DOE/EA-1093

ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT

Surface Water Drainage System

United States Department of Energy
Rocky Flats Environmental Technology Site
Golden, Colorado

May 1996

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LIST OF ABBREVIATIONS AND SYMBOLS

ACL	Administrative Control Level
ALARA	As Low As Reasonably Achievable
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COE	Corps of Engineers
DOE	Department of Energy
EDE	effective dose equivalent
EPA	Environmental Protection Agency
HI	hazard index
HSP	Health and Safety Practices Manual
IAG	Interagency Agreement
IHSS	Individual Hazardous Substance Site
MSDS	Material Safety Data Sheets
NCRP	National Council on Radiation Protection
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRPCP	Natural Resource Protection and Compliance Program
PPE	personal protective equipment
PPCD	Plan for the Prevention of Contaminant Dispersal
RCRA	Resource Conservation and Recovery Act
SID	South Interceptor Ditch
SWMP	Surface Water Management Plan
USFWS	United States Fish and Wildlife Service
WWTP	Wastewater Treatment Plant

1.0 PURPOSE AND NEED FOR ACTION

1.1 Background

This Environmental Assessment (EA) is written pursuant to the National Environmental Policy Act (NEPA). The document identifies and evaluates the action proposed to correct deficiencies in, and then to maintain, the surface water drainage system serving the Department of Energy's Rocky Flats Environmental Technology Site (Site), located north of Golden, Colorado.

Many of the activities proposed would not normally be subject to this level of NEPA documentation. However, in many cases, maintenance of the system has been deferred to the point that wetlands vegetation has become established in some ditches and culverts, creating wetlands. The proposed activities would damage or remove some of these wetlands in order to return the drainage system to the point that it would be able to fully serve its intended function - stormwater control. The Department of Energy (DOE) regulations require that activities affecting environmentally sensitive areas like wetlands be the subject of an EA.

Most portions of the surface water drainage system are presently inadequate to convey the runoff from a 100-year storm event. As a result, such an event would cause flooding across much of the Site and possibly threaten the integrity of the dams at the terminal ponds. Severe flooding would not only cause damage to facilities and equipment, but could also facilitate the transport of contaminants from individual hazardous substance sites (IHSSs). Uncontrolled flow through the A- and B-series ponds could cause contaminated sediments to become suspended and carried downstream. Additionally, high velocity flood flows significantly increase erosion losses.

The deficient state of the surface water drainage system is the result of two long-standing operating conditions. First, a comprehensive and integrated approach has never been taken for the development of the Site's drainage system. Rather, the system has been constructed incrementally, in a piecemeal fashion, as the Site has grown. With each additional building and parking lot, the impermeability of the Site has significantly increased. This hinders infiltration of precipitation, and results in increased volumes of runoff being diverted to the drainage system for like-magnitude storm events. Therefore, a drainage segment, which was originally sized to convey runoff from a 25-year storm event, is no longer able to convey the runoff from that same magnitude storm event. As development occurs, downstream drainage, if inadequate, must be upgraded in order to maintain required flow capacities.

The second condition which has added to the deficiency of the surface water drainage system is the lack of a conscientiously applied sitewide maintenance program. This lack of maintenance has allowed heavy vegetation and sediment deposits to develop in much of the drainage system. Heavy vegetation reduces flow capacities and clogs conveyances. Sediment deposits reduce channel volumes and block culverts. Additionally, concerns for creating hazardous waste by removing contaminated sediments, and disturbing threatened and endangered species and their habitats, have presented roadblocks to accomplishing maintenance goals.

The proposed action was developed based on several related studies, reports, and plans which were prepared in recent years. According to these studies, the integrity of the drainage system is considered inadequate, primarily due to lack of upkeep. Selected recommendations from these previous studies were analyzed by surface water specialists in an *Options Analysis* (see Appendix A). Among the criteria used in the analysis was avoiding or minimizing disturbance of wetlands. Preferred options were selected in the *Options Analysis.* The preferred options were analyzed in a *Programmatic Support Study* (see Appendix B) to determine the environmental control measures necessary to eliminate or minimize environmental effects of the proposed activities. It used a series of definitions and matrices as a systematic tool to develop the environmental control measures. The proposed action consists of the preferred options and the environmental control measures. These studies and their findings are summarized in Appendix C.

1.2 Purpose and Need

The DOE needs to correct deficiencies in the surface water drainage system so that the system will be able to handle storm events up to a 100-year event and comply with the Clean Water Act §402(p)(1)(B), the Site's National Pollution Discharge Elimination System (NPDES) permit, and DOE Order 6430 requirements for controlling stormwater runoff.

2.0 DESCRIPTION OF ALTERNATIVES - INCLUDING THE PROPOSED ACTION

This section describes the alternatives considered by DOE to correct deficiencies in the Site surface water drainage system. The alternatives considered in detail are the proposed action, a partial implementation of the proposed action, and the no action alternative. The proposed action includes programs and projects that comprise a surface water drainage system management program. No action means continuing with the present course of action with no changes. Alternatives considered but not analyzed in detail were: rerouting drainage flows to different drainage conveyances within the system, reducing runoff into the drainage system, and upgrading the entire drainage system.

2.1 Proposed Action

The proposed action is the implementation of a management program that includes repair, upgrade, and maintenance of the Site's surface water drainage system. The proposed action consists of the following maintenance programs, projects, and environmental control measures (accepted or predetermined procedures taken to prevent or minimize adverse effects):

- Industrial Area Maintenance Program
- Buffer Zone Maintenance Program
- Pond A-1 Bypass Upgrades Project
- South Interceptor Ditch Repair Project
- South Walnut Creek Improvements Project
- Environmental Control Measures
  - Contaminant Transport Control
  - Wetland Impact Minimization
  - Wetland Replacement
  - Spill Prevention, Containment, and Cleanup
  - Biota Protection
  - Erosion Control
  - Revegetation
  - Work Specifications
  - Worker Health Protection

In some cases, work described in this EA will be performed in Individual Hazardous Substance Sites (IHSSs). IHSSs have been established in accordance with the Interagency Agreement (IAG), and therefore, work in IHSSs will be performed as directed by the IAG. Contaminated soils will be handled as hazardous waste, and non-contaminated soils will be land disposed.

For the purpose of this EA, *repair* is defined as fixing the deficient component in place and *replace* as putting in a functionally similar component. Further, *install* is defined as building or somehow introducing a new or significantly bigger item and *alter*, as removing or significantly changing the function, size, height, or configuration of a drainage system component. The terms *replace* and *repair* essentially denote maintenance activities, which are differentiated from *install* and *alter* for the purpose of indicating a severity of environmental effects, since maintenance generally does not substantially change the configuration or size of the original drainage system structure.

2.1.1 Industrial Area Maintenance Program

The industrial area is the 384-acre developed portion of the Site where buildings and other facilities are located (see Figure 3-2). Maintenance activities proposed for the industrial area would include the following:

- Removal of vegetation, accumulated sediment, and debris upstream and downstream of most culverts or in areas where ditch flow capacity has become inadequate. Vegetation would be removed from an area the width of conveyance and from 5 to 30 feet from the culvert opening, depending on the culvert size
- Replacement of plugged culverts where sediment removal would not remedy flow problems or where culverts are damaged beyond repair
- Installation or repair of riprap areas for erosion protection
- Installation, replacement, or removal of security constrictions
- Repair of ditch embankments
- Installation of concrete headwalls for culverts.

2.1.2 Buffer Zone Maintenance Program

The buffer zone consists of the remaining undeveloped acreage of the Site and is primarily natural and regenerated prairie (see Figure 3-2). A limited amount of roadway and utilities have been constructed within it. Maintenance activities proposed for the buffer zone would include the following:

- Removal of vegetation, accumulated sediment, and debris upstream and downstream of most culverts or in areas where ditch flow capacity has become inadequate. Vegetation would be removed from an area the width of conveyance and approximately 5 to 30 feet from the culvert opening, depending on the culvert size
- Replacement of plugged culverts where sediment removal would not remedy flow problems or where culverts are damaged beyond repair
- Providing erosion protection through such means as installation of riprap or repair of similar energy dissipation structures
- Repair or grouting of outlet pipes at the upper A-series and B-series dams

- Removal of vegetation near streamflow measurement devices for increased accuracy
- Installation of new measurement systems for such items as drainage flows or dam safety parameters
- Removal of vegetation on or near dam structures such as spillways for improved flow capabilities
- Repair of damaged ditch embankments
- Installation of concrete headwalls for culverts.

2.1.3 Pond A-1 Bypass Upgrades Project

The Pond A-1 Bypass collects runoff from above the A-series ponds and routes it around Ponds A-1 and A-2, which are used for spill containment (see Figure 3-2). The flow capacity of the Bypass would be upgraded by either installing a parallel pipeline or ditch, or replacing the existing pipeline with a larger one. Riprap would be installed at the outlet. The project would reduce the probability of contaminated sediment transport from the upper A-series ponds (Ponds A-1 and A-2) to the lower A-series ponds (Ponds A-3 and A-4). The bypass is planned to be upgraded, at a minimum, to pass up to a 100-year storm event, whereas it currently cannot pass a 2-year storm event.

2.1.4 South Interceptor Ditch Repair Project

The South Interceptor Ditch (SID) would be repaired such that it would be returned to its original design function (see Figure 3.2). It would be capable of intercepting stormwater from a 100-year storm event and conveying it to Pond C-2. This would be accomplished by building up the embankment along the ditch in a few key locations, replacing culverts in at least one location, improving culvert flow capabilities through inlet improvements in at least one location, clearing several partially plugged culverts, and removing vegetation at culvert inlet and outlet areas.

Additional improvements to the SID would include additions of riprap at the culvert inlet and outlet locations to protect against erosion; cutting back of trees growing in the channel to improve flow conditions; localized road improvements along the ditch; and addition of cross gutters in areas where the road crosses the ditch in order to ensure that potentially contaminated runoff enters the SID instead of flowing into Woman Creek. Potentially contaminated runoff would originate from the southern portion of the industrial area, particularly the old landfill, the 881 hillside french drain, or the Operable Unit 1 treatment facility.

In conjunction with work that would be conducted at the SID, improvements to the Woman Creek Bypass Canal would be undertaken to reduce overflows to Pond C-2 during large storm events. Two embankment locations along the bypass canal would be raised approximately 2 to 4 feet to reduce overflow during a 100-year storm event, and to prevent overflow from up to a 25-year storm event.

The Woman Creek diversion wall, located upstream from the bypass culverts, would also be raised approximately 1 to 3 feet if subsequent calculations reveal that it would further reduce inflows to Pond C-2 significantly enough to justify the cost. Raising the height of the embankment and diversion wall would negate the need to remove material from within the bottom of the bypass canal. Operation of the system would also rely on relatively low Pond C-2 levels before any storm to help prevent flow through the Dam C-2 spillway. Removal of vegetation at the inlet and outlet areas of the bypass culverts, with potential additions of riprap for erosion protection, would be conducted.

2.1.5 South Walnut Creek Improvements Project

Potential flooding along South Walnut Creek would be addressed to reduce the probability of contaminated sediment transport from the upper B-series ponds (Ponds B-1 and B-2) to the lower B-series ponds (Ponds B-3, B-4, and B-5) (see Figure 3-2). The Pond B-1 Bypass collects runoff from above the B-series ponds and routes it around Ponds B-1 and B-2, which are used for spill containment. Project components would likely include some or all of the following: upgrading the existing Pond B-1 Bypass by installing a parallel pipeline or ditch or by replacing the existing pipeline with a larger one; manipulating existing culverts near the Wastewater Treatment Plant (WWTP) in order to promote ponding along South Walnut Creek near the WWTP; building floodwalls around parts of the WWTP and possibly along part of the road near the WWTP; removing large amounts of refuse (mostly rocks) from two of the large culverts in the Building 991 area; and replacing several security constrictions in the large culverts along South Walnut Creek with newly designed security constrictions which would increase capacities.

2.1.6 Environmental Control Measures

The following subsections describe the environmental control measures that would be implemented as part of the scope of work for the action as proposed in the previously defined programs and projects.

2.1.6.1 Contaminant Transport Control

Due to past spills and releases, areas of contaminated media exist at the Site. Soils, groundwater, and sediments impacted by the projects and programs discussed in this EA may potentially contain contaminants including organic solvents, heavy metals, petroleum products, and radionuclides. Control measures will be implemented to minimize or prevent the transport of contaminated media. Determination of the need for contaminant transport control measures would be based on: a) an assessment of potential contamination utilizing location information and assessment of historical releases and past operations; b) a review of existing sample results; c) collection and analysis of new samples; or d) a combination thereof. Specific control measures that may be utilized to control the spread of contaminants found in soils, sediments, or water would include:

- Containerized storage for future disposition;
- Treatment;
- Placement back into the original contaminated or potentially contaminated zone; and
- Preventing wind, water, and physical transport from a contaminated or potentially contaminated area.

Wind and water transport could be minimized through erosion control. Physical transport could be minimized by rinsing equipment at a Site decontamination pad and removing personal protective clothing at the boundary of a work area.

Contaminant transport control would be applied to excavation dewatering activities, when necessary, through the Site's *Incidental Waters Program* (EG&G 1991a). This program requires the sampling of water prior to dewatering for several standard water quality parameters. Sampling requirements would be modified based on location information or previous sample information. Water found to be unacceptable for discharge to a surface drainage would typically be collected for transport to the appropriate treatment location. The treatment method is dependent upon the contaminant types and levels. An alternative would be to modify work plans to avoid dewatering when possible.

Contaminant transport control would be applied to soils/sediments primarily through the Site's excavation permitting process. This phased process first utilizes location information or previous sampling results to identify control requirements. Additional control requirements are developed as necessary to address results from new soil or sediment samples. Figure 2-1, Soil/Sediment Containment Control Measure Decision Tree, illustrates a decision tree that outlines the basic approach to this contaminant control process.

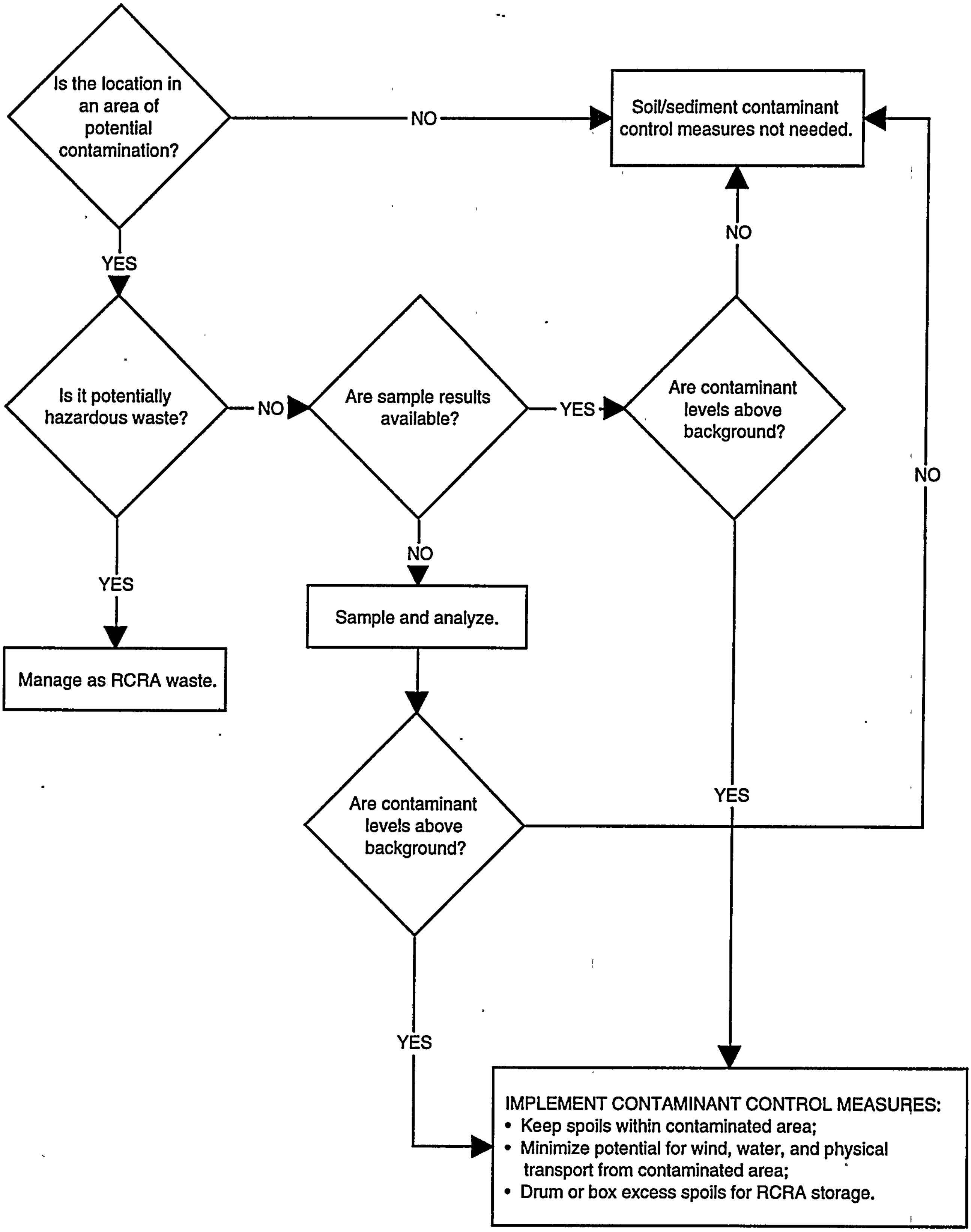

Figure 2-1 Soil/Sediment Containment Control Measure Decision Tree

2.1.6.2 Wetland Impact Minimization

This environmental control measure would involve modifying, reducing, or eliminating scope of work in or near a wetland area in order to avoid or reduce the amount of wetland to be cut back or removed. Vegetation can typically be cut back to within 6 inches of the ground surface and maintained at this height by ongoing maintenance usually without disturbing the subsurface or root system. Depending upon the conditions at the constricted location, this cut or removal would generally occur within 30 feet on the inlet side and 30 feet on the outlet side and consist of a few trees or a few square yards of cattails. Larger areas to be cut could range from 0.1 to 0.5 acres. This control measure was used in defining the project scope of work during the *Options Analysis.*

2.1.6.3 Wetland Replacement

This measure would involve the creation of wetland areas in new locations to compensate for the removal or destruction of wetland vegetation. Newly created wetland areas would be located at an offsite location or at a location within Site boundaries. Implementation of this environmental control would be in keeping with the wetland requirements of 40 CFR Part 230; §404(b)(1): *Guidelines for Specification of Disposal Sites for Dredged or Fill Material.*

Vegetation removal would involve the removal of a specified amount of groundcover, brush, and trees existing within a drainage channel or other conveyance, usually within 30 feet on the inlet side and 30 feet on the outlet side. In areas with limited overgrowth or access, vegetation would be removed manually using a hoe or shovel. In areas where manual removal would not be possible, a backhoe or small grader would be used.

2.1.6.4 Spill Prevention, Containment, and Cleanup

Spill prevention and control measures will be implemented to address the potential for leaks and spills associated with equipment that will be utilized to perform the work covered in this EA. Leaks may occur from equipment reservoirs and spills during fueling operations. The work to be performed should not impact existing tanks or fluid transfer lines. Therefore, consideration will not be given to such systems for which there are existing control measures.

This control would involve measures to prevent, contain, and clean up accidental spills. Prevention includes inspecting and maintaining equipment so that accidental spills are minimized. Spill containment includes secondary containment around equipment and spill response efforts which would involve the placement of barriers around or in the path of spills. Spill cleanup typically would involve removal of the spilled material, absorbents, and most or all environmental media contaminated by the spilled material. The Site's hazardous materials team performs most spill response activities.

2.1.6.5 Biota Protection

Biota protection would be accomplished in many ways. Most of the other environmental controls, such as contaminant transport control, protect biota from effects due to specific contaminants or spilled material, or avoid habitat loss through controls like wetland impact minimization and revegetation.

During nesting seasons, work areas would be inspected for bird nests about 2 weeks prior to construction to ensure that the work would not disrupt any nesting activities. If such a potential exists, work would be delayed or modified to avoid disruption. This effort ensures compliance with the Migratory Bird Treaty Act. In addition, all work locations are evaluated for potential impact to endangered species or to species that are anticipated to be protected under the Endangered Species Act. If there was potential for unacceptable impact to any such species, work would be delayed, modified, or canceled.

Individual field activities, and the personnel undertaking such actions, would be subject to the notification and survey requirements of the Site's procedures for Migratory Bird Evaluation and Protection (EG&G 1991c) and Identification and Protection of Threatened, Endangered, and Special-Concern Species (EG&G 1991a).

2.1.6.6 Erosion Control

Erosion control would be necessary for tasks involving clearing, excavating, or creating spoil piles. Erosion is caused by precipitation runoff and wind action. For clearing and excavation activities, the affected area would be wetted to prevent wind erosion. If the area is susceptible to erosion due to runoff, temporary mulch and sediment traps, such as weed-free straw bales, would be placed in downstream drainages. Revegetation, described below, provides erosion control at the completion of the task. For spoil piles, both wind and water erosion would be controlled by covering the piles. Methods for implementing erosion controls are specified in the Site's *Watershed Management Plan* (DOE 1993c).

2.1.6.7 Revegetation

Revegetation would be performed at the completion of a task in order to minimize erosion and reestablish habitat. Revegetation would typically be established through seeding. Seed mixtures have been developed which are appropriate mixtures of fast growing and hardy native species. Revegetation would occur at the onset of proper growing seasons. Methods for implementing revegetation are specified in the Site's *Watershed Management Plan* (DOE 1993c).

2.1.6.8 Work Specifications

Many potential environmental effects would be addressed by utilizing administrative controls in the form of work specifications. Work specifications would be placed in subcontracts or work procedures. Work specifications would identify sensitive areas to be protected, materials to be used, precautions to be observed, or methods for performing tasks.

2.1.6.9 Worker Health Protection

Typically, worker health protection would be accomplished through the implementation of the Site's OSHA-based standards. In addition, industrial hygiene and radiological health and engineering personnel would review and monitor the work and specify personal protection equipment (PPE) as required.

2.2 Partial Implementation of the Proposed Action

As previously discussed, the proposed action is generally a mixture of repair, upgrade projects, and maintenance programs for the Site's surface water drainage system. The "partial implementation" alternative would consist of only those parts of the proposed action that involve repair or replacement. This alternative represents a lesser/downgraded level of effort and a middle ground between the other two alternatives. As noted previously, *replace* and *repair* essentially denote maintenance activities, which are differentiated from *install* and *alter* for the purpose of indicating a severity of environmental effects, since maintenance generally does not substantially change the configuration or size of the original drainage system structure. Applicable environmental control measures would be considered part of the repair or replacement effort. Based on the project descriptions in the proposed action, partial implementation would consist of the following actions.

2.2.1 Industrial Area Maintenance Program

Structure cleanout would go forward under this alternative, as would any repair of riprap and replacement of culverts. However, the installation or removal of security constrictions would not occur.

2.2.2 Buffer Zone Maintenance Program

As with industrial area maintenance, structure cleanout, riprap repair, and culvert replacement would occur. Repairing or grouting of the outlet pipes and repair of ditch embankments would occur since the effort would not involve new construction.

2.2.3 Pond A-1 Bypass Upgrades Project

This project would not take place under the partial implementation alternative.

2.2.4 South Interceptor Ditch Repair Project

Under the partial implementation alternative, structure cleanout, riprap repair, culvert replacement, and road repair would occur in the SID. Increasing the height of existing ditch embankments would also occur. Road improvements, installation of road barriers, cross gutters, and monitoring instrumentation would not occur. Increasing the height of the existing diversion wall and nearby embankments on Woman Creek would occur as part of this project.

2.2.5 South Walnut Creek Improvements Project

This project would not take place under the partial implementation alternative, but would include maintenance.

2.3 No Action

The no action alternative would continue the status quo of the Site's drainage system operation, that is, a continuance of the approved routine maintenance of the drainage system in areas where no wetland vegetation or protected biota occurs. Thus, structure cleanout of soil, sediment, or vegetation would occur, but <u>not</u> in wetland areas. No work would be undertaken to restore or improve the desired capacity of the system. Effects from flooding events would be minimized through the implementation of response plans and through the management of detention pond volumes.

2.4 Alternatives Not Analyzed in Detail

Alternatives initially considered, but not analyzed in detail were total upgrade of the surface water drainage system, rerouting of drainage flows to a centralized waterway, and reduction of runoff into the surface water drainage system.

2.4.1 Total Upgrade of the Surface Water Drainage System

This alternative would involve a program to upgrade the entire surface water drainage system such that it would have the capacity to convey runoff from a 25-year precipitation event, with 100-year storm event capacity in critical locations. The existing system was not designed as a whole; rather it has been developed and retrofitted over the years. For this reason, ditch capacities were not based on the same design criteria; culverts are of various materials, and conveyances and structures are in varying stages of disrepair.

Upgrading the entire surface water drainage system would require construction of new or parallel conveyance structures, drop structures, or detention ponds. The size of most conveyances would need to be increased. Some structures would need to be regraded and rebuilt.

This alternative could conceivably meet the criteria of a management program and effectively operate the surface water drainage system at the Site. However, it was considered unreasonable and not analyzed further based on the following: a) a total upgrade was viewed as excessive and expensive given the current needs and mission of the Site; and b) the amount of disturbance to Site soil, sediment, wetlands, biota, and daily operations was unacceptably high.

2.4.2 Rerouting of Drainage Flows to a Centralized Waterway

This alternative would involve a program to centralize the drainage system in one of the existing waterways. The South Interceptor Ditch, Woman Creek, South Walnut Creek, and North Walnut Creek are currently incapable of conveying runoff from a 100-year storm event without overtopping their drainage structures. It would be possible to upgrade one of these waterways to handle 100-year storm events (for example South Walnut Creek) and reroute the other two waterways to the upgraded waterway. This action would likely require rechanneling to upgrade the waterway, upgrading existing culverts, installing pipelines, and installing pumping stations at key locations.

As with the previous alternative, this alternative was considered unreasonable and not analyzed further based on the following: a) rerouting of waterways to the chosen waterway was viewed as excessive and expensive given the current needs and mission of the Site; and b) the amount of disturbance to Site soil, sediment, wetlands, biota, and daily operations was unacceptably high.

2.4.3 Reduction of Runoff into the Surface Water Drainage System

This alternative would involve a program to reduce the runoff that enters and is carried by the Site's surface water drainage system. One method to effect this reduction would involve removal of portions of the low infiltration surfaces at the Site, such as parking lots, walkways, roads, and concrete-lined ditches, to encourage natural infiltration of water into the soil. Another method would involve allowing runoff to back up behind culverts or similar drainage structures to create temporary detention ponding and also to encourage natural infiltration.

Another technique to reduce runoff would be to prevent upstream water from entering the Site. Upstream surface water is already diverted from the main drainage system on the Site via natural and manmade ditches and canals as described in Section 3.0, Affected Environment. The Standley Lake Protection Project is currently being installed to protect the Standley Lake sole source municipal water supply from an inadvertent release of contaminants from the Site. This project involves construction of a pipeline to route water from Coal Creek directly to Standley Lake instead of the current flow path through the Site via Kinnear Ditch or Woman Creek. This diversion would further limit the amount of runoff carried in the Site's drainage system. Total diversion of upstream waters would require several additional projects of this magnitude and would not affect the flows in most of the problem areas.

This alternative is considered unacceptable since it would require extensive disturbance to the environment, as well as Site facilities, and would not provide sufficient runoff control. Replacing paved parking areas and roadways with dirt structures is an impractical method for increasing infiltration, and would result in additional erosion and contaminant transport concerns. Also, there is not adequate detention volume available within the industrial area to allow water to accumulate upstream of drainage structures.

3.0 AFFECTED ENVIRONMENT

The Rocky Flats Environmental Technology Site (Site) is located in northern Jefferson County, Colorado, approximately 16 miles northwest of Denver, Colorado (Figure 3-1). The cities of Boulder, Broomfield, Westminister, and Arvada are located within a 10-mile radius. The Site is located on Federal land consisting of approximately 6,550 acres at an elevation of about 6,000 feet. Buildings have been constructed within a 384-acre secured industrial area. The remaining acres surrounding the industrial area constitute the buffer zone. The Site is situated on a plateau at the eastern edge of the foothills to the Rocky Mountains.

An overview of the environment in and around the Site that may be affected by the proposed action and alternatives is presented in this section. Considered in this EA are biological resources - vegetation, wildlife, and wetlands, and physical resources - surface water. Because the proposed action and alternatives are not expected to impact other physical resources, such as air, soil, and groundwater, they were not considered in this EA.

3.1 Biological Resources

Biological resources are an important consideration because the areas where work is proposed tend to contain higher concentrations of both animal and plant life than other areas of the Site. The potentially affected biological resources considered are vegetation, threatened and endangered vegetative species, wetlands, wildlife, migratory birds, and threatened and endangered wildlife species. A brief description of these resources is presented in the following subsections.

3.1.1 Vegetation

The area in the immediate vicinity of the Site is primarily agricultural or undeveloped (DOE 1980). The natural environment and ecology of the Site is largely influenced by its proximity to the Front Range of the Rocky Mountains, and the elevation of approximately 6,000 feet (DOE 1980). The Site is situated in a region where plains grassland vegetation meets lower montane forest (DOE 1980).

The present vegetation of the upper plains grassland has been characterized (Marr 1964) as consisting primarily of heavily grazed pastures (grazing ended over 20 years ago) composed of herbs and relatively unpalatable grasses (DOE 1980). Since acquisition of the Site property, vegetation recovery in disturbed plant communities has begun and continues as a slow process. Recovery and redevelopment of native plant communities has been notable (DOE 1992a).

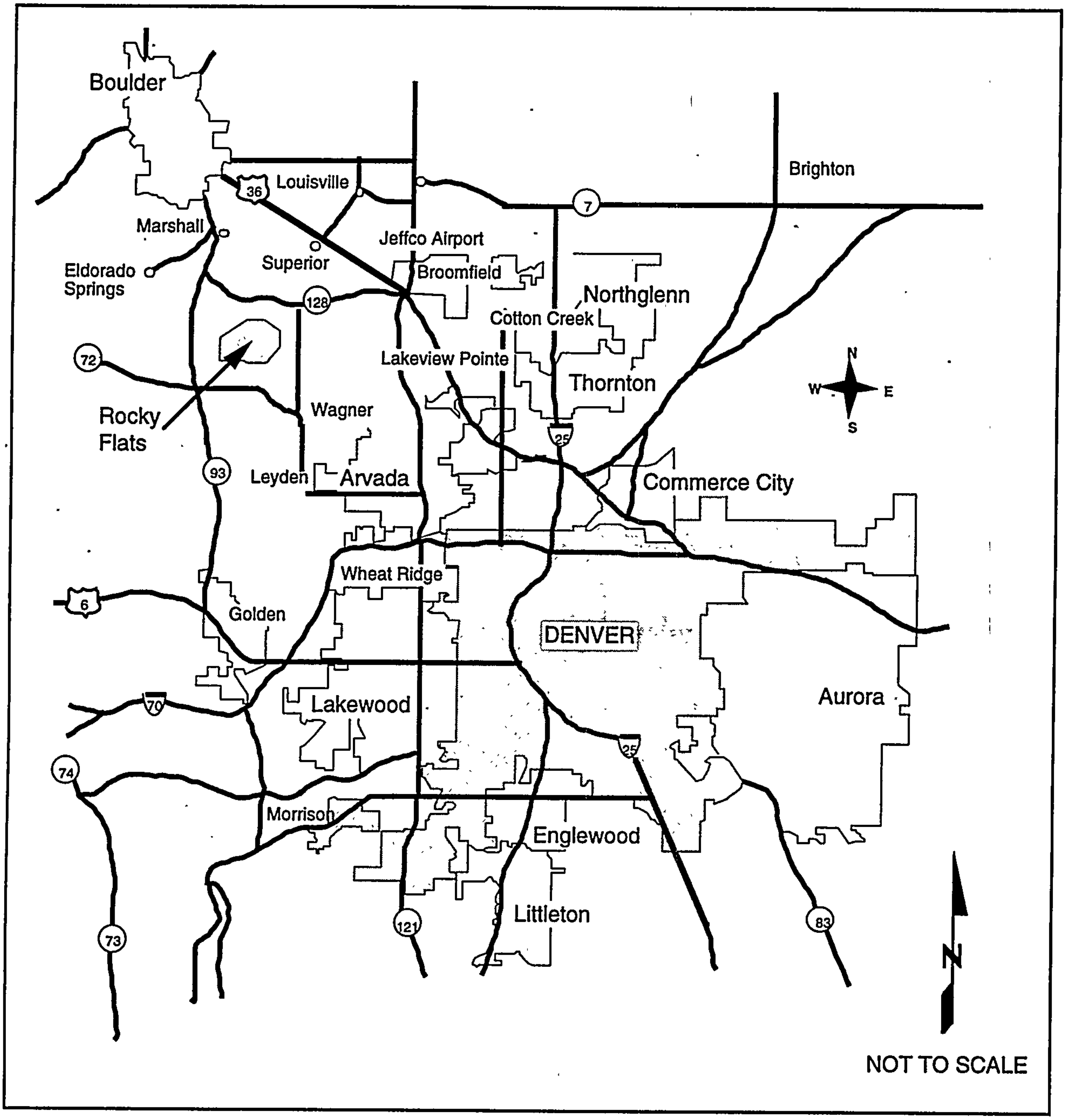

Figure 3-1 Location of Rocky Flats Environmental Technology Site

The *Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant, Final Report* (DOE 1992a), lists 532 terrestrial plants, including 25 lichens, 16 bryophytes, 4 vascular cryptogams, and 487 vascular plants. Of these, trees and shrubs account for 7 percent of the total species, cacti 1 percent, graminoids (grasses and grass-like plants) 25 percent, and forbs (broad-leaf herbs) 67 percent.

The baseline characterization reported that the Site has three hydrologic zones: xeric, mesic, and hydric. These zones were further divided into 17 communities and subcommunities. Xeric conditions occur on ridge tops and terraces. Xeric soils have the lowest moisture content. There were 91 species of plants found in these areas. Mesic conditions are found on hillsides in ravines and valleys. Mesic soils have a greater moisture content than xeric soils. There are 149 species of plants that reside in the mesic zone. Hydric conditions are generally found near creek channels, hillside seeps, and springs. Hydric soils have a high water content. Riparian woodlands, which include bottomland shrubs, contained 280 species of plants and 162 species were found in marshlands (DOE 1992a).

3.1.2 Threatened and Endangered Vegetative Species

The Site's procedure for identifying and protecting threatened and endangered species and their habitat is 1-DO6-EPR-END.03, *Identification and Protection of Threatened, Endangered, and Special-Concern Species* (EG&G 1994b). In addition, an inventory of vegetative species at the Site is updated regularly based on field investigations. As of December 1994, 512 species of vascular plants had been identified at the Site (EG&G 1994a). A recent evaluation of threatened, endangered, and sensitive plant species at the Site noted the following (EG&G 1995):

> Ute Lady's-tresses: The Ute Lady's-tresses is listed as threatened by the U.S. Fish and Wildlife Service and on List 1 of the Colorado Natural Areas Program (species that are federally threatened, endangered, or a candidate for listing). No plants were located during an inventory of the Site conducted during the summers of 1992, 1993, and 1994. Potentially suitable habitat is found along drainages onsite (ESCO 1993b).
>
> Colorado Butterfly Plant: This plant is included on List 1 of the Colorado Natural Areas Program. Such plants are rare throughout their range, or characterized by extremely narrow geographic distribution. Colorado butterfly plants were not located during an inventory of the Site conducted during the summer of 1993. Potentially suitable habitat is found along drainages on plantsite (ESCO 1993b).

Bell's Twinpod: This plant is a Federal Category 2 species, meaning that more information is needed before a decision can be made regarding listing the species, and has been located near the Site with potentially suitable habitat available at the Site; however, no plants have been found onsite.

Forktip Threeawn: This species has no federal status, but is included on List 3 of the Colorado Natural Heritage Program, for which more information is needed. This species was observed at the Site in 1973, and confirmed during recent studies (DOE 1992a).

Toothcup: This species has no federal status, but is included on List 3 of the Colorado Natural Areas Program. It is not known to occur at the Site, but potentially suitable habitat is available.

Sedge: This species is listed as a Colorado Species of Special Concern because of its rarity throughout its former range. Sedge occurs as small patches within mixed grasslands at the Site.

3.1.3 Wetlands

Historically, wetlands have existed in and around the watersheds of the Site. According to *Rocky Flats Plant Wetlands Mapping and Resource Study*, a wide variety of wetlands presently occur along the valley slopes, floodplains, and stream channels of the Site (COE 1994). The majority of these wetlands are natural systems. The ecological structure and function of these systems are controlled by the pattern of slope runoff and ponding, channel discharge and morphology, and groundwater seepage or discharge.

The U.S. Fish and Wildlife Service classification system (Cowardin et al. 1979) was used to classify wetlands on the Site. This classification includes five major wetland systems, three of which occur at the Site (riverine, lacustrine, and palustrine). The resource study determined that the Site's wetlands are primarily palustrine; that is, vegetated or consisting of only small, open water bodies less than 20 acres in size and 6.5 feet in depth (COE 1994).

About 1,100 wetlands and deep water habitats were classified and described during the resource study as shown in Table 3-1, Watershed Wetland Summary. Wetlands occupy approximately 191 of the total 6,550 acres of the Site (COE 1994). The study also determined that about 27 percent of the Site's wetlands are found on the valley slopes, as a result of groundwater seeps, while the remainder occur along the drainage channels. In terms of amount, about 60 percent of the Site's wetlands are found in the Walnut and Rock Creek drainages; although, in terms of a real extent, about 60 percent lie within the Woman and Rock Creek drainages that have more of the larger slope wetland complexes. The Walnut Creek drainage supports more stream wetlands and deep water habitats because of the highly dissected topography and numerous impoundments (COE 1994).

Table 3-1 Watershed Wetland Summary

Watershed	Stream Wetlands		Slope Wetlands		Total Wetlands	
	No. of Wetlands	Acreage	No. of Wetlands	Acreage	No. of Wetlands	Acreage
Rock Creek	163	25.37	152	32.17	315	57.55
Woman Creek	135	29.98	85	25.76	220	55.74
Smart Ditch	204	28.21	17	1.39	221	29.60
Walnut Creek	300	40.08	43	8.06	343	48.14
Totals	802	123.64	297	67.38	1,099	191.03

Source: COE 1994.

Stream Wetlands: The wetlands within the subject drainages are primarily stream wetlands. According to the U.S. Army Corps of Engineers, the water regime of wetlands along the stream bottoms varies greatly due to location in the drainage, channel shape, channel substrate, flow regulation, streamflow obstructions, flow seasonality, flow duration, and total annual flow (COE 1994). In general, the more structurally diverse and productive stream wetlands were in channel areas subject to relatively steady water levels (that is, the pond areas in the abruptly incised and deeper drainages of the Rock Creek watershed).

The vegetation communities of the slope and stream wetlands share some similarities, but typically contrast in terms of botanical composition and structure (COE 1994). Palustrine wetlands associated with the streams are forested, scrub-shrub, herbaceous, and aquatic (ponds). Forest species include plains cottonwood, peach-leaved willow, white poplar, and russian olive. Dominant scrub-shrub species are sandbar willow and indigo bush. Understory herbaceous species include baltic rush, Nebraska sedge, and wintercress.

Alien Plants: The resource study indicated that some invader plants were observed in the wetland areas (COE 1994). These included cheatgrass, smooth brome, quackgrass, Canada thistle, and common St. John's Wort. Most of these species were limited to temporary wetlands and unlikely to threaten wetland integrity, although it was noted that intrusion of Canada thistle at Antelope Springs was especially of concern because it could affect patterns of wildlife use, reduce biodiversity, and negatively affect wetland hydrology. In addition, hybrid cattail, white poplar, and russian olive, in sufficient numbers, may constitute a nuisance.

Wetland Value: The U.S. Army Corps of Engineers concluded that the natural values of the Site's wetlands include erosion control, floodwater storage and attenuation, water quality maintenance, natural heritage, and fish and wildlife habitat. These wetland areas also provide habitat for muskrats, waterfowl, shore birds, amphibians, and some reptiles. Wetlands in the Rock Creek and the Antelope Springs area (upper Woman Creek) exhibit the greatest biodiversity and are very productive ecosystems (COE 1994).

3.1.4 Wildlife

Wildlife at the Site is generally characteristic of prairie habitats. The *Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant, Final Report* identifies three hydrologic vegetation zones (mesic, xeric, and hydric) divided into 17 plant communities. These same 17 communities were grouped into five wildlife habitat types - shrubland, grassland, disturbed areas, woodland, and marshland (DOE 1992a).

The baseline report lists terrestrial animal species in five taxonomic groups: arthropods, amphibians, birds, mammals, and reptiles. Thirty-three bird species were confirmed to nest on the Site, while another twenty-two species were characterized as possible breeding species. Thirty-one mammal species were documented (DOE 1992a). The most common large mammal is the mule deer. Other mammals on the Site include the coyote, red fox, striped skunk, long-tailed weasel, northern pocket gopher, white-tailed jackrabbit, and the meadow vole. Also recorded were 6 amphibians, 8 reptiles, and 124 families of arthropods.

Through its *Natural Resource Protection and Compliance Program* (NRPCP), the Site monitors the status of several wildlife groups to ensure that operations at the Site remain in compliance with state and federal wildlife protection statutes. The Site conducts year-round surveys to monitor the health of wildlife populations such as game species, high visibility species, indicator organisms, or species afforded special protection by statute. Data collected by NRPCP ecological monitoring during 1993 and 1994 have confirmed the presence of many additional species at the Site. Mammal species that were added to those known to occupy the Site are beaver, gray fox, bobcat, fox squirrel, and elk. The number of bird species recorded at the Site has increased to 167 species, bringing the total known mammal species to 37. Eight waterfowl species have now been confirmed as breeding at the Site (DOE 1994).

Due to their intermittent nature, Rock, Walnut, and Woman Creeks do not support sizable amounts of fish. Minnow species have been observed in impoundments of Walnut and Woman Creeks, and sunfish have been observed in impoundments of Woman Creek (EG&G 1991a).

3.1.5 Migratory Birds

One-hundred sixty-seven species of birds have been recorded at the Site (DOE 1994). These include waterfowl, birds of prey, game birds, and passerine (song) birds, most of which are protected under the Migratory Bird Treaty Act. The most commonly observed migratory birds in the subject drainage areas include red-winged blackbirds, song sparrows, and common yellowthroats (during the breeding season) and tree sparrows (during the winter months). Depending upon the season, passerine species less commonly observed in the drainage areas are western meadowlarks, marsh wrens, and house finches. Great blue herons and black-crowned night herons hunt in the shallow open waters of impoundments and ditch pools. Yellowheaded blackbirds have not been observed in the subject drainage areas, but are commonly observed in similar habitat in the southeast portion of the Site near the D-Series ponds.

Raptors and owls are common at the Site year round, but the species composition changes seasonally. Several species of hawks, as well as great horned owls, have been documented as nesting at the Site. Large cottonwood trees along the watercourses are used as nesting and roosting sites by raptors and owls; however, these trees are not located in potential work areas.

The largest numbers of waterfowl and shorebirds have been recorded in or around the impoundments of the Walnut Creek and Smart Ditch drainages, and in lesser numbers in the Woman Creek drainage. The open water of the impoundments attracts a variety of waterfowl and shore bird species during migration, and provides breeding habitat for some species as well.

3.1.6 Threatened and Endangered Wildlife Species

The Site provides habitat for several Colorado Species of Special Concern and incidental foraging habitat for the bald eagle and the peregrine falcon. These two raptor species are currently listed by the U.S. Fish and Wildlife Service (USFWS) as threatened or endangered. Studies conducted in 1991 indicate that habitat potentially suitable for the endangered black-footed ferret and the whooping crane is present on the Site, although no sitings have been recorded.

Bald Eagle: A pair of nesting bald eagles was observed in November 1991, November 1992 to March 1993, and October 1993 to March 1994 at Standley Lake, which is a mile east of the Site (CBO 1994). As many as 10 to 12 additional bald eagles are known to winter in the Rocky Flats vicinity. Records from the NRPCP indicate that a growing number of bald eagles winter in the area (DOE 1994). Numerous sightings are made during the March to April migration period each year as well (DOE 1994). Current Rocky Flats monitoring programs have recorded casual use of the Site by bald eagles, generally during the winter months. The more sensitive raptors tend to avoid drainages where a high level of human activity takes place (DOE 1994).

Peregrine Falcon: Two subspecies of peregrine falcon could potentially occur at the Site. The arctic peregrine falcon is listed as threatened and is a migrant through the area in spring and fall. The American peregrine falcon nests in Colorado and is listed federally and by the State as endangered (DOE 1991lb). The Site may be used for hunting by the peregrine falcon. However, no habitat features critical to this species are present (DOE 1991b). Two historic aeries, or nesting sites (one occupied in 1991), occur within a 10-mile radius of the Site (EG&G 1991b). Peregrine falcons are periodically observed at the Site. This species is suspected to forage for waterfowl on some of the impoundments. (DOE 1994; DOE 1991c).

Black-footed Ferret: The black-footed ferret is listed federally and by the State of Colorado as endangered (DOE 1991b). Black-footed ferrets require large prairie dog colonies or complexes of small prairie dog colonies as habitat. Based on recent surveys of the Site area, 15 acres of prairie dog towns occur within the facility boundary (EG&G 1991b, DOE 1991a). The colonies are part of a complex totaling 753 acres, which would be of sufficient size to support the black-footed ferret (DOE 1991b). No confirmed sightings of the black-footed ferret have been reported for this area (EG&G 1991b).

Among the Colorado Species of Special Concern are:

Long-billed Curlews: Long-billed curlews are casual visitors to the Site during migration. The Site is not within traditional summering or breeding grounds, but suitable foraging habitat exists. The individuals observed onsite were apparently on rest stop-overs during migration.

Greater Sandhill Cranes: Greater Sandhill Cranes are frequently observed flying over the Site during spring and fall migrations. While suitable foraging habitat exists and stop-overs may occur at the Site, no individuals of this species have been observed on the ground foraging. The traditional wintering and summering grounds are hundreds of miles distant from the Site.

American White Pelicans: American White Pelicans have been observed at several impoundments on the Site during the spring and summer seasons. Suitable nesting habitat does not exist at the Site. This species periodically uses impoundments at the Site as foraging habitat.

Blue Grosbeaks: Blue Grosbeaks are frequently observed in bottomland shrublands along the riparian corridors at the Site. While this is an uncommon species at the Site during the spring and summer, breeding has been confirmed in the Rock Creek, Woman Creek, and Smart Ditch drainages. This is a species of concern due to low population numbers.

Black-throated Gray Warbler: A single Black-throated Gray Warbler was reported during the winter season of 1994. This woodland species is not considered to be resident at the Site, but is an occasional visitor during migration.

3.1.7 Candidate Species

Several candidate species for federal listing may potentially occur at the Site. Most are Federal Category 1 or 2 Candidate species, meaning that listing may be appropriate, but that further information is required to support listing as threatened or endangered. These species include the white-faced ibis, northern goshawk, western burrowing owl, ferruginous hawk, mountain plover, Baird's sparrow, Preble's meadow jumping mouse, eastern short-horned lizard, and swift fox (EG&G 1995). Of these species, only the ibis, plover, and swift fox have not been observed at the Site.

The loggerhead shrike was a Category 2 predatory bird species that was commonly observed on the Site during seasonal migration periods. The shrike principally eats insects and small mammals. At the time of this writing, the shrike had been downlisted at the federal level, although Region 6 of the USFWS was protesting this action. The Preble's meadow jumping mouse, a Federal Category 2 Candidate species and a state Species of Concern, has been captured in three main watersheds at the Site and may occur in willow thickets found in the drainages.

Preble's Meadow Jumping Mouse: The Site's buffer zone is home to a population of the Preble's mouse. Preble's mice have also been documented recently within the City of Boulder Open Space. The Preble's mouse has been recorded in all major drainages at the Site (Rock Creek, Walnut Creek, Woman Creek, and Smart Ditch). Nineteen mice were captured during trapping sessions conducted in 1992 and 1993. Captures were made in both Woman Creek and Rock Creek drainages (ESCO 1993a; DOE 1994). The apparent preferred habitat for this species is moist riparian areas that contain willows. At the Site, the mice exist primarily in mixed shrub-grass communities within the drainages. Critical habitat for the mice has not been determined, although it is postulated by Site biologists that the species is surviving and reproducing, at least to some extent, under current ecological conditions. Currently, further study is being conducted for the species specific habitat and occurrence at the Site.

The Preble's mouse is currently under review for federal listing on the Endangered and Threatened Wildlife and Plants list. Since 1985, the USFWS has listed the Preble's mouse as a Federal Category 2 species, which means that more information is needed before a decision can be made regarding listing the species. The State of Colorado has classified the mouse as a "nongame" Species of Special Concern since 1990. This classification protects the species by denying permits for the take of the species. The "Category 2 Federal Candidate" designation offers no legal protection for the species or its habitats.

On August 9, 1994, a petition was filed with the USFWS to list the Preble's mouse pursuant to section 4(b)(3)(A) of the Endangered Species Act (16 U.S.C. 1531 et seq.). The petition seeks to elevate the classification of the mouse from a Candidate species-Category 2 mammal to a threatened or endangered species. Regional distribution of the mouse population is thought to be vulnerable to expanding residential, agricultural, mining, recreational, and industrial development in the region. Within the buffer zone of Rocky Flats, the mouse population is believed to be under pressure from remediation and clean-up efforts, and sand and gravel operations at the headwaters of Rock Creek.

The 90-day finding issued by the USFWS on February 27, 1995 in response to this petition concluded that, after reviewing the best scientific and commercial information available, ". . . there is substantial information to indicate that the requested action may be warranted." The finding indicates that designation of critical habitat is not petitionable under the Endangered Species Act. "However, if the 12-month finding determines that the petitioned action to list the Preble's meadow jumping mouse is warranted, the Act requires that the designation of critical habitat be addressed in the subsequent proposed rule."

Prior to publication of the 12-month finding, a taxonomic/systematics review is planned. Data regarding preferred habitat, diet, and behavior being compiled by ecology researchers is considered an integral contribution to the finding. In addition, a number of environmental and anthropogenic factors are being postulated and investigated as possible causes of decline in mouse populations, including habitat fragmentation and modification, disease or predation, inadequacy of regulatory mechanisms currently in place, displacement of indigenous forage grasses with introduced grasses, and pollution.

Ferruginous Hawk: Ferruginous hawks, a Federal Category 2 species, were observed adjacent to the industrial area in the winter, spring, and early summer of 1990-1991. Ferruginous hawks are observed at the Site during the late fall and winter, then out-migrate in the spring. It is possible that the hawk could occur at the Site throughout the year, but no nests have been recorded within the Site (DOE 1991b; DOE 1980; DOE 1991c; DOE 1992a; DOE 1994). Most observations of this species have been in association with black-tailed prairie dog colonies in the southeast and northeast portions of the Site. The USFWS has been petitioned to add the ferruginous hawk to the endangered species list, and a status review of the species is ongoing.

Northern Goshawk: Northern goshawk, a Federal Category 2 species, has been observed occasionally at the Site. It is unlikely that this species is other than an occasional visitor because it is normally a forest dwelling species.

Baird's Sparrow: Baird's sparrow, a Federal Category 2 species, has been recorded at the Site in grassland and shrubland habitats. This species is a rare visitor to the Site, and seldom uses habitat such as will be affected by the proposed actions.

Western Burrowing Owl: The owl, a Federal Category 2 species, has been observed on the Site in conjunction with black-tailed prairie dog colonies. To date, the owls have not been recorded as nesting at the Site, although nests have been confirmed on lands adjacent to the Site. The owls have not been recorded in habitats similar to the potential work areas.

Eastern Short-Horned Lizard: The lizard, a Federal Category 2 species, has been observed on the Site in xeric grassland habitats. While this species appears to be widespread at the Site, observations are uncommon. Due to its preference for dry upland areas, this species would not be found in potential work areas.

3.2 Physical Resources

The potentially affected physical resource considered is surface water.

3.2.1 Surface Water

The surface water drainage area for the Site lies within the Big Dry Creek basin. Big Dry Creek is an 86 square-mile tributary of the South Platte River. Its confluence with the South Platte is 42 miles downstream of the Site near Brighton, Colorado (DOE 1992c). The Upper Big Dry Creek drainage basin extends eastward from the base of the foothills near the mouth of Coal Creek Canyon to Standley Lake, which is located downstream and east of the Site.

The Site annually receives an average of 15.4 inches of precipitation, with a range of 7.8 to 24.9 inches based on 24 years of data from 1953 to 1976. Typically, more than 70 percent of the precipitation falls as rain between April and September. The estimated long-term average annual yields of Walnut Creek and Woman Creek at Indiana Avenue are 34.5 and 32.1 acre-feet (ASI 1990). These yields are low and the streams are considered to be essentially dry most of the year except during storm events and from May through June. Flow in the spring months are largely irrigation return flows.

Natural Drainage

Surface water drainage generally flows in a west to east direction along four ephemeral streams within the Site's boundaries: North Walnut Creek, South Walnut Creek, Woman Creek, and Rock Creek (Figure 3-2). Walnut Creek is a tributary to the Great Western Reservoir and Woman Creek is a tributary to Standley Lake, both of which ultimately flow into Big Dry Creek. Rock Creek flows into Coal Creek, which is a tributary of Boulder Creek.

Rock Creek is located in the northern portion of the buffer zone and is upstream and physically separated from the industrial area. It has remained in a physically undisturbed condition since the Site boundaries were established in 1952 (EG&G 1991a).

North Walnut Creek receives most of its flow from surface water runoff from the northern portion of the Site's industrial area. North Walnut Creek runoff is controlled through a series of four in-channel detention ponds and associated control structures (Ponds A-1 through A-4).

South Walnut Creek receives most of its flow from surface water runoff from the central portion of the industrial area. South Walnut Creek runoff is controlled through a series of five in-channel detention ponds and associated control structures (Ponds B-1 through B-5). The North and South Walnut Creek drainage basins collectively constitute Operable Unit 6.

Woman Creek receives water at its start from Coal Creek via Kinnear Ditch, as well as runoff from the south buffer zone. It also receives water from Last Chance Ditch and Smart Ditch near Indiana Street. Woman Creek flows through Pond C-1 and is routed around Pond C-2 via the Woman Creek Bypass. The portion of the Woman Creek drainage basin with the Site boundaries, including Pond C-2, constitutes Operable Unit 5.

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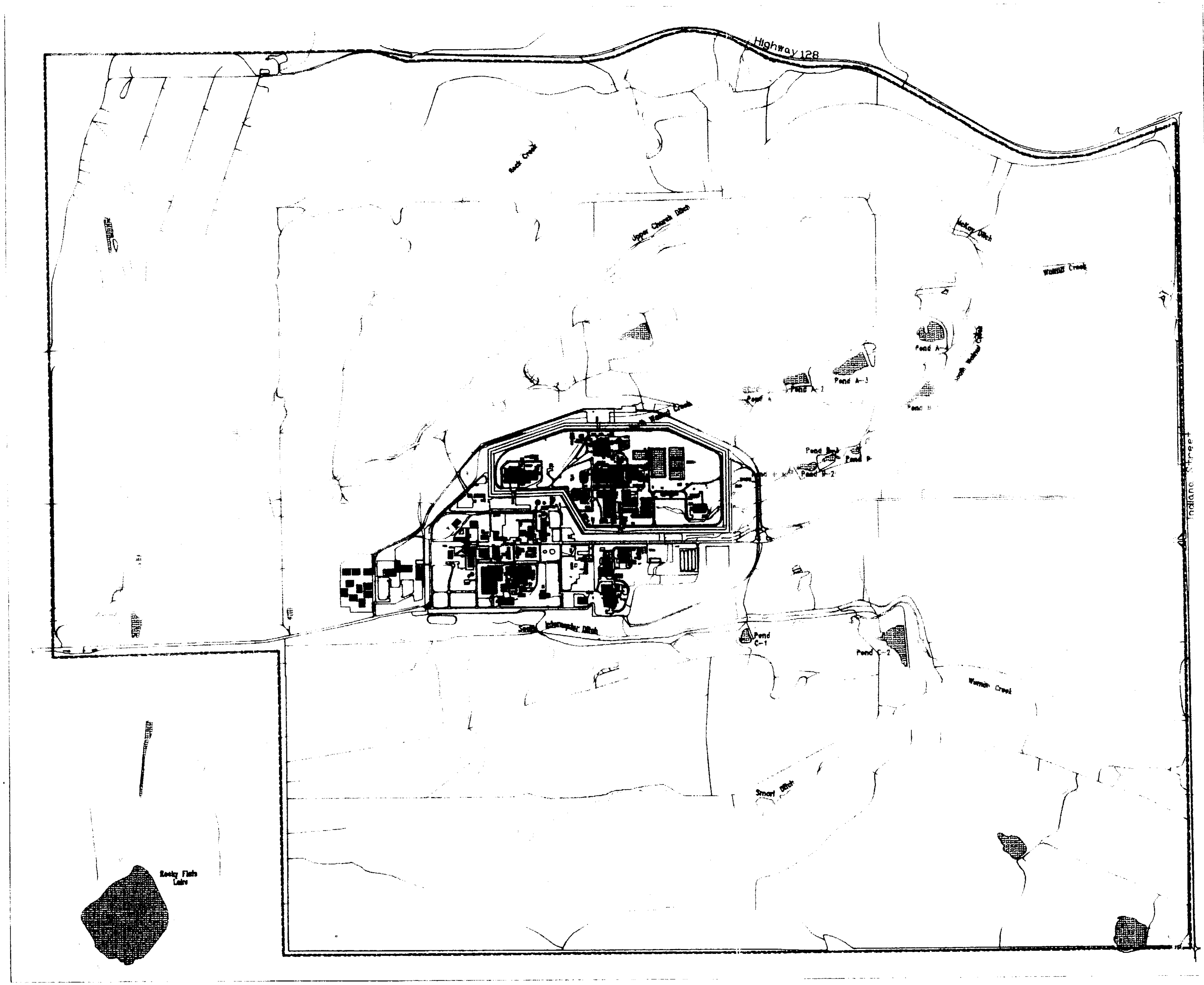
FIGURE 3-2

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE SURFACE WATER FEATURES



Manmade Drainage

Upstream surface water is conveyed around or through the Site via several canals or ditches as shown in Figure 3-2. The South Boulder Diversion Canal is located west of the Site and supplies raw water to the Site and to Ralston Reservoir, which contains Denver water supply and is located 5 miles southwest of the Site. Last Chance Ditch, Upper Church Ditch, McKay Ditch, and Kinnear Ditch tap and divert water from Coal Creek (situated west of the Site) around the Site. The South Interceptor Ditch intercepts runoff from the southern portion of the industrial area and routes it to Pond C-2.

The Last Chance Ditch delivers water to Rocky Flats Lake and Standley Lake. Outflow from the Rocky Flats Lake is transferred by Smart Ditch 1, which crosses the southern buffer zone, and by Smart Ditch 2, which empties into Woman Creek and ultimately is diverted to Mower Reservoir and Standley Lake. Upper Church Ditch supplies water to Upper Church Lake and Great Western Reservoir. McKay Ditch supplies water to Great Western Reservoir. Kinnear Ditch empties into Woman Creek and supplies water to Standley Lake and Mower Ditch. Mower Ditch diverts Woman Creek water to Mower Reservoir.

Rocky Flats Lake is a privately owned reservoir located southwest of the Site boundary. Standley Lake and Great Western Reservoir are located downstream of the Site and supply drinking water to the municipalities of Broomfield, Federal Heights, Westminster, Thornton, and Northglenn. Mower Reservoir is located downstream of the Site along Woman Creek and is used for agricultural purposes.

Management

Most runoff outside of the industrial area is routed around the area through various flow-through ditches and creeks. Runoff from the industrial area is routed through ditches and storm sewers into the Site's detention ponds. This runoff is stored in the A- or B-series ponds or Pond C-2 for sampling and treatment, if needed, prior to discharge. The Site holds no rights to this water.

In addition, nonindustrial wastewater is treated at the sanitary wastewater treatment plant, which discharges to Pond B-3. All treated wastewater, along with industrial area stormwater runoff and limited groundwater, discharges to receiving streams and is stored in various ponds prior to discharge to Segment 4 of Big Dry Creek. Pond releases are made only upon the assurance that all numeric standards for Segment 4 of Big Cry Creek will be met and after consultation with the Colorado Department of Public Health and Environment.

These ponds are used for spill control, water treatment, flow measurement, water quality sampling, and detention of Site water prior to downstream release. Since 1989, all Rocky Flats pond discharges have been diverted around Great Western Reservoir and Standley Lake through pipelines and diversion ditches (EG&G 1991a). Implementation of planned improvements, described in the Surface Water Management Plan (SWMP), would further increase the level of flood protection and reduce spill-related risks.

Surface water quality is routinely monitored at over 100 locations for radionuclides, organics, metals and other substances to meet specific regulatory requirements, assist with operations, and provide needed information on water quality. In addition, meteorologic and hydrologic measurements are taken at various locations around the Site (Rehmann, et al. 1991).

4.0 ENVIRONMENTAL EFFECTS

This section presents the potential environmental effects on selected resources from the proposed action, partial implementation, and no action alternatives. The resources potentially affected are biological resources (wetlands and wildlife), physical resources (surface water), and human health.

4.1 Proposed Action

As discussed in Section 2.0, Description of Alternatives - Including the Proposed Action, the proposed action consists of a mixture of repair, upgrade, maintenance, and environmental control measures. Environmental effects from the proposed action are primarily construction-related and are rendered negligible through proper execution of the applicable environmental control measures.

4.1.1 Biological Resources

Wetlands

Wetland vegetation would be directly affected by the proposed action as shown in Figure 4-1, Proposed Action in Wetland Areas. Vegetation such as baltic rush, cattails, sedges, bulrushes, and riparian woodland and shrubland species (for example leadplant, cottonwoods, and willows) would either be removed in small parcels, cut back in small parcels, covered by riprap, or temporarily affected by vehicular access and construction activities.

Vegetation that now constricts flow within various culverts and ditches would be cut back annually to within 6 inches of the ground surface, leaving the root system intact. The cutback of wetland vegetation would not markedly affect wetland habitat. The area to be cut would be small and adjacent to culvert inlets and outlets. Species of wildlife that might have used the cut-back vegetation would probably relocate to nearby existing vegetation.

The proposed action would initially affect an estimated 0.29 acres of wetland, primarily due to soil, sediment, and vegetation removal associated with structure cleanout as shown in Table 4-1, Sediment/Vegetation Removal Affective Wetlands: Estimate. Of the 0.29 acres, 0.14 acres would be removed within the South Interceptor Ditch, 0.10 acres within the drainages in the buffer zone, and 0.05 acres within the system structures in the industrial area. The total wetland area to be damaged or removed by the proposed action ranges from an anticipated 0.29 to 1.0 acres. As discussed in Section 3.0, Affected Environment, wetlands occupy approximately 191 acres of the Site's 6,550 total acres. The percentage of wetland area lost represents approximately 1.0 percent of the Site's 191 acres.

It is necessary to remove the wetland acreage to accomplish the purpose of the program. The removal of this acreage would be permanent as long as control of stormwater is required. This acreage represents an unavoidable impact following the consideration of avoidance and minimization in the Appendix A, Management Program Options Analysis and Appendix B, Programmatic Support Study. Avoidance, minimization, and compensatory measures are acceptable methods to avoid adverse impacts and offset unavoidable impacts under the Memorandum of Agreement between the EPA and Corps of Engineers (COE) regarding the Clean Water Act §404(b)(1) Guidelines (EPA 1990).

Activities involving installation or repair of riprap, ditches, gutters, monitoring instrumentation (as well as the earthwork, vegetation removal, and debris/spoil disposition associated with these activities) would also affect wetlands. Vehicular access and placement of riprap within drainage channels could temporarily flatten some wetland vegetation. Wetlands would be disturbed for a short time by construction of pipelines, floodwalls, bank enhancements, and temporary use of sumps and cofferdams.

Avoidance and minimization would be applied to program activities as part of the environmental control measures, proposed actions which incorporate de minimis earthwork and vegetation removal requirements, runoff controls, design and construction constraints, revegetation and restoration requirements, and protection of sensitive areas, as directed in DOE wetlands environmental review (10 CFR 1022.12). For example, access to and from structures within wetlands would be confined to existing roads within the buffer zone or the industrial area, except where no roads exist. Where practicable, manual labor would be substituted for mechanized operations. Erosion control methods would be implemented according to the guidelines set forth in the *Watershed Management Plan for Rocky Flats* (DOE 1993c).

A wetlands assessment conducted in association with this EA found that many of the wetland areas that would be affected by program activities are small and located in excavated ditches in developed areas. These wetland areas provide low quality wetland habitat and perform limited wetland functions (as defined by the COE). For instance, these wetlands generally are not effective in providing groundwater recharge; groundwater discharge; floodflow alteration; nutrient removal or transformation; production export; aquatic diversity or abundance; wildlife diversity or habitat for breeding, migration, and wintering; nor do they provide recreational opportunities, uniqueness or heritage functions.

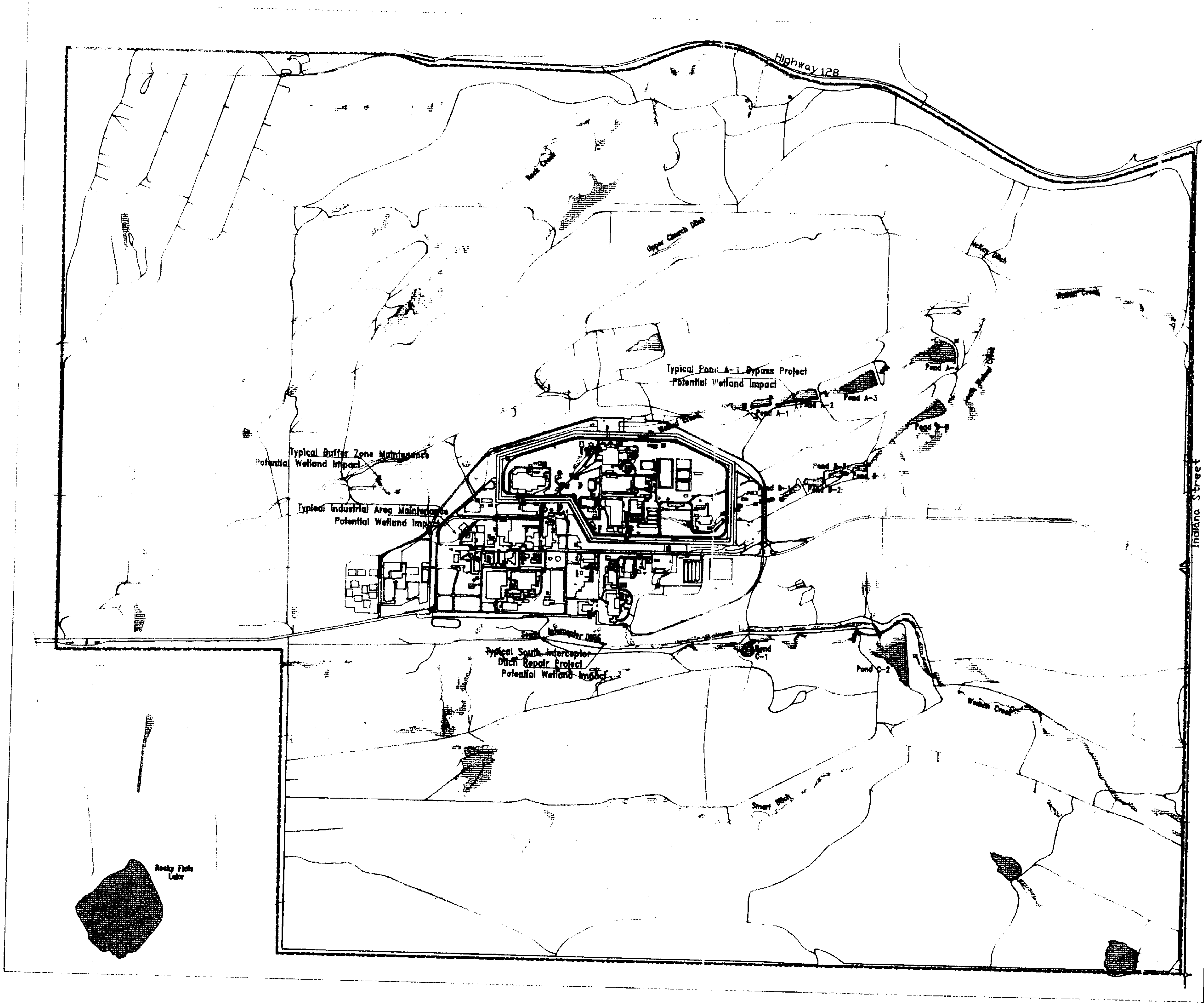


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FIGURE 4-1

PROPOSED ACTION IN WETLAND AREAS

- Tentative Locations of Proposed Actions in Wetland Areas (Note: Not to Scale)
- Wetland Areas
- Ponds and Lakes
- Buildings
- Streams and Drainages
- Roads and Fences
- RFETS Border

July, 1995

Table 4-1 Sediment/Vegetation Removal Affective Wetlands: Estimate

LOCATION	DRAINAGE SYSTEM	DRAINAGE STRUCTURE TYPE OR IDENTIFICATION NUMBER	AFFECTED AREA (sq. feet)	AFFECTED AREA (acres)
Buffer Zone	Woman Creek Bypass	outlet	1984	0.04555
Buffer Zone	Woman Creek Bypass	inlet	620	0.01423
Buffer Zone	Pond C-2	outfall	16	0.00037
Buffer Zone	Pond C-1	spillway headcut	84	0.00193
Buffer Zone	Pond C-1	outlet works	4	0.00009
Buffer Zone	McKay Bypass	outlet	260	0.00597
Buffer Zone	McKay Bypass	inlet	330	0.00758
Buffer Zone	McKay Bypass	slough	147	0.00337
Buffer Zone	Landfill Pond	spillway	225	0.00517
Buffer Zone	Pond A-3	outlet works	72	0.00165
Buffer Zone	Pond A-3	flume (both sides)	140	0.00321
Buffer Zone	Pond A-4	flume (east side only)	50	0.00115
Buffer Zone	Pond B-4	uncontrolled outlet	100	0.00230
Buffer Zone	Pond B-3	spillway (cottonwood stand)	5	0.00011
Buffer Zone	Pond A-1	spillway	36	0.00083
Buffer Zone	Pond B-5	flume	50	0.00115
Buffer Zone	Pond A-1	bypass flume	96	0.00220
Buffer Zone	Walnut/Indiana Streets	flumes (6 in. and 36 in.)	30	0.00069
Buffer Zone	Culvert #30		30	0.00069
Buffer Zone	T130 Complex	culvert	30	0.00069
		SUBTOTAL	4309	0.09892
Buffer Zone	South Interceptor Ditch	ditch	6247	0.14341
		SUBTOTAL	6247	0.14341
Industrial Area	North Walnut Creek	18" culvert #46 inlet/outlet	30	0.00069
Industrial Area	North Walnut Creek	18" culvert #gg-1a inlet	12	0.00028
Industrial Area	North Walnut Creek	12" culvert #bbb-1 outlet	30	0.00069
Industrial Area	North Walnut Creek	18" culvert #125 inlet	12	0.00028
Industrial Area	North Walnut Creek	48" culvert #126 outlet	144	0.00331
Industrial Area	North Walnut Creek	36" culvert #139 outlet	30	0.00069
Industrial Area	North Walnut Creek	18" culvert #s-1023 inlet	12	0.00028
Industrial Area	North Walnut Creek	60" culvert #33 inlet/outlet	72	0.00165
Industrial Area	North Walnut Creek	60" culvert #34 inlet/outlet	72	0.00165
Industrial Area	North Walnut Creek	18" culvert #41 outlet	30	0.00069
Industrial Area	North Walnut Creek	48" culvert #jc-3 inlet	72	0.00165
Industrial Area	North Walnut Creek	48" culvert #s-1057 inlet	144	0.00331
Industrial Area	North Walnut Creek	30" culvert #s-1026 outlet	60	0.00138
Industrial Area	North Walnut Creek	18" culvert #57 inlet	30	0.00069
Industrial Area	North Walnut Creek	12" culvert #59 inlet/outlet	30	0.00069
Industrial Area	North Walnut Creek	36" culvert #s-1028 outlet	144	0.00331
Industrial Area	North Walnut Creek	36" culvert #s-2051 i/o	144	0.00331
Industrial Area	North Walnut Creek	36" culvert #s-2052 i/o	144	0.00331
Industrial Area	North Walnut Creek	30" culvert #s-2053 i/o	30	0.00069
Industrial Area	North Walnut Creek	24" culvert #51 inlet	60	0.00138
Industrial Area	North Walnut Creek	64" culvert #52 inlet	144	0.00331
Industrial Area	North Walnut Creek	16" culvert #47 inlet/outlet	30	0.00069
Industrial Area	South Walnut Creek	24" culvert #18 inlet	60	0.00138
Industrial Area	South Walnut Creek	12" culvert #102 i/o	24	0.00055
Industrial Area	South Walnut Creek	18" culvert #108 outlet	12	0.00028
Industrial Area	South Walnut Creek	18" culvert #109 outlet	12	0.00028
Industrial Area	South Walnut Creek	30" culvert #134 outlet	30	0.00069
Industrial Area	South Walnut Creek	30" culvert #134a outlet	30	0.00069
Industrial Area	South Walnut Creek	72" culvert #bb-1 outlet	72	0.00165
Industrial Area	South Walnut Creek	72" culvert #bb-2 outlet	72	0.00165
Industrial Area	South Walnut Creek	60" culvert #aa-2 outlet	72	0.00165
Industrial Area	South Walnut Creek	60" culvert #bb-7 inlet	72	0.00165
Industrial Area	South Walnut Creek	30" culvert #95 inlet	72	0.00165
Industrial Area	Woman Creek	18" culvert #nn-2 i/o	30	0.00069
Industrial Area	Woman Creek	18" culvert #mm-1 outlet	30	0.00069
		SUBTOTAL	2064	0.04738
		ESTIMATED TOTAL =	12620	0.28972

Note: Structures are tributary to the drainage system listed.

The wetlands assessment revealed that wetland areas that would be affected by program activities perform some limited sediment stabilization and sediment/toxicant retention. However, these functions occur in inappropriate locations and are contributing to disruptions in surface flow patterns and are causing localized flooding.

The wetlands assessment indicated that replacement wetlands should be constructed to perform these limited functions at least as well as the existing wetlands do. Consolidation of many small wetland areas into fewer larger areas would also contribute to the likelihood that replacement wetlands would perform useful wetland functions to a greater degree.

Replacement of wetlands would be feasible by integrating the proposed drainage system program and its unavoidable effects with an offsite wetlands compensatory agreement that is currently under negotiation between the DOE and the EPA. Combining replacement wetlands to compensate for all unavoidable wetland effects at the Site would likely result in increased environmental and economic benefits since a higher percentage of available funds would be spent on actual wetland creation as opposed to the additional administrative costs associated with many separate actions. This strategy provides a conservative approach to protecting the natural environment and would, therefore, ensure that the work is performed in a manner that is not inconsistent with long-term natural resources strategic plans for the Site. At a minimum, the compensatory measure would result in wetland replacement at a proportional ratio agreed on by both parties.

Based on the requirements of the DOE wetlands environmental review, the proposed action has been designed and modified to minimize potential harm to the affected wetlands. The limited acreage of affected wetlands would have a very limited effect upon the survival, quality, and beneficial values of the wetlands at the Site — especially if compensatory measures are integrated into the DOE wetland strategy, effecting an overall "no net loss" policy.

Wildlife

The majority of the proposed action would take place in semi-dry (ephemeral) ditches, inlet and outlet works, and other similar drainage areas that are less attractive habitat to migratory birds. Waterfowl typically use ditches for forage only. Broods of young waterfowl are not observed in these areas until they have become highly mobile. Thus, while migratory birds and waterfowl occasionally visit areas that would be affected by the proposed actions, they do not nest in these areas or rely exclusively on the areas for food sources. The trees in the South Interceptor Ditch are fairly young and would be too small to support raptor nests.

The proposed action has the potential to affect the Preble's meadow jumping mouse. As discussed in Section 3.0, the Preble's mouse is listed as a Category 2 Candidate species by the USFWS and is currently under review for federal listing on the Endangered and Threatened Wildlife and Plants list. Direct disturbance or destruction of individuals or habitats may occur as a result of cutback or removal of wetland vegetation and construction activities. Individuals or habitats may be indirectly affected through disruption of the current hydrological regime of the subject drainages.

To avoid such effects, the Site would comply with the protection requirements of the Endangered Species Act. In addition, any actions taken would be subject to compliance with the notification and survey requirements of the Site's standard procedures for Migratory Bird Evaluation and Protection [EG&G 1994c] and Identification and Protection of Threatened, Endangered, and Special-Concern Species [EG&G 1994b]. Among other requirements, the procedures mandate that the proposed project location be surveyed by qualified ecology personnel once within 6 months prior to starting work and 2 weeks prior to starting work. Any change in the classification of the Preble's mouse resulting from the 12-month finding would be reflected in the internal criteria of the Site's protection procedures.

4.1.2 Physical Resources

Surface Water

The proposed action would not present a new source of contamination since the direct sources of existing contamination within the surface water drainage system are the result of past and present Site mission operations. The Site consistently meets or exceeds the water quality required by Segment 4 standards for waters discharged offsite.

A function of the proposed action would be to provide best management practices for achieving water quality standards in compliance with the National Pollutant Discharge Elimination System (NPDES) permit. In this way, the proposed action would have a positive impact on water quality. For example, controlling stormwater runoff would reduce or eliminate downstream contaminant transport due to scouring or overtopping; the filtering and erosion control functions of riparian vegetation would be maintained through de minimis removals; and riprap would aid in the stabilization of the sediment, reducing the potential for sediment transport and, thus, improving water quality.

Construction activities have the potential to adversely affect water quality by resuspending sediments and causing turbidity. Resuspension of sediments into the water column could impede the scheduling of discharges of waters offsite and transfers between ponds could have an adverse effect on water quality and associated resources if an emergency occurred during that time.

To avoid resuspension effects, all final plans for construction activities would be subject to the Site's standard procedures outlined in the *Watershed Management Plan for Rocky Flats* (DOE 1993c). For example, the plan requires riprap for channel-fill, drop structures to reduce flow energy, and embankment protection for erosion control.

4.1.3 Human Health

The following subsections describe the potential impact on the public within the vicinity of the Site and to the workers performing the tasks required to implement the proposed action. Impacts to the public and workers could result from exposure to contaminants that potentially exist in the soil, sediment, or water which may be resuspended by the proposed action. Impacts to workers could also result from injuries due to accidents at the job site or exposure to hazardous material used in conjunction with equipment.

4.1.3.1 Exposure to Contaminants

Environmental protection activities at the Site are designed to minimize and, where practical, eliminate the release of hazardous materials. A variety of monitoring prgrams are in place to measure the Site's performance in meeting this objective. The Site continuously monitors radioactive air emissions at 63 locations in 17 buildings. Ambient air samplers located onsite, at the Site perimeter, and in surrounding communities monitor airborne dispersion of radioactive materials from the Site into the surrounding environment. These samplers are positioned at 23 locations onsite, at 14 locations around the Site boundary, and in 11 neighboring communities. Nonradioactive ambient air monitoring is performed in an area near the east entrance to the Site and provides baseline information on particulate levels.

Surface waters at Rocky Flats are extensively analyzed to ensure that water quality standards are met, to characterize background water quality, and to evaluate potential contaminant releases from specific locations. Two types of liquid effluents, treated sanitary water and surface water runoff, are collected, controlled, and monitored in a series of ponds before discharge offsite. Before discharge from the terminal ponds A-4 and C-2, samples are taken and split for analysis among CDPHE, Rocky Flats, and independent EPA-registered laboratories. Discharges are monitored in accordance with the NPDES permit limitations. In addition, water quality is tested before release to ensure that the water meets Colorado Water Quality Control Commission standards for Segment 4 of Big Dry Creek. Water is released with concurrence from CDPHE.

A risk assessment was performed based on the proposed action occurring at the SID and encompassing downwind exposures. The function of the SID is to intercept runoff from the southern portion of the industrial area to prevent any potentially contaminated runoff from reaching Woman Creek. Because of this function, the risk assessment postulated that the SID receives more contaminants than other surface water drainage system components at the Site and represents the greatest opportunity for risk compared to the other components. Concerns regarding exposure to contaminants which are addressed in the South Interceptor Ditch Human Health Risk Assessment are summarized in this section. The entire assessment is presented in Appendix D, South Interceptor Ditch Human Health Risk Assessment.

The risk assessment followed the procedures outlined by the EPA (EPA 1989) and used a residential scenario where long-term exposure occurs as a result of contact with SID sediments that have been placed on the ground surface. Under such unfavorable conditions, a person exposed to sediments over a lifetime would have a 3.1×10^{-6} (or 3.1 chances in 1 million) probability of contracting a cancer due to the proposed action. Direct contact at the source, airborne particulates and vapors, and ionizing radiation were the mechanisms by which contaminants of concern could be transported to human receptors that were considered. Exposure pathways considered as the potentially predominant risk contributors were inhalation of resuspended particulates, as well as incidental ingestion of, and dermal contact with, sediments from the SID.

The risk assessment found that dermal contact and absorption are not significant routes of exposure for the contaminants of concern. The analysis also strongly suggested that the contaminants detected in the SID cannot be distinguished from expected concentrations in natural surface soils (that is, background). The assessment concluded the following:

- The results of the risk assessment for ingestion of metals and radionuclides to the public are 2.1E-6 and 2.9E-7 respectively, for a total of 2.4E-6 for this pathway. This value is slightly above the EPA's 1E-6 (1×10^{-6}) threshold but is acceptable. For the inhalation pathway, the carcinogenic risk to the public was 1.9E-7 for metals and 5.5E-7 for radionuclides; for a total of 7.4E-7. This value is below the EPA's target level of 10^{-6} risk, therefore, this risk is considered acceptable. The sum of risks (for inhalation and ingestion) due to metals is 2.3E-6 and for radionuclides 8.4E-7; the sum of these risks is 3.14E-6. This value is slightly above the EPA level.

- The EPA describes the hazard index (HI) as a means to assess overall noncarcinogenic effects posed by more than one hazard. Noncarcinogenic health effects are adverse health effects other than cancer. The total noncarcinogenic average hazard indices estimated risk to the public for the inhalation and ingestion pathways as 0.041 from metals. The noncarcinogenic HI value for inhalation was 0.001 and for ingestion was 0.04; thus, the sum total was 0.041. An HI of less than 1.0 indicates that chronic systemic effects resulting from exposure are not expected. Using the HI value of 1.0 as a reference value, 0.041 is less than 1.0 and, therefore, there are no potential adverse health effects to the public.

- The chemical and radionuclide contamination in the SID is insignificant from a practical health perspective. The total carcinogenic risk to a person at the SID is slightly above the minimum acceptable risk of 1E-6. The actual carcinogenic lifetime excess cancer mortality risk calculated was 2.3E-6 for metals and 8.4E-7 for radioactive constituents.

- Radionuclide concentrations detected in the SID are well within limits required by DOE Order 5400.5 *Radiation Protection of the Public and the Environment* for unrestricted release of soils.

There is negligible risk to the public and the workers from inhalation and ingestion pathways for the detectable RCRA-listed wastes and inorganics analyzed at the SID. Likewise, there is negligible radionuclide risk from both inhalation and ingestion to the public and the workers.

Protection would also be provided by procedures in place to prevent resuspension of any contaminated sediments into the air or water. For instance, the Site maintains a series of standard operating procedures under the environmental management operations addressing surface water and field operations. Likely to be applicable to the proposed action are air monitoring and dust control; equipment decontamination; radioactivity screening; disposition of waste material; personal protective equipment (PPE); as well as the handling of purge and development water, drilling fluids, investigative derived material, decontamination water/wastewater, and soil, sediment, or water samples.

Should contaminants become resuspended within the water of the drainages, three management programs are in place to prevent them from being discharged offsite. First, the Site's Incidental Waters Program controls those waters which accumulate outside of the drainage system, such as water that collects at excavation sites. The program evaluates this water for potential contamination prior to disposition. Based on analytical results, incidental water may be directed to process water treatment or to the holding ponds.

Second, the Site's pond system maintains water quality through a program of monitoring, treatment, transfer, and volume management. Detention of water in the pond system for a designated period allows sedimentation to occur. Sedimentation effectively settles potentially contaminated suspended solids, removing them from the water column for as long as the sediments are not resuspended by disturbance. The waters discharged from the Site consistently meet or exceed the quality required by Segment 4 standards.

Third, to ensure that construction activities do not adversely impact the environment, the *Plan for the Prevention of Contaminant Dispersal* (PPCD) was mandated by the Interagency Agreement (IAG) and was finalized in 1991. The PPCD is applicable to intrusive field activities conducted primarily as part of interim actions. It provides project-specific procedures for managing even minor excavations. The PPCD procedures may be integrated into any final project plans (DOE 1991e).

Workers are exposed routinely to ionizing radiation at As Low As Reasonably Achievable (ALARA) levels during operations at Rocky Flats. Accordingly, worker doses are maintained below regulatory and contractual limits. Occupational Radiation Protection regulatory limits (10 CFR Part 835) apply to individual workers, and contractual limits with DOE for individual Rocky Flats workers are dramatically lower than the regulatory limits for individual workers in general.

Current regulatory limits are consistent with the 1987 National Council on Radiation Protection (NCRP) recommendations. The goal of the NCRP recommendations for occupational exposure is to limit radiation worker risk to a level that is reasonable and acceptable with respect to the value of the work being performed. The regulatory limit stated in 10 CFR Part 835 is 5.0 rem effective dose equivalent (EDE) annually. The contractual limit with DOE for individual Rocky Flats workers is 2.0 rem EDE annually.

Rocky Flats has a far lower Administrative Control Level (ACL) of 0.75 rem EDE annually, and actual individual worker doses have been below the ACL. The ACL helps ensure that worker exposures are ALARA. Based on the radiogenic cancer assumptions in the 1987 NCRP recommendations, workers receiving the ACL dose experience an annual latent cancer fatality risk of about 0.000082. When combined with the annual nonradiation fatal accident rate for the industry of 0.000025, radiation workers at Rocky Flats have a risk of 0.00011. This risk represents approximately one work-related fatality in 10,000 workers per year, which is the all-industry average.

4.1.3.2 Worker Health Protection

As part of the environmental control measures to ensure a working environment safe from accidental worker injury or exposure to hazardous material used in conjunction with equipment, personnel would be governed by programs designed to protect employees. These programs include industrial hygiene, nuclear safety, occupational safety, and radiological health. No work would take place until the project-specific health and safety plan has been reviewed by the safety organization to ensure that the plan meets all applicable safety requirements. Such oversight of the proposed action would be accomplished through the use of procedural compliance prior to and throughout implementation of the plan.

Specifically, risk to the health and safety of the workers is controlled according to the procedures in the Site's Health and Safety Practices Manual (HSP). In particular, the minimum safety and health requirements for all construction activities at the Site, including maintenance construction, are controlled by a Site procedure, 1-C18-HSP-24.01, *Safety and Health Responsibilities for Construction Activities*, which is designed to ensure that monitoring requirements for health surveillance have been addressed and are properly performed. The Site's HSP Manual also is used to determine the radiological monitoring and PPE, as necessary.

As a result of the analysis presented in Appendix A and the precautions prescribed in the HSP for worker safety and minimization of risk, human health concerns are negligible and remain below the carcinogenic risk limit set by the EPA.

4.2 Partial Implementation of the Proposed Action

The partial implementation alternative would consist of only those parts of the proposed action that involve repair or replacement. Applicable environmental control measures would be considered part of the repair or replacement effort. This alternative would minimize certain effects associated with the proposed action with regard to biological resources and increase potential effects with regard to water quality. A quantitative estimate of impacts may be obtained by referring to Table 4-1 after determining which locations would be impacted if the partial implementation alternative was pursued.

4.2.1 Biological Resources

The alternative involves a less disruptive level of environmental impact than the proposed action since repair and replacement essentially denote maintenance-type activities and maintenance generally does not include any modification that would substantially change the configuration or size of the original drainage system structure (COE 1986). Earthwork would be done to a lesser extent under this alternative. For example, repair of a culvert in place would likely require minimal earthwork. Replacement of a culvert with a culvert of similar size would require a minimum of earthwork to allow for removal, replacement, and backfill. For example, an upgrade from a 36-inch culvert to a 72-inch culvert would increase the limits of construction and earthwork to accommodate the increase in size.

However, effects to biological resources under the partial implementation alternative would be similar to those delineated in the proposed action. Because structure cleanout activities would go forward under this alternative, the potential exists for affecting wetlands and, thus, Preble's mouse individuals or habitat. The amount of wetland affected would likely be reduced by half, since installation activities would not take place and the potentially affected wetland associated with these activities would not be disturbed. As with the proposed action, environmental control measures would be in place to avoid adverse effects to these resources.

4.2.2 Physical Resources

Water quality may be affected to a certain extent under this alternative. Because the Pond A-1 Bypass upgrade, the South Walnut Creek upgrades, and other miscellaneous upgrades would not occur under this alternative, the potential for the overtopping of drainage structures or ponds and the scouring of sediments would be increased. This increase would, at a minimum, reduce the opportunity for water quality improvement through stormwater control. At a maximum, the need for water treatment would increase following a storm event, pond detention levels may be exceeded, and the ability to meet water quality standards would be impaired.

Under this alternative, structure cleanout activities may resuspend sediments and cause turbidity within the water column. As with the proposed action, the appropriate environmental control measures would be implemented to avoid adverse impacts from this activity.

4.2.3 Human Health

As a result of the analysis presented in Appendix A and the precautions prescribed in the Site's health and safety procedures for worker safety and minimization of risk, human health concerns are negligible and remain below the carcinogenic risk limit set by the EPA. The risk assessment performed for the proposed action postulates a worst-case scenario. Because the activities of this alternative are similar to those defined for the proposed action, it would be assumed that risks would be comparable.

4.3 No Action

The no action alternative would maintain the status quo of the drainage system. Approved routine maintenance of the system in areas where no wetland vegetation or protected biota occurs would continue. Work would not be undertaken to restore the desired capacity of the system and there would be a potential for water transport of contaminated sediments which could result in additional Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup requirements in the lower ponds and could negatively impact the quality of water discharged to downstream locations from the lower ponds.

Effects from flooding events would be minimized through the implementation of response plans and through the management of detention pond volumes. The no action alternative does not satisfy the underlying purpose and need for agency action.

4.3.1 Biological Resources

Because construction activities would not take place within wetlands, there would be no direct effect to existing wetlands with the no action alternative. It would be unlikely that Preble's mouse individuals or habitat would be directly affected with this alternative because work would not occur within the species' potential habitat. Approved routine maintenance activities would comply with the protection requirements of the Endangered Species Act and would be subject to compliance with the notification and survey requirements of the Site's standard procedures for *Migratory Bird Evaluation and Protection* (EG&G 1991c) and *Identification and Protection of Threatened, Endangered, and Special-Concern Species* (EG&G 1991b).

4.3.2 Physical Resources

As with the partial implementation alternative, water quality may be adversely affected with the no action alternative. Since the alternative does not produce an adequate flow capacity, overtopping of drainage structures and scouring of potentially contaminated sediments may occur. This would cause turbidity within the water column and indirectly affect aquatic biota adversely. Resuspension of these sediments could reduce the water quality within the drainage system and require that, prior to discharge from the Site, the water may need to be treated to meet water quality standards.

4.3.3 Human Health

Currently, the risk associated with continuing with the status quo is assumed to be within acceptable levels. The Site's 1980 environmental impact statement indicates that the drainage system was developed over the last 40 years to prevent contaminant migration to downstream, populated areas via water courses (DOE 1980). At the present time, a risk analysis of baseline conditions has not been performed.

4.4 Cumulative Effects of the Proposed Action

The cumulative effect of the proposed action would be an incremental and temporary decrease in the regional wetlands. However, should compensatory replacement become a viable part of the drainage system program, the opportunity would exist to increase both the amount and quality of regional wetlands over the long term. Consequently, the potential habitat for the Preble's meadow jumping mouse may be increased through the same venue. The long-term natural resource strategic plans for the Site may be influenced by the proposed action depending on the outcome of the 12-month finding on the petition for federal listing of the Preble's mouse on the Endangered and Threatened Wildlife and Plants list. In addition, the ability to control stormwater effectively would have the overall cumulative effect of maintaining or increasing water quality.

5.0 AGENCIES AND PERSONS CONSULTED

Colorado Department of Public Health and Environment

Colorado Division of Wildlife

U.S. Army Corps of Engineers

U.S. Environmental Protection Agency, Region VIII

U.S. Fish and Wildlife Service

6.0 REFERENCES

ABBREVIATION	CITATION
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7.0 GLOSSARY

alluvium: The materials eroded, transported, and deposited by streams.

alter: Relative to construction, significantly changing the function, size, height, configuration of a drainage system component.

buffer zone: The undeveloped portion of the Rocky Flats Environmental Technology Site consisting of approximately 6,150 acres.

bypass culverts: A culvert routed to the side of a particular object.

channel: An open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water.

cofferdam: A temporary structure built around a site to allow the removal of water and to permit free access to the area within.

colluvium: Alluvium deposited by unconcentrated surface runoff or sheet erosion, usually at the base of a slope.

conveyance: A structure, such as an open channel or culvert, designed to direct or divert stormwater and wastewater flows.

culvert: A drain crossing under a structure.

drainage structure: A designed system and its appurtenant components, either constructed or manufactured, that is used to control, route, or monitor flow of surface water

drop structure: A mechanism for controlled release of water from a surface impoundment.

effluent: Outgoing waste stream from a treatment process, such as the Waste Water Treatment Plant.

emergent plants: Plants that grow rooted in permanent water that have stems emerging from and growing above the water.

emission: A release of a gas, liquid, solid, or radionuclide from a process.

ephemeral streams: Streams that flow only when there is rainfall or snowmelt to feed them; lasting for a brief period of time; short-lived, transitory.

erosion: A process by which materials such as soil are loosened, dissolved, or worn away, and moved from one place to another.

floodwalls: Structures constructed for protection of property subject to damaging floods.

flume: A standard device used to measure the flow of water.

gate: A device for controlling the flow of water.

hydric: Habitat characterized by an abundance of moisture.

incidental waters: Water that accumulates independently of the drainage system, such as water which would seep into a trench during construction activities.

industrial area: The 384-acre area at the Rocky Flats Environmental Technology Site consisting of production and support buildings.

install: Relative to construction, building or somehow introducing a new or modified drainage system component.

lacustrine: Nonflowing wetland area with erect persistent vegetation comprising less than 30 percent of the area or with a depth of greater than 6.6 feet.

loam: A loose solid of mixed clay, sand, and silt. A classification of sandy soil.

mesic: Hillside areas of medium local moisture conditions.

NPDES permit: National Pollution Discharge Elimination System permit under the Clean Water Act allowing point source discharge into waters of the United States.

off-channel reservoir: A manmade reservoir or pond located outside of the natural stream bed.

overtopping: A condition during which floodwaters rise to a level higher than the top of the banks or structures that normally contain them.

palustrine: Nontidal wetlands dominated by trees, shrubs, persistent emergents, or emergent mosses and lichens.

passerine birds: Small, migratory song birds.

perennials: Plants that grow and bloom from the same rootstock every year.

pioneering annuals: Weedy plant species that reseed themselves and grow from seed every year.

repair: Relative to construction, fixing a deficient drainage system component in place.

replace: Relative to construction, putting in a functionally similar drainage system component.

riprap: Large gravel to cobble-sized rock materials used in stream channels or other erosion-prone areas to control or eliminate erosion.

riparian: Of or relating to the bank of a stream or lake.

risk: An expression of the probability of a negative or unwanted consequence. Mathematically, it can be expressed as the probability of an undesirable event occurring in an interval of time multiplied by the consequences of the event.

riverine: All wetlands and deepwater habitats contained within a channel, except for those dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens.

scouring: The rapid erosion of soils and resuspension of sediments caused by uncontrolled flood flows.

sediment: Solid material that has settled from a state of suspension in a liquid.

seep: The point at which slowly percolating water flows to the surface through cracks or pores in the ground.

spillway: A device for storage and detention dams to release surplus or flood water which cannot be contained in the allotted storage space.

spoils: Waste materials typically resulting from excavation activities.

toe: The bottom of the downstream face of a dam.

turbidity: A measurement of sediment suspended in water.

weir: A device placed in a stream to measure or direct water flow.

xeric: Habitat characterized by a low or inadequate supply of moisture such as a dry, rock plateau and ridge top areas.

25-year, 6-hour storm event: A storm event with a duration of 6 hours, the magnitude of which will be equaled or exceeded on average at least once in any 25-year period. This magnitude is location dependent and is calculated to be 3 inches of precipitation at Rocky Flats.

100-year, 6-hour storm event: A storm event with a duration of 6 hours, the magnitude of which will be equaled or exceeded on average at least once in any 100-year period. This magnitude is location dependent and is calculated to be 3.08 inches of precipitation at Rocky Flats.

Appendix A

Management Program Options Analysis

APPENDIX A
MANAGEMENT PROGRAM OPTIONS ANALYSIS

A.1 Introduction

Three specific drainage deficiencies are discussed within this options analysis. For each deficiency, two or more repair or improvement options to address the deficiency are discussed. Most of the options require detailed design and a significant level of construction work that cannot be addressed within the scope of a routine drainage maintenance program, and therefore constitute a separate project. The three deficiencies are described below:

South Interceptor Ditch Overflow: This ditch conveys runoff from a portion of the industrial area to Pond C-2 where the runoff can be sampled prior to downstream discharges. Hillside movement from Operable Unit 1 construction activities and a lack of ditch maintenance have created a situation where routine storm events will overtop the ditch and flow directly into Woman Creek, which flows directly off the Site. Temporary measures are now in place to help prevent overflow from up to a 25-year storm event. A solution that would permanently repair this ditch to where it could convey runoff to Pond C-2 from up to a 100-year storm event is the goal.

In conjunction with work that would be conducted at the South Interceptor Ditch (SID), improvements are needed to address the Woman Creek Bypass Canal overflow. The Woman Creek Bypass Canal is intended to divert Woman Creek flows around Pond C-2 up to at least the 100-year storm event. A lack of maintenance has led to extensive vegetative growth within the canal, reducing the amount of flow that the canal can pass. Overflow of Woman Creek water into Pond C-2 increases the probability that Pond C-2 would overflow. Overflow of Pond C-2 is undesirable since Pond C-2 is designed to collect runoff from the southern end of the industrial area and allow settling of potentially contaminated suspended solids prior to discharge. A solution that would reduce the probability of Woman Creek water overflowing into Pond C-2 by increasing the flow capability of the Woman Creek Bypass Canal is the goal.

South Walnut Creek Flooding: A lack of maintenance, increased upstream development without upgrading downstream drainage structures, and the use of poorly designed security constrictions within key drainage structures are major factors which contribute to flood problems. These flood problems are most severe along the lower industrial area section of South Walnut Creek and at the B-1 Bypass Pipeline where water is diverted around the upper B-Series Ponds. A solution that would reduce the potential for flood damage to buildings and support structures, reduce the potential for flood related emergency response or injury problems, and decrease the probability of sediment transport from the relatively contaminated upper B-Series Ponds to the relatively clean lower B-Series Ponds is the goal.

North Walnut Creek Flooding at the Pond A-1 Bypass Pipeline: The Pond A-1 Bypass Pipeline diverts storm runoff around Ponds A-1 and A-2 and into Pond A-3 during normal operations. Increased upstream development has resulted in a situation where the Pond A-1 Bypass Pipeline cannot prevent runoff from entering the upper A-Series Ponds during relatively routine storm events. A solution that would lower the probability of sediment transport from the relatively contaminated upper A-Series Ponds to the relatively clean lower A-Series Ponds is the goal.

As mentioned above, the process of developing a solution to correct an identified deficiency involves the identification of reasonable repair or improvement options. Table A-1 of this Analysis is a listing of the identified options for each deficiency. These options reflect different solution approaches that were considered. Table A-2 is a description of possible approaches, with examples, and Table A-3 is a matrix showing primary and secondary approaches that each repair or improvement option utilizes. Not all approaches are utilized for each drainage location because options discussed in this appendix are limited to approaches that were considered feasible.

Repair or improvement options were not developed for the buffer zone and industrial area maintenance work because these are programs consisting of numerous separate, relatively small tasks at a large number of different locations.

Sections A.2 through A.4 provide a short description of each drainage location's repair or improvement options and the rationale for selecting the preferred option to address each deficiency. Section A.5 is a summary of the selected options and the industrial area and buffer zone Maintenance Programs.

A.2 South Interceptor Ditch and Woman Creek Bypass Canal Overflow Repair or Improvement

A.2.1 South Interceptor Ditch

Option 1: Repair SID in Select Locations. This option addresses ditch deficiencies primarily in the areas where work needs to be done to allow conveyance of the 100-year storm event. The reason such an option as this can be successfully pursued is because the SID consists of a series of sections separated by drop structures. Each section is like a link in a chain where most ditch sections are sufficiently large enough to pass required storm flows even though some of these ditch sections contain significant quantities of vegetation.

A large part of this option includes raising the south side of the embankment several feet in height along the area where hillside movement has constricted the ditch. Other work plans include replacement of culverts at two dirt road crossings, improving the inlet area at another culvert location, cutting or removing trees from within the ditch to avoid restrictive flow conditions, minor raising of the embankment height at a few additional locations, and the addition of flow measurement and sampling instrumentation at three locations within the ditch.

Advantages to this option include a significantly lower cost and a significant reduction in impacted wetland areas. These wetland areas provide wildlife habitat, help protect the ditch against erosion, and improve the quality of the water flowing through a downstream stormwater monitoring location since the wetland vegetation promotes removal of suspended solids and potential contaminants through settling and chelation. One possible disadvantage of this option is that the slow flows and additional water retention along the ditch tends to promote seepage of surface water to groundwater. Another disadvantage is that there may be an occasional need to thin wetland vegetation along some stretches of the ditch.

Option 2: Repair and Regrade SID. The purpose of this option is to return the whole length of the SID to its original design condition by regrading most of the ditch, rebuilding most drop structures, and removing most wetland vegetation along the length of the ditch to the point where the ditch is more of a grass-lined or riprap-lined channel. It is likely that the south side of the embankment where hillside movement has constricted the ditch would still need to be raised as under Option 1 since excavation through this area may only promote movement of the hillside back down into the ditch again. This option would also replace culverts at the two dirt road crossings, improve the inlet area at another culvert location, and add flow measurement and sampling instrumentation at three locations.

The advantage to this option would be the ability of the ditch along most sections to move greater quantities of water at a faster rate to Pond C-2, the improved maintainability of the whole ditch length, and reduction of surface water seepage to groundwater. Disadvantages include a very high cost, the need to disposition large amounts of debris and spoils, the large amount of lost wetland vegetation which must be replaced, the loss of wildlife habitat, and potential reductions in erosion protection and downstream water quality.

Option 3: Repair and Concrete Line the SID. This option is the same as Option 2, except that the whole ditch length is lined with concrete once it is regraded. The advantages to this option are increased flow capacity, improved erosion protection, greatly improved maintainability, and the potential for total reduction in seepage of surface water to groundwater along the whole ditch length. Disadvantages include a very high cost, the need to disposition large amounts of debris and spoils, the large amount of lost wetland vegetation which must be replaced, the loss of wildlife habitat, and potential reduction in downstream water quality.

A.2.1.1 Option Selection Considerations

Summary of Option Cost/Impact Selection Considerations

Option Number	Estimated Wetland Impact	Cost Estimate ($M)
1	Minor (about 0.15 acre)	1.6
2	Significant (about 2 acre)	4.2
3	Significant (about 2 acre)	7

NOTE: Costs are based on formal cost estimates prepared for each option.

A.2.1.2 Option Selection

Option 1: Repair SID in Select Locations was chosen for the following reasons:

- The cost of this option is less than half of any of the other options, with potential savings of greater than $2.5M.
- The impact to wetland areas is less than 10% of the impact associated with any of the other options.
- There are significantly fewer spoils to disposition, although sediment samples along the SID imply that disposal should not be a major concern.
- There are water quality improvements offered by the wetland vegetation, which qualifies as a desirable management practice under Clean Water Act stormwater guidelines.
- There are no water quality concerns from ditch seepage based on existing water and groundwater data and expected contaminant types from storm events. These contaminants would likely be bound to soil particles and would not be expected to migrate into the groundwater.

A.2.2 Woman Creek Bypass Canal

Option 1: Routine Maintenance Only. This option relies primarily on an approach of doing nothing and planning for the flood, which means planning for increased inflows to Pond C-2 from large storm events. Pond C-2 would need to be maintained at low levels in order to avoid overflow during the 100-year storm event (reference overflow conditions summary below). It is assumed that flow improvements would be limited to one location where there are several bypass culverts. Improving the flow here would likely be accomplished by removing vegetation (mostly cattails) about 100 feet in front of and behind the bypass culverts location in order to allow unimpeded flow through these culverts. Some riprap or other cover may be placed at the outlet and inlet areas to protect against erosion and to discourage future vegetation growth.

All work under this options would be included as part of the buffer zone Maintenance Program, while maintaining Pond C-2 at low levels would fit within the responsibility of pond water management operations.

Selection of this option would do little to improve existing overflow conditions, but would at least prevent future problems at the culverts. The advantages to this option are low cost, minimal impacts to wetland areas, and essentially no potential for impact to species currently protected by, or expected to be protected by, the Endangered Species Act (ESA).

Option 2: Limited Bypass Improvements. As is the case for Option 1, this option also relies primarily on an approach of doing nothing and planning for increased inflows to Pond C-2 from large storm events. The same level of maintenance would be performed at the bypass culverts. The only difference is that two locations along the bypass canal would be raised approximately 2 to 4 feet to reduce overflow during a 100-year storm event, and to prevent overflow from up to the 25-year storm. The Woman Creek diversion wall upstream from the bypass culverts would also be raised approximately 1 to 3 feet if subsequent calculations reveal that it would further reduce inflows to Pond C-2 at significant volumes to justify the cost. Raising the embankment height and diversion wall avoids material removal from within the bypass canal, although planning around the flood event is still the primary approach for this option since there will be significant inflows into Pond C-2 during the 100-year storm event (reference overflow conditions summary below).

Raising the embankment in two locations and any increase in the diversion wall height would be included as part of the project to address the South Interceptor Ditch Overflow deficiency if this option were to be selected. Vegetation removal and other work at the culverts would be included as part of the buffer zone Maintenance Program. Maintaining Pond C-2 at low levels would fit within the responsibility of pond water management operations.

Selection of this option would result in upgrading the Woman Creek Bypass Canal to where it would not overflow from the 25-year storm event, although the disadvantage is that there would still be significant overflow into Pond C-2 from the 100-year storm event. The advantages to this option are low cost, minimal impacts to wetland areas, and essentially no potential for impact to species currently protected by, or expected to be protected by, the ESA.

Option 3: Extensive Vegetation Removal. This option utilizes vegetation removal as the primary approach to allow the bypass canal to handle flows up to the 100 year event. The canal would probably be maintained somewhat as a grass lined channel to reduce the extensive storm flow interference currently caused by the dense vegetation along this stretch. Some minor channel regrading and riprap additions are possible. Vegetation removal would be from the area of the bypass culverts to an approximate location where canal overflow would no longer enter Pond C-2. All vegetation removal, regrading, and general improvements could possibly be included under the buffer zone Maintenance Program if this option were to be selected.

The advantage of this option is that it completely eliminates overflow to Pond C-2 during the 100-year storm event. The disadvantages of this option are the relatively large amount of impact to wetland habitat and the uncertainty of how this option could impact the Preble's Meadow Jumping Mouse, which could potentially be protected under the ESA in the near future.

Although vegetation removal and other work described would be simple and inexpensive from an engineering perspective, it is extremely difficult to estimate project cost, schedule, or even whether this option is feasible at this time because of the uncertainty revolving around potential impact to the Preble's Meadow Jumping Mouse.

Option 4: Significant Embankment Upgrades. This option focuses on an approach that avoids most vegetation removal by increasing the bank height from below the bypass culverts to a location where canal overflow would no longer enter Pond C-2. This canal embankment height increase, estimated at 3 to 5 feet, would be on both sides of the canal from the bypass culverts to the South Interceptor Ditch location, and on one side of the canal downstream from the South Interceptor Ditch. It is estimated that the diversion wall upstream from the bypass culverts would also need to be raised 2 to 4 feet. Vegetation removal and possible riprap additions would still be pursued at the inlet and outlet areas of the bypass culverts as discussed under Option 1.

The advantage of this option are that it completely eliminates overflow to Pond C-2 during the 100-year storm event with minor impacts to wetland areas and possibly no impact to species currently protected by, or expected to be protected by, the ESA. The disadvantage is the very high cost relative to most of the other options. This option may represent the only one of the four options that would be pursued as a separate project, which would further add to relatively high cost.

A.2.2.1 Option Selection Considerations

Summary of Overflow Conditions and Pond C-2 Management Requirements for Each Option

Option Number	100-Year Storm Overflow to Pond C-2 (Million Gallons)	25-Year Storm Overflow to Pond C-2 (Million Gallons)	Pond C-2 Maximum Operating Level to Contain 100-Year Flood
1	8.6	0.4	20%
2	6.8	0	30%
3	0	0	60%
4	0	0	60%

A.2.2.2 Summary of Option Cost/Impact Selection Considerations

Option Number	Estimated Wetland/Habitat Impact Potential	Planning Level Cost Estimate ($1000)
1	Minimal (<0.1 acre)	5
2	Minimal (<0.1 acre)	20 - 50
3	Relatively Large (> 0.5 acre)	100 - 500
4	Relatively Small (<0.2 acre)	150 - 400

NOTE: Planning level cost estimates are based on engineering judgment or experience with similar projects.

A.2.2.3 Option Selection

Option 2: Limited Bypass Improvements was selected based on the following considerations:

- Relatively low cost. This is significant given the trend toward large budget reductions for projects such as this one.
- Small amount of impact to wetland areas.
- The possibility of no impact to species currently protected by or expected to be protected by the ESA.
- The fact that Pond C-2 is often maintained below 30% of maximum capacity, although it is probable that transfers and discharges from Pond C-2 will need to be addressed in a more aggressive and timely manner than has been done historically to ensure containment of site runoff within Pond C-2 during a 100-year storm event.
- Because there do not appear to be significant issues involved with this option, the work could be performed in a timely manner.
- The fact that the work can be combined with the selected option for addressing the South Interceptor Ditch overflow deficiency.

A.3 South Walnut Creek Flooding Repair or Improvement

Option 1: Detention Pond Above Building 991. The option focuses primarily on the increased upstream detention approach by building a stormwater detention dam along S. Walnut Creek upstream from Building 991 and downstream from the 750 Pad area. A percentage of Central Avenue Ditch flow would be routed into this new pond through a newly built pipeline. Modifications would also be made to some downstream culverts to promote additional stormwater detention along S. Walnut Creek below the Wastewater Treatment Plant, where significant stormwater detention already occurs during large storm events. It is expected that this option would also implement other drainage improvements in the vicinity of Building 991 to help alleviate flooding in this area. These improvements include replacement or removal of one or more security constrictions, enlarging a ditch south of Building 991, and cleaning out several of the large drainage culverts in the area.

The major advantage of this option is the fact that it addresses all of the significant flooding concerns along S. Walnut Creek up to the 100-year storm event. Other advantages include the potential for creation of additional wetland at the new detention dam location, the potential use of the dam for spill control, and the potential to increase downstream water quality through sedimentation within the new ponding area. Disadvantages include the high cost, the large amount of excavation in potentially contaminated areas, the large amount of construction work within a security area, and fairly significant maintenance and inspection requirements for new drainage system structures such as the new detention dam.

Option 2: Central Avenue Ditch Diversion. This option focuses primarily on rerouting drainage flows to a new location within the same drainage system by routing Central Avenue Ditch flows directly to Pond B-5 and avoiding the need for the B-1 Bypass Pipeline to carry these flows. This would require significant improvements and modifications to several upstream portions of the Central Avenue Ditch and essentially rebuilding the existing channel from the developed portion of the Site to Pond B-5. This channel would require fairly extensive energy dissipation structures along the lower portion where flows are directed down into Pond B-5 to avoid erosion and hillside stability problems.

The advantage to this option is that much of the work is outside of wetlands and potentially contaminated areas. The major disadvantages include the extremely high estimated cost and the fact that there would still be some flooding concerns along S. Walnut Creek, although the flooding severity would be greatly reduced.

Option 3: B-1 Bypass Upgrade. This option would increase the flow capabilities of the B-1 Bypass Pipeline either by replacing the existing pipeline culvert with a larger one, or by adding a parallel culvert or ditch.

The advantage of this option is that it directly attacks the problem of potential transport of contaminated sediments from the upper to lower B-Series Ponds. Disadvantages include the fact that it does not address several of the upstream flooding concerns and the fact that additional work will likely be required to avoid Dam B-4 safety concerns associated with larger flows now reaching Pond B-4.

Option 4: Combination of Other Options. This option recognizes that none of the other options appear to offer a complete and desirable solution, and the best approach may be to combine pieces of these other options. The combined pieces include Option 1 components such as replacement of security constrictions, cleaning of large culverts, and enlarging the ditch south of Building 991. Option 3 is represented by adding a parallel culvert to the B-1 Bypass Pipeline, although the capacity of the new pipeline may be limited somewhat to avoid Dam B-4 safety concerns. And finally, Option 5 is represented by creating additional stormwater detention near the Wastewater Treatment Plant, although detention requirements may be reduced if the B-1 Bypass Pipeline is also upgraded.

The advantage of this approach is that it provides flexibility in implementing the desired components of the other options with the result that it addresses most or all flood concerns areas.

Option 5: Increased Stormwater Detention Near the Wastewater Treatment Plant. This option focuses on increased stormwater detention at an upstream location to avoid downstream flooding concerns at the B-1 Bypass Pipeline. The existing road berm over S. Walnut Creek near the Wastewater Treatment Plant (WWTP) already provides significant stormwater detention because the culverts under the road are not capable of handling large storm flows. This option would further increase flood storage by partially blocking the existing culverts, and by adding an additional flood wall along the road. In addition, a floodwall would be required for the WWTP.

Advantages to this option include relatively low cost, no expected wetland impact, and very little work in or near potentially contaminated areas. A major disadvantage to this approach is that it does not address the upstream flood concerns.

Option 6: Increased Stormwater Detention within Ponds B-1 & B-2. This option involves increasing storage capabilities behind Dam B-2 or Dam B-1 to handle flood waters which overflow at the B-1 Bypass Pipeline and enter Ponds B-1 and B-2. This would involve increasing the crest and spillway height of Dam B-2 and possibly Dam B-1.

There do not appear to be any clear advantages to this approach. Disadvantages include the fact that upstream flood concerns are not addressed, there is significant work in or near contaminated sediments, there would be additional water management requirements for water entering Ponds B-1 and B-2 during large storms, and the fact that Dams B-1 and B-2 have already been upgraded once and additional upgrades do not appear to be feasible.

A.3.1 Option Selection

Option 4: Combination of Other Options was chosen because no single other option addresses all flooding concerns in a complete and cost effective manner, whereas most options have components that are desirable for a particular flood concern that can be modified and combined with other option components to produce the best solution. This option will allow for best flexibility when addressing cost concerns while trying to minimize impacts to the environment and potentially contaminated areas.

A.4 North Walnut Creek Flooding at Pond A-1 Bypass Pipeline Repair or Improvement

A.4.1 Description of Project Options

Option 1: A-1 Bypass Upgrade. This option involves the complete replacement of the upper portion of the A-1 Bypass Pipeline, which consists of a culvert running from above Pond A-1 to just above Pond A-3. This portion of the pipeline would be replaced with a larger culvert or a parallel culvert/ditch capable of passing the 100-year storm event. An advantage to this approach is that water is prevented from flowing into the upper A-Series Ponds, which can lead to additional water management costs associated with these upper A-Series Ponds.

Option 2: Increased Stormwater Detention within Ponds A-1 and A-2. This option involves increasing storage capabilities behind Dam A-2 or Dam A-1 to handle flood waters which overflow at the A-1 Bypass Pipeline and enter Ponds A-1 and A-2. This would involve increasing the crest and spillway height of Dam A-2 and possibility Dam A-1. There do not appear to be any advantages to this approach over the Option 1 approach. Disadvantages include additional water management requirements for water entering Ponds A-1 and A-2, and the fact that Dams A-1 have already been upgraded once and additional upgrades do not appear to be feasible. Costs and impacts to the environment are similar for each option.

A.4.2 Option Selection Considerations

In summarizing the Option Cost/Impact Selection Considerations, it was determined that both options are estimated to have similar costs and impacts to the environment.

A.4.3 Option Selection

Option 1: A-1 Bypass Upgrade was selected for the following reasons:

- There are dam safety and feasibility concerns associated with raising the crest and spillway of either Dam A-1 or A-2.
- Upgrading the A-1 Bypass Pipeline may result in stormwater flows to Pond A-3 greater than originally intended.
- Under Option 1, flood flows greater than the 100-year event will enter Ponds A-1 and A-2 and may be contained there. Under Option 2, flood flows greater than the 100-year event will overflow both upper ponds and enter Pond A-3, possibly transporting sediments from Ponds A-1 and A-2 to Pond A-3.
- Option 1 is expected to involve less work in potentially contaminated areas.

A.5 Summary of the Selected Project Options and the Maintenance Program Components

South Interceptor Ditch Repair Project. Rocky Flats Field Office proposes to repair the South Interceptor Ditch (SID) to where it is capable of intercepting storm water up to the 100-year storm event and conveying this storm water to Pond C-2. This will be accomplished by building up the embankment along the ditch in a few key locations, replacing culverts in at least one location, improving culvert flow capabilities through inlet improvements in at least one location, clearing several partially plugged culverts, and removing vegetation at culvert inlet and outlet areas. Additional improvements include riprap additions at culvert inlet and outlet locations to protect against erosion, removal of trees for improved flow conditions, localized road improvements along the ditch, cross gutter additions at areas where the road crosses the ditch to ensure potentially contaminated runoff enters the SID instead of flowing into Woman Creek, and the addition of flow measurement weirs with sampling capabilities.

In addition, this project will also incorporate minor upgrades to the nearby Woman Creek Bypass. Two embankment locations along the bypass canal would be raised approximately 2 to 4 feet to reduce overflow during a 100-year storm event, and to prevent overflow from up to the 25-year storm. The Woman Creek diversion wall upstream from the bypass culverts would also be raised approximately 1 to 3 feet if subsequent calculations reveal that it would further reduce inflows to Pond C-2 at significant volumes to justify the cost.

South Walnut Creek Flood Prevention Project. Rocky Flats Field Office proposes to address potential flooding problems along South Walnut Creek. The major goal is to reduce the probability of contaminated sediment transport from the upper B-Series Ponds (Ponds B-1 and B-2) to the lower B-Series Ponds (Ponds B-3, B-4, and B-5). This transport of sediments could result in additional CERCLA cleanup requirements in the lower ponds and could negatively impact the quality of water discharged to downstream locations from the lower ponds. Several options to address this problem have been proposed, and at this time it appears that the final project design will utilize components from a few of the proposed options. Project components will likely include some or all of the following: upgrading the existing Pond B-1 Bypass, manipulating existing culverts near the Wastewater Treatment Plant (WWTP) in order to promote ponding along South Walnut Creek in this area, building flood walls around parts of the WWTP and possibly along part of the road near the WWTP, removing large amounts of debris (mostly rocks) from within two of the large culverts in the Building 991 area, and replacing several security constrictions within the large culverts along South Walnut Creek with newly designed security constrictions that will permit greater storm water flows.

Pond A-1 Bypass Upgrades Project. Rocky Flats Field Office proposes to upgrade the flow capacity of the Pond A-1 Bypass by either installing a parallel pipeline or replacing the existing pipeline with a larger one. This effort will reduce the probability of contaminated sediment transport from the upper A-Series Ponds (Ponds A-1 and A-2) to the lower A-Series Ponds (Ponds A-3 and A-4). This transport of sediments could result in additional CERCLA cleanup requirements in the lower ponds and could negatively impact the quality of water discharged to downstream locations from the lower ponds. The bypass would likely be upgraded to convey the runoff from a 100-year storm event at a minimum, whereas it presently cannot convey the runoff from a 2-year storm event.

Industrial Area Maintenance Program. Rocky Flats Field Office proposes to perform ongoing maintenance, as needed, on drainage structures (primarily ditches and culverts) in the industrial area to improve flow capabilities for these structures within the industrial area. This would, at a minimum, entail the following: 1) removal of vegetation and accumulated sediment in designated areas (approximately 5 to 30 feet, depending on culvert size, upstream and downstream of most culverts or in areas where ditch flow capacity is jeopardized); 2) replacement of plugged culverts where sediment removal will not remedy flow problems or where culverts are damaged beyond repair; and 3) installation or repair of riprap areas for erosion protection.

Buffer Zone Maintenance Program. Rocky Flats Field Office proposes to perform ongoing maintenance, as needed, on drainage structures (ditches, culverts, flumes, and dams) in the buffer zone to re-establish design flows, increase flow measurement accuracy, and allow for safe dam operations. This would, at a minimum, entail the following: 1) removal of vegetation and accumulated sediment in designated areas (approximately 5 to 30 feet, depending on culvert size, upstream and downstream of all culverts or in areas where ditch flow capacity is jeopardized); 2) replacement of plugged culverts where sediment removal will not remedy flow problems or where culverts are damaged beyond repair; 3) provision of erosion protection through such means as installation of riprap or repair of energy dissipation structures; 4) grouting of outlet pipes or repairing/sealing of outlet structures against leakage for the upper A-Series and B-Series Dams; 5) removal of vegetation near streamflow measurement devices for increased accuracy; 6) addition of new measurement systems for such items as drainage flows or dam safety parameters; 7) removal of vegetation on or near dam structures such as spillways for improved flow capabilities; and 8) repair of damaged ditch embankments.

Table A-1

List of Developed Options for Each Drainage Deficiency

SOUTH INTERCEPTOR DITCH (SID) OVERFLOW

- Option 1: Repair SID in Select Locations (Selected Option)
- Option 2: Repair & Regrade SID
- Option 3: Repair & Concrete Line SID

WOMAN CREEK BYPASS CANAL OVERFLOW

- Option 1: Routine Maintenance Only
- Option 2: Limited Bypass Improvements (Selected Option)
- Option 3: Extensive Vegetation Removal
- Option 4: Significant Embankment Upgrades

SOUTH WALNUT CREEK FLOODING

- Option 1: Detention Pond Above Building 991
- Option 2: Central Avenue Ditch Diversion
- Option 3: B-1 Bypass Upgrade
- Option 4: Combination of Other Options (Selected Option)
- Option 5: Increased Stormwater Detention Near Wastewater Treatment Plant
- Option 6: Increased Stormwater Detention Within Ponds B-1 & B-2

NORTH WALNUT CREEK FLOODING AT THE POND A-1 BYPASS PIPELINE

- Option 1: A-1 Bypass Upgrade (Selected Option)
- Option 2: Increased Stormwater Detention Within Ponds A-1 & A-2

Table A-2

Approach Description/Example for Resolving Drainage Deficiencies

APPROACH	EXAMPLE
1. Complete replacement of existing drainage structure with no changes in original flow design:	Replacing a damaged or plugged culvert with one of the same size.
2. Complete replacement of existing drainage structure with an upgraded structure:	Replacing a damaged or plugged culvert with one of a larger size or of a better design.
3. Reestablish or improve drainage structure flow capabilities through removal of material:	Removing sediments, vegetation, or other constriction from within a ditch or stream.
4. Increase flow capabilities through the use of parallel structures:	Constructing a parallel pipe, culvert, or ditch adjacent to existing component or system.
5. Improve drainage structure flow capabilities by avoiding material removal or replacement:	Increasing height of a ditch bank.
6. Reroute drainage flows to other locations within the given drainage system:	Diverting Central Ave. Ditch flows to Pond B-5 or to new pond above Bldg. 991.
7. Reroute drainage flows to a different drainage system:	Diverting South Interceptor Ditch flows to South Walnut Creek.
8. Increase detention to avoid downstream flooding or contaminant transport problems:	Creating new ponding area or enhancing an existing ponding area; increasing detention volumes within existing A or B-Series Dams.
9. Reduce runoff through increased infiltration:	Replacing parking lots or other impervious structures with grass fields.
10. Place material to improve flow conditions:	Placing riprap within a drainage for erosion protection, vegetation control, or bank stabilization.
11. Address drainage problem by protecting areas where flood damage could occur:	Building or structurally modifying floodwalls.
12. Do nothing and plan for the flood:	Implementing administrative actions such as not storing material in flood locations.

Table A-3
Approach Matrix for Drainage Deficiency Repair/Improvement Options

REPAIR/IMPROVEMENT OPTIONS	APPROACH NUMBER 1	2	3	4	5	6	7	8	9	10	11	12
SID Opt 1	-	x	x	-	xx	-	-	-	-	x	-	-
SID Opt 2	-	x	xx	-	x	-	-	-	-	x	-	-
SID Opt 3	-	x	xx	-	x	-	-	-	-	xx	-	-
S. Waln. Cr. Opt 1	-	x	x	-	-	xx	-	xx	-	-	-	-
S. Waln. Cr. Opt 2	-	x	x	x	-	xx	-	-	-	-	-	-
S. Waln. Cr. Opt 3	-	xx	x	xx	-	-	-	-	-	-	-	-
S. Waln. Cr. Opt 4	-	xx	x	xx	-	-	-	xx	-	-	x	-
S. Waln. Cr. Opt 5	-	x	-	-	-	-	-	xx	-	-	x	-
S. Waln. Cr. Opt 6	-	x	x	-	-	-	-	xx	-	-	-	-
N. Waln. Cr./A-1 Bypass Opt 1	-	xx	-	xx	-	-	-	-	-	x	-	-
N. Waln. Cr./A-1 Bypass Opt 2	-	-	-	-	-	-	-	xx	-	-	-	-
Woman Cr. Opt 1	-	-	x	-	-	-	-	-	-	x	-	xx
Woman Cr. Opt 2	-	-	x	-	x	-	-	-	-	-	-	xx
Woman Cr. Opt 3	-	-	xx	-	-	-	-	-	-	-	-	-
Woman Cr. Opt 4	-	-	x	-	xx	-	-	-	-	-	-	-

xx primary option approach
x secondary option approach
- essentially not part of the option

Appendix B

Programmatic Support Study

APPENDIX B
PROGRAMMATIC SUPPORT STUDY

B.1 Background

In association with the Environmental Assessment, a support study was conducted to determine what environmental control measures would be routinely taken as integral elements of the proposed programs and projects (Figure B-1). This study followed the guidance of U.S. Department of Energy NEPA regulations regarding inclusion of ancillary analyses in the preparation of an environmental assessment [§1021.321(b)].

The study employed a systematic approach to integrating the recommendations in the Council on Environmental Quality NEPA regulations for avoiding, minimizing, rectifying, reducing, eliminating, or compensating for potential adverse environmental effects [§1508.20]. This exercise was also in keeping with the purpose, spirit, and intent of NEPA to integrate ". . . the NEPA process into early planning to insure appropriate consideration of NEPA's policies . . . [§1501.1]," such that " . . . planning and decisions reflect environmental values . . . [§1501.2]."

The support study examines programs and projects selected through an *Options Analysis* that preceded it. A number of independent studies, reports, and plans were prepared in recent years that status the condition of the Site's surface water drainage system as inadequate. Recommendations from these documents were reviewed by the Site's surface water specialists. An analysis of various options available to implement selected recommendations was undertaken. Among the criteria used in the analysis were avoidance of or minimizing disturbance of wetlands. The programs and projects finally selected in the *Options Analysis* represent the anticipated scope of a management program for repairing and maintaining the surface water drainage system.

B.2 Methodology

The support study used a series of definitions and matrices to systematically link proposed programs and projects with environmental control measures, through which the environmental control measures would become a part of the proposed action. The methodology used a sequential dissection of the programs and projects into itemized "activities" and then "tasks," from which potentially adverse "effects" were postulated. Routine "environmental control measures" to prevent or rectify such effects were then identified. Each of these sequential levels was defined during the dissection in order to bound the next step. Specific steps (or links) in the methodology are described below.

B.2.1 Link 1: Programs -- Projects to Activities

The initial step in the methodology was to define the "programs and projects." The objective and scope of each program and project was determined through the *Options Analysis*. Descriptions of each program and project are presented in Section B.3. From these descriptions, individual "activities" comprising the programs and projects were identified.

For the purpose of the support study, an *activity* was defined as follows: a distinct component of a program or project required to achieve the goals of the management program; the end result of one or more tasks; and an indicator of: (a) type and level of effort (e.g., installation, alteration, replacement, or repair); (b) anticipated materials and equipment; and (c) duration (i.e., one-time, ongoing). For example, many of the programs and projects involve the activity of structure cleanout, while only certain projects involve the activity of installing new security constrictions. Activities in relation to the programs and projects are presented in matrix form in Table B-1 and are defined in section B.4.

B.2.2 Link 2: Activities to Tasks

Once activities were identified for the programs and projects, the methodology identified tasks that make up each activity. For the purpose of the support study, a *task* was defined as follows: a generic part(s) of an activity; a procedure (usually construction-related; temporary or long-term) required to conduct an activity. The task would be used to establish an index of environmental effect.

Several tasks may be necessary to complete an activity. For example, the activity of structure cleanout may involve vehicle and equipment access, vegetation cutting, water diversion, and debris or spoil disposition. Tasks in relation to the activities are presented in matrix form in Table B-2 and are defined in section B.5.

B.2.3 Link 3: Tasks to Effects

Once tasks were identified for the activities, the methodology identified potential environmental effects that may occur as a result of that task being performed. For example, the task of structure cleanout may increase sediment transport (turbidity) within a given stream area. This link also noted whether an effect would be temporary (e.g., during construction only) or whether an effect would be ongoing, which assisted in determining a degree of environmental effect (i.e., temporary effects may require different environmental control measures than an ongoing effect). Effects in relation to the tasks are presented in matrix form in Table B-3 and are defined in section B.6.

B.2.4 Link 4: Effects to Environmental Control Measures

The final linkage established environmental control measures. These measures are accepted or predetermined procedures to be taken in association with the proposed action to prevent or minimize any adverse effects. It was determined that certain tasks affect the environment in typical and anticipated ways. Measures can be taken which negate or diminish these effects. The measures include established Site procedures, best management practices, or strategies developed by resource by resource specialists. Environmental control measures in relation to the effects are presented in matrix form in Table B-4 and are defined in section B.7.

B.3 Descriptions of Programs and Projects

The following section describes two programs and three projects identified by the *Surface Water Drainage System Options Analysis* for inclusion within the proposed management program.

B.3.1 Industrial Area Maintenance Program

The industrial area is the 384-acre developed portion of the Site where buildings and other facilities are located. Maintenance activities proposed for the industrial area would include the following:

- Removal of vegetation, accumulated sediment, and debris upstream and downstream of most culverts or in areas where ditch flow capacity has become inadequate. Vegetation would be removed from an area the width of the conveyance and from 5 to 30 feet from the culvert opening, depending on culvert size.
- Replacement of plugged culverts where sediment removal would not remedy flow problems or where culverts are damaged beyond repair.
- Installation or repair of riprap areas for erosion protection.
- Installation, replacement, or removal of security constrictions.
- Repair of ditch embankments.
- Installation of concrete headwalls for culverts.

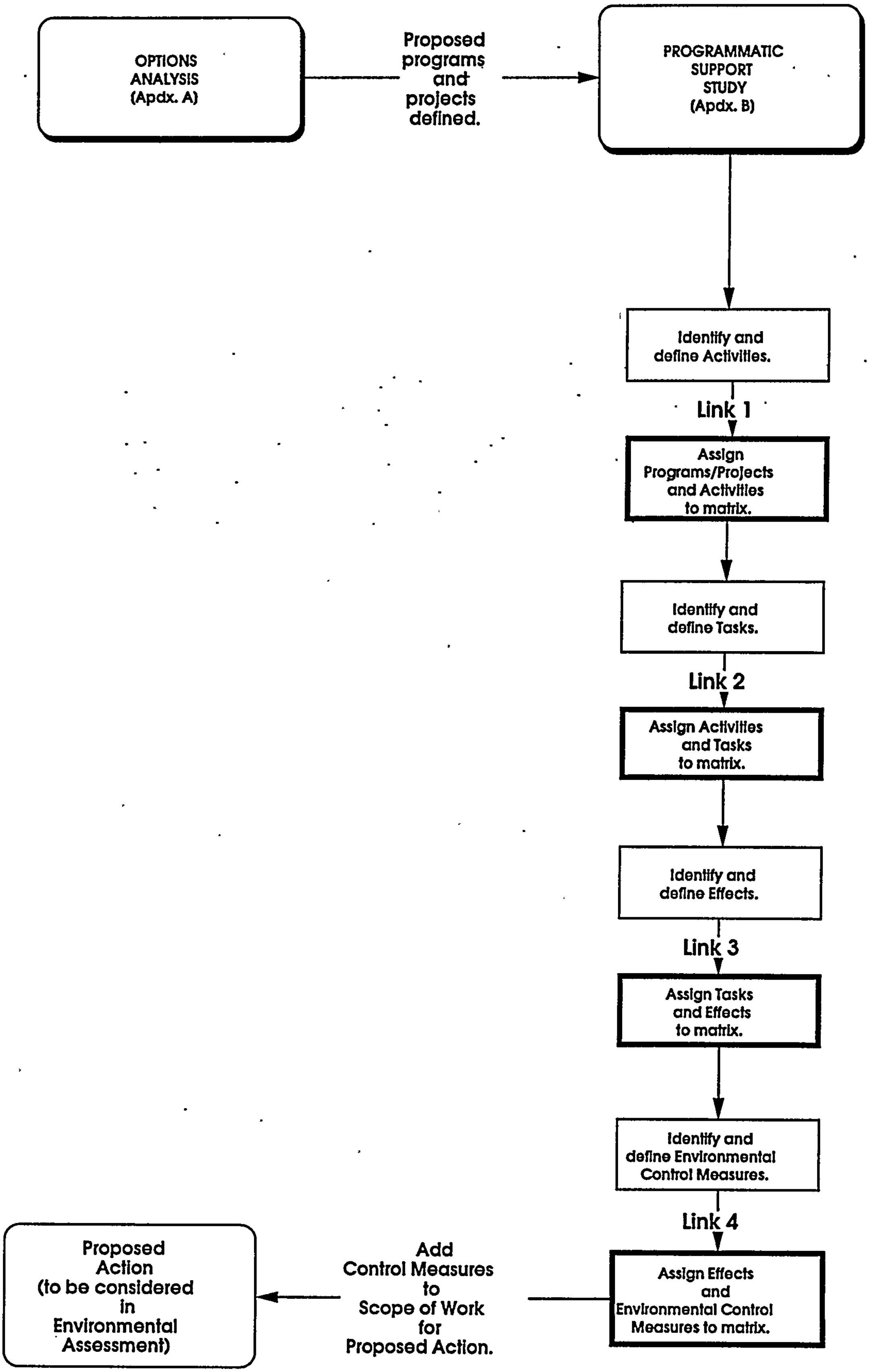


Figure B-1 Programmatic Support Study Methodology

Table B-1 Link 1: Activities per Program/Project

PROGRAM OR PROJECT	ACTIVITY								
	STRUCTURE CLEANOUT	INSTALL/ REPAIR RIPRAP	INSTALL/ REPAIR DRAINAGE DITCH	INSTALL/ REPLACE/ REPAIR CULVERT/PIPE	INSTALL/ REMOVE SECURITY CONSTRICTION	INSTALL INTERCEPTION GUTTER	INSTALL/ REPAIR CULVERT PIPE INLET	INSTALL ROAD BARRIER	INSTALL MONITORING INSTRUMENT-ATION
Industrial Area Maintenance	●	●	●	●	●	●	●	----	●
Buffer Zone Maintenance	●	●	●	●	----	●	●	----	●
Pond A-1 Bypass	----	○	----	○	----	----	○	----	----
South Interceptor Ditch Repair	○	○	○	○	----	○	○	○	○
South Walnut Creek Improvements	○	○	----	○	○	----	○	----	----

TABLE B-1 (continued)

PROGRAM OR PROJECT	ACTIVITY			
	GROUT/CAP OUTLET PIPE OR CULVERT	REBUILD/ REPAIR ROAD	INCREASE BANK HEIGHT	INSTALL/ INCREASE HEIGHT OF FLOODWALL
Industrial Area Maintenance	----	----	●	●
Buffer Zone Maintenance	●	●	●	●
Pond A-1 Bypass	----	----	----	----
South Interceptor Ditch Repair	----	○	○	○
South Walnut Creek Improvements	○	----	----	----

● = Ongoing activity ○ = One time activity ---- = Not applicable

Table B-2 Link 2: Tasks per Activity

ACTIVITY	TASK											
	VEHICLE OR EQUIPMENT ACCESS	VEGETA-TION CUTTING	CREATE SPOIL PILE	WATER DIVER-SION	DE-WATERING	CLEARING AND EARTHWORK	ADD FILL OR OTHER MATERIAL	FORM AND POUR CONCRETE	PAVING	SEDIMENT/ DEBRIS REMOVAL	DEBRI/ SPOIL DISPOSI-TION	VEGETA-TION REMOVAL
Structure Cleanout	○	●	●	○	○	●	----	----	----	●	●	○
Install/repair riprap	●	○	○	○	○	○	●	----	----	○	○	○
Install/repair drainage ditch	●	----	●	○	○	●	●	----	○	●	●	○
Install/replace/repair culvert/pipe	●	○	●	○	○	●	●	○	○	●	●	○
Install/remove security constriction	●	----	●	●	●	●	●	●	○	●	●	----
Install interception gutter	----	----	●	----	----	●	●	●	○	----	●	----
Install/repair culvert pipe inlet	●	●	●	○	○	●	●	●	----	----	●	○
Install road barrier	----	----	----	----	----	●	○	----	----	----	----	----
Install monitoring instrumentation	----	●	●	○	○	●	●	●	----	●	●	○
Grout/cap outlet pipe or culvert	○	○	○	----	○	○	----	●	----	----	----	----
Rebuild/repair road	●	----	○	○	----	●	●	----	○	----	●	----
Increase bank height	●	----	○	○	----	●	●	----	----	----	●	----
Install/Increase height of floodwall	●	○	○	----	○	○	○	●	----	----	●	○

● = Typical ○ = Situational ----= Not applicable

Table B-3 Link 3: Potential Effects per Task

TASK	POTENTIAL EFFECT										
	BIOLOGICAL				PHYSICAL						
	WETLAND CUTBACK	WETLAND REMOVAL	BIOTA SPECIES DISTURBANCE	BIOTA SPECIES HABITAT DISTURBANCE	WORKER INJURY	SOIL/ SEDIMENT TRANSPORT (WATER)	CONTAMINANT TRANSPORT (WATER)	ACCIDENTAL SPILL	SOIL/ SEDIMENT TRANSPORT (AIR)	CONTAMINANT TRANSPORT (AIR)	VEHICLE/ EQUIPMENT EXHAUST
Vehicle or equipment access	----	●	●	●	○	●	●	○	●	●	○
Vegetation cutting	●	----	●	●	○	○	○	○	○	○	○
Create spoil pile	----	----	●	●	○	○	○	○	○	○	○
Water diversion	○	●	○	○	○	●	●	○	●	●	○
Dewatering	----	----	----	----	○	○	○	○	----	----	○
Clearing and earthwork	----	●	●	●	○	●	●	○	●	●	○
Add fill or other material	----	●	●	●	○	●	●	○	●	●	○
Form and pour concrete	----	●	●	●	○	●	●	○	●	●	○
Paving	----	----	----	----	○	----	○	○	○	○	○
Sediment/debris removal	----	●	●	●	○	●	●	○	●	●	○
Debri/spoil disposition	----	----	●	●	○	●	●	○	●	●	○
Vegetation removal	----	●	●	●	○	●	●	○	●	●	○

● = Potentially permanent ○ = Temporary ---- = Not applicable

Table B-4 Link 4: Environmental Control Measures per Potential Effect

POTENTIAL EFFECT	ENVIRONMENTAL CONTROL								
	CONTAMINANT TRANSPORT CONTROL	WETLAND IMPACT MINIMIZATION	WETLAND REPLACEMENT	SPILL PREVENTION AND CONTROL	BIOTA PROTECTION	EROSION CONTROL	REVEGETATION	WORK SPECIFICATIONS	WORKER HEALTH PROTECTION
BIOLOGICAL									
Wetland cutback	----	●	----	----	----	----	----	●	----
Wetland removal	----	●	●	----	----	----	●	●	----
Biota species disturbance	----	●	●	----	●	----	●	●	----
Biota species habitat disturbance	----	●	●	----	●	----	●	●	----
Worker injury	----	----	----	----	----	----	----	----	●
PHYSICAL									
Soil/sediment transport (water)	----	----	----	----	----	●	●	●	----
Contaminant transport (water)	●	----	----	----	----	●	●	●	----
Accidental spill	----	----	----	●	----	----	----	----	----
Soil/sediment transport (air)	----	----	----	----	----	●	●	●	----
Contaminant transport (air)	●	----	----	----	----	●	●	●	----
Vehicle/equipment exhaust	----	----	----	----	----	----	----	●	----

● = Implement ---- = Not applicable

B.3.2 Buffer Zone Maintenance Program

The buffer zone is the remaining undeveloped acreage of the Site. The buffer zone consists primarily of natural and regenerated prairie, although a limited amount of roadway and utilities have been constructed within it. Maintenance activities proposed for the buffer zone would include the following:

- Removal of vegetation, accumulated sediment, and debris upstream and downstream of most culverts or in areas where ditch flow capacity has become inadequate. Vegetation would be removed from an area the width of the conveyance and approximately 5 to 30 feet from the culvert opening, depending on culvert size.
- Replacement of plugged culverts where sediment removal would not remedy flow problems or where culverts are damaged beyond repair.
- Provision of erosion protection through such means as installation of riprap or repair of similar energy dissipation structures.
- Repair or grouting of outlet pipes at the upper A-series and B-series dams.
- Removal of vegetation near streamflow measurement devices for increased accuracy.
- Installation of new measurement systems for such items as drainage flows or dam safety parameters.
- Removal of vegetation on or near dam structures (such as spillways) for improved flow capabilities.
- Repair of damaged ditch embankments.
- Installation of concrete headwalls for culverts.

B.3.3 Pond A-1 Bypass Upgrades Project

The Pond A-1 Bypass collects runoff from above the A-Series ponds and routes it around Ponds A-1 and A-2, which are used for spill containment. The flow capacity of the Bypass would be upgraded by either installing a parallel pipeline or ditch, or replacing the existing pipeline with a larger one. Riprap would be installed at the outlet. The project would reduce the probability of contaminated sediment transport from the upper A-series ponds (Ponds A-1 and A-2) to the lower A-series ponds (Ponds A-3 and A-4). The bypass is planned to be upgraded, at a minimum, to pass up to a 100-year storm event, whereas it currently cannot pass a 2-year storm event.

B.3.4 South Interceptor Ditch Repair Project

The South Interceptor Ditch (SID) would be repaired such that it would be returned to its original design function. It would be capable of intercepting stormwater from a 100-year storm event and conveying it to Pond C-2. This would be accomplished by building up the embankment along the ditch in a few key locations, replacing culverts in at least one location, improving culvert flow capabilities through inlet improvements in at least one location, clearing several partially plugged culverts, and removing vegetation at culvert inlet and outlet areas.

Additional improvements to the SID would include additions of riprap at culvert inlet and outlet locations to protect against erosion; cutting back trees growing in the channel to improve flow conditions; localized road improvements along the ditch; the addition of flow measurement weirs with sampling capabilities; and the addition of cross gutters in areas where the road crosses the ditch in order to ensure potentially contaminated runoff enters the SID instead of flowing into Woman Creek. Potentially contaminated runoff would originate from the southern portion of the industrial area, particularly the old landfill, the 881 hillside french drain, or the Operable Unit 1 treatment facility.

In conjunction with work that would be conducted at the SID, improvements to the Woman Creek Bypass Canal would be undertaken to reduce overflows to Pond C-2 during large storm events. Two embankment locations along the bypass canal would be raised approximately 2 to 4 feet to reduce overflow during a 100-year storm event, and to prevent overflow from up to a 25-year storm event.

The Woman Creek diversion wall, located upstream from the bypass culverts, would also be raised approximately 1 to 3 feet if subsequent calculations reveal that it would further reduce inflows to Pond C-2 significantly enough to justify the cost. Raising the height of the embankment and diversion wall would negate the need to remove material from within the bottom of the bypass canal. Operation of the system would also rely on relatively low Pond C-2 levels prior to any storm to help prevent flow through the Dam C-2 spillway. Removal of vegetation at the inlet and outlet areas of the bypass culverts, with potential additions of riprap for erosion protection, would be conducted.

B.3.5 South Walnut Creek Improvements Project

Potential flooding along South Walnut Creek would be addressed to reduce the probability of contaminated sediment transport from the upper B-series ponds (Ponds B-1 and B-2) to the lower B-series ponds (Ponds B-3, B-4, and B-5). The Pond B-1 Bypass collects runoff from above the B-Series ponds and routes it around Ponds B-1 and B-2, which are used for spill containment. Project components would likely include some or all of the following: upgrading the existing Pond B-1 Bypass by installing a parallel pipeline or ditch or by replacing the existing pipeline with a larger one; manipulating existing culverts near the Wastewater Treatment Plant (WWTP) in order to promote ponding along South Walnut Creek near the WWTP; building floodwalls around parts of the WWTP and possibly along part of the road near the WWTP; removing large amounts of refuse (mostly rocks) from two of the large culverts in the Building 991 area; and replacing several security constrictions in the large culverts along South Walnut Creek with newly designed security constrictions which would increase capacities.

B.4 Descriptions of Activities

An activity was defined as a distinct component of a program or project required to achieve the goals of the management program. It may be the end result of one or more tasks. Activities indicate a type and level of effort, such as installation, alteration, replacement, or repair. The activity description would also give some indication of anticipated materials, equipment, and duration (i.e., one-time, ongoing).

It should be noted that because DOE Orders require that completion of the NEPA process preclude the expenditure of funds (and thus, the final design phase), activity descriptions are based on best available information. Also, due to the variable conditions found in the field, it is not possible to prepare a complete list of all the equipment, materials, and labor necessary to implement the activity. Therefore, the locations, equipment, and quantities delineated are derived from the pre-conceptual design phase, previous or typical situations, or best estimates. It should also be noted that the following terms were defined for the purpose of clarity:

- DRAINAGE STRUCTURE — a designed system and its appurtenant components, either constructed or manufactured, that is used to control, route, or monitor flow of surface water (e.g., ditches, culverts, flumes, dams, headwalls, riprap drop structures, piping, gutters, inlets/outlets, embankments).
- INSTALL — building or somehow introducing a new or a significantly bigger component.
- ALTER — significantly changing the function, size, height, configuration of a component.
- REPLACE — putting in a functionally similar component.
- REPAIR — fixing in place the deficient component.

The terms replace and repair essentially denote maintenance activities, which are differentiated from install and alter for the purpose of indicating a severity of environmental effects, since maintenance generally does not substantially change the configuration or size of the original drainage system structure.

The following sections describe the activities expected to be representative of the proposed programs and project.

B.4.1 Structure Cleanout

The buildup of soil, sediment, and rock on the floor of a drainage ditch or other drainage structure prevents a comparable volume of water from flowing through that conveyance (water backs up) or displaces a comparable volume such that water may overflow the drainage structure. In order to allow the conveyance to function properly, this buildup must be removed. The activity would be relatively short-term, but ongoing, to maintain the desired carrying capacity. Depending upon the size of the conveyance and the amount of buildup, typical cleanout quantities would be expected to range from 1 to 10 cubic yards per conveyance, although there would likely be a few instances where cleanout volumes would range up to and possibly exceed 100 cubic yards.

Because ongoing maintenance has not been conducted, excessive vegetation has grown and now constricts flow within several conveyances, especially near inlets and outlets to culverts. This constriction may cause water to back up on the upstream side of the conveyance. In many situations, total removal of the vegetation would not be necessary to return the operating flow to the culvert. Such vegetation can typically be cut back to within 6 inches of the ground surface and maintained at this height by ongoing maintenance (usually without disturbance of subsurface or root system). In other situations, it may be necessary to remove the vegetation completely (which would involve removal of the root system). Depending upon the conditions at the constricted location, this cut or removal would generally occur within 30 feet on the inlet side and 30 feet on the outlet side and consist of a few small trees and saplings or a few square yards of cattails. Larger areas to be cut could range from 0.1 to 0.5 acres.

In certain situations, vegetation would be cut in conjunction with soil or sediment removal. The waste vegetation would be transported by truck to the Site's landfill.

B.4.2 Install or Repair Riprap

Riprap would be installed in a ditch or near culvert inlets and outlets to provide stabilization, erosion protection, or flow control and dissipation. Riprap would consist of large, angular stones (ranging in average size from 6 to 24 inches) placed in the ditch at locations that may susceptible to erosion, that have been recently disturbed, or at select locations for flow control and dissipation. Depending upon such criteria as percent slope or flow characteristics, an area requiring riprap would generally range from 10 square feet to 1,000 square feet. Locations requiring repair of existing riprap would generally involve a smaller area. Repair would be necessary, for instance, where riprap has been displaced or covered by sediment.

Site preparation of the riprap location may include some sediment or debris removal, vegetation cutting, and earthwork, which may include placement of a geo-textile fabric to prevent vegetative growth. This would be accomplished generally through a combination of manual effort and power equipment (such as a backhoe and front-end loader). Typically, riprap material would be secured from an offsite source and then stockpiled at the Site. The loader would access the stockpile and transport the material to the designated location for placement.

B.4.3 Install or Repair Drainage Ditch

Installation of a new ditch would likely involve upgrading a poorly defined natural drainage through regrading or excavation. Earthwork would be accomplished with earth-moving equipment within the selected area (e.g., grader, backhoe, front-end loader). The size and length of the new ditch would be based on design requirements, and would generally range from 1 to 10 feet in depth and from several feet to a few miles in length. Repair of an existing ditch would be necessary if it no longer functions adequately. Such repairs would likely include rebuilding eroded or slumped areas of embankments and enlarging ditch capacity through widening or deepening the ditch at select areas.

B.4.4 Install, Replace, or Repair Culvert or Pipe

The drainage system may include a number of underground drainage conveyance structures of various types, materials, or size (corrugated metal, iron, steel, plastic, and concrete pipe or culverts). Some of these structures require varying forms of improvement or repair. For example, some structures are too small to carry the required flows; are corroded; are split at the seams; are bent, crushed, or cracked; or are no longer needed. Depending upon the condition of the particular structure, a new or larger structure may need to be installed; the existing structure may need to be replaced with a new, but similar, structure; or the existing structure may need to be repaired (e.g., rewelded, patched, or lining with new pipe or culvert).

In certain situations, such as a proposed new road, a new structure may need to be installed in a drainage system where one does not currently exist. Installations generally require more large-scale construction efforts than repairs and replacements. Necessary equipment may include large backhoes, front-end loaders, off-load transport trailers, and compaction equipment. Part of the displaced soils would generally be replaced. Compactable fill, as necessary, would likely be brought in with a dump truck from an offsite source.

B.4.5 Install, Replace, or Remove Security Constriction

In order to improve flow capacities or control sedimentation build-up, it may be necessary to replace or remove select existing security constrictions located inside the culverts which pass under the Site's Protected Area (PA). The existing security constrictions would be replaced with more hydraulically efficient security constrictions or removed if the required security condition no longer exists. The existing constrictions are located at the inlet or outlet of the culvert and consist of a series of small-diameter pipes encased in concrete. The Site's civil engineers have completed a design for new security constrictions that increase the available flow area by up to 100 percent while maintaining the required security penetration delay. The new design employs a different pipe configuration with a welded grid that would be grouted in place inside the culvert.

Installation of the new design would involve (a) removal of existing security constriction concrete and pipes, typically using a jackhammer; and (b) placement of new pipe and welded grid. In certain situations, where removal of the existing constriction would significantly damage the culvert, installation may require partial culvert replacement at the inlet/outlet ends or replacement of the full length of the culvert (see applicable activity description in Section B.4).

B.4.6 Install Interception Gutter

Interception gutters would be installed to capture and reroute surface water runoff into a more preferable drainage system. The gutters would be placed to intercept potentially contaminated runoff and keep it from following the natural drainage into a creek (e.g., rerouting into the SID to prevent runoff from entering Woman Creek). Installation typically involves minimal grading to the subgrade to receive a V-shaped, poured-in-place concrete interceptor gutter. This effort would likely require a small backhoe, a concrete transport truck, and concrete finishing tools. The interception gutters would likely be 36 inches wide, and the length would generally vary from 10 to 20 feet.

B.4.7 Install or Repair Culvert Pipe Inlet or Outlet

Erosion protection or improved entrance or exit flow conditions would be required at some culvert openings. A poured-in-place concrete or prefabricated metal/plastic structure would be used. The structure would generally consist of sidewalls and a bottom slab that funnels water into the culvert. The size of the walls would vary with the culvert size, although wall thicknesses generally range from 6 to 12 inches. Installation would typically be accomplished by first removing soil from around the culvert (generally with hand-tools or a backhoe). Secondly, a concrete structure would require setting concrete forms around the culvert and pouring and finishing the concrete. A concrete truck would transport the concrete to the culvert location. Repair to an existing inlet or outlet would typically require patching or widening the concrete, metal, plastic inlet or outlet. A trash rack would also be installed on some new or existing culvert inlets to prevent large refuse from entering the culverts. This typically involves fitting steel bar grating (or similar material) into the concrete, metal, or plastic structure using standard equipment for drilling and welding.

B.4.8 Install Road Barriers

As part of the Site's *Watershed Management Plan*, a number of roads are currently being closed and abandoned. To limit general vehicle traffic on these roads, barriers would be installed. Steel gates or chain gates would be installed at access points that need to remain accessible for inspection or maintenance vehicles. Steel gates would be prefabricated offsite and transported to the desired location and attached between two posts. Chain gates would consist of a chain draped between two posts or between pre-fabricated concrete barriers. Posts, if used, would be set in concrete at the appropriate location using manual or mechanically powered post-hole diggers. A concrete transport truck may provide the concrete for setting the posts or the concrete may be mixed at the barrier site.

B.4.9 Install Monitoring Instrumentation

Monitoring instrumentation to be installed may include plastic or metal well casings, weirs, flumes, or sampling equipment. Plastic or metal casings would likely be used as piezometers (to measure water levels) or inclinometers (to measure movement within an embankment) on dam crests or toes. Typically, a 3- to 4-inch borehole would be drilled to bedrock using a hollow-stem auger attached to a drill rig. Upon reaching bedrock, a piezometer or inclinometer casing would be inserted into the borehole. The borehole would then be backfilled with sand and sealed with a bentonite seal or grout. Dam crests are generally accessible by vehicle. Vehicular access to some dam toes may be within wetlands. The size of the area affected may range from between 1,600 to 3,000 square feet. Piezometers and inclinometers would remain in place for the life of the dam. The number of piezometers or inclinometers placed at a dam site would usually be a function of the dam size.

Weirs and flumes are used to measure water flows through a drainage channel or seepage area. Sampling equipment would be used to measure potential contaminants. Weirs would be constructed of metal, plastic, or concrete. A common weir structure would be a tapered V-notch weir placed across and slightly obstructing the water flow path causing some pooling directly upstream of the structure.

Flumes would be constructed of similar material and installed within the water flow path, creating a controlled chute-type flow section from which flows could be measured. Sampling equipment would generally be small, although a small shelter (dog-house size) on a concrete pad may be needed to house the equipment. Installations of these monitoring devices may involve earthwork (manually or with a backhoe) to receive forms for cast-in-place concrete structures. A concrete truck would transport the concrete to the structure location. The work may require employing a water diversion (see applicable task description in Section B.5).

B.4.10 Grout or Cap Pipes or Culverts

The outlet pipes at some dams are no longer used for discharge because they would pull water off the bottom of the ponds, which has the potential of also pulling sediments off the bottom of the pond into the discharge or increasing the chance of re-suspending the sediments. Instead, discharge operations are conducted with a floater line attached to a pump that pulls water from the top of the ponds.

Because an abandoned pipe or culvert may rust and cause problems, or an improperly sealed culvert or pipe may leak, the pipe or culvert would be filled or sealed appropriately. This would be accomplished typically by setting plywood forms somewhere inside or at the outlet of the pipe or culvert, then pumping concrete grout into the pipe or culvert until the required length would be filled. The concrete would be typically pumped from a concrete pump truck. Additionally, grouting or capping may be employed if it is determined that it is desirable that a culvert or outlet be unable to pass flows in order to increase the water storage in the area, or to eliminate the flow from a culvert to an area.

B.4.11 Install or Repair Roads

The embankments of some drainages also serve as roadways. Installing or repairing this type of road may occur incidentally (as the result of upgrading the embankment) or to maintain the condition of the road or embankment. The work would likely require removal or replacement of the aggregate base course and some surrounding soils, or fine-grading of existing road surfaces, and would be accomplished using typical earth-moving equipment (road grader, front-end loader, dump truck, or compaction equipment). An additional road base, if required, would be imported from off-site.

B.4.12 Increase Bank Height

The height of a ditch bank would be increased such that the ditch would have the capacity to pass storm flows without overtopping the bank. In certain cases, increasing the bank height would be preferable to internal ditch excavation (e.g., to avoid disturbing sediments). Raising the bank height would generally require the use of dump trucks, front-end loaders, or compaction equipment.

B.4.13 Install or Increase Height of Floodwall

To prevent inundation of (flows into or around) certain buildings or areas by potential floodwater, or to provide additional ponding and storage in an area, a new concrete floodwall may be constructed. This would involve trenching for the wall foundation; forming, pouring, and finishing the foundation and wall; backfilling and compacting the trench; and grading for positive drainage using typical earth-moving equipment (road grader, front-end loader, dump truck, or compaction equipment). A concrete truck would transport the concrete to the structure location.

To prevent potential floodwater from overtopping an existing floodwall, the height of an existing wall may need to be increased. This would be accomplished by pouring additional concrete atop the existing wall (which involves setting concrete forms, pouring and finishing the concrete). A concrete truck would transport the concrete to the structure location.

B.5 Descriptions of Tasks

A task was defined as a generic part of an activity; that is, an individual procedure (usually construction-related; temporary or long-term) required to conduct an activity. Tasks were used to establish an indicator of environmental effect (see section B.6). Several tasks may be necessary to complete an activity. For example, the activity of soil or sediment removal may involve vehicle and equipment access, vegetation cutting, water diversion, and debris or spoil disposition. The tasks which would be expected to be used to accomplish the previously identified activities are described in the following sections.

B.5.1 Vehicle or Equipment Access

Vehicle or equipment access refers only to such equipment that must be driven, transported, or used offroad in the buffer zone or industrial area.

B.5.2 Vegetation Cutting

Vegetation cutting would refer to the cutting of vegetation above the ground surface without disturbing the established root system. In areas with limited access or overgrowth, vegetation can be cut manually, that is without powered tools. Manual tools may include one more of the following: (a) a light-weight, hand-held sickle/weed-whacker used to remove grasses, cattails, and other herbaceous vegetation; (b) a hand-held pruning saw used to remove branches or trunks of small caliper woody vegetation (1-3 inch caliper); or (c) a hand-pulled rake used to remove small amounts of vegetation.

In areas where manual removal of vegetation would not be possible or feasible, this vegetation would be removed using powered tools. Powered tools may include one or more of the following: (a) a hand-held chainsaw used to remove branches or trunks of larger caliper woody vegetation (3 inches or larger); (b) a hand-held weed-whacker used to remove grasses, cattails, or other herbaceous vegetation; or (c) a lawn-and-garden-sized tractor-drawn mower (driven by a person) used to mow herbaceous vegetation along ditch banks or floors.

B.5.3 Create Temporary Spoil Piles

Temporary spoil piles would be created when excavated material such as excavated soils, sediment, roadbase, rocks, and gravel are removed from an excavation point and temporarily piled nearby. The spoil would usually be used as backfill within the same excavation area or would be moved to other designated locations.

B.5.4 Water Diversion

Water diversion involves the movement of water around a work location so that the work can be undertaken in a dry environment. The water source upstream from the work site is typically a normal flow (continuous or during/after storm events). The diversion would be accomplished through collection or pumping. A temporary collection structure, such as an earthen cofferdam, would be built to collect the water flow. In some cases, additional excavation just upstream of the cofferdam would be necessary to increase water volume detention capabilities. Depending on the volume of water that needs to be diverted, pumping would be accomplished by use of a submersible pump or a diesel-operated pump with an intake line that extends to the water retention area. The water would be typically pumped through a temporary diversion line (made of plastic or rubber) to a location within the same drainage path downstream from where work would be occurring.

B.5.5 Dewatering

Dewatering would involve the removal of water that accumulates within a work site. The source water would likely be groundwater seeping into an excavation, precipitation that falls directly on the area of construction, precipitation that flows into the drainage area of the construction, or a combination of all three. Dewatering would normally be accomplished through placement of a submersible pump within the area of accumulated water, which would be pumped to a location away from where work is underway. The amount of water involved could range any where from a few gallons to several thousand gallons depending on the location, size of work area, time of year, and weather conditions. The act of dewatering could be fairly continuous (e.g., when working in an excavation below the water table) or intermittent (e.g., working in a low area where water only collects after a significant precipitation event).

B.5.6 Earthwork

Earthwork would involve physical manipulation of soil for grading or excavation either manually or using power machinery. Grading would encompass (a) the surficial movement of soil to level an area worked to a smooth horizontal or predetermined sloped surface; and (b) the movement of soil as borrowed earth for constructing embankments, berms, or temporary cofferdams. Expected grading depths could range from several inches to 2 feet. Excavation would displace the soil by means of digging, trenching, or scooping. Expected quantities of excavated displaced soil could range from a few cubic yards to several thousand cubic yards. Clearing would involve the removal of topsoil, groundcover, brush, and trees existing on the surface of an area where earthwork would take place.

B.5.7 Add Fill or Other Material

Filling typically involves returning an excavated area to its original or desired grade through the use of replacement of previously excavated material or placement of clean imported material. The fill is then compacted and prepared for final grading or revegetation. Filling may also involve paving with gravel or related loose material.

B.5.8 Form and Pour Concrete

Concrete work would involve positioning and securing wooden or metal forms at a selected site such that the forms create an outline of the desired structure shape into which concrete can be poured and left to cure. The forms are usually removed within 1 to 3 days after the concrete has set and holds the desired shape. The concrete work can range from small jobs (in which the concrete can be mixed by hand or with a small powered concrete mixer) to large jobs (in which premixed concrete is transported to the job site or the use of concrete pumping equipment is required). Concrete pumping equipment would generally be used for conveying the concrete to inaccessible locations.

B.5.9 Paving

Paving would involve the replacement of asphalt on pre-established paved roadways or vehicle parking areas. Such replacement of asphalt paving material would likely be required when excavation has been performed to install new or replace existing culverts under roadways or vehicle parking areas.

B.5.10 Sediment or Debris Removal

This task involves removal of sediment or debris from within a drainage structure, primarily for the purpose of returning the flow capabilities to the structure. The method for removal of the material would depend on the location and size of the conveyance. One or more of the following could be employed: manual removal with a shovel, mechanical removal with a medium-sized backhoe, or flushing out the conveyance with a high-powered water jet (usually a hand-held hose based from a truck-mounted pump). Flushing would most likely be used in inaccessible culvert situations. Small removal amounts would typically be accomplished with manual tools such as shovels, whereas a backhoe or similar piece of equipment would be used for larger removal quantities. Most sediment removal locations are within a culvert or at the inlet and outlet locations of a culvert.

B.5.11 Debris or Spoil Disposition

Disposition of debris or spoil would involve determining how excess material from construction or maintenance work would be handled. Debris involved would typically include such items as trees, brush, old culverts, asphalt pieces, concrete pieces, rebar, or other items which no longer have any value or use. Spoil would be typically comprised of excavated soils, sediment, roadbase, rocks, or gravel.

Disposition would include, but would not be limited to, the following: using the material (typically spoil in this case) for backfill, spreading the material in the immediate area or some other selected location at the Site, placing the material in the sanitary landfill, or placing the material in waste drums or waste crates. In some situations, large debris items would be cut into smaller pieces to accommodate disposition. It is possible for debris and spoil to be mixed and dispositioned together. The amount of debris or spoil to be dispositioned may range in volume from a few cubic feet to several cubic yards.

B.5.12 Vegetation Removal

Vegetation removal involves the removal of a specified amount of groundcover, brush, and small trees and saplings existing within a drainage channel or other conveyance, usually within 30 feet on the inlet side and 30 feet on the outlet side. In areas with limited overgrowth or access, vegetation would be removed manually using hoe or shovel. In areas where manual removal would not be possible, a backhoe or small grader would be used.

B.6 Descriptions of Potential Effects

An effect was defined as an alteration of the current status of a resource as a result of implementing one or more of the previously defined tasks. The degree of effect was based on whether the effect would be temporary or ongoing. Effects were categorized based on whether they were primarily biological or physical in nature. The following sections describe the effects expected to result from the aforementioned tasks.

B.6.1 Potential Biological Effects

Effects considered primarily biological were those that would likely directly alter vegetation, wildlife, or human health.

B.6.1.1 Wetland Cutback or Thinning

Vegetation cutting, when performed in a wetland, would remove wetland vegetation above the ground surface (leaving the roots intact) to allow adequate flow through a conveyance. The effect from the cutting would be ongoing since the task would become part of the routine maintenance program. Thus, the cutback or thinning of most of the above surface vegetation mass would be permanent.

This thinning would typically be accomplished by cutting the vegetation. Some cutback may be done as a one time event in association with construction work, although this effect would be temporary. The task of water diversion would only temporarily deprive wetland vegetation of normal water conditions, which would be restored once work is complete and the diversion is removed.

Adverse effects from wetland cutback or thinning could include loss of biological habitat and reduced erosion protection, although wetland thinning could be beneficial to some species which cannot utilize excessively thick growth areas. Adverse effects on wetlands were considered in the Options Analysis, and thus a certain amount of impact was avoided or minimized during the early planning process for the development of the management plan. Individual areas expected to be affected through cutback or water diversion would generally be less than 0.1 acre in size, but could range up to approximately 1 acre in size.

B.6.1.2 Wetland Removal

Clearing and earthwork would totally remove wetland vegetation, including the root system. This removal may be the desired goal where improved drainage flow conditions are desired, or may be ancillary due to construction work occurring where wetland vegetation exists. Vehicular and equipment access may also temporarily flatten wetland vegetation.

Adverse effects from wetland removal include loss of habitat, reduced erosion protection, and increased potential for contaminant transport. Adverse effects on wetlands were considered in the Options Analysis, and thus, a certain amount of impact was avoided or minimized during the early planning process for the development of the management plan. Individual areas expected to be affected through wetland removal would generally be less than a few square feet in size, but could range up to approximately 0.2 acres.

B.6.1.3 Biota Species Disturbance

Biota species, both vegetation and wildlife, could be directly impacted by the performance of the identified tasks. Direct disturbance of vegetation, other than wetlands, may consist of plant flattening, compaction, cutting, or removal. Direct disturbance of wildlife may result from personnel or machinery being in or near the species or through deposition of spoil piles. Species disturbance would generally be temporary during construction, or may be permanent, in the case of clearing. Individual areas expected to be affected through disturbance would generally be less than a few square feet in size, but could range up to approximately 0.5 acres in size.

B.6.1.4 Biota Species Habitat Disturbance

A biota species may be indirectly impacted by the disturbance of habitats. Plant habitat can be altered by dewatering or excavation operations, or by the addition of fill material. Such disturbances could be either temporary or permanent. In the case of animal species, habitat can include nesting or refuge areas, as well as feeding, watering, and breeding areas. Habitat disturbance may be temporary, such as a cutting operation, or be permanent, as in a clearing or excavation. The habitat disturbance may or may not have a long-term effect on the size and health of the impacted species. The area of biota species habitat disturbance can range from a few square feet to more than an acre.

B.6.1.5 Worker Injury

Effects to workers could result from injuries due to accidents at a job site, exposure to hazardous material used with equipment, or exposure to contaminants that may potentially exist in the soil, sediment, or water.

B.6.2 Potential Physical Effects

Effects considered primarily physical were those that would likely directly alter water or air.

B.6.2.1 Soil or Sediment Transport (Water-Related)

Soil and sediment transport can occur whenever exposed soil or sediment particles become suspended in surface water runoff and transported along a drainage. This transport leads to an increase in erosion. Construction related tasks typically create newly exposed soils or sediments which can often lead to increased erosion. The potential for soil or sediment transport along a drainage area would increase with increased exposed area size, increased surface water flow volumes and velocities, increased time of exposure, and decreased distance from a drainage location. Negative impacts from this transport include a reduction in water quality associated with an increase in suspended particles, and the filling of drainage structures with deposited soils (sediment), which reduces drainage flow capabilities. Other negative impacts include damage to the natural terrain in the form of gullying, the loss of soils suited for growing desirable vegetation cover, and the generally negative appearance associated with eroded areas.

B.6.2.2 Contaminant Transport (Water-Related)

Water-related contaminant transport can result from surface water flows transporting newly exposed contaminants or resuspension of sediments. This transport of contaminants would be often associated with erosion since contaminants often attach to the soil and sediments particles being transported in the surface water flows. In addition, surface water flows can transport some types of exposed contaminants which dissolve in the water. Dewatering can also lead to contaminant transport when the groundwater or other water collected within an excavation has become contaminated.

B.6.2.3 Accidental Spill

Accidental spills generally result from equipment usage during construction work. Spillage may occur due to ruptured engine hoses, ruptured tanks, poor seals, or during refueling operations. Potentially spilled material would likely be gas, diesel fuel, hydraulic oil, or engine oil. Spill quantities are typically less than 1 to 2 gallons, but could range to 50 gallons or more under certain conditions. Refueling and other handling operations generally pose the greatest spill risk.

B.6.2.4 Soil or Sediment Transport (Air-Related)

Construction work often leads to airborne soil or sediment particles which are usually transported some distance in the air. Also, soil or sediment particles can become airborne when newly exposed areas become dry and there are sufficient wind speeds to move these particles in the air (fugitive dust). Another potentially undesirable side effect would be the loss of soils suited for growing desirable vegetation cover (wind erosion).

B.6.2.5 Contaminant Transport (Air-Related)

Air-related contaminant transport could result from construction activities or winds suspending newly exposed contaminants in the air. Air contaminants may be solid particles or those attached to soil or sediment particles. Such contaminants could be introduced into the air in the same manner as fugitive dust and wind erosion. In addition, contaminants may volatilize out of soil and enter the air as vapors.

B.6.2.6 Vehicle or Equipment Exhaust

Internal combustion and diesel exhaust emissions can be associated with the use of powered equipment. Vehicles used to access work areas and vehicles such as earth movers and mowers used to accomplish the actual work produce exhaust, as do pumps and gasoline-powered weed cutters. Vehicle and equipment exhaust would be temporary in all cases. The increase in air contaminant levels would be relatively minor.

B.7 Descriptions of Environmental Control Measures

Environmental control measures are accepted or predetermined procedures taken in association with the proposed action to prevent or minimize any adverse effects. It was determined that certain tasks affect the environment in typical and anticipated ways. Measures would be taken which negate or diminish these effects. The measures include established Site procedures, best management practices, or strategies developed by resource specialists.

Because the environment is not comprised of isolated components, it should be recognized that implementation of a specific environmental control measure may result in multiple benefits which would overlap with the goals of other environmental control measures. For example, wetland impact minimization not only protects a wetland area, but also protects biota through habitat protection, and also helps control erosion. Contaminant transport would also be controlled through erosion control measures, since contaminants may be attached to or mixed with the soil or sediment particles.

The following section describes environmental control measures that would be implemented as part of the scope of work for the action as proposed in the previously defined programs and projects.

B.7.1 Contaminant Transport Control

Contaminant transport control would be utilized to prevent or minimize the transport of contaminants. Contaminant transport control measures are based upon (a) an assessment of potential contamination utilizing location information and assessment of historical releases and past operations; (b) a review of existing sample results; (c) collection and analysis of new samples; or (d) a combination thereof. Specific control measures for contaminated or potentially contaminated material, which would typically be soils, sediments, or groundwater, would include one or more of the following:

- Containerized storage for future disposition
- Treatment
- Placement back into the original contaminated or potentially contaminated zone
- Preventing wind, water, and physical transport from a contaminated or potentially contaminated area.

Wind and water transport would be minimized through erosion control. Physical transport would often be accomplished by rinsing equipment at a decontamination pad and removing personal protective clothing at the boundary of a work area.

Contaminant transport control would be applied to excavation dewatering activities through the Site's *Incidental Waters Program* (EG&G 1991a). This program requires the sampling of water prior to dewatering for several standard water quality parameters. Sampling requirements would be modified based on location information or previous sample information. Water found to be unacceptable for discharge to a surface drainage would typically be collected for transport to the appropriate treatment location. The treatment method is dependent upon the contaminant types and levels. An alternative would be to modify work plans to avoid dewatering when possible.

Contaminant transport control would be applied to soils and sediments primarily through the Site's excavation permitting process. This phased process first utilizes location information or previous sampling results to identify control requirements. Additional control requirements are developed as necessary to address results from new soil or sediment samples. Figure B-2 illustrates a decision tree that outlines the basic approach to this contaminant control process.

B.7.2 Wetland Impact Minimization

This environmental control measure would involve modifying, reducing, or eliminating the scope of work in or near a wetland area in order to avoid or reduce the amount of wetland to be cut back or removed. This control measure was used in defining the project scope of work during the *Options Analysis.*

Because ongoing maintenance has not been conducted, excessive vegetation has grown and now constricts flow within several conveyances, especially near inlets and outlets to culverts. These constrictions cause water to back up on the upstream side of the conveyance section. In many situations, total removal of the vegetation would not be necessary to return the operating flow capacity to the culvert. Such vegetation can typically be cut back to within 6 inches of the ground surface and maintained at this height by ongoing maintenance (usually without disturbance of subsurface or root system). In other situations, it would be necessary to remove the vegetation completely (which would involve removal of the root system). Depending upon the conditions at the constricted location, this cut or removal would generally occur within 30 feet on the inlet side and 30 feet on the outlet side and consist of a few trees or a few square yards of cattails. Larger areas to be cut could range from 0.1 to 0.5 acres.

B.7.3 Wetland Replacement

This measure would involve the creation of wetland areas in new locations to compensate for the removal or destruction of wetland vegetation. Newly created wetland areas would be located at an offsite location or at a location within Site boundaries. Implementation of this environmental control would be in keeping with the wetland requirements of 40 CFR Part 230; §404(b)(1): *Guidelines for Specification of Disposal Sites for Dredged or Fill Material.*

Vegetation removal would involve the removal of a specified amount of groundcover, brush, and trees existing within a drainage channel or other conveyance, usually within 30 feet on the inlet side and 30 feet on the outlet side. In areas with limited overgrowth or access, vegetation would be removed manually using hoe or shovel. In areas where manual removal would not be possible, a backhoe or small grader would be used.

B.7.4 Spill Prevention and Control

This control would involve measures to prevent, contain, and clean up accidental spills. Prevention includes inspection and maintenance of equipment such that accidental spills are minimized. Spill containment includes secondary containment around equipment, and spill response efforts which would involve the placement of barriers around or in the path of spills. Spill cleanup typically would involve removal of the spilled material, absorbents, and most or all environmental media contaminated by the spilled material. The Site's hazardous materials team performs most spill response activities.

B.7.5 Biota Protection

Biota protection would be accomplished in many ways. Most of the other environmental controls, such as contaminant transport control, protect biota from effects due to specific contaminants or spilled material, or avoid habitat loss through controls like wetland impact minimization and revegetation.

During nesting seasons, work areas would be inspected for bird nests about two weeks prior to construction to ensure that the work would not disrupt any nesting activities. If such a potential existed, work would be delayed or modified to avoid disruption. This effort ensures compliance with the Migratory Bird Act. In addition, all work locations are evaluated for potential impact to endangered species or to species that are anticipated to be *protected* under the Endangered Species Act. If there was potential for unacceptable impact to any such species, work would be delayed, modified, or canceled.

Individual field activities, and the personnel undertaking such actions, would be subject to the notification and survey requirements of the Site's procedures for *Migratory Bird Evaluation and Protection* (EG&G 1991c) and *Identification and Protection of Threatened, Endangered, and Special-Concern Species* (EG&G 1991b).

B.7.6 Erosion Control

Erosion control would be necessary for tasks involving clearing, excavation, or the creation of spoil piles. Erosion is caused by precipitation runoff and wind action. For clearing and excavation activities, the affected area would be wetted to prevent wind erosion. If the area is susceptible to erosion due to runoff, a temporary mulch and sediment traps, such as weed-free straw bales, would be placed in downstream drainages. Revegetation, described below, provides erosion control at the completion of the task. For spoil piles, both wind and water erosion would be controlled by covering the piles. Methods for implementing erosion controls are specified in the Site's *Watershed Management Plan* (DOE 1993wmp).

B.7.7 Revegetation

Revegetation would be performed at the completion of a task in order to minimize erosion and reestablish habitat. Revegetation would typically be established through seeding. Seed mixtures have been developed which are appropriate mixtures of fast growing and hardy native species. Revegetation would occur at the onset of proper growing seasons. Methods for implementing revegetation are specified in the Site's *Watershed Management Plan* (DOE 1993c).

B.7.8 Work Specifications

Many potential environmental effects would be addressed by utilizing administrative controls in the form of work specifications. Work specifications would be placed in subcontracts or work procedures. Work specifications would identify sensitive areas to be protected, materials to be used, precautions to be observed, or methods for performing tasks.

B.7.9 Worker Health Protection

Typically, worker health protection would be accomplished through the implementation of the Site's OSHA-based standards. In addition, industrial hygiene and radiological health and engineering personnel would review and monitor the work and specify personal protection equipment (PPE) as required. Material Safety Data Sheets (MSDS) are available for all chemicals used on the site in accordance with the federal *Emergency Planning and Community Right-To-Know Act* (40 CFR Sections 311-312).

Appendix C

Previous Studies

APPENDIX C
PREVIOUS STUDIES

The Site's surface water drainage system, as with similar systems, serves to minimize or eliminate damage from stormwater flooding. Stormwater flooding, however, may have greater implications at the Site, due to mission-related activities, the potential presence of contamination, and the proximity of the Site to the aforementioned reservoirs. Addressing issues relative to flooding, therefore, may also involve downstream water quality. Water quality of stormwater runoff is, by requirement, characterized both as it enters and leaves the Site.

Water quality at the Site is currently governed by a series of primary and secondary laws (e.g., Atomic Energy Act, Clean Water Act, Colorado Water Quality Control Commission standards), agreements (e.g., Agreement in Principle, NPDES Federal Facilities Compliance Agreement, Interagency Agreement), and collateral laws (e.g., CERCLA, RCRA, NEPA).

A number of studies, reports, and plans have been prepared in recent years that status the Rocky Flats Environmental Technology Site's surface water drainage system as inadequate, due primarily to deficiencies in maintenance implementation. The most relevant documents are summarized in this section.

C.1 Dam Safety Periodic Inspection Report No. 2, July 1989

The U.S. Army Corps of Engineers was authorized to initiate a program of safety inspections for the 12 dams located at the Site, by letter dated March 23, 1984, from the Department of Energy, Chief of Engineering and Construction Branch, Rocky Flats Field Office. The program of annual inspections was initiated to bring the dams into compliance with the regulations of the State of Colorado. The inspections evaluate the dams' safe storage capacity, assure that the dams are being operated and maintained properly, and identify any conditions that could jeopardize dam safety.

Findings: The report noted that the dams posed no immediate safety problems, although timely completion of recommendations made to assure continued dam safety was considered a necessity. Among the recommendations were: a) the low level conduits for Dams A-1 and A-2 should be grouted throughout the length to prevent seepage and guard against possible uncontrolled releases; b) the erosion scarps on the upstream slopes of Dams A-2 and A-3 should be repaired; c) a layer of riprap underlain by a layer of bedding material should be placed along the toe of Dam B-1 to protect it from erosion; d) piezometers should be installed at the crest and toe of Dams A-4 and C-2; and e) surface movement monuments should be installed to monitor embankment movements.

C.2 Rocky Flats Plant Drainage and Flood Control Master Plan, April 1992

The master plan provided a comprehensive analysis of the flood hydrology of the Site, including the implications of water rights and water quality issues, the condition of the Site's drainage system, and the Site's overall flood potential. The analysis also reviewed 13 related studies and took into consideration the drainage basins in the immediate vicinity of the Site. To ensure compatibility with downstream drainage plans approved by Colorado's Urban Drainage and Flood Control District (UDFCD), the analysis utilized a methodology similar to that used in UDFCD planning.

Modeling of the Site's industrial area drainage system was undertaken to delineate the adequacy of the system to handle 25-year and 100-year storm events. These two performance criteria for drainage facilities were used per the U.S. Department of Energy Order 6430.1A *General Design Criteria*, which provides that:

> Stormwater management systems shall be designed for not less that the 25-year, 6-hour storm. The potential effect of larger storms (up to the 100-year, 6-hour storm) shall also be considered. With the approval of the cognizant DOE authority, lesser design storms may be used where a large expenditures [sic] for flood protection cannot be economically justified.

Findings: The master plan identifies deficiencies within the industrial area based primarily on a 25-year storm event. The majority of computed deficiencies occur along the Central Avenue corridor. In other locations, stormwater flooding above the roadway centerline would subject some buildings to flooding because their exterior elevation is below that of the centerline. Stormwater would back up and flood at driveway crossings along Central Avenue. Under a 100-year storm event, the embankment and the downstream roadway of the B-Series ponds bypass canal would be overtopped and the canal itself likely breached. Deficiencies were a result of insufficient storage and conveyance capacities of outlet facilities, either due to lack of maintenance or undersized conveyances.

C.3 Draft Surface Water Management Plan, July 1992

The management plan was developed to integrate water quality management activities and address regulatory requirements and public concerns in an effective, unified manner. The plan provides a comprehensive and informative summary of all aspects of surface water management at the Site both in the context of regulations and public concern, as well as a plan of action for present and future surface water management at the Site.

Findings: As part of the overall management plan, correction of deficiencies of the drainage system were recognized as activities that would be undertaken over the short term of the plan.

C.4 Rocky Flats NPDES-Stormwater Pollution Prevention Plan: Structural Stormwater Control Inventory, June 1993

The report presents the results of a comprehensive inventory completed to identify the type, location, and condition of all accessible structural stormwater control measures. The inventory was conducted to collect data for inclusion in the Site's Stormwater Pollution Prevention Plan and for general maintenance programming.

Previous records were used to establish a baseline inventory. Site reconnaissance was conducted from the baseline inventory and new mapping was developed to note where control structures had been removed, abandoned, or constructed. A rating system was established to identify the physical condition of the structure and the need for maintenance. Physical condition was rated in terms of whether the structure was new, average, or severe. The average condition indicated that the structure showed signs of limited corrosion or slightly displaced joints, although the conveyance capacity was not materially affected. A condition was determined to be severe if it limited or eliminated the functional purpose of the structure and required immediate repair or replacement (e.g., crushed culvert).

Need for maintenance was rated in terms of whether the structure was either recently installed, had 0-50 percent blockage, or had 50-100 percent blockage. A middle-rating indicated that a structure was 0-50 percent filled with sediment, although the condition did not severely impede flow or limit the functional purpose of the structure. A high-rating indicated that a structure was 50-100 percent filled or buried with sediment, or was completely blocked by vegetation or refuse, such that the condition severely limited or eliminated the functional purpose of the structure.

Findings. The findings of the inventory were based on the rating points assigned to each structure. The condition and maintenance rating for the structures were combined to assist with prioritization of future maintenance and inspection schedules. The priority levels reflected the need for either immediate replacement/repair/maintenance, or annual maintenance. The report noted that, in general, replacement and maintenance of structures within the protected area of the Site was of greater priority. The report also found that the recommendations from a storm sewer inspection review (conducted for the Site in 1989 and describing maintenance needs and a potential for flooding at certain locations) had not yet been implemented. Finally, the report cited good housekeeping, preventive maintenance, and visual inspections as "best management practices" identified by the Environmental Protection Agency that result in minimization or elimination of potential stormwater contamination.

C.5 Drainage Repairs and Improvements Plan, September 1994

The intent of the Plan was to address the most serious of the deficiencies in the stormwater drainage systems, as identified in the 1992 *Drainage and Flood Control Master Plan* and subsequent flooding studies, and to provide recommendations for the correction of these deficiencies. Possible impacts from flooding during high-runoff storm events include floodwater inundation of facilities and equipment, loss of critical access to buildings and operational areas, scouring of contaminated sediments, and failure of detention or diversion structures. The Plan noted that such impacts could result in injuries to Site personnel or the public, costly repairs, or significant contaminant transport. A flood-flow analysis was performed for each drainage deficiency identified. The Plan then detailed alternatives and cost estimates for correcting the deficiencies and set priority levels for implementation of recommended actions..

Findings. The Plan determined there was a need for a sitewide approach to correcting the deficiencies because the resolution to flooding problems along one drainage section may result in increased downstream flows and exacerbate flood damage concerns in other areas. It was also determined that many of the deficiencies could be corrected by performing relatively minor maintenance, such as removing sediments from within culverts and clearing vegetation and debris from certain drainage ditches. Such maintenance activities could greatly reduce flooding severity within the industrial area for the more frequent storm events without causing significant increases in downstream flooding. It was also recommended that any maintenance program be preventative in nature so that flooding concerns do not continually reoccur.

The Plan developed a priority ranking for correcting deficiencies based, first, on potential impact to Site operations from flooding, and second, on a cost-benefit rationale. Among the deficiencies ranking high in the analysis were the following: (a) the likelihood that a 100-year storm event would overtop the B-1 Bypass structure, flow into and overtop Ponds B-1 and B-2 (potentially scouring pond sediments); (b) stormwater overtopping the channel and spilling into Pond C-2 due to heavy vegetation in the channel and a low bank height, (the capacity of the Woman Creek Bypass channel in its present condition is 230 cubic feet per second, which is less than needed for a 25-year, 6-hour storm); and (c) the need to replace security constrictions at the north end of the Protected Area with a modified structure that maintains a hydraulic capacity of 134 cubic feet per second in order to pass a 25-year, 6-hour storm event; and (d) culverts would be overtopped and flow into the A-Series ponds due to extensive sedimentation of culverts and an undersized culvert which have reduced the capacity of an area of North Walnut Creek.

Appendix D

South Interceptor Ditch
Human Health Risk Assessment

APPENDIX D

SOUTH INTERCEPTOR DITCH HUMAN HEALTH RISK ASSESSMENT

D.1 Summary

A human health risk assessment supports maintenance operations at the South Interceptor Ditch (SID). Maintenance activities are required on the SID so that the design flow for a 100-year flood event can be accommodated. This human health risk assessment is to become part of the environmental assessment analysis (EA). The findings of the risk assessment presented in this report show there is negligible risk to the public from exposure to the SID and that:

1. The chemical and radionuclide contamination in the SID is insignificant from a practical health perspective. The excess carcinogenic risk of a person at the SID is slightly above the minimum acceptable value of 1E-6 (1×10^{-6}). The actual lifetime excess cancer mortality risk calculated was 2.3E-6 for metals and 8.4E-7 for radioactive constituents.

2. The noncarcinogenic total average hazard indices (HI) estimated to the public from metals is 0.041 for the inhalation and ingestion pathways. A hazard index of less than 1.0 indicates that chronic systemic effects resulting from exposure are not expected.

3. Radionuclide concentrations detected in the SID are well within limits required by DOE Order 5400.5 Radiation Protection of the Public and the Environment for unrestricted release of soils.

D.2 Introduction

The SID risk assessment estimated the public risks of the maintenance activities. Over the years, the ditch was not properly maintained. The SID is on a geomorphic bench adjacent to a steep slope that borders the southern portion of the industrial area at the Site. It is approximately 7,700 linear feet in length.

Most of the sediment to be removed comes from the erosion of the north slope. The soil upslope from the SID is contaminated by past waste disposal practices. Immediately northwest of the SID is the old landfill site where hazardous waste and radioactive waste debris and equipment were discarded. The contents of the landfill contaminate the soil. Throughout the years, contaminated soil has slowly filled the SID. The result has been detectable levels of metals, some of which are Resource Conservation and Recovery Act (RCRA) listed wastes, and radionuclides in the sediments of the SID.

D.3 Risk Assessment Methodology

The risk assessment follows the procedures outlined in the Environmental Protection Agency's (EPA's) Risk Assessment Guidance For Superfund, Volume I, Human Health Evaluation Manual (Part A) (RAGS,1989). For assessing noncarcinogenic risks, a reference dose, or RfD, is used for evaluating noncarcinogenic effects from exposure. A chronic RfD is a daily exposure level for the human population, including sensitive subpopulations, that is likely to have no deleterious effects during a lifetime. Chronic RfDs were the basis for evaluating potential noncarcinogenic effects from exposures between 7 years and a lifetime.

Noncarcinogenic effects are evaluated by comparing an exposure level over a specified time period (e.g. lifetime) with the reference dose. RfDs are used to determine what is called a hazard quotient (HQ). The HQ is the ratio of exposure level (E or intake) to toxicity (RfD), or HQ=E/RfD. The hazard quotient describes the potential for noncarcinogenic toxicity to occur in an individual. Noncancer hazard quotient assumes there is a level of exposure (i.e., RfD) below which sensitive populations are not likely to experience adverse health effects (RAGS, 1989). As a rule, the greater the value of HQ above one, the greater the level of concern (RAGS, 1989). The generic formula for noncancer hazard quotient is defined as:

$$HQ = Intake / RfD.$$

To assess overall potential for noncarcinogenic effects posed by more than one chemical, a hazard index (HI) approach has been developed by the EPA (RAGS, 1989). The hazard index is equal to the sum of the hazard quotients. When the HI exceeds unity, there may be a concern for potential health effects. The generic formula for noncancer hazard index is defined as:

$$HI = \Sigma HQ.$$

For carcinogens, risk is the incremental probability of an individual developing cancer during a lifetime as a result of exposure to a carcinogen. Slope factors (SF) are used to estimate this probability. The slope factor is the relationship between dose and response. Slope factors are calculated for potential carcinogens in classes: A (human carcinogen), B1 (probable human carcinogen), and B2 (probable human carcinogen, but with inadequate evidence or no evidence in humans). Risk is calculated from multiplying the SF by the chronic daily intake (CDI), henceforth to be referred to as "intake," averaged over 70 years. The generic formula for calculating the probability of an individual developing cancer is defined as:

$$Risk = CDI \times SF.$$

The values for RfDs and slope factors are available in the Integrated Risk Information System (IRIS) database, the primary source of these numbers, and the Health Effects Assessment Summary Tables (HEAST).

D.4 SID Data Analysis Methodology

Samples of the SID sediments were analyzed for the presence of RCRA F-listed wastes. The RCRA F-list (40 CFR 261.31) identifies hazardous wastes from nonspecific sources. In order to determine the contaminants of concern, it was necessary to determine background and non-background concentrations. If there were less than 50% detections of contaminants in the grouped samples, then these samples were statistically analyzed as mean zero. If there were more than or equal to 50% detection of contaminants in the grouped samples, these samples were statistically analyzed as mean half. Chemical analyses for organics and metals were performed using methods comparable to EPA's contract laboratory program routine analytical service (CLP-RAS); radiochemistry methods were comparable to CLP Special Analytical Methods (CLP-SAM). This analysis strongly suggests that the contaminants detected in the SID cannot be distinguished from expected concentrations in natural surface soils.

From the data set, volatiles, semi-volatiles, and pesticides were all undetected or "U" data, and, therefore, were eliminated from the original data set from further analysis in addition to metals and radionuclides with no hits (Tables D-1 and D- 2). Acetone and methylene chloride were not included in the analysis because they are common laboratory contaminants . Metals below the detection limits of the laboratory analysis capability, and radionuclides associated with natural or anthropogenic background were eliminated from the human health analysis. If the mean half and the mean zero for metals, and the mean and median for radionuclides, were above the upper tolerance interval for the sediment in the background geochemical report for an analyte, then a risk assessment was performed on that specific metal or radionuclide.

A summary list of the detectable metals included in the SID risk assessment is summarized in Table D-3. Note that the table does not include radionuclides because they are dealt with later in the assessment.

D.5 Exposure Pathways at the SID

An exposure pathway exists if a contaminant of concern can be transported from the source to a person. The mechanisms by which the contaminants of concern can be transported to human receptors include direct contact at the source, airborne particulates and vapors, and ionizing radiation. The exposure pathways consist of inhalation of resuspended particulates, and incidental ingestion of, and dermal contact with, sediments from the SID. Inclusion of the ingestion pathway is conservative because the likelihood of a residence being constructed on the banks of the SID is remote. The human health evaluation for these exposure pathways is presented below.

D.6 Risk Assessment Assumptions

The scenario is a residential setting where long-term exposure occurs as a result of contact with SID sediments that have been placed on the ground surface. In performing the risk, it was assumed that there would be maximally exposed individuals at the SID. The human health evaluation for these identified complete exposure pathways is presented below. A conservative approach was used to calculate all the risks.

Risk Assessment Assumptions- Residential:

<u>Soil Ingestion</u>

Soil Ingestion Rate: 120 mg/day

Exposure Frequency: 290 day/year

Exposure Duration: 30 years

Soil Concentration: Arithmetic Average

<u>Inhalation of Suspended Particulates</u>

Inhalation Rate: 20 m^3/day

Exposure Frequency: 290 day/year

Exposure Duration: 30 years

Suspended Particle

Concentration: 37 ug/m^3

Soil Concentration: Arithmetic Average

<u>Dermal Contact</u>

Dermal contact and absorption is not a significant route of exposure for the contaminants of concern.

Risk Assessment Assumptions - Worker:

<u>Inhalation</u>

Total Suspended

Particulates: 0.0398 ug/m^3

Inhalation Rate: 1.4 m^3/day

Exposure Frequency: 1 26 days/year (6 months)

Exposure Duration: 1 year, 8 hour shifts

D.7 Detectable Metals at the SID

D.7.1 Generic Equations for Intake and Risk Calculations - Residual Exposure

For the ingestion pathway of contaminants (i.e., metals) in the soil, the following generic calculations from RAGS (1989) were used to calculate intakes. Following the sequence listed, first the intake for the analyte was determined by inserting the mean half from the data for each detectable metal into the intake formula for the variable "CS" (see below) or "concentration in soil". This value was substituted into either the carcinogenic risk formula or the noncarcinogenic hazard quotient formula (equations 1 and 2 below). The carcinogenic risk or the hazard quotient for each metal is summarized in Table D-4 for the ingestion pathway.

D.7.1.1 Ingestion (Oral) of Surface Soils

$$\underset{\text{(mg/kg-day)}}{\text{"INTAKE"}} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

Where:

CS	=	Concentration in Soil, mg/kg (Site specific measured value)
IR	=	Ingestion Rate = 120 mg/day (Time-weighted average; these are default values)
CF	=	Conversion Factor = 1Ex10^{-6} kg/mg
FI	=	Fraction from Contaminated Soil = 1.0 (Conservative assumption)
EF	=	Exposure Frequency = 290 days/year (Adjusted for 60 days snow cover)
ED	=	Exposure Duration = 30 years (yrs.)
BW	=	Body Wt. = 59 kg (Time weighted average)
AT	=	Average Time = 30 years (For noncarcinogens)
AT	=	Ave. Time = 70 years (For carcinogens; lifetime)

INGESTION EQUATIONS:

(1) Carcinogenic Intake :

- Intake $= \frac{(CS)\ (120\ mg/kg)\ (1E\text{-}6)\ (1.0)\ (290\ days/year)\ (30\ years)}{(59\ kg)\ (70\ years)\ (365\ days/year)}$

$= (6.93\ x10\text{-}7\ day^{-1})\ (CS)$

Risk Equation:

- Ris = (Intake) (SF)

where: SF = slope factor

(2) Noncarcinogenic Intake :

- Intake $= \frac{(CS)\ (120\ mg/kg)\ (1E\text{-}6)\ (1.0)\ (290\ days/year)\ (30\ years)}{(70\ kg)\ (30\ years)\ (365\ days/year)}$

$= (1.36E\text{-}6\ day^{-1})\ (CS)$

Hazard Quotient Equation:

- HQ = Intake / RfD

therefore; ΣHQ = Hazard Index (HI)

For the inhalation pathway of metals in soil, the following generic calculations from RAGS (1989) were used to calculate intakes. Following the sequence listed, first the intake for the analyte was determined by inserting the mean half from the data for each detectable metal into the intake formula for the variable "CS" (see below). Once this number was determined, it was substituted into either the carcinogenic intake formula to calculate risk or the noncarcinogenic formula to calculate the hazard quotient (equations 3 and 4 below). This process was repeated for each analyte, and the carcinogenic risk or the hazard quotient for each is summarized in Table D-5 for the inhalation pathway.

D.7.1.2 Inhalation of Suspended Soils

$$\text{"INTAKE" (mg/kg-day)} = \frac{CS \times IR \times CF \times EF \times ED \times PC \times DF}{BW \times AT}$$

Where:

CS	=	Concentration in Soil, mg/kg (Site specific measured value)
IR	=	Inhalation Rate = 20 m^3/day (Very conservative)
CF	=	Conversion Factor = 1E-9 kg/ug
EF	=	Exposure Frequency = 290 days/yr.
ED	=	Exposure Duration = 30 years
BW	=	Body Wt. = 70 kg (Time weighted average)
AT	=	Average Time = 30 yrs. (For noncarcinogens)
AT	=	Ave. Time = 70 yrs. (For carcinogens; lifetime)
PC	=	Particulate Concentration In Air = 0.37 ug/m3
DP	=	Deposition Factor = 0.25 (MRI, 1985)

INHALATION EQUATIONS

(3) Carcinogenic Intake :

- Intake = $\frac{\text{(CS))0.37 ug/m}^3\text{)(1E-09 kg/ug)(20 m}^3\text{/day)(290 days/year)(30 years)(.25)}}{\text{(70 kg) (70 years) (365 days/year)}}$

  = (CS) (9.0E -12day -1)

Risk Equation:

- Risk=(Intake) (SF)

(4) Noncarcinogenic Intake:

- Intake = $\frac{\text{(CS))0.37 ug/m}^3\text{) (1E-09 kg/ug) (20 m}^3\text{/day) (290 days/year) (30 years)(0.25)}}{\text{(70 kg) (30 years) (365 days/year)}}$

  = (CS) (2.10E-11 day -1)

Hazard Quotient Equation:

- $HQ = Intake / RfD$

therefore; $\Sigma HQ = \text{Hazard Index (HI)}$

D.8 Radionuclide Analysis at the SID

D.8.1 Generic Equations for Radionuclide Intake and Risk Calculation - Residual Exposure

For the ingestion and inhalation pathways of radionuclides from surface soil, the generic calculations for determining the intakes and carcinogenic risk are provided below. Following the sequence listed, first the intake for the radionuclide was determined by inserting the mean half from the data into the intake formula for the variable "CS" (see below). Once this number was determined, it was substituted into the carcinogenic intake formula to calculate risk (equations 5 and 6 below). This process was repeated for each analyte, and the carcinogenic risk for each is summarized in Table D-6 for the ingestion and inhalation pathways.

D.8.1.1 Ingestion of Radionuclides from Surface Soils

"INTAKE" = CS x IR x CF x FI x EF x ED

Where:

CS	=	Radionuclide Concentration In Soil, pCi/g (Site specific measured value)
IR	=	Ingestion Rate = 120 mg/day
CF	=	Conversion Factor = 1E-3 g/mg
FI	=	Fraction From Contaminated Soil = 1.0 (Conservative assumption)
EF	=	Exposure Frequency = 290 days/year
ED	=	Exposure Duration = 30 years

INGESTION EQUATIONS:

(5) Ingestion Intake:

- Intake = (CS) (120 mg/day) (1E-3 g/mg) (1.0) (290 days/year) (30 years)

  = (1044 g) (CS)

D.8.1.2 Inhalation of Radionuclides from Surface Soils

"INTAKE" = CS x PC x CF x IR x EF x ED x DF

Where:

CS	=	Radionuclide Concentration In Soil, pCi/g (Site specific measured value)
PC	=	Particulate Concentration In Air = 37 ug/m^3
IR	=	Ingestion Rate = 120 mg/day (Time-weighted average)
CF	=	Conversion Factor = 1E-6 g/ug
FI	=	Fraction From Contaminated Soil = 1.0 (Conservative assumption)
EF	=	Exposure Frequency = 290 days/year
ED	=	Exposure Duration = 30 years
DF	=	Deposition Factor = 0.25 (MRI, 1985)

INHALATION EQUATIONS

(6) Inhalation Intake:

- Intake = (CS) (0.37 ug/m^3)(1E-6 g/ug)(1.0)(20 m^3/day)(290 days/year)(30 years)(0.25)

  = (0.016 g) (CS)

D.8.1.3 Carcinogenic Risk from Radionuclides

- RISK=[(Intake) (SF)] Ingestion + [(Intake) (SF)] Inhalation

  = [(1044 g) (CS) (SF) Ingestion] + [(0.016 g) (CS) (SF) Inhalation.]

- RISK=CS [(1044 g) (SF Ingestion) + (0.016 g) (SF Inhalation)] Used for Radionuclide Risk

Based upon the above calculations, the risk due to radionuclides per pathway and the sum of radionuclide risk is presented in Table D-6.

D.9 Results

The results of the risk assessment for ingestion of metals and radionuclides to the public are 2.1E-6 and 2.9E-7 respectively for a total of 2.4E-6 for this pathway. This value is slightly above the EPA's 1×10^{-6} threshold but is acceptable.

For the inhalation pathway, carcinogenic risk to the public from metals was 1.9E-7 and for radionuclides 5.5E-7 for a total of 7.4E-7. Since this value is below the EPA's target level of 10^{-6} risk, this risk is considered acceptable.

The sum of risks (for inhalation and ingestion) due to metals is 2.3E-6 and for radionuclides 8.4E-7; therefore, the sum of these risks is 3.14E-6. This value is slightly above the EPA level.

The noncarcinogenic HI value for inhalation is 0.001 and for ingestion is 0.04. The sum total of the HIs is 0.041. Using the HI value of one as reference value, 0.041 is less than one, and therefore, there are no potential adverse health effects to the public.

CONCLUSION

There is negligible risk to the public from inhalation and ingestion pathways for the detectable RCRA F-listed wastes and inorganics analyzed at the SID. Likewise, there is negligible radionuclide risk from both inhalation and ingestion to the public.

REFERENCES

International Commission on Radiological Protection (ICRP), Reference Manual, ICRP Publication 23, Pergamon Press, New York, New York. 1975

Midwest Research Institute (MRI), "Rapid Assessment of Exposure to Particulate Emissions for Surface Contamination Sites", EPA 600/8-85/002, February, Midwest Research Institute, Kansas City, Missouri, 1985.

TABLE D-1
TOTAL DETECTABLE METALS

ANALYTE	# OF DETECTS/ TOTAL	SEDIMENT-UPPER TOL. LIMIT #(mg/kg)	SEDIMENT X̄ HALF (mg/kg)	SEDIMENT X̄ ZERO (mg/kg)	DO RISK?
ALUMINUM	8/8	8994.74	9980.00	9980.00	YES
*ARSENIC	8/8	———	4.85	4.85	YES
*BARIUM	8/8	———	138.29	138.29	YES
BERYLLIUM	3/8	———	0.55	0.34	YES
*CADMIUM	1/8	———	0.52	0.15	YES
CALCIUM	8/8	———	13341.25	13341.25	YES
*CHROMIUM	8/8	20.8456	11.74	11.74	NO
COBALT	3/8	———	5.69	3.36	YES
COPPER	8/8	———	18.45	18.45	YES
IRON	8/8	15664.9050	15142.50	15142.50	NO
*LEAD	8/8	18.8158	25.77	25.77	YES
LITHIUM	5/8	———	7.08	4.98	YES
MAGNESIUM	8/8	———	2772.50	2772.50	YES
MANGANESE	8/8	357.6192	200.62	200.62	NO
*NICKEL	8/8	———	15.78	15.78	YES
POTASSIUM	6/8	———	1242.69	1087.13	YES
*SELENIUM	3/8	———	0.29	0.17	YES
SILICON	3/8	———	1610.00	1610.00	YES
SODIUM	3/8	357.6192	113.53	72.00	NO
STRONTIUM	7/8	———	58.69	54.81	YES
VANADIUM	8/8	24.1350	29.09	29.09	YES
ZINC	8/8	91.7952	107.37	107.37	YES

*F-LISTED WASTES
NOTE: All "U" data eliminated e.g., volatiles, semi-volatiles, pesticides, etc.

TABLE D-2
TOTAL RADIONUCLIDES - SEDIMENTS

ANALYTE	# OF DETECTS/ TOTAL	SEDIMENT-UPPER TOL. INTAKE (pCi/g)	$\bar{X}$ (pCi/g)	MEDIAN	DO RISK?
AMERICIUM-241	11/11	0.0281	0.0479	0.0330	YES
CESIUM-137	11/11	2.5959	0.0725	0.0674	NO
GROSS ALPHA	11/11	57.7542	17.0802	10.0200	NO
GROSS ALPHA	11/11	51.7571	26.0455	25.1300	NO
Pu-238	2/2	———	0.0075	0.0075	YES
Pu-239	11/11	0.0744	0.2826	0.1820	YES
RADIUM-226	11/11	1.1701	0.9737	0.9635	NO
RADIUM-228	11/11	1.5765	1.6520	1.8350	YES
STRONTIUM-90	11/11	1.1015	0.1864	0.1966	NO
TRITIUM	9/9	1.1157 (pCi/ml) *0.1004 (pCi/g)	97.1033	88.8900	YES
URANIUM-233, 234	11/11	1.6135	1.2053	1.1200	NO
URANIUM-235	11/11	0.9710	0.0839	0.0678	NO
URANIUM-238	11/11	0.8462	1.3900	1.2900	YES

CONVERSION FOR TRITIUM:

- Porosity
  8.78% H2O by Mass
- Bulk Density of Alluvium = 2 g/cc
  0.19 g H2O
  cc Soil
  0.09 g H2O/g Soil
  (pCi/ml) (.09g H2O) (ml) [1 cc = 1 ml]
  (g Soil)(lg)

TABLE D-3
TOXICITY VALUES SUMMARY CHART FOR DETECTS AND F-LISTED WASTES

ANALYTE ABOVE BACKGROUND (All Analyzed)	ORAL RfD (mg/kg/day)	ORAL SF (mg/kg/day)-1	INHALATION RfD (mg/m^3)	INHALATION SF (mg/kg/day)-1
ALUMINUM	——	——	——	——
*ARSENIC	3E-4 (I)**	——	——	5.0E+1 (H)**
*BARIUM	7E-2 (I)	——	5E-04 (H)	——
BERYLLIUM	5E-3 (I)	4.3E+0 (1,H)	——	8.4E+0 (H)
*CADMIUM	1E-3 (I)	——	——	6.1E+0 (H)
CALCIUM	——	——	——	——
*CHROMIUM VI	5E-3 (I)	——	——	4.1E+1 (H)
COBALT	——	——	——	——
COPPER	——	——	——	——
IRON	——	——	——	——
*LEAD	——	——	——	——
LITHIUM	——	——	——	——
MAGNESIUM	——	——	——	——
*NICKEL	2E-2 (I)	——	——	——
POTASSIUM	——	——	——	——
*SELENIUM	5E-3 (I)	——	——	——
SILICON	5E-3 (H)	——	——	——
SODIUM	——	——	——	——
STRONTIUM	8.8E-1 (H)	——	——	——
VANADIUM	7E-3 (H)	——	——	——
ZINC	2E-1 (H)	——	——	——

TABLE D-4
INGESTION CALCULATIONS OF METALS IN SOIL: CARCINOGENS AND NONCARCINOGENS

ANALYTE	$\overline{X}$ HALF (mg/kg)	SF	RfD	CARCIN INTAKE	NON-CARCIN INTAKE	RISK	HQ
ARSENIC	4.03	———	3E-4	———	6.5E-6	———	2.17E-2
BARIUM	122.08	———	7E-2	———	1.9E-4	———	2.82E-3
BERYLLIUM	0.7	4.3E+0	5E-3	4.85E-7	1.13E-6	2.08E-6	2.26E-4
CADMIUM	0.56	———		———	9.05E-7	———	9.05E-4
CHROMIUM III*	13.7	———		———	2.2E-5	———	2.21E-5
MANGANESE	61.8	———	2E-2	———	9.99E-5	———	9.99E-4
NICKEL	12.9	———	5E-3	———	2.08E-5	———	1.04E-3
SELENIUM	0.77	———	8.8E-1	———	1.2E-6	———	2.49E-4
STRONTIUM	54.71	———	7E-3	———	8.84E-5	———	1.04E-4
VANADIUM	30.1	———	2E-1	———	4.86E-5	———	6.9E-3
ZINC	86.1	———		———	1.39E-4	———	6.96E-4

ORAL RISK SUMMARY

Ingestion Risk Summary Based on $\overline{X}$ Half:
(a) Σ Risk Metals = 2.1 E-6
(b) HI Metals = 0.0357

TABLE D-5
INHALATION CALCULATIONS OF METALS IN SOIL: CARCINOGENS AND NONCARCINOGENS

ANALYTE	$\overline{X}$ HALF (mg/kg)	SF	RfD	CARCIN INTAKE	NON-CARCIN INTAKE	RISK	HQ
ARSENIC	4.03	5.0E+1	———	3.63E-9	———	1.81E-7	———
BARIUM	122.06	———	5E-4	———	2.56E-7	———	5.13E-4
BERYLLIUM	0.7	8.4E+0	———	6.3E-10	———	5.29E-9	———
CADMIUM	0.56	6.1E+0	———	5.04E-10	———	3.07E-9	———
MANGANESE	67.3	———	4.0E-4	———	1.41E-7	———	3.53E-4

INHALATION RISK SUMMARY

Inhalation Risk Summary Based on $\overline{X}$ Half:
(a) Σ Risk Metals = 1.9E-7

(b) HI Metals = 8.66E-4

TABLE D-6
RADIONUCLIDE RISK CALCULATIONS

RADIO-NUCLIDE ABOVE BACKGROUND	$\overline{X}$ HALF (pCi/g)	MEDIAN (pCi/g)	ORAL SF (pCi-1)	INHALATION SF (pCi-1)	$\overline{X}$ HALF	MEDIAN
AMERICIUM-241	0.0479	0.0330	2.4E-10 (H)	3.2E-8 (H)	2.6E-8	1.8E-8
PU-238	0.0075	0.0075	——	——	——	——
PU-239	0.2826	0.1820	2.3E-10 (H)	3.8E-8 (H)	1.7E-7	1.1E-7
RA-228	1.6520	1.8350	1.0E-10 (H)	6.9E-10 (H)	2.2E-7	2.4E-7
TRITIUM	97.1033	88.8900	——	——	——	——
URANIUM-238	1.3900	1.2900	2.8E-11 (H)	5.2E-8 (H)	6.1E-7	5.7E-7

NOTE: CS 137; Gross Alpha and Beta; Radium 226; Strontium 90; Uranium 233, 234, and 235, were below background, therefore no risk is associated.

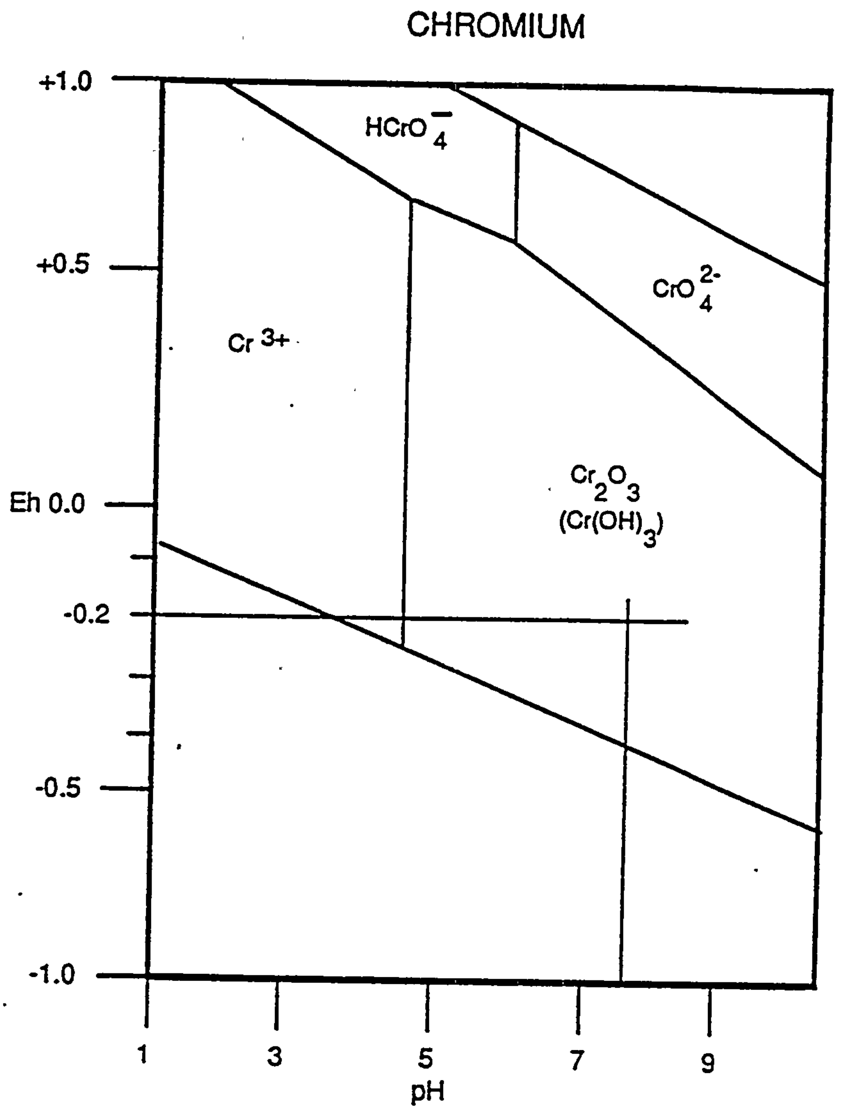
TOTAL RADIONUCLIDE RISK

(a)Σ Ingestion Risks = 2.93E-7

(b)Σ Inhalation Risks = 5.52E-7

Total Risk Due to Radionuclides = 8.45E-7

FIGURE D-1
Eh-pH DIAGRAM FOR A CHROMIUM-H_2O SYSTEM



Eh-pH Diagram for a Chromium-H_2O System, Where Chromium Activity is 10^{-6} (Dragun, 1988).

Appendix E

Memorandum of Agreement for the Administration of a Wetland Bank at Rocky Flats

MEMORANDUM OF AGREEMENT
FOR THE ADMINISTRATION OF A WETLAND BANK
AT ROCKY FLATS

Introduction

The Rocky Flats Environmental Technology Site (RFETS) is owned by the Department of Energy (DOE). The current site mission is environmental restoration, waste management, management of special nuclear materials, and decontamination and decommissioning of facilities.

The environmental impacts associated with past, present, and future activities at the site are being investigated by DOE pursuant to the requirements of the Atomic Energy Act (AEA), the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Response actions undertaken may result in wetland impacts regulated by Section 404 of the Clean Water Act (CWA) on the RFETS. Wetland impacts resulting from CERCLA and non-CERCLA actions require mitigation.

The 6,265 acre RFETS has approximately 1100 wetlands covering approximately 191 acres that were identified and mapped in a 1994 sitewide wetland delineation performed by the U.S. Army Corps of Engineers (the Corps) Omaha District. The wetland inventory as identified by the Corps map is the basis for the RFETS wetlands map (Wetlands Map) which establishes the baseline for the wetlands inventory.

Regulatory Authority

Section 121 (e) of CERCLA establishes that a CWA Section 404 permit is not required for CERCLA response actions conducted entirely on site. However, it is EPA's responsibility to ensure that the substantive requirements of CWA Section 404 are met. CERCLA response actions must meet the substantive requirements of Section 404 of the CWA. For non-CERCLA actions on RFETS, the Corps administers the substantive and administrative requirements of CWA Section 404 including compliance with CWA Section 404(b)(1) Guidelines. By agreement between EPA and the Corps, EPA will make the determination of whether or not wetlands impacts on RFETS are related to CERCLA response actions. If impacts are not CERCLA related, the Corps has jurisdiction. For the purposes of this memorandum, the regulatory agency with jurisdiction will be considered the Lead Agency.

This Memorandum of Agreement for the Administration of a Wetland Bank at RFETS (MOA) has been designed with consideration given to the Draft Federal Guidance for the Establishment, Use, and Operation of Mitigation Banks (Guidance).

Mitigation projects will comply with the following:

1. Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR Part 230) .

2. The Memorandum of Agreement between the EPA and the Department of the Army Concerning the Determination of Mitigation under the Clean Water Act Section 404(b)(1) Guidelines

3. The substantive requirements of Executive Order 11988, Floodplain Management.

4. The substantive requirements of Executive Order 11990, Protection of Wetlands.

5. The substantive requirements of 10 CFR 1022, Compliance with Floodplain/Wetland Environmental Review Requirements.

Purpose

This MOA is an agreement between DOE Rocky Flats Field Office (DOE, RFFO), EPA, the Corps, and the U.S. Fish and Wildlife Service (FWS), that describes how wetland impacts and mitigation will be accounted for using a mitigation bank established and maintained by DOE, RFFO. The sole purpose of this MOA is to provide the administrative procedure for using the acreage established by a wetland bank to ensure that RFETS wetland functions and values will be maintained.

This MOA is intended to enable DOE, RFFO to track compensatory mitigation for unavoidable wetland impacts resulting from DOE activities on the RFETS. This agreement is also intended to establish a means of tracking consolidation of compensatory mitigation for impacts to small, isolated, fragmented wetlands into parcels that provide enhanced wetland functions and values. The Parties agree that compensatory mitigation projects should be located where there are appropriate physical, hydrological, chemical, and biological characteristics to establish and maintain wetland functions and values in advance of wetland disturbance.

The Parties to this agreement have established that the goal of wetland mitigation is to achieve no overall net loss of wetland functions and values. This goal will be achieved by developing sustainable, functioning wetlands that provide compensatory mitigation for authorized unavoidable wetland impacts, while allowing CERCLA/RCRA response actions and other Site activities to proceed without unreasonable delays. The Parties to this agreement recognize that "no net loss" may not be achieved. However, it remains a goal to achieve no overall net loss of wetland functions and values resulting from RFETS activities.

Bank Administration

The DOE, RFFO, EPA, the Corps, and the FWS have agreed to the terms of this MOA, thereby establishing the administrative framework for managing the wetlands bank. DOE will take all necessary steps and use its best effort to obtain timely funding to meet commitments that may arise under this MOA. The Parties agree that any obligation of funds required as a result of this MOA are subject to the availability of appropriated funds, and no provisions shall be interpreted to require obligation or payments in violation of the Anti-Deficiency Act, 31 U.S.C. Sec. 1341.

Bank Sponsor/Administrator

DOE, RFFO is the wetland bank sponsor/administrator responsible for the overall management of the wetland inventory and responsible for ensuring wetland mitigation. DOE, RFFO will track compensatory mitigation for unavoidable impacts to wetlands resulting from DOE activities occurring within the RFETS boundary or within Operable Units associated with RFETS.

DOE, RFFO shall establish and maintain an accounting system in the form of a ledger that will document and track the credits and debits of the wetland bank. This ledger will provide an up to date running total of available wetland mitigation acreage. An example ledger used to administratively record each transaction is presented in Appendix A. Auditing of the ledger may be performed by EPA, the Corps, or the FWS on an as needed basis. In addition, field inspections and verification may be undertaken by any party to this MOA at any time.

DOE, RFFO shall prepare an annual report which documents all bank transactions occurring in the preceding 12 month period. This annual report shall be submitted to EPA, the Corps, and the FWS along with a revised site wetland inventory map. The revised map will show locations of projects that resulted in credits or debits for the preceding 12 month period.

Necessary Credit/Debit Documentation

Each wetland **credit** project submittal shall address the following information as appropriate:

* Identification of the Project Manager as point of contact
* Project description, including location maps and a description of the class and approximate acreage of wetland to be developed
* Plans for the restoration, creation, enhancement, or preservation of the compensatory wetland
* Project schedule
* Long term ownership and protection of the mitigation wetland, including appropriate real estate agreements and legal instruments which prevent harmful activities that would jeopardize the continued conservation purpose of the wetland
* Opportunity for public review and participation
* Availability of the water supply
* Funds for the development, operation, maintenance, and monitoring of the project during the bank's operational life, as well as for management of the project
* Performance standard for determining success of the wetland project and a monitoring plan to ensure that the standards are being met.
* Field verification of approximate acreage and kind, when established
* Maintenance plan.
* Remedial action plan describing the procedures for identifying and implementing appropriate remedial action when the need is identified by the monitoring plan.

Each wetland **debit** project submittal shall address the following information as appropriate:

* Identification of the Project Manager as the point of contact
* Project description, including location maps and a description of the class and approximate acreage of wetland to be impacted.
* Sequencing documentation
* Reasons and plans for impacting the wetlands
* Field verification of approximate acreage and kind

* Project schedule
* Opportunity for public review and participation

Checklists of required items for each credit and/or debit wetlands project are presented in Appendix B. The Parties may enlist the participation of various local, state, or federal entities to assist in the development of individual wetland projects.

Credit/Debit Evaluation

In general, the same methodology will be used to evaluate both credits and debits. DOE shall submit credit and debit documentation to the EPA and the Corps. Individual project requirements and schedules will be established by agreement between the Lead Agency and the DOE, RFFO project manager. In general, the Lead Agency will review documents submitted by DOE within 30 days. DOE will revise and resubmit documents for review within 30 days of receipt of comments and shall request approval from the Lead Agency.

The EPA and the Corps, in consultation with the FWS, will review mitigation projects proposed by DOE for use as wetland bank credits in accordance with the provisions of this MOA. Projects proposed by DOE for use as wetland mitigation bank credits will be identified using the 1987 Corps of Engineers Wetlands Delineation Manual, the same methodology as that used in the 1994 sitewide wetland delineation. After review, the EPA and the Corps will then, if they deem appropriate, approve. If approval is not given, EPA and/or the Corps will provide detailed explanation for disapproval.

For debit projects, the Lead Agency, in consultation with the FWS, will review the documentation. The Lead Agency will then, if deemed appropriate, approve. If approval is not given, the Lead Agency will provide detailed explanation for disapproval.

The credits and debits will be based on the number of acres of wetlands and on the Cowardin class of the wetland. Compensatory wetlands of the same Cowardin class as those being impacted will be considered in-kind mitigation. Appropriate mitigation ratios will be determined on a case by case basis, using professional judgment.

The credit value will be determined based on acreage to be attained from the compensatory wetlands at the time of debiting. The maturity of the compensation wetland and its apparent ability to survive and function, based on best professional judgment, should be factors in determining the value of the credits available. The debit value will be determined based on the areal extent of the impacted wetland, after considering the condition of the impacted wetland. The Lead Agency will make the determination of the relative value of credit and debit acreage.

Timing of Debits

In general, impacts to wetlands will not occur unless there is sufficient acreage available in the wetland bank to adequately mitigate for the impacts. It may be appropriate to allow limited debiting based upon a projected wetland acreage. Once an area has been mitigated for any project, that area will not require any future mitigation for impacts from that project (e.g., impacts associated with maintenance of ditches).

Sequencing Requirements

Site wetland mitigation will consist of sequentially avoiding wetland impacts, minimizing wetland impacts, and finally providing compensatory mitigation for any remaining unavoidable impacts. This sequencing will be consistent with mitigation policies established under the Section 404(b)(1) Guidelines and described in the MOA between the EPA and the Department of the Army. Bank credits will be used to provide compensatory mitigation only after this sequencing has been followed.

Wetlands Map

A RFETS Wetland Map will be prepared that is based on the wetlands delineation undertaken by the Corps of Engineers in 1994. The RFETS Wetland Map will be updated to reflect changes that occur in wetland extent and location.

Siting of Compensatory Wetlands

Compensatory mitigation should be undertaken in areas adjacent or contiguous to the impact site when practicable and environmentally preferable. The preference for on-site mitigation, however, should not preclude the use of an off-site mitigation project when there is no practicable opportunity for on-site compensation, or when use of an off-site project is environmentally preferable to on-site compensation. Mitigation locations will be selected after consideration of the potential for the site to provide the necessary physical, chemical, hydrologic, and biological characteristics and the desired wetland functions and values. The adequacy of the water supply, and the compatibility with adjacent land uses and watershed management plans will also be considered during site selection. Impacts to ecologically significant resources (e.g., upland and wetland), cultural resources, and threatened and endangered species will be avoided to the maximum extent practicable.

Compensatory wetland sites that allow in-kind replacement of wetlands will be preferable; however, locations that best support a different type of wetland (out-of-kind) may be used as compensatory mitigation in situations determined by the Lead Agency to be environmentally preferable.

Dispute Resolution

Except as discussed below, any disputes resulting over issues related to the mitigation bank will be addressed and resolved according to the dispute resolution provisions identified in the *Federal Guidance for the Establishment, Use, and Operation of Mitigation Banks*. The Guidance referenced above contemplates only banks for Corps lead activities and projects. In activities related to CERCLA response actions, EPA is the lead agency and the parts of the Guidance referencing the Corps' role shall be interpreted to mean EPA's role.

The Parties to this agreement reserve their right to challenge any decision made by the other Parties to this agreement under all applicable laws relating to that decision.

Mitigation MOA Operational Life

This MOA will terminate upon written notification by any one of the signatories to DOE, the EPA, the Corps, and the FWS. Management and protection of the individual wetland projects undertaken will continue in compliance with the requirements of applicable laws.

MEMORANDUM OF AGREEMENT
FOR THE ADMINISTRATION OF A WETLAND BANK
AT ROCKY FLATS

James K. Hartman
Assistant Manager of Site Support and Security
DOE, RFFO Representative

Oct. 25, 1995
Date

Max H. Dodson
Director, Ecosystems Protection and Remediation Division
EPA, Region VIII Representative

11/15/95
Date

Michael S. Meuleners
Colonel, District Engineer
U.S. Army Corps of Engineers Representative

2/6/96
Date

U.S. Fish and Wildlife Service Representative

3-11-96
Date

REFERENCES

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. La Roe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U. S. Fish and Wildlife Service Biological Report FWS/OBS-79/31.

DOE, 1991, Rocky Flats Interagency Agreement, January 22, 1991.

Draft Federal Guidance for the Establishment, Use and Operation of Mitigation Banks, Federal Register, Vol. 60, No. 43, March 6, 1995.

Executive Order 11988 (Floodplain Management).

Executive Order 11990 (Protection of Wetlands).

Letter from Bradley Miller, EPA to Tim Carey, U. S. Army Corps of Engineers dated January 5, 1993.

Letter from Timothy Carey, U. S. Army Corps of Engineers to David Simonson, DOE, RFFO, dated December 27, 1991.

Memorandum of Agreement between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation under the Clean Water Act Section 404(b)(1) Guidelines.

Section 404 (b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR Part 230).

U.S. Corps of Engineers. 1987. Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

U. S. Army Corps of Engineers. 1994. Rocky Flats Plant Wetlands Mapping and Resource Study. Prepared for U. S. Department of Energy, Golden, Colorado. U. S. Army Corps of Engineers, Omaha District.

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
WETLAND MITIGATION BANK - CREDITS
EXAMPLE

Transaction #	Date	Map Location	Project Description	Acres	Credit
0001		Map 2 - A-7	Offsite wetland creation as part of Standley Lake Protection Project, completed June 25, 1995 at a cost of $XX,XXX.	8.07 PSS 3.65 PEM	8.07 PSS 3.65 PEM
0005		Map 3 - C -8	Two Ponds Wetlands Enhancement, completed September 21, 1995 at a cost of $XX,XXX	2.00 PFO	2.00 PFO

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
WETLAND MITIGATION BANK - DEBITS
EXAMPLE

Transaction #	Date	Map Location	Project Description	Acres	Mitigation Ratio	Total Debit
0002		Map 1 - F-4	RFETS Sandrock Blanket installation at Pond X-X, completed X, X, 1995. Mitigation credit taken from Standley Lake Protection Project (Map 2-A-7)	0.01 PSS	2 to 1	0.02 PSS
0003		Map 1 - C-5	Cleanout of culverts located in XXXXX, completed X, X, 1995. Mitigtaion credit taken from Standley Lake Protection Project (Map 2-A-7)	0.50 PSS 0.02 PEM	2 to 1 2 to 1	1.00 PSS 0.04 PEM
0004		Map 1 - D - 3	Cleanout of culverts located in XXXX, completed X, X, 1995. Mitigation credit taken from Standley Lake Protection Project (Map 2 - A - 7)	0.04 PSS 0.08 PEM	2 to 1 2 to 1	0.08 PSS 0.16 PEM
0006		Map 1 - D - 1	Cleanout of culverts located in XXXX, completed X, X, 1995. Mitigation credit taken from Standley Lake Protection Project (Map 2 - A - 7)	0.02	2 to 1	0.04

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
WETLAND MITIGATION BANK - DEBITS AND CREDITS COMBINED
EXAMPLE

Transaction #	Date	Map Location	Project Description	Type of Trans.	Acres	Mitig. Ratio	Total Debit	Total Credit
0001		Map 2 - A-7	Offsite wetland creation as part of Standley Lake Protection Project, completed June 25, 1995 at a cost of $XX,XXX.	Credit	8.07 PSS 3.65 PEM			8.07 PSS 3.65 PEM
0002		Map 1 - F-4	RFETS Sandrock Blanket installation at Pond X-X, completed X, X, 1995. Mitigation credit taken from Standley Lake Protection Project (Map 2-A-7)	Debit	0.01 PSS	2 to 1	0.02 PSS	
0003		Map 1 - C-5	Cleanout of culverts located in XXXXX, completed X, X, 1995. Miitgiaion credit taken from Standley Lake Protection Project (Map 2-A-7)	Debit	0.50 PSS 0.02 PEM	2 to 1 2 to 1	1.00 PSS 0.04 PEM	
0004		Map 1 - D - 3	Cleanout of culverts located in XXXX, completed X, X, 1995. Mitigation credit taken from Standley Lake Protection Project (Map 2 - A - 7)	Debit	0.04 PSS 0.08 PEM	2 to 1 2 to 1	0.08 PSS 0.16 PEM	
0005		Map 3 - C -8	Two Ponds Wetlands Enhancement, completed September 21, 1995 at a cost of $XX,XXX	Credit	2.00 PFO			2.00 PFO

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
WETLAND MITIGATION BANK BALANCE LEDGER
EXAMPLE

Trans. No.	Date	Credits (Acres) Wetland Type						Debits (Acres) Wetland Type						Balance (Acres) Wetland Type					
		PEM	PSS	PAB	PUB	PFO	PSB	PEM	PSS	PAB	PUB	PFO	PSB	PEM	PSS	PAB	PUB	PFO	PSB
0001		3.65	8.07											3.65	8.07				
0002									0.02					3.65	8.05				
0003								0.04	1.00					3.61	7.05				
0004								0.08	0.04					3.53	7.01				
0005						2.00								3.53	7.01			2.00	
0006												0.02		3.53	7.01			1.98	
0007									2.10					3.53	4.91			1.98	
0008								0.53						3.00	4.91			1.98	
0009																			
0010																			
0011																			
0012																			
0013																			
0014																			

CHECKLIST

for

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE WETLAND MITIGATION BANK CREDIT PROJECTS

Each compensatory wetland mitigation project submittal should address the following information as appropriate:

- Identification of Project Manager as point of contact.
- Project description, including location maps and a description of the class and approximate acreage of wetland to be developed.
- Plans for the restoration, creation, enhancement, or preservation of the compensatory wetland.
- Project schedule.
- Long term ownership and protection of the mitigation wetland, including appropriate real estate agreements and legal instruments which prevent harmful activities that would jeopardize the continued conservation purpose of the wetland.
- Opportunity for public review and participation.
- Availability of the water supply.
- Funds for the development, operation, maintenance, and monitoring of the project during the Banks operational life, as well as for management of the project.
- Performance standards for determining success of the wetland project.
- Maintenance plan.
- Field verification of approximate acreage and kind, when established.
- Monitoring plan adequate to evaluate the success of the wetland and to identify field conditions requiring remedial action.
- Remedial action plan describing the procedures for determining and implementing appropriate remedial actions when the need is identified by the monitoring plan.
- Contingency plan, including sufficient funding, to be used in the event of a project failure.

CHECKLIST

for

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
WETLAND MITIGATION BANK DEBIT PROJECTS

Each wetland impact project submittal should address the following information as appropriate:

- Identification of Project Manager as point of contact.
- Project description, including location maps and a description of the class and approximate acreage of wetland to be impacted.
- Sequencing documentation.
- Reasons and plans for impacting the wetlands.
- Project schedule.
- Field verification of approximate acreage and kind.
- Opportunity for public review and participation.

U. S. Department of Energy
Finding of No Significant Impact
Surface Water Drainage System at
Rocky Flats Environmental Technology Site

U. S. DEPARTMENT OF ENERGY
FINDING OF NO SIGNIFICANT IMPACT
SURFACE WATER DRAINAGE SYSTEM AT
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

SUMMARY: The Department of Energy (DOE) has prepared an environmental assessment (EA), DOE/EA-1093, of activities proposed to correct deficiencies in, and then to maintain, the surface water drainage system serving the DOE's Rocky Flats Environmental Technology Site (Rocky Flats or Site) near Golden, Colorado. The scope of the EA includes alternatives to the proposed action including the no action alternative and partial implementation of the proposed action. No comments were received during a public comment period from September 1 to October 1, 1995.

The DOE has determined that portions of the surface water drainage system may not be adequate to convey the runoff from a 100-year storm event, thus creating the potential for terminal pond dams to be breached and contaminants to be transported from the individual hazardous substance sites into surface water.

PROPOSED ACTION: To ensure the surface water drainage system at the Site is adequate and to comply with the Clean Water Act §402(p)(1)(B), the Site's National Pollution Discharge Elimination System permit, and DOE Order 6430 requirements for controlling stormwater runoff, the DOE proposes that a management program including repair, upgrade, and maintenance of the Site's surface water drainage system be implemented. The following maintenance programs, projects, and environmental control measures are integral to the proposed integrated program:

- Industrial Area Maintenance Program
- Buffer Zone Maintenance Program
- Pond A-1 Bypass Upgrades Project
- South Interceptor Ditch Repair Project
- Environmental Control Measures
    - Contaminant Transport Control
    - Wetland Impact Minimization
    - Wetland Replacement
    - Spill Prevention, Containment, and Cleanup
    - Biota Protection
    - Erosion Control
    - Revegetation
    - Work Specification
    - Worker Health Protection

The specifics of these programs, projects, and control measures are described in the EA. While the EA analyzes the full scope of the proposed action as described above, the DOE may implement any, all, or none of the actions described.

ALTERNATIVES CONSIDERED: The EA examined the no action alternative which would maintain the status quo by continuing routine maintenance of the drainage system in areas where there are no protected biota or wetland vegetation. This alternative was deemed unacceptable because it did not meet the need to make improvements so that the surface water drainage system is adequate. Partial implementation of the proposed action, consisting of only those parts of the proposed action involving repair or replacement, was the other alternative considered in detail. This alternative would provide some improvements to the drainage system, but was deemed insufficient.

Alternatives initially considered but not analyzed in detail were total upgrade of the surface water drainage system, rerouting of drainage flows to a centralized waterway, and reduction of runoff into the surface water drainage system. The total upgrade alternative was determined to be too expensive given the current Site mission and would cause too much disturbance to Site soil, sediment, wetlands, biota, and daily operations. The rerouting of drainage flows alternative was dismissed for the same reasons. Reducing runoff into the surface water drainage system was also determined to be unfeasible because it, too, would require extensive disturbance to the environment and Site facilities and would not provide sufficient runoff control.

ENVIRONMENTAL EFFECTS: The proposed action would potentially affect biological resources (wetlands and wildlife), physical resources (surface water), and human health. Approximately 0.29 acres of wetlands would be damaged or removed during structure cleanout which is necessary to meet the need for correcting deficiencies in the Site's surface water drainage system identified in the EA. Replacement wetlands from the Site Wetland Mitigation Bank will be utilized to mitigate the loss of wetlands resulting from the proposed action, as agreed to in a Memorandum of Agreement between the DOE, the Environmental Protection Agency, the Army Corps of Engineers, and the Fish and Wildlife Service dated April 16, 1996 . The Site's standard procedures for complying with the Endangered Species Act and the Migratory Bird Treaty Act would be followed to minimize effects on Site wildlife.

Construction activities could potentially affect water quality by resuspending sediments and creating turbidity. To avoid these impacts, all final construction plans would be subject to the Site's standard procedures outlined in the Watershed Management Plan for Rocky Flats. Project-specific health and safety plans would be developed and reviewed by the safety organization to ensure that all applicable safety requirements for protection of human health were met.

DETERMINATION: Based on the information and analyses of impacts in the EA, the DOE has determined that the proposed action does not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the NEPA. Therefore, preparation of an environmental impact statement is not required. The DOE is approving this Environmental Assessment and issuing this Finding of No Significant Impact for the proposed action.

Signed in Golden, Colorado, this 21st day of May, 1996.

Mark N. Silverman
Manager
Rocky Flats Field Office
U.S. Department of Energy

FOR FURTHER INFORMATION ABOUT THIS ACTION CONTACT:

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PUBLIC AVAILABILITY:

Copies of this EA or further information on the DOE NEPA process are available from:

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