2002; Appendix E of Part II of the PBA). Additional findings from this report stated,

“Keep trees, brush, and vegetation cleared at all times from the toe areas near the low-level outlets at A-2, A-3, and C-2 [ponds]. This is important so that changes in seepage in the vicinity of the low-level outlet pipes can be monitored regularly.” As a result, it is necessary to remove vegetation around the outlet works and other locations on the dams throughout the growing season and not just in the early spring as previously consulted on.

As a result, all the ponds are included in this project (A-1, A-2, A-3, B-1, B-2, B-3, B-4, B-5, and C-1). The East Landfill Pond (Present Landfill Pond), and the A-4 and C-2 ponds, are not located in Preble’s habitat and are therefore not considered (see figures in Appendix E). Vegetation removal will involve mowing, hand clipping, and weed whacking vegetation on dams (at the toe of the dams, surrounding the outlet works, and interior and exterior of dam faces) necessary to allow dam inspections throughout the year. The areas will be accessed on foot and hand tools – mechanical and/or powered – will be used to cut the vegetation. Appendix E of Part II of the PBA contains figures of each dam and shows where these activities may be conducted. The total acreage of these activities in current Preble’s mouse protection areas is 3.38 acres. Of this, however, 3.16 acres are in lower quality habitat, 0.22 acres are in higher quality habitat. Per discussions with the USFWS, because these impacts are ongoing, they are being considered permanent.

For additional dam safety, riprap must occasionally be replaced or repositioned on the inside of the dam faces or at some spillway locations to protect the integrity of these structures. This activity is not only necessary to protect the integrity of the dams during high flow periods, but also to protect the downstream Preble’s habitat. This activity may involve bringing new riprap to the dams to be placed at specific locations or in some cases may involve simply moving or repositioning riprap that has moved or settled over time. Heavy equipment will be required for this activity, but will remain on the dam crests or on spillway locations to conduct the work. No off-dam travel into undisturbed Preble’s habitat is expected. Additional locations where riprap may need to be added are in the McKay Ditch, McKay Ditch bypass, SID, Woman Creek bypass around C-2, other ditches and riprap areas on Site. Riprap, as mentioned above, is not considered Preble’s mouse habitat, therefore any work conducted in the riprap will not disturb the mouse or its habitat. Note: If the dams are not removed during Site closure, then dam maintenance activities will continue indefinitely.

3.9 Waste Water Treatment Plant (WWTP) Removal

The WWTP treats and discharges Site-generated liquid sanitary waste . Non-hazardous, non-radioactive liquid wastes are received at the WWTP; treated using activated sludge, tertiary clarification, sand filtration, and Ultra-Violet (UV) light disinfection; and released via pipeline to South Walnut Creek. About 150,000 gallons of sewage are treated daily to meet NPDES Permit requirements. Removal of these structures (buildings and pipelines) will be accomplished prior to closure of the Site.

Approximately 1/3 of the WWTP (eastern 1/3) lies within the current Preble's protection area at the Site (Figure 2). The WWTP buildings and parking lots are not considered Preble's habitat, however, some reclaimed grassland and riparian vegetation occur just south of the WWTP. Much of this may be disturbed and recontoured along with the North Access Road and Culvert Removal project described earlier that will remove the road embankments and restore the stream channel above ground. This latter acreage has been included with the North Access Road and Culvert Removal project. The remainder of the project disturbance (approximately 0.28 acres) consists of roads, parking areas, and the buildings. Once the parking lots and building (not considered habitat) are removed and revegetated these areas will be considered a creation of Preble's habitat and will be counted as a credit. The creation of Preble's habitat is discussed further in the mitigation section of Part II of the PBA.

Best management practices will be used to minimize these impacts and disturbance to the surrounding Preble's mouse habitat. Redundant erosion controls may be used to prevent erosion and sedimentation problems in the streams. Revegetation of project areas would be conducted after completion of the project using native plant species and would follow the basic guidance provided in the habitat mitigation techniques document provided in Appendix A of Part II of the PBA. Post-mitigation monitoring would be completed following the protocols provided in Appendix B of Part II of the PBA.

3.10 Site Water Reduction

This portion of the PBA discusses the water reduction issues with respect to Platte River species and the Preble's mouse at the Site. It addresses water reductions resulting from the loss of imported water to the Site and from the replacement of impervious land surfaces such as buildings and parking lots to vegetated plant communities.

3.10.1 Platte River Water Depletions

On July 1, 1997, the States of Nebraska, Colorado, Wyoming and the United States Department of the Interior entered into a cooperative agreement to address water depletion issues and threatened and endangered species along the Platte River. The purpose of the partnership is to develop a basin-wide recovery program for threatened and endangered species in the Central Platte River Basin. Called the Platte River Cooperative Agreement (PRCA), the program's primary purpose is to provide recovery oriented habitat for the whooping crane, piping plover and the interior least tern. The pallid sturgeon, which uses the Platte only near the mouth of the river, is also a target species for the proposed program. Other species which are now evaluated for impacts along the Platte River include Eskimo curlew, American burying beetle, and the western prairie fringed orchid. As a result, any activities that may deplete water going to the Platte River must be evaluated for potential impacts to these species.

The target flows for the endangered species in the Central Platte reflect the flow levels the USFWS believes are needed to provide adequate habitat for those species. Actual daily

flows historically have fallen short of those target flows, in the aggregate, by an average of approximately 417,000 acre feet (af) per year.

3.10.2 Preble's Mouse Water Reduction Issues

At the Site, the Preble's mouse habitat exists along each of the streams. As Site cleanup and closure proceeds, imported water for sanitary purposes and the associated discharge will be eliminated. In addition, as the buildings and parking lots (impervious surfaces) are removed and replaced by grassland, water infiltration will be increased in those areas, reducing surface water run off to the drainages.

A recently completed Site-Wide Water Balance (SWWB) modeling study (K-H 2002b) allows for estimation of changes in surface and subsurface hydrology at the Site. For more details of the water balance study results, please refer to the complete copy of the report found on CD-ROM Appendix F of Part II of the PBA.

Based on the water balance study, no changes will be made to water flows in Rock Creek as a result of Site closure activities. This watershed is isolated from the IA activities. The study also showed that in Woman Creek, surface flows exiting the Site near Indiana Street will be largely unaffected by changes resulting from the Site closure activities. Wet year or dry year water flows stayed at slightly above 200,000 m³/year during wet years, and at slightly below 100,000 m³/year in dry years. Upstream of the C-2 pond no changes in surface flows are expected as a result of the IA cleanup and closure because currently no water reaches the stream from the IA because of the SID. Although runoff in the SID basin is expected to decrease as a result of changes in the IA, no discharges were predicted for Pond C-2 in any of the scenarios modeled. As a result, little change should occur in Woman Creek flows.

The model, however, did show substantial changes in the hydrology of Walnut Creek. Walnut Creek discharges decreased for the following three reasons: (1) Waste Water Treatment Plant contributions to Walnut Creek were eliminated; (2) impervious surfaces in the Industrial Area were removed, thereby eliminating fast runoff; and (3) building drain discharges to Industrial Area streams were eliminated.

Based on the Site Wide Water Balance Study, under the No Imported Water Scenario, off-Site surface discharge in Walnut Creek decreased from about 800,000 m³/year to 510,000 m³/year in wet years, and from 450,000 m³/year to 190,000 m³/year in dry years. Under the Land Configuration Scenario, off-Site surface discharge in Walnut Creek decreased from about 800,000 m³/year to 180,000 m³/year in wet years. In dry years the modeling showed a decrease from 450,000 m³/year to 20,000 m³/year. The Land Configuration Scenario described the combined effect of the no imported water in addition to the reduced water from surface water flows in the IA. Overall reductions of water flow at the Site boundary in Walnut Creek are estimated to range from about 78 percent in wet years to about 96 percent in dry years.

3.10.3 Analysis of Impacts

3.10.3.1 Platte River Species

The changes in water flows at the Site resulting from imported water losses and increased infiltration in the Industrial Area (IA) associated with removal of impervious surfaces, will have no effect on Platte River species. While an overall decrease in the volume of water leaving the Site boundary will occur, the imported waters cannot be counted, because the water purchased from the Denver Water Board is western slope water. The water originates west of the continental divide (from tributaries to the Fraser River), is pumped through the Moffat Tunnel into Gross Reservoir, then runs through the South Boulder Diversion Dam into Ralston Reservoir. From Ralston Reservoir, the water enters the Site and into the raw water pond through an under ground pipeline. Western slope water cannot be used to alleviate depletions in the Platte River basin. Remaining water losses from removal of the ponds and impervious surfaces at the Site are returning the Site to the pre-disturbance state which existed prior to Rocky Flats. Reestablishment of the natural stream flows and revegetation of the IA will have no effect on the Platte River species.

3.10.3.2 Preble's Mouse

Historically, prior to European settlement, no data on the water flows or vegetation communities exists. Prior to DOE acquisition, however, the area was used for ranching. Historical aerial photographs from 1937 and 1951 show little to no riparian vegetation (i.e. shrubs and trees) along the stream courses at the Site due to the heavy grazing pressures that were present prior to DOE purchase. However, after DOE acquired the Site, grazing was no longer permitted and in any of the three drainages (Rock Creek, Walnut Creek, and Woman Creek) and riparian vegetation began to establish and grow along the streams. The riparian vegetation that is currently along the streams at the Site has established over the past several decades since DOE purchase. In Rock Creek and Woman Creek these changes have occurred naturally since no changes in hydrology (i.e. no additional imported water) had occurred. The natural flows in these drainages were sufficient to establish and sustain the riparian vegetation in these drainages once the grazing pressure was removed. In Walnut Creek, natural water flows were augmented by imported water (2002 = approximately 420,000 m³/year; K-H 2002b). Thus more water has been available in Walnut Creek since the DOE purchase than would have been available previously.

Modeling study results indicate that no water reduction will take place in Rock Creek due to Site closure activities. In Woman Creek, any changes that occur will be minimal, at most. While water flows in the Walnut Creek basin will be substantially less after Site closure, little to no scientific data exist to determine what will happen to the riparian vegetation along Walnut Creek. Preliminary modeling data from the Site Wide Water Balance Study suggest the water table could drop between one and three feet depending on the location along Walnut Creek. Discussions with regional ecologists and restorationists have suggested that some change in the vegetation is likely in the long-

term, however, the level of change is unknown. For many of the shrubs and trees currently growing near the stream, these plants are well established and are rooted deeply enough that even if the water table would drop, the plants would still be rooted deeply enough so most would likely survive. Additionally, any die off of trees or shrubs that might occur at specific locations where enough water was not available would likely happen slowly and not immediately. Ultimately, however, no one can predict accurately what may happen in the Walnut Creek drainage below the ponds.

Due to the uncertainty of what can be expected to occur in Walnut Creek in the long-term as a result of the water reductions, DOE and the USFWS have agreed to develop an adaptive management plan as part of the mitigation measures. This adaptive management plan will be developed in cooperation with the USFWS after the approval of the entire PBA. The adaptive management plan will identify parameters to be measured regarding Preble's mouse populations and habitat in Walnut Creek and adaptive management actions which may be taken if substantial threats to the Preble's mouse population are detected.

3.11 Unforeseen Projects Inside Current Preble's Protection Areas

The attempt has been made to identify every possible project at the Site that might occur in current Preble's protection areas. However, it is possible that something may have been missed or some new project identified will have to be conducted that may adversely affect the Preble's mouse. Therefore an additional total of two acres of current Preble's habitat are requested for potential disturbance under this PBA for unforeseeable project disturbances. Of the two acre total, a maximum of 0.25 acres could be a permanent loss of habitat. It is assumed to be higher quality habitat. Best management practices will be used to minimize disturbance to the Preble's mouse habitat. Revegetation of project areas would be conducted after completion of the project using native plant species following the basic guidance provided in the habitat mitigation techniques document provided in Appendix A of Part II of the PBA. Post-mitigation monitoring would be completed following the protocols provided in Appendix B of Part II of the PBA. Use of any portion of this two acre allotment will be documented and provided to the USFWS, however, the purpose of this allotment is to allow any unforeseen project(s) to go forward without delay.

4. Cumulative Effects

The Endangered Species Consultation Handbook (USFWS 1998) defines cumulative effects as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (50 CFR §402.02). A description of the surrounding lands and activities conducted on those lands is presented below.

The Site is surrounded by city, county, state, and federal lands. A variety of land use activities occurs on these lands. The land to the south of the Site is privately owned rangeland. It is currently used for grazing cattle. However, there are plans to develop portions of these properties as residential subdivision and business developments. The State of Colorado School Board land in Section 16 is also primarily rangeland, grazed by cattle throughout different times of the year. Gravel mining has occurred on this property in the past, however, none has taken place in recent years. The lands between Highway 93 and the mountain front to the west are largely City of Boulder, Boulder County, and Jefferson County open space properties used for some grazing and recreation activities. No development beyond perhaps some trails in the future is planned for these areas. Between the Site and Highway 93 there is a narrow strip of private property that the current landowner has attempted to develop in the past, with no success. If development would occur, it would most likely be some type of small business (either office space or perhaps light industry). On the western edge of the Site, within Site boundaries, two gravel mine operations are currently active. Current plans, dependent on permitting, would mine much of the western portions of the BZ at the Site.

The northwest corner of the Site is bounded by the National Renewable Energy Laboratory facility (NREL). Research on renewable wind energy is conducted at the facility. Most activities involve the installation and removal of large wind generators. To the north, the Site is bordered by City of Boulder and Boulder County open space property. On the east, most of the land is City of Broomfield and City of Westminster open space property. A small amount of development (housing and office space) has occurred along Highway 128 east of Indiana Street. Along the eastern edge of the Site, there is a measure included in the Rocky Flats Wildlife Act that would allow a 300 foot corridor for development of the C-470 highway.

Because most of the surrounding land use is either rangeland or open space, no cumulative effects are expected to the Preble's mouse from these lands. These lands actually provide additional buffer areas around the Site as habitat. Where riparian habitat exists on some of these properties, steps (e.g. the use of fencing to keep cattle away from the streams) have been taken to preserve and enhance these corridors as wildlife habitat. Development activities planned for private property around the Site edges would be away from drainages at the Site and would have minimal or no effect on the mouse habitat at the Site.

The gravel mining operations on the western edge of the Site pose a potential threat to the Preble's mouse habitat at the Site. Subsurface flows provide water to the many seeps or stream flows that sustain Preble's habitat at the Site, particularly in the Rock Creek drainage. Because the drainages on Site lie largely at the headwaters of their respective watersheds, mining could potentially alter the subsurface water and surficial water flows on the Site. Currently no data exists on how the mining might impact the local hydrology. The mine operator continues to renew mining permits in order to expand

mining operations. Unchecked weed infestations on the mining operations could pose additional potential impacts to the Preble's mouse.

The proposed C-470 highway would potentially cut off the eastern most edges of the Preble's habitat at the Site in both the Walnut Creek and Woman Creek drainages. However, the habitat at these locations is of much lower quality than that found further west in either drainage. Preble's mice have never been captured within the area that would potentially become the highway.

Numerous easements exist at the Site for utilities such as power lines, gas lines, and telephone lines. Also water conveyance ditches for water rights owned by non-DOE parties cross the Site at various locations (McKay Ditch, Mower Ditch, Smart Ditch – D-Series Pond water rights). Mineral rights and mining operations are also present at the Site at some locations as mentioned above. Currently no planned activities at the Site related to these easements are scheduled. The responsibility for USFWS consultation for potential impacts to listed species resulting from normal operations, maintenance, and new construction activities related to these easements at the Site are the responsibility of the easement parties and would be dealt with through separate consultation with the USFWS.

Activities in areas surrounding the Rocky Flats Environmental Site will have no effect on DOE activities related to the cleanup of the Site.

5. Analysis Of Impacts

5.1 Definitions

The following definitions, cited from the Endangered Species Consultation Handbook (USFWS 1998), were used in categorizing the effects from actions discussed in Part II of the PBA on the selected threatened or endangered species considered in the PBA:

- “*No effect*” — the appropriate conclusion when the action agency determines its proposed action will not affect a listed species or designated critical habitat.
- “*May affect*” — the appropriate conclusion when a proposed action may pose any effects on listed species or designated critical habitat. When the Federal agency proposing the action determines that a "may affect" situation exists, then they must either initiate formal consultation or seek written concurrence from the Services that the action "is not likely to adversely affect".
- “*Is not likely to adversely affect*” — the appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial.
- “*Is likely to adversely affect*” — the appropriate finding in a biological assessment (or conclusion during informal consultation) if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial (see definition of "is not likely to adversely affect"). In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action "is likely to adversely affect" the listed species. If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made. An "is likely to adversely affect" determination requires the initiation of formal section 7 consultation.
- “*Jeopardize the continued existence of*” — to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

5.2 Part II Findings (Excluding Preble’s Mouse)

The activities listed in Part II of the PBA will not affect water depletions within the greater Platte River basin. Therefore, no effects on the lower Platte River species are

likely to occur from these on-Site actions. Lower Platte River species considered in this evaluation include the piping plover, the least tern, the whooping crane, the pallid sturgeon, the Eskimo curlew, the American burying beetle and the western prairie fringed orchid.

The bald eagle is a casual user of the Site. Site wildlife surveys have noted approximately one observation per year for the past six years. Bald eagle nesting has never been observed on Site. Therefore, DOE actions described in Part II of this PBA will have no effect on the bald eagle. Black-footed ferrets, boreal toads, Canada lynx, greenback cutthroat trout, Mexican spotted owls, mountain plovers, and Pawnee montane skippers do not occur at or near the Site. Ten years of ecological monitoring have never documented these species at the Site (DOE 1992, 1994a, 1995; K-H, 1997, 1998, 1999, 2000, 2001b, 2002a, RMRS 1996). Therefore, the DOE actions described in Part II of this PBA will have no effect on these species. The black-tailed prairie dog occurs at the Site, but is a candidate species which is non-statutory and therefore is not considered in this PBA.

Ute ladies'-tresses, and Colorado butterfly plant, both listed species, though occurring in the Site's vicinity, have not been documented on the Site nor in off-Site areas that might be affected by these actions (ESCO 1993, 1994). DOE activities described in Part II of this PBA will have no effect on these species.

5.3 Preble's Mouse Analysis of Impacts and Findings

The Preble's mouse occurs at the Site, and has been documented and studied extensively in each of the main drainages at Rocky Flats. Studies at the Site have focused on trapping and tagging Preble's mice, and tracking their movements through the use of telemetry. In addition, habitat characterization has been done to quantify habitat parameters for the mouse at the Site. The data from these studies have yielded information on Preble's mouse habitat, areas of occupation, home ranges, and mouse movement at the Site. Using this information, Site ecologists developed the PPP (DOE 2000) that includes a Preble's mouse protection area map and a means of evaluating Site activities for potential impacts to the mouse. These actions have been taken proactively by DOE to protect the Preble's mouse and its habitat at the Site.

During 2002, the USFWS proposed critical habitat for the Preble's mouse (67 CFR 47154). On June 23rd of 2003, the USFWS finalized the critical habitat ruling for the Preble's mouse (68 FR 37275). The final rule excluded Rocky Flats Environmental Technology Site from critical habitat designation because the Site will become a USFWS National Wildlife Refuge after closure. Therefore, project disturbances described in this PBA are based on the current protection areas mapped in Figure 6. Because the Preble's mouse occurs at the Site, the major focus of Part II of the PBA has been on potential impacts to the Preble's mouse. The following paragraphs analyze the potential for the projects listed in Part II of the PBA to affect the Preble's mouse. Habitat creation

resulting from the project activities will be discussed in the mitigation section of Part II of the PBA.

As previously mentioned under each project description, “take” is likely as a result of these projects because of the potential each has to harm or harass the Preble’s mouse. This determination is based on the USFWS definitions (USFWS 1998) that defines harm as “*significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering*” and harass “*as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering.*” Each of the projects in Part II of the PBA are located within the current Preble’s protection area. Some of the projects may result in a permanent loss of habitat. Some of the projects have the potential to disturb large areas of Preble’s protection areas. Many of the project activities will be conducted off established roads, two-tracks, or historical travel routes. Heavy equipment (i.e., front end loaders, track hoes, back hoes, etc.) is necessary to conduct most of the activities when in the current Preble’s protection area. Additionally, many of the projects will require vegetation to be removed or damaged during these activities, and soil disturbance will likely occur for some of the projects. Finally, the activities listed in Part II of the PBA exceed the criteria listed in Part I of the PBA for “no effect” and “may affect, but not likely to adversely affect” impacts. As a result, the scale and scope of these projects have resulted in a finding that these projects will likely adversely affect the Preble’s mouse and are likely to result in some “take”.

One of the projects is largely located on the hillside located adjacent to the riparian habitat along the stream in Woman Creek (Original Landfill Project). Most of the direct impacts from this project will be a temporary loss of mesic grassland habitat on the hillside adjacent to the stream. Some disturbance of the higher quality riparian habitat on the north side of the stream within the project area is expected. The hillside areas are of lower quality habitat because these areas are grassland vegetated with exotic graminoid species. Restoration with native plant species will improve the quality of the grassland habitat at most of these locations where weeds or exotic graminoids are present and provide higher quality habitat in the long-term for the Preble’s mouse.

The Monitoring Well Installation project may or may not have much impact to the Preble’s mouse depending on where in current Preble’s protection areas the project actually takes place. If project activities occur along the streams in riparian habitat, where Preble’s mice are known to occur, there is greater impact potential than if they occur on the adjacent mesic grasslands or in areas where Preble’s mice have never been captured. Temporary loss of habitat is the major impact from these activities, with most of this being scattered throughout the drainages or project area. Because these activities are not disturbing large areas at one location the impacts are reduced. Some small permanent loss of habitat will occur if monitoring wells are installed, however, with the placement of concrete well pads (about 13 square feet per well). Revegetation with

native plant species will reestablish the plant communities and vegetation structure at these project locations.

The Surface Water Monitoring Equipment Removal and Surface Water Permanent Flume Removal projects are scattered along the streams and will temporarily impact Preble's mouse habitat while ultimately increasing and improving the amount of habitat by removing man-made structures from the streams. Depending on the location of these projects along the streams the quality of Preble's habitat may vary from higher quality habitat where mice have been captured to lower quality habitat where no mice have been captured. Revegetation with native species will restore the areas to higher quality habitat for the mouse.

Impacts from the Surface Water Permanent Flume Installation and Replacement Project will occur largely in the riparian habitat along the stream. Most impacts will be temporary with the exception of where the flume itself is located. Depending on the actual location, the quality of the habitat may vary from lower to higher quality.

The Dam Safety and Maintenance Projects will occur near or on the dam faces. Because the vegetation removal needed for dam safety inspections must occur during the active season of the mouse there is the potential for adverse effects. The habitat on the dams themselves is largely lower quality habitat (i.e., grass) and provides little cover from predators. Therefore the potential to affect the mouse is somewhat lessened.

The North Access Road and Culvert Removal Project is likely to have some impact on the mouse where the project encroaches into mouse habitat. However, this impact is offset by the fact that the removal of the culverts and re-establishment of the stream drainage above ground has the potential to create additional Preble's mouse habitat and provide better connectivity between isolated patches of habitat along Walnut Creek. This is discussed further in the mitigation section.

The Pond Remediation and Removal Projects have the potential to have the greatest impacts to the Preble's mouse. These activities will take place along the streams themselves and may temporarily eliminate large areas of riparian vegetation at the project locations. Each of these areas is known to contain Preble's mouse populations (with the exception of the area around the C-2 pond and between the A-3 and A-4 ponds). Some potential to create habitat exists if open water, riprap, and road surfaces are converted to habitat.

The removal of the WWTP from Preble's habitat will itself have little direct impact to the Preble's mouse. No Preble's mice have been captured west of the North Access road at that location (DOE 2003). Additionally, most of the project area consists of buildings and parking lots and is not considered habitat. Removal of the buildings and parking lots will create additional Preble's mouse habitat and so will have a positive benefit on the mouse.

The water reduction response of the vegetation in lower Walnut Creek resulting from the loss of imported water and changes in the IA are unknown. Because no data are available on what will happen when water is turned off to a drainage, DOE and the USFWS have agreed to develop an adaptive management plan to address the Preble's mouse and habitat issues and strategies to monitor and manage the habitat in Walnut Creek.

Projects listed in Part II of the PBA will likely adversely affect the Preble's mouse. The potential exists for direct take of the mouse because of excavation activities and use of heavy equipment as well as from indirect effects that may affect vegetation structure along the streams. Disturbance of the vegetation will temporarily remove protective cover and potential food and nesting materials. Disturbance of the ground could impact hibernacula along the streams. Thus, given the potential scope and scale of these projects in Part II of the PBA, it is likely that adverse effects to the Preble's mouse will occur.

Although the projects listed in Part II of the PBA will temporarily disturb Preble's habitat at several locations, the locations are generally spatially separated from one another with quality habitat adjacent to and in between project locations so that the Preble's mice can continue to use these areas (Figure 2). At each of the project locations there are typically several hundred feet of undisturbed riparian habitat available for the Preble's mouse to use during the project duration. Additionally, the project areas themselves are not located directly in the prime habitat areas in Walnut Creek or Woman Creek and so the major populations known to occur in these areas will not be directly impacted. In Walnut Creek, the high population areas are located above the A-1 pond, between the B-4 and B-5 ponds, and below the confluence of Walnut Creek with the McKay Ditch in lower Walnut Creek. None of these areas will be located within the project areas. In Woman Creek, the Preble's mice are known to occur between the C-1 and C-2 ponds, and west of the C-1 pond to the Site boundary. So several thousand feet of quality Preble's habitat exists adjacent to the project areas in the two drainages.

The final 4(d) rule for the Preble's mouse (67 FR 61531-61537) set forth a precedent that in principle if suitable habitat exists adjacent to a temporary project disturbance (i.e., ditch maintenance as addressed in the 4(d) rule), the action would "result in only minimal take of Preble's and is consistent with the protection and enhancement of Preble's habitat." Previous projects conducted in Preble's habitat at the Site during the active season of the mouse have shown the mice can co-exist near active project areas with little apparent impacts (DOE 1996, K-H 2000). At both the B-4 dam toe slope sand/rock blanket project (DOE 1996) and the East Trenches treatment system project (K-H 2000), trapping and/or telemetry studies during the project timeframes demonstrated that the Preble's mice continued to exist adjacent to the ongoing projects. For both of these projects heavy equipment, vegetation removal, soil disturbance, and excavation, were being conducted in current Preble's protection areas. At the East Trenches treatment system project, several hundred feet of Preble's habitat was disturbed along the entire B-series of ponds (B-1 to B-4). The USFWS concurred that the East Trenches treatment system project would not have an adverse effect on the Preble's mouse (USFWS concurrence letter dated January 22, 1999; Part II, Appendix D). In neither case,

however, did the Preble's mice leave the stream reach where the project activities were taking place. Rather they continued to be captured in the traps, and based on telemetry data, continued to use the habitat adjacent to the project areas during the duration of the projects. Often the Preble's mice were found just across the silt fence from where project activities were taking place. The conclusions of these studies were that the mice would not be extirpated from areas where projects occurred provided that suitable Preble's habitat was available adjacent to the project areas.

Further evidence of the resilience of the Preble's mouse to disturbance was observed during the summer of 2002 in the Rock Creek drainage at the Site where a wildfire in February 2002 burned about 27 acres. Almost 2,200 linear feet of the grassland and riparian vegetation on the north side of Rock Creek was burned along the stream edge. Of this, an additional 280 feet of habitat was burned completely across the stream where the fire crossed the stream and burned to the pediment top on the opposite side of the valley. Small mammal trapping was conducted in June 2002 and a set of 50 traps was located in and adjacent to the burn area. Twenty-five traps were located on the north side of the fire (with nearly all the traps located in burned areas) and 25 traps located on the south side of Rock Creek in unburned habitat. Two Preble's' mice, an adult male and adult female, were captured about two meters from the edge of the burned area on the north side of the stream on different days. Additionally, while running the trap line one morning, an individual Preble's mouse was observed hopping along in the burn area. So a natural disturbance, much larger than any of the planned cleanup activities in Part I of the PBA did not extirpate the Preble's mouse from these areas since they stayed in the habitat adjacent to the wildfire and even ventured into the burn area.

For each of the projects outlined in Part II of the PBA, in addition to those in Part I, substantial Preble's habitat exists upstream and downstream of the project areas that will not be disturbed. Preble's mice have been documented to move almost one mile in a single night at the Site (K-H 1999), and 2.7 miles over a year or two based on data from the Air Force Academy (Schorr 2003). Therefore, although the closure activities outlined in Part I and Part II of the PBA will disturb several locations along the streams at the Site, in some cases simultaneously, there will be substantial Preble's habitat available adjacent to the project areas where the mice can move to for the duration of the projects. In the end, the long-term result of these projects will remove human influence and structures from the Preble's habitat areas and result in higher quality habitat for the mouse in the future.

5.4 Summary of Findings

The following table summarizes the findings of Part II of the PBA.

Fauna	Legal Status	No Effect	May Affect, No Adverse Effects	Adverse Effects
American burying beetle*	LE	X		
Bald eagle	LT	X		
Black-footed ferret	LE	X		
Black-tailed prairie dog	C	X		
Boreal toad	C	X		
Canada lynx	LT	X		
Eskimo curlew*	LE	X		
Greenback cutthroat trout	LT	X		
Least tern *	LE	X		
Mexican spotted owl	LT	X		
Mountain plover	PT	X		
Pallid sturgeon*	LT	X		
Pawnee montane skipper	LT	X		
Piping plover*	LT	X		
Preble's meadow jumping mouse	LT			X
Whooping crane*	LE	X		
Flora				
Colorado butterfly plant	LT	X		
Ute ladies' -tresses	LT	X		
Western prairie fringed orchid*	LT	X		

* = Lower Platte River species

C = Candidate for listing

LT = Listed threatened

LE = Listed endangered

PT = Proposed threatened

Should any of the Site activities listed in Part II of the PBA change in scope, function, or process from what is presented in this document, further consultation (informal or formal) with the USFWS will be pursued.

5.5 Environmental Baseline

In Jefferson County, the Preble's mouse has been captured or suitable habitat exists along portions of Coal Creek and Ralston Creek, in addition to that found in Rock Creek, Walnut Creek, Woman Creek, and Smart Ditch at the Site. More detailed information on Preble's mice at the Site is contained in Appendix A of Part I of the PBA that contains the Preble's Protection Plan ("*Designation of Preble's Mouse Protection Areas at Rocky*

Flats Environmental Technology Site”). Based on the availability of potentially suitable habitat and lack of trapping information, Preble’s mice are assumed to occupy appropriate habitat throughout Jefferson County.

In Boulder County, the Preble’s mouse has been captured or suitable habitat exists along portions of Coal Creek, South Boulder Creek, Saint Vrain Creek, and within the City of Boulder Open Space and Mountain Parks system. Preble’s habitat also exists along South Boulder Canal, Doudy Draw, and Spring Brook. Based on the availability of potentially suitable habitat and lack of trapping information, Preble’s mice are assumed to occupy appropriate habitat throughout Boulder County.

During 2002, the USFWS proposed critical habitat for the Preble’s mouse (67 CFR 47154). On June 23rd of 2003, the USFWS finalized the critical habitat ruling for the Preble’s mouse (68 FR 37275). The final rule excluded the Rocky Flats Environmental Technology Site from critical habitat designation because the Site will become a USFWS National Wildlife Refuge after closure.

6. Conservation Measures

In accordance with the Endangered Species Consultation Handbook (USFWS 1998), conservation measures are defined as follows: “Conservation measures represent actions pledged in the project description that the action agency or applicant will implement ... Since conservation measures are part of the proposed action, their implementation is required under the terms of the consultation.” To offset the potential impacts of the projects described in Part II of the PBA for the Site, the following conservation measures are proposed.

6.1 Current Conservation Measures at the Site

6.1.1 Memorandum of Agreement

A memorandum of agreement for coordination of endangered species compliance for Site activities was signed by the DOE, USFWS, EPA, CDPHE, and CDNR, in 1999 (DOE 1999). The purpose of the MOA was to develop a process by which the various parties could work together to achieve compliance with the mandates of the RFCA, Site closure activities, and the ESA. The PBA is one of the outcomes of the MOA.

6.1.2 Site Procedures

Two Site procedures also exist that help protect the Preble’s mouse habitat. The two procedures are the *Identification and Protection of Threatened, Endangered, and Special-Concern Species* and *Wetland Identification and Protection* (DOE 1994b, 1997). These procedures require projects to be evaluated for ESA and wetland issues.

6.1.3 Monitoring

Since the early 1990’s when the Preble’s mouse was first discovered to occur at the Site, DOE has actively pursued gathering scientific information on the mouse. Through the use of live trapping, tagging, and telemetry, in addition to extensive habitat characterization, the Site has provided a great deal of knowledge to the scientific community on the behavior and habitat requirements of the Preble’s mouse. These data were used to develop the PPP and associated map and have been used to evaluate proposed projects. Ecology staff at the Site have contributed to the technical working group for the Preble’s mouse for the past several years.

6.2 Conservation and Mitigation Considerations

One of the things that needs to be considered regarding the Site closure activities is that the work the Site is doing is the opposite of what most ESA Section 7 consultations involve. Most other Section 7 consultations are conducted with regard to projects that are

intruding into and permanently destroying Preble's habitat. Urbanization and development, along with other activities along the Front Range continues to reduce and destroy more and more habitat especially along the riparian corridors. Therefore it is increasingly important to protect not only the corridors themselves, but also the buffer areas around the corridors that provide the essential factors and services needed to sustain the roles and functions of the riparian communities. Therefore the criteria used to evaluate projects should be more stringent (i.e. protecting larger, wider areas of habitat along the streams and riparian corridors) when projects are intruding on Preble's habitat and replacing it permanently. At the Site, however, the opposite is occurring. While the cleanup activities are necessary for Site closure, the vast majority of the activities that are taking place in Preble's habitat are being done not to develop areas within Preble's habitat, but to remove previous evidence of human activities or structures. The goal is to return the Site, and in particular, the stream drainages to a more natural, functioning ecosystem. Therefore some consideration of the larger picture is essential when evaluating and developing the conservation and mitigation requirements for impacts resulting from Site closure activities.

6.3 Proposed Conservation Measures

In addition to the current conservation measures already in place at the Site (mentioned above), the following conservation measures, are proposed to offset potential impacts from the projects in this PBA.

6.3.1 General Conservation Measures

The general conservation measures are those to be implemented that are not project specific.

- Education of Site personnel may be conducted to inform employees of the ESA issues. The use of the Site newspaper, email system, the environmental checklist process, and communication with project managers will be used to inform employees of ESA issues.
- Continue to use best management practices to avoid and minimize impacts to Preble's mouse habitat.
- No seeding of non-native plant species will be conducted for Preble's mitigation projects (with exception of certain cover crops if necessary).

6.3.2 Project Specific Conservation Measures

Project specific conservation measures are those that will be required of actual projects impacting Preble's habitat.

- First avoid then minimize potential impacts to the Preble's mouse habitat. If these options are not feasible, then mitigate.

- Limit disturbance to the smallest area practical to accomplish the work.
- Vehicle use shall be limited to existing routes and areas of disturbance except as necessary to access or define boundaries for new areas of construction or operation.
- All workers shall strictly limit their activities and vehicles to designated areas.
- Workers shall be informed of these terms and conditions.
- Erosion controls (i.e., silt fence, hay bales, mulching, tackifiers, surface roughening) will be used to prevent wind and water erosion, and sedimentation at project locations. Redundant erosion control may be used where necessary.

6.3.3 Mitigation Measures

Mitigation for impacts to Preble's mouse habitat (current Preble's protection areas) will be conducted as follows. Impacts to lower quality habitat will be mitigated at a ratio of 1.5:1 and impacts to higher quality habitat will be mitigated at a ratio of 2:1.

- The removal of the North Access Road and associated culverts will restore the travel corridors for Preble's mouse movement into the upper reaches of North and South Walnut Creek, the side drainage off North Walnut Creek that goes up between Buildings 371 and 771, and a new south stream reach off North Walnut Creek that will be created in the borrow area (Figure 5). The middle location will connect the drainage east of Buildings 116 and 117 to North Walnut Creek. When a 100 foot buffer is placed around the edge of these new Preble's mouse corridors, like that used from the edge of the riparian habitat for the current Preble's protection area map, this will create up to an additional 41.00 acres of Preble's habitat at the Site (Figure 5). These actions will remove barriers to Preble's mouse movement, restore previously existing travel corridors, increase wetlands acreages, add to the available suitable habitat for the Preble's mouse, and potentially increase the long-term sustainability of Preble's mouse populations in Walnut Creek at the Site. These areas will be reseeded with native plant species following the guidelines outlined in Appendix A of Part II of the PBA.
- Within current Preble's protection areas, open water, riprap, concrete, roads, and structures are not considered Preble's habitat. If project activities convert these types of areas from non-habitat to habitat, through removal and reseeded efforts, these actions will be considered habitat creation. After project completion, created habitat will be delineated and mapped, acreage calculated, and that area taken as credit to offset debits. It will be tracked in the mitigation debit/credit worksheet discussed below.
- A total of 30 acres (60:1 ratio for the 0.5 acres needing mitigation) of weed control to control noxious weeds on uplands adjacent to Preble's mouse habitat at the Site will

- be conducted for three years as mitigation. Locations will be selected in Walnut or Woman Creek based on annual weed infestation evaluations.
- Since 1999, RFETS has conducted weed control on approximately 4,600 acres of upland area surrounding Preble's mouse habitat at the Site (both ground and aerial herbicide applications). Additionally, hundreds of biocontrol insects have been released at the Site to help control weeds such as diffuse knapweed, dalmatian toadflax (*Linaria dalmatica*), musk thistle (*Carduus nutans*), Canada thistle (*Cirsium arvense*), St. Johns-wort (*Hypericum perforatum*), and bindweed (*Convolvulus arvensis*). These actions have been taken to maintain the high quality of the surrounding upland habitat at the Site.
 - Develop an adaptive management plan with the USFWS for the Walnut Creek drainage to identify parameters to be measured regarding Preble's mouse populations and habitat in Walnut Creek and adaptive management actions which may be taken if substantial threats to the Preble's mouse population are detected.
 - Provide education, training, and information to Site employees and subcontractors about Preble's mouse issues and to refer to this PBA before conducting the covered activities listed in the PBA.

The table below listed the type of impact, mitigation ratio, total acreage impacted, and the total acreage to be mitigated.

Impact Type Debits	Mitigation Ratio	Maximum Acreage Impacted	Total Mitigation Acreage Needed
Temporary Lower Quality Habitat	1.5:1	37.20	55.8
Temporary Higher Quality Habitat	2:1	13.98	27.96
Permanent Lower Quality Habitat	1.5:1	4.14	6.21
Permanent Higher Quality Habitat	2:1	1.36	2.72
Total Debits			92.69
Total In-Situ Mitigation (Acres)			51.18
Debit Remaining After In-Situ Mitigation			41.51
Total Habitat Creation Credits (Acres)*			41.00
Balance			-0.51
Remaining balance to be made up with weed control and small project habitat creation. See bullets above.			

* Total Habitat Creation Credits (Acres) = These credits are largely coming from the North Access Road and Culvert Removal Project that will re-establish the connectivity between the lower and upper reaches of Walnut Creek and provide Preble's habitat throughout the drainages the IA. The (+) has been added because additional habitat creation is expected, but cannot currently be quantified, at locations where roads, riprap areas, dams, parking lots, structures, and open water (that are not considered habitat even though they lie within the current Preble's protection areas) are converted to habitat.

Based on the table above, a total of up to 41.00 acres will be mitigated for disturbances resulting from closure activities specified in Part II of the PBA by re-establishing and re-connecting the stream reaches in the IA to North and South Walnut Creek. The

additional mitigation necessary will be achieved by weed control efforts and smaller project habitat creation as discussed above.

6.4 Benefits of remediation actions.

Although long-term benefits to an endangered species cannot be used as justification for allowing an action, these are still positive benefits that will result to the Preble's mouse habitat from the Site closure. Some of these include:

- Increase in Preble's habitat at the Site.
- Removal of travel barriers and re-establishment of travel corridors for Preble's mice in Walnut Creek.
- Restoration of more natural stream drainages.
- Restoration of natural stream flows.
- Reduced human impacts and disturbances from monitoring and/or project activities along the streams.
- Removal of buildings and other artificial structures from Preble's mouse habitat.
- Creation of higher quality Preble's habitat at some locations (i.e., replacement of some ponds and cattail marshes with riparian woodlands/shrublands).
- Better connectivity of previously separated or isolated Preble's populations in the drainages.
- Return of Site to more natural conditions.

6.5 Tracking Debits and Credits to Preble's Habitat

A spreadsheet will be used to track debits and credits for Preble's impacts at the Site. An example of the mitigation debit/credit spreadsheet and the associated definitions are shown in Appendix G of Part II of the PBA. This information will be provided to the USFWS in the annual report discussed below.

6.6 Reporting

An annual report will be produced and provided to the USFWS by December 31 of each year that includes:

- A summary of annual activities conducted under the PBA,
- The total disturbed acreage of Part II projects on a project basis and as an annual total tracked in a project database,
- Documentation of monitoring and revegetation success of Part II projects per PBA,
- Documentation of any additional consultation discussions with the USFWS on PBA issues or amended projects.

The reporting requirement will continue until DOE and the USFWS agree that the requirements of the PBA have been met.

7. Summary

Part II of the PBA was prepared in order to address activities that are “likely to adversely affect” the species under consideration in this PBA or the Preble’s mouse or its habitat (current protection areas at the Site).

The species evaluated in Part II of the PBA include the American burying beetle*, Bald eagle, Black-footed ferret, Black-tailed prairie dog, Boreal toad, Canada lynx, Eskimo curlew*, Greenback cutthroat trout, Least tern *, Mexican spotted owl, Mountain plover, Pallid , sturgeon*, Pawnee montane skipper, Piping plover*, Preble’s mouse, Whooping crane*, Colorado butterfly plant, Ute ladies’-tresses, and Western prairie fringed orchid*. Species noted with an (*) are South Platte River species.

Impact analyses determined that there would be no effect from any of the activities listed Part II of the PBA on the species evaluated, with the exception of the Preble’s mouse. The findings with respect to the Preble’s mouse indicate that each of the activities presented in Part II of the PBA are likely to adversely affect the Preble’s mouse. Conservation and mitigation measures are proposed to minimize and mitigate for impacts to the Preble’s mouse. In light of impact analyses, and the mitigation and conservation commitments, the DOE’s proposed activities necessary to close the Site are not likely to jeopardize the continued existence of any federally listed, proposed, or candidate species.

8. References

DOE. 1992. Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant. Final Report. U.S. Department of Energy, Rocky Flats Plant, Golden, CO. September 1992.

DOE. 1994a. Fiscal Year 1993 Annual Wildlife Survey Report. U.S. Department of Energy, Rocky Flats Office, Golden, CO. April 29, 1994.

DOE. 1994b. Identification and Protection of Threatened, Endangered, and Special-Concern Species. U.S. Department of Energy, Rocky Flats Field Office, Golden CO. January 14, 1994.

DOE. 1995. 1994 Annual Wildlife Survey Report. Natural Resource Protection and Compliance Program. U.S. Department of Energy, Rocky Flats Office, Golden, CO. April 24, 1995.

DOE. 1996. Study Results of Dam Toe Slope Sand/Rock Blanket Installation Effects on the Preble's Meadow Jumping Mouse. Rocky Flats Field Office, U.S. Department of Energy, Golden, CO. January 29, 1996.

DOE. 1997. Wetland Identification and Protection. U.S. Department of Energy, Rocky Flats Field Office, Golden CO. January 3, 1997.

DOE. 1999. Memorandum of Agreement for Coordination of Endangered Species Act Compliance with activities at Rocky Flats Environmental Technology Site between Department of Interior Fish and Wildlife Service, Department of Energy, Environmental Protection Agency, Colorado Department of Public Health and Environment, and Colorado Department of Natural Resources. U.S. Department of Energy, Rocky Flats Environmental Technology Site, Golden, CO. May 17, 1999.

DOE. 2000. Preble's Meadow Jumping Mouse Protection Plan. U.S. Department of Energy, Rocky Flats Field Office, Golden, CO. July 14, 2000.

DOE. 2002. Water Measurement Flume Replacement Project. U.S. Department of Energy, Rocky Flats Field Office, Golden, CO. January 2002.

DOE. 2003. 2003 Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*) Monitoring at the Rocky Flats Environmental Technology Site. Annual Report for the U.S. Fish and Wildlife Service permit #TE 051719-0. U.S. Department of Energy, Rocky Flats Field Office, Golden, CO

ESCO. 1993. Report of Findings, Ute Ladies'-Tresses and Colorado Butterfly Weed Surveys. Rocky Flats Buffer Zone. ESCO Associates, Inc., Boulder, CO. September 24, 1993.

ESCO. 1994. Report of Findings, Ute Ladies'-Tresses and Colorado Butterfly Weed Surveys. Rocky Flats Buffer Zone. ESCO Associates, Inc., Boulder, CO. September 13, 1994.

K-H. 1997. 1996 Annual Wildlife Survey Report. Natural Resource Compliance Protection Program. Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. March 1997.

K-H. 1998. 1997 Annual Wildlife Survey Report. Natural Resource Compliance Protection Program. Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. May 1998.

K-H. 1999. 1998 Annual Wildlife Survey Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. June 1, 1999.

K-H. 2000. 1999 Annual Wildlife Survey Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. June 2000.

K-H. 2001a. RFCA Standard Operating Procedure for Asphalt and Soil Management. Rev. 0. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. August 2001.

K-H. 2001b. 2000 Annual Wildlife Monitoring Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. June 2001.

K-H. 2002a. 2001 Annual Wildlife Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. August 2002.

K-H. 2002b. Site-Wide Water Balance Model Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC, Golden, CO. May 2002.

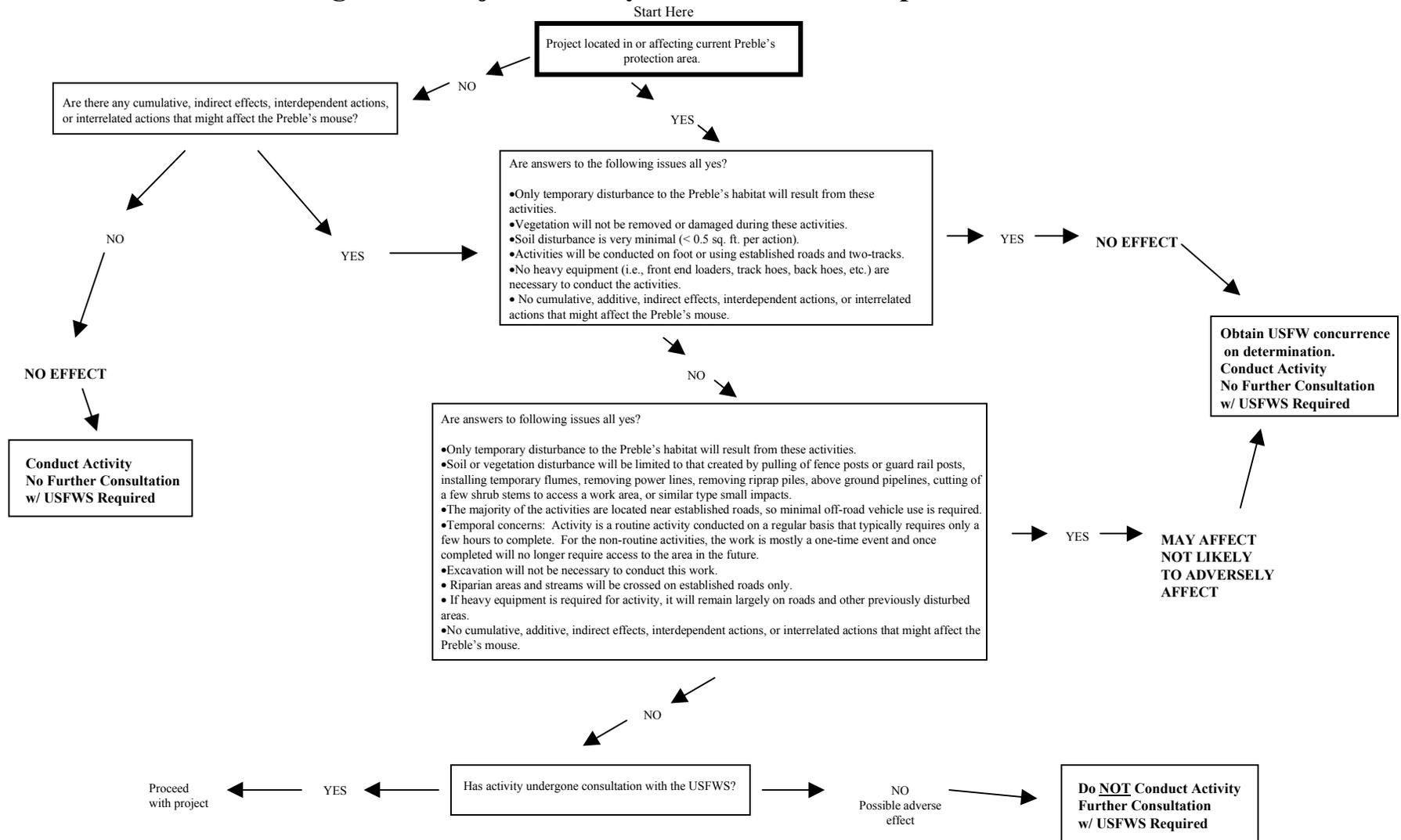
RMRS. 1996. 1995 Annual Wildlife Survey Report for the Rocky Flats Environmental Technology Site. Natural Resource Protection and Compliance Program. Rocky Mountain Remediation Services, LLC. Rocky Flats Environmental Technology Site, Golden, CO. April 25, 1996.

Schorr, R. 2003. 2002 Trapping Results for the Air Force Academy, Colorado Springs, CO. Presentation at the 2003 Preble's Meadow Jumping Mouse Technical Working Group Meeting, Colorado Division of Wildlife Headquarters, Denver, CO. March 12, 2003.

USFWS. 1998. Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act. U.S. Fish and Wildlife Service and National Marine Fisheries Service. Final. March 1998.

USFWS. 2002. Biological Opinion for Water Measurement Flume Replacement Project at the Rocky Flats Environmental Technology Site. U.S. Fish and Wildlife Service, Lakewood, CO. August 1, 2002.

Figure 1. Project Activity Preble's Mouse Impact Determination Flowchart



2075000 2080000 2085000 2090000

Projects

- #1 Road and Culvert Removals
- #2 Original Landfill Project
- #3 Pond Remediation and Removal Projects
- #4 Waste Water Treatment Plant

Projects Likely to Adversely Affect the Preble's Mouse
 Programmatic Biological Assessment
 Part II

Figure 2

LEGEND

- Current Preble's Protection Areas
- Project Footprint

Standard Features

- Buildings
- Demolished Buildings
- Lakes & ponds
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours (20 ft. intervals)

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.

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1000 0 1000 Feet

State Plane Coordinate Projection
 Colorado Central Zone
 Datum: NAD27

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

Prepared by: **Professional Environmental Group, L.L.C.**

For: Kaiser-Hill Company, LLC

RFETS GIS Dept.

303-966-7707

MAP ID: 04-0009

January 15, 2004

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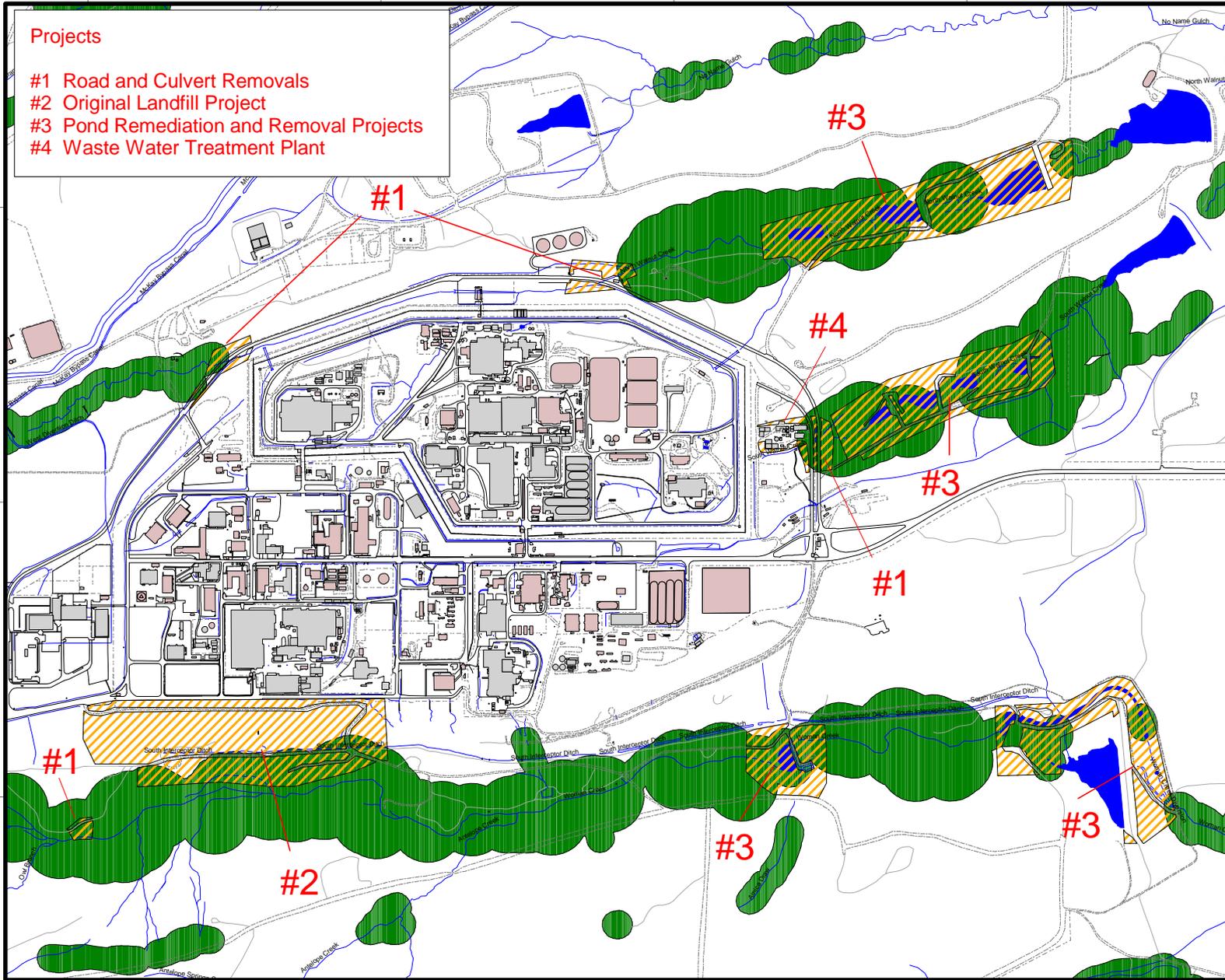
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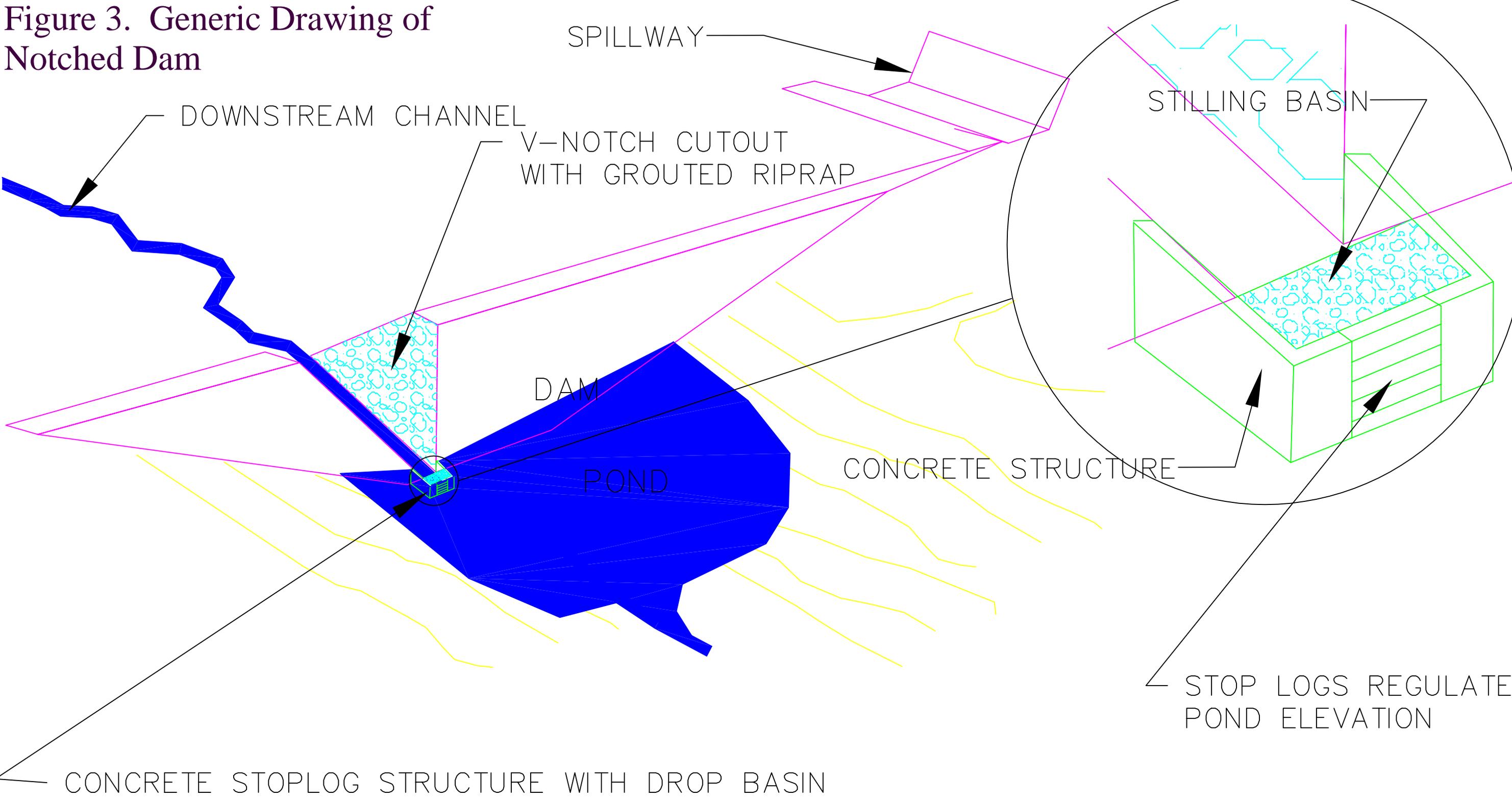
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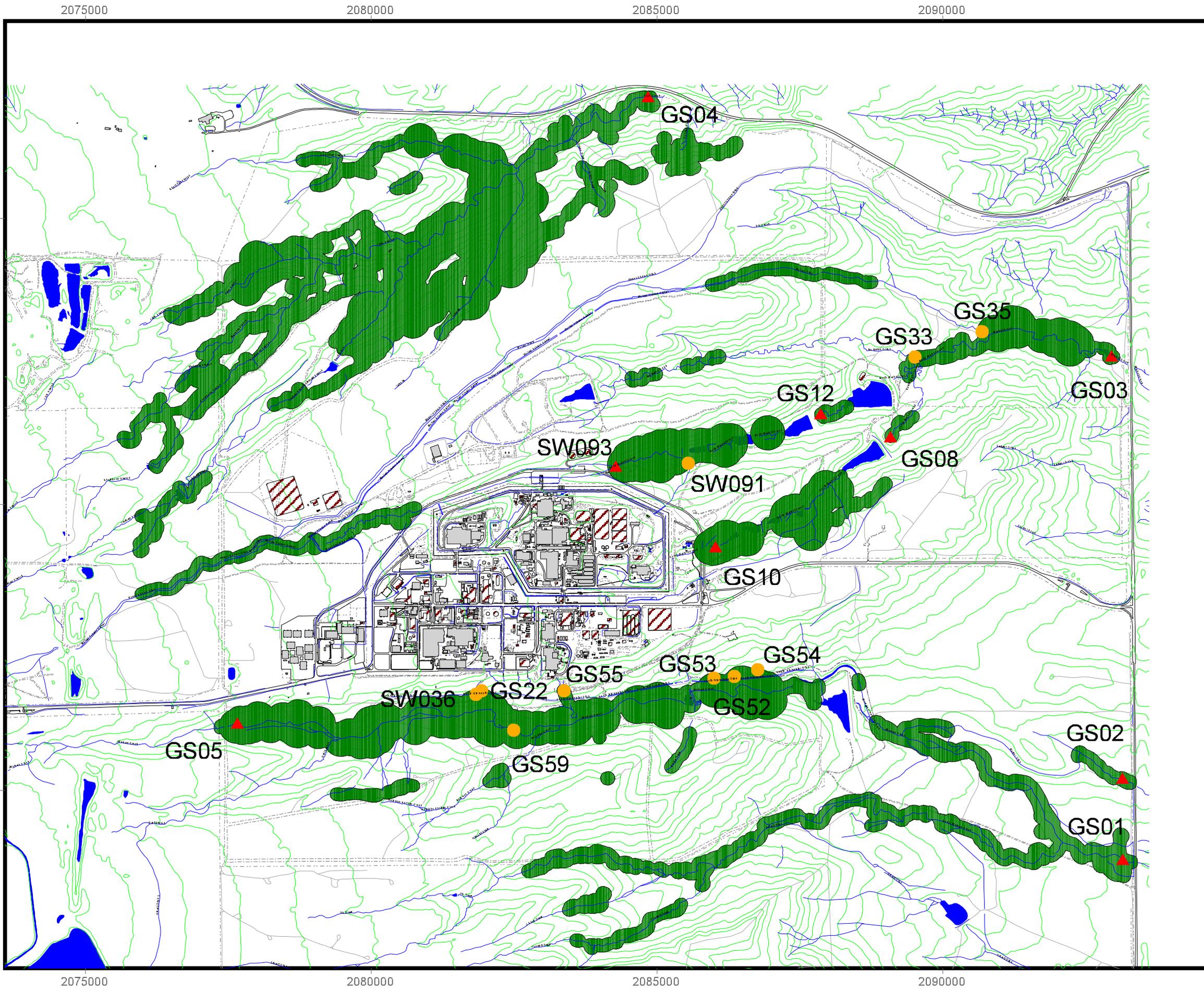
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Figure 3. Generic Drawing of Notched Dam





Surface Water Flume Removal Locations At RFETS

Figure 4

Legend

- ▲ Permanent Flume Locations
- Temporary Flume Locations
- Current Preble's Protection Areas

Standard Features

- Buildings
- Demolished Buildings
- Lakes & ponds
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours (20 ft. intervals)

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.

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State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

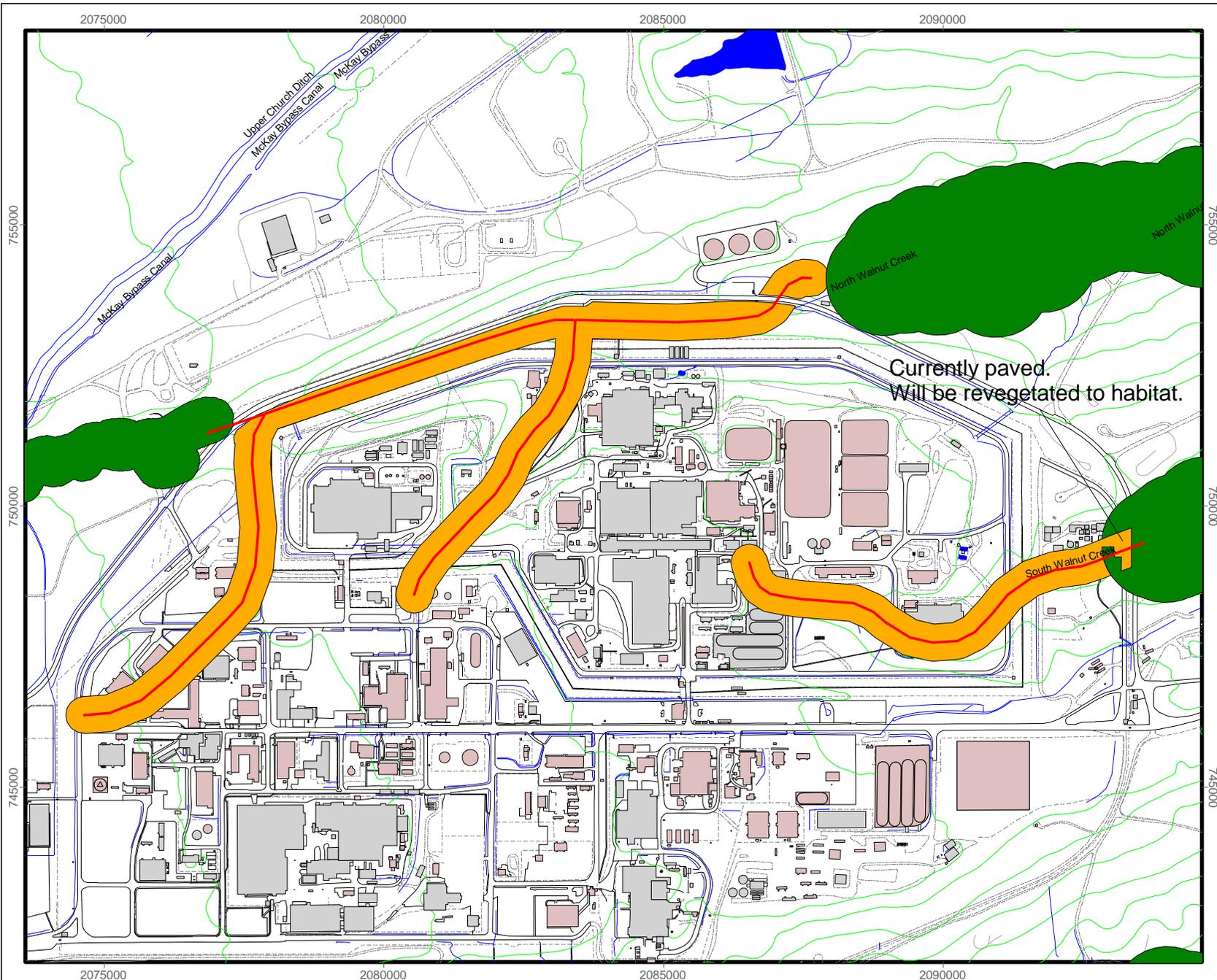
U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: **Professional Environmental Group, L.L.C.**

For: Kaiser-Hill Company, LLC
RFETS GIS Dept. 303-966-7707

MAP ID: 04-0010 January 15, 2004

C:\Projects\F\2004\04-0010\flume_removal\04.apr\flume locations



IA Preble's Mouse Habitat Creation

Figure 5

- Current Preble's Protection Areas
- IA Preble's Habitat Creation
- IA stream locations (reconnected or re-established)

Standard Features

- Buildings
- Demolished Buildings
- Lakes & ponds
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours (20 ft. intervals)

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.

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State Plane Coordinate Projection
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**Preble's Meadow Jumping Mouse
Current Protection Areas
at RFETS
December 2003**

Figure 6

Legend

- Current Preble's Protection Areas
- Contiguous Wetlands
- Preble's mouse telemetry points

Standard Features

- Buildings
- Demolished Buildings
- Lakes & ponds
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours (20 ft. intervals)

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.

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State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

**U.S. Department of Energy
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Prepared by: **Professional Environmental Group, L.L.C.**

For: **Kaiser-Hill Company, LLC** RFETS GIS Dept. 303-966-7707

MAP ID: 04-0006 December 16, 2003

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Rocky Flats, Colorado Site Revegetation Plan



U.S. Department
of Energy

Office of Legacy Management

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**U.S. Department of Energy
Office of Legacy Management**

**Rocky Flats, Colorado, Site
Revegetation Plan**

PREDECISIONAL DRAFT

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1.0 Introduction

The Rocky Flats Site (Rocky Flats) is under the jurisdiction of the U.S. Department of Energy (DOE) Office of Legacy Management. S.M. Stoller Corporation conducts long-term surveillance and maintenance activities at Rocky Flats under the Legacy Management Support (LMS) contract. Vegetation management is conducted as part of the surveillance and maintenance activities at Rocky Flats, which include activities conducted pursuant to the Rocky Flats Legacy Management Agreement. That agreement established the regulatory framework to implement the final response action selected and approved in the Rocky Flats Corrective Action Decision/Record of Decision under the Comprehensive Environmental Response, Compensation, and Liability Act; the Resource Conservation and recovery Act; and the Colorado Hazardous Waste Act to ensure that the response action remains protective of human health and the environment.

The Rocky Flats closure activities included the removal of existing buildings and structures within the former Industrial Area (IA) of the site. As the buildings and other facilities and structures were removed across the site, revegetation of the areas was conducted to stabilize the soil, minimize erosion, and promote the establishment of native plant communities. In 2007, much of the former Buffer Zone was transferred to the U.S. Fish and Wildlife Service to become the Rocky Flats National Wildlife Refuge. The portion of the site retained by DOE comprises the IA and surrounding ponds and landfill areas. The DOE retained area is known as the Central Operable Unit (COU), and the refuge areas are part of the Peripheral Operable Unit (POU) (Figure 1).

1.1 Goals and Objectives

The following goals and objectives were established for the original revegetation effort at the site and apply to any future revegetation efforts:

Goal 1. Provide a vegetative cover in disturbed and degraded areas to stabilize the soil and minimize erosion.

Goal 2. Wherever possible, avoid or minimize the loss of native habitat where it is still present.

Goal 3. Develop sustainable native plant communities that provide habitat for native wildlife species that occur at the site. The goal is revegetation, not restoration.

Goal 4. If warranted, remove areas of planted, exotic plant species that were used for landscaping purposes.

Goal 5. Control noxious weeds in revegetation areas using an appropriate Integrated Weed Management Program strategy outlined in the Vegetation Management Plan (DOE 2008).

As defined for this plan, “revegetation” means reseeding the dominant native plant species for a given plant community type. Revegetation differs from restoration, which is defined as the reestablishment of the pre-disturbance native plant communities and all the associated natural processes and functions. However, although initially the common native plant species are being

seeded, other grasses, forbs, or shrubs found on the native prairie at the site could be seeded and planted at a future time, if desired, to provide greater diversity to the revegetation locations.

1.2 Site Description and History

At an elevation of approximately 6,000 feet, the site (both COU and POU areas) contains a unique ecotonal mixture of mountain and prairie plant species resulting from the topography of the area and its proximity to the mountain front. The POU, the area surrounding the former IA, is one of the largest remaining undeveloped tracts of its kind along the Colorado Piedmont. The Colorado Natural Heritage Program has identified a number of plant communities present at the site as increasingly rare and unique. These communities include the xeric tallgrass prairie, tall upland shrubland, wetlands, and Great Plains riparian woodland communities. Small inclusions of a number of other increasingly rare plant communities are also found on the site.

The upper flat surfaces at the site (pediment tops) are composed of Rocky Flats alluvium. The soil types on this surface are classified as Flatirons very cobbly sandy loam and Nederland very cobbly sandy loam (SCS 1980). The vegetation on this surface is predominantly xeric tallgrass prairie on the western portions of the site and gradually changes to a needle and thread grass community as the alluvium thins to the east. Based on evidence from the current vegetation map, soil types, and historical aerial photographs, much of the COU was probably xeric tallgrass prairie prior to its construction. Common species on the xeric tallgrass prairie include *Andropogon gerardii*, *Andropogon scoparius*, *Muhlenbergia montana*, *Stipa comata*, *Bouteloua gracilis*, *Bouteloua curtipendula*, *Carex heliophila*, *Poa compressa*, and a variety of other graminoid and forb species. The dominance of these species varies from location to location.

The hillsides at the site are dominated by the mesic mixed grassland community. Soils on the hillslopes are classified as Denver-Kutch-Midway clay loams (SCS 1980). Common species on the mesic mixed grasslands include *Bouteloua gracilis*, *Bouteloua curtipendula*, *Agropyron smithii*, *Stipa viridula*, *Poa pratensis*, *Poa compressa*, *Bromus japonicus*, and other forbs and graminoids. The hillside areas in the COU were largely composed of this community prior to disturbance.

Riparian areas at the site are typically characterized by *Populus deltoides*, *Salix exigua*, *Amorpha fruticosa*, *Symphoricarpos occidentalis*, *Rosa arkansana*, and various wetland herbaceous plants such as *Carex nebrascensis*, *Juncus balticus*, and *Spartina pectinata*. The soils on the floodplains and stream terraces at the site are classified as Haverson loams (SCS 1980). Within the COU, historical aerial photographs show that two small tributaries to Walnut Creek drained the former IA and would have contained some wetland and riparian vegetation. These tributaries, however, were modified and the channels moved for construction of some of the buildings at the site.

Prior to purchase by DOE, most of the land where the site occurs was rangeland that had been heavily overgrazed (Clark et al. 1980). Historical aerial photographs show little riparian woodland or shrubland vegetation along the streams at the site, likely attributable to overgrazing in the riparian corridors. After DOE purchase, grazing was stopped and the native plant communities were allowed to return with little or no management.

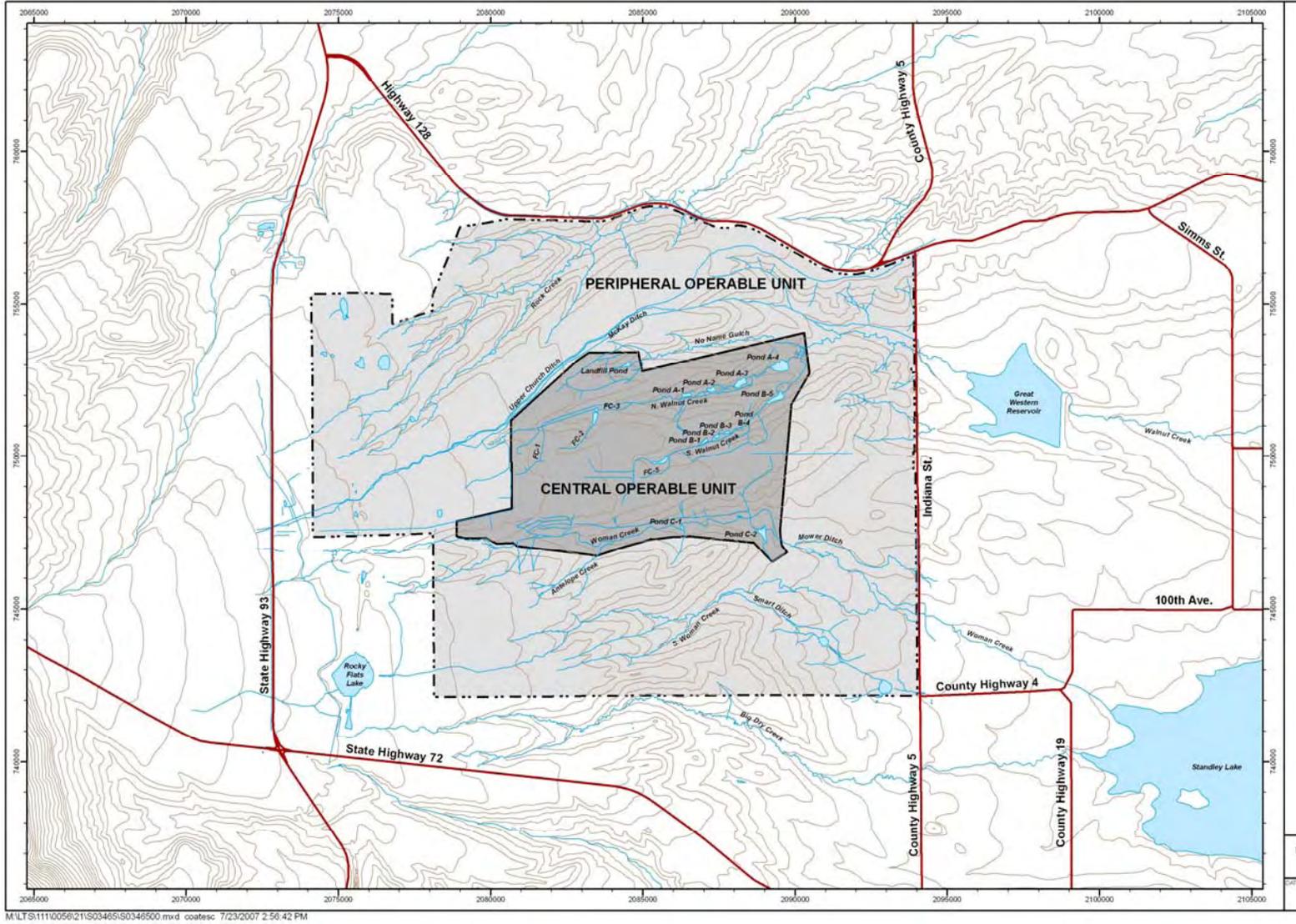


Figure 1. Locations of the Central Operable Unit and Peripheral Operable Units at the Rocky Flats Site

2.0 Revegetation (Seeding)

2.1 Revegetation Planning Assumptions

This revegetation plan is intended as guidance. It may be modified, altered, or departed from as specific locations warrant or as particular needs arise. This plan is specifically developed for use in the COU; however, because it is based on the native plant communities in both the COU and POU, it could also be used by the U.S. Fish and Wildlife Service (USFWS) on the refuge if desired. This plan applies to revegetation locations in the COU, excluding those areas covered specifically by regulatory agreements that may have other requirements. Preble's mouse and wetland mitigation revegetation are not addressed in this document. The guidance in this plan may be used for these mitigation areas; however, Preble's mouse and wetland mitigation issues may have more specific requirements that are outlined in the documents that govern the mitigation. Disturbance and mitigation of Preble's mouse habitat are addressed in USFWS consultation documents such as biological evaluations, biological assessments, and biological opinions for specific projects. Disturbance of jurisdictional wetland areas would require an approval by the U.S. Environmental Protection Agency or U.S. Army Corps of Engineers that would provide specifications for the wetlands, including reconstruction or mitigation. The wetland mitigation issues are covered in the *Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan* (DOE 2006). This plan also does not address revegetation of soil covers (e.g., Present Landfill, Original Landfill), which may have specific requirements for vegetation based on the purpose of the covers.

2.2 Revegetation Best Management Practices

Appendix A contains the seed mix specifications. Different seed mixes are provided depending on the topographic location and hydrologic conditions at the revegetation location. The following seed mixes are used for revegetation at the site:

- Flat areas seed mix—use on the pediment tops at the site.
- Hillside slope areas seed mix—use on the hillslope areas at the site.
- Drainage bottom areas seed mix—use along drainage bottoms at the site (depending on the hydrology at a location, this may be combined with the wetland areas seed mix).
- Wetland areas seed mix—use for wetland areas at the site.
- Temporary seeding seed mix 1—use for temporary cover.
- Temporary seeding seed mix 2—use for temporary cover.

These seed mixes may be modified for specific projects as warranted. All revegetation projects at the site must involve the Rocky Flats ecologist, who will coordinate with project management to provide project-specific revegetation specifications (e.g., seedbed preparation, soil amendments) to go into the Statement of Work. This approach is required because of the complexity of the landscapes and regulatory/compliance issues in Preble's mouse habitat and wetland areas at the site. The Rocky Flats ecologist or designee must also be contacted for all erosion control requirements at the site prior to project initiation. The *Erosion Control Plan for Rocky Flats Property—Central Operable Unit* (DOE 2007) will be used to address erosion control issues for revegetation projects.

2.3 Soil Characterization

Soil characterization of several revegetation locations representative of general IA conditions was conducted during the summer of 2003. The soil sampling plan and results are presented in Appendix B. No nitrogen amendments were applied to any of the revegetation areas because scientific evidence indicated that the addition of nitrogen would foster weed growth at the expense of desired species. If needed, additional location-specific soil characterization for revegetation factors may be conducted.

2.4 Prohibited Species

The plant species listed below are prohibited for use at the site because (1) they are nonnative species, and (2) they are aggressive and outcompete many of the native species.

- 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*

The use of a sterile hybrid of wheat known as ReGreen is allowed under certain conditions at the site; however, prior approval from the Rocky Flats ecologist is required.

The use of any nonnative species at the site is only allowed with prior approval by the Rocky Flats ecologist and will only be considered under very special conditions. No species found on the Colorado State noxious weed list or the Jefferson County noxious weed list are allowed to be planted at the site.

3.0 Long-Term Monitoring and Management

Monitoring and management of the revegetation areas may be required for several years until the vegetation has been reestablished. The following considerations can be adapted and changed as necessary to achieve the desired goals and success criteria for the revegetation areas.

3.1 Revegetation Management

Management of the revegetation areas is critical to final success. Management measures may include weed control, reseeding areas as necessary, thinning vegetation through fire or other mechanical means, relocating or eliminating undesirable wildlife species, incorporating erosion control measures, and controlling or limiting anthropogenic activities within revegetated areas. The *Rocky Flats, Colorado, Site Vegetation Management Plan* (DOE 2008) outlines the integrated weed management program for the site and addresses potential tools that may be used to help establish desired vegetation while controlling noxious weeds. Initial success of all revegetation efforts is not a guarantee of long-term viability. Many factors can influence the success of revegetation. Some of these factors include variable climate (precipitation amounts, timing of precipitation events, temperatures), seedbed preparation, seed viability, soil fertility, undesirable species competition for resources, and herbivory. Even if all these factors are favorable and conditions are conducive for revegetation success, a planting may fail. Therefore, a revegetation project the size of that at Rocky Flats should have appropriate monitoring and management to increase the chances that initial revegetation efforts will succeed.

Time is a critical factor for establishing a native revegetation planting, and it will take several years for the revegetation areas to begin to resemble the native prairies found on the undisturbed portions of the site. It is normal for any revegetation effort to go through an initial stage of annual weeds followed by the establishment and dominance of the desired perennial species. Depending on the weed species, however, weed control is not always immediately warranted. Species such as *Kochia scoparia*, *Salsola iberica*, *Helianthus annuus*, *Erodium cicutarium*, and various annual mustard species are often common at the site during the first 2 or 3 years of a revegetation effort. These species are adapted to the early successional environmental conditions and often will not substantially reduce the growth and development of the desired perennial species. The species can actually protect the developing perennial vegetation by creating shade, providing a buffer from the wind, and creating favorable moisture conditions. In addition, they provide additional organic matter to the topsoil. After the first 2 or 3 years of establishment, control of the annual species may be desirable. However, control of noxious weeds should be conducted as regulated and as needed, using appropriate control methods (DOE 2008).

Native plants often take longer to germinate and establish than nonnative species. For the first year or two, many native species spend most of their energy developing a substantial root system before sending up much aboveground growth. Therefore, reseeding is not always an immediate recommendation if some establishment is taking place. Reseeding is recommended only after it is determined that the desired perennial vegetation is not progressing adequately toward the revegetation goals and success criteria. Two potential scenarios may trigger reseeding efforts: (1) bare areas greater than 500 square feet exist over the course of a single growing season, and (2) after four growing seasons, quantitative data show that the total vegetation cover is less than 70 percent of the success criteria (Section 3.2).

Access to the revegetation areas may be restricted to provide the greatest opportunity for success of the revegetation effort. Access may be restricted through the use of fencing, signage, and education, as needed.

3.2 IA Revegetation Success Criteria

Success criteria and monitoring are an important component of a revegetation project. Revegetation success is typically judged according to criteria for species richness, species composition, and total ground cover. These criteria are important indicators of site conditions and stability, and they can be adjusted as desired to achieve the objectives. Also, conditions at some locations may never reach specified success criteria simply because the physical, environmental, and climatic factors at a location are not conducive for substantial vegetative growth. Situations such as this currently exist at some locations on the native prairie at the site. These success criteria are provided as initial guidance; however, common sense combined with scientific data must be applied to final evaluations to determine whether further management actions are required. The success criteria also depend on the goals or requirements for establishment of a good stand of vegetation at a specific location.

Quantitative grassland success criteria

- The revegetation site will have a minimum of 30 percent relative foliar cover of live desired species (seeded or nonseeded native species). Relative cover is defined as the percentage of cover of a given species divided by the total amount of vegetation cover present. Example: Species A has 20% absolute cover, and total vegetation cover (all individual species cover values summed) is 80%. Relative cover = $(20/80) \times 100 = 25\%$.
- The revegetation site will have a minimum of 70 percent total ground cover that comprises litter cover, current year live vegetation basal cover, and rock cover.
- A minimum of 50 percent of the seeded native species will be present at the revegetation site.
- No single species will contribute more than 45 percent of the relative foliar cover (except in areas where dominance by a single species is appropriate for long-term wildlife and habitat management objectives).

Noxious weeds

Noxious weeds will be evaluated on a species-specific basis, and weed control will be employed as necessary using appropriate integrated weed management strategies (DOE 2008) to achieve the success criteria listed above.

Monitoring will be conducted annually at selected locations to provide information necessary for planning of management activities. Monitoring should be continued until success criteria have been achieved at the selected monitoring locations or until determined to be unnecessary. The success criteria and monitoring described here do not necessarily apply to revegetation where other regulatory drivers take precedence (e.g., Preble's mouse habitat, wetlands, landfill covers). These locations may have their own monitoring protocols and success criteria.

3.3 Revegetation Monitoring Methodology

Revegetation monitoring will consist of a two-fold approach that uses both qualitative and semiquantitative methods. Qualitative monitoring will be conducted through the use of permanent photo points and field notes. Photo points will be visited at least annually. Additional

photographs may be taken at other times if necessary. Both landscape and quadrat photographs may be used as appropriate. Field notes will be taken to note the status of the revegetation and any management needs. Appendix C shows an example of a Qualitative Revegetation Evaluation Form that may be used to assess the revegetation locations. Qualitative evaluations may be used to evaluate the revegetation success and determine if additional management actions are needed at these locations.

Semiquantitative monitoring will consist of weed mapping and quadrat sampling. Weed mapping in the revegetation areas will be conducted as part of the sitewide weed-mapping efforts to provide information for integrated weed management (DOE 2008). Weed species to be mapped will be selected annually and mapped when most visible. Mapping data will be entered and stored in the site Geographical Information System (GIS).

Quadrats will be used to determine species richness and estimate vegetation, litter, and rock cover. A 0.5-square-meter rectangular quadrat will be used for semiquantitative revegetation monitoring. Species richness will be determined by listing all species found rooted within or overhanging the quadrat. Foliar cover by species will be estimated visually using the Daubenmire cover class system (Table 1). The midpoint of each cover class will be used for analysis. Estimates of total foliar and basal vegetation cover, litter cover, and rock cover will also be estimated for the entire quadrat. To assist in the estimates of cover, the edges of the quadrat may be painted using the Daubenmire method to aid in the estimation of 5 percent, 25 percent, 50 percent, and 75 percent cover increments (Bonham 1989).

Table 1. Daubenmire Cover Class System

Cover Class	Range of Cover (%)	Class Midpoints (%)
1	0–5	2.5
2	5–25	15
3	25–50	37.5
4	50–75	62.5
5	75–95	85
6	95–100	97.5

(From Bonham 1989)

Revegetation areas will be divided into monitoring areas or units according to a variety of factors that may include slope, aspect, historical location information, project-specific information, seedbed preparation, erosion control type, or landmark features. Random quadrat locations will be generated for each monitoring area. Random locations will be generated using a GIS or the Visual Sample Plan software program (Hassig et al. 2005). Quadrat locations will be located in the field using a Global Positioning System unit. Data will be analyzed and summarized for each year to evaluate revegetation success and change.

4.0 References

Bonham, C.D., 1989. *Measurements for Terrestrial Vegetation*, John Wiley and Sons, New York.

Clark, S.V., P.J. Webber, V. Komarkova, and W.A. Weber, 1980. Map of Mixed Prairie Grassland Vegetation, Rocky Flats, Colorado. Occasional Paper No. 35. Institute of Arctic and Alpine Research. University of Colorado, Boulder, Colorado.

DOE (U.S. Department of Energy), 2006. *Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan*, DOE-LM/GJ1207-2006, Office of Legacy Management, Rocky Flats, Colorado, Site, June.

DOE (U.S. Department of Energy) 2007. *Erosion Control Plan for Rocky Flats Property—Central Operable Unit*, DOE-LM/1497-2007, Office of Legacy Management, Rocky Flats, Colorado, Site, July.

DOE (U.S. Department of Energy), 2008. *Rocky Flats, Colorado, Site Vegetation Management Plan*, LMS/RFS/S04513, Office of Legacy Management, Rocky Flats, Colorado, Site.

Hassig, N.L., J.E. Wilson, R.O. Gilbert, B.A. Pulsipher, and L.L. Nuffer, 2005. Visual Sample Plan Version 4.0 Software and User's Guide, PNNL-15247, Pacific Northwest National Laboratory, Richland, Washington, Internet: <http://dgo.pnl.gov/vsp/document.htm>, accessed 11/10/05.

SCS (Soil Conservation Service), 1980. *Soil Survey of Golden Area, Colorado*, U.S. Department of Agriculture.

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Appendix A

Revegetation Seed Mixes

(NOTE: Revegetation specifications will be provided in the Statement of Work for each project because of location specific requirements.)

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**Flat Areas Seed Mix (Areas On Pediment Tops* With Slopes Less Than 10%)
 (Based on 50 seeds/sq.ft.)**

**This Revegetation Specification Sheet Supercedes All Previous Revegetation Information For Rocky Flats
 Date: 04/07**

Scientific Name	Common Name	Variety	% of Seed Mix	# Seeds Needed	# Seeds/Lb.	# Seeds/Sq. Ft.	Lbs./Acre (PLS)
Graminoids							
Agropyron smithii	Western Wheatgrass	Arriba	20	435600	120000	10.0	3.63
Agropyron trachycaulum	Slender Wheatgrass	San Luis	10	217800	120000	5.0	1.82
Andropogon gerardii	Big Bluestem	Bonilla	10	217800	130000	5.0	1.68
Andropogon scoparius	Little Bluestem	Aldous	8	174240	225000	4.0	0.77
Bouteloua curtipendula	Side-Oats Grama	Vaughn	15	326700	190000	7.5	1.72
Bouteloua gracilis	Blue Grama	Hachita	15	326700	710000	7.5	0.46
Buchloe dactyloides	Buffalo Grass	Texoka	5	108900	45000	2.5	2.42
Koleria pyramidata	June Grass		3	65340	2315400	1.5	0.03
Sorghastrum nutans	Indian Grass	Cheyenne	2	43560	120000	1.0	0.36
Sporobolus cryptandra	Sand Dropseed		7	152460	5298000	3.5	0.03
Stipa viridula	Green Needlegrass	Lodorm	5	108900	115000	2.5	0.95
Total			100	2178000		50.0	13.86

Sq. ft/acre 43560
 Seeds/sq. ft. 50
 Seeds needed/acre 2178000

- 1) This pounds per acre assumes drill-seeding is used. If the seed is to be broadcast, the application rates are to be doubled.
- 2) PLS = pure live seed. Be sure to specify this to the seed dealer when ordering.
- 3) The seed is to be certified weed free.

NOTE:
 * The pediment tops are the upper flat surface areas at the Site.

**Hillside Slope Areas Seed Mix (Hillside Areas Or Areas With Slopes Greater Than 10%)
 (Based on 50 seeds/sq.ft.)**

**This Revegetation Specification Sheet Supercedes All Previous Revegetation Information For Rocky Flats
 Date: 04/07**

Species	Common Name	Variety	% of Seed Mix	# Seeds Needed	# Seeds/Lb.	# Seeds/Sq. Ft.	Lbs./Acre (PLS)
Graminoids							
Agropyron dasystachyum	Thickspike Wheatgrass	Critana	5	108900	150000	2.5	0.73
Agropyron smithii	Western Wheatgrass	Arriba	23	500940	120000	11.5	4.17
Agropyron trachycaulum	Slender Wheatgrass	San Luis	15	326700	120000	7.5	2.72
Bouteloua curtipendula	Side-Oats Grama	Vaughn	13	283140	190000	6.5	1.49
Bouteloua gracilis	Blue Grama	Hachita	24	522720	710000	12.0	0.74
Buchloe dactyloides	Buffalo Grass	Texoka	10	217800	45000	5.0	4.84
Stipa viridula	Green Needle Grass	Lodorm	10	217800	180000	5.0	1.21
	Total		100	2178000		50.0	15.90
	Sq. ft/acre		43560				
	Seeds/sq. ft.		50				
	Seeds needed/acre		2178000				

- | |
|---|
| <p>1) This pounds per acre assumes drill-seeding is used. If the seed is to be broadcast, the application rates are to be doubled.</p> <p>2) PLS = pure live seed. Be sure to specify this to the seed dealer when ordering.</p> <p>3) The seed is to be certified weed free.</p> |
|---|

Temporary Seeding Seed Mix 1
 (Based on 50 seeds/sq.ft.)

This Revegetation Specification Sheet Supercedes All Previous Revegetation Information For Rocky Flats
 Date: 04/07

Species	Common Name	Variety	% of Seed Mix	# Seeds Needed	# Seeds/Lb.	# Seeds/Sq. Ft.	Lbs./Acre (PLS)
Agropyron smithii	Western Wheatgrass	Arriba	25	544500	120000	12.5	4.5
Agropyron trachycaulum	Slender Wheatgrass	San Luis	40	871200	120000	20.0	7.3
Bouteloua curtipendula	Side-oats Grama	Vaughn	35	762300	190000	17.5	4.0
	Total		100	2178000		50.0	15.8

Sq. ft/acre 43560
 Seeds/sq. ft. 50
 Seeds needed/acre 2178000

- 1) This pounds per acre assumes drill-seeding is used. If the seed is to be broadcast, the application rates are to be doubled.
- 2) PLS = pure live seed. Be sure to specify this to the seed dealer when ordering.
- 3) The seed is to be certified weed free.

**Temporary Seeding Seed Mix 2
 (Based on 50 seeds/sq.ft.)**

**This Revegetation Specification Sheet Supercedes All Previous Revegetation Information For Rocky Flats
 Date: 04/07**

Species	Common Name	Variety	% of Seed Mix	# Seeds Needed	# Seeds/Lb.	# Seeds/Sq. Ft.	Lbs./Acre (PLS)
Agropyron trachycaulum	Slender Wheatgrass	San Luis	90	1960200	120000	45.0	16.3
Triticum aestivum x Elytrigia elongata	ReGreen®		10	217800	11000	5.0	19.8
	Total		100	2178000		50.0	36.1

Sq. ft/acre 43560
 Seeds/sq. ft. 50
 Seeds needed/acre 2178000

- 1) This pounds per acre assumes drill-seeding is used. If the seed is to be broadcast, the application rates are to be doubled.
- 2) PLS = pure live seed. Be sure to specify this to the seed dealer when ordering.
- 3) The seed is to be certified weed free.

Appendix B

IA Revegetation Areas Soil Characterization Data From Summer 2003

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Industrial Area Revegetation Plan Soil Sampling

Problem

After remediation activities have been completed in the Industrial Area (IA) for various projects, revegetation of the locations is necessary to prevent soil erosion and to return the areas to a more native state. The seedbed into which seeding will take place consists of the material left after the remediation portion of the project is completed. Soil characterization sampling is being done to characterize soil conditions at revegetation locations to determine whether soil amendments will need to be added for optimal plant growth. For the best revegetation success it is important to know if any soil parameters are outside the range required for optimal plant growth.

Identification of Decisions

The characterization sampling and analysis question to be evaluated is:

1. Do the selected soil parameters at the revegetation locations fall within the range specified for optimal plant growth and revegetation success (Savage and Savage 2003)?

Inputs to the Decisions

Information needed to evaluate the confirmation sampling and analysis question are as follows:

1. List of soil parameters to measure and the range of optimal values for each parameter. See Table 1 below.

Table 1. Soil Parameters To Be Measured

pH
Electrical Conductivity (EC; mmhos/cm)
Sodium Adsorption Ratio (SAR)
Saturation (%)
Boron (ppm)
Selenium (ppm)
Textural Class
Coarse Fragments
Nitrogen (NO₃)
 < 1% organic matter
 1-2% organic matter
 >2% organic matter
Phosphorus
Potassium

2. Soil sampling locations.
3. Sampling results.

Study Boundaries

Samples will be collected from each of three broad categories identified for different seed mixes in the IA: flat areas, hillside slope areas, and drainage bottom areas. Figure 1 shows the general locations where soil samples will be taken initially. As additional areas are prepared for revegetation, additional samples may be collected.

For the flat area category (representing the pediment top in the IA), the solar ponds and the building footprints for T893A, T893B, and 125 have been selected for initial sampling. A total of three composite samples will be taken from these areas—one from the solar ponds, one from the T893A and T893B buildings, and one from Building 125. For the hillside area category, three samples will be taken—one from the north-facing hillside where Buildings 993 and 987 were located, one from the old Perimeter Intrusion Detection Assessment System (PIDAS) area west of the waste water treatment plan that was regraded as part of the solar pond project, and a one from a small disturbance along the north access road where a fence corner was removed. Table 2 summarizes the locations and number of samples to be taken. As additional hillside areas in the IA are prepared for revegetation, additional sampling will be conducted. For the drainage bottom categories, no samples will be taken currently since no areas in this category have been disturbed. Sampling for these areas will be conducted when these areas become ready for revegetation.

Table 2. Soil Sampling Locations and Number of Samples

Location	# of Samples	# Subsamples for Compositing
Solar Ponds	1	15
T893A and T893B	1	10
Building 125	1	10
Fence corner	1	4
Old PIDAS	1	10
Buildings 993 and 987 area	1	10
Total # Samples	6	

The soil samples will be collected and shipped to an off-site soil laboratory for analysis. A composite sample of the top 18 inches of plant growth medium from representative locations within the revegetation parcels will be collected for each sample. Specific locations for representative subsamples within the revegetation parcels will be subjectively selected and flagged in the field by site ecologists. Randomization of subsamples is not required so that the apparent visual variability can be taken into account. Samples will be taken from areas recently revegetated. The subsamples from each location will be composited into one sample for each area to be sent to the laboratory for analysis. Site procedures and policies will be followed for the collection and shipping of samples. Soil volumes collected will be consistent with the amounts needed to conduct the laboratory analyses. Table 1 lists the soil parameters that are to be measured.

Results will be provided in hardcopy and electronic form to the K-H Ecology Group.

Decision Rules

The sampling and analysis decision rules that describe how the data will be evaluated are listed below.

1. Laboratory results for each composite sample will be compared to the range of suggested optimal values the CDMG column in Table 1 from Savage and Savage (2003). If any of the values for the parameters measured fall outside the optimal values listed in Table 1 evaluation of potential corrective actions will be taken.

Tolerable Limits on Decision Errors

The composite sampling method will provide a good overall measure of the soil conditions present at the revegetation locations. No statistical analysis is required or necessary for these data. A simple descriptive comparison of laboratory results to the values in Table 1 will be sufficient for the level of accuracy and scope required.

Optimization of Plan Design

Optimization of this sampling design does not need to meet rigorous statistical analysis. It is a simple descriptive comparison of laboratory results to the values in Table 1 in Savage and Savage (2003) will be sufficient for the level of accuracy and scope required.

References

Savage and Savage, 2003. *Rocky Flats Environmental Technology Site Industrial Area Revegetation Plan*, Final Draft, Prepared by Savage and Savage, Inc., Louisville, Colorado, for Kaiser-Hill Company, LLC., January.

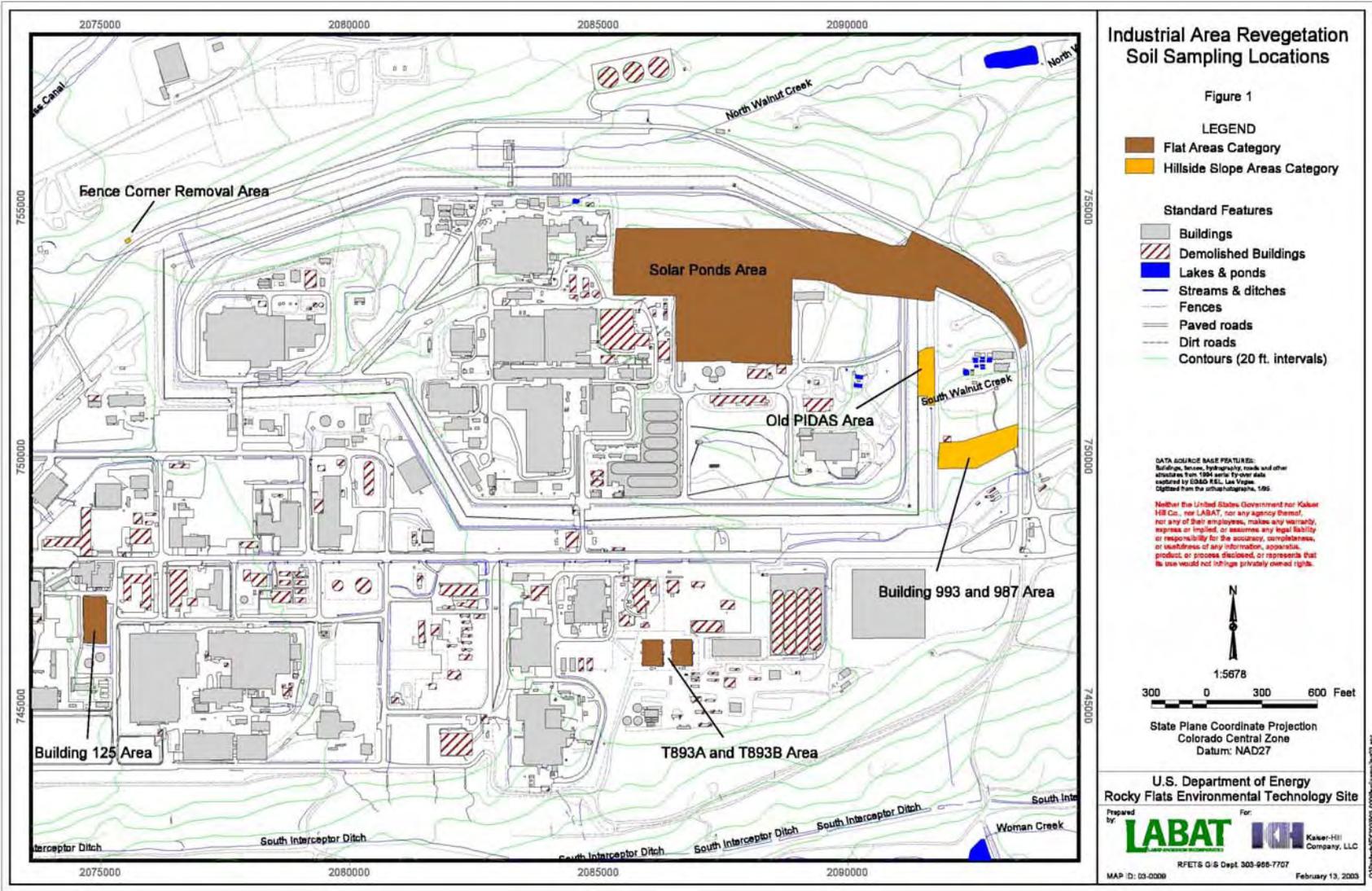


Table 1. Rocky Flats Industrial Area Revegetation Soil Sampling Summary

Soil Variable	Mesic		Xeric		CDMG*
	Mean	SD	Mean	SD	
Nitrogen (ppm)	4.27	2.72	5.93	4.06	<6 ppm
% Organic Matter	1.66	0.43	1.39	0.45	1-2
Phosphorus (ppm)	4.67	2.31	4.33	2.31	<3 ppm
Potassium (exchan; ppm))	170.00	60.00	126.67	15.28	<60 ppm
pH	7.43	0.29	8.23	1.01	<5.5, >8.8
Electrical Conductivity (mmhos/cm)	0.58	0.13	1.55	0.96	>8.0
SAR	1.17	0.72	1.50	1.11	>10
% Saturation	38.77	1.35	32.73	8.24	<25, >80
Boron (ppm)	0.07	0.02	0.25	0.28	>5 ppm, (pH >8.0)
Selenium (ppm)	0.00	0.00	0.00	0.00	>2.0, (pH >8.0)
Soil Texture	Loam		Loam, sandy loam		clay, siltclay, sand

n = 3 for each habtype

* CDMG = Colorado Division of Minerals and Geology unpublished guidance document (Savage and Savage, 2003)

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Appendix C

**Qualitative Revegetation
Evaluation Form**

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Qualitative Revegetation Evaluation Form

Form # _____

Date _____

Observer(s) _____

Location ID _____

Photographs taken today? Y N

Are seeded plant species present? Y N

Which seeded species are present? How abundant are the seeded species? Estimate overall cover of each seeded species using the following cover class system (1 = <5%; 2 = 6-25%; 3 = 26-50%; 4 = 51-75%; 5 = >75%). Comments on their condition.

Any evidence of nutrient or water deficiencies? If so, describe. _____

Are noxious weeds present? Y N

If yes, what species of noxious weeds are present? How abundant are the noxious weed species? Estimate overall cover of each noxious species using the following cover class system (1 = <5%; 2 = 6-25%; 3 = 26-50%; 4 = 51-75%; 5 = >75%).

Are other weedy species present? Y N

If so, what species and how abundant are they? Estimate overall cover of each weedy species using the following cover class system (1 = <5%; 2 = 6-25%; 3 = 26-50%; 4 = 51-75%; 5 = >75%).

Total Vegetation Cover (Estimate to nearest percent) _____



Rocky Flats, Colorado, Site Vegetation Management Plan



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**U.S. Department of Energy
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**Rocky Flats, Colorado, Site
Vegetation Management Plan**

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1.0 Introduction

The Rocky Flats Site (Rocky Flats) is under the jurisdiction of the U.S. Department of Energy (DOE) Office of Legacy Management (LM). S.M. Stoller Corporation, the DOE-LM Legacy Management Support contractor, conducts long-term surveillance and maintenance activities at Rocky Flats. Vegetation management activities are conducted as part of the surveillance and maintenance activities, which include activities conducted pursuant to the Rocky Flats Legacy Management Agreement. This agreement established the regulatory framework to implement the final response action selected and approved in the Rocky Flats Corrective Action Decision/Record of Decision under the Comprehensive Environmental Response, Compensation, and Liability Act; the Resource Conservation and recovery Act; and the Colorado Hazardous Waste Act to ensure that the response action remains protective of human health and the environment.

The vegetation management goal at Rocky Flats is to exercise good stewardship for preservation of the natural resources while complying with applicable federal, state, and local regulations. The program incorporates an integrated ecosystem approach to natural resource management utilizing as many management techniques as possible. This Vegetation Management Plan uses an integrated framework of techniques to control excessive vegetation that can increase wildfire hazards, to control present and future infestations of noxious weeds, and to enhance the native plant communities and wildlife habitat.

Some vegetation management actions are regulated by law, but various levels of control are required depending upon the species to be controlled. Other vegetation management actions serve dual purposes of controlling the spread of invasive weeds and reducing the accumulation of fuels that can carry uncontrolled wildfires across Rocky Flats and into nearby areas. Invasions of nonnative vegetation at Rocky Flats are degrading existing habitat quality in the undisturbed areas and are reducing the coverage of the site's high-value vegetation communities. The lack of grazing and long-term suppression of wildfires, combined with the past prohibition of prescribed burning at Rocky Flats (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.

By controlling excessive weed growth and mowing vegetation, fuel accumulation is reduced, and the sitewide noxious weed control effort is enhanced. These vegetation control efforts also reduce the secondary seed source from noxious weeds that grow in disturbed areas of Rocky Flats.

Although no single weed control strategy will completely remedy the noxious weed problems at Rocky Flats, 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 (Table 1). 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.

Weed problems on surrounding lands are also of concern. Without great expense, it is difficult or impossible in the long term to maintain a weed-free island surrounded by weed-covered lands. Establishing cooperative agreements and working with surrounding landowners is necessary to

address more regional weed issues that cannot be effectively controlled solely by individual landowners. It is recommended that DOE-LM remain in contact with surrounding landowners and suggest working together to help control noxious weeds on DOE-LM land and adjacent properties. When observations of noxious weeds warrant, DOE-LM should contact landowners of adjacent properties, report observations, and request that actions be taken to address problem areas.

Table 1. Weed Control Methods for Rocky Flats

Treatment Option	Control Method
Administrative controls	Administrative policies and procedures
Cultural controls	Revegetation requirements
Physical or mechanical controls	Mowing
	Prescribed burns
	Hand-pulling
Biological controls	Biological control insects
	Grazing
	Interseeding
Chemical controls	Herbicide applications

2.0 Weed Control Strategy

2.1 Weed Control Program

Vegetation management at Rocky Flats includes integration of the noxious weed control efforts with other means of vegetation control necessary for health and safety, resource conservation, and wildfire control. Most noxious weeds invade ecosystems because of disturbance, degradation, or changes in the natural system that alter resource availability, thus making the plant community more prone to invasions (Davis et al. 2000). Long-term control of these noxious weeds will ultimately depend on restoring the natural processes (e.g., 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.

2.1.1 Weed Control Planning

A total of 30 species of Colorado state-listed noxious weeds are known to occur or have historically occurred at Rocky Flats (Table 2). However, not all species are slated for control. Many of the state-listed species are only found at isolated disturbed locations and are not presently having an impact on the native plant communities or revegetation locations at Rocky Flats. Many of these species are also not aggressive, invasive species (under current conditions at the site) and are therefore not currently high-priority species for control.

At Rocky Flats, the species with the greatest potential to affect the native plant communities and greatest difficulty of control are annual rye, Canada thistle, dalmatian toadflax, Dame's rocket, diffuse knapweed, Russian knapweed, Scotch thistle, tamarisk, jointed goatgrass, and yellow starthistle. (**Note:** the list is in alphabetical order. Yellow starthistle was found once and pulled and has never been observed again). The aggressive nature of these species and their ability to dominate and degrade the native plant communities makes control especially important.

Table 2. Noxious Weeds Occurring at the Rocky Flats Site

Common Name	Scientific Name	CO Noxious Weed List ^a	CO List ^b (A, B, or C)	CO State Management Plan Goal ^c	JeffCo ^d Noxious Weed List/ Control	Rocky Flats Weed Problem ^e
Annual rye	<i>Secale cereale</i>	N	NA	NA		Y
Bird's-foot trefoil	<i>Lotus corniculatus</i>	N	NA	NA		Y
Bouncingbet	<i>Saponaria officinalis</i>	Y	B	NA		Y
Bull thistle	<i>Cirsium vulgare</i>	Y	B	NA		Y
Canada thistle	<i>Cirsium arvense</i>	Y	B	NA	Y/Control	Y
Chicory	<i>Cichorium intybus</i>	Y	C	NA		Y
Common burdock	<i>Arctium minus</i>	Y	C	NA		N
Common mullein	<i>Verbascum thapsus</i>	Y	C	NA		Y
Common St. Johnswort	<i>Hypericum perforatum</i>	Y	C	NA		Y
Crown vetch	<i>Coronilla varia</i>	N	NA	NA		Y
Dalmatian toadflax	<i>Linaria dalmatica</i>	Y	B	NA		Y
Dame's rocket	<i>Hesperis matronalis</i>	Y	B	NA		Y
Diffuse knapweed	<i>Centaurea diffusa</i>	Y	B	Suppression	Y/Control	Y
Downy brome	<i>Bromus tectorum</i>	Y	C	NA		Y
Field bindweed	<i>Convolvulus arvensis</i>	Y	C	NA		Y
Hoary cress	<i>Cardaria draba</i>	Y	B	NA	Y/Control	Y
Houndstongue	<i>Cynoglossum officinale</i>	Y	B	NA	Y/ Control	Y
Jointed goatgrass	<i>Aegilops cylindrica</i>	Y	C	NA		Y
Leafy spurge	<i>Euphorbia uralensis</i>	Y	B	NA	Y/Control	Y
Lens-padded hoary cress	<i>Cardaria chalepensis</i>	N	NA	NA		Y
Mayweed chamomile	<i>Anthemis cotula</i>	Y	B	NA		N
Moth mullein	<i>Verbascum blattaria</i>	Y	B	NA		N
Musk thistle	<i>Carduus nutans</i>	Y	B	NA	Y/Control	Y
Oxeye daisy ^f	<i>Chrysanthemum leucanthemum</i>	Y	B	Eradication by 2007	Y/Eradication	Y
Perennial Sowthistle	<i>Sonchus arvensis</i>	Y	C	NA		N
Poison Hemlock	<i>Conium maculatum</i>	Y	C	NA		N
Quackgrass	<i>Elytrigia repens</i>	Y	B	NA		N
Redstem Filaree	<i>Erodium cicutarium</i>	Y	B	NA		N
Russian olive	<i>Elaeagnus angustifolia</i>	Y	B	NA		Y

Table 2 (continued). Noxious Weeds Occurring at the Rocky Flats Site

Common Name	Scientific Name	CO Noxious Weed List ^a	CO List ^b (A, B, or C)	CO State Management Plan Goal ^c	JeffCo ^d Noxious Weed List/Control	Rocky Flats Weed Problem ^e
Saltcedar	<i>Tamarix ramosissima</i>	Y	B	NA	Y/Eradication	Y
Scotch thistle	<i>Onopordum acanthium</i>	Y	B	NA	Y/Control	Y
Yellow starthistle ^g	<i>Centaurea solstitialis</i>	Y	A	Eradication	Y/Eradication	Y

^aNoxious weeds as listed by the State of Colorado Noxious Weed Act (CNWA). Rules updated in 2005 (Title 8 Code of Colorado Regulations [CCR] Part 1203-19), 2006 (8 CCR 1206-2), and 2007 (8 CCR 1206-2).

^bNoxious weeds in Colorado are ranked on different lists—A, B, or C—depending on how problematic they are. The lists are provided in the CNWA and are typically updated annually.

^cThis category states what the State Weed Management Plan (SWMP) goal is for this species in the part of Jefferson County where Rocky Flats is located. NA means there either is no SWMP for this species or it is not applicable to the site in Jefferson County. The SWMPs are outlined in the CNWA.

^dRocky Flats is in Jefferson County (JeffCo), Colorado.

^eThis category is used for species not on the CNWA lists, but that are problematic at the site.

^fThis species was last observed on the site in the 1990s. It has not been observed since then.

^gThis species was eradicated from the site in the past and has never been seen since.

Plant nomenclature follows that of GPFA (1986), Weber (1976), and Weber (1990), in that order of determination.

3.0 Vegetation Management

Table 1 lists the weed and vegetation control methods currently in use at Rocky Flats. The weed control measures in this section are listed in the order they should be considered from an integrated weed management viewpoint, starting with the least toxic, nonchemical measures.

3.1 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 Rocky Flats. The preventive actions incorporated into this Vegetation Management Plan are listed in Table 3.

Table 3. Preventive Actions for Weed Control

Type of Action	Explanation
Weed-free materials	All revegetation projects at the site will use weed-free seed and mulch sources. Seed mixes will be composed of native species appropriate for the locations.
Approved seed mixtures only	All seed mixtures for site revegetation projects must be approved by the Rocky Flats ecologist. Use of native species will be required in all cases, except when specific written prior approval has been obtained from the Rocky Flats ecologist.
Sterile mulch	All straw and other mulch materials used on the site will be weed-free.
Follow-up weed control	Weed control and reseeding should be a part of all revegetation efforts for a minimum of 2 years after their initiation.
Immediate eradication of new species	Any new noxious weed species found on the site will be controlled immediately to reduce their populations and prevent their future increase.

Revegetated areas will be monitored to evaluate the success of the revegetation and monitoring results will be used to determine if future management actions are needed. When warranted,

weed control and reseeded of these areas will be conducted to establish the desired native plant species.

The following graminoid species shall not be used in seed mixtures for 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*

The use of a sterile hybrid of wheat known as ReGreen is allowed under certain conditions at Rocky Flats; however, prior approval from the Rocky Flats ecologist is required.

3.2 Physical or Mechanical Control

3.2.1 Mowing

Some areas along Rocky Flats roads may 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 the roads and can help reduce collisions between wildlife and cars; mowing also provides better visibility at intersections. Reduction of roadside vegetation height also reduces the available fuel at the margins of the firebreak and gravel roads, functionally enhancing their ability to impede the spread of wildfires and aiding firefighters in extinguishing fires in these lower-fuel buffer areas. Mowing and weed-whacking may also be conducted in native grassland or revegetation areas as needed to control weeds when this method is effective.

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 or prescribed burning of such debris out of fences in situ. Fuel reduction shall occur as needed. Vegetation debris *shall not* be tossed loose or disposed of *anywhere* except in appropriate waste containers destined for off-site landfill disposal. Prescribed burns, if permitted on site, will require an approved, prescribed burn plan and conform to policies outlined in DOE Order 450.1A, *Environmental Protection Program*.

3.2.2 Prescribed Burning

The use of prescribed burns on Rocky Flats 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 will take the place of the target species. 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 process of fire is essential for prairie health. Prescribed burns, if permitted on Rocky Flats, will require an approved prescribed burn plan and must conform to policies outlined in DOE Order 450.1A.

3.2.3 Hand Pulling/Control

Hand pulling/control may be used on small infestations where practical and when pulling has been shown to be an effective control measure. If weed species that are being hand pulled have already set seed, then they shall be disposed of in appropriate waste containers destined for off-site landfill disposal.

3.3 Biological Controls

3.3.1 Biological Control Insects

Biological control agents (i.e., insects) are being used at Rocky Flats to assist in the control of musk thistle, bull 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 and U.S. Fish and Wildlife Service (USFWS) through an agreement with Texas A&M University to target specific weed infestations. Table 4 lists the biological controls that have been released at Rocky Flats.

It is recommended that cooperative efforts with these groups continue with regard to the release of biological control agents for weed control at Rocky Flats. 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 is recommended to keep abreast of any new findings and techniques.

Table 4. Biological Control Agents Released at Rocky Flats

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.
	<i>Cyphocleonus achates</i>	A root-boring weevil.
Musk thistle (<i>Carduus nutans</i>)	<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.
Bull thistle (<i>Cirsium vulgare</i>)	<i>Urophora stylata</i>	A gall fly that attacks flower heads and reduces seed set.
Canada thistle (<i>Cirsium arvense</i>)	<i>Urophora carduii</i>	A gall fly.
	<i>Cassida rubiginosa</i>	A defoliating beetle.
St. Johnswort (<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.

3.3.2 Grazing

Similar to the use of prescribed burning, grazing 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. As stated earlier, weed control strategies that focus solely on the weed species and not on enhancing conditions for desired native species will provide only limited success. Grazing is a management tool that has not been and is currently not allowed at Rocky Flats. Grazing may be proposed to become part of the management toolbox at Rocky Flats in the future. The USFWS may graze cattle on the Rocky Flats National Wildlife Refuge at some point in the future.

3.3.3 Interseeding

Interseeding is defined as seeding additional species into an already established plant community. With respect to weed control, this may be done to help establish new desirable vegetation more quickly so that it can fill the voids and empty spaces created by the removal of weed species. The use of native desirable species will accomplish this purpose at the site when it is conducted.

3.4 Chemical Controls

Table 5 lists the herbicides approved for use on the site. Herbicides *not* on the current list *may not* be used until they are approved pursuant to the Rocky Flats Chemical Management Plan.

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 on site by unlicensed applicators. Empty containers may not be washed on site, and used containers must be removed by the applicator at the end of the work shift. Disposal of restricted-use herbicides 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, 1996a, 1996b, 1997a, 1997b, 2001, CNAP 2000).

Table 5. Approved Herbicides for Use at Rocky Flats (Last Updated 5/5/08)

<u>Herbicide Name</u>	<u>Active Ingredient</u>
Aquatic 2,4-D	2,4-Dichlorophenoxyacetic acid
Banvel	Dicamba
Clarity	Diglycolamine
Escort	Metsulfuron
Garlon 3A	Triclopyr
Habitat	Imazapyr
Karmex	Diuron
Milestone	Aminopyralid
Navigate	2,4-Dichlorophenoxyacetic acid
Oust	Sulfometuron
Plateau	Imazapic
Redeem	Chlopyrilid + trichlopyr amine
Rodeo	Glyphosphate
Roundup	Glyphosphate
Telar	Chlorsulfuron
Transline	Clopyralid
Tordon 22K	Picloram
Vanquish	Diglycolamine

The following compounds were removed from the approved list in 2007 based on recommendations from the herbicide subcontractor: Arsenal (Imazapyr), Barricade (Prodiamine), Buctril (Bromoxyni), Gallery (Isoxaben), Sahara (Diuron; Imazapyr), and Surflan (Oryzalin). These compounds were used prior to and throughout site closure but have limited use given the current resource management objectives. These compounds could be added back to the list if they were needed.

Chemical controls have been used effectively in the past at Rocky Flats to control various noxious weed species. Proposed herbicide application locations will be developed on the basis of noxious-weed-mapping results and field observations.

3.5 Vegetation Management and the Preble's Mouse

The Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is a listed threatened species under the Endangered Species Act. The USFWS must be consulted before weed control activities are conducted in Preble's mouse habitat at Rocky Flats. In 2006, DOE-LM received concurrence to conduct weed control activities in Preble's mouse habitat as outlined in the *Biological Evaluation for Weed Control in Preble's Mouse Habitat at the Rocky Flats, Colorado, Site* (DOE 2006; USFWS 2006). In 2007, DOE-LM received concurrence to continue weed control

activities in Prebles' mouse habitat according to the guidance outlined in the *Amendment to the Biological Evaluation for Weed Control in Preble's Mouse Habitat at the Rocky Flats, Colorado, Site* (DOE 2007, USFWS 2007). All weed control activities at the site that take place in Preble's mouse habitat are required to follow the guidance provided in these documents. The USFWS must be consulted before any changes or modifications can be made to the weed control activities as outlined in these documents.

4.0 References

DOE Order 450.1A. *Environmental Protection Program*, June 4, 2008.

Beck, K.G., 1992. *Weed Management for Small Rural Acreage Owners*, Colorado State University Cooperative Extension, No. 3.106, Ft. Collins, Colorado.

Beck, K.G., 1996a. *Russian Knapweed*, Colorado State University Cooperative Extension, No. 3.111, Ft. Collins, Colorado.

Beck, K.G., 1996b. *Canada Thistle*, Colorado State University Cooperative Extension, No. 3.108, Ft. Collins, Colorado.

Beck, K.G. 1997a. *Diffuse and Spotted Knapweed*, Colorado State University Cooperative Extension, No. 3.110, Ft. Collins, Colorado.

Beck, K.G., 1997b. *Musk Thistle*, Colorado State University Cooperative Extension, No. 3.102, Ft. Collins, Colorado.

Beck, K.G., 2001. *Biology and Management of the Toadflaxes*, Colorado State University Cooperative Extension, No. 3.114, Ft. Collins, Colorado.

CNAP, 2000. *Creating an Integrated Weed Management Plan: A Handbook for Owners and Managers of Lands with Natural Value*, Caring for the Land Series, Vol. 4, Colorado Natural Areas Program, State of Colorado, Denver, March.

Davis, M.A., J.P. Grime, and K. Thompson, 2000. "Fluctuating resources in plant communities: a general theory of invisibility," *Journal of Ecology*, 88: 528–534.

DOE (U.S. Department of Energy), 2006. *Biological Evaluation for Weed Control in Preble's Mouse Habitat at the Rocky Flats, Colorado, Site*, Office of Legacy Management, Grand Junction, Colorado, April.

DOE (U.S. Department of Energy), 2007. *Amendment to the Biological Evaluation for Weed Control in Preble's Mouse Habitat at the Rocky Flats, Colorado, Site*, Office of Legacy Management, Grand Junction, Colorado, February.

GPFA, 1986. *Flora of the Great Plains*, 2nd printing with 1991 supplement, Great Plains Flora Association, University Press of Kansas, Lawrence, Kansas.

USFWS (U.S. Fish and Wildlife Service), 2006. Concurrence letter for the *Biological Evaluation for Weed Control in Preble's Mouse Habitat at the Rocky Flats, Colorado, Site*, USFWS Letter ES/CO: T&E/Rocky Flats MS 65412 LK, Ecological Services, Colorado Field Office, Lakewood, Colorado, April 25.

USFWS (U.S. Fish and Wildlife Service), 2007. Concurrence letter for the *Amendment to the Biological Evaluation for Weed Control in Preble's Mouse Habitat at the Rocky Flats, Colorado, Site*, USFWS Letter ES/CO: T&E/Rocky Flats TAILS: 65412-2006-I-0031, Ecological Services, Colorado Field Office, Lakewood, Colorado, April 4.

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

Weber, W.A., 1990. *Colorado flora: Eastern Slope*, University Press of Colorado, Niwot, Colorado.



Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan

June 2006



U.S. Department
of Energy

Office of Legacy Management

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Wetland Mitigation Monitoring and Management Plan

1.1 Purpose

The Rocky Flats Wetland Mitigation Monitoring and Management Plan has been developed to outline a strategy to determine whether wetland mitigation efforts at Rocky Flats have successfully mitigated for wetland impacts resulting from cleanup and closure activities.

1.2 Wetland Monitoring Plan

The following wetland monitoring methodology is provided as guidance to evaluate the success of the restored or created mitigation wetlands at Rocky Flats. Approximately 7.7 acres of wetlands were affected by site cleanup and closure activities at Rocky Flats. The overall performance objective is to re-establish a minimum of 7.7 acres of wetlands to mitigate and replace those that were affected by closure activities. Additional wetlands that develop on-site (above and beyond the mitigation needed) are an added bonus for water quality and wildlife habitat at the Rocky Flats Site (Site). Both in-situ wetland re-establishment and additional creation of wetlands was conducted at the Site to mitigate for these impacts. Current estimates suggest that approximately 10 to 11 acres of wetlands may develop as a result of land configuration activities at the Site. Rather than evaluate wetland mitigation on a project-by-project basis, a site-wide approach is being taken because of the limitations faced at various project locations. Additionally, from an ecological and wildlife standpoint, the issue of specific project locations is inconsequential compared to the overall quality and abundance of wetlands at the Site.

Interim monitoring during the first four years after planting will provide information for the management and establishment of these wetlands (i.e., vegetation establishment, reseeding, weed control). In the fifth year after planting, the mitigation wetlands will be delineated following the accepted U.S. Army Corps of Engineers wetland delineation manual methods (USACOE 1987). The total number of acres of created wetland types will be determined and compared to pre-disturbance wetland amounts. The goal is that at a minimum, the amount of created/re-established wetlands will equal that impacted by closure activities. If the total amount of wetlands re-established in-situ or created at Rocky Flats exceeds the number of wetland acres impacted by closure activities, the additional wetlands on-site will provide an added bonus for water quality and wildlife habitat at the Rocky Flats National Wildlife Refuge. Monitoring will be conducted by the U.S. Department of Energy or its designee.

During years one through four, the interim monitoring/management issues will revolve around the successful establishment of wetland vegetation and control of noxious weeds. (NOTE: Noxious/invasive weeds are defined as those listed by the State of Colorado on the current State Noxious Weed List as provided by the Colorado Noxious Weed Act.) Therefore, the following questions/issues will be evaluated to provide useful management information:

- What wetland types are present (e.g., open water, emergent, scrub-shrub, forested)?
- Estimates of the percent of the ground that is vegetated and the percent of the vegetated area that contains wetland species.

- What are the dominant plant species present at each wetland in each wetland type? What is the estimated cover of each species?
- List of the prevalent plant species.
- Are the desired wetland species establishing? Are there any issues regarding the establishment of the desired wetland species?
- Are the hydrologic conditions appropriate for successful establishment and sustainability of the wetland?
- Are noxious weeds present in the wetlands? If so, what species are present? Estimate the overall abundance of each noxious weed species in the wetland.
- What specific management actions are suggested, if any? What management actions have been conducted, if any?

As needed, photographs, maps, or other diagrams may be used to illustrate annual conditions of the wetlands. The interim wetland monitoring methodology and schedule is listed in [Table 1](#).

Table 1. Wetland Monitoring Methodology and Schedule

Methodology	Schedule
Photographs, Maps, Diagrams (as needed)	Annually
Interim Qualitative Wetland Assessments	Annually
Noxious Weed Evaluations	Monthly (June–August)
Wetland Delineation and Mapping	5 years after project completion

During years one through four, interim qualitative wetland assessments will be made to evaluate the successful establishment of desirable wetland species, noxious weed problems, and hydrologic conditions at selected wetland mitigation locations at Rocky Flats. These assessments will be conducted annually at the height of the growing season. Photographs will be taken from the same locations annually to document the status of the wetland. Semi-quantitative methods (e.g., weed mapping, vegetation mapping, quadrats, etc.) may be used to collect information during the initial years of wetland development. Wetland acreage calculations will be made annually to evaluate the progress of wetland development. In addition to the annual interim qualitative assessments, monthly noxious weed evaluations will be conducted at each of the wetland mitigation areas from June through August each year. A monthly weed evaluation will allow early detection of potential noxious weed problems that will help to control and manage noxious weed issues.

During the fifth year after project completion, a wetland delineation and mapping effort will be conducted to determine the type and extent of the wetlands. Wetland delineations typically involve characterizing and determining whether hydrophytic vegetation, hydric soils, and wetland hydrology exist at a location. The wetland delineation method will follow that approved and used by the regulatory agencies. The current approved wetland delineation methods are those found in the *1987 U.S. Army Corps of Engineers Wetlands Delineation Manual* on-line edition (Technical Report Y-87-1; USACOE 1987).

An annual report will be prepared by March 1 of the following calendar year to summarize the data collected during the previous field season. The report will include summaries of vegetation

data collected, noxious weed issues, management issues, and what, if any, management or corrective actions were taken during the previous calendar year or are planned for the future. The annual report for the fifth year will contain the wetland delineation data and will serve as the final wetland mitigation report (unless further monitoring is required by the regulatory agencies).

1.3 Wetland Maintenance/Management Plan

Maintenance and management of restored wetlands is important for long-term success and sustainability of wetland areas and therefore the effective mitigation of wetland impacts. The following maintenance/management guidance is provided to improve the chances of success for restored and created wetlands at Rocky Flats. If monitoring data show maintenance or corrective actions are necessary, corrective actions will be taken as soon as appropriate and/or possible. The maintenance/management plan includes evaluations on the following:

- Hydrologic conditions
- Inspection of water control structures (where applicable)
- Plant replacement/reseeding
- Weed control
- Erosion control

1.4 Hydrologic Conditions

Water availability and timing of water is critical to wetland establishment and sustainability. The key issues with hydrology are to make sure water is present in the wetlands at the appropriate depths and during the times it is needed for growth of the desired species. The Rocky Flats Pond Operations Plan (RFPOP) addresses hydrologic conditions with respect to pond management and operations. It should be recognized however, that the primary responsibility and objective of the RFPOP is to ensure water quality and dam safety. Therefore, the issue of hydrologic conditions for wetlands is of secondary nature at these locations.

1.4.1 Inspection of Water Control Structures

The inspections of the ponds and water control structures associated with the ponds are addressed in the RFPOP.

1.4.2 Plant Replacement/Reseeding

Often due to a variety of reasons, seedings and plantings of wetland species may fail. Based on the qualitative wetland assessments, the success of the revegetation will be evaluated. Professional judgment based on the results of the assessments will be used to determine whether areas should be replanted/reseeded.

1.4.3 Weed Control

Uncontrolled noxious weeds have the potential to choke out desired vegetation. Additionally, the Colorado Noxious Weed Act requires landowners to control noxious weeds on their properties. Based on the results of the qualitative wetland assessments and weed evaluations, appropriate

weed control efforts will be developed and implemented using an integrated weed management approach, which utilizes administrative, mechanical, biological, and chemical control methods as needed. The vegetation management actions (i.e., weed control) will be developed as part of the larger site-wide vegetation management plans. Herbicide applications will be based on professional judgment in consultation with a licensed commercial applicator following the manufacturer's label instructions and recommendations. Noxious weed species cover must be less than 10 percent of the total wetland area in the third growing season in the wetland mitigation areas.

1.4.4 Erosion Control

Erosion controls are important to protect water quality, prevent excessive sedimentation in the wetlands, and protect the surrounding upland areas as revegetation progresses. Evaluation of potential erosion/sedimentation issues should be made periodically and after storm events to evaluate any potential problems and ensure the continued proper functioning of erosion control structures. Maintenance and repairs to erosion control materials and structures should be made as needed. The post-closure Erosion Control Management System for the Rocky Flats Site (under development) addresses erosion control inspection and maintenance activities at the Site.

1.5 References

USACOE, 1987. *Corps of Engineers Wetlands Delineation Manual. Wetlands Research Program Technical Report Y-87-1* (on-line edition), U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi, January.

Appendix A

Rocky Flats Wetland Impacts Spreadsheet

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USACOE and EPA Final Jurisdictional Wetland Impacts and Projected Mitigation Acreage Summary for RFETS
10/17/2005

Figure ID Number	Project Description	Agency	Estimated Temporary Acres Impacted	Estimated Permanent Acres Impacted	Estimated In-Situ Restored Acres	Estimated Mitigation Needed Beyond In-Situ	Estimated Additional Wetland Acres Created	Actual Temporary Acres Impacted *	Actual Permanent Acres Impacted +	Projected In-Situ Wetland Acres Restored @	Projected Additional Wetland Acres Created ^	Comments	GIS File Locations
1	East Shooting Range Project	EPA	0.022	0.000	0.022	0.000	0.000	0.017	0.000	0.017	0.000	Wetlands issues submitted under modifications to IM/IRA.	* @ = 05-0008: ESR wetland calcs.xls
2	Original Landfill Project	EPA	0.000	1.240	0.000	1.240	0.000	0.086	1.171	0.086	0.139	Wetland plan submitted with IM/IRA document.	* + @ ^ = 06-0002: OLF wetland impact calcs.xls
3	Present Landfill Project	EPA	3.045	0.010	3.045	0.010	0.000	0.800	2.131	0.800	0.000	Wetland plan submitted with IM/IRA. Because of outlet works height will now be the maximum height the water can reach, the wetland cannot re-establish to original levels. Therefore there is a loss because of less open water.	* + = 05-0030: PLF wetland impact calcs 062205.xls @ = 05-0041: KHDOE wetland acreage.xls
4	B-Pond Remediation Project	EPA	2.600	0.000	2.600	0.000	0.000	1.874	0.361	1.874	0.000	Wetlands addressed in RSOP notification. Wetland design has resulted in smaller emergent wetlands with less open water.	* + = 05-0031: Bponds wetland impact calcs.xls @ = 05-0041: KHDOE wetland acreages.xls
EPA Subtotal			5.667	1.250	5.667	1.250	0.000	2.777	3.663	2.777	0.139		
5	C-1 Pond	USACOE	0.400	0.000	0.000	0.000	0.000	0.249	0.002	0.249	0.011		* + @ ^ = 05-0017: C-1 Pond wetland impact calcs.xls
6	C-2 Pond	USACOE	0.500	0.000	0.500	0.000	0.000	0.500	0.000	0.500	0.000	All disturbance on pond bottom, so assumed will return.	This value was an initial eyeball estimate because the area was all on the pond bottom and is assumed to return. No GIS data was used for the calcs.
7	Road North of B131	USACOE	0.050	0.000	0.050	0.000	0.030	0.039	0.010	0.039	0.036	Road area assumed to become wetland.	* + @ ^ = 06-0001: B131 wetland impact calcs.xls
8	Wetland West of Parking Area North of B771 (FC2/FC3 Confluence)	USACOE	0.000	0.120	0.000	0.120	1.310	0.180	0.000	0.180	0.106	Wetland area now larger than originally because final outlet is higher than previously.	* + @ ^ = 05-0027: fc2 3 wetland calcs.xls
9	Functional Channel 1 (includes North Access Road NW of B371)	USACOE	0.100	0.000	0.100	0.000	1.000	0.005	0.026	0.005	8.435	Road area assumed to become wetland. Also some wetland will be present in drainage to be created to the south. Assumed most of bottom of FC#1 will be wetland.	* + @ ^ = 06-0001: B371NAR wetland impact calcs.xls
10	Functional Channel 2	USACOE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.085	Acreage created includes only the FC#2 constructed wetland area. Willow area above it not included at this time.	^ = 05-0027: functional channel wetland creation calcs.xls
11	Functional Channel 3 (Area Near SW093)	USACOE	0.020	0.000	0.020	0.000	0.000	0.000	0.009	0.000	0.098	Acreage created includes only the FC#3 constructed wetland area. Small areas of soil covered riprap counted as wetland since they have water flowing through them or are saturated.	+ = 05-0027: fc3 wetland calcs.xls ^ = 05-0027: functional channel wetland creation calcs.xls
12	Functional Channel 4 (North Access Road Near WWTP (east and west of road), (B991 and Old Pidas Area)	USACOE	0.134	0.117	0.134	0.117	0.000	0.119	0.117	0.119	1.345	Acreage created includes only the FC#4 constructed wetland area. Areas above the created wetland that are not riprapped will have to wait and see if they become wetlands.	* + @ = 05-0003: fc4 wetland impact calcs.xls ^ = 05-0027: functional channel wetland creation calcs.xls
USACOE Subtotal			1.204	0.237	0.804	0.237	2.340	1.092	0.164	1.092	11.116		
Grand Total			6.871	1.487	6.471	1.487	2.340	3.869	3.827	3.869	11.255		

Does not include any impacts to wetlands associated with water depletion due to cessation of wastewater.

Off-Site Ratios will be 1:1 for the following reasons:

1. Off-site wetlands replace comparable wetlands impacted.
2. Off-site wetlands are close to impacted site (~1 1/2 miles).
3. Off-site wetlands are located in the same stream drainage.

Shaded projects have been GPS'ed after project completion and actual values are final as of October 17, 2005. All values rounded at third decimal place. Values shown as 0.000 were beyond three decimal places.

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Appendix B

Annual Site Inspection Checklist

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Annual Site Inspection Check List (See RFLMA Attachment 2, section 5.3.4; 5.3.6 and 5.4.3)

Date: _____

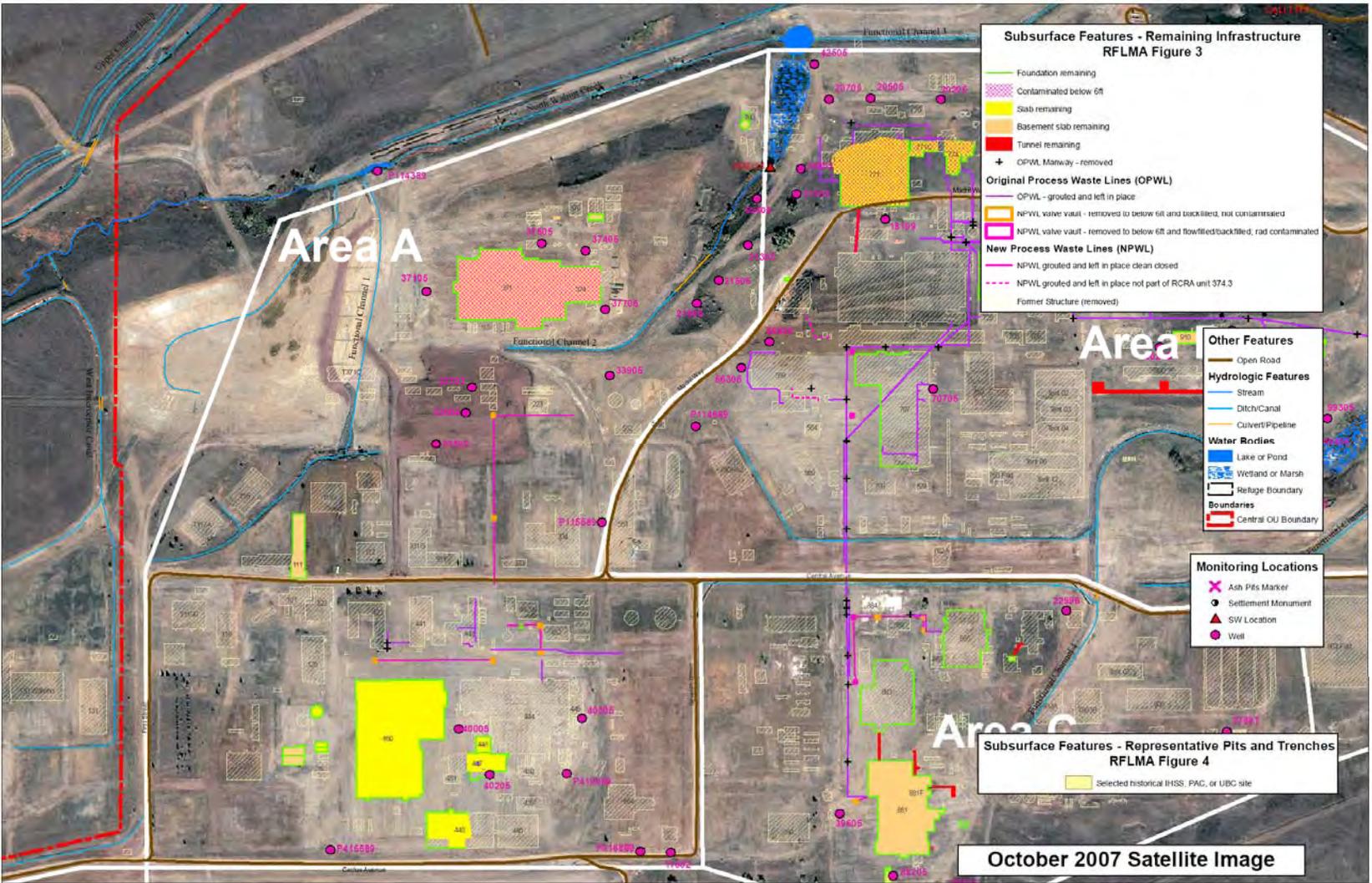
Inspection Area: _____

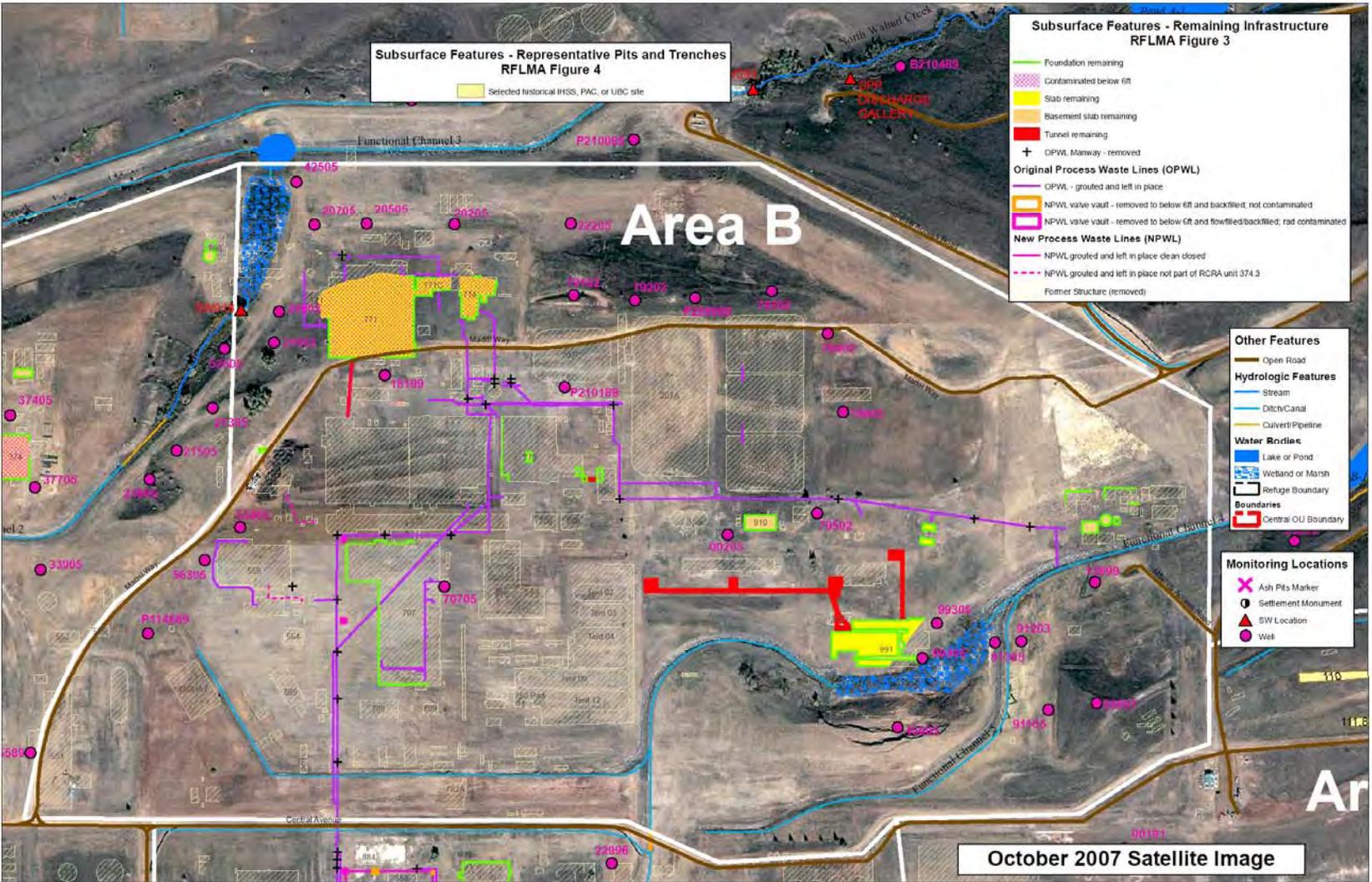
INSPECTION PERFORMED BY (print each name): _____

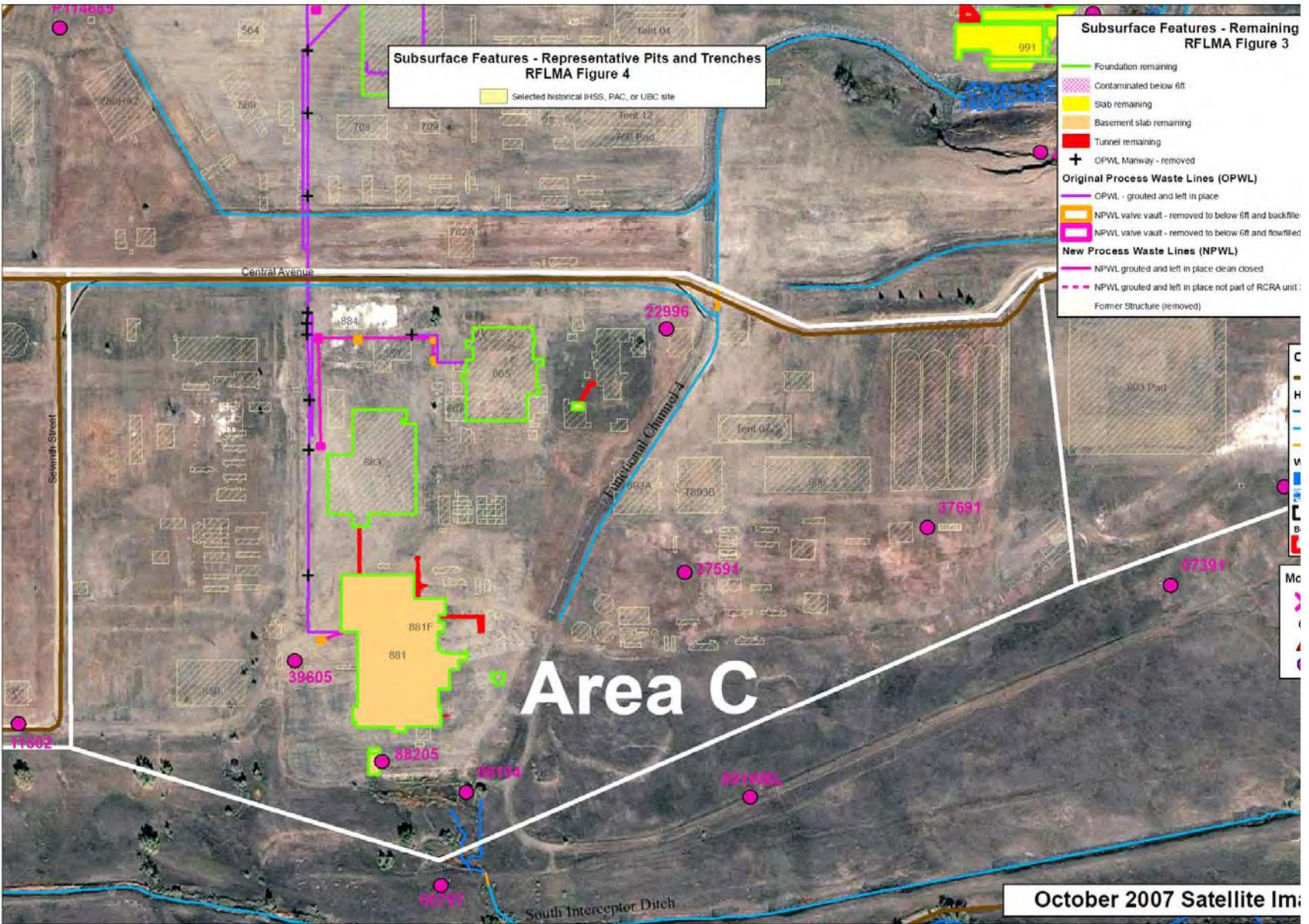
CHECK ALL BOXES THAT APPLY. PUT ID# ON FLAG AND PLACE FLAG MARKER IN LOCATION OF OBSERVATION FOR FOLLOW UP.								
Flag ID#	Evidence of Soil Erosion or Deposition	Evidence of cracks, Rills, Gullies	Evidence of Sink Holes or Burrows	Evidence of Depressions or Subsidence	Evidence of Institutional Control Violation ¹	Problem with signs or other physical controls ²	Adverse biological condition	Photo(s) taken? ³

Notes (Reference Flag ID #):

¹ Indicate the RFLMA IC# (RFLMA Attachment 2, Table 1-7) for which violation is indicated.
² These are required to be inspected Quarterly per RFLMA Attachment 2 section 5.3.5, and completion is documented separately – documented here if problem noted during Annual inspection.
³ If photo taken, show location and orientation of photo on Area map.







**Subsurface Features - Representative Pits and Trenches
RFLMA Figure 4**

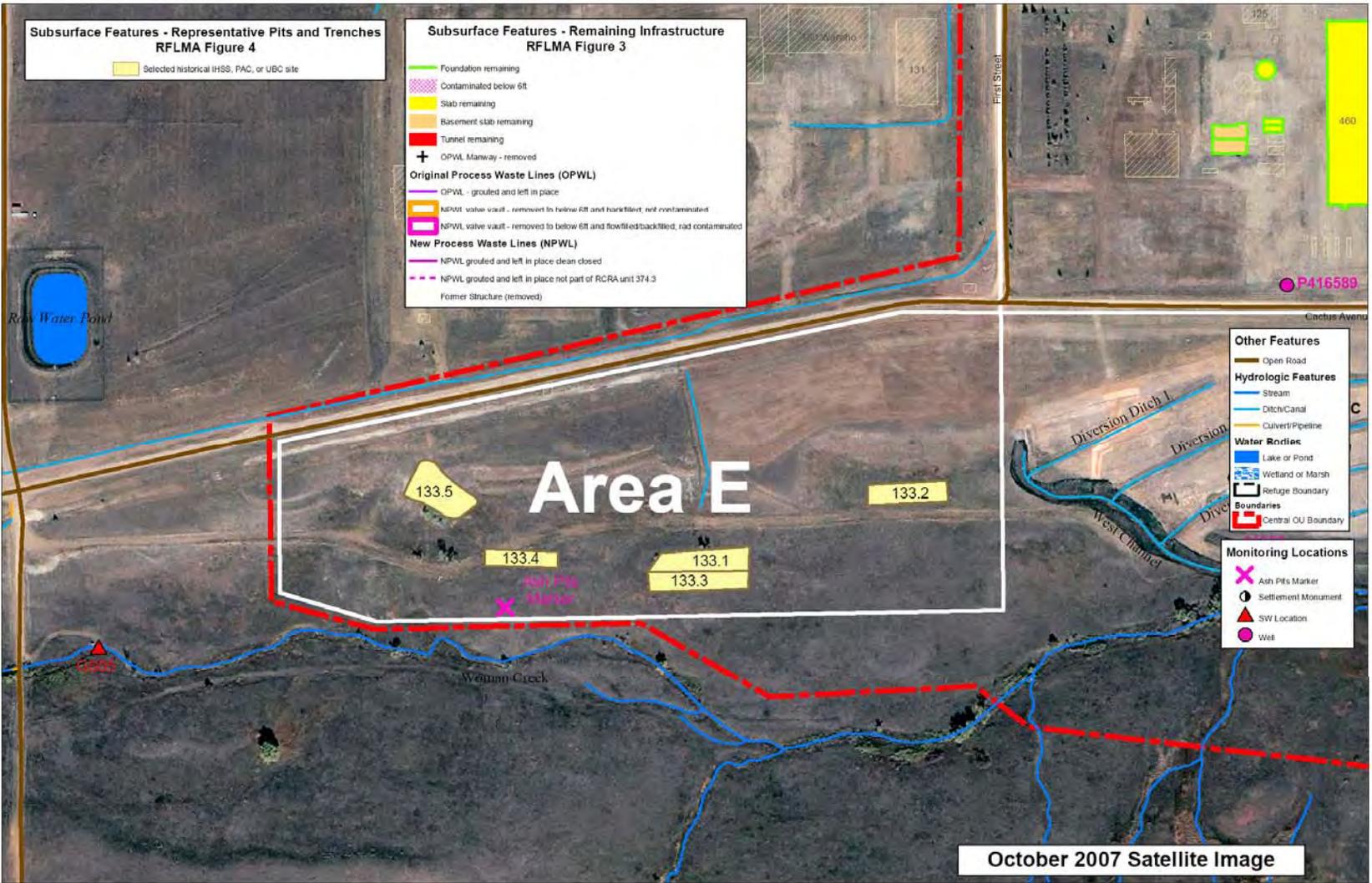
Selected historical IHSS, PAC, or UBC site

**Subsurface Features - Remaining
RFLMA Figure 3**

- Foundation remaining
- Contaminated below 6ft
- Slab remaining
- Basement slab remaining
- Tunnel remaining
- OPWL Manway - removed
- Original Process Waste Lines (OPWL)**
- OPWL - grouted and left in place
- NPWL valve vault - removed to below 6ft and backfiled
- NPWL valve vault - removed to below 6ft and flowfilled
- New Process Waste Lines (NPWL)**
- NPWL grouted and left in place clean closed
- NPWL grouted and left in place not part of RCRA unit
- Former Structure (removed)

Area C

October 2007 Satellite Image



**Subsurface Features - Representative Pits and Trenches
RFLMA Figure 4**

Selected historical IHSS, PAC, or UBC site

**Subsurface Features - Remaining Infrastructure
RFLMA Figure 3**

- Foundation remaining
- Contaminated below 6ft
- Slab remaining
- Basement slab remaining
- Tunnel remaining
- + OPWL Manway - removed
- Original Process Waste Lines (OPWL)**
- OPWL - grouted and left in place
- NPWL valve vault - removed to below fill and backfilled, not contaminated
- NPWL valve vault - removed to below fill and flowfilled/backfilled, rad contaminated
- New Process Waste Lines (NPWL)**
- NPWL grouted and left in place clean closed
- NPWL grouted and left in place not part of RCRA unit 374.3
- Former Structure (removed)

Other Features

Hydrologic Features

- Open Road
- Stream
- Ditch/Canal
- Culvert/Pipeline
- Water Bodies**
- Lake or Pond
- Wetland or Marsh
- Refuge Boundary
- Boundaries**
- Central OU Boundary

Monitoring Locations

- Ash Pits Marker
- Settlement Monument
- SW Location
- Well



Ecological Monitoring Methods Handbook for the Rocky Flats, Colorado, Site

September 2008



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**U.S. Department of Energy
Office of Legacy Management**

**Ecological Monitoring Methods
Handbook for the Rocky Flats, Colorado, Site**

Predecisional Draft

September 2008

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1.0 Introduction

The Rocky Flats Site (Rocky Flats) is under the jurisdiction of the U.S. Department of Energy (DOE) Office of Legacy Management (LM). S.M. Stoller Corporation conducts long-term surveillance and maintenance activities at Rocky Flats under the Legacy Management Support contract. Ecological monitoring is conducted as part of the surveillance and maintenance activities, which include activities conducted pursuant to the Rocky Flats Legacy Management Agreement. That agreement established the regulatory framework to implement the final response action selected and approved in the Rocky Flats Corrective Action Decision/Record of Decision under the Comprehensive Environmental Response, Compensation, and Liability Act; the Resource Conservation and Recovery Act; and the Colorado Hazardous Waste Act to ensure that the response action remains protective of human health and the environment.

The *Ecological Monitoring Methods Handbook for the Rocky Flats Site* is provided as a general guidance document that outlines the methodology that was used through closure and since then for the ecological monitoring conducted at Rocky Flats. As with all monitoring, information needs should determine the type of methodology used. As new information needs arise and new methodologies are used or developed to collect the information needed at Rocky Flats, this handbook will be updated.

2.0 General Vegetation Monitoring—Qualitative

2.1 Revegetation Area Qualitative Assessment

Purpose: This method provides a qualitative assessment of revegetation success to evaluate the success of revegetation establishment, note problems, and suggest management strategies.

Location: For revegetation areas throughout the Central Operable Unit.

Time: Conducted during height of the growing season and other selected times (e.g., when specific weed species are present).

Equipment needed: Field notebook or qualitative assessment forms.

Any of the following may be recorded:

- List of seeded species present. Additional species present.
- Quality of revegetation establishment. Problems?
- Erosion control problems.
- Weed issues.
- Potential and needed weed management actions.
- Resource management needed, if any.
- General counts of shrubs and trees, as appropriate or required.

2.2 Weed Mapping Surveys

Purpose: This survey documents the distribution and density of selected noxious weeds on site. Noxious weeds are defined under the Colorado Noxious Weed Act. The Colorado Department of Agriculture typically updates this list annually. The species on this list and others considered problematic at Rocky Flats may be mapped. Not every noxious weed species occurring at Rocky Flats is mapped.

Location: Sitewide.

Time: Conducted while species of interest are flowering or highly visible.

Equipment needed: Vehicle; binoculars; a blank 44- × 34-inch base map of the site with landmarks and contour lines; red, green, yellow, and blue markers or pencils; PDA with ArcPad.

(**Note:** Individual maps may be produced for each species of interest. The actual species to be mapped will be determined annually.)

- Classify infestation areas into general density categories of high, medium, low, and scattered based on a subjective interpretation of the extent, visual density, need for control, and aggressive nature of the species.
 - *Red*: high density. In general, use a high-density category to indicate an area that is dominated by a nearly solid infestation or very high cover of the species being mapped.
 - *Blue*: medium density. Use a medium-density category where the infestation provides less cover and is less homogeneous than the red distribution of the species.
 - *Yellow*: low density. Use the low-density category where individuals of the species are present in fewer numbers and are not visually dominating the landscape but are beginning to establish a foothold in the community.
 - *Green*: scattered. The scattered-density category indicates an initial infestation or sporadic occurrence of the species in an area.
- While driving or walking across Rocky Flats, locate the weed species of interest.
- Using colored pencils or markers, mark the locations and densities of the species of interest on the map or enter this information into ArcPad using a PDA.
- After collecting the field data, enter the data into the Geographical Information System (GIS) database; conduct quality assurance (QA) on the data prior to analysis. Analysis consists of producing a weed map for each species and calculating the overall extent of infestation for each density category and on Rocky Flats as a whole.

2.3 Rare Plant Surveys

Purpose: This survey documents the status of rare plant species that occur at Rocky Flats (based on species listed as rare and imperiled by the Colorado Natural Heritage Program).

Location: Previously known locations of these species at Rocky Flats.

Time: Conducted while species of interest are flowering or highly visible.

Equipment needed: Location maps, field notebook, pens, PDA with ArcPad.

Species monitored: Rare plant populations to be monitored on site include the following:

- Forktip three-awn (*Aristida basiramea*)
- Carrion flower greenbriar (*Smilax herbacea* ssp. *lasioneuron*)
- Mountain sedge (*Carex oreocharis*)
- Dwarf leadplant (*Amorpha nana*).

Species monitored may vary depending on the rankings determined by the Colorado Natural Heritage Program.

- Locate the species of interest and evaluate the health and quality of the populations.
- Note any issues or threats to their continued existence.
- Record any suggestions for management of the species.
- Document and map any new populations of a rare species.

2.4 Photographic Documentation:

Purpose: This method documents and evaluates changes in natural and revegetated areas on site through time using repeat photography.

Location: Coordinates for the photo-point locations are maintained in the GIS database for Rocky Flats. The GIS can be used to generate maps for field use and to print out x,y coordinates for locating the points in the field. **Note:** Additional photo points may be added at any time.

Time: Varies depending on when last photos were taken or what information is required.

Equipment needed: Vehicle, maps of photo-point locations, photo-point coordinates, Global Positioning System (GPS) unit, series of photos from previous years, quadrat (size: 0.5 square meter [m^2], shape: square, or other size/shape as needed), compass, a placard (whiteboard and marker or blackboard and chalk), digital camera.

Landscape views:

- Using photo-point map, GPS coordinates, or previous year's photos, locate the photo-point location in the field.
- Position the camera above the rebar or photo-point location (i.e., stand over the point).
- Using previous year's photos, determine the direction of the photo and the framing needed to match up with previous photos. Some zoom adjustment may be necessary depending on camera type.
- Take the photo.

Photo quadrats:

- Using photo-point map, GPS coordinates, or previous year's photos, locate the photo-point location in the field. At most locations, there should be a piece of rebar in the ground with a metal tag on it with the photo-point identification information.
- Place the quadrat frame on the ground with the rebar located at the southwest corner of the quadrat.
- Use a compass to orient the quadrat sides north-south and east-west using true north.
- Place a placard showing the date and identification code of the quadrat just outside the quadrat frame. Place the placard on the south edge of the quadrat facing south. Angle the placard such that the information is easily readable.
- Take the photo standing on the north side of the quadrat facing south. Using the previous year's photos, frame the photo appropriately and take the photograph. Take the photographs from directly above the quadrat while standing on the north edge, semi-straddling the edges of the quadrat.

Download and manage the photos in the Rocky Flats photo file structure.

2.5 Vegetation Mapping

Purpose: This method is used to map vegetation on site. The mapping may be conducted for a variety of reasons, such as updating the Rocky Flats vegetation map, mapping weeds (see Section A2, “Weed Mapping Surveys”), and classifying vegetation and rare plants.

Location: Sitewide.

Time: When appropriate for information needs.

Equipment needed: Vehicle, binoculars, a blank 44- × 34-inch base map of the site with landmarks and contour lines, acetate overlays, markers or pencils, PDA with ArcPad, GPS unit.

- Map vegetation according to the specifications required for the information needed.
- Map vegetation on hard-copy maps (possibly with acetate overlays), or use a PDA with ArcPad, or use a GPS unit.
- While driving or walking across Rocky Flats, identify the vegetation according to the classification scheme being used.
- In the field, enter the polygon, line, or point locations and classification of the vegetation type on hard-copy maps, PDA, or GPS unit.
- After collecting field data, enter the data into the GIS and conduct QA prior to analysis.
- Produce maps.

3.0 General Vegetation Monitoring—Quantitative

3.1 Belt Transect

Purpose: This method is used to determine species richness and frequency in an area.

Location: Across Rocky Flats according to information needs.

Time: Conducted during the height of the growing season or as feasible, depending on information needs.

Equipment needed: Metric measuring tape (at least 50 m long), a meter-long stick, field notebook or data sheets, pens, rebar or some type of stakes to mark transect endpoints, PDA.

- Locate transect locations. For new transects these are typically located randomly.
- Using a measuring tape, lay out a straight, 50-m transect line.
- If needed, use stakes or rebar to mark transect endpoints. Pin flags can be used to secure measuring tape in place so tape can be stretched and flattened out to mark transect.
- Record by species all species rooted within 1 meter of the transect (measuring tape) on either side of the transect. Record information on data sheets or electronically in PDA. Use a meter-long stick or rod to determine the 1-meter width on each side of the transect. Each belt transect survey encompasses 100 m².
- When collecting additional information on woody plant and cactus density, count any woody plant stems and cactus stems within the 100-m² area and record by species. Record on data sheets or electronically in PDA.

3.2 Point Intercept Transects

Purpose: This method is used to measure species cover and frequency. Frequency is measured when more than one transect is sampled in a given location.

Location: Across Rocky Flats according to information needs.

Time: Conducted during the height of the growing season, as feasible, or depending on information needs.

Equipment needed: Metric measuring tape (at least 50 m long), notebook or data sheets, pens, a 6-millimeter-diameter rod at least 2.0 m in length, rebar or some type of stakes to mark transect endpoints, PDA.

- Locate transect locations. This type of monitoring is typically conducted on the same transect lines used for the belt transects.
- Using a measuring tape, lay out a straight, 50-m transect line.
- If needed, use stakes or rebar to mark transect endpoints. Pin flags can be used to secure measuring tape in place so tape can be stretched and flattened out to mark transect.
- Starting at 0.5 m and ending at 50 m, drop the rod vertically at half-meter intervals on the right side of the tape. (100 hits per transect).
- Hold the rod vertically.
- Record foliar vegetation hits (defined as a portion of a plant touching the rod) by species in three categories as defined by height and growth form. Record the topmost hit of each growth form by species. The growth forms measured will include herbaceous, woody <2 m in height, and woody >2 m in height.
- Record basal (ground) hits according to the type of material the rod hits at the ground surface. Categories include bare ground, rock (pebbles or rocks greater than the rod diameter), water, litter (dead vegetation matter, erosion control matting, straw), or vegetation hit. Record basal vegetation hits by species only if the rod is touching the stem or crown of the plant where the plant enters the ground.
- Record basal hits and foliar hits separately by species or category (for basal hits) for separate analysis. Record on data sheets or electronically in PDA.

3.3 Quadrat Sampling

Purpose: This method determines species richness, cover, frequency, and plant density.

Location: Across Rocky Flats according to information needs.

Time: Conducted during the height of growing season or when the species of interest is at maximum growth.

Equipment needed: Metric measuring tape (at least 50 m long), quadrat frame (0.5 m², 1 m², or other size if preferred), notebook or data sheets, pens, PDA.

- Locate quadrat. If transects are used to place quadrats, place the edge of the quadrat next to the measuring tape with the lower left corner located at the random number location along the measuring tape. If transects are not used, random coordinates may be located in the field for sampling using a GPS unit with coordinates generated in the GIS or by some other random method.
- For species richness, record all plant species rooted within the quadrat. Record on data sheets or electronically in a PDA. Calculate species frequency as the number of quadrats within which a species occurred divided by the total number of quadrats sampled.
- For species cover, estimate and record the visual cover of each species or categories of species (e.g., graminoids, forbs) in the quadrat. Record on data sheets or electronically in a PDA. Visually estimate the cover using one of the following cover class systems or estimate to the nearest percent:

1 = <5%		1 = <5%
2 = 6–25%	or	2 = 6–25%
3 = 26–50%		3 = 26–50%
4 = 51–75%		4 = 51–75%
5 = >75%		5 = 75–95%
		6 = 96–100%

Note: An alternate cover class system may be used if desired for a specific project. Record the cover class used in the field notebook, or specify in the field sampling plan, or document in the summary report.

- Record plant density as the number of plants or stems of a species rooted within the quadrat. Record on data sheets or electronically in a PDA. **Note:** If the quadrat is not 1 m² in size, convert the density to the number of plants/stems per square meter.

3.4 Vegetation Profile Board

Purpose: This method provides a measurement of vertical vegetation density and is used primarily as a measure for Preble's mouse habitat along the riparian corridors, where a measure of the vertical vegetation density is important.

Location: Across Rocky Flats as needed.

Time: Conducted during the height of the growing season.

Equipment needed: 1.0-m² vegetation profile board (graduated by decimeters), notebook or data sheets, pens, PDA.

- Position the vegetation profile board upright at the selected location.
- Record a total of four measurements (offset by 90°) at each location. Read each measurement facing perpendicular to a side of the board.
- Read the vegetation profile board at a distance of approximately 10 m from the board itself at a height of approximately 1.0 meter (i.e., the level of the top of the board).
- Record the amount of the vegetation profile board covered by vegetation. Determine this value by counting the number of squares that are covered by vegetation. Add together portions of squares not completely covered and estimate the total vegetation cover. Take this measurement from all four sides of the board. Record on data sheets or electronically in a PDA. Average these values to get the average vertical herbaceous cover for that location.

4.0 General Wildlife Monitoring

4.1 Boreal Chorus Frog Vocalization Survey

Purpose: This survey is used to document population trends and distribution of boreal chorus frogs (*Pseudacris triseriatus*) on site. The survey is used as a tool to detect change in the health of the Rocky Flats aquatic ecosystem.

Location: Figure 1 shows the frog vocalization survey locations that have been used in the past at Rocky Flats. Coordinates of all locations are in the GIS database for Rocky Flats.

Time: Conducted in late April to early May, when frogs are most likely to be calling. Surveys will be conducted after water temperatures have reached 10 °C (50 °F). Surveys will begin about dusk and should be completed within 2 to 3 hours after sunset.

Equipment needed: Map of survey locations, coordinates (if needed), GPS unit (if needed), notebook, data sheets, pens, anemometer, two thermometers (Celsius), flashlights, watch, vehicle, insect repellent, frog call recordings/tape recorder/CD player (if needed).

- Drive to each sample location. After arriving at each sample location, wait one minute before beginning the survey.
- After the one-minute adjustment period, listen for boreal chorus frog vocalizations for 3 minutes.
- Categorize vocalizations using one of the following indexes:
 - 0 = No calling heard.
 - 1 = Individuals can be counted; calls not overlapping, there is space between calls.
 - 2 = Calls of individuals are distinguishable, but some calls overlap.
 - 3 = Full chorus; numerous frogs can be heard; calls are constant, continuous, and overlapping.
- Record the following at each location (where possible): air temperature (°C), water temperature (°C), wind speed (miles per hour), cloud cover, precipitation, and noise interference.
- Use an anemometer to record wind speed.
- Record cloud cover on a scale of 0 to 8, where 0 = no clouds, 4 = 50% cloud cover, and 8 = 100% cloud cover. Estimate intermediate levels.
- Record noise interference (from cars, nearby sampling equipment, etc.) as **Low**, **Medium**, **High**, or **None**.
- Document the species and the vocalization index of any other frog or toad species present at each location.

4.2 Circle Plot Bird Surveys

Purpose: These surveys document bird species richness, diversity, and density. This could be used to document how bird populations are changing in the former Industrial Area (IA) compared to the interface (IA/grassland), and reference areas (native grassland) as the revegetation in the IA progresses after physical completion of cleanup.

Location: Figure 2 shows previously used bird circle plot locations. New plots can be established as needed. Each bird plot is 100 m in diameter. Of the plots previously used, eight are located in the IA, eight are in the interface area, and eight are in the reference area. Coordinates of all locations are maintained in the GIS database for Rocky Flats.

Time: Each sample point is sampled once a week during the month of June (four times total), between sunrise and 10:30 a.m.

Equipment needed: Notebook or data sheets, pens, rebar, wooden stakes (1.0 m in length), flagging, pin flags, watch, binoculars, bird field guide, list of bird species at the site.

- Visit or mark the plots before starting the surveys to make locating the center points easier.
- Using GPS coordinates, locate the center point of each circle plot. The center points were originally marked with rebar but may need to be remarked. Each point should be marked so that it is visible above the height of the surrounding grass.
- On day of survey, stand at the center point of the circle where there is an unobstructed view of the entire plot.
- While approaching the plot and center point, record any birds flushed from within the circle plot as “in the plot at start.” Record the species and number of individuals flushed from the 100-m-diameter plot at the arrival.
- On arriving at the center point, stand still for one minute, then start the 10-minute survey.
- Record bird observations in the following ways during the 10-minute survey:
 - Include in the “in plot tally” category any species seen or heard in a stationary location within the 100-m-diameter circle during the survey.
 - Include in the “fly-ins tally” category species (except swallows, swifts, and raptors) entering the 100-m-diameter circle during the 10-minute survey.
 - Use the “on-wing tally” category only for swallows and swifts. The tally in this field will include birds entering the plot for the first 5 minutes and the last 4 minutes of the survey. Enter a one-minute tally of the 6th minute “on-wing tally” observations for these species into the “On-Wing 1-Minute” field. This category was created when the Industrial Area was present, and numerous swallows were constantly flying in and out of the plot during the 10-minute period, and it was difficult to keep track or know whether they had been counted previously. It is probably no longer necessary to track birds in this category.
 - Record raptors as being in the plot if they occur within 200 m of the center point of the plot (400-m-diameter circle). If they are seen or heard within 200 m of the center point, record them in the appropriate field.
 - Record any bird species seen or heard within 200 m of the plot center (400-m-diameter circle) throughout entire 10 minute survey in the “SpecCode” column. However, list the number of these bird observations in the other columns only if they fall within the appropriate distances as outlined above.

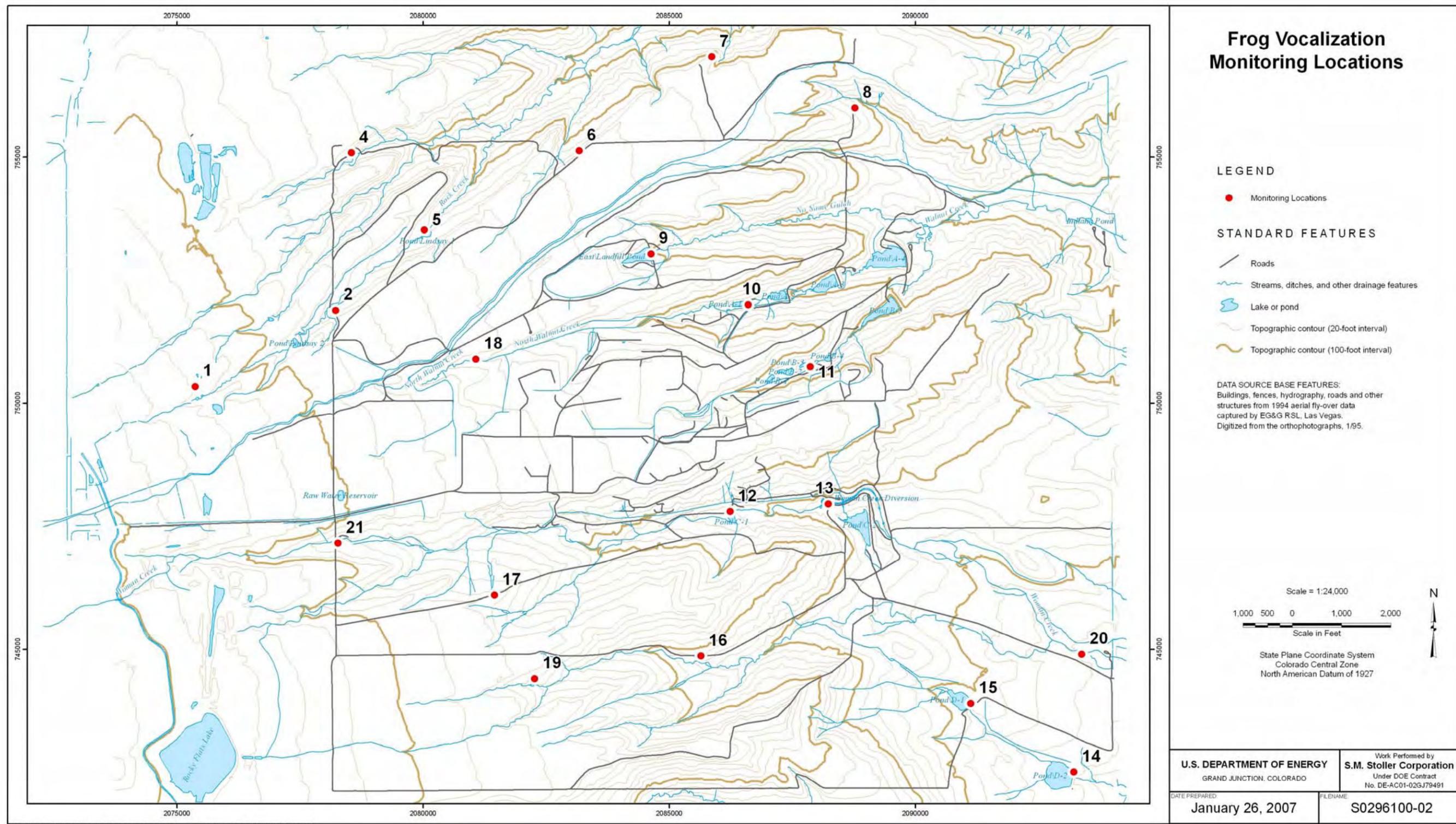
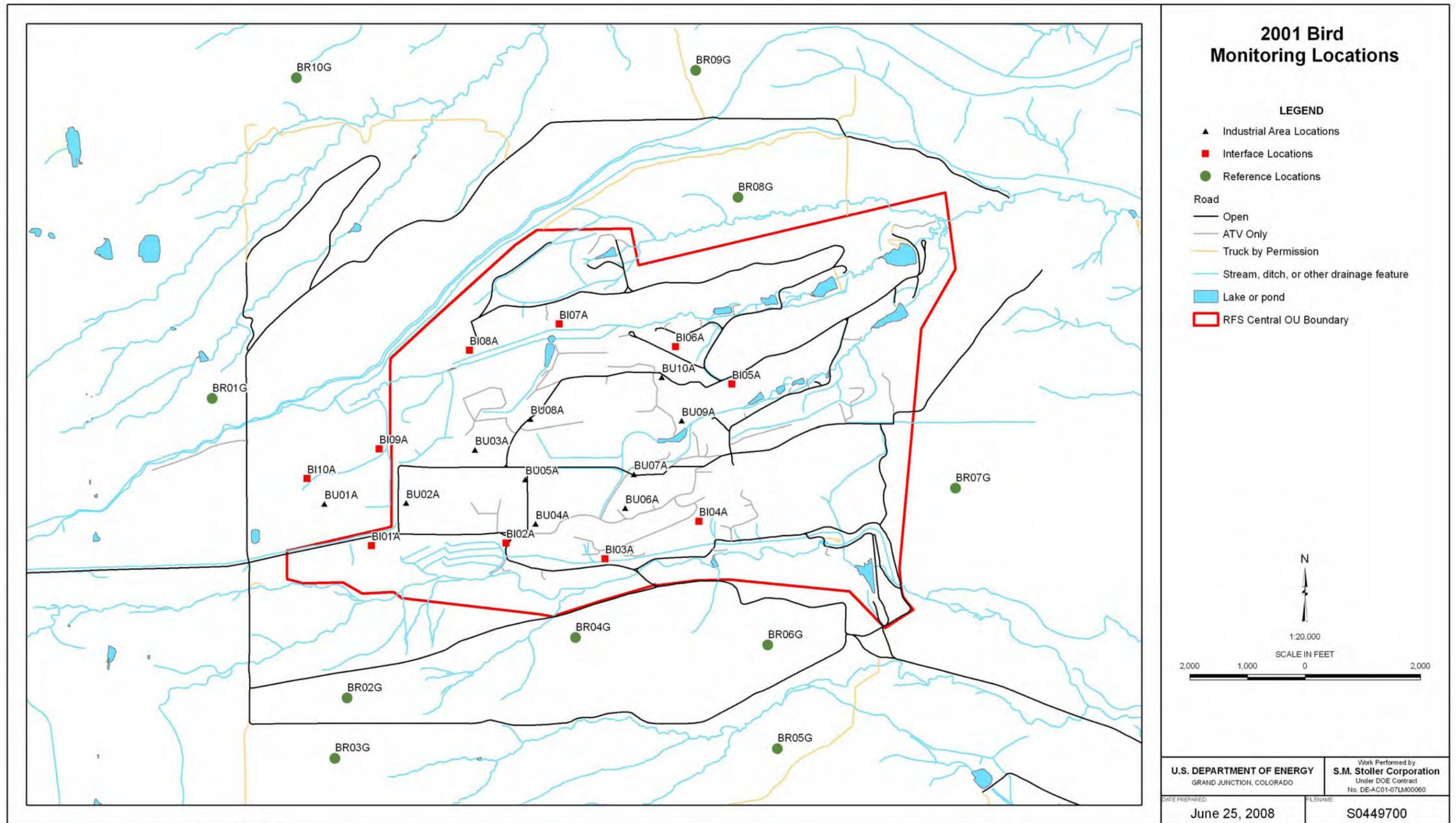


Figure 1. Frog Vocalization Monitoring Locations



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Figure 2. 2001 Bird Monitoring Locations

4.3 Small Mammal Trapping

Note: Obtain all appropriate federal, state, and local permits or approvals before beginning this activity. For trapping the Preble's meadow jumping mouse (PMJM), all trapping activities must conform to the U.S. Fish and Wildlife Service's *Preble's Meadow Jumping Mouse Survey Guidelines*, April 2004 revision or most recent version.

Purpose: This method is used to determine and monitor small mammal species population and composition at different locations. This method may also be used to evaluate changes as vegetation becomes reestablished at disturbed areas at Rocky Flats.

Location: Sitewide.

Time: Typically conducted in spring and late summer.

Equipment needed: Sherman small mammal live traps, GPS unit, sweet feed for bait, gallon plastic zip bags, Pesola spring scales, camera (digital or 35 millimeter), raccoon traps and peanut butter for bait, field notebook or trapping forms, pens, cotton or wool fiber balls for nesting material in traps during cooler times, latex gloves, leather gloves, and any other required personal protective equipment.

- Choose trapping sites at random or predetermined locations on the basis of information needs and requirements.
- Use a transect, "web" design, or other appropriate pattern to lay out the trapline. Traplines typically consist of 50 or 100 traps or more depending on the information needs.
- Space the traps approximately 5 m apart (may be modified on the basis of design requirements).
- After positioning the trapline, use a GPS to record the endpoints and the locations of the traps. These data will be added to the Rocky Flats GIS database.
- Determine the length of time the traps will be baited and run according to the design requirements of the study.
- Bait the traps with sweet feed and nesting material, and set after heat of day in the evening. After the first night of trapping, raccoon traps may need to be placed throughout the trapline if many of the traps were disturbed by animals during the night.
- Always check the baited and set traps the following morning before the heat of the day. After checking the traps, close them so that no animals become trapped during the heat of the day.
- When checking the traps, handle all animals with two layers of gloves—leather first, then latex on top.
- Observe captured small mammals by placing them in 1-gallon plastic zip bags initially. Wear the leather-plus-latex gloves to take the animals out of the bag for additional observation or to make the appropriate measurements.
- Record the species, sex, age (adult/juvenile), any breeding activity (e.g., lactating, pregnant) for all species captured.

- Gather additional data if any PMJM are captured. See Small Mammal Trapping (PMJM) methods.
- Release all animals near their capture location as soon as possible after completing measurements.
- Close all empty un-sprung traps.
- After the trapping session is complete, collect and disinfect all traps before storage.

4.4 Prairie Dog Surveys

Note: Prairie dog relocations require a prairie dog relocation permit from the Colorado Division of Wildlife.

Purpose: This survey is used to document the location and distribution of prairie dogs on site.

Location: Sitewide.

Time: Best conducted when prairie dog colonies are most visible during the year.

Equipment needed: Notebook or data sheets, pens, binoculars, maps, GPS unit.

- Determine the extent of active prairie dog colonies either by visually estimating and drawing the colony on a map or by using a GPS unit to map the extent while walking around the perimeter of the colony. If needed, each prairie dog hole can be mapped with a GPS to determine the overall extent of the colony.
- Collect any other information such as vegetation cover, weediness, and species richness, as necessary.
- Prairie dog counts may be made by observing the colony with binoculars from a distance and recording the number of animals observed.
- These data can be used to compare prairie dog abundance and colony present/size to that of previous years. These data may become important if prairie dogs begin to establish colonies in undesirable locations such as the Present Landfill Cover, Original Landfill Cover, 903 Pad and Lip Area, and others.

4.5 Deer Count Survey

Purpose: The deer count survey documents the distribution and population size of mule deer and white-tailed deer on site.

Location: Sitewide.

Time: Conducted in the winter, typically December or January when snow is on the ground, deer are most visible, and sex of the deer is most distinguishable.

Equipment needed: Vehicle, field notebook or data sheets, pens, binoculars, map, PDA.

- Conduct this driving survey on all Rocky Flats roads. Most areas are visible from roads or with binoculars.
- Document the locations of deer observations on a map of Rocky Flats.
- Record the following for any deer sightings:
 - Date
 - Time
 - Species
 - Location on map
 - Main activities of individual or group
 - The dominant vegetation community where the animal is located.
 - Number of males, females, and young of the year (where distinguishable)

5.0 Specific Vegetation Monitoring (Special Projects)

5.1 Wetland Monitoring and Delineation Methods

Purpose: This method is used to monitor and delineate wetland vegetation reestablishment and growth.

Location: Sitewide as needed.

Time: Conducted during the height of the growing season.

Equipment needed: GPS unit, field notebook or U.S. Army Corps of Engineers (USACOE) wetland delineation data sheets, PDA, GPS unit, pens, camera, pin flags, site wetland indicator species list, site plant species list, plant field guides, photo-point coordinates or maps, previous photo-point photographs.

Wetland Delineation: Follow the 1987 USACE *Wetlands Delineation Manual*, or current accepted methods, for delineation.

Qualitative Wetland Evaluation:

- Use this evaluation as qualitative wetland assessments to determine the status of the wetland reestablishment and whether management actions are warranted.
- Photograph wetlands from previously established wetland photo-points. Use GPS coordinates, maps, and previous photos to line up and retake photographs.
- Make a list of all plant species found growing within the wetland boundary.
- Visually estimate the cover of each recorded plant species across the entire wetland. An alternative method is to randomly locate quadrats and follow the quadrat methodology for listing species and estimating cover. Then combine the quadrat data and determine the overall species list and cover values for each species.
- Using a GPS unit, map the perimeter of the potential wetland (remember, this is not an official delineation; this is just for an annual record of where the edge was thought to be). This information can then be used to determine if the wetland is establishing appropriately and to estimate how much mitigation acreage may be expected to be achieved.

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Wildland Fire Management Plan for the Rocky Flats Site



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Wildland Fire Management Plan for the Rocky Flats Site

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Acronyms and Abbreviations

AEA	Atomic Energy Act
CAD/ROD	Corrective Action Decision/Record of Decision
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 USC 9601, <i>et seq.</i>)
COU	Central Operable Unit
DOE	U.S. Department of Energy
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
FMP	Fire Management Plan
ISMS	Integrated Safety Management System
LM	Legacy Management
NFPA	National Fire Protection Association
OU	Operable Unit
POU	Peripheral Operable Unit
RCRA	Resource Conservation and Recovery Act (42 USC 6901, <i>et seq.</i>)
RFCA	Rocky Flats Cleanup Agreement
RFLMA	Rocky Flats Legacy Management Agreement
RFSOG	Rocky Flats Site Operations Guide
USFWS	U.S. Fish and Wildlife Service

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Executive Summary

The U.S. Department of Energy's (DOE's) Rocky Flats Site (Rocky Flats), which is located northwest of Denver, Colorado, was listed on the Comprehensive Environmental Response, Compensation, and Liability Act National Priorities List in 1989. Cleanup and closure of the Site was completed in October 2005. The DOE Office of Legacy Management (LM) is responsible for implementing the final response action selected in the *Final Corrective Action Decision/Record of Decision* (CAD/ROD) (DOE 2006) issued on September 29, 2006, for the Site.

Under the CAD/ROD, two Operable Units (OUs) were established within the boundaries of the Rocky Flats property: the Peripheral OU and the Central OU (COU). On July 12, 2007, most of the property outside the COU was transferred to the U.S. Department of the Interior for establishment of a National Wildlife Refuge managed by the U.S. Fish and Wildlife Service (USFWS). DOE retained the COU and is responsible for implementing the CAD/ROD final response action and ensuring that it remains protective of human health and the environment.

This Wildland Fire Management Plan presents DOE-LM's approach to dealing with natural fires, human-caused accidental fires, and prescribed fires at the COU. (Fires occurring within the surrounding Refuge are the responsibility of USFWS. Fires occurring within the permitted mining claims are the responsibility of the permit operator.) This document describes current conditions at the COU, measures taken to prevent fires from occurring, and the fire suppression contract currently in place with a local fire district.

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1.0 Introduction and Purpose

The U.S. Department of Energy's (DOE's) Rocky Flats Site (Rocky Flats), which is located approximately 16 miles northwest of Denver, Colorado, was listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List in 1989. Figure 1 provides the site location. The DOE Office of Legacy Management (LM) is responsible for implementing the final response action selected in the *Final Corrective Action Decision/Record of Decision* (CAD/ROD) (DOE 2006) issued September 29, 2006, for Rocky Flats. Prior to the CAD/ROD, cleanup and closure activities were completed in accordance with the requirements of the *Rocky Flats Cleanup Agreement* (RFCA) (CDPHE *et al.* 1996).

Under the CAD/ROD, two Operable Units (OUs) were established within the boundaries of the Rocky Flats property: the Peripheral OU (POU) and the Central OU (COU) (Figure 2). The COU consolidates areas of the site that require additional remedial/corrective actions, while also considering practicalities of future land management. The POU includes the remaining, generally unimpacted portions of the site and surrounds the COU. The response action in the Final CAD/ROD is no action for the POU and institutional and physical controls with continued monitoring for the COU.

On July 12, 2007, most of the property outside the COU was transferred to the U.S. Department of the Interior for establishment of a National Wildlife Refuge managed by the U.S. Fish and Wildlife Service (USFWS). The U.S. Environmental Protection Agency (EPA) certified that cleanup and closure of Rocky Flats was complete and the COU remedy was operating properly and successfully, in accordance with requirements for DOE to transfer land not required for remedy implementation to USFWS for establishing the Refuge. DOE retained jurisdiction over the active permitted mining claims on the west edge of the POU; however, operations in these areas are the responsibilities of the permit operators. DOE retained the COU and is responsible for implementing the CAD/ROD final response action and ensuring that it remains protective of human health and the environment. The monitoring, surveillance, and maintenance activities for which quarterly, annual, and 5-year review reports are issued are included in the *Rocky Flats Legacy Management Agreement* (RFLMA).

The RFLMA, signed on March 14, 2007, superseded RFCA. RFLMA is a Federal Facility Agreement and Consent Order under CERCLA, the Resource Conservation and Recovery Act (RCRA), and the Colorado Hazardous Waste Act, among DOE, EPA Region 8, and the Colorado Department of Public Health and Environment (CDPHE). The purpose of RFLMA is to establish the regulatory framework for Attachment 2, "Legacy Management Requirements."

The *Rocky Flats Site Operations Guide* (RFSOG) was prepared by DOE-LM as a document to guide work at the COU. The RFSOG provides details on the surveillance and maintenance needed to satisfy the requirements of the CAD/ROD as well as best management practices at the site. As a "desktop procedure," the RFSOG explains how DOE will fulfill its long-term surveillance and maintenance obligations at the COU.

This Wildland Fire Management Plan (FMP) describes the current fire environment at the COU and the fire prevention and mitigation approach. The site currently contracts with a local fire district for firefighting and related activities. This agreement is described, along with other informal agreements in place for additional firefighting assistance.

DOE Order 450.1, *Environmental Protection Program*, requires all DOE elements to incorporate an Environmental Management System (EMS) approach into their Integrated Safety Management Systems (ISMSs) (DOE Policy 450.0). DOE Order 450.1 defines an EMS as a continuing cycle of planning, implementing, evaluating, and improving processes and actions undertaken to achieve environmental goals. The Order also mandates the inclusion of policies, procedures, and training to identify activities with significant environmental impacts in the EMS, as well as methods for managing, controlling, and mitigating the impacts of these activities.

The Order specifically states that the protection of resources from wildland and operational fires should be considered (DOE Order 450.1 § b[1][e]). In addition, a February 24, 2003, memorandum, “Department of Energy (DOE) Wildfire Management Policy,” from the Secretary of Energy to the Under Secretary for Energy, Science and Environment and the Administrator of the National Nuclear Security Administration directed each Program Secretarial Officer to ensure that sites have wildland fire management plans in place that are consistent with the *2001 Federal Wildland Fire Management Policy and Implementing Actions*.

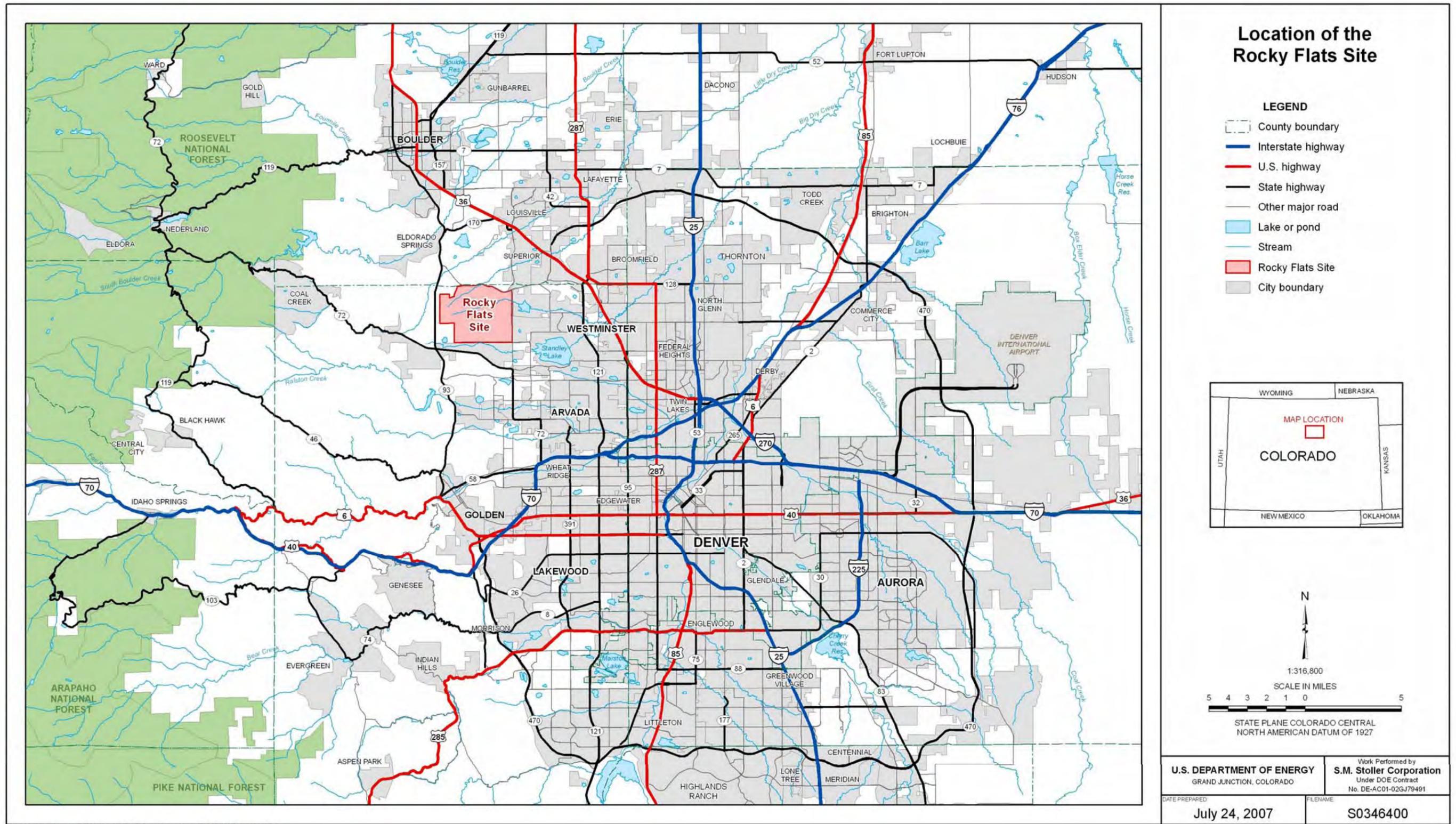
In addition, DOE Order 420.1A, *Facility Safety*, requires compliance to Codes and Standards of the National Fire Protection Association (NFPA), including NFPA Standard 1143, *Wildland Fire Management*, and NFPA Standard 1144, *Protection of Life and Property from Wildfire*.

2.0 Background

2.1 Rocky Flats History

Beginning in 1951, DOE and its predecessor agencies and contractors managed and operated Rocky Flats under authorization of the Atomic Energy Act (AEA). Rocky Flats was part of the United States’ nationwide nuclear weapons complex to manufacture nuclear weapons components from various radioactive, hazardous, and nonhazardous materials. Other support activities included chemical recovery and purification of recyclable transuranic radionuclides (i.e., plutonium, which is a “special nuclear material” under the AEA) and research and development in metallurgy, machining, nondestructive testing, coatings, remote engineering, chemistry, and physics. Manufacturing activities, accidental industrial fires and spills, and support activities, including waste management resulted in the release of hazardous substances, hazardous wastes, and hazardous waste constituents to air, soil, sediment, groundwater, and surface water at Rocky Flats.

The majority of Rocky Flats structures were located within an approximately 300-acre industrialized area (currently located within the COU) at the center of the approximately 6,220-acre property. The Industrial Area was surrounded by the security Buffer Zone (currently referred to as the POU), which contained some supporting activities, such as waste disposal, but was left mostly undisturbed.



M:\LTS\11110056\21\1S03464\1S0346400.mxd coatasc 7/24/2007 7:32:29 AM

Figure 1. Location of the Rocky Flats Site

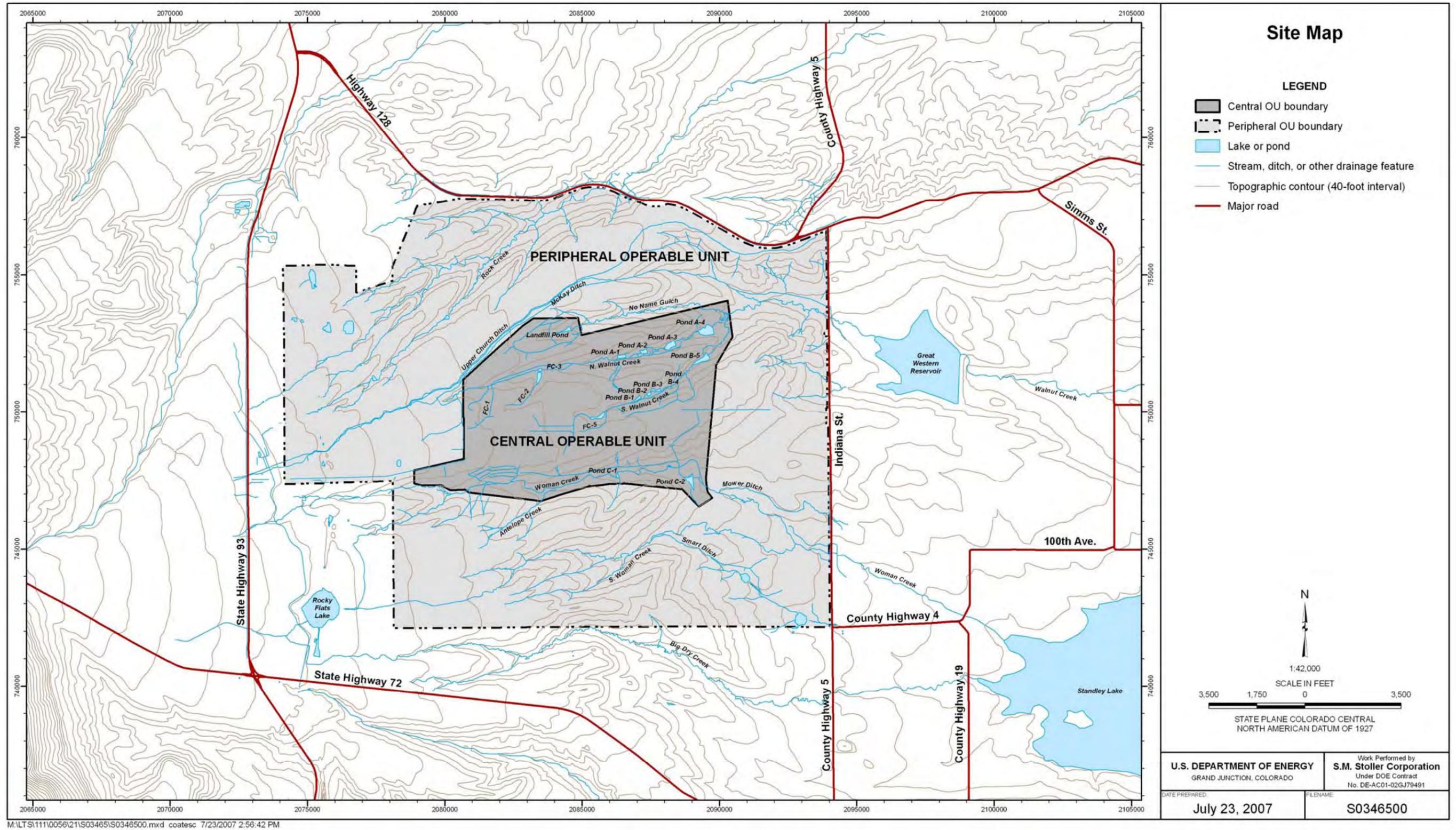


Figure 2. Site Map

Investigation and cleanup of released hazardous substances, including hazardous wastes, began in the 1980s. Beginning in 1992, when weapons components production halted, the Rocky Flats mission included the safe storage and shipment of special nuclear material, nuclear deactivation and decommissioning, waste management and shipment, environmental investigations, cleanup, and site closure.

All planned cleanup actions have been completed and much of the POU portion of the Site has been transitioned to the Rocky Flats National Wildlife Refuge. Potential future users of the wildlife refuge include wildlife refuge workers and visitors.

2.2 Land and Resource Use

Until recently, land around Rocky Flats consisted primarily of rangeland, preserved open space, mining areas, and low-density residential areas. However, this rural pattern is beginning to change due to the spread of development from surrounding communities. The towns of Superior, Broomfield, and Arvada have already experienced extensive development north, northeast, and southeast of Rocky Flats.

State-owned lands southwest and west of Rocky Flats are used for grazing, mining, and storage and conveyance of municipal water supplies. Along Highway 93, an area of land approximately 1,200 feet wide adjacent to the Rocky Flats western boundary is available for eventual development, open space, or highway right-of-way. The 259-acre DOE National Wind Technology Center is located adjacent to the northwestern corner of the POU. Preserved open space is the primary existing and proposed use of the lands immediately north (Boulder County and City of Boulder) and east (cities of Broomfield and Westminster) of the POU.

Areas within the POU and adjacent privately owned lands west of Rocky Flats have been permitted by the State of Colorado and Jefferson County for mineral extraction (primarily clay, sand, and gravel mining). Several cattle and horse operations and small hay fields lie to the south. However, a mixed-use residential and commercial development known as Vauxmont, within the City of Arvada, is proposed for an area immediately adjacent to the southern boundary of Rocky Flats Refuge lands. By 2020, the Denver Regional Council of Governments projects that the entire area south of the Rocky Flats Refuge will be developed, as well as areas to the southeast that are either not already developed or protected as open space (by the City of Westminster) around Standley Lake.

The COU is the property of the United States, with activities there administered by DOE. Rocky Flats is currently closed to public access; however, per the Refuge Act, jurisdiction for the majority of the Site (generally the POU) was transferred to USFWS in July 2007 for the purpose of establishing the Rocky Flats National Wildlife Refuge.

Specific prohibitions related to activities on lands to be retained by DOE for implementation of the remedy (i.e., the COU) are included in the CAD/ROD remedy as institutional controls. DOE is required to implement administrative procedures to control modification, maintenance, or other activities requiring excavation within the COU to prevent violation of the restrictions listed in RFLMA Attachment 2. DOE must also ensure that such activities will not compromise the integrity or function of the remedy or result in uncontrolled releases of or exposures to subsurface contamination, in accordance with the land-use restrictions in RFLMA Attachment 2.

In addition, DOE must implement work control procedures to help maintain the use restrictions and ensure protection of the integrity of the institutional controls. These procedures are derived from EPA and State of Colorado regulation and guidance as well as DOE Orders and guidance. The DOE ISMS utilizes processes such as the job hazard analysis to identify and mediate environmental, health, and safety risks to ensure work is performed in a safe and environmentally protective manner.

2.3 Natural and Historical Role of Fire

Historical documentation indicates grasslands in the vicinity of the Rocky Flats area have been subjected to lightning- and human-caused fires for thousands of years (DOE 1999). These fires likely played a major role in promoting native vegetation growth and diversity. Since 1972, wildfires have not been allowed to burn, and only one controlled burn has been conducted in the grasslands at Rocky Flats. As a result, a fuel load of dead vegetation has been building in the grasslands at the site for at least 30 years. Seven wildfires have been documented on the site since 1993. In addition, a prescribed burn was conducted on April 6, 2000. These grassland fires are summarized in Table 1.

Table 1. Grassland Fires Documented at Rocky Flats Since 1993

Date	Wildfire or Controlled Burn?	Location	Estimated Burn Area (acres)
1993	Wildfire	South BZ, approximately 0.2 mile southeast of Pond C-1	0.14
1994	Wildfire	North BZ, adjacent to Highway 128, directly north of IA	70
1996 (Labor Day)	Wildfire	Southwest BZ, contained by BZ roads	104
2000 (April 6)	Controlled burn	Southwest BZ, contained by BZ roads (partial overlap with 1996 Labor Day fire area)	48
2000 (July 10)	Wildfire	Southeast BZ, approximately 0.3 mile south of east access gate on Indiana Street	8
2000 (September 10)	Wildfire	Northwest BZ, north of Pond A-4 and approximately 0.2 mile south of Highway 128	0.52
2002 (February 24)	Wildfire	Northeast BZ, adjacent to Highway 128, north of Landfill Pond	26
2002 (February 24)	Wildfire	Northeast BZ, between Highway 128 and Lindsay Pond 1	1
2005	Wildfire	Original Landfill – 2 separate fires (erosion control material)	1
2006 (April 2)	Wildfire	Northeast BZ	850

Source: Rocky Flats National Wildlife Refuge Final CCP and EIS (USFWS 2004) and wildfires since that time.

In 1994, the Spring Grassland Fire burned 70 acres between Highway 128 on the north boundary and the north access road. In 1996, the 104-acre Labor Day Grassland Fire burned much of an area bounded by access roads in the southern portion of the site. A 48-acre prescribed burn was conducted on April 6, 2000. The prescribed burn occurred in the same area as the 1996 wildfire. In February 2002, a 27-acre fire burned through portions of the Rock Creek drainage on the south side of Highway 128.

A grass fire on April 2, 2006, burned approximately 850 acres on the northeast corner of the POU/COU. Surface water monitoring station GS08 was destroyed by the fire and subsequently replaced; other damaged items, such as fences, were repaired. Several permanent photomonitoring locations were established in and around the wildfire location to document the ecological effects of the fire. Initial photos were taken shortly following the fire and throughout the 2006 growing season to track effects of the fire on vegetation.

3.0 Current Fire Environment and Mitigation Approach

3.1 Wildfire Seasons

The wildfire season along the Front Range, which includes Rocky Flats, typically runs from May 1 through the end of October, with June through August as the critical months.

3.2 Fuels at the Site

As stated above, since 1972, wildfires have not been allowed to burn, and only one controlled burn has been conducted in the grasslands at Rocky Flats. As a result, a fuel load of dead vegetation has been accumulating in the grasslands at the site for at least 30 years.

The grasslands at the COU are characterized by tall- and mid-grass species such as big bluestem, little bluestem, Indian grass, blue grama, western wheatgrass, needle-and-thread, and prairie Junegrass, in addition to common reclamation grasses such as smooth brome and intermediate wheatgrass. These grasses are adapted to the relatively frequent disturbance of fire and benefit from fast moving, “cool” fire, as it will remove excessive dried biomass and add nutrients to the soil. When the accumulation of thatch and the encroachment of brush increases fuel loads, high-intensity fires may have damaging effects. This may include the reduction of grass cover, increased erosion, or encroachment of non-native species. The COU area consists primarily of grassland, with riparian woodland/shrubland along the streams in the bottoms of the drainages. The riparian areas are dominated by scattered plains cottonwood and peachleaf willow trees, coyote willow, and wild indigo shrubs. Due to the narrow nature of the riparian woodland/shrubland areas, they are not considered a major fuel load source. A few small patches of planted landscaping trees (ponderosa pine, Rocky Mountain juniper, and blue spruce) remain scattered throughout the former Industrial Area. These are not considered a major fuel load source.

Fire return intervals (i.e., the number of years between two successive fires at a given location) for these types of grasslands range from approximately 10 to 35 years, allowing for a rapid departure from the historic fire regime conditions when fire is excluded. Although brush and timber fires are known for more intense fire behavior than grass fuels, the potential impact of grass fires should not be overestimated. These light, flashy fuels can be resistant to suppression, producing rapid rates of spread and flame lengths in excess of 10 feet. They can pose a risk to firefighter safety and a threat to property.

In addition to the vegetation fuels present at the Site, the East Shed contains gasoline and other flammable liquids.

3.3 Special Hazards

No special hazards exist at the COU. Any residual radiological contamination associated with activities conducted at Rocky Flats is buried beneath at least 3 feet of clean soil.

3.4 Mitigation

Wildfire behavior and severity are dictated by fuel type, weather conditions, and terrain. Given that fuel is the only variable of these that can be practically managed, it is the focus of many mitigation efforts. The objective of fuels management may include reducing surface fire intensity, reducing the likelihood of crown fire initiation, and improving wildland health. In grassland communities, these objectives may be accomplished by reducing surface fuels through mowing, grazing, or prescribed burning. Fuel breaks may also be used to break up larger areas into smaller defendable units. These are strategically located areas where fuels have been reduced in a prescribed manner, often along roads. These fuel breaks may be associated with or tapered into larger area treatments.

Improperly implemented fuel treatments can have negative impacts in terms of ecosystem health and fire behavior. Mowing or prescribed fire improperly applied in grasslands can degrade the health of indigenous species and create openings for invasive species. Some brush species respond to mechanical treatment with vigorous resprouting unless combined with additional cuttings, prescribed fire, or chemical treatment. The overall benefits of properly conducted mitigation treatments are, however, well documented.

The current mitigation strategy at Rocky Flats incorporates:

- Selected mowing (primarily for weed control rather than for fire mitigation)
- Requiring projects to have refueling plans and procedures that minimize fire potential
- Controlling personnel activities such as smoking or parking in areas of tall vegetation that have potential to cause fire
- Maintaining site roads as fire breaks
- Requiring hot work permits for construction or maintenance activities that require heat or an open flame

Prescribed fire or grazing may be considered in the future as management tools; however, neither are planned for use in the near term. Future use of prescribed fire would require the appropriate wildland fire planning, permits, and approvals prior to implementation

3.5 Collaboration with Outside Agencies

DOE-LM consults with the Rocky Mountain Fire District and USFWS on a routine basis regarding the Site fire status. In addition to the fire suppression contract with the Rocky Mountain Fire District, DOE has an informal agreement with USFWS which has agreed to respond to a range fire on the COU assuming staff and resources are available. USFWS administers the Rocky Flats National Wildlife Refuge that surrounds the COU and will respond to fires on Refuge lands.

4.0 Response to Fires at the Site

The current fire response at Rocky Flats is one of suppression. The Rocky Mountain Fire District is currently under contract to provide firefighting, rescue, hazardous materials, and Advanced Life Support emergency response to the Site. With respect to firefighting, the Fire District will completely extinguish and overhaul all fires; contain the spread of a grass, vehicle, or structure fire to less than 2 acres of proximity to grassland; and contain a range fire within the boundaries of the site. Neither the Rocky Flats Site, nor its personnel have firefighting capability.

Prescribed fire, which is a tool to accomplish resource management objectives such as hazardous fuels reduction, plant species diversity, and noxious weed abatement, is not currently used at Rocky Flats. Any future use of prescribed fire would require the appropriate wildland fire planning, permits, and approvals prior to implementation.

4.1 Initial Response

In accordance with terms of the current contract with the Rocky Mountain Fire District, the District will arrive at the site Access Road and State Highway 93 within 20 minutes of dispatch by a Public Service Answering Point, with an equipped vehicle and qualified crew (three personnel minimum on a Class A pumper) appropriate to mitigate the event as reported. This time is considered from the home station of the apparatus and assumes road conditions are unimpeded by severe weather conditions or unanticipated road closures/blockages. It also assumes an area disaster-type incident has not stressed local first responder resources. Anticipated conditions such as normal rush hour traffic are encompassed within the 20 minutes. This time does not apply to backup units, additional alarm units, or specialty apparatus such as boats, heavy rescue vehicles, and HAZMAT vehicles; the latter three being in addition to a 20-minute criteria first responder vehicle.

There is no assurance that federal or contracted employees will be on site at the initiation or early stage of emergencies to provide information or assistance. Typical work activities at the site include servicing air, surface, and groundwater monitoring stations; fence maintenance; erosion and weed control; firebreak maintenance; and similar activities. Visitor volume at the site is projected to be low. Surface mining of aggregates may be in progress along the north side of the Access Road. Such activity is by private commercial interests exercising mineral rights on Rocky Flats.

A double-swing gate approximately 0.25 mile east of State Highway 93 allows primary access road to the site. Keys and/or combinations to the gate locks will be provided. However, forcible entry by the Fire District is authorized by DOE as necessary. The COU is surrounded by a four-strand barbed wire fence. Gates along the fence are located in five different locations, as shown on Figure 3. These gates use the same key that is used to access the west gate. As above, forcible entry by the Fire District is authorized as necessary. Use of firebreak road access gates at the locations along the site perimeter is also authorized. However, the continuity or condition of these roads is not assured.

No assured water supply is on the site; however, the Fire District may use surface water sources that are identified by DOE-LM and are accessible during an incident. The Fire District is

responsible to secure/provide all water necessary for the control/extinguishment of fires. Automatic alarms, hard-wire telephones, or commercial electricity or water services are not available on the site. Overhead electrical high-voltage transmission lines and two buried natural gas transmission lines transit the site.

4.2 Resources

The Rocky Mountain Fire District will have the capability to perform the scope of tasks using in-house resources assuming full availability conditions. When a site incident or area emergency situations have stressed in-house resources, the utilization of mutual-aid or other backup/fill-in agreements to provide timely response or assistance is appropriate. Subcontractor membership in regional consortiums such as HAZMAT and Technical Rescue Teams is considered in-house resources.

4.3 Incident Reports

The Rocky Mountain Fire District will submit an Incident Summary Report within seven business days of each response to the site. The report will provide a brief description of the incident, apparatus used, actions taken, times for dispatch and significant occurrences, and injuries/deaths.

LMS incident reporting is required in accordance with LMS procedures and timelines. Certain types of incidents must be reported and classified within two hours.

5.0 Summary

The current fire management situation at the COU involves suppressing all wildland fires. DOE-LM currently contracts with the Rocky Mountain Fire District to provide firefighting support. This FMP will be revised when conditions change.

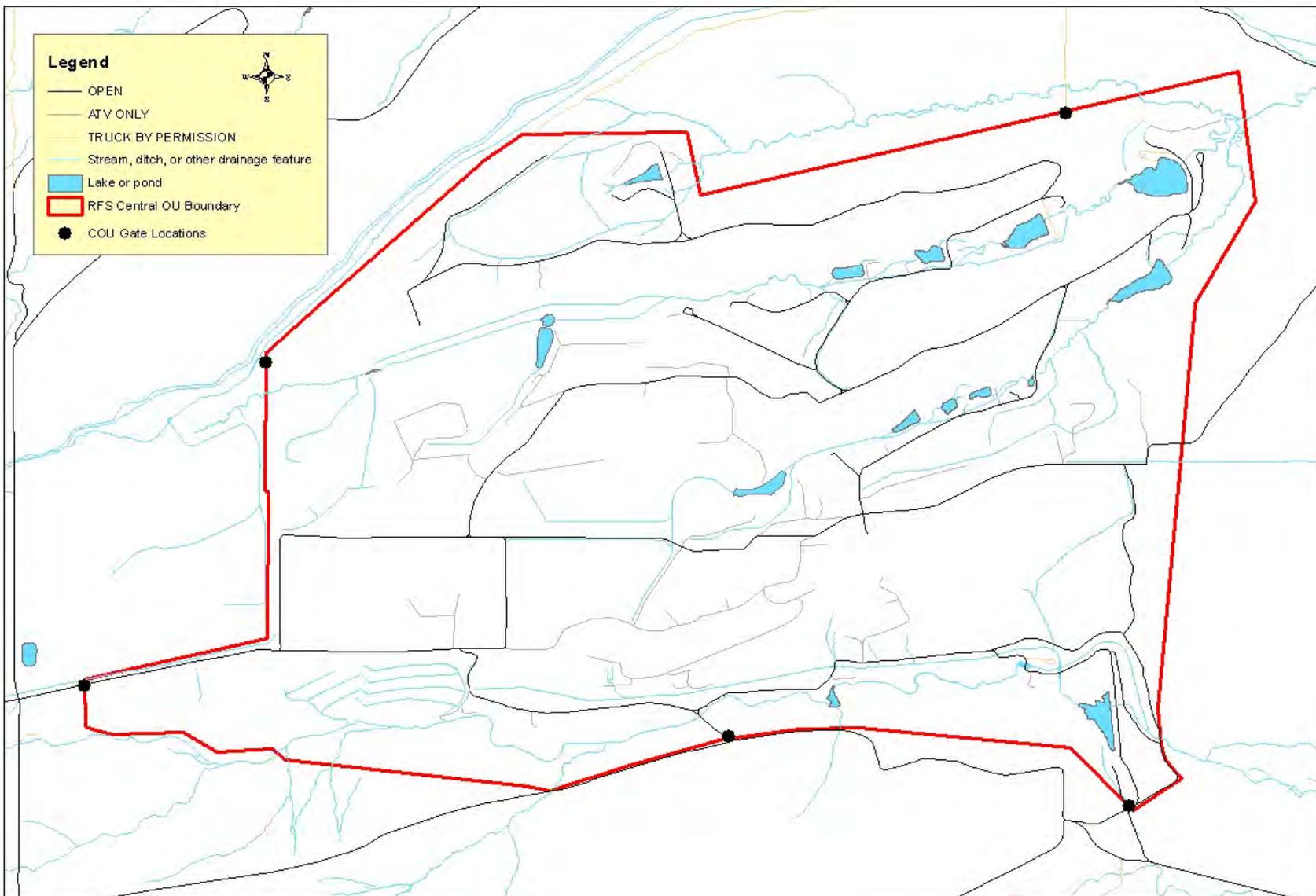


Figure 3. COU Gate Locations Map

6.0 References

CDPHE, DOE, and EPA (Colorado Department of Public Health and Environment, U.S. Department of Energy, and U.S. Environmental Protection Agency), 1996. *Final Rocky Flats Cleanup Agreement*, Federal Facility Agreement and Consent Order, CERCLA VIII-96-21 RCRA (3008(h)) VIII-96-01, State of Colorado Docket #96-07-19-01.

DOE (U.S. Department of Energy), 1999. *Vegetation Management Environmental Assessment*, Rocky Flats Field Office.

DOE (U.S. Department of Energy), 2006. *Corrective Action Decision/Record of Decision for Rocky Flats Plant (USDOE) Peripheral Operable Unit and Central Operable Unit*, September.

USFWS (U.S. Fish and Wildlife Service), 2004. *Rocky Flats National Wildlife Refuge Final CCP and Environmental Impact Statement*.

Rocky Flats Environmental Technology Site

Survey Control Network Report



Submitted by

Flatirons Surveying, Inc.

September 27, 2005

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- I. Introduction
- II. Location
- III. Conditions
- IV. Field Work
- V. Data Processing
- VI. Budget
- VII. Comments
- VIII. Attachments

Introduction

Flatirons Surveying, Inc. (FSI) of Boulder, CO established a survey control network to provide limited coverage of the Rocky Flats Environmental Technology Site (RFETS) for the purpose of surveying with Real Time Kinematic (RTK) Global Positioning System (GPS). Control was established to horizontal and vertical first order accuracy (Horizontal Class I, Vertical Class II based on Federal Geodetic Control Committee Standards). From August 15 – September 8, 2005 FSI performed fieldwork, processed data, and delivered information to Kaiser-Hill (KH). FSI is contracted to URS Corporation (URS), which is contracted to Kaiser-Hill Corporation. Jason Jung directed this project for FSI.

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Flatirons Surveying, Inc.
5825 Iris Avenue
Boulder, CO
80301

II. Location

Rocky Flats Environmental Technology Site is located in Jefferson County, Colorado. The industrial area of this site is approximately 2 miles long by 1.5 miles wide. Its surficial soil deposits consist of Rocky Flats Alluvium and artificial fill materials (*EG&G 1992*). These soils contain coarse sands, poorly sorted, unconsolidated coarse gravels, and gravelly clays with discontinuous lenses of clay, silt, and sand (*Final Buffer Zone Sampling and Analysis Plan*).

III. Conditions

As RFETS nears closure, conditions were extremely variable and changed daily. A verbal task order was provided (number and date not provided to FSI) and work performed under the direction of Tom Lindsay of Safe Sites, LLC, who is contracted to KH as the Project Manager for Land Configuration at RFETS. Numerous site sectors are closed and required permits, which were obtained for FSI by Tom Hanson. Tom Hanson is the Project Manager for URS and the administrator of the FSI contract. Time was the most important factor influencing control placement. At the client's request "all work needs to be completed by the end of the federal fiscal year." Bob Davis, Project Director in charge of Land Configuration for Kaiser-Hill Corporation, chose all control locations. According to Mr. Davis, control locations were chosen based on contractual site closure requirements agreed upon between KH and the US Department of Energy. Because of time constraints, National Geodetic Survey (NGS) Bluebook Monumentation Standards could not be met.

IV. Field Work

Jason Jung and Chad McFadden of Flatirons Surveying, Inc completed reconnaissance and preparation of the project. This included existing site drawing assessments, multiple field visits, and historical control investigation. Jason Jung and Chad McFadden designed the network with consultation from Devin Kowbuz of Flatirons Surveying, Inc (B.S. Geomatics Engineering, University of Calgary) and Matt Nawrocki of Vectors, Inc. The network design was submitted to and approved by Joseph Chumbley, PLS of CH2Mhill. The control network consisted of 11 stations at first order accuracy. The survey contained 11 of 11 or 100% with double occupation and 6 of 11 or 54.55% with triple (or greater) occupation. In addition, 2 of 22 or 9.1% of baselines will have repeat observations to provide redundant baselines. For conventional surveying, 4 of 11 or 36.36% are intervisible. Consideration was given to optimum satellite coverage during observations. Existing NGS control was used to establish horizontal control including:

- TT 23 J
- JEFFCO RESET

Our session method occupied points using four receivers, which allowed more efficient fieldwork and good geometry for site coverage. Field observations were made using Trimble 5700 GPS receivers using Zephyr Geodetic antennas or 5800 GPS receivers with R8/5800 Internal antennas and performed by FSI staff in accordance with CDOT static GPS survey procedures (Chapter 3, *GPS Surveys*, October, 2003). FSI equipment dedicated to control work was used for GPS set up. A zero baseline calibration was not performed due to time-constraints.

Mission planning was designed to incorporate remaining existing monumentation, which is given in Rocky Flats Coordinates System. Observations were made in GRS80 datum. Horizontal and vertical coordinates are in NAD 83(1992) and NAVD 88 (derived through Geoid99). Due to time constraints and clients request, differential leveling was not performed.

Monuments were purchased and set by FSI. These are 3.25" brass caps mounted on finned steel rods. They were center punched and contained an identifying 4 digit point number. As well, Carsonite reference posts were set at each location. Normal weather conditions for Rocky Flats for this time of year prevailed during work. It was mostly sunny with temperatures in the 80's (F), and Westerly winds of 10-15 knots. The following FSI personnel perform fieldwork:

- | | |
|-----------------------------------|--|
| • Jason Jung, LSIT Survey Manager | (field observations, data processing, reporting) |
| • Chad McFadden, Project Manager | (field observations, data processing, reporting) |
| • Jeff English | (field observations) |
| • Eric Padia | (field observations) |
| • Derek Leapoldt | (field observations) |
| • Steve Downing | (field observations) |
| • Charles Sorg | (set points, field observations) |
| • Ben Reeves | (set points, field observations) |

All survey work was performed in accordance with RFETS standard operating procedures listed in the URS Site Characterization Health and Safety Plan, which included, Job Hazard Assessments, Pre-Evolution Briefings, and Plan of the Day meetings.

V. Data Processing

Data was downloaded daily from each receiver to a FSI computer with an AMD-64 processor @ 2200 Mhz, 2 GB of RAM, 150 GB of hard drive space and running Windows 2000. Data analysis, checks, and adjustments were performed using Trimble Geomatics Office (TGO) v.1.62. No problems were encountered with this process. Jason Jung and Chad McFadden prepared deliverables, including drawings, point descriptions, GPS vector solutions, and adjustments. FSI proposed using TT 24 J as the initial occupation point, however at the start of observations, another surveyor occupied TT 24 J. In order to expedite fieldwork, we used TT 23 J, which is of equal proximity and accuracy. A Minimum Constraint Adjustment was performed using TT 23 J. A Full Constraint Adjustment was performed using TT 23 J and JEFFCO RESET. For the adjustment, all points were weighted evenly as unknown points. After the passing Chi squared test, this completed the Least Squares Adjustment. The residuals for the adjustment can be found in the attached report. Additionally, no outliers were found, thus no vectors were eliminated or edited. Post processing of loop closures was conducted and the report is attached.

VI. Comments

This project was completed ahead of schedule, and under budget. No additional staff was required to continue normal site operations for projects supported by Flatirons staff. Although the fieldwork was brief, it contributed to a heavier than normal workload.

Rocky Flats Site Closure Datum points included in drawing and spreadsheet were translated from NAD27 to the Rocky Flats historical grid datum. The mean difference between NAD27 and RF is approximately 0.6 USFT. Original RF datum documents were unavailable for review (data classified), thus vertical and horizontal datum sources for RF are unknown. Errors between datums coincide with inherent errors in NAD27.

Special Note: The following information is intended as reference information for all site work completed by FSI, which is beyond the scope of this project. It is mentioned at the request of multiple project managers.

Additionally, site surveying by Flatirons Inc. and others (Merrick, Drexel Barrel & Co., Montgomery Phillips, Inc., EG & G, etc...) was performed in this datum (possibly other datums for the aforementioned companies). Flatirons GPS was calibrated for normal site operations by using a hybrid of available historical control from Montgomery Phillips, Inc. (former site survey company) and Rocky Flats posted control data.

VII. Attachments

- Observation Schedule
- Conversion Factors
- Coordinate List
- NGS Data Sheets
- Reports
- Project Drawing

SESSION	POINTS OBSERVED IN SESSION	POSITION FOR NEXT SESSION
A	TT 24 J	BASE
A	1001	HINGE
A	1002	HINGE
A	1003	HINGE
B	1001	HINGE
B	1002	1007
B	1003	1008
B	1004	HINGE
C	1001	1003
C	1004	HINGE
C	1007	HINGE
C	1008	1005
D	1003	1006
D	1004	1010
D	1005	HINGE
D	1007	HINGE
E	1005	1008
E	1006	1011
E	1007	HINGE
E	1010	HINGE
F	1007	1009
F	1008	1006
F	1010	HINGE
F	1011	HINGE
G	1006	JEFFCO RESET
G	1009	HINGE
G	1010	END
G	1011	HINGE
H	1009	END
H	1011	END
H	JEFFCO RESET	END

Rocky Flats Environmental Technology Site Surveying

The following explains the processes for changing coordinates between Colorado State Plane and Rocky Flats Coordinate System.

State Plane to Rocky Flats Coordinate System:

1. Insert the following points into the State Plane Coordinate System drawing:

State Plane Coordinates

<u>Point</u>	<u>Northing</u>	<u>Easting</u>	<u>Elevation</u>	<u>Description</u>
3	747633.2251	2078764.6108	6093.5700	LEV=FB2/61
200	750471.8406	2080805.3185	6039.2000	
201	751475.8703	2082101.6792	6007.7300	
202	749491.2460	2086607.1040	0.0000	
208	749979.3939	2088943.9068	0.0000	

2. Scale the entire drawing around base point 0,0,6000 (x, y, z) by the factor 1.00025586417. The coordinate results from this action result in modified State Plane coordinates, with the inserted points having coordinates as follows.

Modified State Plane Coordinates

<u>Point</u>	<u>Northing</u>	<u>Easting</u>	<u>Elevation</u>	<u>Description</u>
3	747824.519	2081337.722	6093.5700	LEV=FB2/61
200	750663.859	2081337.722	6039.2000	
201	751668.146	2082634.414	6007.7300	
202	749683.014	2087140.992	0.0000	
208	750171.288	2089478.391	0.0000	

3. Move the entire drawing, using Point 202 (2087140.992,749683.014 (x, y)) as the base point and moving it to 23500,36500 (x, y).
4. Rotate the entire drawing around base point Point 202 (23500,36500 (x, y)) -0.1891666 degrees. The resulting drawing is in Rocky Flats Coordinate System, and should be verified by checking that the coordinates of the inserted points are as follows.

Rocky Flats Coordinate System

<u>Point</u>	<u>Northing</u>	<u>Easting</u>	<u>Elevation</u>	<u>Description</u>
3	34667.4130	15649.4070	6093.5700	LEV=FB2/61
200	37500.0000	17700.0000	6039.2000	
201	38500.0000	19000.0010	6007.7300	
202	36500.0000	23500.0000	0.0000	
208	36980.5530	25839.0000	0.0000	

Rocky Flats to State Plane Coordinate System:

1. Insert the points from step 4 under State Plane to Rocky Flats Coordinate System above into the Rocky Flats Coordinate System drawing.
2. Rotate the entire drawing around base point Point 202 (23500,36500 (x, y)) $+0.1891666$ degrees.
3. Move the entire drawing, using Point 202 (23500,36500 (x, y)) as the base point and moving it to 2087140.992,749683.014 (x, y). This result is Modified State Plane Coordinates that can be crosschecked with the coordinates in Step 2 under State Plane to Rocky Flats Coordinates System above.
4. Scale the entire drawing around base point 0,0,6000 (x, y, z) by the factor 0.999744201298. The resulting drawing is in the State Plane Coordinate System, and should be verified by checking that the coordinates of the inserted points are as listed in Step 1 under State Plane to Rocky Flats Coordinates System above.

**NAD83 (1992) State Plane
Datum Coordinates GRID
Colorado Central Zone 502**

POINT NUMBER	NORTHING	EASTING	ELEVATION	DESCRIPTION
1000	1763000.772	3074799.454	5901.81	TT23J
1001	1747376.888	3079339.68	6036.03	1001
1002	1749384.202	3079824.628	6064.65	1002
1003	1750481.766	3080651.026	6042.51	1003
1004	1749813.815	3082752.124	6009.90	1004
1005	1751485.849	3081947.333	6011.02	1005
1006	1753139.167	3083021.528	5985.60	1006
1007	1750102.121	3084635.336	5976.88	1007
1008	1747442.626	3085394.3	5851.99	1008
1009	1753270.843	3089530.499	5764.37	1009
1010	1751523.094	3087721.785	5916.45	1010
1011	1746991.763	3087764.048	5904.75	1011
1015	1757316.703	3112964.13	5557.78	JEFFCO RESET

**NAD27 State Plane Datum
Coordinates GRID
Colorado Central Zone 502**

POINT NUMBER	NORTHING	EASTING	ELEVATION	DESCRIPTION
1000	762991.136	2074954.101	5901.81	TT23J
1001	747367.46	2079494.384	6036.03	1001
1002	749374.759	2079979.315	6064.65	1002
1003	750472.322	2080805.699	6042.51	1003
1004	749804.401	2082906.783	6009.90	1004
1005	751476.409	2082101.988	6011.02	1005
1006	753129.724	2083176.162	5985.60	1006
1007	750092.726	2084789.977	5976.88	1007
1008	747433.265	2085548.953	5851.99	1008
1009	753261.473	2089685.075	5764.37	1009
1010	751513.72	2087876.39	5916.45	1010
1011	746982.433	2087918.684	5904.75	1011
1015	757307.563	2113118.464	5557.78	JEFFCO RESET

**NAD27 Site
Closure Datum -
Adjusted**

POINT NUMBER	NORTHING	EASTING	ELEVATION	DESCRIPTION
1001	747366.9547	2079494.042	6032.73	1001
1002	749374.2537	2079978.973	6061.35	1002
1003	750471.8167	2080805.357	6039.21	1003 (RF-200)
1004	749803.8957	2082906.441	6006.60	1004
1005	751475.9037	2082101.646	6007.71	1005 (RF-201)
1006	753129.2187	2083175.82	5982.30	1006
1007	750092.2207	2084789.635	5973.58	1007
1008	747432.7597	2085548.611	5848.69	1008
1009	753260.9677	2089684.733	5761.07	1009
1010	751513.2147	2087876.048	5913.15	1010
1011	746981.9277	2087918.342	5901.45	1011

IX. The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

DATABASE = Sybase ,PROGRAM = datasheet, VERSION = 7,28

1 National Geodetic Survey, Retrieval Date = SEPTEMBER 28, 2005

KK0655 *****

KK0655 DESIGNATION - TT 23 J

KK0655 PID - KK0655

KK0655 STATE/COUNTY- CO/BOULDER

KK0655 USGS QUAD - LOUISVILLE (1994)

KK0655

KK0655 *CURRENT SURVEY CONTROL

KK0655

KK0655* NAD 83(1992)- 39 55 40.61368(N) 105 13 59.89777(W) ADJUSTED

KK0655* NAVD 88 - 1798.925 (meters) 5901.97 (feet) ADJUSTED

KK0655

KK0655 X - -1,287,268.742 (meters) COMP

KK0655 Y - -4,727,074.383 (meters) COMP

KK0655 Z - 4,072,998.249 (meters) COMP

KK0655 LAPLACE CORR- -18.74 (seconds) DEFLEC99

KK0655 ELLIP HEIGHT- 1783.06 (meters) (12/03/02) GPS OBS

KK0655 GEOID HEIGHT- -15.83 (meters) GEOID03

KK0655 DYNAMIC HT - 1797.140 (meters) 5896.12 (feet) COMP

KK0655 MODELED GRAV- 979,570.8 (mgal) NAVD 88

KK0655

KK0655 HORZ ORDER - FIRST

KK0655 VERT ORDER - FIRST CLASS II

KK0655 ELLP ORDER - FOURTH CLASS II

KK0655

KK0655.The horizontal coordinates were established by GPS observations

KK0655.and adjusted by the National Geodetic Survey in February 2000.

KK0655

KK0655.The orthometric height was determined by differential leveling

KK0655.and adjusted by the National Geodetic Survey in June 1991.

KK0655

KK0655.The X, Y, and Z were computed from the position and the ellipsoidal ht.

KK0655

KK0655.The Laplace correction was computed from DEFLEC99 derived deflections.

KK0655

KK0655.The ellipsoidal height was determined by GPS observations

KK0655.and is referenced to NAD 83.

KK0655

KK0655.The geoid height was determined by GEOID03.

KK0655

KK0655.The dynamic height is computed by dividing the NAVD 88

KK0655.geopotential number by the normal gravity value computed on the

KK0655.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

KK0655.degrees latitude (g = 980.6199 gals.).

KK0655

KK0655.The modeled gravity was interpolated from observed gravity values.

KK0655

KK0655; North East Units Scale Factor Converg.

KK0655;SPC CO N - 370,854.808 937,199.209 MT 0.99997263 +0 10 20.4

KK0655;SPC CO N - 1,216,712.82 3,074,794.40 sFT 0.99997263 +0 10 20.4

KK0655;SPC CO C - 537,363.710 937,200.748 MT 1.00004006 +0 10 05.5

KK0655;SPC CO C - 1,763,000.77 3,074,799.45 sFT 1.00004006 +0 10 05.5

KK0655;UTM 13 - 4,419,786.279 480,064.235 MT 0.99960489 -0 08 59.1

KK0655'6.6 MI S FROM BOULDER.

KK0655'6.65 MILES SOUTH ALONG STATE HIGHWAY 93 FROM THE UNIVERSITY
KK0655'INTERMEDIATE SCHOOL AT BOULDER, 30 FEET EAST OF THE CENTER LINE
KK0655'OF THE HIGHWAY, 1 FOOT WEST OF A FENCE, 3 FEET NORTH OF A WITNESS
KK0655'POST, SET IN THE TOP OF A CONCRETE POST WHICH PROJECTS 0.6 FOOT
KK0655'ABOVE THE GROUND.

KK0655

STATION RECOVERY (1977)

KK0655

KK0655'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1977 (LHW)
KK0655'STATION IS ABOUT 12 MILES NORTH OF GOLDEN, 6-3/4 MILES SOUTH-
KK0655'SOUTHEAST OF BOULDER, 3/4 MILE NORTH OF THE BOULDER-JEFFERSON
KK0655'COUNTY LINE, ON STATE HIGHWAY RIGHT-OF-WAY, IN THE NORTH
KK0655'CENTRAL 1/2 OF SEC 32, T 1 S, R 70 W.

KK0655'

KK0655'TO REACH THE STATION FROM THE JUNCTION OF STATE HIGHWAYS
KK0655'93 AND 128, ABOUT 7 MILES SOUTH OF BOULDER, GO EAST ON HIGH-
KK0655'WAY 128 FOR 0.1 MILE TO THE STATION ON THE RIGHT. TO REACH
KK0655'THE AZIMUTH MARK FROM THE STATION, GO EAST AND SOUTHEAST
KK0655'ON HIGHWAY 128 FOR 0.3 MILE TO A CUTBANK ON THE LEFT AND THE
KK0655'MARK ON THE LEFT ATOP THE CUTBANK AND NEAR THE NORTH
KK0655'RIGHT-OF-WAY FENCE.

KK0655'

KK0655'STATION MARK, STAMPED---TT 23 J 1936---, IS A BRONZE BENCH
KK0655'MARK DISK OF THE U.S. GEOLOGICAL SURVEY, SET IN THE TOP OF
KK0655'AN 8-INCH SQUARE CONCRETE MONUMENT THAT PROJECTS 5 INCHES.
KK0655'IT IS 106 FEET SOUTH OF THE CENTER OF HIGHWAY 128, 19 FEET
KK0655'NORTH OF THE SOUTH RIGHT-OF-WAY FENCE AND 2 FEET NORTH OF A
KK0655'METAL WITNESS POST AND 4 INCH BY 4 INCH WOODEN POST.

KK0655'

KK0655'REFERENCE MARK 1, STAMPED---TT 23 J USGS NO 1 1977---, IS A
KK0655'STANDARD DISK CEMENTED IN A DRILL HOLE IN A TRIANGULAR
KK0655'SHAPED BOULDER THAT PROJECTS 2 INCHES. IT IS 65 FEET
KK0655'SOUTH OF THE CENTER OF THE HIGHWAY AND 55.5 FEET NORTH OF
KK0655'THE RIGHT-OF-WAY FENCE.

KK0655'

KK0655'REFERENCE MARK 2, STAMPED---TT 23 J USGS NO 2 1977---, IS A
KK0655'STANDARD DISK CEMENTED IN A DRILL HOLE IN A 12-INCH ROUND
KK0655'BOULDER THAT PROJECTS 1 INCH. IT IS 33 FEET EAST OF THE
KK0655'WITNESS POST AND 14 FEET NORTH OF THE FENCE.

KK0655'

KK0655'AZIMUTH MARK, STAMPED---TT 23 J USGS 1977---, IS A STANDARD
KK0655'DISK CEMENTED IN A DRILL HOLE IN A 12-INCH ROUND BOULDER
KK0655'THAT PROJECTS 4 INCHES. IT IS 4 FEET NORTHWEST OF A METAL
KK0655'WITNESS POST AND 3.5 FEET SOUTHWEST OF THE RIGHT-OF-WAY
KK0655'FENCE.

KK0655'

KK0655'HEIGHT OF LIGHT ABOVE STATION WAS 1.4 METERS.

KK0655

STATION RECOVERY (1982)

KK0655

KK0655'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1982
KK0655'0.2 KM (0.1 MI) EAST OF STATE HIGHWAY 93, 32.3 M (106 FT) SOUTH OF
KK0655'THE CENTERLINE OF THE SOUTH LANE OF COLORADO STATE HIGHWAY 128, AND
KK0655'5.5 M (18 FT) NORTH OF AN EAST-WEST RIGHT OF WAY FENCE.

KK0655

STATION RECOVERY (1984)

KK0655

KK0655'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1984
KK0655'RECOVERED IN GOOD CONDITION. A NEW DESCRIPTION FOLLOWS. 4.0 KM
KK0655'(2.5 MI) SOUTH ALONG U.S. HIGHWAY 36 FROM ITS NORTH JUNCTION WITH

KK0655'STATE HIGHWAY 119 IN BOULDER, THENCE 0.4 KM (0.25 MI) WEST ALONG
KK0655'BASELINE ROAD, THENCE 9.0 KM (5.6 MI) SOUTHERLY ALONG STATE HIGHWAY
KK0655'93, 115.0 METERS (377.3 FT) EAST OF THE CENTERLINE OF THE HIGHWAY,
KK0655'32.3 METERS (106.0 FT) SOUTH OF THE CENTERLINE OF THE SOUTHEAST BOUND
KK0655'LANES OF STATE HIGHWAY 128, AND 5.4 METERS (17.7 FT) NORTH OF A FENCE.
KK0655'THE MARK IS 0.7 METERS N FROM A WITNESS POST.
KK0655'THE MARK IS ABOVE LEVEL WITH THE HIGHWAY.

KK0655

STATION RECOVERY (1986)

KK0655

KK0655

KK0655'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1986 (RSC)

KK0655'THE STATION WAS RECOVERED AT THIS DATE.

KK0655'RECOVERED IN GOOD CONDITION AND AS DESCRIBED.

KK0655'

KK0655'DESCRIBED BY R.S. COHEN.

KK0655

STATION RECOVERY (1986)

KK0655

KK0655

KK0655'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1986 (MCG)

KK0655'THE DESIGNATED MARK WAS RECOVERED AS PREVIOUSLY DESCRIBED.

KK0655'THE MARK WAS RECOVERED IN GOOD CONDITION.

KK0655

STATION RECOVERY (1998)

KK0655

KK0655

KK0655'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1998 (RSC)

KK0655'RECOVERED IN GOOD CONDITION AND AS DESCRIBED WITH THE FOLLOWING

KK0655'ADDITION. AT STATE HIGHWAY 128 MILEPOST 0.1.

*** retrieval complete.

Elapsed Time = 00:00:02

X. The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

DATABASE = Sybase ,PROGRAM = datasheet, VERSION = 7.28

1 National Geodetic Survey, Retrieval Date = SEPTEMBER 28, 2005

KK1432 *****

KK1432 DESIGNATION - JEFFCO RESET

KK1432 PID - KK1432

KK1432 STATE/COUNTY- CO/JEFFERSON

KK1432 USGS QUAD - LAFAYETTE (1994)

KK1432

KK1432 *CURRENT SURVEY CONTROL

KK1432

KK1432* NAD 83(1992)- 39 54 43.05405(N) 105 05 50.35674(W) ADJUSTED

KK1432* NAVD 88 - 1694.016 (meters) 5557.78 (feet) ADJUSTED

KK1432

KK1432 X - -1,276,321.740 (meters) COMP

KK1432 Y - -4,731,138.095 (meters) COMP

KK1432 Z - 4,071,568.452 (meters) COMP

KK1432 LAPLACE CORR- -11.98 (seconds) DEFLEC99

KK1432 ELLIP HEIGHT- 1677.27 (meters) (10/21/02) GPS OBS

KK1432 GEOID HEIGHT- -16.78 (meters) GEOID03

KK1432 DYNAMIC HT - 1692.394 (meters) 5552.46 (feet) COMP

KK1432 MODELED GRAV- 979,608.9 (mgal) NAVD 88

KK1432

KK1432 HORZ ORDER - FIRST

KK1432 VERT ORDER - FIRST CLASS II

KK1432 ELLP ORDER - FIFTH CLASS I

KK1432

KK1432.The horizontal coordinates were established by GPS observations

KK1432.and adjusted by the National Geodetic Survey in May 1996.

KK1432

KK1432.The orthometric height was determined by differential leveling

KK1432.and adjusted by the National Geodetic Survey in June 1991.

KK1432.WARNING-GPS observations at this control monument resulted in a GPS

KK1432.derived orthometric height which differed from the leveled height by

KK1432.more than one decimeter (0.1 meter).

KK1432

KK1432.The X, Y, and Z were computed from the position and the ellipsoidal ht.

KK1432

KK1432.The Laplace correction was computed from DEFLEC99 derived deflections.

KK1432

KK1432.The ellipsoidal height was determined by GPS observations

KK1432.and is referenced to NAD 83.

KK1432

KK1432.The geoid height was determined by GEOID03.

KK1432

KK1432.The dynamic height is computed by dividing the NAVD 88

KK1432.geopotential number by the normal gravity value computed on the

KK1432.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

KK1432.degrees latitude (g = 980.6199 gals.).

KK1432

KK1432.The modeled gravity was interpolated from observed gravity values.

KK1432

KK1432;	North	East	Units	Scale	Factor	Converg.
KK1432:SPC CO C	- 535,631.202	948,833.364	MT	1.00003606		+0 15 14.3
KK1432:SPC CO C	- 1,757,316.70	3,112,964.13	sFT	1.00003606		+0 15 14.3
KK1432:SPC CO N	- 369,123.462	948,831.230	MT	0.99997423		+0 15 36.7
KK1432:SPC CO N	- 1,211,032.56	3,112,957.13	sFT	0.99997423		+0 15 36.7
KK1432:UTM 13	- 4,417,990.187	491,682.022	MT	0.99960085		-0 03 44.8

KK1432

KK1432! - Elev Factor x Scale Factor = Combined Factor

KK1432:SPC CO C - 0.99973694 x 1.00003606 = 0.99977299

KK1432:SPC CO N - 0.99973694 x 0.99997423 = 0.99971118

KK1432:UTM 13 - 0.99973694 x 0.99960085 = 0.99933789

KK1432

KK1432:	Primary Azimuth Mark	Grid Az
KK1432:SPC CO C	- JEFFCO AZ MK	172 17 12.5
KK1432:SPC CO N	- JEFFCO AZ MK	172 16 50.1
KK1432:UTM 13	- JEFFCO AZ MK	172 36 11.6

KK1432

KK1432	-----		
KK1432	PID	Reference Object	Distance Geod. Az
KK1432			dddmmss.s
KK1432	KK2051	BROOMFIELD GREEN TANK	APPROX. 3.8 KM 0273815.4
KK1432	KK1745	NORTHGLENN MUN TANK	APPROX. 8.2 KM 1140841.6
KK1432	KK1433	JEFFCO AZ MK	APPROX. 1.1 KM 1723226.8
KK1432	CP8324	JEFFCO RM 2	10.748 METERS 17414
KK1432	CP8323	JEFFCO RM 1	10.279 METERS 35356
KK1432	LL1409	ERIE ALEXANDER DAWSON SCH TANK	APPROX.16.9 KM 3564737.8
KK1432	-----		

KK1432

KK1432

SUPERSEDED SURVEY CONTROL

KK1432

KK1432	ELLIP H (05/15/96)	1677.29 (m)	GP() 3 1
KK1432	NAD 83(1992)-	39 54 43.05416(N)	105 05 50.36276(W) AD() 1
KK1432	NAD 83(1986)-	39 54 43.04308(N)	105 05 50.35714(W) AD() 1
KK1432	NAVD 88 (05/15/96)	1694.02 (m)	5557.8 (f) LEVELING 3
KK1432	NGVD 29 (??/??/??)	1693.087 (m)	5554.74 (f) ADJUSTED 1 2

KK1432

KK1432.Superseded values are not recommended for survey control.

KK1432.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

KK1432.See file dsdata.txt to determine how the superseded data were derived.

KK1432

KK1432_U.S. NATIONAL GRID SPATIAL ADDRESS: 13SDE9168217990(NAD 83)

KK1432_MARKER: DH = HORIZONTAL CONTROL DISK

KK1432_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT

KK1432_SP_SET: CONCRETE POST

KK1432_STAMPING: JEFFCO 1977 1980

KK1432_MARK LOGO: NGS

KK1432_PROJECTION: FLUSH

KK1432_MAGNETIC: O = OTHER; SEE DESCRIPTION

KK1432_STABILITY: D = MARK OF QUESTIONABLE OR UNKNOWN STABILITY

KK1432_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

KK1432+SATELLITE: SATELLITE OBSERVATIONS - April 06, 1999

KK1432

KK1432 HISTORY	- Date	Condition	Report By
KK1432 HISTORY	- 1980	MONUMENTED	NGS
KK1432 HISTORY	- 1981	GOOD	NGS
KK1432 HISTORY	- 19811209	GOOD	NGS
KK1432 HISTORY	- 1984	GOOD	NGS
KK1432 HISTORY	- 1986	GOOD	NGS
KK1432 HISTORY	- 19951202	GOOD	CHANCE
KK1432 HISTORY	- 19990223	GOOD	NGS
KK1432 HISTORY	- 19990406	GOOD	NGS

KK1432

KK1432

STATION DESCRIPTION

KK1432

KK1432'DESCRIBED BY NATIONAL GEODETIC SURVEY 1980 (CLN)

KK1432'STATION WAS RECOVERED AND OCCUPIED IN 1979, ALL MARKS WERE IN GOOD
KK1432'CONDITION. AT TIME OF PRESENT RECOVERY, STATION MARK AND BOTH
KK1432'REFERENCE MARKS WERE NOTED TO BE COVERED BY FILL DIRT. STATION MARK
KK1432'WAS FOUND, A 12 INCH METAL PIPE, 3.7 FEET IN HEIGHT WAS PLACED OVER
KK1432'THE ORIGINAL SURFACE MARK AND MARK RAISED TO SURFACE OF GROUND. AN
KK1432'8 INCH PIPE WAS PLACED OVER REFERENCE MARK NUMBER 2 AND RAISED TO
KK1432'GROUND SURFACE. REFERENCE MARK NUMBER 1 WAS NOT SEARCHED FOR BUT IS
KK1432'PROBABLY STILL IN ITS ORIGINAL LOCATION UNDER ABOUT 4 FEET OF FILL
KK1432'DIRT. AZIMUTH MARK IS IN GOOD CONDITION. A NEW REFERENCE MARK,
KK1432'NUMBER 3 WAS ESTABLISHED AT THIS TIME. DISTANCE AND DIRECTION TO
KK1432'REFERENCE MARK 2 AND THE HORIZONTAL ANGLE BETWEEN THE NORTH GLENN
KK1432'TANK AND THE AZIMUTH MARK COMPARED FAVORABLY WITH PREVIOUS DATA. A
KK1432'NEW JEFFERSON COUNTY AIRPORT TERMINAL BUILDING IS BEING CONSTRUCTED
KK1432'ABOUT 0.05 MILES WEST OF THE STATION.

KK1432'

KK1432'STATION MARKS ARE STANDARD DISKS. ORIGINAL SURFACE AND SUBSURFACE
KK1432'DISKS ARE STAMPED--JEFFCO 1977--AND THE SURFACE DISK IS NOW ABOUT
KK1432'3.7 FEET DEEP. PRESENT SURFACE DISK IS STAMPED--JEFFCO 1977 1980--,
KK1432'SET IN THE TOP OF A 12 INCH ROUND CONCRETE FILLED METAL PIPE FLUSH
KK1432'WITH THE GROUND, 117 FEET WEST OF CENTER STATE HIGHWAY 121, 2.8 FEET
KK1432'EAST OF A CONCRETE CURB, 2.2 FEET SOUTH OF A METAL WITNESS POST.

KK1432'

KK1432'REFERENCE MARK 2 SUBSURFACE DISK IS STAMPED--JEFFCO NO 2 1977--AND
KK1432'IS ABOUT 3 FEET DEEP. PRESENT SURFACE DISK IS STAMPED--JEFFCO 1977
KK1432'NO 2 1980-- , SET IN THE TOP OF AN 8 INCH ROUND METAL PIPE FLUSH WITH
KK1432'THE GROUND, 117 FEET WEST OF CENTER HIGHWAY 121 SOUTHBOUND LANE.

KK1432'

KK1432'REFERENCE MARK 3 IS A STANDARD DISK, STAMPED--JEFFCO 1977 NO 2
KK1432'1980-- , SET IN THE TOP OF A ROUND CONCRETE MONUMENT FLUSH WITH THE
KK1432'GROUND, 77 FEET WEST OF CENTER HIGHWAY 121 SOUTHBOUND LANE, 1.8 FEET
KK1432'EAST OF EAST EDGE OF A CONCRETE WALK AND ABOUT 5 FEET LOWER THAN
KK1432'STATION MARK.

KK1432'

KK1432'AZIMUTH MARK IS A STANDARD DISK, STAMPED--JEFFCO 1977-- , SET IN
KK1432'THE TOP OF A ROUND CONCRETE MONUMENT FLUSH WITH THE GROUND, 119 FEET
KK1432'EAST OF CENTER HIGHWAY 121 NORTHBOUND LANE, 3 FEET NORTHWEST OF A
KK1432'METAL WITNESS POST, 1.3 FEET WEST OF A FENCE.

KK1432'

KK1432'DESCRIPTION OF HOW TO REACH STATION IS STILL ADEQUATE.

KK1432

KK1432

STATION RECOVERY (1981)

KK1432

KK1432'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1981 (RMM)

KK1432'THE STATION MARK (STAMPED JEFFCO 1977 1980), RM 2 (STAMPED JEFFCO NO
KK1432'2 1977 1980), AND THE AZIMUTH MARK (STAMPED JEFFCO 1977) WERE
KK1432'RECOVERED IN GOOD CONDITION. NO DESCRIPTION AVAILABLE.

KK1432'
KK1432' AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN--1 MILE SOUTHWEST OF
KK1432' BROOMFIELD.

KK1432

STATION RECOVERY (1981)

KK1432

KK1432' RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1981 (CLN)

KK1432' THE STATION MARK, REFERENCE MARK 3 AND THE AZIMUTH MARK WERE RECOVERED

KK1432' IN GOOD CONDITION. REFERENCE MARK 2 SET IN 1980 WAS FOUND LOOSE IN

KK1432' THE GROUND TO SUCH AN EXTENT THAT IT WAS DESTROYED. THE ORIGINAL

KK1432' REFERENCE MARKS 1 AND 2 ARE BURIED UNDER FILL DIRT. TWO NEW REFERENCE

KK1432' MARKS WERE SET AT THIS TIME AND NUMBERED 4 AND 5. A CHECK WAS MADE OF

KK1432' THE DISTANCE TO THE AZIMUTH MARK FROM THE STATION MARK AT THE REQUEST

KK1432' OF THE JEFFERSON COUNTY MAPPING GROUP AND A 100 METER (328.1 FT) BUST

KK1432' WAS FOUND AS MY DISTANCE CHECKED THEIRS. THE DISTANCE AND DIRECTIONS

KK1432' CHECKED WITHIN LIMITS WITH THE 1977 AND 1980 OBSERVATIONS. THE

KK1432' LOCATION AND TO REACH ARE ADEQUATE TO RECOVER THE STATION. A NEW

KK1432' BUILDING TO THE WEST OF THE STATION ABOUT 0.1 KM (0.05 MI) AND WHOSE

KK1432' LAND REFERENCE MARKS 4 AND 5 ARE LOCATED ON, BELONGS TO, ROCKY

KK1432' MOUNTAIN ENERGY, 10 LONGS PEAK DRIVE, P.O. BOX 2000, BROOMFIELD, CO.

KK1432' 80020.

KK1432' REFERENCE MARK NO 4 IS A STANDARD NGS DISK STAMPED--JEFFCO 1977 NO 4

KK1432' 1981--, SET INTO THE TOP OF A CURB ON THE EASTSIDE OF A SHORT DEAD END

KK1432' STREET. LOCATED 3.5 METERS (11.5 FT) EAST FROM THE CENTER OF A PAVED

KK1432' DEADEND STREET WEST OF STATION. 6.1 METERS (20.0 FT) NORTH FROM A

KK1432' METAL WITNESS POST WITH SIGN. 7.5 METERS (24.6 FT) NORTH FROM THE END

KK1432' OF THE STREET AND 1.0 FEET (0.3 M) HIGHER THAN THE STATION.

KK1432' REFERENCE MARK NO 5 IS A STANDARD NGS DISK STAMPED--JEFFCO 1977 NO 5

KK1432' 1981--, SET INTO THE WESTSIDE OF A CONCRETE CURB OF A SHORT DEADEND

KK1432' STREET. LOCATED 7.9 METERS (25.9 FT) WEST FROM A METAL WITNESS POST

KK1432' AND SIGN. 3.5 WEST FROM THE CENTER OF A DEADEND STREET WEST OF THE

KK1432' STATION. 3.4 METERS (11.2 FT) NORTH FROM THE END OF THE STREET AND

KK1432' 1.0 FEET (0.3 M) HIGHER THAN THE STATION.

KK1432'

KK1432

STATION RECOVERY (1984)

KK1432

KK1432' RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1984

KK1432' 1.1 KM (0.7 MI) SOUTH FROM BROOMFIELD.

KK1432' 1.1 KM (0.7 MI) SOUTHERLY ALONG STATE HIGHWAY 121 FROM ITS JUNCTION

KK1432' WITH U.S. HIGHWAY 287 IN BROOMFIELD, 0.4 KM (0.25 MI) NORTH OF THE

KK1432' ENTRANCE TO THE JEFFCO AIRPORT, 99.0 METERS (324.8 FT) EAST OF THE

KK1432' EAST FACE OF A STUCCO BUILDING, 28.5 METERS (93.5 FT) WEST OF THE

KK1432' CENTERLINE OF THE SOUTH BOUND LANES OF THE HIGHWAY, AND 0.3 METERS

KK1432' (1.0 FT) EAST OF A FENCE.

KK1432' THE MARK IS 0.6 METERS S FROM A WITNESS POST.

KK1432' THE MARK IS 5.0 M ABOVE THE HIGHWAY.

KK1432

KK1432

STATION RECOVERY (1986)

KK1432

KK1432' RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1986 (MCG)

KK1432' THE DESIGNATED MARK WAS RECOVERED AS PREVIOUSLY DESCRIBED.

KK1432' THE MARK WAS RECOVERED IN GOOD CONDITION.

KK1432

KK1432

STATION RECOVERY (1995)

KK1432

KK1432' RECOVERY NOTE BY JE CHANCE AND ASSOCIATES 1995 (FND)

KK1432' STATION AND REFERENCE MARKS NO. 4 AND NO. 5 WERE RECOVERED IN GOOD

KK1432' CONDITION AS DESCRIBED. A NEW DESCRIPTION FOLLOWS--THE STATION IS

KK1432' LOCATED IN THE SOUTHERLY PART OF THE CITY OF BROOMFIELD, ABOUT 1 MI

KK1432' (1.6 KM) EAST OF JEFFERSON COUNTY AIRPORT, 3.5 MI (5.6 KM)

KK1432'NORTH-NORTHEAST OF STANLEY LAKE, 5 MI (8.0 KM) SOUTH-SOUTHEAST OF
 KK1432'LOUISVILLE, 6 MI (9.7 KM) EAST-NORTHEAST OF THE ROCKY FLATS
 KK1432'ENVIRONMENTAL TECHNOLOGY SITE, IN THE NORTHEAST 1/4 OF SECTION 3, T 2
 KK1432'S, R 69 W, 6TH P.M. OWNERSHIP--COLORADO DEPARTMENT OF
 KK1432'TRANSPORTATION\$TO REACH THE STATION FROM THE INTERSECTION OF U.S.
 KK1432'HIGHWAY 36 AND WADSWORTH BYPASS (STATE HIGHWAY 121) , GO SOUTHWEST
 KK1432'ALONG WADSWORTH BYPASS (HIGHWAY 121) FOR 0.2 MI (0.3 KM) TO THE
 KK1432'INTERSECTION WITH STATE HIGHWAY 128 ON THE RIGHT. CONTINUE AHEAD AND
 KK1432'GO SOUTH ALONG WADSWORTH BYPASS (HIGHWAY 121) FOR 0.15 MI (0.24 KM) TO
 KK1432'THE STATION ON THE RIGHT. FOR CLOSER ACCESS, CONTINUE AHEAD AND GO
 KK1432'SOUTH ALONG WADSWORTH BYPASS (HIGHWAY 121) FOR 0.2 MI (0.3 KM) TO THE
 KK1432'INTERSECTION WITH JEFFCO AIRPORT AVENUE ON THE RIGHT. TURN RIGHT AND
 KK1432'GO WEST ALONG JEFFCO AIRPORT AVENUE FOR 0.1 MI (0.2 KM) TO THE
 KK1432'INTERSECTION WITH LONGS PEAK DRIVE ON THE RIGHT. TURN RIGHT AND GO
 KK1432'NORTH, NORTHWEST, AND NORTH ALONG LONGS PEAK DRIVE FOR 0.4 MI (0.6 KM)
 KK1432'TO THE ENTRANCE TO BALL CORPORATION COLORADO ENGINEERING CENTER ON THE
 KK1432'RIGHT. TURN RIGHT AND GO EAST ALONG THE DRIVEWAY FOR 0.1 MI (0.2 KM)
 KK1432'TO AN INTERSECTION WITH A DRIVEWAY ON THE RIGHT AT A SIGN FOR SHIPPING
 KK1432'AND RECEIVING AND THE WEST SIDE OF A PARKING LOT. TURN RIGHT AND GO
 KK1432'SOUTH ALONG THE DRIVEWAY FOR 0.05 MI (0.08 KM) TO AN ANGLE POINT LEFT.
 KK1432'TURN LEFT AND GO EAST ALONG THE DRIVEWAY, PASSING ALONG THE NORTH SIDE
 KK1432'OF THE BUILDING, FOR 0.15 MI (0.24 KM) TO AN INTERSECTION WITH A
 KK1432'NORTH-SOUTH DRIVE NEAR THE RIGHT-OF-WAY FENCE OF WADSWORTH BYPASS.
 KK1432'TURN RIGHT AND GO SOUTH ALONG THE DRIVE AND ALONG THE RIGHT-OF-WAY
 KK1432'FENCE FOR 0.03 MI (0.05 KM) TO THE END OF THE DRIVE AND THE STATION ON
 KK1432'THE LEFT\$THE STATION MARK IS A STANDARD NGS HORIZONTAL CONTROL MARK
 KK1432'DISK STAMPED --JEFFCO 1977 1980-- SET IN THE TOP OF A CONCRETE POST
 KK1432'0.2 FT (6.1 CM) BELOW GROUND LEVEL. IT IS 118 FT (36.0 M) WEST OF THE
 KK1432'CENTERLINE OF THE SOUTH-BOUND LANES OF WADSWORTH BYPASS, 15 FT (4.6 M)
 KK1432'EAST OF THE CENTERLINE OF THE DRIVEWAY, 1.7 FT (0.5 M) EAST OF THE
 KK1432'RIGHT-OF-WAY FENCE, 2.4 FT (0.7 M) NORTH OF THE BACK OF THE CONCRETE
 KK1432'CURB (PROJECTED EAST) AT THE SOUTH END OF THE DRIVEWAY, 29.9 FT (9.1
 KK1432'M) WEST OF THE WEST EDGE OF AN 8 FOOT (2.4 M) WIDE CONCRETE SIDEWALK,
 KK1432'2.3 FT (0.7 M) SOUTH OF A METAL WITNESS POST WITH SIGN, AND 3.9 FT
 KK1432'(1.2 M) NORTH OF A CARSONITE WITNESS POST\$DESCRIBED BY F.N. DREXEL

KK1432

STATION RECOVERY (1999)

KK1432

KK1432

KK1432'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1999 (RSC)

KK1432'RECOVERED AS DESCRIBED.

KK1432

STATION RECOVERY (1999)

KK1432

KK1432

KK1432'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1999 (RSC)

KK1432'THE MARK WAS RECOVERED IN GOOD CONDITION AND THE 1995 DESCRIPTION IS

KK1432'GOOD. ADD- AT STATE HIGHWAY 121 MILEPOST 25.6. ABOUT 6 M (19.7 FT)

KK1432'ABOVE THE HIGHWAY,

*** retrieval complete.

Elapsed Time = 00:00:01

Recompute Report

Project : FLATS-CONTROL-NET-NAD-83

User name	Jjung	Date & Time	8:26:17 AM 9/14/2005
Coordinate System	US State Plane 1983	Zone	Colorado Central 0502
Project Datum	NAD 1983 (Conus)		

Vertical Datum		Geoid Model	GEOID99 (Conus)
Coordinate Units	US survey feet		
Distance Units	US survey feet		
Height Units	US survey feet		

Contents

-  [Point Derivations](#)
-  [Closures](#)
-  [Survey Data \(Observations and Coordinates\)](#)

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Closures

Closures have been detected for the following points

[1015](#)

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Point Derivations

Observations or coordinates in red are out of tolerance. They have not been used to determine the coordinate of the point.

Resultant coordinates for point : 1004

Northing		Easting		Elevation	Height		
1749813.812sft 		3082752.088sft 		6009.910sft 	5957.478sft 		
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
 CW298 Adjustment	NEeh	Enabled	0.000sft 	0.000sft 	0.000sft 	0.000sft 	0.000sft 

Resultant coordinates for point : 1003

Northing		Easting		Elevation	Height		
1750481.766sft 		3080650.994sft 		6042.522sft 	5990.281sft 		
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
 CW297 Adjustment	NEeh	Enabled	0.000sft 	0.000sft 	0.000sft 	0.000sft 	0.000sft 

Resultant coordinates for point : 1001

Northing		Easting		Elevation		Height	
1747376.894sft		3079339.642sft		6036.045sft		5983.999sft	
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
<u>CW300 Adjustment</u>	NEeh	Enabled	0.000sft	0.000sft	0.000sft	0.000sft	0.000sft

Resultant coordinates for point : 1002

Northing		Easting		Elevation		Height	
1749384.205sft		3079824.594sft		6064.662sft		6012.526sft	
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
<u>CW299 Adjustment</u>	NEeh	Enabled	0.000sft	0.000sft	0.000sft	0.000sft	0.000sft

Resultant coordinates for point : 1007

Northing		Easting		Elevation		Height	
1750102.114sft		3084635.299sft		5976.903sft		5924.288sft	
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
<u>CW302 Adjustment</u>	NEeh	Enabled	0.000sft	0.000sft	0.000sft	0.000sft	0.000sft

Resultant coordinates for point : 1008

Northing		Easting		Elevation		Height	
1747442.619sft		3085394.257sft		5852.002sft		5799.364sft	
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
<u>CW301 Adjustment</u>	NEeh	Enabled	0.000sft	0.000sft	0.000sft	0.000sft	0.000sft

Resultant coordinates for point : 1005

Northing	Easting	Elevation	Height
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ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
1751485.845sft			3081947.302sft		6011.036sft	5958.651sft	
<u>CW303 Adjustment</u>	NEeh	Enabled	0.000sft	0.000sft	0.000sft	0.000sft	0.000sft

Resultant coordinates for point : 1006

Northing		Easting		Elevation		Height	
1753139.162sft		3083021.498sft		5985.612sft		5933.094sft	
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
<u>CW304 Adjustment</u>	NEeh	Enabled	0.000sft	0.000sft	0.000sft	0.000sft	0.000sft

Resultant coordinates for point : 1010

Northing		Easting		Elevation		Height	
1751523.080sft		3087721.749sft		5916.471sft		5863.551sft	
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
<u>CW305 Adjustment</u>	NEeh	Enabled	0.000sft	0.000sft	0.000sft	0.000sft	0.000sft

Resultant coordinates for point : 1011

Northing		Easting		Elevation		Height	
1746991.753sft		3087764.001sft		5904.771sft		5851.929sft	
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
<u>CW306 Adjustment</u>	NEeh	Enabled	0.000sft	0.000sft	0.000sft	0.000sft	0.000sft

Resultant coordinates for point : 1009

Northing		Easting		Elevation		Height	
1753270.823sft		3089530.462sft		5764.390sft		5711.280sft	
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
<u>CW307 Adjustment</u>	NEeh	Enabled	0.000sft	0.000sft	0.000sft	0.000sft	0.000sft

Resultant coordinates for point : 10

Northing		Easting		Elevation		Height	
1763000.772sft ▲		3074799.454sft ▲		5901.808sft ?		5849.920sft ▲	
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
●CW55 Office entered	NEeh	Enabled	0.000sft ▲	0.000sft ▲	0.000sft ▲	0.000sft ?	0.000sft ▲

Resultant coordinates for point : 1015

Northing		Easting		Elevation		Height	
1757316.637sft ⊗		3112964.082sft ⊗		5557.858sft ?		5502.925sft ⊗	
ID	Used to calc.	Status	Δ North	Δ East	Distance (Horiz)	Δ Elevation	Δ Height
●CW261 Office entered		Enabled	-0.066sft ▲	-0.048sft ▲	0.081sft ▲	0.078sft ?	0.078sft ▲
●CW308 Adjustment	NEeh	Enabled	0.000sft ⊗	0.000sft ⊗	0.000sft ⊗	0.000sft ?	0.000sft ⊗

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Survey Data

●Coordinates

ID	Point Name	Source	Latitude	Longitude	Height	Elevation
C298(geod-WGS)	<u>1004</u>	Adjustment	39°53'30.05594"N ⊗	105°12'18.37040"W ⊗	5957.478sft ?	?
C297(geod-WGS)	<u>1003</u>	Adjustment	39°53'36.72332"N ⊗	105°12'45.29812"W ⊗	5990.281sft ?	?
C300(geod-WGS)	<u>1001</u>	Adjustment	39°53'06.08108"N ⊗	105°13'02.24579"W ⊗	5983.999sft ?	?
C299(geod-WGS)	<u>1002</u>	Adjustment	39°53'25.90274"N ⊗	105°12'55.94433"W ⊗	6012.526sft ?	?
C302(geod-WGS)	<u>1007</u>	Adjustment	39°53'32.84390"N ⊗	105°11'54.19851"W ⊗	5924.288sft ?	?

C301(geod-WGS)	<u>1008</u>	Adjustment	39°53'06.53728"N	105°11'44.57605"W	5799.364sft	? ?
C303(geod-WGS)	<u>1005</u>	Adjustment	39°53'46.60494"N	105°12'28.62600"W	5958.651sft	? ?
C304(geod-WGS)	<u>1006</u>	Adjustment	39°54'02.90889"N	105°12'14.77520"W	5933.093sft	? ?
C305(geod-WGS)	<u>1010</u>	Adjustment	39°53'46.78298"N	105°11'14.53947"W	5863.550sft	? ?
C306(geod-WGS)	<u>1011</u>	Adjustment	39°53'02.00221"N	105°11'14.19750"W	5851.929sft	? ?
C307(geod-WGS)	<u>1009</u>	Adjustment	39°54'03.99226"N	105°10'51.25530"W	5711.279sft	? ?
C55(geod-WGS)	<u>10</u>	Office entered	39°55'40.61368"N	105°13'59.89777"W	5849.920sft	? ?
C261(geod-WGS)	<u>1015</u>	Office entered	39°54'43.05405"N	105°05'50.35674"W	5502.847sft	? ?
C308(geod-WGS)	<u>1015</u>	Adjustment	39°54'43.05340"N	105°05'50.35736"W	5502.925sft	? ?

ID	Point Name	Source	Quality	Latitude	Longitude	Height
C1(soln)	<u>1004</u>	DAT file (15532380.dat)	?	39°53'30.08027"N	105°12'18.45914"W	5961.287sft
C5(soln)	<u>1004</u>	DAT file (15532380.dat)	?	39°53'30.12236"N	105°12'18.41521"W	5967.693sft
C9(soln)	<u>1004</u>	DAT file (15532380.dat)	?	39°53'30.17185"N	105°12'18.38302"W	5961.122sft
C2(soln)	<u>1003</u>	DAT file (24292380.dat)	?	39°53'36.74904"N	105°12'45.38689"W	5993.703sft
C11(soln)	<u>1003</u>	DAT file (53962381.dat)	?	39°53'36.83988"N	105°12'45.31465"W	5993.615sft
C26(soln)	<u>1003</u>	DAT file (24292370.dat)	?	39°53'36.74274"N	105°12'45.33462"W	5987.672sft
C3(soln)	<u>1001</u>	DAT file (53962380.dat)	?	39°53'06.10428"N	105°13'02.33752"W	5987.618sft
C7(soln)	<u>1001</u>	DAT file (53962380.dat)	?	39°53'06.14291"N	105°13'02.29485"W	5994.522sft
C27(soln)	<u>1001</u>	DAT file (53962370.dat)	?	39°53'06.10419"N	105°13'02.28623"W	5981.732sft
C4(soln)	<u>1002</u>	DAT file (58502381.dat)	?	39°53'25.92726"N	105°12'56.03605"W	6015.257sft
C28(soln)	<u>1002</u>	DAT file (58502370.dat)	?	39°53'25.92545"N	105°12'55.98172"W	6010.187sft
C6(soln)	<u>1007</u>	DAT file (24292381.dat)	?	39°53'32.90820"N	105°11'54.24231"W	5934.993sft

C10(soln)	<u>1007</u>	DAT file (24292382.dat)	?	39°53'32.95675"N	105°11'54.20288"W	5927.974sft
C14(soln)	<u>1007</u>	DAT file (24292383.dat)	?	39°53'32.90502"N	105°11'54.22422"W	5911.592sft
C18(soln)	<u>1007</u>	DAT file (24292384.dat)	?	39°53'32.85744"N	105°11'54.29064"W	5930.155sft
C8(soln)	<u>1008</u>	DAT file (58502382.dat)	?	39°53'06.60390"N	105°11'44.62147"W	5809.653sft
C17(soln)	<u>1008</u>	DAT file (15532382.dat)	?	39°53'06.53959"N	105°11'44.67178"W	5804.621sft
C12(soln)	<u>1005</u>	DAT file (58502383.dat)	?	39°53'46.71974"N	105°12'28.63941"W	5962.550sft
C16(soln)	<u>1005</u>	DAT file (58502384.dat)	?	39°53'46.66465"N	105°12'28.65196"W	5946.897sft
C13(soln)	<u>1006</u>	DAT file (15532381.dat)	?	39°54'02.97354"N	105°12'14.79980"W	5920.926sft
C21(soln)	<u>1006</u>	DAT file (15532383.dat)	?	39°54'02.90906"N	105°12'14.80692"W	5931.885sft
C15(soln)	<u>1010</u>	DAT file (53962382.dat)	?	39°53'46.84561"N	105°11'14.56982"W	5850.734sft
C19(soln)	<u>1010</u>	DAT file (53962383.dat)	?	39°53'46.78804"N	105°11'14.63203"W	5868.447sft
C23(soln)	<u>1010</u>	DAT file (53962383.dat)	?	39°53'46.78649"N	105°11'14.57321"W	5862.796sft
C20(soln)	<u>1011</u>	DAT file (58502385.dat)	?	39°53'02.01175"N	105°11'14.29206"W	5858.064sft
C24(soln)	<u>1011</u>	DAT file (58502386.dat)	?	39°53'02.00325"N	105°11'14.22799"W	5851.346sft
C29(soln)	<u>1011</u>	DAT file (58502387.dat)	?	39°53'02.03944"N	105°11'14.14872"W	5859.532sft
C22(soln)	<u>1009</u>	DAT file (24292385.dat)	?	39°54'04.02821"N	105°10'51.31953"W	5716.434sft
C31(soln)	<u>1009</u>	DAT file (24292386.dat)	?	39°54'04.02740"N	105°10'51.20448"W	5719.723sft
C25(soln)	<u>10</u>	DAT file (15532371.dat)	?	39°55'40.63738"N	105°13'59.93412"W	5847.186sft
C30(soln)	<u>1015</u>	DAT file (15532384.dat)	?	39°54'43.08882"N	105°05'50.31010"W	5511.138sft

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Coordinate System Details

Project : FLATS-CONTROL-NET-NAD-83

User name	jjung	Date & Time	7:17:29 AM 9/28/2005
Coordinate System	US State Plane 1983	Zone	Colorado Central 0502
Project Datum	NAD 1983 (Conus)		
Vertical Datum		Geoid Model	GEOID99 (Conus)
Coordinate Units	US survey feet		
Distance Units	US survey feet		
Height Units	US survey feet		

Coordinate System

Coordinate System : US State Plane 1983
Zone : Colorado Central 0502
Datum : NAD 1983 (Conus)
Ellipsoid Name : Geodetic Ref System 1980
Geoid Model : GEOID99 (Conus)
Site : Not selected

Ellipsoid
Ellipsoid Name : Geodetic Ref System 1980
Flattening 1/f : 298.257
Semi Major Axis : 20925604.474sft

Datum Transformation : Three Parameter
WGS84 to Geodetic Ref System 1980
Translation X : 0.000sft Rotation X : N/A
Translation Y : 0.000sft Rotation Y : N/A
Translation Z : 0.000sft Rotation Z : N/A
Scale Factor : N/A ppm

Lambert Conformal Conic Two Parallel Projection
Projection Origin False Origin
Latitude : 37°50'00.00000"N False Northing : 1000000.000sft
Longitude : 105°30'00.00000"W False Easting : 3000000.000sft
Height : N/A False Elevation : N/A
Scale Factor : N/A

Shift grid name : None
Azimuth at projection centre : N/A
Azimuth at equator : N/A
Projection Parallel 1 : 39°45'00.00000"N
Projection Parallel 2 : 38°27'00.00000"N
Projection Ferro Constant : N/A
Projection Point 1 Latitude : N/A
Projection Point 1 Longitude : N/A
Projection Point 2 Latitude : N/A
Projection Point 2 Longitude : N/A
Projection grid name : N/A

Local site settings
Project latitude : N/A
Project longitude : N/A
Project height : N/A
Ground scale factor : N/A
False northing offset : N/A
False easting offset : N/A

GPS Site Calibration Details

Horizontal Adjustment
North Origin : N/A Translation North : N/A
East Origin : N/A Translation East : N/A
Scale : N/A Rotation : N/A

Vertical Adjustment
North Origin : N/A
East Origin : N/A

Vertical constant correction : N/A
Slope North : N/A
Slope East : N/A

Network Adjustment Parameters

Longitude Deflection : ?
Latitude Deflection : ?
Azimuth Rotation : 0°00'00.426579"
Network Scale : 0.99999916
Distance Scale : 1.00000000
Distance Constant : 0.00000000sft
Height Constant : 0.00000000sft

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Network Adjustment Report

Project : FLATS-CONTROL-NET-NAD-83

User name	jjung	Date & Time	10:23:05 AM 9/28/2005
Coordinate System	US State Plane 1983	Zone	Colorado Central 0502
Project Datum	NAD 1983 (Conus)		
Vertical Datum		Geoid Model	GEOID99 (Conus)
Coordinate Units	US survey feet		
Distance Units	US survey feet		
Height Units	US survey feet		

Adjustment Style Settings - 95% Confidence Limits

Residual Tolerances

To End Iterations : 0.000033sft
Final Convergence Cutoff : 0.016404sft

Covariance Display

Horizontal

Propagated Linear Error [E] : U.S.
Constant Term [C] : 0.00000000sft
Scale on Linear Error [S] : 1.96

Three-Dimensional

Propagated Linear Error [E] : U.S.
Constant Term [C] : 0.00000000sft
Scale on Linear Error [S] : 1.96

Elevation Errors were used in the calculations.

Adjustment Controls

Compute Correlations for Geoid : False

Horizontal and Vertical adjustment performed

Set-up Errors

GPS

Error in Height of Antenna : 0.000sft

Centering Error : 0.000sft

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Statistical Summary

Successful Adjustment in 1 iteration(s)

Network Reference Factor : 1.00

Chi Square Test ($\alpha=95\%$) : PASS

Degrees of Freedom : 34.00

GPS Observation Statistics

Reference Factor : 1.00

Redundancy Number (r) : 34.00

Individual GPS Observation Statistics

Observation ID	Reference Factor	Redundancy Number
B1	1.03	1.49
B5	1.46	0.82
B6	1.32	0.95
B8	1.28	1.52
B11	1.40	1.26
B12	0.46	1.58
B13	0.48	0.95
B14	1.22	2.09
B18	1.19	0.63
B20	0.63	1.22
B21	0.47	0.78
B23	0.77	2.18
B25	1.53	2.30
B27	1.36	1.07
B28	0.94	1.66
B31	0.34	1.18
B35	0.73	1.35

B36	1.08	1.60
B37	0.65	1.79
B38	0.37	1.97
B39	0.48	1.90
B43	0.97	1.76
B46	1.23	1.95

Weighting Strategies

GPS Observations

User-defined Scalar Applied to All Observations

Scalar : 2.67

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Adjusted Coordinates

Adjustment performed in WGS-84

Number of Points : 13

Number of Constrained Points : 2

Horizontal and Height Only : 2

Adjusted Grid Coordinates

Errors are reported using 1.96σ .

Point Name	Northing	N error	Easting	E error	Elevation	e error	Fix
1003	1750481.766sft	0.016sft	3080651.026sft	0.019sft	N/A	N/A	
1004	1749813.815sft	0.016sft	3082752.124sft	0.021sft	N/A	N/A	
1002	1749384.202sft	0.016sft	3079824.628sft	0.020sft	N/A	N/A	
1001	1747376.888sft	0.017sft	3079339.680sft	0.023sft	N/A	N/A	
1008	1747442.626sft	0.018sft	3085394.300sft	0.024sft	N/A	N/A	
1007	1750102.121sft	0.017sft	3084635.336sft	0.021sft	N/A	N/A	
1005	1751485.849sft	0.017sft	3081947.333sft	0.020sft	N/A	N/A	
1006	1753139.167sft	0.021sft	3083021.528sft	0.020sft	N/A	N/A	
1010	1751523.094sft	0.023sft	3087721.785sft	0.022sft	N/A	N/A	
1011	1746991.763sft	0.021sft	3087764.048sft	0.026sft	N/A	N/A	
1009	1753270.843sft	0.025sft	3089530.499sft	0.023sft	N/A	N/A	

10	1763000.772sft	0.000sft	3074799.454sft	0.000sft	N/A	N/A	N E h
1015	1757316.703sft	0.000sft	3112964.130sft	0.000sft	N/A	N/A	N E h

Adjusted Geodetic Coordinates

Errors are reported using 1.96σ .

Point Name	Latitude	N error	Longitude	E error	Height	h error	Fix
1003	39°53'36.72332"N	0.016sft	105°12'45.29771"W	0.019sft	5990.273sft	0.020sft	
1004	39°53'30.05598"N	0.016sft	105°12'18.36994"W	0.021sft	5957.465sft	0.022sft	
1002	39°53'25.90271"N	0.016sft	105°12'55.94389"W	0.020sft	6012.517sft	0.020sft	
1001	39°53'06.08102"N	0.017sft	105°13'02.24531"W	0.023sft	5983.988sft	0.020sft	
1008	39°53'06.53735"N	0.018sft	105°11'44.57550"W	0.024sft	5799.348sft	0.026sft	
1007	39°53'32.84397"N	0.017sft	105°11'54.19804"W	0.021sft	5924.269sft	0.026sft	
1005	39°53'46.60497"N	0.017sft	105°12'28.62560"W	0.020sft	5958.635sft	0.026sft	
1006	39°54'02.90895"N	0.021sft	105°12'14.77482"W	0.020sft	5933.080sft	0.032sft	
1010	39°53'46.78312"N	0.023sft	105°11'14.53899"W	0.022sft	5863.528sft	0.036sft	
1011	39°53'02.00231"N	0.021sft	105°11'14.19690"W	0.026sft	5851.907sft	0.036sft	
1009	39°54'03.99246"N	0.025sft	105°10'51.25482"W	0.023sft	5711.255sft	0.046sft	
10	39°55'40.61368"N	0.000sft	105°13'59.89777"W	0.000sft	5849.920sft	0.000sft	Lat Long h
1015	39°54'43.05405"N	0.000sft	105°05'50.35674"W	0.000sft	5502.847sft	0.000sft	Lat Long h

Coordinate Deltas

Point Name	Δ Northing	Δ Easting	Δ Elevation	Δ Height	Δ Geoid Separation
1003	0.000sft	0.000sft	N/A	0.000sft	N/A
1004	0.000sft	0.000sft	N/A	0.000sft	N/A
1002	0.000sft	0.000sft	N/A	0.000sft	N/A
1001	0.000sft	0.000sft	N/A	0.000sft	N/A
1008	0.000sft	0.000sft	N/A	0.000sft	N/A
1007	0.000sft	0.000sft	N/A	0.000sft	N/A
1005	0.000sft	0.000sft	N/A	0.000sft	N/A
1006	0.000sft	0.000sft	N/A	0.000sft	N/A
1010	0.000sft	0.000sft	N/A	0.000sft	N/A
1011	0.000sft	0.000sft	N/A	0.000sft	N/A

1009	0.000sft	0.000sft	N/A	0.000sft	N/A
10	0.000sft	0.000sft	N/A	0.000sft	N/A
1015	0.000sft	0.000sft	N/A	0.000sft	N/A

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Control Coordinate Comparisons

Values shown are control coord minus adjusted coord.

Point Name	ΔNorthing	ΔEasting	ΔElevation	ΔHeight
10	N/A	N/A	N/A	N/A
1015	N/A	N/A	N/A	N/A

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Adjusted Observations

Adjustment performed in WGS-84

GPS Observations

GPS Transformation Group: <GPS Default>

Azimuth Rotation : 0°00'00.4266" (1.96σ) : 0°00'00.2529"

Network Scale : 0.99999916 (1.96σ) : 0.00000070

Number of Observations : 23

Number of Outliers : 0

Observation Adjustment (Critical Tau = 3.17). Any outliers are in red.

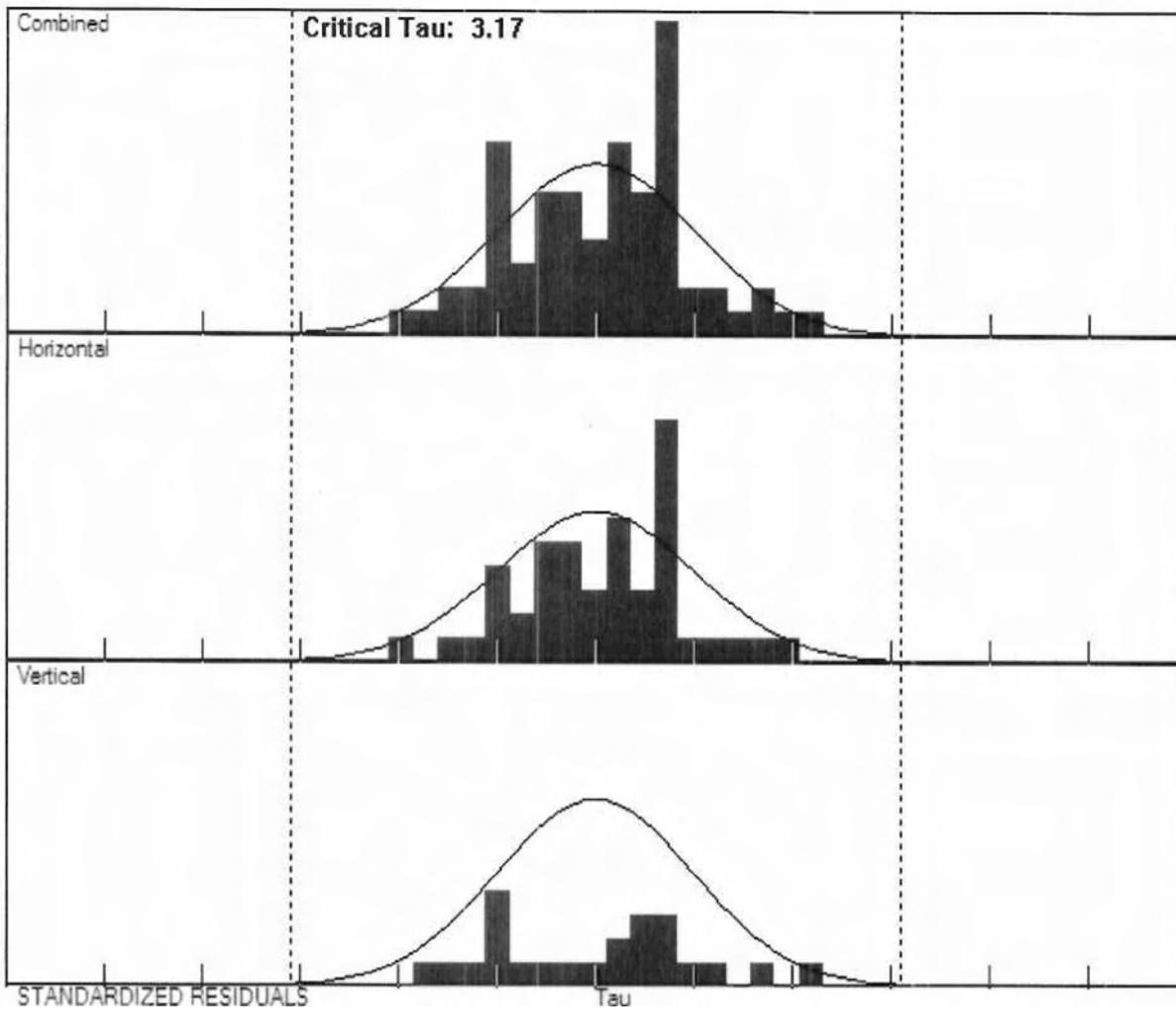
Obs. ID	From Pt.	To Pt.		Observation	A-posteriori Error (1.96σ)	Residual	Stand. Residual
B5	1003	1002	Az.	217°09'32.0074"	0°00'00.9962"	0°00'00.2124"	0.63
			ΔHt.	22.249sft	0.013sft	0.009sft	2.14
			Dist.	1373.848sft	0.006sft	-0.001sft	-0.90
B25	1008	1007	Az.	344°15'51.8484"	0°00'00.4003"	0°00'00.0388"	0.08
			ΔHt.	124.926sft	0.014sft	-0.020sft	-1.01
			Dist.	2765.586sft	0.008sft	-0.017sft	-2.02
B14	1004	1003	Az.	287°49'18.8385"	0°00'00.5227"	-0°00'00.2099"	-0.51
			ΔHt.	32.813sft	0.014sft	-0.002sft	-0.18

			Dist.	2204.644sft	0.005sft	0.008sft	1.97
B27	1011	1008	Az.	280°58'10.6424"	0°00'01.3923"	-0°00'00.2090"	-0.30
			ΔHt.	-52.554sft	0.031sft	0.015sft	0.87
			Dist.	2412.184sft	0.010sft	0.006sft	1.84
B46	1009	1015	Az.	80°24'18.9477"	0°00'00.3301"	0°00'00.0422"	0.21
			ΔHt.	-208.403sft	0.046sft	-0.120sft	-1.72
			Dist.	23779.483sft	0.032sft	-0.028sft	-0.99
B6	1002	1001	Az.	193°45'41.0998"	0°00'00.5991"	0°00'00.1722"	0.75
			ΔHt.	-28.524sft	0.014sft	0.008sft	1.69
			Dist.	2064.998sft	0.007sft	-0.003sft	-1.22
B18	1003	1005	Az.	52°25'15.6415"	0°00'00.9481"	-0°00'00.0017"	-0.01
			ΔHt.	-31.633sft	0.019sft	-0.010sft	-1.56
			Dist.	1639.640sft	0.007sft	-0.002sft	-1.01
B11	1008	1007	Az.	344°15'51.8484"	0°00'00.4003"	-0°00'00.2677"	-1.53
			ΔHt.	124.926sft	0.014sft	0.003sft	0.45
			Dist.	2765.586sft	0.008sft	0.004sft	0.92
B36	1011	1010	Az.	359°39'46.7381"	0°00'00.5553"	0°00'00.4845"	1.41
			ΔHt.	11.627sft	0.032sft	-0.022sft	-1.06
			Dist.	4531.385sft	0.017sft	0.011sft	1.18
B8	1001	1004	Az.	54°38'47.7652"	0°00'00.3761"	-0°00'00.1581"	-0.76
			ΔHt.	-26.517sft	0.016sft	0.012sft	1.37
			Dist.	4193.124sft	0.006sft	0.001sft	0.17
B23	1005	1007	Az.	117°25'21.7694"	0°00'00.7023"	0°00'00.6477"	0.85
			ΔHt.	-34.362sft	0.020sft	-0.016sft	-1.19
			Dist.	3023.154sft	0.009sft	0.007sft	0.65
B35	1009	1011	Az.	195°54'50.1430"	0°00'00.4869"	0°00'00.0951"	0.40
			ΔHt.	140.657sft	0.042sft	0.024sft	1.12
			Dist.	6522.612sft	0.021sft	0.008sft	0.78
B1	1003	1004	Az.	107°49'01.5684"	0°00'00.5227"	0°00'00.1069"	0.39
			ΔHt.	-32.803sft	0.012sft	-0.005sft	-0.90
			Dist.	2204.644sft	0.005sft	-0.003sft	-1.10
B20	1006	1010	Az.	109°09'39.5216"	0°00'00.7124"	0°00'00.2348"	0.66
			ΔHt.	-69.546sft	0.026sft	-0.008sft	-0.90
			Dist.	4970.157sft	0.013sft	0.005sft	0.73

B43	1015	1011	Az.	247°58'29.0922"	0°00'00.2541"	0°00'00.0943"	0.83
			ΔHt.	349.065sft	0.036sft	0.029sft	0.59
			Dist.	27232.313sft	0.036sft	0.009sft	0.42
B37	10	1003	Az.	155°06'58.0026"	0°00'00.1506"	-0°00'00.0229"	-0.24
			ΔHt.	140.358sft	0.020sft	-0.009sft	-0.77
			Dist.	13818.553sft	0.016sft	0.009sft	0.83
B21	1006	1005	Az.	213°11'57.6470"	0°00'01.3848"	0°00'00.1780"	0.34
			ΔHt.	25.561sft	0.021sft	0.004sft	0.81
			Dist.	1971.572sft	0.014sft	-0.002sft	-0.46
B12	1001	1008	Az.	89°33'22.4782"	0°00'00.3702"	0°00'00.0555"	0.23
			ΔHt.	-184.635sft	0.020sft	0.002sft	0.13
			Dist.	6054.793sft	0.007sft	0.003sft	0.78
B28	1007	1010	Az.	65°28'09.7803"	0°00'00.9456"	-0°00'00.1378"	-0.24
			ΔHt.	-60.735sft	0.031sft	0.020sft	0.77
			Dist.	3397.732sft	0.013sft	-0.005sft	-0.58
B13	1004	1007	Az.	81°28'55.4664"	0°00'00.7961"	-0°00'00.1438"	-0.66
			ΔHt.	-33.192sft	0.016sft	0.003sft	0.49
			Dist.	1905.092sft	0.006sft	0.000sft	0.15
B39	10	1002	Az.	159°54'42.1866"	0°00'00.1382"	0°00'00.0322"	0.34
			ΔHt.	162.602sft	0.020sft	-0.007sft	-0.57
			Dist.	14513.720sft	0.016sft	-0.003sft	-0.27
B31	1006	1009	Az.	89°01'39.6650"	0°00'00.6659"	-0°00'00.0528"	-0.19
			ΔHt.	-221.820sft	0.042sft	-0.001sft	-0.05
			Dist.	6510.081sft	0.016sft	-0.004sft	-0.51
B38	10	1001	Az.	163°57'52.6375"	0°00'00.1240"	-0°00'00.0423"	-0.47
			ΔHt.	134.073sft	0.020sft	0.005sft	0.37
			Dist.	16269.621sft	0.017sft	0.000sft	0.03

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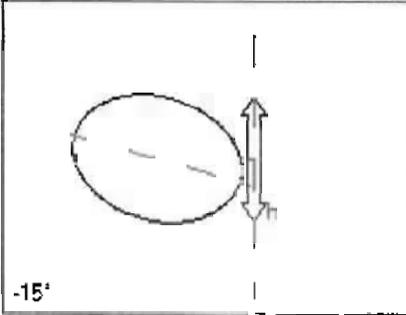
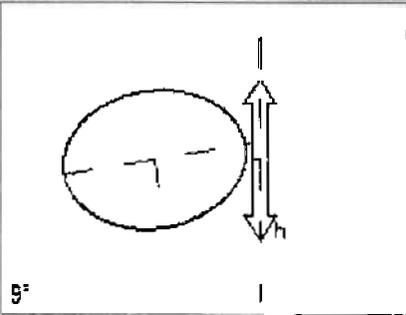
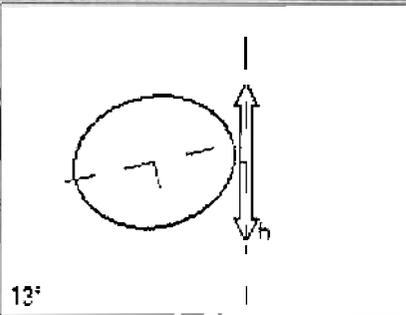
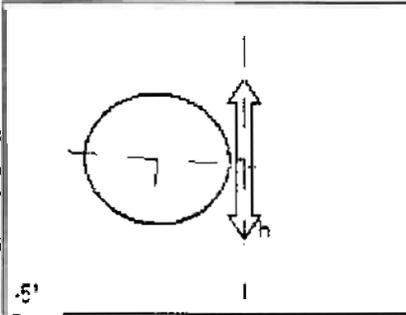
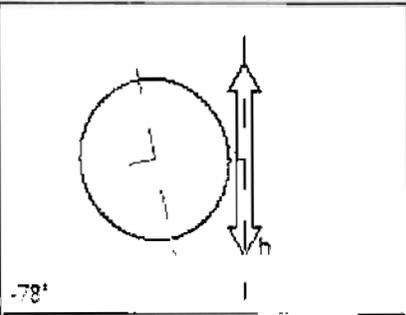
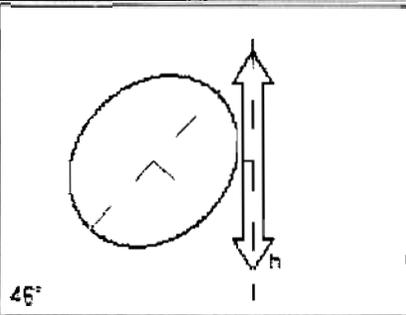
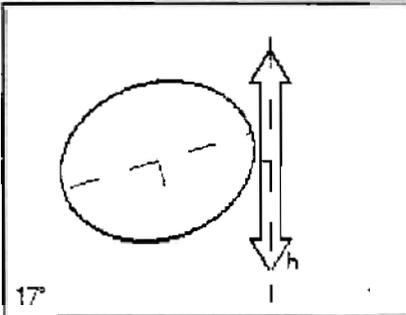
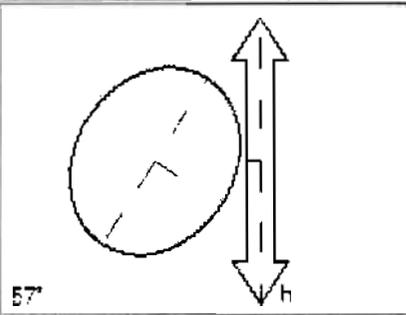
Histograms of Standardized Residuals



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Point Error Ellipses

1003	1004	1002
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		
1001	1008	1007

		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		
1005	1006	1010
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		
1011	1009	
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		

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Covariant Terms

Adjustment performed in WGS-84

From Point	To Point		Components	A-posteriori Error (1.96σ)	Horiz. Precision (Ratio)	3D Precision (Ratio)
1003	1004	Az.	107°49'01.1418"	0°00'00.5669"	1:436619	1:436619
		ΔHt.	-32.808sft	0.012sft		
		ΔElev.	?	?		
		Dist.	2204.646sft	0.005sft		
1003	1002	Az.	217°09'31.5808"	0°00'01.0173"	1:239337	1:239337

		ΔHt.	22.244sft	0.013sft		
		ΔElev.	?	?		
		Dist.	1373.849sft	0.006sft		
1003	1005	Az.	52°25'15.2149"	0°00'00.9684"	1:224331	
		ΔHt.	-31.638sft	0.019sft		
		ΔElev.	?	?		
		Dist.		0.007sft		
1003	10	Az.	335°07'45.4389"	0°00'00.2711"	1:805239	
		ΔHt.	-140.353sft	0.020sft		
		ΔElev.	?	?		
		Dist.	13818.565sft	0.017sft		
1004	1001	Az.	234°39'15.4756"	0°00'00.4388"	1:624099	1:624099
		ΔHt.	26.522sft	0.015sft		
		ΔElev.	?	?		
		Dist.	4193.128sft	0.007sft		
1004	1007	Az.	81°28'55.0399"	0°00'00.8124"	1:317241	1:317241
		ΔHt.	-33.197sft	0.017sft		
		ΔElev.	?	?		
		Dist.	1905.094sft	0.006sft		
1002	1001	Az.	193°45'40.6732"	0°00'00.6529"	1:287666	1:287666
		ΔHt.	-28.529sft	0.014sft		
		ΔElev.	?	?		
		Dist.	2065.000sft	0.007sft		
1002	10	Az.	339°55'22.7911"	0°00'00.2724"	1:824120	1:824120
		ΔHt.	-162.597sft	0.020sft		
		ΔElev.	?	?		
		Dist.	14513.733sft	0.018sft		
1001	1008	Az.	89°33'22.0516"	0°00'00.4104"	1:780226	1:780226
		ΔHt.	-184.640sft	0.020sft		
		ΔElev.	?	?		
		Dist.	6054.799sft	0.008sft		
1001	10	Az.	343°58'29.1971"	0°00'00.2714"	1:886642	1:886642
		ΔHt.	-134.068sft	0.020sft		
		ΔElev.	?	?		

		Dist.	16269.634sft	0.018sft		
1008	1007	Az.	344°15'51.4218"	0°00'00.4664"	1:357045	1:357045
		ΔHt.	124.921sft	0.015sft		
		ΔElev.	?	?		
		Dist.	2765.588sft	0.008sft		
1008	1011	Az.	100°57'50.7358"	0°00'01.3537"	1:255954	1:255954
		ΔHt.	52.559sft	0.031sft		
		ΔElev.		?		
		Dist.	2412.186sft	0.009sft		
1007	1005	Az.	297°25'43.4237"	0°00'00.7364"	1:328791	1:328791
		ΔHt.	34.367sft	0.021sft		
		ΔElev.	?	?		
		Dist.	3023.157sft	0.009sft		
1007	1010	Az.	65°28'09.3537"	0°00'00.9514"	1:256768	1:256768
		ΔHt.	-60.740sft	0.031sft		
		ΔElev.	?	?		
		Dist.	3397.735sft	0.013sft		
1005	1006	Az.	33°11'48.3361"	0°00'01.3813"	1:137095	1:137095
		ΔHt.	-25.556sft	0.022sft		
		ΔElev.	?	?		
		Dist.	1971.574sft	0.014sft		
1006	1010	Az.	109°09'39.0950"	0°00'00.7539"	1:368512	1:368512
		ΔHt.	-69.551sft	0.026sft		
		ΔElev.	?	?		
		Dist.	4970.161sft	0.013sft		
1006	1009	Az.	89°01'39.2385"	0°00'00.6521"	1:421385	1:421385
		ΔHt.	-221.825sft	0.041sft		
		ΔElev.	?	?		
		Dist.	6510.086sft	0.015sft		
1010	1011	Az.	179°39'46.0921"	0°00'00.6020"	1:262778	1:262778
		ΔHt.	-11.622sft	0.033sft		
		ΔElev.	?	?		
		Dist.	4531.389sft	0.017sft		
1011	1009	Az.	15°54'35.0026"	0°00'00.5409"	1:307826	1:307826

		ΔHt.	-140.652sft	0.042sft		
		ΔElev.	?	?		
		Dist.	6522.617sft	0.021sft		
1011	1015	Az.	67°55'00.9474"	0°00'00.1564"	1:1037324	1:1037324
		ΔHt.	-349.060sft	0.036sft		
		ΔElev.	?	?		
		Dist.	27232.336sft	0.026sft		
1009	1015	Az.	80°24'18.5211"	0°00'00.2072"	1:1015089	1:1015089
		ΔHt.	-208.408sft	0.046sft		
		ΔElev.	?	?		
		Dist.	23779.503sft	0.023sft		

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JEFFERSON COUNTY SHERIFF'S OFFICE

200 Jefferson County Parkway
Golden, Colorado 80401-2697

(303) 271-5305
FAX (303) 271-5307

Ted Mink
SHERIFF

Ray Fleer
UNDERSHERIFF

May 8, 2006

Scott Surovchak, Site Manager
U. S. Department of Energy
Office of Legacy Management
12101 Airport Way, Unit C
Broomfield, CO 80021-2583

Dear Mr. Surovchak,

Enclosed are two copies of the contract between the Jefferson County Sheriff's Office and The United States Department of Energy.

Please indicate your acceptance of this contract by signing both originals and return one fully executed copy to Judy Cook in the enclosed envelope.

Thank you,

Sincerely,

A handwritten signature in cursive script that reads "Patsy Mundell".

Patsy Mundell, Division Chief
Support Services Division

/jc

COPY

**MEMORANDUM OF UNDERSTANDING
BETWEEN
THE JEFFERSON COUNTY SHERIFF'S OFFICE
AND
THE UNITED STATES DEPARTMENT OF ENERGY**

The parties to this Memorandum of Understanding (MOU), the Jefferson County Sheriff's Office (hereinafter referred to as "JCSO"), and the United States Department of Energy Office of Legacy Management (hereinafter referred to as "DOE-LM"), hereby agree to the following:

1. The purpose of this MOU is to formalize and understanding of mutual cooperation and assistance between the above-listed Parties in providing law enforcement services.
2. The authority for DOE-LM to enter into this MOU is the Department of Energy Organization Act, Public Law 95-91, Section 646(a) (42 U.S.C. § 7256(a)).
3. JCSO shall provide the following services to DOE-LM at the former Rocky Flats Environmental Technologies Site (hereinafter referred to as "Rocky Flats Site"):
 - a. Law enforcement protection services consistent with reasonable and prudent law enforcement practices.
 - b. Coordination for emergency law enforcement services that might be required by DOE-LM.
 - c. Services provided by the Sheriff hereunder shall be no greater than those provided to DOE-LM in the absence of this MOU.
4. DOE-LM shall:
 - a. Provide all reasonably available resources, including information and technical assistance, and expertise to JCSO necessary to assist with any law enforcement action including but not limited to theft, trespass, vandalism, sabotage, and ecological or environmental terrorism that may arise at the Rocky Flats Site. Such resources shall be deployed at the direction or request of the JCSO.
 - b. Provide an introduction to the site to familiarize the JCSO with its roads, facilities, fence lines, gates, and associated operation and risks.

- c. Make available to JCSO the DOE-LM site Emergency Preparedness and Response plans, security plans, contingency plans or other such plans, including all updates and addenda to those plans.
5. This MOU is subject to availability of personnel and shall not give rise to any liability or responsibility for failure to respond to any request for assistance, for lack of prompt response to a request of for any cause whatsoever. Each party to this MOU is responsible and liable for its own actions and does not assume any liability for the actions of the other party to this MOU.
6. Any services performed under the terms of this MOU by any employee of JCSO shall not constitute Federal employment for the purposes of Subchapter 1 of Chapter 81 of Title 5 of the United States Code. This MOU shall not create a joint venture or partnership between the parties. This MOU shall not constitute any change in employment status of any employees of the parties to this MOU.
7. Subject to the Freedom of Information Act, 5 U.S.C. § 552 and the requirements of the Colorado Public Records Act, decisions on the disclosure of information to the public regarding services and activities referenced in this MOU shall be made by DOE-LM following consultation with representatives of JCSO.
8. This MOU shall apply to and be binding upon the Parties, together with their administrative officers, agents, and employees, notwithstanding any change in administration or governance of the Parties.
9. This MOU may be amended by written agreement between the Parties.
10. This MOU may be terminated by mutual written agreement of the Parties, or by either Party upon 30 day's written notice to the other Party.
11. This MOU shall become effective upon the latter date of signature of the Parties, and shall remain in effect until canceled by mutual agreement.

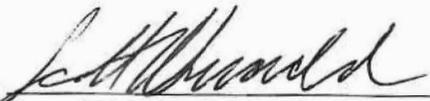
Jefferson County Sheriff's Office

By: T. B. Mink
Ted Mink, Jefferson County Sheriff

Date: 04.26.06

U.S. Department of Energy
Legacy Management, Rocky Flats Site

Memorandum of Understanding Between
The Jefferson County Sheriff's Office and
The U.S. Department of Energy

By: 
Scott Surovchak, LM Site Manager

Date: 5-16-06



Rocky Flats, Colorado, Site Chemical Management Plan



U.S. Department
of Energy

Office of Legacy Management

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**Rocky Flats, Colorado, Site
Chemical Management Plan**

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Appendix

Appendix A Authorized Chemical List

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1.0 Introduction

Only the chemicals authorized by this Chemical Management Plan (CM Plan) may be used in Rocky Flats operations. Authorized chemicals shall be procured, handled, stored, and disposed of in accordance with this CM Plan. Response to chemical spills shall also be performed in accordance with this CM Plan.

All chemicals may present human or environmental health hazards, even if the chemical is not regulated as hazardous under any of the human health or environmental protection laws. The intent of this CM Plan is to strictly limit the chemicals authorized for use, such that it is tailored to address and manage the hazards posed by these authorized chemicals.

This CM Plan provides information specific to Rocky Flats to supplement the requirements of the following Site Operations Guide (SOG) sections and the following manuals:

- SOG Chapter 9—Non-Routine Activities
- SOG Chapter 10—Health and Safety/Training
- SOG Chapter 11—Emergencies and Corrective Action
- SOG Chapter 13—Regulatory Compliance
- SOG Chapter 14—Waste Management
- LMS/POL/S04320—*Quality Assurance Manual*
 - Personnel Training and Qualification
 - Work Processes
 - Procurement
- LMS/POL/S04321—*Health and Safety Manual*
 - Fire Prevention and Protection
 - Personal Protective Equipment
 - Compressed Gas Cylinders
 - Job Safety Analysis
 - Hazard Communication Program
- LMS/POL/S04324—*Construction Procedures Manual*
 - Solicitation Package
 - Site Control
- LMS/POL/S04326—*Comprehensive Emergency Management System*
 - Emergency Response
- LMS/POL/S04328—*Integrated Safety Management System Description with Embedded Worker Safety and Health Program*
 - Appendix A, General Approach to Worker Safety and Health Functional Areas

- LMS/POL/S04329—*Environmental Protection Manual*
— Chemical Management Program
- LMS/POL/S04334—*Procurement Manual*
— Preparation and Review of Purchase Requisitions

2.0 Chemical Control Officer

The Rocky Flats site manager shall designate a staff member as the Rocky Flats chemical control officer (CCO). The site manager shall ensure that the CCO has an appropriate level of knowledge, skills, and abilities through work experience, formal or on-the-job training, and education to properly perform the CCO duties in relation to the hazards posed by authorized chemicals. The site manager, in consultation with the CCO and the Legacy Management Support (LMS) Health and Safety organization, shall identify additional training the designated CCO may need and the reasonable time for completion of the training.

The CCO shall consult with the LMS Health and Safety (including Occupational Medicine), environmental management, and emergency response organizations as necessary to properly perform the CCO duties.

The CCO shall be the liaison with local emergency response organizations to properly perform the CCO duties.

Other specific CCO duties are described in each section of this CM Plan, where applicable.

3.0 Authorized Chemicals

The Authorized Chemicals List for Rocky Flats Site Operations (Authorized Chemical List) shall be approved by the site manager and maintained and administered by the CCO. The Authorized Chemical List is located in Appendix A. Among other information, the Authorized Chemical List includes the name of the chemical, authorized amount, and storage location for all of the typical quantities of chemicals in use or in storage at Rocky Flats.

The CCO shall revise the Authorized Chemical List as needed to add or remove a chemical and to change any storage location or quantity as needed to support site operations.

The list is divided into the following chemical use categories:

- Category 1—Environmental media analytical activities
- Category 2—Vegetation management and pest control activities
- Category 3—Document printing and copying activities
- Category 4—Janitorial and similar to consumer/household use

Chemicals that are not on the Authorized Chemical List may be used for Rocky Flats operations only if covered in an approved Job Safety Analysis (JSA) for that activity. The JSA must provide the chemical management plan for the JSA work, and the CCO must concur with the JSA requirements.

4.0 Chemical Management

Users of chemicals shall use them only for their intended use as indicated on the Authorized Chemical List and as outlined in the Material Safety Data Sheets (MSDSs). Chemical users must read and follow the manufacturers' or suppliers' use instructions and MSDSs.

Category 1 and 2 chemicals are subject to all chemical management requirements in this section. Because of the low hazard profile for Category 3 and 4 chemicals, these chemicals are only subject to certain chemical management requirements, as specified in this section.

4.1 Material Safety Data Sheets and Other Information

The CCO shall make available the following in a location that is accessible to all workers at or near the places where the chemical is used:

- Authorized Chemical List
- MSDS

The chemicals that are included in the Authorized Chemical List will also be represented by a current MSDS that will be kept and made available to all workers by the CCO in a central location at the Rocky Flats Office Building, 11025 Dover Street, and at the Rocky Flats Site property.

4.2 Procurement

Only chemicals on the Authorized Chemicals List or in an approved JSA may be purchased. The person ordering any chemicals is responsible for reviewing and following any applicable chemical procurement requirements in the *Integrated Safety Management System Description with Embedded Worker Safety and Health Program* and must ensure that the quantity being ordered will not result in a total quantity exceeding the in-use plus in-storage authorized limit for chemicals at Rocky Flats. The authorized amount can be found on the Authorized Chemical List.

The person ordering any Category 1 or 2 chemicals must obtain CCO concurrence with the order.

If applicable, only chemicals and quantities listed in a job-specific JSA chemical management plan may be brought on site by a subcontractor. The site lead for the work covered by the JSA, in coordination with the CCO, must routinely assess compliance and require the subcontractor to remove any chemicals or quantities not allowed under the JSA. The subcontractor must follow all requirements of this plan for storage, use, and disposal of chemicals.

4.3 Storage and Use Locations

Chemicals shall be stored in accordance with the MSDS storage requirements. These requirements include environmental conditions (e.g., temperature) and any incompatibility with other stored chemicals.

All chemicals shall be stored in their original containers with the manufacturers' labels intact. Chemicals that are being used may be transferred to appropriate use containers, unless prohibited by the MSDS instructions, AND the containers must be marked to show the chemical name and any hazardous classification or properties indicated on the manufacturer's original container label.

Category 1 chemicals, except for gases, and Category 2 chemicals that are liquids shall be stored in cabinets, drip pans, or on absorbent drip pads composed of materials that will withstand and not chemically react with spills or leaks. The storage cabinets, drip pans, or absorbent pads shall have sufficient free space to hold the contents of the largest stored chemical container if the contents were to leak out of the container.

WARNING: Acids and bases can be highly reactive and corrosive compounds. They must generally be stored in ventilated areas away from water, which can cause evolution of heat. Acids and bases should never be stored together.

Incompatible chemicals shall not be stored in the same cabinet or drip pan or on the same absorbent pad, and shall be stored in a manner that prevents the incompatible chemicals from coming into contact with each other.

Category 1 chemicals are used at the sampling locations, the sample preparation areas, and laboratory. Category 2 chemicals may be used anywhere on the Rocky Flats property, which includes areas requiring application of herbicides or pesticides.

Category 3 and 4 chemicals may be used in any location at the 11025 Dover Street Office Building or Rocky Flats Site property. The CCO shall coordinate with the users of Category 3 and 4 chemicals to designate the storage locations and amount of storage space for these chemicals. The CCO may remove, or arrange for removal, and dispose of any of these chemicals that do not comply with the designated storage space amount or location.

4.4 Handling

Handling precautions are identified in the chemical's MSDS and shall be followed using a graded approach based on the quantity of chemical used.

Category 1 chemicals are to be used in accordance with applicable analytical laboratory procedures. The volume of chemical used in each procedure is small and does not present an inhalation hazard when used with normal building ventilation. Personal protective equipment (PPE) consists of chemical resistant gloves (nitrile), a lab coat to provide skin protection for the arms, and safety glasses with side shields to provide eye protection from splashes or touching the eyes.

Acids and bases shall be carried from the storage location to the use location in rubber carriers to catch any spills if the container should leak or break. **NOTE:** When diluting an acid for general use, add acid to water; never add water to a concentrated strong acid. Never pour water onto solid bases. In general, nitrile gloves are effective PPE materials for acids and bases. Safety glasses with side shields shall be worn when pouring materials.

Category 2, 3, and 4 chemicals must be used in accordance with the manufacturers' instructions, including any handling precautions.

4.5 Disposal

The volume of chemicals allowed under the Authorized Chemicals List is strictly limited so that the amount of hazardous chemical waste generated, including waste that could be generated in a spill response, qualifies as Conditionally Exempt Small Quantity Generator hazardous waste under the Colorado Hazardous Waste Regulations. This amount is not to exceed 220 pounds of wastes defined as hazardous wastes generated or stored per month. Waste chemicals, including materials that are generated in performing spill response described in Section 5.1, shall be segregated for evaluation by the CCO and the LMS Environmental Compliance staff to determine proper disposal requirements. In some instances, disposal may be required at a permitted hazardous waste treatment, storage, and disposal facility.

The CCO shall manage waste chemicals to stay below this threshold for any hazardous wastes by arranging for proper disposal on a routine basis. Waste chemicals may only be stored pending disposal in the approved storage and use locations.

5.0 Spills and Emergencies

5.1 Spill Response

The volume of chemicals allowed under the Authorized Chemicals List is strictly limited so that the amount of chemical that could be released in a spill will be below the threshold for reporting to the National Response Center.

Except as described below for concentrated acids and bases, spills of Category 1, 2, 3, and 4 chemicals may be safely cleaned up by persons wearing PPE consisting of chemical resistant gloves, a lab coat or other long sleeve garment to provide skin protection for the arms, and safety glasses with side shields to provide eye protection from splashes or touching the eyes. Spill response precautions are identified in the chemical's MSDS and shall be followed using a graded approach based on the quantity of chemical spilled.

Spills shall be cleaned up using absorbent material to soak up any free liquid, and washing the affected area with soap and water.

For Category 1 chemicals, acid and base spill kits are to be maintained by the CCO in the storage and use area for Category 1 chemicals. These spill kits are for use only when the spill is generally less than 1 pint and can be safely cleaned up using normally available PPE. Larger

spills of Category 1 chemicals must be reported to the local emergency response organization, and the Rocky Flats Emergency Response Procedure shall be implemented.

5.2 Emergency Response and First Aid Measures

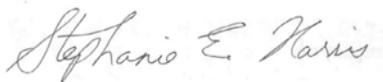
If the use or storage of chemicals creates an emergency situation, such as an unplanned significant exposure to chemicals or an unplanned significant release of chemicals, emergency assistance shall be immediately sought by calling 911.

First aid measures shall be taken to address exposures that may cause or have caused injury. Sometimes, the nature and extent of injury that may result from chemical exposure are not readily apparent, and medical attention as a precautionary measure should be immediately sought.

The MSDS contains first aid information and should be consulted pending medical attention. In general, eyes that come into contact with a chemical shall be flushed with water for 15 minutes using an eye wash station, and areas of skin that come into contact with a chemical shall be continuously flushed with water to remove the chemical.

Emergency medical facilities are identified in the Emergency Response Plan for Rocky Flats.

Approved by CCO:



Date: 7-28-08

Revisions to the Authorized Chemical List may be made by the CCO, in accordance with the CM Plan.

Appendix A

Authorized Chemical List

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Category 1—Environmental Media Analytical Activities

Chemical Name	Authorized Amount	MSDS #/CAS	Comments	Reportable Quantity
Alkali solution for Ca/Mn test	250 milliliters	M00284		
Ascorbic acid	500 milliliters	A7608		
pH buffer solutions	3 gallons	B5631		
Conductivity standard	4 liters	291-A		
DR2010 Accu-vac reagents	500 grams	NA		
EDTA/EGTA solutions	500 milliliters	M00282		
Hydrochloric acid	500 milliliters	H3 886	Concentrated acid	
Nitric acid	5 liters	16550	Concentrated acid	
Quinhydrone	500 grams	Q3250		
Sodium chloride Standard solution	500 milliliters	M00374		
Sodium hydroxide	500 grams	S4034	Concentrated base	Section 304/ CERCLA
Sodium hydroxide	500 milliliters	S4034	Concentrated base	Section 304/ CERCLA
Sodium sulfite	500 grams	S5022		
Sodium thiosulfate	500 grams	S5230		
Sulfuric acid	2 liters	S8234	Concentrated acid	
Turbidity standards	2 liters	9003-70-7	No hazard	
Zinc acetate	500 grams	Z1140		
Isobutylene (isobutene)	1 liter @500 psi	2110	Compressed gas	
Mixed gas cocktail	1 liter @500 psi	NA	Compressed gas	

Category 2—Vegetation Management and/or Pest Control Activities

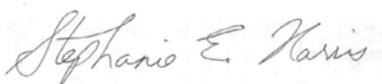
Chemical Name	Authorized Amount	MSDS #/CAS	Comments	Reportable Quantity
Roundup herbicide	2 gallons	6058		
Cutter insect repellent	6 oz. bottles	51025	One case	
Off insect repellent	6 oz. bottles	111886002	One case	
Off Deep Woods	6 oz. bottles	111845004	One case	
Engine oil, 15W-40	20 gallons	622315001	2 cases/quarts	
Engine oil, 15W-30	20 gallons	62613001	2 cases/quarts	
Oil, 2-cycle	10 gallons	0781319805	1 case/quarts	
Fuel—gasoline	60 gallons	NA	Outside of vehicle	
Fuel—diesel	60 gallons	AG1BF	Outside of vehicle	
Multipurpose grease	20 pounds	665005002		
d-Con rodenticide	5 pounds	NA		
Foodlube grease	20 pounds	NA		
Bearing grease		A5088/NA		
Lubriplate mineral oil	20 gallons	NA		
Hornet/wasp spray	20 oz. bottles	010981055	One case	
Road stabilizer/dust suppressant	10,000 gallons	NA/NA		NA
Milestone herbicide		007887/566191-89-7		
Milestone VM herbicide		DASCI-236/150114-71-9 & mixture		
Rodeo herbicide		006694/038641-94-0 & mixture		NA
Escort herbicide		DU002103/74223-64-6		NA
Sustane 8-2-4		NA/NA		NA
Telar herbicide		DU008091/64902-72-3		NA
Vanquish herbicide		397/1918-00-9		Spills >17 gallons (based on 1,000 pounds of Dicamba)

Category 3—Document Printing and Copying Activities

Chemical Name	Authorized Amount	MSDS #/CAS	Comments	Reportable Quantity
3M Desk Cleaner	5 liters	179561/mixture	EPA HazWaste # (RCRA) D001	
Duster II	2 liters	192432/75-37-6	Compressed gas	NA
Print cartridge ink	1 liter	NA		
Toner	60 liters	PPC-0783		
Roller cleaner	5 liters	NA/67-63-0		
Multikleen Wipes	5 liters	NA/mixture		NA

Category 4—Janitorial and Similar to Consumer/Household Use

Chemical Name	Authorized Amount	MSDS #/CAS	Comments	Reportable Quantity
Auto truck de-icer	1 liter	DEI/mixture		
Static cleaner	2 liters	BSMNC/mixture		
Rust-Oleum paint	2 gallons	NA/mixture		
WD-40	2 liters	NA/mixture		NA
Clorox bleach	3 qt. bottles	93098/mixture		NA
Liquinox	30 pounds	NA/25155-30-0		NA

Approved by CCO:  Date: 7/28/08

Revisions to the Authorized Chemical List may be made by the CCO, in accordance with the CM Plan.

The approved list shall be kept in the master MSDS book, maintained by the CCO, and an electronic version also posted to the network share folder designated for the CM Plan. An index showing the approval dates for each subsequent CCO-approved list will also be maintained in the network share folder designated for the CM Plan.

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