1020363

CORRECTIVE ACTION DECISION/ RECORD OF DECISION FOR ROCKY FLATS PLANT (USDOE) PERIPHERAL OPERABLE UNIT AND CENTRAL OPERABLE UNIT

JEFFERSON AND BOULDER COUNTIES, COLORADO

DECLARATION

SITE NAME AND LOCATION

The Rocky Flats Plant (also referred to as the Rocky Flats Environmental Technology Site, RFETS, Rocky Flats, or simply as the site), is a 6,241-acre Department of Energy (DOE) facility owned by the United States. Rocky Flats is located in the Denver metropolitan area, approximately sixteen miles northwest of Denver, Colorado, and ten miles south of Boulder, Colorado. Nearby communities include the Cities of Arvada, Broomfield, and Westminster, Colorado. The majority of the site is located in Jefferson County, with a small portion located in Boulder County, Colorado.

The EPA Superfund Identification Number for Rocky Flats is CO7890010526. Two Operable Units (OUs) are present within the boundaries of the site: the Peripheral OU and the Central OU. The Central OU consolidates all areas of the site that will require additional remedial/corrective actions, while also considering practicalities of future land management. The Offsite Areas at Rocky Flats, also known as OU 3, were addressed under a separate Corrective Action Decision/ Record of Decision (CAD/ROD) dated June 3, 1997, EPA/ROD/R08-97/196 1997 (DOE 1997).

STATEMENT OF BASIS AND PURPOSE

This document presents the selected corrective actions/remedial actions for the Peripheral OU and the Central OU at Rocky Flats. These actions were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986. The selected remedies/corrective actions were also chosen in accordance with the Colorado Hazardous Waste Act (CHWA). The Resource Conservation and Recovery Act (RCRA) is administered in Colorado through the CHWA, by the Colorado Department of Public Health and Environment (CDPHE). This document fulfills the requirements of a Corrective Action Decision under CHWA. To the extent practicable, the selected remedies are also consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

Rocky Flats was investigated and the remedies were selected in compliance with the Federal Facility Agreement and Consent Order – Rocky Flats Cleanup Agreement (RFCA) (DOE, et al. 1996), signed by the U.S. Environmental Protection Agency (EPA), the State of Colorado, and DOE on July 19, 1996. RFCA governed the cleanup of Rocky Flats. The remedy selection for the Peripheral OU and the Central OU is based on the Administrative Record for Rocky Flats. The State of Colorado and EPA concur with the selected remedy/corrective action.

ASSESSMENT OF THE SITE

Rocky Flats was proposed by EPA for inclusion on the CERCLA National Priorities List in 1984 (EPA 1984), and the listing became final in 1989 (DOE 1989). The site was proposed for listing because activities at Rocky Flats resulted in the release of materials defined by CERCLA as hazardous substances, contaminants, and pollutants. Hazardous substances released to the environment from the activities at Rocky Flats have included, but were not limited to: radionuclides (such as plutonium-239/240, americium-241, and various uranium isotopes), organic solvents (such as trichloroethene, tetrachloroethene, and carbon tetrachloride), metals (such as chromium), and contaminants such as nitrates. Apart from the activities of DOE and its contractors, there are no other known, significant, human-caused sources of contamination at Rocky Flats.

Considerable site remediation took place during the late 1990s and early 2000s under the auspices of RFCA, which adopted an accelerated action approach to the cleanup, equivalent to the removal authority found in CERCLA. Major site accomplishments completed under RFCA, and to complete site closure in general, included:

- removal of 21 tons of weapons-grade nuclear material (plutonium and enriched uranium);
- removal of 800 structures, including five major plutonium facilities and two major uranium facilities;
- treatment to date of more than sixteen million gallons of contaminated groundwater and seep water;
- investigation and appropriate disposition of 421 Individual Hazardous Substance Sites (IHSSs);
- construction of three passive groundwater treatment systems, one passive seep treatment system, and two engineered covers over abandoned landfills; and,
- removal of more than 1.3 million cubic meters of waste, including contaminated soils.

The RCRA Facility Investigation-Remedial Investigation/Corrective Measures Study-Feasibility Study (RI/FS) (DOE 2006) and Proposed Plan (DOE 2006a) evaluated site conditions and considered the need for additional remedial actions in light of the cleanup activities already performed at Rocky Flats.

In accordance with the Rocky Flats National Wildlife Refuge Act of 2001, Public Law 107-107 (Refuge Act), the future use of Rocky Flats is as a national wildlife refuge. The U.S. Fish and Wildlife Service (USFWS) will assume jurisdiction and control of most of the site for wildlife refuge purposes. The DOE will retain jurisdiction of real property and facilities to be used in carrying out any final response actions. There is no current or planned residential use of the site, and Rocky Flats is not an environmental justice site.

Based upon the RI/FS report, which included both a Human Health and Ecological Risk Assessment, DOE (as the Lead Agency under CERCLA) has determined that no action is necessary to protect public health or welfare or the environment for the Peripheral Operable Unit. For the Central Operable Unit, the response action selected in this CAD/ROD is necessary to protect public health or welfare or the environment from actual or threatened releases of pollutants or contaminants from this site.

DESCRIPTION OF THE SELECTED REMEDIES

The selected remedy/corrective action for the Peripheral OU is no action. The RI/FS report concludes that the Peripheral OU is already in a state protective of human health and the environment. The NCP provides for the selection of a no action remedy when an OU is in such a protective state and therefore, no remedial action for the Peripheral OU is warranted.

The selected remedy/corrective action in the Central OU is institutional and physical controls, incorporating continued monitoring and maintenance. As mentioned, substantial remedial actions have already been conducted at Rocky Flats. The RI/FS evaluated site data and the need for additional remedial actions in light of the accelerated actions that had already been completed. The selected remedy/corrective action includes management actions that are designed to ensure that the site remains protective of human health and welfare and the environment, and to ensure that existing remedies continue to function properly.

Source materials constituting principal threats in the Central OU at Rocky Flats (that is, solvents such as trichloroethene, also known as dense non-aqueous phase liquids) have been addressed through accelerated actions such as source removal, installation of passive groundwater collection and treatment systems, and groundwater quality enhancements. These actions are not expected to eliminate groundwater contamination in the short term, but are expected to have a positive long-term impact on groundwater and surface water quality.

The major components of the selected remedy/corrective action for the Central OU are as follows:

1) monitoring and maintenance of accelerated actions completed at the Present and Original Landfills, and at the passive groundwater collection and treatment systems;
2) environmental monitoring based upon the Rocky Flats Fiscal Year (FY) 2005 Integrated Monitoring Plan (K-H 2005), as well as additional sampling to reduce some uncertainties associated with the Ecological Risk Assessment;
3) the following institutional controls –
    a. the construction and use of buildings that will be occupied on a permanent or temporary basis (such as for residences or offices) is prohibited;
    b. excavation, drilling and other intrusive activities below a depth of three feet are prohibited, except for remedy-related purposes and routine or emergency maintenance of existing utility easements, in accordance with pre-approved procedures;
    c. no grading, excavation, digging, tilling, or other disturbance of surface soils of any kind is permitted, except in accordance with an erosion control plan (including Surface Water Protection Plans submitted to EPA under the Clean Water Act) approved by EPA or CDPHE; any such soil disturbance shall restore the soil surface to pre-existing grade;
    d. surface water may not be used for drinking water or agricultural purposes;
    e. the construction or operation of groundwater wells is prohibited, except for remedy-related purposes;
    f. digging, drilling, tilling, grading, excavation, construction of any sort, and vehicular traffic, are prohibited on the covers of the Present and Original Landfills, except for authorized response actions; and,
    g. activities that may damage or impair the proper functioning of any engineered component of the response action, including but not limited to any treatment system, monitoring well, landfill cap or surveyed benchmark are prohibited; and,
4) physical controls to consist of signage to be installed along the perimeter of the Central OU, and protection of engineered components of the remedy, monitoring locations and survey points so as to ensure that they continue to function as designed.

The selected remedy/corrective action will be implemented through a modification to the Rocky Flats Environmental Covenant (DOE 2006b) to include all of the institutional controls required for the Central OU, through DOE retention of jurisdiction for or access to any real property to be used in carrying out the final response action (that is, the Central OU and designated monitoring points outside the Central OU), and through an interagency agreement/corrective action order among DOE, EPA and CDPHE.

CERCLA STATUTORY DETERMINATIONS

The selected remedy/corrective action for the Peripheral OU attains the mandates of CERCLA Section 121, and to the extent practicable, the NCP. The selected remedy for the Peripheral OU is protective of human health and the environment, complies with applicable or relevant and appropriate requirements (ARARs), and is cost-effective. The selected remedy/corrective action complies with applicable requirements of the CHWA. No accelerated actions were taken in the Peripheral OU, and no remedial action alternatives were evaluated for the Peripheral OU. Because no hazardous substances, pollutants, or contaminants occur in the Peripheral OU above levels that allow for unlimited use and unrestricted exposure, a five-year review will not be required for the selected remedy/corrective action in the Peripheral OU.

The selected remedy/corrective action for the Central OU attains the mandates of CERCLA Section 121, and to the extent practicable, the NCP. The selected remedy/corrective action for the Central OU is protective of human health and the environment, complies with ARARs, and is cost-effective. The selected remedy/corrective action utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and also satisfies the statutory preference for treatment as a principal element of the remedy. The selected remedy/corrective action complies with applicable requirements of the CHWA. Because this remedy will result in hazardous substances, pollutants or contaminants remaining in the Central OU above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years to ensure that the remedy continues to be protective of human health and the environment. In order to coordinate this review with the schedule for periodic review already established at Rocky Flats (DOE 2002), the next remedy review will be performed by September 2007.

CAD/ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this CAD/ROD. Additional information can be found in the CAD/ROD Administrative Record file for Rocky Flats.

- Analytes of Interest (AOIs) and chemicals of concern (COCs) and their respective concentrations.

- Comprehensive risks represented by the chemicals of concern.

- Cleanup levels established for surface and groundwater AOIs and the basis for these levels.

- How source materials constituting principal threats are addressed (not applicable to the Peripheral OU).

- Current and reasonably anticipated future land use assumptions and potential future beneficial uses of groundwater used in the comprehensive risk assessment and the CAD/ROD.
- Potential land and groundwater use that will be available at Rocky Flats as a result of the selected remedies/corrective actions.
- Estimated capital, annual operation and maintenance, and total present worth costs, and the number of years over which the remedy cost estimates are projected (not applicable to the Peripheral OU).
- Key factors that led to selecting the remedies/corrective actions.

AUTHORIZING SIGNATURES

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9/29/06
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DECISION SUMMARY

1. SITE NAME, LOCATION AND DESCRIPTION

The Rocky Flats Plant (also referred to as the Rocky Flats Environmental Technology Site, RFETS, Rocky Flats, or simply as the site), is a 6,241-acre DOE facility owned by the United States. Rocky Flats is located in the Denver metropolitan area, approximately sixteen miles northwest of Denver, Colorado, and ten miles south of Boulder, Colorado (Figure 1). Nearby communities include the Cities of Arvada, Broomfield, and Westminster, Colorado. The majority of the site is located in Jefferson County, with a small portion located in Boulder County, Colorado.

The EPA Superfund Identification Number for Rocky Flats is CO7890010526. DOE is the lead agency for the remediation under CERCLA, in accordance with Executive Order 12580. EPA and CDPHE are the Support Agencies. DOE provided funding for the cleanup activities at Rocky Flats, and will continue to provide for the ongoing remedy, using funds appropriated annually by Congress.

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Rocky Flats was a large industrial facility, comprised of over 800 structures, including several large processing facilities for plutonium and uranium. The vast majority of industrial activities (including waste disposal), took place in or near the center of the site, in the approximately 300-acre Industrial Area. Several waste disposal pits and two larger landfills are or were present at the site (Figure 2).

The majority of the site, known previously as the Buffer Zone, contained some supporting activities such as waste disposal, but was generally left undisturbed. This land provided a security and safety buffer area around the Industrial Area. Portions of the Buffer Zone have been co-managed by the U.S. Fish and Wildlife Service for ecological resources since 1999.

The Atomic Energy Commission and its successor agency, the Energy Research and Development Administration, had jurisdiction and control of Rocky Flats from 1951 to 1974, and from 1975 to 1977, respectively. Since 1977, the site has been under the jurisdiction and control of DOE. Since 1951, four companies have managed and operated Rocky Flats on behalf of DOE or its predecessors. Dow Chemical Company managed the site from its inception until 1975, at which time Rockwell International Company (Rockwell) became the contractor. EG&G Rocky Flats became the contractor in 1990. Kaiser-Hill Company, LLC (K-H) was the contractor after July 1, 1995. K-H was DOE's contractor that performed the vast majority of cleanup and closure work at Rocky Flats. Ongoing site operations are performed by the DOE Office of Legacy Management, with site operations performed under contract to S.M. Stoller Corporation.

The mission of the site changed in the early 1990s. In February 1991, DOE introduced a plan to realign the Nation's nuclear weapons program. As part of this realignment, DOE announced in February 1992 that Rocky Flats would no longer have a nuclear weapons production mission. Since that time (with the exception of limited production of stainless steel parts that continued through the early 1990s), the mission at Rocky Flats was the safe storage and disposition of nuclear weapons materials and wastes, the safe deactivation of nuclear production facilities, demolition and removal of buildings and infrastructure, and environmental cleanup. The vast majority of these activities were completed in late 2005. Current site activities include environmental monitoring, maintenance of environmental response actions, and land and natural resources management. Per the Refuge Act of 2001, the Secretary of Energy shall transfer administrative jurisdiction over certain lands at Rocky Flats to the Secretary of the Interior, for the purpose of establishing the Rocky Flats National Wildlife Refuge. This transfer is expected to occur in 2007.

Over the decades, manufacturing activities, accidental industrial fires and spills, and support activities such as waste management resulted in the release of contaminants to the air, soil, sediment, groundwater, and surface water at Rocky Flats. Some of the more noteworthy environmental incidents and practices were:

- Building fires occurred on a number of occasions at Rocky Flats; of these, two are most notable. On September 11, 1957, a fire occurred in a glovebox in historic Building 771 in a plutonium fabrication line. The fire and subsequent control efforts resulted in the spread of contamination within the building and breached the filter plenums. On May 11, 1969, a major fire occurred in gloveboxes in historic Building 776, started by the spontaneous ignition of plutonium, causing extensive building contamination and release of plutonium to the atmosphere. The fire led to a number of follow-on actions including use of inert atmospheres in gloveboxes, upgrades to the retention pond system, and purchase (in 1974) of additional buffer zone property.

- Drum storage in the area known as the historic 903 Pad, located off the southeast corner of the former Industrial Area, caused environmental contamination. The Plant stored drums containing radioactive waste on the Pad beginning at least in 1958, and possibly as early as 1955. The wastes contained various hazardous constituents, including beryllium, solvents and uranium, as well as waste oils containing plutonium-239/240. Leaking drums were discovered as early as 1959, when a rust inhibitor was added to the drum contents in an attempt to prevent further deterioration. The area was closed in April 1967 when a heavy rainstorm caused the release of more contamination from the drums. The drums were removed in 1968, by which time numerous drums were empty, their contents having leaked entirely. Plant personnel placed an asphalt pad over the area in November 1969. The 903 Pad is the major source for plutonium-239/240 releases to the environment from Rocky Flats operations.

- The Plant used various disposal trenches and waste dumps during its early years. Many of these historic disposal sites, such as the Mound and Trenches T-1, T-3, and T-4, are located just to the northeast of the 903 Pad, in the Mound-East Trenches Area. The various disposal areas were used from about 1954 to 1968. Many of the wastes that ended up there originated from historic Building 444 or other buildings on the south side of the former Industrial Area. Common contaminants included depleted uranium and solvents; uranium in drums excavated from Trench T-1 made it necessary to take precautions to prevent these drums from catching fire from spontaneous combustion. A number of these sites (the Mound Source Area and Trenches T-1, T-3 and T-4) were remediated in the late 1990s.

- The Plant put wastewaters containing nitrates and radioactive contaminants (primarily uranium) in a series of solar evaporation ponds that were in use in various configurations since December 1953. The Solar Ponds were located in the northeast corner of the former Industrial Area, and were lined with earth, clay, concrete, asphalt and other materials at one time or another. In 1961, results from monitoring wells showed high nitrate concentrations in groundwater around the ponds, and a French drain system to capture this groundwater was installed in the 1960s. This system was upgraded in 1981, to include a pump house to capture more of the contaminated water. The Solar Ponds no longer exist, having been drained and the sludge removed from them in the 1980s and 1990s.

- Two major landfills operated at the site. The first, known as the Original Landfill, occupies about twenty acres on the north side of Woman Creek. The Original Landfill operated as a waste dump from the opening of Rocky Flats in 1952 until 1968. The landfill contains about 70,000 cubic yards of waste of various types, including construction debris, concrete, scrap metal, etc. The landfill also contains solvents, paints, oils, pesticides, and items contaminated with beryllium and uranium. The second landfill, known as the Present Landfill, was located north of the former Industrial Area at the head of No Name Gulch, the drainage immediately to the north of North Walnut Creek. Disposal operations began there in 1968, and continued until 1998. The landfill was originally intended as a sanitary landfill to receive uncontaminated solid wastes such as office trash, construction debris, scrap metal, etc. However, the landfill also received hazardous wastes streams (such as paints and solvents), beryllium-contaminated materials, asbestos-containing materials, PCBs from fluorescent light ballasts, and radioactively contaminated sludge from the Rocky Flats Sewage Treatment Plant. The landfill occupies about twenty acres, and is unlined.

Locations of the aforementioned areas are shown on Figure 2. Contaminants released to the environment from the activities at Rocky Flats have included, but were not limited to: radionuclides (such as plutonium-239/240, americium-241, and various uranium

isotopes), organic solvents (such as trichloroethene, tetrachloroethene, and carbon tetrachloride), metals (such as chromium), and nitrates.

In 1989, The Federal Bureau of Investigation and EPA agents executed a search warrant to confirm alleged violations of federal environmental laws and regulations at Rocky Flats. Following the search, the U.S. Department of Justice indicted Rockwell, the management and operating contractor at the time of the search, for commission of environmental crimes at the site. In 1992, Rockwell's plea of guilty for environmental crimes was accepted in District Court, and Rockwell consequently agreed to pay a fine of $18.5 million.

Results of early environmental investigations indicated that such operations at Rocky Flats had resulted in the release of materials defined by CERCLA as hazardous substances, contaminants and pollutants, and by the RCRA as hazardous wastes and hazardous waste constituents. Environmental investigation and cleanup of Rocky Flats took place under the auspices of three compliance agreements/orders.

The 1986 Compliance Agreement - - On July 31, 1986, DOE, EPA and CDPHE entered into a Compliance Agreement (CERCLA VIII-86-08 and RCRA VIII-86-06) (DOE et al. 1986) that established milestones for major environmental operations and investigations at the site, and requirements for compliance with CERCLA. This Agreement also established roles and requirements for compliance with RCRA and the CHWA, through compliance with interim status requirements and submittal of permit applications and closure plans for hazardous waste units. Under this Agreement, DOE and Rockwell identified over 2,000 waste generation points and178 Solid Waste Management Units (SWMUs) and RCRA/CHWA-regulated closure sites. SWMUs, per RCRA, are inactive waste disposal sites, accidentally contaminated sites, and sites found to pose environmental concerns.

The Interagency Agreement (IAG) - - The 1986 Compliance Agreement did not reflect the requirements of the 1986 Superfund Amendments and Reauthorization Act, including the requirements governing Federal facilities under Section 120 of CERCLA. In addition, the environmental priorities at the site had been clarified in light of the investigations that had taken place under the 1986 Compliance Agreement. For these reasons, DOE, EPA and CDPHE negotiated the IAG (Federal Facility Consent Order CERCLA VIII-91-03, RCRA [3008{h}] VIII-91-07, and State of Colorado Docket #91-01-22-01), which was signed on January 22, 1991 (DOE et al., 1991). The IAG regulated and provided for enforcement of DOE's investigation, planning and conduct of environmental response actions at Rocky Flats. The IAG organized remedial activities into sixteen OUs, based upon similarities of geography, contaminants, or other interrelationships. Considerable environmental investigation and planning work took place under the IAG, which had a schedule containing over 200 individual milestones. It became apparent in 1992 and 1993 that DOE would be unable to meet some of these milestones. Under the terms of a Tolling Agreement signed among the Parties on July 7, 1994, DOE paid cash penalties and conducted supplemental environmental projects

totaling $2.8 million. In light of these events, the Parties began in mid-1994 to negotiate a comprehensive environmental agreement to replace the IAG.

RFCA - - On July 19, 1996, DOE, EPA and CDPHE signed RFCA (Federal Facility Agreement and Consent Order CERCLA VIII-96-21, RCRA [3008{h}] VIII-96-01, and State of Colorado Docket #96-07-19-01) (DOE et al. 1996). RFCA expanded the cleanup scope to include the disposition of all buildings (not included in the IAG), and changed the regulatory approach in several other significant respects. It incorporated an unenforceable Preamble that set out objectives for eight subject areas, developed in consultation with local stakeholders. The eight subject areas addressed in the Preamble were: Weapons Useable Materials and Transuranic Waste, Waste Management, Water Quality, Cleanup Guidelines, Land Use, Environmental Monitoring, Building Disposition, and Mortgage Reduction. RFCA consolidated the sixteen IAG OUs into two primary OUs: the Industrial OU, for which CDPHE served as the Lead Regulatory Agency (LRA); and the Buffer Zone OU, for which EPA served as the LRA. The LRA held sole authority for approval of documents and cleanup activities in the area under its purview. RFCA coordinated all of DOE's cleanup obligations under CERCLA, RCRA and the CHWA into a single document.

RFCA also implemented a consultative, accelerated action approach toward work at the site, focusing on IHSSs (of which there would ultimately be more than four hundred; selected IHSSs are shown in Figure 2), rather than the larger OUs. RFCA also committed the Parties to make use of accelerated actions to remediate IHSSs, allowing remedial work to be conducted through accelerated review and approval processes. Rather than use the RI/FS process, accelerated actions were reviewed, approved, and conducted under decision documents. Types of decision documents included:

- Proposed Action Memoranda (PAMs), used when remedy selection was straightforward and the project in question was estimated to take place in six months or less;

- Interim Measure/Interim Remedial Actions (IM/IRAs), used when a formal evaluation of remedial options was needed, and/or when a project was anticipated to take more than six months to complete; and,

- RFCA Standard Operating Protocols (RSOPs), used for routine accelerated actions that were similar in nature, for which standardized procedures were developed.

Decision documents were made available for formal and informal public review prior to approval by the LRA.

As mentioned, building removal at Rocky Flats was also performed under the auspices of RFCA. As required by RFCA, a Decommissioning Program Plan established the framework for the disposition of all facilities at the site. Facilities were screened for contamination, and were assigned as Type 1, 2, or 3, depending on the type and amount

of contamination associated with the facility. Type 1 buildings were those free of contamination, although hazardous substances such as polychlorinated biphenyls or friable asbestos may have been present in the facility's structure. Type 1 buildings included facilities such as office buildings and cafeterias. Type 2 buildings were without significant contamination or hazards, but in need of some decontamination, and included the majority of industrial facilities at Rocky Flats. Type 3 buildings were those with significant contamination and/or hazards. These were the buildings that were used for plutonium component production, plutonium storage and/or plutonium reprocessing, and included Buildings 371/374, 707, 771/774, 776/777, and 779. Pre-demolition characterization of buildings was done according to LRA-approved characterization plans and protocols. Decommissioning of facilities was performed under the auspices of PAMs, IM/IRAs, and RSOPs, although for Type 3 buildings a separate decision document, the Decommissioning Operations Plan, was used.

The need for and extent of an accelerated action under RFCA was determined by evaluating environmental conditions against action levels found in RFCA Attachment 5 (DOE et al. 2003). Action levels were calculated for soils, groundwater and surface water, as follows:

- soil action levels were calculated to be protective of a wildlife refuge worker based on either a lifetime excess cancer risk of 1×10^{-5} or a Hazard Index of 1, whichever resulted in a lower number;

- groundwater action levels were based on surface water protection based on maximum contaminant levels or (where these were not available) a residential groundwater ingestion-based preliminary remediation goal; and,

- surface water action levels were based on the Colorado surface water use classifications for Rocky Flats, with numeric values derived from either basic or site-specific standards.

Perhaps the most prominent of the actions levels established under RFCA was the action level for plutonium in surface soil. This action level was set at 50 picoCuries per gram (pCi/g), which corresponds roughly to an excess lifetime cancer risk to the wildlife refuge worker of 5×10^{-6}. This level appears in the modifications to RFCA Attachment 5, dated May 28, 2003, and was based upon extensive scientific research (submitted for peer review), and close consultation with local stakeholders. The complete listing of action levels that guided the accelerated actions under RFCA appears in Attachment 1 of this CAD/ROD.

Three environmental permits covering operations at Rocky Flats were issued to DOE and its contractors. These were: a National Pollutant Discharge Elimination System Permit (CO-0001333), a CHWA Permit (CO7890010526), and a State of Colorado Air Quality Operating Permit (FID#0590003, OP#96OPJE124). As cleanup and closure activities have progressed, all of these permits have been terminated. In lieu of a post-closure

CHWA permit for the Present Landfill, DOE, EPA and CDPHE are entering into an enforceable agreement including post-closure requirements, which will be known as the Rocky Flats Legacy Management Agreement (RFLMA). In addition, DOE has granted an environmental covenant (DOE 2006b) to CDPHE pursuant to Section 25-15-321, Colorado Revised Statutes. This covenant, dated May 22, 2006, incorporates institutional controls and other post-closure requirements for the Rocky Flats Present Landfill.

Activities performed at Rocky Flats under the auspices of RFCA, and to complete site closure in general, included the following:

- All special nuclear materials were packaged and shipped to other DOE facilities, including:
  - Approximately 21 tons of weapons-grade material; and
  - Approximately 100 tons of plutonium residues and 30,000 liters of plutonium and enriched uranium solutions, which were processed to meet transportation and receiver site requirements;
- More than 800 structures were decontaminated to the degree necessary and removed, including five major plutonium facilities and two uranium facilities totaling over one million square feet;
- 1,457 gloveboxes, many of them highly contaminated with radioactive materials, were decontaminated, removed from their buildings and disposed of off-site;
- 690 tanks, many of which were highly contaminated, were decontaminated, removed and shipped off-site;
- 421 IHSSs, Potential Areas of Concern, Under Building Contamination Sites, and Potential Incidents of Concern were investigated and dispositioned, either by accelerated actions or by a determination that no accelerated action was required;
- Engineered covers were installed on the Present Landfill and the Original Landfill;
- Three groundwater treatment systems (addressing contamination from the Solar Ponds, East Trenches disposal area, and the Mound Site disposal area) and one seep treatment system (at the Present Landfill) were installed and continue to operate; more than 11 million gallons of groundwater and 5 million gallons of seep water have been successfully treated to date;
- All waste from cleanup and closure activities was managed and packaged appropriately, and shipped for off-site disposal, including:

- More than 15,000 cubic meters (m^3) of transuranic and transuranic mixed waste;
- More than 500,000 m^3 of low-level and low-level mixed radioactive wastes (this includes contaminated soils from areas such as the 903 Pad and Lip Area);
- More than 820,000 m^3 of sanitary waste, much of it building debris; and
- More than 4,300 m^3 of non-radioactive hazardous waste.

Many of these activities were achieved by or in coordination with the conduct of accelerated CERCLA and RCRA/CHWA remedial actions, using RFCA action levels. To complete the cleanup and closure process, a final CERCLA and RCRA/CHWA remedial decision was required based on the levels of hazardous substances remaining after the completion of the aforementioned actions. The RI/FS for Rocky Flats (DOE 2006), dated June 2006, analyzed site conditions following the completion of these actions, calculated the risks posed by residual contaminants to the anticipated future land users, and evaluated alternatives for the final remedial action. The Rocky Flats Environmental Technology Site Proposed Plan (DOE 2006a), dated July 2006, identified DOE's preferred final remedy for the site and provided the rationale for that preference. The selected final remedial decisions for Rocky Flats are documented in this CAD/ROD.

RFCA remains in effect as of the date of this CAD/ROD. It will be superseded by RFLMA. The purpose of RFLMA is to establish the regulatory framework for implementing the final remedial/corrective actions specified in this CAD/ROD, serve as the enforceable agreement for post-closure requirements, and ensure that the final remedial action remains protective of human health and the environment.

The Refuge Act provides that future ownership and management of Rocky Flats shall be retained by the United States. Under the Refuge Act, the Secretary of Energy will retain administrative jurisdiction over those engineered structures at the site used for carrying out a response action, and any lands or facilities related to a response action. This CAD/ROD presents the final delineation of engineered structures, lands and facilities to be retained related to response actions.

3. COMMUNITY PARTICIPATION

The Draft RI/FS report for the Rocky Flats Environmental Technology Site (DOE 2005) was released for public review and information in October 2005, and was available at that time in the Rocky Flats public reading rooms and online. Several informational public meetings on the draft RI/FS were held, at which representatives from DOE and its contractor, EPA and CDPHE were present to answer questions. These meetings included a discussion at the Rocky Flats Citizens Advisory Board meeting on November 3, 2005. The final RI/FS report was approved by EPA and CDPHE on July 5, 2006. Copies of the final RI/FS report were placed at seven information centers in the Denver metropolitan area on July 14, 2006. In addition, the RI/FS report was available on line at

www.rfets.gov, and copies on compact disc were available at the public information meetings during the comment period for the Proposed Plan.

DOE, EPA and CDPHE held a pre-release informational meeting for the Proposed Plan on May 30, 2006, to explain changes that were made to the draft RI/FS report, and to describe the major components of the Proposed Plan. The Proposed Plan was released for formal public comment on July 14, 2006. Notice of the public comment period appeared in *The Rocky Mountain News* and *The Denver Post* from May 22 through May 28, 2006, and was also provided at the informational public meeting. DOE sent out community and media advisories prior to the release of the Proposed Plan, and prior to each informational meeting and the public hearing. The Proposed Plan was placed in seven information centers in the Denver metropolitan area, was available at the informational meetings held during the comment period, and was available on line at www.rfets.gov. The Proposed Plan included discussions on future land use and use of groundwater at Rocky Flats. The Rocky Flats administrative record file was available for public review at the Front Range Community College reading room in Westminster, Colorado, as well as on line at www.rfets.gov.

DOE held two informational meetings during the public comment period, at which agency representatives presented the scope and purpose of the Proposed Plan, discussed opportunities to provide input on the Proposed Plan, and responded to questions from the public. The first informational meeting was held on July 19, 2006, in Golden, Colorado, and the second informational meeting took place in Westminster, Colorado on August 8, 2006. Prior notice of each meeting was provided through advertisements in the aforementioned newspapers, running from July 13 through July 19, 2006, and again from August 2 through August 8, 2006. A public hearing for the Proposed Plan took place on August 31, 2006, in Arvada, Colorado; separate sessions were held in the afternoon and in the evening on that date to accommodate as many members of the public as possible. Prior notice of the public hearing was accomplished through advertisements in the aforementioned newspapers that ran on August 30 and August 31, 2006, with a display ad posted in both papers on August 29, 2006. Both written and oral public comments were accepted at the public hearing. A transcript of the public hearing has been made available to the public and placed in the Rocky Flats administrative record file.

The public comment period for the Proposed Plan extended from July 14 through September 13, 2006. No requests for extension of the public comment period were received. DOE's responses to public comments received during the comment period are included in the Responsiveness Summary section of this CAD/ROD.

4. SCOPE AND ROLE OF OUS

OUs were created at Rocky Flats based upon the source of contamination, contamination type, and distribution of contamination. The IAG grouped IHSSs by similar contaminant or geographic location into sixteen OUs. Under the IAG, no-action CAD/RODs were

completed for three of these OUs: OU 11 (the West Spray Field), OU 15 (Inside Building Closures) and OU 16 (Low-Priority Sites).

RFCA began the consolidation of these sixteen OUs into ten, when it was signed in 1996. The ten retained OUs consisted of the three for which CAD/RODs were obtained under the IAG, the Off-Site Areas (OU 3), and four other OUs for which CAD/RODs were anticipated to be completed in the near future: OU 1 (the 881 Hillside), OU 5 (Woman Creek), OU 6 (Walnut Creek) and OU 7 (Present Landfill). The remaining OUs were consolidated into the Buffer Zone (or BZ) OU, for which EPA was the LRA, and the Industrial Area (or IA) OU, for which CDPHE was the LRA. Under RFCA, a no-action CAD/ROD for OU 3 (DOE 1997) was approved by EPA and CDPHE in June 1997. The CAD/ROD for OU 1 (DOE 1997a) was also signed in 1997, with the selected remedy/corrective action including removal of contaminated soil and pumping and treatment of contaminated groundwater. Soil contamination at OU 1 was later addressed jointly with other contaminated soil removed in connection with the 903 Pad Drum Storage Site (IHSS 112). Subsequent investigation failed to find significant contamination sources at OU 1. In light of that, a major modification to the CAD/ROD for OU 1 (DOE 2001) was approved in 2001, allowing cessation of groundwater treatment after additional monitoring. Groundwater treatment was discontinued at OU 1 in 2002.

The OUs were further consolidated in 2004, when the RFCA Parties modified the 1996 OU consolidation plan that appeared in RFCA Attachment 1. The IHSSs contained in OUs 5, 6, and 7 were placed in the BZ OU to reduce the need for additional, individual CAD/RODs for these areas. This consolidation resulted in a final total of seven OUs under RFCA (the BZ OU, the IA OU, and the five OUs for which CAD/RODs were approved). The BZ OU-IA OU boundary is shown in Figure 2. The RI/FS report evaluated conditions in the BZ and IA OUs, taking into account the accelerated actions that had been taken for the IHSSs in these OUs pursuant to RFCA. The RI/FS report re-evaluated information from those OUs on site for which CAD/RODs had already been approved (i.e., OUs 1, 11, 15, and 16), and the results of this re-evaluation are incorporated into this CAD/ROD. The RI/FS report did not further evaluate conditions in OU 3 (the Off-Site Areas), for which a no-action CAD/ROD had already been approved.

The RI/FS report identifies the areas at Rocky Flats that have been impacted by DOE activities. Based upon this, the RFCA Parties decided to reconfigure the OU boundaries to consolidate all areas of the site that may require further remedial action into a single OU. This OU is called the Central OU, and is surrounded by the Peripheral OU (Figure 3). The boundary of the Central OU was also drawn considering the practicalities of future land management. The information presented in the RI/FS report, including the results of the Comprehensive Risk Assessment, provide the basis for evaluating remedial alternatives and rendering the final remedial action/corrective action decisions for the Peripheral and Central OUs.

5. SITE CHARACTERISTICS

Physical Characteristics of Rocky Flats

Rocky Flats is located at the interface between the Great Plains and the Rocky Mountains. Approximately two miles west of the site's western boundary, the foothills of the Front Range of the Rocky Mountains rise sharply above the plains. The site's western portion is located on a broad, relatively flat pediment that slopes eastward from these foothills. On the eastern portion of Rocky Flats, the pediment surface is dissected by small stream valleys that trend generally from the west down to the east. The primary topographic features at the site are the Rock Creek, Walnut Creek and Woman Creek drainages. Sixteen named, man-made retention ponds exist at the site, including ten in the Walnut Creek drainage, two in the Woman Creek drainage, two in the Rock Creek Drainage, and two along Smart Ditch near the site's southern boundary (Figure 4). In addition, several man-made ditches cross the site, including the South Interceptor Ditch, McKay Ditch, Upper Church Ditch and Smart Ditch.

Rocky Flats is biologically diverse, reflecting its geographical setting. Five primary plant communities occur there: mesic mixed grassland, xeric tall grass prairie, wetlands, riparian woodlands and tall upland shrubs. Grasslands are the dominant plant communities. Typical wildlife includes mammals such as mule deer, coyote, whitetail deer, black-tailed prairie dogs, foxes, elk, skunks, and a variety of rodents and other small mammals. The Preble's meadow jumping mouse (*Zapus hudsonius preblei*), a Federally-listed threatened species at the time of this CAD/ROD, is found along the drainages. Over 200 species of birds have been observed at Rocky Flats. A small number of reptiles and amphibians occur at the site, including the prairie rattlesnake. The U.S. Fish and Wildlife Service began native fish restoration efforts in 2002 with the introduction of common shiners and northern redbelly dace into the Lindsay Ranch Pond.

Site accelerated remedial actions resulted in removal of buildings, except for the former east and west vehicle inspection sheds. Surface pavement has been removed. Revegetation and erosion mats and/or hydromulching were utilized to control erosion in areas of disturbed soil and sloping surfaces. Five functional channels were configured to also minimize soil disturbance and were generally placed in areas of existing major surface water drainage features. Erosion was controlled in the functional channels by armoring the entire length of the channel with riprap or erosion matting and revegetation. Each of the five functional channels was designed to convey the 100-year storm event.

Other manmade features of the site include protective covers constructed under approved IM/IRA decision documents at two landfills, the Original Landfill (DOE 2004) and Present Landfill (DOE 2004a), which were used for historic site operations. The Original Landfill, located in the southwestern corner of the historic IA OU, has a soil cover layer with a minimum thickness of two feet. Present Landfill cover consists of a soil cover, geosynthetic clay liner, flexible membrane liner, geocomposite drainage layer, cushion layer, cobble layer, and soil cover layer.

Between the ground surface and three feet below grade, essentially all structures have been removed, with the exception of some utility lines less than two inches in diameter, three groundwater collection and treatment systems that serve an ongoing function, and the Present Landfill seep collection and treatment system. At depths greater than three feet below grade, some subsurface structures remain in place following the completion of accelerated actions under RFCA. These include slabs, tunnels, and building foundations (including in some areas caissons or grade beams); sewer lines and water lines; culverts, foundation drains, and storm drains; and valve vaults and process waste lines (both Original Process Waste Lines and New Process Waste Lines). Figures 5 and 6 depict remaining slabs, tunnels, and building foundations, as well as remaining valve vaults and process waste lines.

Some subsurface features may contain residual contamination (see Figures 5 and 6). In particular, these features include slabs and building foundations, as well as valve vaults and process waste lines. Portions of the former Buildings 371/374 basement and sub-basement slab/walls, former Building 730 basement slab, former Building 771 first and second floor slabs and walls, former Building 771C slab, former Building 774 first and second floor slab/walls, and the tunnel between former Buildings 771 and 776 have residual americium-241 and plutonium-239/240 contamination. The remaining contamination in these former building slabs, walls, and tunnel is fixed within the building concrete matrix after concrete surface removal by mechanical decontamination was performed to the extent practical. In addition, portions of former Building 991 floor slabs have residual non-friable asbestos contamination.

With regard to site geology, Pierre Shale and Fox Hills Sandstone underlie the site, with the latter exposed in quarries along the western edge of the site. The Laramie and Arapahoe Formations are exposed at the surface or underlie the site. Unconsolidated surficial deposits (for example, the Rocky Flats Alluvium [RFA] and the Verdos terrace alluvium) unconformably overlie bedrock. The unconsolidated surficial deposits, combined with the weathered portion of subcropping bedrock formations, form the upper hydrostratigraphic unit (UHSU). Figure 7 shows a generalized stratigraphic column for the Rocky Flats area. Because of the wide extent of unconsolidated surficial materials beneath the historic IA and eastern BZ OUs, and relatively high hydraulic conductivity compared to that of the underlying weathered claystone, the unconsolidated portion of the UHSU is the primary influence on groundwater flow and contaminant transport at the site. Groundwater flow in the UHSU generally follows site topography (Figure 8).

In the western portions of the site, where the thickness of the RFA may exceed 100 feet, the depth to UHSU groundwater is 50 to 70 feet. The depth to groundwater generally becomes shallower, and the saturated thickness becomes thinner, from west to east as the alluvial layer thins and the underlying claystones are closer to the surface. The amount of groundwater in the UHSU is limited. Although some monitoring wells in the UHSU are capable of producing enough water for residential uses, groundwater at the site has never been used as a drinking water source, and this use is not anticipated in the future.

The relatively small portion of infiltrating precipitation that does become shallow groundwater ultimately discharges to surface water before reaching the eastern boundary of the Central OU. Therefore, the UHSU groundwater that has been impacted by site activities discharges to surface water prior to leaving the Central OU. In addition to the UHSU, a lower hydrostratigraphic unit (LHSU) has been identified at the site. The UHSU and LHSU are separated by extremely low-permeability claystone that serves to isolate them hydraulically. The LHSU is composed of the unweathered Arapahoe, Laramie, and Fox Hills Formations. The upper Laramie Formation claystones of the LHSU, with low permeability, act as an effective aquitard that restricts downward vertical groundwater flow from the UHSU to the LHSU. Because the LHSU is hydraulically isolated from the UHSU, and because the LHSU does not show evidence of contamination from the UHSU, the LHSU is not a concern as a contaminant transport pathway from RFETS.

Two archeological surveys were conducted at Rocky Flats, in 1989 and 1991. These surveys identified local points of interest in the former BZ OU, such as Lindsay Ranch and an apple orchard. However, at that time, no sites or artifacts were found to be eligible for listing on the National Register of Historic Places.

On January 16, 1998, 64 buildings and facilities at Rocky Flats were included in a district that was formally added to the National Register of Historic Places. A Historic American Engineering Record (HAER) (HAER 1998) for the district was created using various reports, photographs, and drawings to document the history and significant contributions from 1953 to 1992 for the Rocky Flats Plant. The Rocky Flats district HAER was reviewed and accepted by the U.S. Department of Interior, National Park Service on January 22, 1999, and the HAER was transmitted to the Library of Congress. As a result of the National Park Service accepting the HAER, decontamination, decommissioning, and demolition of buildings within the historic district complied with National Historic Preservation Act requirements.

6. CHARACTERIZATION AND SAMPLING APPROACH

The DOE began more than 20 years ago to develop an extensive body of documentation about the use of hazardous substances and the known or suspected release of hazardous substances at Rocky Flats. Information was gathered from an extensive review of Rocky Flats operating records and contemporaneous documents. In addition, interviews were conducted of persons with knowledge of Rocky Flats operations and of events that did release or were suspected of releasing hazardous substances. The information collected is organized in the Rocky Flats Historical Release Report (HRR), originally published in 1992, which has been periodically updated as investigation and cleanup of the site progressed. The final version of the HRR is provided as Appendix B of the RI/FS report.

Sampling and analysis of surface and subsurface soil, groundwater, and surface water were extensively used to locate and measure hazardous substance contamination at historical IHSSs and guide the conduct and completion of remediation activities. Under

RFCA, environmental monitoring was performed under the auspices of a site-wide Integrated Monitoring Plan (IMP). Additional monitoring was conducted pursuant to environmental permits (including the NPDES permit and the State of Colorado Air Quality Operating Permit) issued to DOE and its contractors. Environmental data for Rocky Flats were collected in accordance with agency-approved Sampling and Analysis Plans (SAPs) and standardized contract-required analytical procedures. Approved Work Plans and SAPs specified the use of EPA-approved sampling procedures and analytical methods, data quality requirements, and data management processes, and specified the appropriate data quality objectives.

Data used in the RI/FS report came from a number of sources, including:

- investigations conducted at Rocky Flats prior to RFCA;
- samples collected to determine whether RFCA accelerated actions were required;
- samples collected to determine if RFCA accelerated actions were complete, or to evaluate the performance of ongoing treatment systems; and
- routine sampling conducted pursuant to environmental permits or the IMP.

Soil data used in the RI/FS report were collected between June 28, 1991, and August 22, 2005; groundwater and pond sediment data were collected between June 28, 1991, and July 31, 2005; and surface water data were collected between January 1, 2000, and July 31, 2005. Approximately two million environmental data records were used in the RI/FS report.

Data used to make accelerated action decisions included field screening methods (gammaspectroscopy and x-ray fluorescence). These data were appropriate for an accelerated action decision because in accordance with approved SAPs, field screening methods were approved as a conservative method to determine when to take an accelerated action. These data are inappropriate for decision making in the RI/FS, because field screening quality control elements do not meet specific RI/FS quality assurance/quality control requirements. Conclusions in the RI/FS report therefore did not include field screening data.

7. THE NATURE AND EXTENT OF ENVIRONMENTAL CONTAMINATION AT ROCKY FLATS

The nature and extent of contamination evaluations considered the following environmental media: soil, groundwater, surface water, sediment, and air. These evaluations were conducted to show the types of analytes of interest (AOIs) remaining in the environmental media and their extent at Rocky Flats following the completion of RFCA accelerated actions. The purpose of identifying AOIs was to focus the nature and extent evaluation on constituents that were detected at concentrations that may contribute

to the risk to future receptors and to show the overall spatial and temporal trends of those constituents on a site-wide basis. These evaluations identified fourteen AOIs for surface soil, ten AOIs for subsurface soil, nineteen AOIs for groundwater, eighteen AOIs for surface water, five AOIs for sediment, and five AOIs for air. AOIs for individual environmental media are discussed in ensuing sections.

Surface and Subsurface Soil Contamination - - Sampling and analysis of surface and subsurface soil, groundwater, and surface water were extensively used to locate and measure hazardous substance contamination at historical IHSSs and guide the conduct and completion of remediation activities for contaminated soil. All historic soil sources of contamination were addressed through the IAG and/or the RFCA accelerated action process. No other areas had activities that indicated any waste management or industrial activities that would potentially affect subsurface soil or other environmental media. To support this conclusion, additional surface soil sampling was conducted in the former BZ OU using radionuclides and metals as indicator parameters. If radionuclides and metals were not detected, the RFCA Parties agreed that there was no indication of subsurface contamination in that area.

Surface soil measurements are for soil within the top six inches at the time of sampling, and subsurface soil measurements are for soil deeper than six inches from the surface at the time of sampling. Subsurface measurements are further sorted by the following depth intervals: six inches to three feet, three to eight feet, eight to twelve feet, and greater than twelve feet. These depths are used in relation to the following general considerations:

- Less than or equal to six inches – Contamination is accessible to surface users by direct contact or suspension from wildlife refuge worker (WRW) surface use activities or wind and/or water erosion.

- Greater than six inches and less than or equal to three feet – Contamination may be accessible by localized disturbance of small areas related to WRW surface uses, such as post-hole digging or vegetation management, and by burrowing animals such as prairie dogs.

- Greater than three feet and less than or equal to eight feet – Contamination may be accessible by possible deeper disturbances related to WRW surface users, or by localized disturbance of small areas by burrowing animals.

- Greater than eight feet and less than or equal to twelve feet – This is below the average depth of burrowing animals.

- Greater than 12 feet – Contamination measurements at depth intervals below twelve feet are presented to further show the vertical gradation of soil contamination levels.

The RI/FS report considered site conditions immediately following completion of accelerated actions prior to any soil backfilling or re-contouring to match the surrounding

geomorphology. Consequently, the RI/FS report did not represent the final configuration of the site. This approach provided a conservative representation of contamination remaining in soil at the site because it did not take into account the additional protectiveness provided by the clean soil added through backfilling and grading.

Approximately 4,400 samples were collected in surface soil at Rocky Flats. Approximately 9000 samples were collected in subsurface soil.

Soil AOIs were identified using the screening process summarized in Figure 9. The screening steps for identification of soil AOIs were:

1) Comparison to background – The background comparison was used to distinguish between contamination related to site activities and naturally-occurring conditions. Background data for Rocky Flats were collected in the 1990s, and are summarized in the RI/FS report. The value used for this comparison was the mean of the analyte plus two standard deviations. If all sample results were less than this value, the analyte was eliminated from further consideration. For non-naturally occurring materials (such as organic solvents), there is no background value; therefore, such compounds were only eliminated if they were not detected.
2) Comparison to WRW Preliminary Remediation Goals (PRGs) – Analytes that were retained for further evaluation after comparison to background were compared to the PRGs for the WRW. The PRGs are levels in soil that correspond to either a 1×10^{-6} lifetime excess cancer risk, or which have a toxicity quotient of greater than 0.1, whichever value is less. If all values for an analyte were below the WRW PRG, it was eliminated from further consideration.
3) Evaluation of process knowledge and frequency of detection – Analytes were assessed using process knowledge (that is, knowledge of historical operations and the use of chemicals at Rocky Flats). Analytes were eliminated from further consideration if they were not used or used in only very limited quantities. Analytes were also eliminated from further consideration if they occurred at levels greater than the WRW PRG less than one per cent of the time, unless the sample occurred in a contiguous area, or if process knowledge showed that the analyte was associated with historic site activities.

The fourteen analytes retained for further evaluation in surface soils the RI/FS report are summarized in Table 1.

Of particular note among these analytes are two radionuclides, plutonium-239/240 and americium-241. These two elements were strongly associated with site activities. Plutonium-239/240 was the material used to make triggers for nuclear weapons at Rocky Flats, and americium-241 is a widely distributed radioactive daughter product of plutonium. Their distributions in surface soils are shown in Figures 10 and 11, respectively. The highest residual surface soil value for plutonium-239/240 was 183 pCi/g, found in a confirmation sample from the floor of an excavation five feet below

grade (now backfilled) near the former Building 776. This location also recorded the highest remaining level of americium-241 in surface soil at Rocky Flats (51.2 pCi/g).

Isotopes of uranium (including uranium-233/234, uranium-235 and uranium-238) are found in surface soil at Rocky Flats as a result of site activities, although a considerable portion of the uranium found at the site has a geologic origin. The maximum levels of uranium-233/234 (47.5 pCi/g), uranium-235 (2.2 pCi/g) and uranium-238 (209.3 pCi/g) in surface soil were found at the historical Ash Pits, located in the southwestern portion of the Central OU. These locations have been backfilled with soil. Other surface soil occurrences of uranium isotopes that exceeded the WRW PRG were found in the Original Landfill, and are now underneath the soil cover there.

The ten AOIs for subsurface soil are summarized in Table 2, which also includes the depth ranges at which these AOIs were encountered. Subsurface AOIs included:

- metals such as lead (which is associated with a former firing range);

- the semi-volatile organic compound benzo(a)pyrene, associated with historic disposal sites, and which is associated with asphalt;

- radionuclides including plutonium-239/240 and americium-241 (associated with historic disposal sites such as the East Trenches Area), as well as isotopes of uranium, associated with the historical Ash Pits; and,

- volatile organic compounds (VOCs) such as trichloroethene and carbon tetrachloride, which were widely used as solvents at Rocky Flats, and which are associated both with historic disposal (such as the East Trenches) and storage.

In general, AOIs in subsurface soils were bound both laterally and vertically by soils containing levels that were below background values or below the WRW PRGs. Certain of the subsurface soil AOIs, such as VOCs and uranium, are found as contaminants in shallow groundwater at Rocky Flats.

Groundwater Contamination - - Groundwater monitoring has been conducted at Rocky Flats since the first groundwater monitoring wells were installed in the vicinity of the historical Solar Evaporation Ponds in 1954. Additional wells were installed in 1960, 1966, and 1971. Until 1974, groundwater monitoring focused primarily on the detection of select radionuclides and major ions (for example, nitrate and fluoride), and the measurement of pH. Additional wells were installed, and the groundwater monitoring program was expanded in 1974 in conjunction with DOE and U.S. Geological Survey efforts to characterize the hydrology of the site. Additional wells were installed in 1981 and 1982 as part of the first RCRA groundwater monitoring program. The groundwater monitoring program was expanded significantly in 1986 when DOE entered into the Compliance Agreement with EPA and CDPHE, followed by the Site being added to the National Priorities List by EPA in 1989. Groundwater monitoring after 1986 included

hazardous, non-hazardous, and radiological constituents to facilitate a comprehensive understanding of the nature and extent of groundwater contamination at Rocky Flats.

In 1991, DOE, EPA, and CDPHE entered into the IAG, which was superseded by RFCA in 1996. The IMP, required under RFCA to implement environmental monitoring programs at the site, served as the site's groundwater monitoring plan. The IMP outlined the monitoring goals for groundwater and described the various components of the groundwater monitoring program. The IMP, originally published in May 1997, replaced the Groundwater Protection and Monitoring Program Plan. Following the signing of this CAD/ROD, groundwater monitoring at Rocky Flats will be conducted under the auspices of RFLMA, which will incorporate the monitoring requirements of this CAD/ROD.

Data used to evaluate the nature and extent of groundwater contamination were obtained from:

- Previous investigations conducted at the site prior to and under RFCA;
- Routine quarterly and semiannual groundwater monitoring under RFCA; and
- Groundwater samples collected to evaluate the performance of RFCA accelerated actions.

Groundwater data were collected in accordance with agency-approved SAPs, the IMP, and standardized analytical procedures. Data used to evaluate groundwater nature and extent include 528,889 records, specifically 488,455 records for the UHSU and 40,434 records for the LHSU. Groundwater data were collected from 939 wells in the UHSU, and from 68 wells in the LHSU.

Groundwater AOIs were identified using the screening process summarized in Figure 12. The screening steps for identification of groundwater AOIs were:

1) Non-detect and background comparison – Analytes that were not detected were not evaluated further. Analytes that were detected in groundwater samples were compared to the 99/99 upper tolerance level (UTL) value, which is a statistical value that includes 99 per cent of the population with 99 per cent confidence. Analytes that exceeded the 99/99 UTL value were retained for further evaluation.
2) Determination of surface water standards and standard comparison – Groundwater at Rocky Flats is managed for the purpose of protection of surface water, and therefore the Colorado Water Quality Control Commission surface water standards are applied to groundwater at the site. Where there is no State of Colorado water quality standard, maximum contaminant levels (MCLs) established by EPA apply. For each analyte, the appropriate surface water standard or MCL was determined. Groundwater analytes that did not have either a surface water standard or an MCL were not evaluated further.

3) Determination of contiguous, mappable plumes – For each remaining analyte, the RI/FS report considered the most recent available data from each well to determine if a contiguous, mappable plume for that analyte exists. In the UHSU, three adjacent wells with analyte concentrations above surface water standards or MCLs formed the basis for a contiguous, mappable plume. If such a plume did exist, the analyte was evaluated further.
4) Process knowledge evaluation – This screen involves an assessment of contaminants that cannot be reasonably be expected to be AOIs, even though they form contiguous, mappable plumes. This includes a number of criteria, including historical site use of a chemical, use of stainless steel pumps or casings, improper well completion, and geohydrology.

Nineteen AOIs were evaluated further for the UHSU. No analytes were considered to be AOIs for the LHSU, based on the lack of potential for groundwater contaminants to migrate downward through the thick, underlying shale strata and reach the regional drinking water aquifer below.

Sampling results for the nineteen AOIs found in UHSU groundwater are summarized in Table 3. The most significant groundwater contaminants are VOCs, uranium and nitrate. VOCs are found in association with historic disposal sites, such as the East Trenches Area, the 903 Pad, the Mound Site and Ryan's Pit. The most prevalent VOCs are tetrachloroethene and trichloroethene, both of which were used extensively as solvents at Rocky Flats. A third VOC, carbon tetrachloride, is also found extensively in UHSU groundwater, both in association with historic disposal sites, and with a leaking underground storage tank formerly located in the vicinity of former Building 771. Other VOCs are found in UHSU groundwater, including vinyl chloride. These are primarily daughter products formed by the degradation of tetrachloroethene, trichloroethene, and carbon tetrachloride, although low levels of benzene have been found in the seep emanating from the Present Landfill.

Total uranium (including the isotopes uranium-233/234, uranium-235, and uranium-238) was the only radionuclide AOI identified in UHSU groundwater. Uranium isotope occurrences above the surface water standard are found in the area of the historic solar evaporation ponds, the Original Landfill, and the Ash Pits, although concentrations in these and other areas of UHSU groundwater are influenced by high uranium concentrations derived from natural sources. The only contiguous, mappable plume for total uranium isotopes is found in the vicinity of the solar evaporation ponds.

Nitrate is a common contaminant of UHSU groundwater at Rocky Flats. Its primary source was the solar evaporation ponds, although smaller nitrate plumes occur in connection with the former 903 Pad and in Operable Unit 1, the former 881 Hillside.

Figure 13 shows the major groundwater plumes for VOCs, uranium and nitrates in the UHSU at Rocky Flats.

Surface Water and Sediment Contamination - -Surface water monitoring has been conducted at Rocky Flats throughout the site's history, from 1952 to the present. Surface water and sediment data were collected under numerous investigations and included analyses for radionuclides, metals, VOs, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, herbicides, dioxins (sediment only), and water quality parameters (including inorganic constituents such as nitrate and fluoride). Data were initially collected for effluent monitoring of Plant releases and reservoir and drinking water monitoring. Subsequently, surface water and sediment data have been reported in numerous site reports and were warehoused in the Rocky Flats Environmental Database System and its successor, the Soil Water Database. Surface water data have been collected from 404 locations and sediment data from 369 locations in four drainage basins that include Rock Creek, Walnut Creek (including the McKay Ditch), Woman Creek, and Lower Smart Ditch since June 28, 1991. Past data were collected under a variety of programs. These programs included, but were not limited to:

- Sitewide characterization (for example, OU RCRA Facility Investigations/RIs);
- Accelerated actions and IM/IRAs;
- NPDES sampling;
- Event-related surface water monitoring;
- Automated surface water monitoring;
- Ponds A-4, B-5, and C-2 pre-discharge sampling;
- Former Building 891 treatment facility effluent monitoring;
- Incidental waters;
- Remediation projects;
- Groundwater treatment system effluent monitoring; and
- Other special projects.

Since May 1997, the IMP, required under RFCA, guided the site's surface water and sediment monitoring programs. Under RFCA, an important feature of the site's surface water monitoring program, particularly for the radionuclides plutonium-239/240 and americium-241, was continual, flow-weighted monitoring at specific locations known as Points of Compliance (POCs) and Points of Evaluation (POEs). Attachment 5 of RFCA specified notifications, evaluations and actions to be taken by DOE if surface water action levels (0.15 picoCuries per liter [pCi/l] for plutonium-239/240 and americium-241) were exceeded at POEs or POCs (exceedances at POCs could subject DOE to

monetary penalties). Figure 14 shows the locations of POEs, POCs and other relevant surface water features.

Surface water AOIs were identified using the screening process summarized in Figure 15. The screening steps for identification of surface water AOIs were:

1) Determination of surface water standard – For each analyte, it was determined whether a surface water standard (based upon the State of Colorado surface water quality standards) existed. Where the standard was lower than the practical quantification level (PQL) for a given analyte, the PQL was used for comparison purposes in subsequent screening steps. Analytes that did not have surface water standards established were not evaluated further.
2) Nondetect and background comparisons – Analytes that were not detected were not evaluated further. Analytes that were detected were compared to the mean background value plus two standard deviations. Analytes that exceeded this value were retained for further evaluation, as were analytes (such as VOCs) that were detected, but for which no background value exists.
3) Surface water standard comparison/frequency of detection – Analytes were compared to their corresponding surface water standard (or PQL). Analytes with values that exceeded standards in more than one per cent of samples were retained for further evaluation.
4) Process knowledge evaluation – Process knowledge was used to determine whether an analyte should be evaluated further, based upon its historic use at the site. Other factors, such as the distribution of an analyte relative to its use at the site, accelerated actions taken to remove the contaminant, and the natural abundance and distribution of an analyte were considered in this step.

Eighteen AOIs were retained for surface water and evaluated further in the RI/FS report.

The principal types of contaminants found in surface water at Rocky Flats are radionuclides, VOCs, and nitrate, although all these contaminants were not found in all surface water drainages at the site (Table 4). Summary statistics for surface water AOIs are presented in Table 5.

Radionuclide AOIs include plutonium-239/240, americium-241 and uranium isotopes. The highest single level of plutonium-239/240 recorded in a surface water sample (259 pCi/l) was from a sample collected at a monitoring station (no longer in existence) known as GS-32, on the northern edge of the former Industrial Area. The sample in question was collected on June 16, 2004, during the demolition of Buildings 779 and 776/777. The relatively high activities for plutonium-239/240 and americium-241 during this period were associated with high total suspended solids concentrations in the water, which in turn resulted from disturbed soils on the Building 779 foundation slab. Plutonium-239/240 and americium-241 activities decreased in August 2004 once slab removal was completed and the area was stabilized. During the active remediation of Rocky Flats, exceedances of water quality action levels occurred at POEs and other monitoring locations in and around the former Industrial Area. However, since the

completion of active remediation, and with the re-contouring and progressive re-vegetation of the site, levels of plutonium-239/240 and americium-241 at surface water POEs and POCs have remained below action levels. Total uranium isotope levels have been increasing in surface water in South Walnut Creek, due to the greater influence of shallow groundwater (which contains substantial concentrations of naturally-occurring uranium) on surface water quality following site closure.

Seven VOCs, including tetrachloroethene, trichloroethene, carbon tetrachloride and certain of their degradation products, were identified as AOIs in surface water. In general, these have occurred in seeps, drain outfalls and ponds along South Walnut Creek. Tetrachloroethene has occurred most frequently at the former Building 771 footing drain outfall, as well as at the outfall of former monitoring station SW056 (disrupted as part of site closure). Trichloroethene occurred transitorily in Ponds B-2 and B-4, at SW-056, and at a seep between Woman Creek and the South Interceptor Ditch southeast of the former 903 Pad. Carbon tetrachloride occurred most frequently at the former Building 771 footing drain outfalls and at monitoring Station SW061. Given the volatile and reactive nature of these analytes, VOC concentrations in surface water at Rocky Flats tend to be low and transitory, and do not have a large geographic extent.

Nitrate in surface water at Rocky Flats occurs in excess of the surface water standard in the North Walnut Creek drainage, at the outfall of the former Building 774 footing drain, at station GS-13, and at the outfalls of Ponds A-2 and A-3. All of these are in the vicinity of the former solar evaporation ponds, which contaminated shallow groundwater with nitrate.

Sediment AOIs were identified using the screening process summarized in Figure 16. The screening steps for identification of sediment AOIs were:

1 Comparison to background – The background comparison was used to distinguish between contamination related to site activities and naturally-occurring conditions. The value used for this comparison was the mean of the analyte plus two standard deviations. If all sample results were less than this value, the analyte was eliminated from further consideration. For non-naturally occurring materials (such as organic solvents), there is no background value; therefore, such compounds were only eliminated if they were not detected.
2 Comparison to WRW PRGs – Analytes that were retained for further evaluation after comparison to background were compared to the PRGs for the WRW. The PRGs are levels in soil that correspond to either a 1×10^{-6} lifetime excess cancer risk, or which have a toxicity quotient of greater than 0.1, whichever value is less. If all values for an analyte were below the WRW PRG, it was eliminated from further consideration.
3 Evaluation of process knowledge and frequency of detection – Analytes were assessed using process knowledge. Analytes were eliminated from further consideration if they were not used or used in only very limited quantities. Analytes were also eliminated from further consideration if they occurred at

levels greater than the WRW PRG less than one per cent of the time. Other factors, such as the distribution of an analyte relative to its use at the site, accelerated actions taken to remove the contaminant, and the natural abundance and distribution of an analyte were considered in this step.

Five analytes were retained as AOIs for sediments, although not all AOIs were present in all drainages (Table 6).

The analytes retained for further evaluation in sediments the RI/FS report are summarized in Table 7. They include one SVOC (benzo(a)pyrene), two metals (arsenic and chromium) and two radionuclides (plutonium-239/240 and americium-241). Benzo(a)pyrene is found in the South Walnut Creek drainage in Pond B-4 sediments, and at various locations in the former Industrial Area. No concentrations of benzo(a)pyrene in sediments exceeded ten times the WRW PRG value. Arsenic values exceeding the WRW PRG are found along North and South Walnut Creeks, and in various locations in the former Industrial Area and Buffer Zone, including many (such as the D-series ponds in the southeastern portion of the site) that were unaffected by Rocky Flats activities.

The only occurrence of americium-241 in sediments above the WRW PRG is from a sample from Pond B-4 in South Walnut Creek. Plutonium-239/240 is more widespread in sediments, with levels above the WRW PRG found in sediments in Ponds A-1, A-2 and B-4, and in various ditches in and around the former Industrial Area, and near the historic 903 Pad. The highest concentration of plutonium-239/240 in sediments (217 pCi/g) occurred in Pond B-4, and was co-located with the aforementioned americium-241 sample. This sample was collected at a depth interval of 2.5 to 3.9 feet. Re-sampling of this location showed that levels of plutonium-239/240 and americium-241 exceeding 50 pCi/g were at depths greater than three feet. Consistent with RFCA action levels, the area was not remediated further.

Air Contamination - - Monitoring programs and other studies were conducted during both the production era and cleanup phase at Rocky Flats. These data show that contaminant emissions and resulting ambient airborne concentrations during both the weapons production era and cleanup phase were always compliant with all regulatory requirements. In fact, compliance monitoring at the facility fence line showed maximum airborne radionuclide concentrations of no more than three per cent of the limiting standard during the entire cleanup phase. With completion of all accelerated actions and the attendant removal of all historical air emissions sources except for wind erosion of the minor, remnant contamination in surface soils, future air emissions from the site will be less than those in the past.

During the weapons production era, the major sources of airborne contamination comprised releases of radionuclides, VOCs and metals from stacks venting building processes and operations; conventional pollutant sources such as fuel combustion in boilers and generators; street sanding, traffic, refrigerant leaks, and fugitive dust from soil disturbance; and resuspension of contaminants deposited on surface soil by prior events (such as fires or leakage of radioactively contaminated oils and VOCs from drums stored

at the historical 903 Pad). During the cleanup phase, building decommissioning, and environmental restoration activities represented additional sources of emissions to air. These sources were eliminated or decreased as buildings were demolished and soil contamination was cleaned up.

With the completion of accelerated actions under RFCA, sources of ongoing emissions to air include the following:

- Volatilization/release of VOCs from residual subsurface contamination and the closed landfills; and

- Resuspension of residual radioactive contaminants attached to surface soil particles.

However, sources of VOC and radionuclide contamination were removed during accelerated actions conducted pursuant to RFCA. Former processing and waste storage buildings have been decommissioned, decontaminated, and demolished. Soils have been evaluated and remediated in accordance with RFCA. Based on the available ambient air monitoring data and the current knowledge of VOC contamination that remains at RFETS, no significant sources of VOC emissions remain following completion of accelerated actions. VOC emissions present no health or environmental concerns at present and future levels in ambient air. Air modeling conducted for radionuclide parameters predict that, even for scenarios involving a fire in the historic 903 Pad area, emissions will be much lower than the EPA's ten millirem benchmark level for an airborne exposure pathway. None of the other potential air contaminants is regarded as having a significant environmental effect at Rocky Flats.

8. FATE AND TRANSPORT OF ENVIRONMENTAL CONTAMINANTS AT ROCKY FLATS

To assess contaminant fate and transport, information is used about the site physical characteristics, contaminant source characteristics, and contaminant distribution to develop a conceptual understanding of the dominant transport processes that affect the migration of different contaminants in various environmental media at Rocky Flats. The primary focus of investigating contaminant fate and transport at the site, consistent with RFCA objectives, is evaluating the potential for contaminants to impact surface water quality.

Evaluation of a contaminant's fate and transport is based upon the following two questions:

1) Does a complete migration pathway to surface water exist based on an evaluation of contaminant transport in each environmental medium?
2) Is there a potential impact to surface water quality based on an evaluation of data at representative groundwater and surface water monitoring locations in the creek drainages?

This fate and transport analysis focuses on contaminants that were identified as AOIs for each medium through the nature and extent evaluation process.

The chemistry of each AOI is unique. As a result, each AOI interacts differently with the geochemical environment surrounding it, making the transport mechanism (particulate, dissolved, or both) and rate of migration highly variable for each AOI. In addition, the persistence in the environment varies greatly from one AOI to another, ranging from certain organic compounds that biodegrade in a period of weeks, to stable metals that persist indefinitely.

The location of the AOI, particularly in relation to surface water drainages, plays an important role in its fate and transport. For example, an AOI located in surface soil is subject to different transport mechanisms, such as wind and water erosion, than a contaminant located several feet below the ground surface. An AOI that is primarily transported by surface transport mechanisms, but is located in subsurface soil (such as waste deposited into a trench during historic operations), may not be mobile and available for transport via subsurface mechanisms. The AOI's geochemistry, persistence, and location, coupled with the results of predictive numerical transport modeling and process knowledge, were considered when the potential migration pathway(s) to surface water was evaluated.

AOIs evaluated for fate and transport fall into one of the following analyte groups:

- Radionuclides;
- VOCs;
- Metals;
- SVOCs;
- PCBs;
- Dioxins; and
- Water quality parameters, including inorganic compounds such as nitrate.

Table 8 presents a listing of all AOIs, and identifies the environmental medium, or media, associated with each. For each of the contaminants identified as an AOI, a description of the fate and transport characteristics for that analyte is provided in Table 9. In addition to general fate and transport characteristics, Table 9 provides fate and transport information specific to Rocky Flats, such as data from site-specific studies related to the chemical form or mobility of specific contaminants.

Based upon the hydrologic flow MIKE SHE model, VOC fate and transport modeling was conducted. The VOC transport modeling in UHSU groundwater focused on

tetrachloroethene and carbon tetrachloride, as well as their degradation products. The modeling was conducted to evaluate the movement and fate of each VOC at potential groundwater discharge areas that could impact surface water quality. The modeling scope included:

- Review of all historical UHSU water quality data;
- Development of a flow and transport model using historical conditions to determine appropriate parameter values; and
- Adaptation of the flow and transport model to the post-accelerated action configuration to predict long-term or maximum groundwater VOC concentrations that may discharge to surface water.

The model results were analyzed to assess whether the simulations conclusively indicated that surface water standards would be exceeded at the groundwater discharge locations. Model simulations predicted that only tetrachloroethene, trichloroethene, and carbon tetrachloride would be above surface water standards at groundwater discharge locations.

Extensive evaluation, research, and actinide modeling was conducted as part of the Actinide Migration Evaluation (AME). The AME Pathway Analysis study was conducted to quantify the environmental transport of plutonium-239/240, americium-241, uranium-233/234, uranium-235, and uranium-238 in different environmental media at Rocky Flats and to provide recommendations for long-term protection of surface water quality. The actinide transport pathways quantified included air, surface water, groundwater, and biota. The results of the AME study confirmed that the dominant transport pathways for plutonium-239/240 and americium-241 are air and water erosion. For uranium the dominant pathway is dissolved transport. In addition, as part of the AME, Rocky Flats samples from select groundwater and surface water monitoring locations were sent to Los Alamos National Laboratory for specialized analyses (High-Resolution Inductively Coupled Plasma/Mass Spectrometry and Thermal Ionization Mass Spectrometry) to quantify uranium isotope fractions and thereby determine the proportions of natural versus anthropogenic uranium in samples of groundwater and surface water.

Representative groundwater monitoring locations assessed potential impacts to surface water quality as measured at Area of Concern (AOC) and Sentinel wells (Figure 14). The AOC and Sentinel well classifications, consistent with the FY 2005 IMP (K-H 2005), are as follows:

- AOC wells – Wells that are within a drainage and downgradient of a contaminant plume or group of contaminant plumes. These wells are monitored to determine whether the plume(s) may be discharging to surface water.
- Sentinel wells – Wells that are typically located near downgradient contaminant plume edges, in drainages, and downgradient of existing

groundwater treatment systems. These wells are monitored to identify changes in groundwater quality.

The environmental media evaluated first were surface soil and sediment because they represent the surface transport mechanisms. Subsurface soil and groundwater are evaluated second as part of the subsurface transport mechanism evaluation process.

Summary of Surface Transport Pathway Evaluation - - Environmental media with contaminants subject to surface transport mechanisms are surface soil and sediment. Complete pathways from surface soil to surface water were identified for two surface soil AOIs: americium-241 and plutonium-239/240. These AOIs have been observed intermittently above the surface water standard (which is higher than background or the PQL) at representative surface water locations upstream of the terminal ponds in the North Walnut Creek, South Walnut Creek, and the South Interceptor Ditch (SID)/Woman Creek drainages. Other than americium-241 and plutonium-239/240, all other surface soil AOIs were identified as having limited surface transport pathways to surface water.

The primary historic source of americium-241 and plutonium-239/240 in surface soil was remediated at the historical 903 Pad/Lip area, which is expected to improve long-term surface water quality. In addition, removal of impervious areas has decreased runoff volumes and peak discharge rates resulting in reduced soil erosion and associated particulate transport of americium-241 and plutonium-239/240 from surface soil to surface water.

For the remaining surface soil AOIs, the most current data for those analytes measured in surface water show concentrations below the highest of the surface water standard, background, or PQL at the representative surface water locations downstream of the terminal ponds in the North Walnut Creek, South Walnut Creek, and SID/Woman Creek drainages.

Complete pathways from sediment to surface water were identified for two sediment AOIs: americium-241 and plutonium-239/240. These are the same AOIs identified in surface soil as having a complete pathway to surface water. Americium-241 and plutonium-239/240 have been observed intermittently in surface water above the surface water standard (which is higher than background or the PQL) at representative surface water locations upstream of the terminal ponds in the North Walnut Creek, South Walnut Creek, and the SID/Woman Creek drainages. All other sediment AOIs are identified as having limited transport pathways to surface water.

Accelerated actions taken to remediate contaminants in sediments include sediment removal at the historical Bowman's Pond and vicinity, located north of former Building 774, and at Ponds B-1, B-2, and B-3 (historical IHSSs NE-142.5, -142.6, and -142.7, respectively) in the South Walnut Creek drainage. As noted for surface soil, removal of impervious areas has decreased runoff volumes and peak discharge rates resulting in

reduced sediment erosion and decreasing the associated transport of americium-241 and plutonium-239/240 from sediment to surface water.

For the remaining sediment AOIs, the most current data for those analytes measured in surface water have concentrations below the highest of the surface water standard, background, or PQL at the representative surface water locations downstream of the terminal ponds in the North Walnut Creek, South Walnut Creek, and the SID/Woman Creek drainages.

Summary of Subsurface Transport Pathway Evaluation - - Environmental media with contaminants subject to subsurface transport mechanisms are subsurface soil and groundwater. Complete pathways from subsurface soil to surface water (via groundwater) were identified for five subsurface soil AOIs, all of which are VOCs. These AOIs include carbon tetrachloride, chloroform, methylene chloride, tetrachloroethene, and trichloroethene. All of these subsurface soil AOIs are associated with one or more groundwater areas, as discussed below. Consequently, these subsurface soil AOIs are also detected in groundwater at concentrations above the surface water standard at one or more Sentinel wells. Tetrachloroethene was observed in subsurface soil at a location south of former Building 991, but it does not form a contiguous, mappable plume in groundwater in that area. All other subsurface soil AOIs were identified as having limited transport pathways from subsurface soil to surface water via groundwater, including plutonium-239/240 and americium-241, which have very low mobility in the subsurface environment.

Accelerated actions related to the subsurface soil AOIs (subsurface soil removals) have been taken at the historical Mound Site/Oil Burn Pit No. 2 area, historical East Trenches, Carbon Tetrachloride Plume (historical IHSS 118.1), and historical 903 Pad/Ryan's Pit area. These actions were taken to disrupt the pathway from subsurface soil to surface water via groundwater, by reducing residual subsurface soil contamination. For the subsurface AOIs, the most current data for those analytes measured in groundwater show concentrations below the highest of the surface water standard, background, or PQL at all AOC wells.

Complete pathways from UHSU groundwater to surface water were identified for ten groundwater AOIs: uranium (sum of isotopes, uranium-233/234, uranium-235, and uranium-238), cis-1,2-dichloroethene, carbon tetrachloride, tetrachloroethene, trichloroethene, chloroform, methylene chloride, nitrate/nitrite, fluoride, and sulfate. No AOIs are identified for groundwater in the LHSU. Groundwater AOIs with complete subsurface pathways (with the potential to impact surface water quality) are primarily associated with one or more Sentinel wells in five groundwater areas. These areas are identified based on groundwater AOIs with complete pathways being detected above the highest of the surface water standard background, or PQL at Sentinel wells. These five groundwater areas and their associated contaminants, shown on Figure 17, are:

- North of former Building 771 (north of the Carbon Tetrachloride Plume) – Trichloroethene;

- The historical East Trenches area – Carbon tetrachloride, chloroform, tetrachloroethene, trichloroethene, methylene chloride, and cis-1,2-dichloroethene. This contamination is captured by the East Trenches Plume Treatment System (ETPTS);

- The historical Solar Ponds area (downgradient portion between the Solar Pond Plume Treatment System and North Walnut Creek)—Nitrate/nitrite, sulfate, and uranium (although uranium at the AOC and Sentinel wells downgradient from the Solar Ponds is predominantly from natural uranium sources, based on analyses of uranium isotope ratios). Nitrate is observed at a Sentinel well in the former 700 Area Northeast Plume which is captured by the Solar Ponds Plume Treatment System (SPPTS);

- The historical Mound Site/Oil Burn Pit No. 2 area (downgradient portion between South Walnut Creek and the Mound Site Plume Treatment System [MSPTS]) – Chloroform, trichloroethene, tetrachloroethene, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,1-dichloroethene, and methylene chloride. These AOIs may exceed the surface water standards between the MSPTS and South Walnut Creek. Carbon tetrachloride, chloroform, methylene chloride, tetrachloroethene, and sulfate exceed the surface water standards between Oil Burn Pit No. 2 and the MSPTS (contaminated groundwater from the historical Oil Burn Pit No. 2 is treated at the MSPTS); and

- The historical 903 Pad/Ryan's Pit area (both the northern flow path downgradient of the 903 Pad area toward South Walnut Creek and the southern flow path downgradient of the 903 Pad/Ryan's Pit areas toward Woman Creek) – Carbon tetrachloride, chloroform, tetrachloroethene, trichloroethene, and cis-1,2-dichloroethene.

South of former Building 991, tetrachloroethene and trichloroethene are observed in subsurface soil and groundwater in Sentinel well 99305, although they do not form a contiguous, mappable plume. To improve surface water quality south of former Building 991, an accelerated action was conducted at the former SW056 location. Accelerated actions related to the groundwater AOIs (that is, installation of groundwater treatment systems) have been taken at the historical Mound Site/Oil Burn Pit No. 2, the historical East Trenches area, and in the area of the historical Solar Ponds. These actions were taken to disrupt the pathway from groundwater to surface water by collecting and treating contaminated groundwater.

For the remaining groundwater AOIs, the most current data for those analytes measured in shallow groundwater show concentrations below the highest of the surface water

standard, background, or PQL at all AOC wells with the exception of well 10594 (located downgradient of Pond A-1 in North Walnut Creek with sulfate results above background, which is higher than the surface water standard or PQL, in samples collected in 1995 and 1996).

Summary of Surface Water Evaluation - - Four surface water AOIs were observed intermittently above the highest of the surface water standard, background, or PQL at representative (non-background) surface water locations. These AOIs are americium-241, plutonium-239/240, uranium (sum of isotopes), and nitrate/nitrite. Americium-241 was observed intermittently above the surface water standard at surface water monitoring locations upstream of the terminal ponds in North Walnut Creek (SW093), South Walnut Creek (GS10), and the SID/Woman Creek drainage (GS51 and SW027). Plutonium-239/240 has been observed intermittently above the surface water standard at the same locations upstream from the terminal ponds as americium-241, as well as at station SW018 in the North Walnut Creek watershed. Uranium (sum of isotopes) was detected above the surface water standard in North Walnut Creek (GS13) and South Walnut Creek (GS10), although at both locations it is predominantly from natural uranium sources, based on analyses of uranium isotope fractions. Nitrate/nitrite was observed in North Walnut Creek (GS13) above the surface water standard. All other surface water AOIs were observed infrequently or not at all at concentrations above the highest of the surface water standard, background, or PQL at the representative surface water locations.

9. CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

As of the date of this CAD/ROD, all of Rocky Flats is the property of the United States, with activities there administered by DOE. The site is closed to public access. Per the Refuge Act, the majority of the site is to have jurisdiction transferred to the U.S. Fish and Wildlife Service (Service), for the purpose of becoming a national wildlife refuge. The transfer will occur upon achieving closure as defined in the Refuge Act.

The purposes of the Refuge are as follows:

- Restoring and preserving native ecosystems;
- Providing habitat for and population management of native plants and migratory and resident wildlife;
- Conserving threatened and endangered species; and
- Providing opportunities for compatible scientific research.

Management options for the Refuge were evaluated and proposed in a Comprehensive Conservation Plan (CCP) (USFWS 2004) prepared by the Service in 2004. The CCP served as the Environmental Impact Statement for this action as required under the National Environmental Policy Act.

As a result of the Refuge Act, the following land management implications are expected:

- Land ownership will remain with the United States; however, jurisdiction for certain portions of Rocky Flats will be transferred from DOE to the U.S. Department of the Interior, although DOE will retain the Central Operable Unit (Figure 3) for remedy-related purposes.

- The U.S. Department of the Interior, specifically USFWS, will administer the Refuge.

- The lands retained by DOE are expected to be managed consistent with the Refuge, unless the needs of the remedy dictate otherwise.

- Once designated as a National Wildlife Refuge, the transferred property will not be subject to annexation by any unit of general local government.

- The Refuge Act prohibits the United States from transferring any rights, title, or interest in land within the boundaries of Rocky Flats, except for the purpose of transportation improvements on the eastern edge of the site that is bordered by Indiana Street.

- Use of the land for residential, commercial, or industrial purposes will not occur, and surface water and groundwater will not be used for potable water supplies. The land is not anticipated to be used as cropland, although the CCP allows for limited livestock grazing for the purpose of vegetation management.

Specific prohibitions on activities on lands to be retained by DOE are discussed in Section 16 of this CAD/ROD.

Until recently, land around the site consisted primarily of rangeland, preserved open space, mining areas, and low-density residential areas. However, this rural pattern is beginning to change due to the spread of development from the surrounding communities. The towns of Superior and Broomfield have already experienced extensive development north and northeast of the site. The population distribution in areas around Rocky Flats as of 2004 is presented in Figure 18.

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

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

As discussed previously, shallow groundwater that has been contaminated by site-related activities becomes surface water prior to leaving the Rocky Flats Central Operable Unit. Surface water in Walnut Creek is not used for drinking water in the vicinity of Rocky Flats. Water in Walnut Creek downstream of Rocky Flats may be impounded by the City of Broomfield in Great Western Reservoir, which stores effluent for re-use as irrigation water. Surface water in Woman Creek is also not used as a drinking water supply. Water leaving the site in Woman Creek is collected in Woman Creek Reservoir above Standley Lake. It is then held, tested, and released to Walnut Creek below Great Western Reservoir. Woman Creek Reservoir is operated by the Woman Creek Reservoir Authority, a consortium of the Cities of Westminster, Thornton and Northglenn, using funds provided by DOE.

10. SUMMARY AND CONCLUSIONS OF THE COMPREHENSIVE RISK ASSESSMENT

This section summarizes the Comprehensive Risk Assessment (CRA) for Rocky Flats. The details of the CRA are found in Appendix A of the RI/FS report. The CRA was conducted in accordance with the regulatory agency-approved CRA Work Plan and Methodology (DOE 2005a). The CRA consisted of two parts: a Human Health Risk Assessment (HHRA) and an Ecological Risk Assessment (ERA). The CRA was designed to provide information to help determine the final remedy that is adequately protective of human health and the environment. The CRA estimated the risks posed by the site if no additional actions were taken. It provided the basis for taking additional action and identified the contaminants and exposure pathways that need to be addressed by the remedial action selected in this CAD/ROD.

Under CERCLA, EPA considers environmental concentrations corresponding to a 10^{-6} to 10^{-4} cancer risk range and a total non-cancer hazard index (HI) less than or equal to 1 to be adequately protective of human health. CDPHE defines acceptable human health risk as a lifetime excess cancer risk less than 1×10^{-6} from exposure to carcinogenic compounds and/or a hazard quotient (HQ) less than 1.0 for non-carcinogenic compounds (CDPHE 1994). CDPHE guidance requires evaluation of contaminant concentrations on a SWMU or release site basis. This was implemented at Rocky Flats on an IHSS-by-IHSS basis during the accelerated action process. By addressing cumulative impacts from multiple release sites, the CRA's exposure unit approach complements, but does not

supplant, CHWA's emphasis on individual release sites. State regulations also require that residual radioactivity be evaluated against annual dose criteria. These regulations establish a 25- millirem (mrem) annual dose limit for human receptors under use restrictions. If institutional controls restricting use were to fail, residual radioactivity must be less than 100 millirems per year (mrem/yr) to the appropriate human receptor.

The overall risk management goal identified for use in the ERA, as stated in the CRA Methodology, is the following:

> *Site conditions due to residual contamination should not represent significant risk of adverse ecological effects to receptors from exposure to site-related residual contamination.*

The ERA was designed and implemented to determine whether site conditions meet the defined goal.

For purposes of the CRA, the site was divided into twelve Exposure Units (EUs) for assessing potential risks for human and terrestrial ecological receptors, and seven Aquatic EUs (AEUs) for assessing potential risks for aquatic ecological receptors. The EUs and AEUs are shown on Figure 19 and Figure 20, respectively. In addition, a site-wide analysis was conducted for wide-ranging terrestrial receptors, such as coyote and mule deer. The EUs were designated based on known sources and potential contaminant release patterns to collectively assess areas with similar types of potential contamination. Other criteria used in distinguishing the EUs included separate watersheds, as well as similar topography and vegetation. The resulting units also represent "functional areas," meaning they all fall within a size range where future wildlife refuge workers would likely spend their time. Table 10 presents a summary of the EU characteristics. The AEUs represent a framework for evaluating population risks to aquatic receptors from exposure to surface water and sediment within aquatic systems at Rocky Flats. The basis for these AEUs is that they represent separate drainages or the upper and lower portions of a large single drainage.

Site Data Quality, Adequacy and Overview- - The data used in the CRA are the result of implementation of regulatory agency-approved SAPs and SAP Addenda that were prepared to characterize background and site conditions for soil, sediment, groundwater, and surface water for the years 1991 through 2005. Data Quality Assessments (DQAs) were prepared for the site-wide data set, for each EU and each AEU. Data quality was assessed using a standard precision, accuracy, representativeness, completeness, and comparability parameter analysis. Field and laboratory quality control sample data were also reviewed. Based on the DQAs, EPA and CDPHE determined that the CRA data met the data quality objectives, and were of adequate quality for the CRA.

In accordance with the CRA Methodology, only data collected on or after June 28, 1991, were used in the CRA, because these data meet the approved analytical quality assurance/quality control programs established by the IAG and RFCA. For the CRA, analytical data for samples collected over this time frame constitute a reasonably

representative data set for use in calculating concentration estimates for the CRA. For subsurface soil and subsurface sediment, only samples from a depth of up to eight feet below ground surface were used in the CRA. This was done because it is not anticipated that workers or burrowing animals will dig to depths deeper than eight feet.

The sampling data used for the HHRA (that is, used for evaluating direct contact pathways including incidental ingestion, inhalation, dermal contact, and external radiation that were evaluated on an EU basis) and ERA for each EU are as follows:

- Combined surface soil/surface sediment data (HHRA);
- Combined subsurface soil/subsurface sediment data (HHRA);
- Surface soil data (ERA); and
- Subsurface soil data (ERA).

For the HHRA, the surface soil and surface sediment data were combined into one medium because both are surficial media and exposure patterns are assumed to be similar. For the same reason, the subsurface soil and subsurface sediment data were also combined for the HHRA.

Sitewide evaluations in the HHRA (that is, evaluations for exposure pathways, including ingestion of surface water and exposure to VOCs in indoor air that were performed on a sitewide basis) were performed using the following data:

- Groundwater data (indoor air pathway);
- Subsurface soil/subsurface sediment data (indoor air pathway); and
- Surface water data.

For the AEUs the following data were used:

- Sediment data; and
- Surface water data.

Approximately two million data records were used in the CRA.

Human Health Risk Assessment - - In the first step of the HHRA, Contaminants of Concern (COCs) were identified. In this step, chemical concentrations in each EU are evaluated to assess whether a quantitative assessment of risk needs to be conducted. The human health COC selection process is illustrated on Figure 21. The COCs selected for each EU are listed in Table 11, including the range of detected concentration and frequency of detection within the EUs. COCs were identified for surface soil/surface

sediment in five of the twelve EUs. The COCs include arsenic, vanadium, benzo(a)pyrene, dioxin and plutonium-239/240.

In the next step of the HHRA, an exposure assessment was conducted to evaluate the pathways through which people may be exposed to the COCs identified for Rocky Flats. The Site Conceptual Model (SCM) provides an overview of potential human exposures at the site. The SCM describes what kind of human populations may be present, through which environmental media humans may be exposed, and through which pathways exposure may occur. The SCM is illustrated on Figure 22. The future land use for Rocky Flats is a wildlife refuge. Therefore, human populations who may be present include WRWs and WRVs. Workers may staff a visitor center, monitor and maintain the trail system, and track the on-site wildlife populations. Visitors may hike, bike, and bird-watch at Rocky Flats. WRW receptors are assumed to be adults, while WRV receptors will likely include both adults and children.

Workers and visitors could theoretically contact contaminants in surface soil, subsurface soil, sediment, surface water, and groundwater. All exposure pathways included in the SCM were identified as complete (meaning that exposure through the pathway is at least theoretically possible). In addition, the pathways were identified as either significant or insignificant. Insignificant pathways were associated with such low exposure that there will be negligible risk even if exposure occurs.

The following exposure pathways were identified as potentially complete and significant in the SCM:

- Incidental ingestion of surface soil/surface sediment;
- Inhalation of dust released from surface soil/surface sediment;
- Dermal exposure to surface soil/surface sediment;
- External irradiation exposure from surface soil/surface sediment;
- Incidental ingestion of subsurface soil/subsurface sediment;
- Inhalation of particulates released from subsurface soil/subsurface sediment;
- Dermal exposure to subsurface soil/subsurface sediment; and
- External irradiation exposure from subsurface soil/subsurface sediment.

These pathways were quantitatively characterized for an EU if COCs were identified. The following exposure pathways were identified as insignificant in the SCM:

- Incidental ingestion of and dermal contact with surface water;

- Inhalation of volatiles released from subsurface soil/subsurface sediment or from groundwater to indoor air; and

- Ingestion of deer and/or grazing animals.

While the indoor air pathway was considered to be insignificant for most areas of the site, VOCs have been detected in the subsurface in some sampling locations, primarily in the Industrial Area EU.

The evaluation for the indoor air inhalation pathway was performed by comparing the maximum detected concentrations (MDCs) of VOCs in subsurface soil/subsurface sediment and groundwater to PRGs for indoor air. The PRGs were developed in the CRA Methodology using the Johnson and Ettinger Indoor Air Model, which has been endorsed by EPA (EPA 2000). The MDCs of volatile compounds in subsurface soil/subsurface sediment and groundwater were compared to the PRGs, and maps were created showing all locations where maximum concentrations (that is, maximum concentrations measured at a groundwater well or in a soil boring) exceeded the PRGs (Figures 23 and 24). In these locations, the indoor air inhalation pathway is potentially significant if buildings were constructed there. In locations where there are no exceedances of the volatilization PRGs, the indoor air inhalation pathway is assumed to be insignificant.

Exposure point concentrations (EPCs) were calculated for the COCs identified in surface soil/surface sediment. EPCs are an estimate of COC concentrations to which people may be exposed. Two types of concentration estimates were used to evaluate exposure at Rocky Flats: Tier 1 and Tier 2. It is usually assumed that the best estimate for the EPC is the average concentration for an area. Because there is some uncertainty in having measured the average concentration accurately, a value higher than the calculated average is used in risk assessments. This value is the upper confidence level (UCL) on the average or mean concentration within an area. The 95 percent UCL is defined as the value that equals or exceeds the true mean with 95 percent confidence. This is the Tier 1 concentration.

If most of the data for an EU were collected in areas associated with historic releases (for example, in the Wind Blown EU, where most samples were collected in association with the 903 Pad and Lip Area), and few data points are available for the non-impacted areas, the Tier 1 EPC is likely to overestimate the concentration for the EU as a whole. Therefore, a second approach was used for the Tier 2 EPCs that equally weighs the data for different sub-areas of an EU. In this approach, averages were first calculated for 30-acre sub-areas of an EU. These averages were then combined to calculate an EU-wide average. Due to the uncertainty in having accurately characterized the average, a UCL was again calculated using the 30-acre sub-area averages; this UCL is the Tier 2 EPC. In areas where the data were evenly spaced throughout the EU, there are only minor differences between the Tier 1 and Tier 2 EPCs. Risks for COCs in surface soil and surface sediment were calculated using both Tier 1 and Tier 2 EPCs.

Exposure assumptions are factors that describe how exposure is assumed to occur. Exposure assumptions describe, for example, how long exposure will occur (exposure duration), how often (exposure frequency), and how much air will be inhaled for every hour spent on the site (inhalation rate). Most assumptions used to evaluate WRW and WRV receptors at Rocky Flats followed EPA guidelines. In addition, several site-specific assumptions were developed. Overall, the exposure assumptions and estimates represent the maximum amount of exposure that the WRW and WRV receptors can reasonably be expected to come into contact with, and are summarized in Tables 12 through 15.

A toxicity assessment, which is an estimate of how much of a chemical it would take to cause adverse human health effects, was performed for the COCs at Rocky Flats. Different chemicals have different potencies, and these are reflected in the toxicity criteria that were used in the HHRA. Toxicity criteria for the COCs are shown in Table 16. These toxicity criteria were used in the risk calculations for the COCs. Two types of toxicity criteria were used: cancer slope factors and reference doses. The former are used to estimate cancer risks, while the latter are used to estimate non-cancer health effects. Because one of the COCs for one EU is a radionuclide (plutonium-239/240), a radionuclide dose was also calculated using the RESRAD computer code. RESRAD was developed by the Argonne National Laboratory for DOE. It is used to calculate radiation dose to a chronically exposed on-site individual, using exposure parameters based on an appropriate site exposure model. RESRAD has been widely applied in decommissioning and cleanup of radioactively contaminated sites in order to determine radiation dose for comparison to regulatory requirements. RESRAD is accepted by both EPA and CDPHE for this purpose.

In the human health risk characterization, the estimated exposures to COCs were combined with the toxicity criteria to calculate risks. For example, cancer risks are calculated by multiplying the exposure estimate for a COC by the cancer slope factor, as illustrated by the following equation:

Cancer risk (unitless) = Dose Estimate (milligrams per kilogram [mg/kg] - day x Cancer Slope Factor (mg/kg – day)

For this equation, an EPC is factored together with exposure duration, exposure frequency, body weight, intake rate, and averaging time to produce the dose estimate. The estimated cancer risk represents a probability of a person developing cancer. EPA considers 1 in 1,000,000 to 1 in 10,000 to be the acceptable risk range, where the acceptable risk for each site is determined based on site-specific conditions (in the results presented in Table 16, a 1-in-1,000,000 risk is written as 1E-06; elsewhere, it appears as 1×10^{-6}). Non-cancer health effects are calculated by dividing the exposure estimate by the reference dose. The ratio between the two levels is called a hazard quotient (HQ), and an HQ less than 1 indicates that people are unlikely to have adverse health effects. An HQ is based on a single contaminant while a hazard index (HI) is based on the summation of HQs of multiple contaminants. For Rocky Flats, risks were estimated for exposure to surface soil/surface sediment by workers and visitors in five EUs where COCs were identified.

A summary of cancer and non-cancer risks and dose estimates for future WRW and WRV receptors at Rocky Flats is presented in Table 17. The cancer risk estimates for the five EUs were at the lower end of EPA's 1×10^{-6} to 1×10^{-4} risk range (that is, less than 1×10^{-5}). The non-cancer health effect estimates (that is, HIs) were all below 1, indicating non-cancer adverse health effects are unlikely.

Radiological dose estimates were developed using RESRAD. The dose estimate for plutonium-239/240 for the WRW is 0.3 mrem per year and for the WRV child is 0.2 mrem per year. These dose estimates are well below the acceptable annual radiation dose of 25 mrem specified in the Colorado Standards for Protection Against Radiation.

More specific discussions for the five EUs which had COCs are as follows:

- No Name Gulch Drainage EU – Non-cancer health effects for this EU were estimated for vanadium; the HI for this EU was well below 1.

- Wind Blown Area EU – The cancer risk estimates for this EU derive from plutonium 239/240 and arsenic, both calculated at 2×10^{-6} for the WRW. The risk estimate for the WRV from plutonium-239/240 for this area is 1×10^{-6}. Arsenic concentrations in this EU are similar to background concentrations.

- Upper Woman Creek Drainage EU – The cancer risk estimate to the WRW in this EU derive from benzo(a)pyrene (7×10^{-6}) and dioxins (2×10^{-6}). The benzo(a)pyrene samples used to calculate the risk level are now buried under several feet of soil beneath the Original Landfill cover. The soil containing dioxins in this EU was subsequently buried during the re-grading of the site, and is now approximately twenty feet below ground surface.

- Industrial Area EU – The cancer risk estimates in this EU are associated with arsenic (2×10^{-6}) and benzo(a)pyrene (1×10^{-6}). Arsenic concentrations are comparable to site background. Benzo(a)pyrene is not associated with any known release in this area, but may instead be associated with historic traffic and pavement.

Background cancer risks and non-cancer health effects from naturally occurring metals at Rocky Flats were calculated on a site-wide basis. All detected metals for which toxicity criteria are available were included in this evaluation. Background cancer risks for WRWs and WRVs are approximately 2×10^{-6} and HIs are 0.3 for the WRW and 0.1 for the WRV. These estimates are similar to the results for the five EUs where COCs were identified and risks and non-cancer hazards were quantitatively evaluated.

Risk assessments are designed to be protective of human health and, as such, employ conservative EPC estimates, exposure assumptions, and toxicity criteria. Using the UCL rather than the average concentration, even when the site has been well characterized, helps ensure that the EPC is protective of human health. The exposure assumptions are expected to overestimate typical exposures at a site. In addition, there are safety factors

built into the toxicity criteria. Because many conservative assumptions were combined, it is expected that the calculated risk for Rocky Flats is protective of any potential future exposures for the anticipated future users.

Ecological Risk Assessment - - Two types of ecological receptors were evaluated as part of the ERA: terrestrial and aquatic. The terrestrial ecological analysis was conducted for the same EUs as defined for the HHRA. A site-wide analysis was also conducted for wide-ranging terrestrial receptors that may range over the entire site (that is, coyotes and mule deer). The aquatic ecological analysis was conducted on a watershed-specific basis using the AEUs.

The overall risk management goal identified for use in this ERA is:

> *Site conditions due to residual contamination should not represent significant risk of adverse ecological effects to receptors from exposure to site-related residual contamination.*

Significant risk of adverse ecological effects implies toxicity that reduces survivorship or reproductive capability and thereby threatens populations or communities of wildlife at Rocky Flats. For species that have additional regulatory protection due to their rare or threatened status, such as Preble's meadow jumping mouse (PMJM), significant adverse effects can occur even if individuals are affected. Therefore, the assessment for the PMJM addresses the potential for individual mice to be adversely affected by contact with ecological contaminants of potential concern (ECOPCs). For other species with stable or healthy populations, the assessment focused on population-level effects, where some individuals may suffer adverse effects; however, the effects are not ecologically meaningful because the overall site population is not significantly affected.

The ERA risk conclusions are summarized in Table 18. The ERA consisted of a data evaluation, an ECOPC identification step, exposure assessments, toxicity assessments, and a risk characterization. Exposure and toxicity assessments and the risk characterization were only performed if ECOPCs were identified for at least one medium in an EU or AEU. Of the twelve EUs that were evaluated for potential risk to terrestrial ecological receptors, eight EUs had ECOPCs identified for surface soil during risk characterization for non-PMJM receptors. PMJM receptors were evaluated for eight EUs; of these EUs, five had surface soil ECOPCs for the PMJM receptor. No ECOPCs were identified for subsurface soil for any of the EUs. The HQs for the ECOPC/receptor pairs in the EUs indicate the potential for adverse effects to PMJM and non-PMJM receptors range from low to moderate in the EUs where ECOPCs were identified. No significant risks were identified for any ecological receptor in any EU, and no high levels of uncertainty were identified for the EU data sets. Therefore, no Ecological Contaminants of Concern (ECOCs) were identified for any of the EUs or for wide-ranging receptors at Rocky Flats.

Of the seven AEUs that were evaluated for potential risk to aquatic ecological receptors, five AEUs had ECOPCs identified for surface water and sediment. The ECOPCs were

evaluated in the risk characterization using multiple lines of evidence, including an HQ assessment using chemical data and review of drainage-specific conclusions from previous studies for ECOPCs. The previous studies included tissue analyses, aquatic population studies, toxicity bioassays, waterfowl and wading bird exposure studies, and contaminant loading analyses.

The AEU assessments indicate there are no continuing, significant risks to aquatic life from residual ECOPCs due to Rocky Flats historic operations. No aquatic ECOCs were identified. While significant risks to aquatic life are not expected, the RI/FS report recommended additional sampling to further reduce the uncertainties in this analysis.

As part of the characterization of risk, the ERA also considered the results of ecological monitoring studies that have been conducted at Rocky Flats since 1991. The purpose of this long-term program was to monitor specific habitats to provide a site-wide database from which to monitor trends in the wildlife populations at Rocky Flats. Although a comprehensive compilation of monitoring results has not been presented, the annual reports of the monitoring program provide localized information and insights on the general health of the Rocky Flats ecosystem. Data collected on wildlife abundance and diversity indicate wildlife species richness remains high at the site. Overall, low risk to survival, growth, and reproduction is predicted for the ecological receptors evaluated. These data appear to support conclusions that there are no significant risks to receptor populations at Rocky Flats.

Basis for Action - - From a risk management standpoint, only one human health COC, plutonium-239/240, required further evaluation. While the risk from exposure to plutonium-239/240 to the WRW was only 2×10^{-6} for the Wind Blown EU, an alternative was evaluated in the FS to remove surface soil to reduce the risk posed by residual plutonium-239/240 to less than 1×10^{-6}.

The indoor air pathway was evaluated on a site-wide basis, and was generally judged to be insignificant. However, this evaluation indicated that subsurface levels of VOCs in certain areas (primarily the Industrial Area EU) exceeded PRGs, making the indoor air pathway potentially significant. This was also further evaluated in the FS.

The overall conclusions for the ERA indicate that site conditions due to residual contamination do not pose a significant risk to ecological receptors. However, additional environmental sampling is indicated to reduce the uncertainties in the ERA.

11. SUMMARY OF THE RESULTS OF THE RI

This section summarizes the results of the RI by environmental medium, and presents the overall conclusions of the RI. Three major analyses were performed as part of the RI. An evaluation of the nature and extent of contamination considered soil, groundwater, surface water, sediment, and air, and showed the types of contaminants remaining at Rocky Flats and their extent, following the completion of accelerated actions under

RFCA. The contaminant fate and transport evaluation used information about the site physical characteristics, contaminant source characteristics, and contaminant distribution across the site to develop a conceptual understanding of the dominant transport processes that affect the migration of different contaminants in various environmental media. The primary focus, consistent with the RFCA objectives, was evaluating the potential for contaminants from any medium to impact surface water quality. The RI included a CRA. The CRA consisted of two parts: an HHRA an ERA. The CRA was designed to provide information to decision makers to help determine the final remedy that is adequately protective of human health and the environment. The CRA evaluated the risks posed by conditions at the site to the anticipated future users, those being the WRW and the WRV. The CRA did not evaluate an unrestricted use scenario, but did consider an indoor air pathway, if occupied structures were to be present at the site in the future.

Important results of these analyses, by environmental medium, are as follows:

- Surface Soil and Surface Sediment - - The nature and extent of contamination evaluation identified fourteen AOIs in surface soil and sediment, including metals (such as arsenic), PCBs, dioxin, SVOCs (including benzo(a)pyrene), and radionuclides (including plutonium-239/240 and americium-241). The fate and transport analysis showed that only two of these substances (plutonium-239/240 and americium-241) had complete pathways to surface water. The HHRA identified only one COC requiring further evaluation, that being plutonium-239/240 in the Wind Blown EU, which posed a risk to the WRW of 2×10^{-6}. While other COCs were identified in the HHRA, they were limited in extent and/or covered by soil (such as benzo(a)pyrene), or posed risks comparable to the Rocky Flats background (in the case of arsenic). All COCs posed risks that were well within or below EPA's accepted risk range. The overall conclusions from the ERA indicated there is no significant risk of adverse ecological effects to receptors from exposure to site-related residual contamination. However, additional sampling was recommended to further reduce uncertainties in this analysis.
- *Subsurface Soil* - - Fourteen subsurface AOIs were identified in the nature and extent of contamination evaluation for subsurface soil. These included metals, PCBs, benzo(a)pyrene, VOCs and radionuclides. Five subsurface soil analytes had complete pathways to surface water (via groundwater); all were VOCs. The HHRA did not identify any subsurface COCs; however, the indoor air pathway analysis did reveal a number of areas at Rocky Flats where subsurface concentrations of VOCs exceeded the indoor air PRGs. In these areas, the potential for exposure resulting in an unacceptable risk to the WRW exists, if occupied structures were to exist there in the future. While contaminated subsurface structures exist in portions of the Central OU, the CRA did not evaluate exposure to this contamination, since it was assumed that the WRW would not dig below three feet. There is no significant risk of adverse ecological effects to receptors from exposure to site-related residual subsurface soil contamination.

- *Groundwater* - - The nature and extent evaluation identified nineteen AOIs in UHSU groundwater, but none in the LHSU. AOIs included uranium, metals (including nickel and chromium), VOCs, and water quality parameters including nitrate/nitrite. The fate and transport analysis showed that ten of these AOIs had the potential to affect surface water quality, including uranium isotopes, VOCs, and nitrate/nitrite. Five groundwater areas in the Central OU were identified as having the potential to impact surface water quality. The RI concluded that residual VOC sources are likely to persist in the environment at Rocky Flats for decades to hundreds of years, notwithstanding accelerated actions that included source removals, construction of passive treatment systems, and enhancements performed pursuant to the Groundwater IM/IRA (DOE 2005b). Groundwater contaminants exist in concentrations above MCLs in the UHSU in the Central OU. The HHRA did not identify any COCs in groundwater; however, the HHRA did not evaluate the use of UHSU groundwater as a drinking water source, since this was inconsistent with both the WRW and WRV use scenarios. As with subsurface soil, the indoor air pathway analysis did reveal a number of areas at Rocky Flats where concentrations of VOCs in shallow groundwater exceeded the indoor air PRGs. In these areas, the potential for exposure resulting in an unacceptable risk to the WRW exists, if occupied structures were to exist there in the future. Groundwater was not specifically evaluated in the ERA, but the only exposure pathway for ecological receptors to groundwater is where groundwater becomes surface water as seeps. The ERA concluded that there are no significant impacts to ecological receptors from surface water, and therefore there are no effects from groundwater.

- *Surface Water* - - The nature and extent evaluation identified eighteen surface water AOIs, including VOCs, metals, radionuclides (including plutonium-239/240, americium-241, and uranium sum of isotopes), and nitrate/nitrite. The fate and transport analysis compared AOI surface water data to surface water standards at non-background surface water locations, including the POCs established under RFCA. Four AOIs (plutonium-239/240, americium-241, uranium sum of isotopes, and nitrate/nitrite) were observed in excess of surface water standards at monitoring locations within the Central OU, although no exceedances of surface water standards occurred at the POCs. Surface water leaving Rocky Flats, downstream of the terminal ponds in each drainage, is suitable for all uses. Other AOIs were observed above surface water standards infrequently or not at all. The HHRA did not identify any COCs in surface water; however, the HHRA did not evaluate the use of UHSU surface water as a drinking water source, since this was inconsistent with both the WRW and WRV use scenarios. The aquatic exposure unit assessments in the ERA indicate that there are no significant risks to aquatic life from residual contamination at Rocky Flats. However, additional sampling was recommended to further reduce some uncertainties in this analysis.

- *Air* - - With the completion of accelerated actions under RFCA, sources of ongoing emissions to air include volatilization of VOCs from residual subsurface contamination and closed landfills, and re-suspension of residual radionuclide contamination associated with surface soils. However, sources of these contaminants were removed as part of the RFCA accelerated actions. VOC emissions present no health or environmental concerns. Historic concentrations of airborne radionuclides have presented radiation doses less that three per cent of the allowable ten millirem standard, based upon samples collected since 1999.

Considering the results of the RI, DOE, EPA and CDPHE concluded that the Peripheral OU was unaffected by site activities from a hazardous waste perspective; that is, no hazardous wastes or constituents have been placed in or migrated to the Peripheral OU. This determination is based on process knowledge including past waste management practices, research into evidence of disturbed areas, and results of extensive sampling in the former Buffer Zone OU. Historical IHSSs, Potential Areas of Concern (PACs), and Potential Incidents of Concern (PICs) in the Peripheral OU are identified on Figure 25, and investigation results are summarized in Table 19.

A small portion of the Peripheral OU was impacted by site activities from a radiological perspective; for example, plutonium-239/240 exists above background in surface soil in the Wind Blown EU. As illustrated on Figure 10, there are a few sampling locations within the Peripheral OU that exceed a level of 9.8 pCi/g. Of these few sampling locations, the highest result is approximately 20 pCi/g. If the highest concentration of 20 pCi/g were considered the average concentration over an appropriate EU, it would correspond to a risk of approximately 1×10^{-5} for a rural resident, which would be in the middle of the CERCLA risk range (10^{-6} to 10^{-4}). These levels of radioactivity are also far below the 231-pCi/g activity level for an adult rural resident[5] that equates to the 25 millirem per year dose criterion specified in the Colorado Standards for Protection Against Radiation.

Figure 26 includes groundwater sampling locations where composite MCLs are exceeded in the Peripheral OU. Figure 23 shows subsurface soil sampling locations where volatilization PRGs are exceeded in the Peripheral OU. Figure 24 shows groundwater sampling locations where volatilization PRGs are exceeded in the Peripheral OU. Details on the analyte(s) causing the exceedance(s) at each location are discussed in Table 20. Further evaluation of these locations is not required.

No ECOCs were identified in the CRA for the Peripheral OU. Therefore, the RI concluded that no action is required in the Peripheral OU and the Peripheral OU is determined to be acceptable for all uses. Further evaluation of the Peripheral OU is not required.

Other significant conclusions of the RI are as follows:

- Air emissions present no health or environmental concerns, and do not need to be evaluated further;

- Further evaluation of surface soil, subsurface soil, groundwater and surface water are warranted;

- Residual surface soil contamination, in particular from plutonium-239/240, may contribute to intermittent exceedances of radionuclide standards for surface water, and poses a potential risk of 2×10^{-6} for a WRW in the Wind Blown EU:

- Certain contaminants in subsurface soil have complete pathways (via groundwater) that may affect surface water, and may pose an indoor air risk in some locations;

- There are five areas where UHSU groundwater may contribute to surface water contamination, UHSU groundwater exceeds MCLs in certain locations, and in some locations groundwater contaminants may pose an indoor air risk;

- Surface water does not always meet standards in the Central OU for some contaminants, including radionuclides; and

- Additional sampling of surface water and sediments will be needed to further reduce uncertainties in the ERA.

Activities to address these conclusions in the Central OU were addressed in the FS, and the final remedial action is contained in this CAD/ROD.

12. REMEDIAL ACTION OBJECTIVES

This section identifies remedial action objectives (RAOs) and applicable or relevant and ARARs for contaminated groundwater, surface water, and soil in the Rocky Flats Central OU. The RAOs were used in developing and evaluating remedial alternatives. The RAOs are contaminant-specific cleanup goals for the final comprehensive response action and are based on:

- Human and ecological receptor exposure pathway scenarios for each contaminated medium, consistent with the reasonably foreseeable future land use as a National Wildlife Refuge;

- ARARs; and

- Target risk levels.

Where transport of contamination occurs between environmental media, the RAOs for each medium are interdependent and are developed with this understanding.

Section 121(d) of CERCLA and NCP Section 300.430(f)(1)(ii)(b) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria and limitations, which are collectively referred to as ARARs. Each remedial alternative was evaluated for compliance with ARARs as part of the overall remedy selection process. ARARs for Rocky Flats are shown in Table 21.

RAOs were developed for groundwater, surface water and soils (surface and subsurface). They are discussed below, together with the status of each following the completion of RFCA accelerated actions.

Groundwater Remedial Action Objective 1

Meet groundwater quality standards, which are the Colorado Water Quality Control Commission surface water standards, at groundwater AOC wells.

Status: Groundwater RAO 1 is met. For the groundwater AOIs, most current data for those analytes measured in groundwater show concentrations below the highest of the surface water standard, background, or practical quantification level at all AOC wells with one exception (well 10594, which is located down-gradient of Pond A-1 in North Walnut Creek, for sulfate results from samples collected in 1995 and 1996).

Groundwater Remedial Action Objective 2

Restore contaminated groundwater that discharges directly to surface water as base flow, and that is a significant source of surface water, to its beneficial use of surface water protection wherever practicable in a reasonable timeframe. This is measured at groundwater Sentinel wells. Prevent significant risk of adverse ecological effects.

Status: The first part of Groundwater RAO 2 (restore contaminated groundwater to its beneficial use) is not met at all Sentinel wells. However, at this time no additional removal, containment or treatment actions can reasonably be taken in addition to the accelerated actions already completed under RFCA. The second part of Groundwater RAO 2 (that is, prevent significant risk of adverse ecological effects) is met.

Groundwater Remedial Action Objective 3

Prevent domestic and irrigation use of groundwater contaminated at levels above MCLs.

Status: This RAO is not met. There are some sampling locations within the Central OU where levels of groundwater contaminants exceed MCLs.

Surface Water Remedial Action Objective
Meet surface water quality standards, which are the Colorado Water Quality Control Commission surface water standards.

Status: This RAO is met at all RFCA surface water POCs. However, surface water in the Central OU does not always meet Colorado surface water quality standards, at monitoring points upstream of the Rocky Flats terminal ponds.

Soil Remedial Action Objective 1
Prevent migration of contaminants to groundwater that would result in exceedances of groundwater RAOs.

Status: This RAO is not met everywhere in the Central OU. Soil sources of contamination have been removed through RFCA accelerated actions. However, some subsurface AOIs with complete pathways from subsurface soils to surface water (via groundwater) may be above surface water standards at one or more Sentinel wells. However, at this time no additional removal, containment or treatment actions can reasonably be taken in addition to the accelerated actions already completed under RFCA.

Soil Remedial Action Objective 2
Prevent migration of contaminants that would result in exceedances of the surface water RAO.

Status: This RAO is met if residual contamination in surface soil is not disturbed, as the fate and transport evaluation found that two soil contaminants (plutonium-239/240 and americium-241) have complete pathways to surface water. Disturbance of residual soil contamination can cause migration via erosion, and some surface water samples in the Central OU have shown levels of plutonium-239/240 and americium-241 that exceed water quality standards as a result.

Soil Remedial Action Objective 3
Prevent exposures that result in an unacceptable risk to the WRW. The 10^{-6} risk level shall be used as the point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at the site or multiple pathways of exposure (40 Code of Federal Regulations 300.430[e][2][i][A][2]). Prevent significant risk of adverse ecological effects.

Status: Soil RAO 3 was determined not to be met for human health. The CRA did not evaluate an unrestricted use scenario, but instead evaluated potential risk to the anticipated future user (the WRW and the WRV). Therefore, this RAO cannot be determined to have been met for surface soil unless all exposure assumptions inherent in the risk evaluation are met. In addition, for subsurface soil, the CRA concluded that the indoor air pathway is potentially significant if buildings were constructed and occupied in portions of the Central OU where there are exceedances of volatilization PRGs in subsurface soil and groundwater. The calculated risks from all surface soil and sediment COCs fell near the low end, or below, EPA's acceptable risk range. However, the Feasibility Study analyzed additional removal of plutonium-239/240 in surface soil the Wind Blown EU to below 9.8 pCi/g, corresponding to the 1×10^{-6} PRG for the WRW. The ERA indicated that soil conditions do not represent significant risk of adverse ecological effects, so this RAO is met for the environment.

In summary, four RAOs are not met for the Central OU, including groundwater RAO 2, groundwater RAO 3, soil RAO 1 and soil RAO 3. Two other RAOs (the surface water RAO and soil RAO 2), are met currently, but would not be met if site conditions changed. Remedial alternatives for the Central OU were developed and evaluated considering the status of each of these RAOs for each environmental medium.

13. DESCRIPTION OF REMEDIAL ALTERNATIVES

The FS developed three alternatives for the Central OU. As mentioned, the RI concluded that no further evaluation was required for the Peripheral OU, and no alternatives were developed or evaluated there. The major components of the three Central OU alternatives are discussed below.

Alternative 1, No Further Action with Monitoring - - This alternative continues environmental monitoring currently required under RFCA, along with operation and maintenance activities in accordance with approved RFCA decision documents. More specifically, the components of Alternative 1 are as follows:

- Management of the Present Landfill cover system and Present Landfill seep treatment system will continue in accordance with the approved Monitoring and Maintenance Plan (2006c). Activities will include regular inspection and maintenance activities for the landfill cover and runoff control systems; RCRA groundwater monitoring at six wells; inspection and maintenance of the passive seep treatment system (designed to treat low levels of benzene in the Present Landfill seep through passive aeration); monitoring of water quality at the seep treatment system; inspection and maintenance of the East Landfill Pond dam; regular reporting to the regulatory agencies; and, institutional controls as required by the Present Landfill IM/IRA.

- Management of the Original Landfill cover system will continue in accordance with the approved Monitoring and Maintenance Plan (DOE 2006d). Activities will include regular inspection and maintenance activities for the landfill cover, toe buttress, and runoff control systems; RCRA groundwater monitoring at four wells; monitoring of surface water in Woman Creek; regular reporting to the regulatory agencies; and, institutional controls as required by the Original Landfill IM/IRA.

- Management of the three existing groundwater treatment systems (the MSPTS, the ETPTS, and the SPPTS). These systems were designed to intercept shallow contaminated groundwater and divert it to underground cells containing treatment media specific to the contaminants in the respective plumes. The MSPTS and ETPTS treat VOCs, which constitute the principal threat wastes at Rocky Flats, by passing groundwater through a medium containing zero-valent iron. The SPPTS treats groundwater containing nitrate and uranium by passing it though media containing sawdust (to facilitate

nitrate removal) and zero-valent iron (for uranium removal). Activities will include regular inspection and necessary maintenance; monitoring to determine system performance; replacement of treatment system media as needed; and, regular reporting to regulatory agencies.

- Surface water and groundwater monitoring as defined in the Fiscal Year 2005 IMP for Rocky Flats will continue, in addition to the action-specific monitoring described above.

- Additional environmental sampling will be performed to further reduce uncertainties identified in the ERA.

DOE will report the results of environmental monitoring to the regulators on a quarterly basis, and will report adverse changes in site conditions in a timely manner.

Alternative 2, Institutional and Physical Controls - - Alternative 2, Institutional and Physical Controls, adds the implementation of institutional and physical controls to Alternative 1. Institutional controls include legally enforceable and administrative land use restrictions and physical controls including signage or other physical features to control access and activity within the Central OU. Land use restrictions are limitations or prohibitions on specific activities within designated areas of the Central OU to ensure that the conditions remain protective for the WRW and WRV, and to ensure the continued functioning of the remedy. Physical controls are items such as signage or monuments along the perimeter of the Central OU to notify the WRW and WRV that they are at the Central OU boundary. Physical controls also include measures that may be necessary to protect monitoring systems or other engineered portions of the remedy. DOE will retain jurisdiction over the engineered structures and monitoring systems associated with the completed actions. Institutional controls for the Central OU are described below.

1) The construction and use of buildings that will be occupied on a permanent or temporary basis (such as for residences or offices) is prohibited. The construction and use of storage sheds or other, unoccupied structures is permitted, consistent with the restrictions contained in items 2 and 3 below, and provided such use does not impair any aspect of the response action at Rocky Flats.
2) Excavation, drilling, and other intrusive activities below a depth of three feet are prohibited, except for remedy-related purposes.
3) No grading, excavation, digging, tilling, or other disturbance of any kind of surface soils is permitted, except in accordance with an erosion control plan approved by CDPHE or EPA. Any such soil disturbance shall restore the soil surface to preexisting grade.
4) Surface water above the terminal ponds may not be used for drinking water or agricultural purposes.
5) The construction or operation of groundwater wells is prohibited, except for remedy-related purposes.

6) Digging, drilling, tilling, grading, excavation, construction of any sort (including construction of any structures, paths, trails or roads), and vehicular traffic are prohibited on the covers of the Present Landfill and the Original Landfill, except for authorized response actions.
7) Activities that may damage or impair the proper functioning of any engineered component of the response action, including but not limited to any treatment system, monitoring well, landfill cap, or surveyed benchmark, are prohibited.

Physical controls will consist of signage installed along the perimeter of the Central OU to notify the WRW and WRV that they are at the Central OU boundary, and to notify them of the land use restrictions in place in the Central OU. Physical controls will also protect the remedy to ensure that it functions as designed.

Institutional and physical controls will be inspected periodically. If evidence of activities that violate the restrictions or damage of the physical controls is found, DOE will develop a plan to correct the condition and the correction will be implemented. Inspections and corrective actions will be documented in an annual report to the regulatory agencies. Institutional and physical controls will be incorporated throughout the Central OU in an environmental covenant granted by DOE to CDPHE.

Alternative 3, Targeted Surface Soil Removal - - Alternative 3, Targeted Surface Soil Removal, will remove the top six inches of soil in areas of residual surface soil contamination that have activities above the plutonium-239/240 WRW PRG (based on 1 x 10^{-6} target risk) concentration of 9.8 pCi/g, as shown on Figure 27. This figure shows that surface soil over approximately 368 acres would be removed. This alternative may not completely remove all plutonium contamination within the 368 acres, but the residual risk based on the EU is expected to be well below 1 x 10^{-6} if Alternative 3 is implemented. Previous RFCA accelerated actions of a similar nature (such as those performed in the 903 Pad and Lip Area) resulted in successful removal of contamination, as verified through post-accelerated action confirmation sampling based on a 90-percent confidence level.

The scope of this alternative would be to excavate the contaminated soil in a defined area to a depth of approximately six inches. The removed soil would be placed in shipping containers and then shipped for disposal at a permitted low-level radioactive waste disposal facility. Confirmation samples would be collected to verify that the contaminated soil was removed to below 9.8 pCi/g. The excavated area will not be back-filled, but graded as necessary to match existing surrounding grades. The area would then be seeded and mulched/matted for erosion control. Temporary access roads, staging areas, and other infrastructure would be built to conduct the work. Temporary construction facilities such as work trailers, equipment parking and fueling areas, and portable electrical power generators would be used during the construction period. With the excavation of six inches of soil within this area, the volume of soil to be removed and shipped to the permitted disposal facility is approximately 10,425,000 cubic feet. The duration of this removal operation is estimated at three years.

Alternative 3 also includes implementation of the features of Alternatives 1 and 2.

Common Elements, Distinguishing Features, and Expected Outcomes of Each of the Alternatives - - Each of the alternatives considered continues to treat groundwater contamination at Rocky Flats, including contamination from VOCs, which are principal-threat wastes. The alternatives also continue the containment of wastes in the Present and Original Landfills, and continue to monitor environmental conditions at the site. Each of the alternatives anticipates establishing the same boundary between the Central OU and Peripheral OU.

Alternative 2 is distinguished from Alternative 1 by adding institutional and physical controls, thereby preventing unacceptable risk if land use assumptions were to change. Alternatives 1 and 2 are similar in their ability to be implemented, in the time frame required to execute them, and in their overall costs.

Alternative 3 is distinguished from the other two alternatives in that it is the only one that contemplates additional contaminant removal actions at Rocky Flats. By removing additional contamination, it provides additional long-term effectiveness and reduces residual risk. However, Alternative 3 is also distinguished by its higher cost, relative difficulty of implementation, and longer time frame required for execution.

Regarding use of land and groundwater resources in the Central OU, each alternative will allow for land use by the anticipated future users, although Alternative 2 (as well as Alternative 3), provides additional protection by preventing changes in conditions that may present unacceptable risks to future users. For each alternative, shallow groundwater contamination will remain in the UHSU for a considerable period of time. A detailed analysis of the alternatives is presented in the ensuing section.

14. DETAILED ANALYSIS OF ALTERNATIVES

The NCP provides that a Record of Decision must explain how the nine CERCLA criteria were used to select the final remedy. Consequently, this section of the CAD/ROD presents an evaluation of alternatives for final remedial actions to be implemented to ensure that the residual contamination at the site does not present an unacceptable risk to human health or the environment. In accordance with the RFCA paragraph 83, after completion of all planned RFCA accelerated actions, CDPHE and EPA will evaluate site conditions and render a final CAD/ROD for each OU.

A detailed analysis of three alternatives developed for the Central OU were evaluated in the RI against the nine CERCLA criteria (40 CFR 300.430[e][9]). The nine evaluation criteria are:

- Overall protection of human health and the environment;
- Compliance with ARARs;

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability;
- Cost;
- State acceptance; and
- Community acceptance.

The evaluation criteria are divided into three groups based on the function of the criteria for remedy selection. The first group is the threshold criteria related to the statutory requirements that each alternative must satisfy in order to be eligible for remedy selection. These include:

- Overall protection of human health and the environment; and
- Compliance with ARARs.

The second group is the primary balancing criteria that are the technical criteria upon which the detailed analysis is based. These include:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

The third group is the modifying criteria, which includes:

- State acceptance; and
- Community acceptance.

As discussed previously, no remedial actions are required for the Peripheral OU, since it is suitable for all uses in its current state. Therefore, no remedial alternatives were developed or analyzed for the Peripheral OU.

A discussion of how each alternative compares with the individual CERCLA criteria appears below, and in summary form in Table 22.

Overall Protection of Human Health and the Environment - - The analysis of this threshold criterion describes how the alternative achieves and maintains protection of human health and the environment.

Alternative 1 is protective of human health and the environment as long as the current land configuration is maintained, and as long as the assumptions embodied in the CRA continue to be met. With the completion of the RFCA accelerated actions, risks to the WRW and WRV from residual contamination were well within the EPA's acceptable risk range for all contaminants in all media. Groundwater treatment systems will continue to operate, the remedies at the Present and Original Landfills will continue to be monitored and maintained, and environmental monitoring will continue, to verify that the site remains protective of human health and the environment. Additional environmental sampling will be conducted as part of this alternative to further reduce uncertainties in the ERA analysis. However, Alternative 1 may not be protective of human health and the environment if the current conditions were to change. Specifically:

- if assumptions embodied in the HHRA were not met, unacceptable exposure of the WRW and WRV to residual contaminants could result;

- disturbance of residual surface soil contamination (particularly plutonium-239/240 and americium-241) could result in exceedance of surface water standards;

- VOCs are present in the subsurface in some areas that could present unacceptable exposures via indoor air if occupied structures were constructed in these areas;

- groundwater in certain areas contains contaminants exceeding MCLs, and consuming this groundwater could cause unacceptable exposure to these contaminants;

- surface water does not always meet standards at some locations above the POCs, and use of this water could result in unacceptable exposures to some contaminants; and

- certain engineered features of the remedy (such as the groundwater collection and treatment systems) do not have explicit controls preventing intrusion.

Additionally, certain RAOs are not met by Alternative 1.

Alternative 2 is protective of human health and the environment in an unqualified manner. It contains institutional and physical controls that will prevent changes in land use that could otherwise result in unacceptable exposure to residual contamination. It meets all RAOs.

Alternative 3 provides somewhat more protection of human health, in that it reduces the risk to the WRW from residual radionuclide contamination in the Wind Blown EU from

approximately 2×10^{-6} to less than 1×10^{-6}. Both Alternatives 2 and 3 incorporate the treatment, monitoring and remedy maintenance features of Alternative 1. *Compliance with ARARs* - - The analysis of this threshold criterion determines how the alternative meets the federal and state ARARs that have been identified for use in the evaluation of the alternatives and the selection of the final remedy at Rocky Flats.

Alternative 1 complies with most, but not all ARARs. Specifically, Alternative 1 does not incorporate an environmental covenant between DOE and CDPHE for the entire Central OU, and so does not meet this requirement throughout the OU. Additionally, while Alternative 1 is compliant with the Colorado Water Quality Control Commission stream standards at the POCs, and so is deemed to meet this ARAR, certain locations upstream of the POCs do not meet these standards at all times.

Alternative 2 achieves compliance with all ARARs. Alternative 2 incorporates an environmental covenant for the entire Central OU, thereby meeting this ARAR. Alternative 2 also incorporates restrictions against surface water use in the Central OU, providing additional human health protection in this regard.

Alternative 3 also achieves compliance with all ARARs.

Long-Term Effectiveness and Permanence - - This analysis considers the magnitude of residual contamination and/or risk after the alternative has been implemented and the adequacy, suitability, and reliability of the alternative to control/manage the residual contamination and risk.

Alternative 1, which incorporates and maintains the positive environmental impacts of the RFCA accelerated actions, provides a moderate degree of long-term effectiveness and permanence for the following reasons:

- Many RFCA accelerated actions included removal of contaminated structures and environmental media, providing a high degree of long-term effectiveness and permanence. It was not, however, technically feasible to remove all contamination.

- Remaining building and other structures either meet free release standards for residual contamination, or have residual contamination that is either fixed in place or otherwise considered to be immobile in the environment.

- Although plutonium-239/240 persists indefinitely in the environment (for the purposes of this analysis), the major historic source of this contaminant at Rocky Flats, the 903 Pad and Lip Area, was remediated through a RFCA accelerated action. In addition to lowering residual risk, this action is anticipated to provide a long-term benefit to surface water quality.

- It is likely that residual contaminant concentrations in subsurface soil and groundwater will persist in the environment for decade to hundreds of years at

Rocky Flats. However, groundwater treatment systems will continue to operate, and enhancements such as source removals were conducted as RFCA accelerated actions. These are anticipated to have positive impacts on surface water and groundwater quality over time; however, no additional actions are considered technically feasible. Therefore, none of the alternatives considered additional groundwater remedies at Rocky Flats.

- The covers constructed at the Present and Original Landfills will continue to be maintained.

- Environmental monitoring will provide data to ensure the continuing effectiveness of the remedy, and additional sampling will be performed to further reduce uncertainties associated with the ERA analysis.

Implementation of Alternative 2 will significantly increase the long-term effectiveness and permanence achieved by the RFCA accelerated actions because institutional controls are designed to provide the mechanisms that permanently maintain the completed actions.

In addition, an environmental covenant will be implemented that will increase the long-term permanence of institutional controls. This covenant will decrease the likelihood that institutional controls will fail in the very long term. Physical controls (such as signage) will be constructed of materials that are highly durable.

Implementation of Alternative 3 increases the overall long-term effectiveness and permanence for the following reasons:

1) Removal of surface soil will permanently and effectively reduce residual plutonium-239/240 contamination to below the WRW target risk-based concentration of 9.8 pCi/g.
2) Surface soil removal reduces remaining residual surface contamination that could be mobilized in the future if disturbed.

Reduction of Toxicity, Mobility or Volume through Treatment - - This analysis considers the treatment of residual contamination to reduce the contaminant toxicity, mobility, or volume. The analysis will describe the treatment process, degree of treatment, degree to which the treatment is irreversible, and volume reduction achieved through treatment.

Alternative 1 exhibits a high degree of reduction of toxicity, mobility, or volume for the following reasons:

1) The three groundwater treatment systems provide for a reduction of VOCs, or uranium and nitrate, reducing the overall volume of contaminants in the groundwater, and protecting the adjacent surface water.
2) The Present Landfill seep treatment system provides treatment to remove the VOC contamination from the landfill seep.

Experience and knowledge gained during accelerated actions have shown that it is not technically feasible to reduce toxicity, mobility, or volume of residual plutonium in surface soil through treatment.

Alternatives 2 and 3 incorporate the groundwater treatment aspects of Alternative 1. Therefore, they also exhibit a high degree of reduction of toxicity, mobility, or volume.

Short-Term Effectiveness - - This analysis addresses the protection of the community and workers while implementing the alternative, environmental impacts while implementing the alternative, and time required to achieve the RAOs.

Alternative 1 exhibits a high degree of short-term effectiveness in that workers and the public are not at risk, since no additional action is required under this alternative. However, certain RAOs are not met under Alternative 1.

Alternative 2 exhibits a high degree of short-term effectiveness, since institutional controls are easily implemented and become effective immediately. Physical controls such as signs can be in place in a very short period of time. As with Alternative 1, workers and the public are not at risk with the implementation of Alternative 2. All RAOs are met under Alternative 2.

Alternative 3 has low short-term effectiveness because:

1) Removal of surface soil in Alternative 3 will result in an incremental risk to the workers and the public through the removal and transportation operations.
2) Removal of surface soil will result in significant short-term adverse impacts to ecological resources.
3) Removal of surface soil increases the potential to mobilize residual contamination, particularly if a large area of soil is removed, or if the removal is on a steep slope or in close proximity to a stream segment. It also increases the potential for wind erosion.
4) Alternative 3 will take approximately three years to complete, once the project is begun. However, RAOs will have already been met with the implementation of Alternative 2, which is a component of Alternative 3.

Implementability - - This analysis considers the ability to build and operate the alternative, reliability of the alternative, ability to monitor the effectiveness of the alternative, administrative feasibility of the alternative, and availability of resources to implement the alternative.

Alternative 1 is easily implemented because all of the accelerated actions are complete, post-accelerated action monitoring at the Present and Original Landfills has been established, and the IMP surface water and groundwater monitoring stations have also been established.

Alternative 2 is also easily implemented by a combination of administrative and physical controls, which are expected to include institutional controls, an environmental covenant, and limited construction work to install signage and other physical controls as needed.

Alternative 3 is moderately difficult to implement. Even though standard earthmoving and transportation equipment is readily available, implementing the alternative without impacting surface water quality is difficult. Weather, wind, and precipitation will

increase the potential for soil erosion and sediment loads to the Rocky Flats drainages. Major construction to support the long duration of the work (new temporary roadways and possibly a new temporary railroad spur) would be required to implement Alternative 3. Implementation of a low-level waste disposal program compliant with DOE, U.S. Department of Transportation, and disposal facility waste acceptance criteria is moderately difficult.

Cost - - This criterion considers order-of-magnitude capital and operation and maintenance (O&M) costs of the alternative. The O&M cost estimates will include the anticipated O&M costs along with administrative costs, replacement costs, and the cost of CERCLA periodic reviews of the remedy. A present-worth analysis is also included for a period of 30 years, using a discount rate of five per cent.

An estimate of capital expenditures for Alternative 1 is not required because all of the required systems were previously installed as part of the completed accelerated action. The O&M costs include the following:

1) Cost of cover inspection and maintenance at the Present Landfill and the Original Landfill;
2) Seep treatment system monitoring and maintenance at the Present Landfill;
3) Groundwater monitoring at the Present Landfill;
4) Groundwater and surface water monitoring at the Original Landfill;
5) Monitoring and maintenance of the three existing groundwater treatment systems;
6) Monitoring of surface and groundwater per the IMP, and maintenance of wells and surface water monitoring equipment;
7) Groundwater treatment system media replacement every five years; and,
8) Preparation of materials for the CERCLA periodic reviews.

The estimated total O&M costs for Items 1 through 6 are $2,530,000 per year. Groundwater treatment system media replacement costs are estimated at $728,000 every five years. The estimated cost for preparing materials for the CERCLA periodic reviews is $153,000. The present worth of these costs for 30 years at a discount rate of five per cent is $41,350,000.

Capital expenditures for Alternative 2 are low and are associated with the preparation of specific written administrative controls, the acquisition and installation of signs, and providing the personnel to implement and monitor compliance with the institutional control requirements. The estimated capital cost of Alternative 2 is $1,120,000.

O&M costs associated with the institutional and physical controls aspect of Alternative 2 are estimated at $45,000 per year and include the quarterly inspection of the site and signage, and a nominal amount of legal support. The total O&M costs for Alternative 2 include those associated with Alternative 1, plus inspection and maintenance of institutional and physical controls. The estimated total annual O&M costs for these items are $2,575,000 per year, not including the media replacement costs and the CERCLA

periodic review costs. The total present worth of these estimated costs for 30 years at a five per cent discount rate is $43,170,000, including the present-worth cost of Alternative 1.

Capital expenditures for Alternative 3 include the cost for the removal and disposal of the soil and the repair of the disturbed area (i.e., re-vegetation and erosion control). The estimated capital cost of Alternative 3 is $222,340,000.

The O&M costs for Alternative 3 include the cost of inspection and maintenance of the area where surface soil was removed and the area re-vegetated. The O&M cost is estimated to vary over the first five years until the new vegetation has been established. The O&M costs are estimated to vary from $206,000 in the first year following implementation, to $70,000 per year in years five through thirty. The estimated total capital cost of Alternative 3, including Alternative 2 capital costs, is $223,460,000.

The estimated total annual O&M cost, including Alternative 2 costs, ranges from $2,781,000 to $2,645,000 per year, less the media replacement costs and CERCLA periodic review costs. The present worth of these estimated costs for 30 years at a five per cent discount rate is $265,510,000, including the present-worth costs of Alternatives 1 and 2.

State Acceptance - - This analysis evaluates any technical and administrative issues and concerns the state regulatory agency may have on the alternatives.

Alternative 1 is not acceptable to the State of Colorado, because it does not meet all ARARs, nor does it achieve all RAOs. Alternative 2 is acceptable to the State, and is preferred over Alternative 3. The State has determined that, while Alternative 3 is acceptable, it is not preferred, owing to concerns relating to short-term effectiveness, implementability, and cost.

Community Acceptance - - This analysis evaluates the level of support and concerns expressed by the public on the alternatives.

The public did not express any support for Alternative 1. The public expressed substantial support for Alternative 2, although numerous comments were submitted on individual aspects of this alternative, including environmental monitoring, institutional and physical controls, and public involvement. Some public support was received for Alternative 3, and certain members of the public expressed support for additional cleanup or other remedial actions that were beyond the scope of the alternatives considered. The responsiveness summary to public comments appears as Section 20 of this CAD/ROD.

15. PRINCIPAL THREAT WASTES

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). The principal threat concept is applied to the characterization of so-called source materials at

a Superfund site. A source material is a material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contaminants to groundwater, surface water, or air, or which act as a source for direct exposure. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur.

At Rocky Flats, VOCs that occur in subsurface soil and groundwater, also referred to as Non-Aqueous Phase Liquids, or NAPLs, are considered to be principal threat wastes. A number of these chemicals (including tetrachloroethene, trichloroethene, and carbon tetrachloride) were identified as AOIs in subsurface soil and groundwater, and they were also identified as having complete pathways to surface water in the fate and transport evaluation in the RI/FS report. The CRA analysis indicated that VOC concentrations in subsurface soil and groundwater in portions of the Central OU could pose unacceptable exposures via the indoor air pathway if occupied structures existed in these areas. Residual VOC sources and their effects on groundwater are expected to persist in the Rocky Flats environment for decades to hundreds of years.

VOCs in subsurface soil and groundwater have been addressed in several ways through accelerated actions performed under RFCA. Two passive groundwater collection and treatment systems were constructed and continue to operate at the East Trenches and Mound Site plumes. Removal actions for subsurface VOCs were conducted at locations such as the 903 Pad and near former Building 771. Additional activities to enhance removal of VOCs from subsurface soils and groundwater were evaluated and implemented pursuant to the Groundwater IM/IRA. These enhancements included injection of a substance known as hydrogen release compound into subsurface soils at the 903 Pad to expedite biologically-mediated breakdown of VOCs. Beyond these enhancement actions, and the other accelerated actions taken to address subsurface VOCs at Rocky Flats, the Groundwater IM/IRA concluded that no additional actions could practically be taken.

All of the alternatives evaluated for Rocky Flats incorporate the accelerated actions already taken to mitigate subsurface VOC contamination, and all of them incorporate ongoing treatment of groundwater for VOCs. None of the alternatives proposes additional remedial actions for VOCs in subsurface soils or groundwater. Therefore, all of the alternatives are equivalent in their approach to principal threat wastes at Rocky Flats.

16. SELECTED REMEDY/CORRECTIVE ACTION FOR THE PERIPHERAL OU

The selected remedy/corrective action for the Peripheral OU is No Action. Considering the results of the RI, DOE, EPA and CDPHE concluded that the Peripheral OU was unaffected by hazardous wastes. They also concluded that the risk and dose from low levels of residual radionuclides in the Peripheral OU were well within the EPA's

acceptable risk range for a rural resident, and were far below the activities corresponding to the State of Colorado's 25-mrem dose criterion for rural residents. Conditions in the Peripheral OU are acceptable for unrestricted use and unlimited exposure.

17. SELECTED REMEDY/CORRECTIVE ACTION FOR THE CENTRAL OU

The selected remedy/corrective action for the Central OU at Rocky Flats is Alternative 2, Institutional and Physical Controls. This section of the CAD/ROD summarizes the rationale for selecting this alternative, describes the remedy and how it will be implemented, and presents a summary of the estimated remedy costs.

Summary of the Rationale for the Selected Remedy/Corrective Action - - Alternative 2 is selected over Alternative 1 (No Further Action with Monitoring), because Alternative 1 is not completely protective of human health and the environment (not all RAOs are accomplished under Alternative 1), especially if land use conditions were to change. Additionally, since Alternative 1 does not incorporate an OU-wide environmental covenant, it is judged not to meet all ARARs. Alternative 2 incorporates institutional and physical controls that will maintain protectiveness of human health and the environment, and accomplishes all RAOs in this manner. Since Alternative 2 incorporates an OU-wide environmental covenant, it meets all ARARs. Alternative 2 is marginally more difficult to implement and more costly than Alternative 1, but these differences are negligible. Additionally, the State of Colorado found Alternative 1 to be unacceptable, and Alternative 1 received no public support.

Alternative 2 is selected over Alternative 3 (Targeted Surface Soil Removal) because of concerns about cost, implementability, and short-term effectiveness associated with Alternative 3, combined with the negligible additional benefit derived from Alternative 3. While it would be protective of human health and the environment, and provides somewhat more long-term effectiveness than Alternative 2 (by virtue of additional removal of contaminants), Alternative 3 has a present-worth cost of $265,510,000 as compared to Alternative 2's present-worth cost of $43,170,000. The short-term effectiveness of Alternative 3 is compromised because of the risk posed to workers involved in the removal of contaminated soil (associated with the operation of heavy equipment), and the risk posed to the public from transportation of these soils to disposal sites. It would be more difficult to meet surface water standards for radionuclides during the excavation period. Implementation of Alternative 3 would be moderately difficult, requiring construction of substantial infrastructure and taking approximately three years to complete. The environmental benefits of Alternative 3 as compared to Alternative 2 are negligible. The Wind Blown EU, in which the excavation would take place, is already in a protective state in terms of surface soil exposure to the WRW from plutonium-239/240. Implementation of Alternative 3 would only result in an anticipated reduction of risk to the WRW from 2×10^{-6} to less than 1×10^{-6}, and the risk to the WRV in the Wind Blown EU is already at 1×10^{-6}. Alternative 2 is preferred by the State of Colorado over Alternative 3 for these reasons. Alternative 2 received substantial public support. Some members of the public supported additional removal of radionuclide

contamination at Rocky Flats, or other remedial actions that were beyond the scope of the alternatives analyzed.

In summary, Alternative 2 is selected over Alternative 1 because Alternative 2 is more protective of human health and the environment, accomplishes all RAOs and meets all ARARs. Alternative 2 is selected over Alternative 3 because Alternative 2 is protective of human health and the environment, and because Alternative 3 provides negligible additional benefits, notwithstanding substantial additional costs, along with difficulties and risks in implementation.

Description of the Selected Remedy/Corrective Action - - The selected remedy/corrective action consists of environmental monitoring and continued operation and maintenance of engineered structures such as landfill covers and groundwater treatment systems. These requirements generally derive from accelerated action decision documents, or from other RFCA-related requirements such as the IMP. To these requirements, the selected remedy/corrective action adds institutional and physical controls, which are generally intended to prevent unacceptable exposures to residual contamination, and to protect engineered components of the remedy. Additional environmental sampling will be performed to further reduce uncertainties associated with the ERA. DOE will perform regular reporting to CDPHE and EPA, and will maintain site data related to the remedy in a manner that is accessible to regulators and the public. The requirements of this remedy will be implemented through RFLMA, as well as through an environmental covenant for the Central OU that will be granted by DOE to CDPHE. Individual components of the remedy are discussed in more detail below.

DOE will continue to perform environmental monitoring for surface water and groundwater. No further, routine monitoring of air, soil, sediment, or ecological resources (plants and animals) will be required.

Surface water monitoring will be conducted, at a minimum, at POCs and POEs. Figure 14 shows current locations of these monitoring points. POCs are currently established in Walnut and Woman Creeks at Indiana Street and at the outfalls of the terminal ponds (Ponds A-4, B-5, and C-2). POCs will remain at these points unless changes in site configuration (such as removal of the terminal ponds or the construction of a new highway along Indiana Street) force their relocation. POCs are established for the purpose of monitoring compliance with surface water quality standards (derived from the stream standards established by the Colorado Water Quality Control Commission) of surface water leaving Rocky Flats, and will be monitored at a minimum for the radionuclides plutonium-239/240 and americium-241. POEs are currently established in major drainages (North and South Walnut Creeks and the South Interceptor Ditch above Pond C-2), and will remain at these points unless changes in site configuration force changes in their location. POEs are established for the purpose of monitoring the quality of water flowing from the former Rocky Flats Industrial Area. At a minimum, POEs will be monitored for those parameters monitored at the POCs, plus additional, drainage-specific contaminants. Monitoring points in addition to POEs and POCs will be

established as needed in surface water at points known to be affected by contamination from Rocky Flats activities, for the purpose of determining the effects of accelerated actions on surface water quality, with monitoring parameters selected as appropriate to the individual monitoring point. Details of the surface water monitoring network not established in this CAD/ROD, including parameters and monitoring frequency, will be based as appropriate upon the FY 2005 IMP, as well as the approved Monitoring and Maintenance Plans for the Original Landfill and Present Landfill. The substantive requirements for surface water monitoring at Rocky Flats will be incorporated as enforceable requirements in RFLMA.

Groundwater monitoring will be conducted, at a minimum, at the following types of locations:

- AOC wells: These wells are located within drainages and are located down-gradient of a contaminant plume or group of plumes. They are monitored to determine whether contaminant plumes are discharging to surface water. AOC wells are established in the following areas:
    - downgradient of the Original Landfill (monitored for VOCs and uranium);
    - downgradient of historic OU 1 at Woman Creek (VOCs);
    - downgradient of the historic 500 and 700 areas in the former IA (VOCs);
    - southeast of the 903 Pad/Ryan's Pit plume at Woman Creek (VOCs, uranium and nitrate);
    - in North Walnut Creek below Pond A-1 (VOCs, uranium and nitrate);
    - in South Walnut Creek above Pond B-5 (VOCs, uranium and nitrate); and,
    - in Woman Creek above Pond C-2 (VOCs and uranium).

  Note that no AOC wells are required for the Present Landfill, as this area is monitored through RCRA wells, discussed below.
- Sentinel wells: These wells are typically located near down-gradient edges of contaminant plumes, in drainages, and at and down-gradient of groundwater treatment systems. They are monitored to determine whether concentrations of contaminants are increasing, which may indicate plume migration or treatment system problems. Sentinel wells are established in the following areas:
    - below the East Present Landfill Pond (monitored for VOCs, uranium and nitrate);
    - in the vicinity of the MSPTS (VOCs);
    - in the vicinity of the ETPTS (VOCs, and in the case of well GW 23296, with the addition of uranium);
    - in the vicinity of the SPPTS (uranium and nitrate, and in the case of well GW P210089, with the addition of VOCs);
    - downgradient of the historic 500 and 700 areas in the former IA (VOCs);

  - in the vicinities of historic Buildings 371/374 (VOCs, uranium and nitrate, with the addition of plutonium-239/240 and americium-241 at wells GW 37405 and GW 37705), 444 (VOCs and uranium), 771/774 (VOCs, uranium, plutonium-239/240 and americium, and in the case of well GW 20705, with the addition of nitrates), 881 (VOCs and uranium), and 991 (VOCs, uranium and nitrate);
  - southeast of the 903 Pad/Ryan's Pit plume (VOCs); and,
  - downgradient of historic Oil Burn Pit No. 2 (VOCs).

- Evaluation wells: These wells are typically located within plumes and near plume source areas, or in the interior of the former Industrial Area. Data from these wells will help determine when monitoring of an area or plume can cease.

- RCRA Wells: Dedicated to monitoring the Present Landfill and Original Landfill to determine the influence on groundwater quality resulting from these areas.

In addition, groundwater monitoring will be conducted as appropriate to meet the requirements of RFCA decision documents. Representative monitoring well locations and types are shown in Figure 14. The specific locations, parameters to be monitored and monitoring frequency for groundwater wells at Rocky Flats will be based on RFCA decision documents, RCRA post-closure requirements and the FY 2005 IMP. The substantive requirements for groundwater monitoring at Rocky Flats will be incorporated as enforceable requirements in RFLMA.

The surface water quality standards for Rocky Flats (against which surface water data will be evaluated) are the site-specific and Statewide standards listed in 5 CCR 1002, including:

- Statewide surface water radioactive materials standards in Section 31.11(2);

- Statewide surface water interim organic pollutant standards in Section 31.11(3); and

- Site-specific surface water quality standards for segments 4a, 4b, and 5 of Big Dry Creek in Section 38.6 of the South Platte Basin Classifications and Standards.

In all cases, the surface water standard is defined as the greater of the lowest surface water standard or PQL. The Colorado Water Quality Control Commission established the Rocky Flats groundwater use classification as surface water protection (5 CCR 1002-42.7[1]). The groundwater standards associated with that use classification are the surface water standards.

The ERA concluded that residual contamination in the Central OU does not represent a significant risk of adverse effects to ecological receptors. However, the RI/FS report

identified the need to perform additional environmental sampling to reduce particular uncertainties in this analysis. DOE will perform additional sampling of aquatic exposure units for this purpose; sampling may include both water and sediment. Specific sampling requirements will be evaluated among DOE, EPA and CDPHE, and will be incorporated as enforceable requirements of RFLMA. Further monitoring of ecological receptors at Rocky Flats will not be required.

DOE will inspect and maintain engineered components of the remedy so as to ensure their continued effective operation. Engineered components of the remedy include:

- the Present Landfill Cover and Seep Treatment System;
- the Original Landfill Cover;
- the Mound Site Plume Treatment System;
- the East Trenches Plume Treatment System; and
- the Solar Ponds Plume Treatment System.

Requirements for the inspection and maintenance of the landfill covers will be derived from the *Monitoring and Maintenance Plan for the Present Landfill* and the *Monitoring and Maintenance Plan for the Original Landfill*, respectively. The substantive requirements of these documents will be incorporated as enforceable requirements in RFLMA. Specific monitoring, inspection and maintenance requirements for the plume treatment systems will be derived from the respective RFCA accelerated action decision documents (i.e., *Decision Document for the Mound Site Plume (DOE 1997b)*, *Proposed Action Memorandum for the East Trenches Plume (DOE 1999)*, and *Final Solar Ponds Plume Decision Document (DOE 1999a)*), as well as the FY 2005 IMP. The substantive, relevant requirements of these documents will be incorporated as enforceable requirements in RFLMA.

As part of the selected remedy/corrective action, DOE will institute a series of institutional controls. These controls will extend throughout the Central OU (see Figure 3). In general, these controls are needed so that the assumptions incorporated into the risk assessments for the likely future users (the WRW and WRV) are not violated, and in turn these users do not receive unacceptable levels of exposure to residual contamination. Certain controls are also needed to prevent damage to engineered components of the remedy. The institutional controls that will be applied to the Central OU, and the objective and rationale for each, are as follows:

1) The construction and use of buildings that will be occupied on a permanent or temporary basis (such as for residences or offices) is prohibited. The construction and use of storage sheds or other, non-occupied structures is permitted, consistent with the restrictions contained in controls 2 and 3 below, and provided such use does not impair any aspect of the response action at Rocky Flats. *(Objective: prevent unacceptable exposures via the indoor air*

pathway. Rationale: The analysis of the indoor air pathway in the CRA indicated that subsurface VOCs were at levels in certain portions of the Central OU that could pose a risk of unacceptable exposure to the WRW if occupied structures were built in these areas.)

2) Excavation, drilling, and other intrusive activities below a depth of three feet are prohibited, except for remedy-related purposes and routine or emergency maintenance of existing utility easements, in accordance with pre-approved procedures. *(Objective: prevent unacceptable exposure to residual subsurface contamination. Rationale: Contaminated structures, such as building basements, exist in certain areas of the Central OU, and the CRA did not evaluate the risks posed by exposure to this residual contamination. Thus, this restriction eliminates the possibility of unacceptable exposures. Additionally, it prevents damage to subsurface engineered components of the remedy.)*
3) No grading, excavation, digging, tilling, or other disturbance of any kind of surface soils is permitted, except in accordance with an erosion control plan (including Surface Water Protection Plans submitted to EPA under the Clean Water Act) approved by CDPHE or EPA. Any such soil disturbance will restore the soil surface to preexisting grade. *(Objective: prevent migration of residual surface soil contamination to surface water. Rationale: Certain surface soil contaminants, notably plutonium-239/240, were identified in the fate and transport evaluation in the RI as having complete pathways to surface water if disturbed. This restriction minimizes the possibility of such disturbance and resultant impacts to surface water. Restoring the soil surface to preexisting grade maintains the current depth to subsurface contamination or contaminated structures.)*
4) Surface water may not be used for drinking water or agricultural purposes. *(Objective: prevent unacceptable exposure to local surface water contamination above the terminal ponds. Rationale: While the CRA did not evaluate the risks posed by the use of surface water for drinking or agricultural purposes, the nature and extent of contamination evaluation in the RI showed that certain contaminants were found at levels exceeding standards above the terminal ponds. This restriction reduces the possibility of unacceptable exposures to the future users from this source.)*
5) The construction or operation of groundwater wells is prohibited, except for remedy-related purposes. *(Objective: prevent unacceptable exposure to contaminated groundwater. Rationale: While the CRA did not evaluate the risks posed by the use of ground water for drinking or agricultural purposes, the nature and extent of contamination evaluation in the RI identified areas in the Central OU where groundwater contaminants exceeded water quality standards or MCLs. This restriction reduces the possibility of unacceptable exposures to future users from this source. Additionally, it prevents the disruption of groundwater flow paths so as to avoid impacts to groundwater collection and treatment systems.)*

6) Digging, drilling, tilling, grading, excavation, construction of any sort (including construction of any structures, paths, trails or roads), and vehicular traffic are prohibited on the covers of the Present Landfill and the Original Landfill, except for authorized response actions. *(Objective: ensure the continued proper functioning of the landfill covers. Rationale: This restriction helps ensure the integrity of the landfill covers.)*

7) Activities that may damage or impair the proper functioning of any engineered component of the response action, including but not limited to any treatment system, monitoring well, landfill cap, or surveyed benchmark, are prohibited. (*Objective: ensure the continued proper functioning of engineered portions of the remedy. Rationale: This restriction helps ensure the integrity of other engineered components of the remedy, including monitoring and survey points.)*

In addition to the specific rationales set forth in the text for the various use restrictions, imposing the institutional controls discussed in the text also results in achieving compliance with the CDPHE risk management policy of ensuring that residual risks to the site user are at or below 1×10^{-6}. CDPHE guidance requires evaluation of contaminant concentrations on a SWMU or release site basis. This was implemented at Rocky Flats on an IHSS-by-IHSS basis during the accelerated action process, when hazardous constituents were remediated to a residual risk level of 1×10^{-5} to the anticipated future user. Imposing the institutional controls obviates the need to conduct a post-remediation analysis of residual risk on a release site basis.

DOE shall notify EPA and CDPHE 45 days in advance of any proposed land use changes that are inconsistent with the objectives of these institutional controls or the selected remedy/corrective action. DOE shall not modify or terminate institutional controls, implementation actions or modify land use without approval by EPA and CDPHE. DOE shall seek prior concurrence before any anticipated action that may disrupt the effectiveness of these institutional controls or any action that may alter or negate the need for institutional controls. For the purposes of this CAD/ROD, DOE may not modify or terminate these institutional controls without the approval of EPA and CDPHE, by formal amendment to this CAD/ROD. These institutional controls will be contained in an environmental covenant for the Central OU that will be granted by DOE to CDPHE. DOE will notify easement holders at Rocky Flats of these controls when the covenant is granted. DOE will also record the covenant with Jefferson County, Colorado, incorporating these institutional controls.

These institutional controls will be maintained by DOE until the concentrations of hazardous substances in soil and groundwater are at such levels so as to allow for unrestricted use and unlimited exposure, and until such time as engineered components of the remedy are no longer needed. DOE is responsible for implementing, maintaining, reporting on and enforcing these institutional controls.

DOE will inspect the Central OU on a regular basis, but no less than annually, to ensure that these institutional controls are maintained. Any activity that is inconsistent with the

objectives of these institutional controls, or any other action that may interfere with their effectiveness will be addressed by DOE as soon as practicable. DOE will notify EPA and CDPHE within two days of discovering any such activity, and at that time will initiate the consultative process to address the situation. In no case will DOE notify EPA and CDPHE more than ten days after the discovery of a situation that may interfere with the effectiveness of the institutional controls. DOE will notify EPA and CDPHE, within ten days after beginning the process to address the situation, of the actions it is taking. Specific provisions for inspection, response and notification regarding institutional controls will be incorporated as enforceable requirements in RFLMA. In addition, a comprehensive list of the institutional controls, a description of the internal procedures for implementing the institutional controls and a commitment by the DOE to notify EPA and CDPHE in advance of any changes to the internal procedures that would affect the institutional controls will be incorporated as enforceable requirements in RFLMA.

The Refuge Act provides that future ownership and management of Rocky Flats shall be retained by the United States. Under the Refuge Act, the Secretary of Energy shall retain administrative jurisdiction over those engineered structures at Rocky Flats used for carrying out a response action, and any lands or facilities related to a response action or other actions to be carried out by the Secretary of Energy at Rocky Flats. Pursuant to the Refuge Act, DOE will retain administrative jurisdiction over the Central OU, as the Central OU contains the engineered structures relating to response actions and, by virtue of the institutional controls that will be in place, the entire Central OU constitutes lands that are related to a response action.

The Refuge Act precludes transfer of ownership of any portion of the Central OU. Should this law be changed and this restriction be removed, and should DOE decide to transfer any portion of the Central OU out of Federal ownership, DOE will provide notice to EPA and CDPHE at least six months prior to any transfer or sale of the Central OU, so that EPA and CDPHE can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective institutional controls. If it is not possible for DOE to notify EPA and CDPHE at least six months prior to any transfer or sale, then DOE will notify DOE and CDPHE as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to institutional controls. In addition to the land transfer notice and discussion provisions above, DOE further agrees to provide EPA and CDPHE with similar notice, within the same time frames, as to federal-to-federal transfer of property. DOE shall provide an executed copy of any instrument transferring the property to EPA and CDPHE. Any property transfer will take place consistent with the terms of the environmental covenant granted to CDPHE by DOE.

DOE will install and maintain physical controls for two purposes. First, DOE will install signs along the perimeter of the Central OU to notify the WRW and WRV that they are at the boundary of the Central OU. These signs will state that the Central OU is land retained by DOE and will forbid trespassing. They will be placed at intervals consistent with standard land management practices and the requirements of CHWA. DOE will

also place signs at the major access points to the Central OU that will notify the WRW and WRV of the land use restrictions in place there. (DOE intends to construct a three- or four-strand barbed wire fence around the perimeter of the Central OU for land management purposes; this fence is not part of the selected remedy/corrective action and is not, therefore, a requirement of this CAD/ROD.) Second, DOE will protect engineered components of the remedy, monitoring locations and survey points so as to ensure that they continue to function as designed. Specific provisions for inspection, maintenance and notification regarding physical controls will be incorporated as enforceable requirements in RFLMA.

DOE will provide regular reports on remedy performance and site conditions to EPA and CDPHE. These reports will include, at a minimum, an annual report describing environmental monitoring data, inspection results, status of institutional controls (including whether the use restrictions and controls described above were referenced in any instrument transferring ownership of the affected property, whether state and local agencies were notified of the use restrictions and controls affecting the property, and whether use of the property has conformed with such restrictions and controls), and maintenance actions taken by DOE. In addition to the annual report, DOE will submit quarterly reports consisting of environmental monitoring data and inspection forms. Specific provisions for reporting will be incorporated as enforceable requirements in RFLMA. Reports provided pursuant to the CAD/ROD will be available to the public.

The substantive requirements of this CAD/ROD will be implemented through RFLMA. The Parties to RFLMA will be DOE, EPA and CDPHE. The purpose of RFLMA is to establish the regulatory framework for implementing the final response action, serve as the enforceable agreement for post-closure requirements, and ensure that the final response action remains protective of human health and the environment. The RFLMA will be a single document that will have the purposes of serving as a CERCLA Section 120 Interagency Agreement and a CHWA corrective action order and enforceable mechanism for post-closure requirements. Specific objectives of RFLMA will be as follows:

- Coordinate all of DOE's post-CAD/ROD obligations under CERCLA, RCRA, and CHWA in a single agreement to streamline compliance with these three statutes;

- Specify how the performance standards in the final response action will be met;

- Specify the requirements for management of the Central OU, including monitoring, operation and maintenance of the final response action selected and approved in this CAD/ROD;

- Specify processes for review, implementation, monitoring, modification, creation, and termination, as appropriate, of response actions; and

- Provide for public information and involvement.

RFLMA will supersede RFCA, and subsume applicable RFCA requirements, including those incorporated in RFCA accelerated action decision documents. The Parties to RFLMA will make the agreement available for public review prior to entering into RFLMA. RFCA shall remain in effect until RFLMA is signed by all Parties, at which point RFCA will be terminated.

As a requirement of this CAD/ROD, DOE will grant an environmental covenant to CDPHE for the entire Central OU, pursuant to Section 25-15-321, Colorado Revised Statutes. The covenant will incorporate use restrictions for the Central OU, and will run with the Property in perpetuity and be binding on DOE and all parties having any right, title or interest in the Property, or any part thereof, their heirs, successors and assigns, and any persons using the land. The covenant granted by DOE to CDPHE for the Central OU will supersede the covenant already granted by DOE to CDPHE for the Present Landfill, and will subsume applicable requirements of the Present Landfill covenant. The Present Landfill covenant will remain in effect until DOE grants the covenant for the Central OU, at which time the Present Landfill covenant will be terminated.

Summary of the Estimated Remedy Costs - - Detailed cost estimates for the selected remedy/corrective action are provided in tables in Attachment 2. The estimated present-worth cost of the selected remedy/corrective action is $43,170,000 for 30 years, assuming an annual discount rate of five per cent. The largest single cost component of the selected alternative is ongoing environmental monitoring, which accounts for approximately $32,700,000 of the estimated present-worth costs. Other significant sources of cost associated with the selected remedy/corrective action, on a present-worth basis, include routine maintenance of landfill covers and groundwater treatment systems (approximately $6,200,000), groundwater treatment system media replacement (approximately $2,000,000), and CERCLA periodic reviews (approximately $425,000). The estimated annual operating cost for the primary, ongoing components of the selected remedy/corrective action (that is, routine maintenance of the landfill covers and groundwater treatment systems and routine environmental monitoring) is $2,530,000, using 2005 as the base year. Environmental monitoring constitutes the majority of the annual cost, and is estimated at $2,130,000, again using 2005 as the base year.

Capital costs for the selected alternative are estimated to be approximately $1,120,000. Most of this cost is associated with construction of physical controls.

The information in this cost estimate summary is based upon the best available information regarding the anticipated scope of the selected remedy/corrective action. Changes in cost estimates are likely to occur as a result of new information collected during the long-term operation of the selected remedy/corrective action. Major changes in costs may be documented as a memorandum in the Rocky Flats Administrative Record file, or as an amendment to this CAD/ROD should changes in scope or costs be sufficiently significant. The estimates presented in this CAD/ROD are order-of-magnitude engineering cost estimates expected to be within +50 to -30 per cent of actual costs.

Expected Outcomes of the Selected Remedy/Corrective Action - - Implementation of the selected remedy/corrective action, which considers the accelerated actions that have been conducted at Rocky Flats under RFCA, is expected to have the following outcomes in the Central OU:

- The land surface of the Central OU will not pose a risk of unacceptable exposure to residual contamination to the WRW or the WRV. Although DOE will not open the Central OU for visitor use, the area is safe for such use, consistent with the assumptions made in the CRA.

- Subsurface contamination remains in certain areas of the Central OU, in soils and associated with remaining structures such as basements. While this contamination does not pose a risk to the anticipated future user, restrictions against accessing the subsurface and constructing occupied buildings will need to remain in place for the foreseeable future in the Central OU.

- Groundwater contamination will remain in the UHSU in the Central OU for decades to hundreds of years, although the accelerated actions performed under RFCA will ultimately lead to improvements in groundwater quality. Restrictions against the use of groundwater in the Central OU will need to remain in place for the foreseeable future.

- Surface water leaving the Central OU (that is, downstream of the Rocky Flats terminal ponds) is anticipated to be suitable for all uses. Limited areas of surface water upstream of the terminal ponds are currently affected by inflow of contaminated groundwater, and do not always meet surface water quality standards. The groundwater accelerated actions performed under RFCA are anticipated to lead to improvements in surface water quality, although restrictions on the use of surface water in the Central OU will be needed for some period of time.

- Residual contamination in the Central OU does not pose a significant risk of adverse effects to ecological receptors.

18. STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, the lead agency (in this case, DOE) must select a remedy that is protective of human health and the environment, complies with ARARs, is cost-effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element of the remedy. The section describes how the selected remedy/corrective action meets these statutory requirements.

Protection of Human Health and the Environment - - The selected remedy/corrective action (Alternative 2 – Institutional and Physical Controls), which takes into account the accelerated actions that have been taken at Rocky Flats under RFCA, is protective of human health and the environment. This degree of protectiveness is achieved through treatment, contaminant removal, engineered controls and institutional controls. Passive groundwater treatment systems and the seep treatment system at the Present Landfill will continue to operate and treat contaminants in UHSU groundwater, including VOCs, uranium and nitrate, and this has been enhanced through actions taken pursuant to the Groundwater IM/IRA. Surface and subsurface removal actions have removed soils contaminated with radionuclides (notably plutonium-239/240) and VOCs, and these have been transported and disposed off-site. Engineered covers at the Present Landfill and Original Landfill have isolated contaminants in these locations, and will continue to be maintained as part of the selected remedy/corrective action. Institutional and physical controls will be in place to ensure that no unacceptable exposures occur to the future site users, and to protect engineered structures from damage. Finally, environmental monitoring will continue, to ensure that the remedy remains protective.

Results of the CRA demonstrate that the risks posed by residual contamination at the site are within the EPA's accepted risk range of 1×10^{-4} to 1×10^{-6} or below. For non-carcinogenic human health effects, all hazard indices are less than 1, and the calculated radiation doses posed by residual contamination are well below the acceptable annual radiation dose of 25 mrem specified in the Colorado Standards for Protection Against Radiation. Residual contamination at Rocky Flats poses no significant risk of adverse effects to ecological receptors.

Compliance with ARARs - - The ARARs to be met at Rocky Flats are listed in Table 21. The selected remedy/corrective action complies with all ARARs. No other advisories, criteria or guidance were included as To Be Considered for this action.

Cost-Effectiveness - - The selected remedy/corrective action is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be considered cost-effective if its costs are proportional to its overall effectiveness." (NCP Section 300.430[f][1][ii][D]) This was accomplished by evaluating the overall effectiveness of those alternatives that were both protective of human health and the environment and met all ARARs, in this case the selected alternative and Alternative 3, Targeted Soil Removal. The costs of these two alternatives were then compared.

Overall effectiveness was evaluated by comparing the long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; and short term effectiveness of the selected alternative to Alternative 3. Alternative 3 has somewhat more long-term effectiveness and permanence than the selected alternative, but this is marginal, as implementation of Alternative 3 only results in a reduction in risk to the WRW from 2×10^{-6} to less than 1×10^{-6} in the Wind Blown EU. The selected alternative is already protective, with residual risks to the anticipated future users that are well

within the EPA's acceptable risk range. These two alternatives are equivalent as regards the criterion relating to the use of treatment, as both incorporate the long-term operation of groundwater and seep treatment systems. The selected remedy/corrective action is effective in the short term, while Alternative 3 poses concerns in this regard relating to the potential for surface water standards exceedances and risks to workers and the public.

The estimated present-worth cost of the selected remedy/corrective action is $43,170,000, compared to the estimated present-worth cost of Alternative 3, which is $265,510,000. The selected remedy/corrective action provides a comparable level of overall protection to Alternative 3 at a substantially lower cost. The selected alternative is, therefore, cost-effective.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable - - The selected remedy/corrective action represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at Rocky Flats. Of the two alternatives that are protective of human health and the environment, and which comply with ARARs, the selected remedy/corrective action provides the best balance as regards the five balancing criteria under CERCLA, which are:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

The selected remedy/corrective action also considers the statutory preference for treatment as a principal element of the remedy, as well as State and community acceptance. While CERCLA incorporates a bias against off-site treatment and disposal, removal of contamination for off-site disposal was in many cases the only practicable approach for reduction of residual risks posed by Rocky Flats.

The selected remedy/corrective action, which takes into account the accelerated actions previously performed under RFCA, treats the source materials constituting principal threats at the site, through the treatment of VOCs in passive groundwater and seep treatment systems. The engineered soil covers at the present Landfill and the Original Landfill will effectively reduce the mobility of and the potential for direct exposure to contaminants remaining in those areas. There are no practicable approaches for the treatment or immobilization of radionuclides (including plutonium-239/240) in soils. The RI/FS report and the Proposed Plan concluded that there were no additional, practicable technologies available for treatment of subsurface contamination, apart from

those already undertaken as accelerated actions under RFCA. The selected remedy/corrective action poses no short-term risks, and can be readily implemented.

Preference for Treatment as a Principal Element - - By treating VOCs in UHSU groundwater and at the Present Landfill using passive groundwater and seep treatment systems, the selected remedy/corrective action addresses the principal threats at the site through the use of treatment technologies. Groundwater treatment systems at Rocky Flats also treat nitrate and uranium in UHSU groundwater, and incorporate additional enhancements pursuant to the Groundwater IM/IRA. By using treatment as a significant portion of the remedy, the selected remedy/corrective action satisfies the statutory preference for remedies that employ treatment as a principal element.

Five-Year Review Requirements - - Because the selected remedy/corrective action will result in hazardous substances, pollutants or contaminants remaining in the Central OU above levels that allow for unlimited use and unrestrictive exposure, a statutory review within five years of the date of this CAD/ROD to ensure that the selected remedy/corrective action remains protective of human health and the environment. In order to coordinate this review with the schedule for periodic review already established at Rocky Flats, the next remedy review will be completed by September 2007.

19. DOCUMENTATION OF SIGNIFICANT CHANGES

The Rocky Flats Environmental Technology Site Proposed Plan was released for public comment in July 2006. The Proposed Plan identified Alternative 2, Institutional and Physical Controls, as the preferred alternative. DOE, EPA and CDPHE reviewed all written, verbal, and e-mail comments received during the public comment period, and determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

While this CAD/ROD does not contain significant changes from the Proposed Plan, it does provide additional detail in areas that were of concern to the public, as reflected in the comments received. The following subject areas are notable in this respect:

1) *Institutional Controls* - - The CAD/ROD contains more detail on the objectives and rationale for the specific institutional controls. It also contains more information on how DOE will implement, monitor, and report on the status of institutional controls at the site.
2) *Signs* - - The CAD/ROD contains more information on the signs that will be installed at the boundary of the Central OU, and the language to be used on these signs. The CAD/ROD specifies two types of signs. One type will be posted at intervals around the Central OU boundary, notifying the WRW and WRV that they are at the Central OU boundary, and prohibiting trespassing. The second type of sign will be posted at access points to the Central OU, and will notify the WRW and the WRV of the restrictions in place there.
3) *Post-CAD/ROD enforceable agreement* - - The CAD/ROD contains more information on the purpose and content of the post-CAD/ROD regulatory

agreement (RFLMA) that will be entered into among DOE, EPA and CDPHE to implement the requirements of the CAD/ROD. The CAD/ROD notes that many of the specifics as regards environmental monitoring, maintenance, inspection and reporting will be contained in RFLMA. The CAD/ROD also requires that RFLMA be submitted for formal public comment.

4) *Central OU Boundary* - - The boundary of the Central OU (the lands to be retained by DOE for remedy-related purposes) was changed slightly from the version appearing in the Proposed Plan. Some additional areas of Woman Creek near the Original Landfill were incorporated into the Central OU in order to better facilitate maintenance of physical controls, and other, minor adjustments were made to accommodate surveying the area. No areas formerly included were removed, and the additional land included in the Central OU totals about 100 acres.
5) *Inspections* - - The Proposed Plan included quarterly inspection of institutional and physical controls. The CAD/ROD requires periodic inspection, with institutional controls inspected not less than annually. Specific requirements for inspection and maintenance of institutional and physical controls will be contained in RFLMA.

While providing more detail on these and other aspects of the selected remedy/corrective action, the remedy selected in this CAD/ROD is consistent with the preferred alternative described in the Proposed Plan.

20. RESPONSIVENESS SUMMARY

Comments were received from USFWS, City and County of Broomfield, Cities of Arvada, Northglenn, and Westminster, Rocky Flats Stewardship Council, environmental activist groups and private citizens. The name of the commenter, comments made and the responses are contained in Attachment 3, Responsiveness Summary.

DOE solicited comments regarding the Proposed Plan during a 60-day public comment period (July 14, 2006 to September 13, 2006). The Proposed Plan and the supporting Remedial Investigation/Feasibility Study, which included the Comprehensive Risk Assessment, was available for the entirety of the public comment period. These documents were available in six city and county public libraries in the area, as well as at the EPA Region 8 library, the Colorado Department of Public Health and Environment and on the Rocky Flats web page. Electronic copies of the documents were also available on CDs upon request from the Rocky Flats Public Affairs office. The Administrative Record was also available on the Rocky Flats and the Office of Legacy Management websites. A series of public meetings were held in association with the Proposed Plan.

The first meeting to roll out the release of the documents was held on May 30, 2006 in Broomfield, Colorado to announce what documents were to be released and to discuss a general description of their contents. Following the release of the Proposed Plan, two public meetings were held two weeks apart, in Golden, Colorado and Westminster,

Colorado, to explain how the document was laid out, where information upon which the document was based could be found, and to answer questions regarding the Proposed Plan. Finally, a public hearing was held from 3:00 pm to 5:00 pm and 6:00 pm to 9:00 pm in Arvada, Colorado. Those in attendance included representatives from DOE, DOE's contractor, EPA, CDPHE, USFWS, city and county officials, public interest groups, and citizens. A Court Reporter transcribed the proceedings. A short presentation was made available to the attendees along with the Proposed Plan. All meetings were announced in the legal announcement section of both major newspapers. In addition, a display ad in both major newspapers was run two days prior to the public hearing.

DOE public involvement activities at the Rocky Flats were initiated in the early 1990s and were designed to inform the public of the nature of the environmental issues associated with Rocky Flats, involve the public in the decision-making process, involve the public in the responses under consideration to remedy these issues, and inform the public of the progress being made to implement the remedy.

Every aspect of the site cleanup, including the plans for site management following closure, received the benefit of early, extensive public involvement dialogue among state and federal regulators, stakeholder organizations, elected officials and members of the general public. The RFCA Parties (DOE, CDPHE and EPA) worked collaboratively with local governments and the community on public input and community perspectives on issues related to the cleanup and closure of the Site.

In addition, Rocky Flats provided opportunities for input in the decision-making process in areas not specified by statutes and regulations. In such cases, DOE initiated a consultative process, inviting the general public, special interest groups, and local governments to participate early in the formulation of policies and prioritization of RFETS activities. The consultative process supplemented the public comment periods required by law.

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ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations

AEU	aquatic exposure unit
AOC	area of concern
AOI	analyte of interest
ARAR	applicable or relevant and appropriate requirement
BZ	buffer zone
CAD	Corrective Action Decision
CAD/ROD	Corrective Action Decision/Record of Decision
CCP	Comprehensive Conservation Plan
CCR	Code of Colorado Regulations
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CHWA	Colorado Hazardous Waste Act
COC	contaminant of concern
CRA	Comprehensive Risk Assessment
CRS	Colorado Revised Statutes
CWQCC	Colorado Water Quality Control Commission
DOE	U.S. Department of Energy
DQA	Data Quality Assessment
ECOC	ecological chemical of concern
ECOPC	ecological chemical of potential concern
EPA	U.S. Environmental Protection Agency

ERA	Ecological Risk Assessment
ETPTS	East Trenches plume treatment system
EU	exposure unit
FS	Feasibility Study
FY	Fiscal Year
HAER	Historic American Engineering Record
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
HRR	Historical Release Report
IA	Industrial Area
IAG	Interagency Agreement
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
IMP	Integrated Monitoring Plan
K-H	Kaiser-Hill Company, LLC
LHSU	lower hydrostratigraphic unit
LRA	Lead Regulatory Agency
m3	cubic meters
MCL	maximum contaminant level
MDC	maximum detected concentration
Mrem/yr	Millirems per year
MSPTS	mound Site plume treatment system
NAPL	non-aqueous phase liquid

NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
OU	Operable Unit
PAC	Potential Area of Concern
PAM	Proposed Action Memorandum
PCB	polychlorinated biphenyl
pCi	picoCurie
pCi/g	picoCuries per gram
pCi/l	picoCuries per liter
PIC	Potential Incident of Concern
PMJM	Preble's meadow jumping mouse
POC	Point of Compliance
POE	Point of Evaluation
PQL	practical quantification level
PRG	preliminary remediation goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual Radioactivity
RFA	Rocky Flats Alluvium
RFCA	Rocky Flats Compliance Agreement
RI	Remedial Investigation
ROD	Record of Decision
RSOP	RFCA Standard Operating Protocol

SAP	Sampling and Analysis Plan
SCM	Site Conceptual Model
SID	South Interceptor Ditch
SPPTS	Solar Ponds plume treatment system
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
U.S.	United States
UBC	Under Building Contamination
UCL	upper confidence limit
UHSU	upper hydrostratigraphic unit
USC	U.S. Code
USFWS	U.S. Fish and Wildlife Service
UTL	upper tolerance limit
VOC	volatile organic compound
WRV	wildlife refuge visitor
WRW	wildlife refuge worker

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Surface Water Action Levels and Standards

Analyte	CAS Reference Number	Standards and Action Levels [a] (mg/L)	Basis [b]	Temporary Modifications [c] (mg/L)	PQLs [d] (mg/L)
Acenaphthene	83-32-9	4.20E-01	W+F, WS		1.00E-02
Acenaphthylene	208-96-8	2.80E-06	W+F		1.00E-02
Acetone	67-64-1	3.65E+00	PRG		
Acrolein	107-02-8	2.10E-02	AL		1.00E-02
Acrylonitrile	107-13-1	5.90E-05	W+F		5.00E-03
Alachlor	15972-60-8	1.20E-03	W+F		2.00E-03
Aldicarb	116-06-3	7.00E-03	WS		1.00E-02
Aldicarb sulfone	1646-88-4	7.00E-03	WS		3.00E-03
Aldicarb sulfoxide	1646-87-3	7.00E-03	WS		3.00E-03
Aldrin	309-00-2	1.30E-07	W+F		1.00E-04
Aluminum, dissolved	7429-90-5	8.70E-02	AL		
Ammonia, un-ionized	7664-41-7	[e]	[e]		
Anthracene	120-12-7	2.10E+00	W+F, WS		1.00E-02
Antimony, total recoverable	7440-36-0	6.00E-03	W+F, WS		1.00E-02
Arsenic, total recoverable	7440-38-2	1.80E-05	W+F		
Atrazine	1912-24-9	3.00E-03	WS		1.00E-03
Barium, total recoverable	7440-39-3	4.90E-01	WS		
Benzene	71-43-2	1.20E-03	W+F, WS	5.00E-03	1.00E-03
Benzidine	92-87-5	1.20E-07	W+F		1.00E-02
alpha-BHC	319-84-6	3.90E-06	W+F		5.00E-05
beta-BHC	319-85-7	1.40E-05	W+F		5.00E-05
gamma-BHC [Lindane]	58-89-9	8.00E-05	AL		5.00E-05
Benzo(a)anthracene	56-55-3	4.40E-06	W+F		1.00E-02
Benzo(a)pyrene	50-32-8	4.40E-06	W+F		2.00E-04
Benzo(b)fluoranthene	205-99-2	4.40E-06	W+F		1.00E-02
Benzo(g,h,i)perylene	191-24-2	4.40E-06	W+F		1.00E-02
Benzo(k)fluoranthene	207-08-9	4.40E-06	W+F		1.00E-02
Beryllium	7440-41-7	4.00E-03	SS, WS		5.00E-03
Boron, total	7440-42-8	7.50E-01	AG, SS		
Bromodichloromethane	75-27-4	5.60E-04	W+F [f]		1.00E-03
Bromoform [Tribromomethane]	75-25-2	4.30E-03	W+F [f]		1.00E-03
Bromomethane [Methyl Bromide]	74-83-9	4.80E-02	W+F		1.00E-03
2-Butanone [Methylethyl ketone]	78-93-3	2.19E+01	PRG		
Butylbenzylphthalate	85-68-7	1.40E+00	W+F, WS		1.00E-02
Cadmium, dissolved	7440-43-9	1.50E-03	TVS [g]		5.00E-03
Carbofuran	1563-66-2	4.00E-02	WS		7.00E-03
Carbon disulfide	75-15-0	3.65E+00	PRG		
Carbon tetrachloride	56-23-5	2.50E-04	W+F	5.00E-03	1.00E-03
Chlordane	5103-71-9	2.10E-06	W+F		1.00E-03
Chlorobenzene	108-90-7	1.00E-01	W+F, WS		5.00E-03
Chloroethane	75-00-3	2.94E-02	PRG		
bis(2-Chloroethyl)ether	111-44-4	3.10E-05	W+F		1.00E-02
Chloroform [Trichloromethane]	67-66-3	5.70E-03	W+F [f]		1.00E-03
bis(2-Chloroisopropyl)ether	39638-32-9	2.80E-01	W+F, WS		1.00E-02
Chloromethane [Methyl chloride]	74-87-3	5.70E-03	W+F		1.00E-03
4-Chloro-3-methylphenol	59-50-7	3.00E-02	AL		5.00E-02
2-Chloronaphthalene	91-58-7	5.60E-01	W+F, WS		

Table 1
Surface Water Action Levels and Standards

Analyte	CAS Reference Number	Standards and Action Levels [a] (mg/L)	Basis [b]	Temporary Modifications [c] (mg/L)	PQLs [d] (mg/L)
2-Chlorophenol	95-57-8	3.50E-02	W+F, WS		5.00E-02
Chloropyrifos	2921-88-2	4.10E-05	AL		1.00E-04
Chromium III, Total Recoverable	16065-83-1	5.00E-02	SS, WS		
Chromium VI, dissolved	18540-29-9	1.10E-02	TVS [g]		
Chrysene	218-01-9	4.40E-06	W+F		1.00E-02
Copper, dissolved	7440-50-8	1.60E-02	TVS [g]		
Cyanide	57-12-5	5.00E-03	SS		
4,4-DDD	72-54-8	8.30E-07	W+F		1.00E-04
4,4-DDE	72-55-9	5.90E-07	W+F		1.00E-04
4,4-DDT	50-29-3	5.90E-07	W+F		1.00E-04
Dalapon	75-99-0	2.00E-01	WS		1.30E-02
Demeton	8065-48-3	1.00E-04	AL		1.00E-03
Dibenzo(a,h)anthracene	53-70-3	4.40E-06	W+F		1.00E-02
Dibromochloromethane	124-48-1	8.00E-02	WS [f]		1.00E-03
1,2-Dibromo-3-chloropropane	96-12-8	2.00E-04	WS		1.00E-03
Di-n-butylphthalate	84-74-2	3.65E+00	PRG		1.00E-02
1,2-Dichlorobenzene	95-50-1	6.00E-01	W+F, WS		1.00E-02
1,3-Dichlorobenzene	541-73-1	4.00E-01	W+F		1.00E-02
1,4-Dichlorobenzene	106-46-7	7.50E-02	W+F, WS		1.00E-02
3,3-Dichlorobenzidine	91-94-1	3.90E-05	W+F		1.00E-02
1,1-Dichloroethane	75-34-3	3.65E+00	PRG		1.00E-03
1,2-Dichloroethane	107-06-2	3.80E-04	W+F, WS	5.00E-03	1.00E-03
1,1-Dichloroethene	75-35-4	7.00E-03	W+F, WS	7.00E-03	1.00E-03
1,2-Dichloroethene (cis)	156-59-2	7.00E-02	WS		5.00E-03
1,2-Dichloroethene (trans)	156-60-5	1.00E-01	W+F, WS		5.00E-03
2,4-Dichlorophenol	120-83-2	2.10E-02	W+F, WS		5.00E-02
Dichlorophenoxyacetic acid [2,4-D]	94-75-7	7.00E-02	WS		1.00E-03
1,2-Dichloropropane	78-87-5	5.20E-04	W+F, WS		1.00E-03
1,3-Dichloropropylene	542-75-6	1.00E-02	W+F		1.00E-03
Dieldrin	60-57-1	1.40E-07	W+F		1.00E-04
Di(2-ethylhexyl)adipate	103-23-1	4.00E-01	WS		6.00E-03
Diethylphthalate	84-66-2	5.60E+00	W+F, WS		1.00E-02
Diisopropyl methyl phosphonate	1445-75-6	8.00E-03	WS		1.00E-03
2,4-Dimethylphenol	105-67-9	1.40E-01	W+F, WS		5.00E-02
Dimethylphthalate	131-11-3	3.13E+02	W+F		1.00E-02
4,6-Dinitro-2-methylphenol	534-52-1	2.70E-03	W+F, WS		5.00E-02
2,4-Dinitrophenol	51-28-5	1.40E-02	W+F, WS		5.00E-02
2,4-Dinitrotoluene	121-14-2	1.10E-04	W+F, WS		1.00E-02
2,6-Dinitrotoluene	606-20-2	2.30E-01	AL		1.00E-02
Dinoseb	88-85-7	7.00E-03	WS		2.00E-03
Dioxin (2,3,7,8 TCDD)	1746-01-6	1.30E-11	W+F		
1,2-Diphenylhydrazine	122-66-7	4.00E-05	W+F		
Diquat	65-00-7	2.00E-02	WS		4.00E-03
Endosulfan	115-29-7	5.60E-05	AL		1.00E-04
Endosulfan, alpha	95-99-88	5.60E-05	AL		1.00E-04
Endosulfan, beta	3321-36-59	5.60E-05	AL		1.00E-04
Endosulfan sulfate	1031-07-8	5.60E-05	AL		1.00E-04

Table 1
Surface Water Action Levels and Standards

Analyte	CAS Reference Number	Standards and Action Levels [a] (mg/L)	Basis [b]	Temporary Modifications [c] (mg/L)	PQLs [d] (mg/L)
Endothall	145-73-3	1.00E-01	WS		9.00E-02
Endrin (technical)	72-20-8	3.60E-05	AL		1.00E-04
Endrin aldehyde	7421-93-4	7.60E-04	W+F		1.00E-04
Ethylbenzene	100-41-4	7.00E-01	W+F, WS		1.00E-02
Ethylene dibromide [1,2-Dibromomethane]	106-93-4	5.00E-05	WS		
bis(2-Ethylhexyl)phthalate	117-81-7	1.80E-03	W+F		1.00E-02
Fluoranthene	206-44-0	2.80E-01	W+F, WS		1.00E-02
Fluorene	86-73-7	2.80E-01	WS		1.00E-02
Fluoride	7782-41-4	2.00E+00	WS		
Glyphosate	1071-83-6	7.00E-01	WS		6.00E-02
Guthion	86-50-0	1.00E-05	AL		1.50E-03
Heptachlor	76-44-8	2.10E-07	W+F		5.00E-05
Heptachlor epoxide	1024-57-3	1.00E-07	W+F		5.00E-05
Hexachlorobenzene	118-74-1	7.50E-07	W+F		1.00E-02
Hexachlorobutadiene	87-68-3	9.30E-03	AL		1.00E-02
Hexachlorocyclohexane, Technical	608-73-1	1.20E-05	W+F		2.00E-04
Hexachlorocyclopentadiene	77-47-4	5.00E-03	AL		1.00E-02
Hexachloroethane	67-72-1	7.00E-03	W+F, WS		1.00E-02
Indeno(1,2,3-cd)pyrene	193-39-5	4.40E-06	W+F		1.00E-02
Isophorone	78-59-1	3.60E-02	W+F		1.00E-02
Lead, dissolved	7439-92-1	6.50E-03	TVS [g]		1.00E-02
Malathion	121-75-4	1.00E-04	AL		2.00E-04
Mercury, total	7439-97-6	1.00E-05	SS		1.00E-03
Methoxychlor	72-43-5	3.00E-05	AL		5.00E-04
Methylene chloride [Dichloromethane]	75-09-2	4.70E-03	W+F, WS		1.00E-03
4-Methyl-2-pentanone [Isopropoacetone]	108-10-1	2.92E+00	PRG		
2-Methylphenol [o-Cresol]	95-48-7	1.83E+00	PRG		
Mirex	2385-85-5	1.00E-06	AL		1.00E-04
Naphthalene	91-20-3	2.80E-02	W+F, WS		1.00E-02
Nickel, dissolved	7440-02-0	1.23E-01	TVS [g]		
Nitrate	14797-55-8	1.00E+01	AG	100 [h]	
Nitrite	14797-65-0	5.00E-01	AL [i]	4.5 [h]	
Nitrobenzene	98-95-3	3.50E-03	W+F, WS		1.00E-02
Nitrophenol 4	100-02-7	5.60E-02	WS, W+F		
Nitrosodibutylamine N	924-16-3	6.40E-06	W+F		1.00E-02
Nitrosodiethylamine N	55-18-5	8.00E-07	W+F		1.00E-02
Nitrosodimethylamine N	62-75-9	6.90E-07	W+F		1.00E-02
n-Nitrosodiphenylamine	86-30-6	5.00E-03	W+F		1.00E-02
n-Nitrosodipropylamine	621-64-7	5.00E-06	W+F		1.00E-02
Nitrosopyrrolidine N	930-55-2	1.60E-05	W+F		1.00E-02
Oxamyl(vydate)	23135-22-0	2.00E-01	WS		2.00E-02
PCBs	1336-36-3	1.70E-04	W+F [j]		1.00E-02
Parathion	56-38-2	1.30E-05	AL		
Pentachlorobenzene	608-93-5	3.50E-03	W+F		1.00E-02
Pentachlorophenol	87-86-5	2.80E-04	W+F		5.00E-02
Phenanthrene	85-01-8	2.80E-06	W+F		1.00E-02
Phenol	108-95-2	2.56E+00	AL		5.00E-02

Table 1
Surface Water Action Levels and Standards

Analyte	CAS Reference Number	Standards and Action Levels [a] (mg/L)	Basis [b]	Temporary Modifications [c] (mg/L)	PQLs [d] (mg/L)
Picloram	1918-02-1	5.00E-01	WS		1.00E-03
Pyrene	129-00-0	2.10E-01	W+F, WS		1.00E-02
Selenium	7782-49-2	4.60E-03	AL		1.00E-02
Silver, dissolved	7440-22-4	6.00E-04	TVS [g]		5.00E-03
Simazine	122-34-9	4.00E-03	WS		7.00E-04
Sulfide	18496-25-8	2.00E-03	SS		
Styrene	100-42-5	1.00E-01	WS		5.00E-03
1,2,4,5-Tetrachlorobenzene	95-94-3	2.10E-03	WS		1.00E-02
1,1,2,2-Tetrachloroethane	79-34-5	1.70E-04	W+F		1.00E-03
Tetrachloroethene	127-18-4	8.00E-04	W+F	5.00E-03	1.00E-03
Thallium	7440-28-0	5.00E-04	W+F, WS		1.20E-02
Toluene	108-88-3	1.00E+00	W+F, WS		5.00E-03
Toxaphene	8001-35-2	2.00E-07	AL		3.00E-03
1,2,4-Trichlorobenzene	120-82-1	5.00E-02	AL		1.00E-02
1,1,1-Trichloroethane	71-55-6	2.00E-01	W+F, WS		5.00E-03
1,1,2-Trichloroethane	79-00-5	3.00E-03	W+F, WS		1.00E-03
Trichloroethene	79-01-6	2.70E-03	W+F	5.00E-03	1.00E-03
2,4,6-Trichlorophenol	88-06-2	2.10E-03	W+F		5.00E-02
Trichlorophenoxyproprionic acid	93-72-1	1.00E-02	W+F		5.00E-03
Vinyl chloride	75-01-4	2.00E-03	W+F, WS		2.00E-03
Xylene (total)	1330-20-7	1.00E+01	WS		5.00E-03
Zinc, dissolved	7440-66-6	1.41E-01	TVS [g]		
PHYSICAL PARAMETERS:					
Dissolved oxygen (minimum)		5.0 mg/L	SS		
pH		6.5-9.0	SS		
RADIONUCLIDES:		pCi/L			
Americium 241	14596-10-2	0.15	BS		
Plutonium 239/240	10-12-8	0.15	BS		
Radium 226/228		5 [k]	BS		
Strontium 89/90	11-10-9	8	BS		
Tritium	10028-17-8	500	SS		
Uranium, total	7440-61-1	11(10) [l]	SS		
Gross alpha, total	14127-62-9	7(11) [l]	SS		
Gross beta, total	12587-47-2	8(19) [l]	SS		

NOTES:
[a] The values in this table reflect the classifications and standards approved by the Colorado WQCC effective October 30, 2001. Values apply as standards in Segments 4a and 4b and as action levels in Segment 5. Values based on PRGs are applied only as action levels and are not enforceable standards. Standards for chloride, dissolved iron, dissolved manganese, and sulfate are Secondary Drinking Water Standards, which are based on aesthetic considerations. They have been removed as site-specific standards since Segments 4a, 4b, and 5 waters will not be used for drinking water supply.
[b] Acronyms: AG = Agriculture; AL = Aquatic Life; BS = Basic Standard; PRG = Preliminary Remediation Goal for residential groundwater ingestion; SS = Site Specific Standard; TVS = Table Value Standard; WS = Water Supply; W+F = Water plus Fish
[c] Temporary modifications affect Segment 5 only and apply until December 31, 2009.
[d] Whenever the practical quantitation level (PQL) for a pollutant is higher (less stringent) than a standard/action level or temporary modification, "less than" the PQL will be used as the compliance threshold. These less stringent PQLs are

Table 1
Surface Water Action Levels and Standards

shaded.
[e] There is no un-ionized ammonia standard for Segment 5 or Segment 4b. A standard of 0.1 mg/L applies to Segment 4a, which begins in Walnut Creek downstream of Indiana Street.
[f] Per the Basic Standards, the Total Trihalomethane (TTHM) standard applies to the sum of the four TTHM compounds. For dibromochloromethane the TTHM value for water supply, 80 parts per billion, was applied.
[g] Table value standards for metals are based on a toxicity equation which uses a hardness value of 143 mg/L.
[h] The temporary modifications for nitrate and nitrite apply to the Walnut Creek drainage only.
[i] The listed nitrite value is the chronic aquatic life standard based on chloride levels in excess of 22 mg/L in Segment 4.
[j] The total PCB standard in the Basic Standards is based on the sum of the Araclor analytes.
[k] Per the basic standard, this value applies to the sum of the two radium isotopes.
[l] Radiological parameters are distinguished by drainage basin in Table 2 of 5 CCR 1002-38. The first value is the standard for Woman Creek and the paranthetical value is the standard for Walnut Creek.
The scientific notation used in this table indicates the power of ten by which the two-decimal-place number is multiplied (e.g., 2.52E-02 = 2.52 X 10-2 = .0252).

Table 2
Ground Water Action Levels

Analyte	CAS Reference Number	Tier I [a] (mg/L)	Tier II (mg/L)	Basis [b]	PQLs [c] (mg/L)
Acenaphthene	83-32-9	2.19E+02	2.19E+00	[2]	1.00E-02
Acetone [c]	67-64-1	3.65E+02	3.65E+00	[2]	
Aldrin	309-00-2	5.01E-04	5.01E-06	[2]	1.00E-04
Aluminum	7429-90-5	3.65E+03	3.65E+01	[2]	
Ammonium (as Ammonia)	7664-41-7	3.54E+03	3.54E+01	[2]	
Anthracene	120-12-7	1.10E+03	1.10E+01	[2]	1.00E-02
Antimony	7440-36-0	6.00E-01	6.00E-03	[1]	1.00E-02
Aroclor-1016	12674-11-2	5.00E-02	5.00E-04	[1]	1.00E-03
Aroclor-1221	11104-28-2	5.00E-02	5.00E-04	[1]	1.00E-03
Aroclor-1232	11141-16-5	5.00E-02	5.00E-04	[1]	1.00E-03
Aroclor-1242	53469-21-9	5.00E-02	5.00E-04	[1]	1.00E-03
Aroclor-1248	12672-29-6	5.00E-02	5.00E-04	[1]	1.00E-03
Aroclor-1254	11097-69-1	5.00E-02	5.00E-04	[1]	1.00E-03
Aroclor-1260	11096-82-5	5.00E-02	5.00E-04	[1]	1.00E-03
Arsenic	7440-38-2	5.00E+00	5.00E-02	[1]	
Barium	7440-39-3	2.00E+02	2.00E+00	[1]	
Benzene	71-43-2	5.00E-01	5.00E-03	[1]	1.00E-03
alpha-BHC	319-84-6	1.35E-03	1.35E-05	[2]	5.00E-05
beta-BHC	319-85-7	4.73E-03	4.73E-05	[2]	5.00E-05
gamma-BHC [Lindane]	58-89-9	2.00E-02	2.00E-04	[1]	5.00E-05
Benzo(a)anthracene	56-55-3	1.17E-02	1.17E-04	[2]	1.00E-02
Benzo(a)pyrene	50-32-8	2.00E-02	2.00E-04	[1]	2.00E-04
Benzo(b)fluoranthene	205-99-2	1.17E-02	1.17E-04	[2]	1.00E-02
Benzo(k)fluoranthene	207-08-9	1.17E-01	1.17E-03	[2]	1.00E-02
Benzoic Acid	65-85-0	1.46E+04	1.46E+02	[2]	
Benzyl Alcohol	100-51-6	1.10E+03	1.10E+01	[2]	
Beryllium	7440-41-7	4.00E-01	4.00E-03	[1]	5.00E-03
Bromodichloromethane	75-27-4	1.00E+01	1.00E-01	[1]	1.00E-03
Bromoform [Tribromomethane]	75-25-2	1.00E+01	1.00E-01	[1]	1.00E-03
Bromomethane [Methyl bromide]	74-83-9	5.11E+00	5.11E-02	[2]	1.00E-03
2-Butanone [Methylethyl ketone]	78-93-3	2.19E+03	2.19E+01	[2]	
Butylbenzylphthalate	85-68-7	7.30E+02	7.30E+00	[2]	1.00E-02
Cadmium	7440-43-9	5.00E-01	5.00E-03	[1]	5.00E-03
Carbon disulfide	75-15-0	3.65E+02	3.65E+00	[2]	
Carbon tetrachloride	56-23-5	5.00E-01	5.00E-03	[1]	1.00E-03
alpha-Chlordane	5103-71-9	2.00E-01	2.00E-03	[1]	1.00E-03
beta-Chlordane	5103-74-2	2.00E-01	2.00E-03	[1]	1.00E-03
gamma-Chlordane	12789-03-6	2.00E-01	2.00E-03	[1]	1.00E-03
4-Chloroaniline	106-47-8	1.46E+01	1.46E-01	[2]	
Chlorobenzene	108-90-7	1.00E+01	1.00E-01	[1]	5.00E-03
Chloroethane	75-00-3	2.94E+00	2.94E-02	[2]	
bis(2-Chloroethyl)ether	111-44-4	7.74E-03	7.74E-05	[2]	1.00E-02
Chloroform [Trichloromethane]	67-66-3	1.00E+01	1.00E-01	[1]	1.00E-03
bis(2-Chloroisopropyl)ether	39638-32-9	1.22E-01	1.22E-03	[2]	1.00E-02
Chloromethane [Methyl chloride]	74-87-3	6.55E-01	6.55E-03	[2]	1.00E-03
2-Chloronaphthalene	91-58-7	2.92E+02	2.92E+00	[2]	
2-Chlorophenol	95-57-8	1.83E+01	1.83E-01	[2]	5.00E-02
Chromium (total)	7440-47-3	1.00E+01	1.00E-01	[1]	
Chrysene	218-01-9	1.17E+00	1.17E-02	[2]	1.00E-02
Cobalt	7440-48-4	2.19E+02	2.19E+00	[1]	
Copper	7440-50-8	1.30E+02	1.30E+00	[3]	

Table 2
Ground Water Action Levels

Analyte	CAS Reference Number	Tier I [a] (mg/L)	Tier II (mg/L)	Basis [b]	PQLs [c] (mg/L)
Cyanide	57-12-5	2.00E+01	2.00E-01	[1]	
4,4-DDD	72-54-8	3.55E-02	3.55E-04	[2]	1.00E-04
4,4-DDE	72-55-9	2.50E-02	2.50E-04	[2]	1.00E-04
4,4-DDT	50-29-3	2.50E-02	2.50E-04	[2]	1.00E-04
Dalapon	75-99-0	2.00E+01	2.00E-01	[1]	1.30E-02
Dibenzo(a,h)anthracene	53-70-3	1.17E-03	1.17E-05	[2]	1.00E-02
Dibenzofuran	132-64-9	1.46E+01	1.46E-01	[2]	
Dibromochloromethane	124-48-1	1.01E-01	1.01E-03	[2]	1.00E-03
1,2-Dibromo-3-chloropropane	96-12-8	2.00E-02	2.00E-04	[1]	1.00E-03
Di-n-butylphthalate	84-74-2	3.65E+02	3.65E+00	[2]	1.00E-02
1,2-Dichlorobenzene	95-50-1	6.00E+01	6.00E-01	[1]	1.00E-02
1,3-Dichlorobenzene	541-73-1	6.00E+01	6.00E-01	[1]	1.00E-02
1,4-Dichlorobenzene	106-46-7	7.50E+00	7.50E-02	[1]	1.00E-02
3,3-Dichlorobenzidine	91-94-1	1.89E-02	1.89E-04	[2]	1.00E-02
1,1-Dichloroethane	75-34-3	3.65E+02	3.65E+00	[2]	1.00E-03
1,2-Dichloroethane	107-06-2	5.00E-01	5.00E-03	[1]	1.00E-03
1,1-Dichloroethene	75-35-4	7.00E-01	7.00E-03	[1]	1.00E-03
1,2-Dichloroethene (total)	75-35-4	7.00E+00	7.00E-02	[1]	5.00E-03
2,4-Dichlorophenol	120-83-2	1.10E+01	1.10E-01	[2]	5.00E-02
2,4-Dichlorophenoxyacetic acid (2,4-D)	94-75-7	7.00E+00	7.00E-02	[1]	1.00E-03
1,2-Dichloropropane	78-87-5	5.00E-01	5.00E-03	[1]	1.00E-03
cis-1,3-Dichloropropene	10061-01-5	4.73E-02	4.73E-04	[2]	1.00E-03
trans-1,3-Dichloropropene	10061-02-6	4.73E-02	4.73E-04	[2]	1.00E-03
Dieldrin	60-57-1	5.32E-04	5.32E-06	[2]	1.00E-04
Diethylphthalate	84-66-2	2.92E+03	2.92E+01	[2]	1.00E-02
2,4-Dimethylphenol	105-67-9	7.30E+01	7.30E-01	[2]	5.00E-02
Dimethylphthalate	131-11-3	3.65E+04	3.65E+02	[2]	1.00E-02
4,6-Dinitro-2-methylphenol	534-52-1	3.65E-01	3.65E-03	[2]	
2,4-Dinitrophenol	51-28-5	7.30E+00	7.30E-02	[2]	5.00E-02
2,4-Dinitrotoluene	121-14-2	1.25E-02	1.25E-04	[2]	1.00E-02
2,6-Dinitrotoluene	606-20-2	1.25E-02	1.25E-04	[2]	1.00E-02
Di-n-octylphthalate	117-84-0	7.30E+01	7.30E-01	[2]	
Endosulfan I	959-98-8	2.19E+01	2.19E-01	[2]	1.00E-04
Endosulfan II	33213-65-9	2.19E+01	2.19E-01	[2]	1.00E-04
Endosulfan sulfate	1031-07-8	2.19E+01	2.19E-01	[2]	1.00E-04
Endosulfan (technical)	115-29-7	2.19E+01	2.19E-01	[2]	1.00E-04
Endrin (technical)	72-20-8	2.00E-01	2.00E-03	[1]	1.00E-04
Ethylbenzene	100-41-4	7.00E+01	7.00E-01	[1]	1.00E-02
bis(2-Ethylhexyl)phthalate	117-81-7	6.00E-01	6.00E-03	[1]	1.00E-02
Fluoranthene	206-44-0	1.46E+02	1.46E+00	[2]	1.00E-02
Fluorene	86-73-7	1.46E+02	1.46E+00	[2]	1.00E-02
Fluoride	7782-41-4	4.00E+02	4.00E+00	[1]	
Glyphosate	1071-83-6	7.00E+01	7.00E-01	[1]	6.00E-02
Heptachlor	76-44-8	4.00E-02	4.00E-04	[1]	5.00E-05
Heptachlor epoxide	1024-57-3	2.00E-02	2.00E-04	[1]	5.00E-05
Hexachlorobenzene	118-74-1	1.00E-01	1.00E-03	[1]	1.00E-02
Hexachlorobutadiene	87-68-3	1.09E-01	1.09E-03	[2]	1.00E-02
Hexachlorocyclopentadiene	77-47-4	5.00E+00	5.00E-02	[1]	1.00E-02
Hexachloroethane	67-72-1	6.08E-01	6.08E-03	[2]	1.00E-02
Indeno(1,2,3-cd)pyrene	193-39-5	1.17E-02	1.17E-04	[2]	1.00E-02
Isophorone	78-59-1	8.96E+00	8.96E-02	[2]	1.00E-02

Table 2
Ground Water Action Levels

Analyte	CAS Reference Number	Tier I [a] (mg/L)	Tier II (mg/L)	Basis [b]	PQLs [c] (mg/L)
Lead (dissolved)	7439-96-5	1.50E+00	1.50E-02	[3]	1.00E-02
Lithium	7439-93-2	7.30E+01	7.30E-01	[2]	
Manganese	7439-96-5	1.72E+02	1.72E+00	[2]	
Mercury	7439-97-6	2.00E-01	2.00E-03	[1]	1.00E-03
Methoxychlor	72-43-5	4.00E+00	4.00E-02	[1]	5.00E-04
Methylene chloride [Dichloromethane]	75-09-2	5.00E-01	5.00E-03	[1]	1.00E-03
2-Methylnaphthalene	91-57-6	1.46E+02	1.46E+00	[2]	
4-Methyl-2-pentanone	108-10-1	2.92E+02	2.92E+00	[2]	
2-Methylphenol	95-48-7	1.83E+02	1.83E+00	[2]	
4-Methylphenol	106-44-5	1.83E+01	1.83E-01	[2]	
Molybdenum	7439-98-7	1.83E+01	1.83E-01	[2]	
Naphthalene	91-20-3	1.46E+02	1.46E+00	[2]	1.00E-02
Nickel	7440-02-0	1.40E+01	1.40E-01	[1]	
Nitrate (MCL as N)	14797-55-8	1.00E+03	1.00E+01	[1]	
Nitrite (MCL as N)	14797-65-0	1.00E+02	1.00E+00	[1]	
2-Nitroaniline	88-74-4	2.19E-01	2.19E-03	[2]	
Nitrobenzene	98-95-3	1.83E+00	1.83E-02	[2]	1.00E-02
4-Nitrophenol	100-02-7	2.92E+01	2.92E-01	[2]	
n-Nitrosodiphenylamine	86-30-6	1.74E+00	1.74E-02	[2]	1.00E-02
n-Nitrosodipropylamine	621-64-7	1.22E-03	1.22E-05	[2]	1.00E-02
Pentachlorophenol	87-86-5	1.00E-01	1.00E-03	[1]	5.00E-02
Phenol	108-95-2	2.19E+03	2.19E+01	[2]	5.00E-02
Pyrene	129-00-0	1.10E+02	1.10E+00	[2]	1.00E-02
Selenium	7782-49-2	5.00E+00	5.00E-02	[1]	1.00E-02
Silver	7440-22-4	1.83E+01	1.83E-01	[2]	5.00E-03
Strontium	7440-24-6	2.19E+03	2.19E+01	[2]	
Styrene	100-42-5	1.00E+01	1.00E-01	[1]	5.00E-03
Sulfate	14808-79-8	5.00E+04	5.00E+02	[4]	
1,1,2,2-Tetrachloroethane	79-34-5	4.26E-02	4.26E-04	[2]	1.00E-03
Tetrachloroethene	127-18-4	5.00E-01	5.00E-03	[1]	1.00E-03
Thallium	7440-28-0	2.00E-01	2.00E-03	[1]	1.20E-02
Tin	7440-31-5	2.19E+03	2.19E+01	[2]	
Toluene	108-88-3	1.00E+02	1.00E+00	[1]	5.00E-03
Toxaphene	8001-35-2	3.00E-01	3.00E-03	[1]	3.00E-03
1,2,4-Trichlorobenzene	120-82-1	7.00E+00	7.00E-02	[1]	1.00E-02
1,1,1-Trichloroethane	71-55-6	2.00E+01	2.00E-01	[1]	5.00E-03
1,1,2-Trichloroethane	79-00-5	5.00E-01	5.00E-03	[1]	1.00E-03
Trichloroethene	79-01-6	5.00E-01	5.00E-03	[1]	1.00E-03
2,4,5-Trichlorophenol	95-95-4	5.00E+00	5.00E-02	[1]	
2,4,6-Trichlorophenol	88-06-2	7.74E-01	7.74E-03	[2]	5.00E-02
Vanadium	7440-62-2	2.56E+01	2.56E-01	[2]	
Vinyl acetate	108-05-4	3.65E+03	3.65E+01	[2]	
Vinyl chloride	75-01-4	2.00E-01	2.00E-03	[1]	2.00E-03
Xylene (total)	1330-20-7	1.00E+03	1.00E+01	[1]	5.00E-03
Zinc	7440-66-6	1.10E+03	1.10E+01	[2]	
RADIONUCLIDES:		pCi/L	pCi/L		
Americium-241	14596-10-2	14.5	0.145	[2]	
Cesium-137+D	10045-97-3	151	1.51	[2]	
Plutonium-239/240	10-12-8	15.1	0.151	[2]	
Radium-226/228+D		2000 [d]	20 [d]	[1]	
Strontium-89/90	11-10-9	85.2	0.852	[2]	
Tritium	10028-17-8	2,000,000	20,000	[1]	
Uranium-233/234	11-08-5	106	1.06	[2]	
Uranium-235	15117-96-1	101	1.01	[2]	

Table 2
Ground Water Action Levels

Analyte	CAS Reference Number	Tier I [a] (mg/L)	Tier II (mg/L)	Basis [b]	PQLs [c] (mg/L)
Uranium-238	7440-61-1	76.8	0.768	[2]	

NOTES:
[a] Tier I action levels are 100 times the corresponding Tier II value.
[b] Basis for Tier II action level:
[1] Maximum Concentration Level (MCL)
[2] Residential groundwater ingestion Preliminary Remediation Goal (PRG)
[3] EPA Action Level based on the Lead and Copper Rule (40 CFR 141.2)
[4] Proposed MCL
[c] If the practical quantitation level (PQL) for a pollutant is higher (less stringent) than an action level, "less than" the PQL will be used as the compliance threshold. These less stringent PQLs are shaded.
[d] This value applies to the sum of the two radium isotopes.

D = Daughters (Indicates that cancer risk estimates for these radionuclides include the contributions from their short-lived decay products, assuming secular equalibrium with the principal nuclide in the environment. Sample analyses for these radionuclides will not include any activity contribution from daughter products.

The scientific notation used in this table indicates the power of ten by which the two-decimal-place number is multiplied (e.g., 2.52E-02 = 2.52 X 10-2 = .0252).

Table 3
Soil Action Levels

Analyte	CAS Reference Number	Wildlife Refuge Worker [a]	Ecological Receptor [b]	Units
ORGANIC ANALYTES				
Acenaphthene	83-32-9	4.08E+07*		µg/kg
Acetone[d]	67-64-1	1.02E+08*	2.11E+05 (PD)	µg/kg
Aldrin	309-00-2	1.62E+03		µg/kg
Ammonium (as Ammonia)	7664-41-7	> 1E+09*[d]		µg/kg
Anthracene	120-12-7	2.04E+08*		µg/kg
Aroclor 1016	12674-11-2	4.64E+04*		µg/kg
Aroclor 1221	11104-28-2	1.24E+04		µg/kg
Aroclor 1232	11141-16-5	1.24E+04		µg/kg
Aroclor 1242	53469-21-9	1.24E+04		µg/kg
Aroclor 1248	12672-29-6	1.24E+04		µg/kg
Aroclor 1254	11097-69-1	1.24E+04	3.71E+05 (PD)	µg/kg
Aroclor 1260	11096-82-5	1.24E+04		µg/kg
Benzene	71-43-2	2.05E+05		µg/kg
alpha-BHC	319-84-6	5.24E+03		µg/kg
beta-BHC	319-85-7	1.84E+04		µg/kg
gamma-BHC (Lindane)	58-89-9	2.55E+04		µg/kg
Benzo(a)anthracene	56-55-3	3.49E+04	8.00E+05 (PD)	µg/kg
Benzo(a)pyrene	50-32-8	3.49E+03	2.57E+04 (I)	µg/kg
Benzo(b)fluoranthene	205-99-2	3.49E+04	1.01E+06 (PD)	µg/kg
Benzo(k)fluoranthene	207-08-9	3.49E+05	1.01E+06 (PD)	µg/kg
Benzoic Acid (at pH 7)	65-85-0	> 1E+09*		µg/kg
Benzyl Alcohol	100-51-6	3.07E+08*		µg/kg
Bromodichloromethane	75-27-4	6.17E+05		µg/kg
Bromoform	75-25-2	3.73E+06		µg/kg
Bromomethane (methyl bromide)	74-83-9	1.93E+05*		µg/kg
2-Butanone (methyl ethyl ketone)	78-93-3	1.92E+08*	4.33E+05 (PD)	µg/kg
Butylbenzylphthalate	85-68-7	1.47E+08*		µg/kg
Carbon disulfide	75-15-0	1.51E+07*		µg/kg
Carbon tetrachloride[c]	56-23-5	8.15E+04*	8.32E+04 (PM)	µg/kg
alpha-Chlordane	5103-71-9	9.44E+04		µg/kg
beta-Chlordane	5103-74-2	9.44E+04		µg/kg
gamma-Chlordane	12789-03-6	9.44E+04		µg/kg
4-Chloroaniline	106-47-8	2.95E+06*		µg/kg
Chlorobenzene	108-90-7	6.09E+06*		µg/kg
Chloroethane (ethyl chloride)	75-00-3	1.32E+07		µg/kg
bis(2-chloroethyl)ether	111-44-4	3.48E+04		µg/kg
Chloroform[c]	67-66-3	1.92E+04*	1.01E+05 (PD)	µg/kg
bis(2-chloroisopropyl)ether	39638-32-9	5.47E+05		µg/kg
Chloromethane (methyl chloride)	74-87-3	3.71E+05		µg/kg
2-Chloronaphthalene	91-58-7	8.18E+07*		µg/kg
2-Chlorophenol	95-57-8	5.11E+06*		µg/kg
Chrysene	218-01-9	3.49E+06		µg/kg
4,4-DDD	72-54-8	1.43E+05		µg/kg
4,4-DDE	72-55-9	1.01E+05		µg/kg
4,4-DDT	50-29-3	1.00E+05		µg/kg

Table 3
Soil Action Levels

Analyte	CAS Reference Number	Wildlife Refuge Worker [a]	Ecological Receptor [b]	Units
Dibenz(a,h)anthracene	53-70-3	3.49E+03		µg/kg
Dibenzofuran	132-64-9	2.95E+06*		µg/kg
Dibromochloromethane	124-48-1	3.29E+05		µg/kg
Di-n-butylphthalate	84-74-2	7.37E+07*		µg/kg
1,2-Dichlorobenzene (o-)	95-50-1	3.12E+07*		µg/kg
1,4-Dichlorobenzene (p-)	106-46-7	8.40E+05		µg/kg
3,3-Dichlorobenzidine	91-94-1	6.13E+04		µg/kg
1,1-Dichloroethane	75-34-3	2.25E+07*		µg/kg
1,2-Dichloroethane	107-06-2	1.06E+05		µg/kg
1,1-Dichloroethene	75-35-4	1.70E+04		µg/kg
1,2-Dichloroethene (total)	540-59-0	9.20E+06*		µg/kg
2,4-Dichlorophenol (at pH 6.8)	120-83-2	3.07E+06*		µg/kg
1,2-Dichloropropane	78-87-5	3.45E+05*		µg/kg
cis-1,3-Dichloropropene	10061-01-5	6.57E+03		µg/kg
trans-1,3-Dichloropropene	10061-02-6	6.57E+03		µg/kg
Dieldrin	60-57-1	1.72E+03		µg/kg
Diethylphthalate	84-66-2	5.90E+08*		µg/kg
2,4-Dimethylphenol	105-67-9	2.04E+07*		µg/kg
Dimethylphthalate	131-11-3	> 1E+09*		µg/kg
4,6-Dinitro-2-methylphenol (4,6-dinitro-o-cresol)	534-52-1	1.02E+06*		µg/kg
2,4-Dinitrophenol	51-28-5	2.04E+06*		µg/kg
2,4-Dinitrotoluene	121-14-2	5.63E+04		µg/kg
2,6-Dinitrotoluene	606-20-2	5.63E+04		µg/kg
Di-n-octylphthalate	117-84-0	1.47E+07		µg/kg
Endosulfan I	959-98-8	4.42E+06*		µg/kg
Endosulfan II	33213-65-9	4.42E+06*		µg/kg
Endosulfan sulfate	1031-07-8	4.42E+06*		µg/kg
Endosulfan (technical)	115-29-7	4.42E+06*		µg/kg
Endrin (technical)	72-20-8	2.21E+05*		µg/kg
Ethylbenzene	100-41-4	4.25E+06		µg/kg
bis(2-ethylhexyl)phthalate	117-81-7	1.97E+06		µg/kg
Fluoranthene	206-44-0	2.72E+07*		µg/kg
Fluorene	86-73-7	4.08E+07*		µg/kg
Fluoride (as fluorine)	7782-41-4	6.13E+07*		µg/kg
Heptachlor	76-44-8	6.12E+03		µg/kg
Heptachlor epoxide	1024-57-3	3.03E+03		µg/kg
Hexachlorobenzene	118-74-1	1.72E+04		µg/kg
Hexachlorobutadiene	87-68-3	1.47E+05*		µg/kg
Hexachlorocyclopentadiene	77-47-4	3.50E+06*		µg/kg
Hexachloroethane	67-72-1	7.37E+05*	1.99E+06 (PD)	µg/kg
Indeno(1,2,3-cd)pyrene	193-39-5	3.49E+04		µg/kg
Isophorone	78-59-1	2.91E+07		µg/kg
Methoxychlor	72-43-5	5.11E+06*		µg/kg
Methylene chloride (dichloromethane)[c]	75-09-2	2.53E+06	3.95E+04 (PD)	µg/kg
2-Methylnaphthalene	91-57-6	2.04E+07*		µg/kg
4-Methyl-2-pentanone (methyl isobutyl ketone)	108-10-1	1.64E+07*		µg/kg

Table 3
Soil Action Levels

Analyte	CAS Reference Number	Wildlife Refuge Worker [a]	Ecological Receptor [b]	Units
2-Methylphenol (o-cresol)	95-48-7	3.69E+07*		µg/kg
4-Methylphenol (p-cresol)	106-44-5	3.69E+06*		µg/kg
Naphthalene	91-20-3	3.09E+06*		µg/kg
2-Nitroaniline	88-74-4	1.67E+07*		µg/kg
Nitrobenzene	98-95-3	3.32E+05*		µg/kg
4-Nitrophenol	100-02-7	8.18E+06*		µg/kg
n-Nitrosodiphenylamine	86-30-6	7.81E+06		µg/kg
n-Nitrosodipropylamine	621-64-7	5.47E+03		µg/kg
Pentachlorophenol	87-86-5	1.62E+05		µg/kg
Phenol	108-95-2	6.13E+08*		µg/kg
Pyrene	129-00-0	2.21E+07*		µg/kg
Styrene	100-42-5	1.23E+08*		µg/kg
1,1,2,2-Tetrachloroethane	79-34-5	1.00E+05		µg/kg
Tetrachloroethene[c]	127-18-4	6.15E+05	3.75E+04 (PM)	µg/kg
Toluene	108-88-3	3.13E+07*	1.28E+05 (PM)	µg/kg
Toxaphene	8001-35-2	2.50E+04		µg/kg
1,2,4-Trichlorobenzene	120-82-1	9.23E+06*		µg/kg
1,1,1-Trichloroethane	71-55-6	7.97E+07*		µg/kg
1,1,2-Trichloroethane	79-00-5	2.36E+05		µg/kg
Trichloroethene[c]	79-01-6	1.96E+04	5.09E+05 (PD)	µg/kg
2,4,5-Trichlorophenol	95-95-4	1.02E+08*		µg/kg
2,4,6-Trichlorophenol	88-06-2	3.47E+06*		µg/kg
Vinyl acetate	108-05-4	9.63E+08*		µg/kg
Vinyl chloride[c]	75-01-4	4.12E+04	1.66E+02 (PM)	µg/kg
Xylene (total)	1330-20-7	2.04E+06		µg/kg
INORGANIC ANALYTES				
Aluminum	7429-90-5	2.28E+05*		mg/kg
Antimony	7440-36-0	4.09E+02*		mg/kg
Arsenic[c]	7440-38-2	2.22E+01	2.16E+01 (PD)	mg/kg
Barium	7440-39-3	2.64E+04*		mg/kg
Beryllium[c]	7440-41-7	9.21E+02*	2.15E+00 (PD)**	mg/kg
Cadmium (food)[c]	7440-43-9	9.62E+02*		mg/kg
Chromium III	16065-83-1	> 1E+06*		mg/kg
Chromium VI	18540-29-9	2.68E+02		mg/kg
Cobalt	7440-48-4	1.55E+03*		mg/kg
Copper	7440-50-8	4.09E+04*		mg/kg
Cyanide	57-12-5	2.04E+04*		mg/kg
Iron	7439-89-6	3.07E+05*		mg/kg
Lead[c]	7439-92-1	1.00E+03[e]	2.56E+01 (K)**	mg/kg
Lithium	7439-93-2	2.04E+04*		mg/kg
Manganese	7439-96-5	3.48E+03*		mg/kg
Mercury (elemental)	7439-97-6	2.52E+04*		mg/kg
Molybdenum	7439-98-7	5.11E+03*		mg/kg
Nickel (soluble)	7440-02-0	2.04E+04*		mg/kg

Table 3
Soil Action Levels

Analyte	CAS Reference Number	Wildlife Refuge Worker [a]	Ecological Receptor [b]	Units
Nitrate	14797-55-8	> 1E+06*		mg/kg
Nitrite	14797-65-0	1.02E+05*		mg/kg
Selenium	7782-49-2	5.11E+03*		mg/kg
Silver	7440-22-4	5.11E+03*		mg/kg
Strontium	7440-24-6	6.13E+05*		mg/kg
Tin	7440-31-5	6.13E+05*		mg/kg
Uranium (Total)		2.75E+03*[f]	6.78E+01 (PD)	mg/kg
Vanadium	7440-62-2	7.15E+03*	4.33E+02 (K)	mg/kg
Zinc	7440-66-6	3.07E+05*		mg/kg
RADIONUCLIDES [g]				
Americium-241[c]	14596-10-2	7.60E+01	1.90E+03	pCi/g
		5.00E+01*/		pCi/g
Plutonium-239/240[c]	10-12-8	1.16E+02 [h]	3.80E+03	pCi/g
Uranium-234[c]	11-08-5	3.00E+02	1.80E+03	pCi/g
Uranium-235[c]	15117-96-1	8.00E+00	1.90E+03	pCi/g
Uranium-238[c]	7440-61-1	3.51E+02	1.60E+03	pCi/g
TO BE DETERMINED [i]				
Acenaphthylene	208-96-8	TBD		
Benzo(g,h,i)perylene	191-24-2	TBD		
4-Bromophenyl phenyl ether	101-55-3	TBD		
Dioxin	1746-01-6	TBD		
Furan	110-00-9	TBD		
Hexachlorocyclohexane, gamma	58-89-9	TBD		
Pendimethalin	40487-42-1	TBD		
Pentachlorobenzene	608-93-5	TBD		
Pentachloronitrobenzene	82-68-8	TBD		
Phenanthrene	85-01-8	TBD		
1,2,4,5-Tetrachlorobenzene	95-94-3	TBD		
Trifluralin	1582-09-8	TBD		

Notes:
[a] Values are based on PRG calculations for a wildlife refuge worker (see RFCA Appendix 3, Implementation Guidance Document Appendix N). Values represent either a 1 x 10-5 lifetime excess cancer risk or a HQ=1 for non-cancer toxicity. An "*" indicates that the value for the wildlife refuge worker is based on HQ=1 for non-cancer toxicity. All toxicity factors used in the calculations are from IRIS, from HEAST, or are approved by the NCEA.
[b] Listed values are based on PRG calculations for ecological receptors (see RFCA Appendix 3, Implementation Guidance Document Appendix N) and are based on Lowest-Observed-Adverse-Effects Level (LOAEL) end points. The action level listed is the lowest action level that was calculated for each of the five selected wildlife receptors: Preble's meadow jumping mouse and black tailed prairie dog (fossorial (burrowing) small mammals), mourning dove (small ground-feeding bird), terrestrial invertebrate (multiple species), and American kestrel (avian predator). The acronym in parentheses is the ecological receptor that is the basis for the Action Level shown: (PM) – Preble's Meadow Jumping Mouse; (PD) - Prairie Dog; (MD) Mourning Dove; (I) - Invertebrate; and (K) - Kestrel.
A "**" indicates that the action level is less than the mean plus 2 standard deviations of the Site background concentration. In these cases, the ecological action levels will default to background levels.
Inferential statistics are recommended to demonstrate cleanup to background levels.
[The Ecological Risk Working Group is evaluating all analytes listed in Table 3 to determine if the analyte is an ecological potential

Table 3
Soil Action Levels

Analyte	CAS Reference Number	Wildlife Refuge Worker [a]	Ecological Receptor [b]	Units

contaminant of concern (PCOC). PRGs will be calculated for analytes determined to be ecological PCOCs. Table 3 will be modified, as appropriate, based on this evaluation.]

[c] Sitewide human health analytes that will be analyzed during characterization at a minimum.

[d] > 1E+09 or >1E+06 indicates the action level has a calculated value greater than 1.00E+09 mg/kg (1,000,000,000 ug/kg) or mg/kg1.00 + 06
(1,000,000 mg/kg) respectively.

[e] U.S. Environmental Protection Agency (EPA). 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. Office of Solid Waste and Emergency Response. Washington, D.C. Directive 9355.4-12

[f] The action level for total uranium in units of mg/kg accounts for the non-cancer risk. If uranium contamination reported in pCi/g is collocated with plutonium and/or americium contamination, the radiological action levels for uranium isotopes will be included in sum-of-ratios calculations. If uranium concentrations exceeds either action level, an action determination in accordance with ALF Section 5.3 is triggered.

[g] Wildlife refuge worker values for radionuclides are from the Task 3 Report and Appendices: Calculation of Surface Radionuclide Soil Action Levels for Plutonium, Americium, and Uranium (September 30, 2002). The values are for individual radionuclides and are based on a 1 x 10-5 excess cancer risk and the 5th percentile of the RSAL distribution. In order to account for the total dose from the multiple radionuclides, sum-of-ratios calculations will be applied to all radionuclides which are present above background. Actual values that trigger actions will therefore likely be lower than the values listed in this table. Action levels for other radionuclides will be determined as necessary and in the same manner used to calculate the values listed in this table.

[h] Although the Pu-239 calculated value at 1 X 10-5 risk is 116 pCi/g, the RFCA parties have agreed that accelerated actions are required for soil with Pu activity levels above 50 pCi/g.

[i] Analytes with the note "TBD" are being reviewed to determine if the analyte was used or could have been used at RFETS. If it is determined that the analyte was used or could have been used at RFETS, then a wildlife refuge worker action level will be determined in the same manner used to calculate the wildlife refuge worker values listed in this table.

The scientific notation used in this table indicates the power of ten by which the two-decimal place number is multiplied (e.g., 2.52E-02 = 2.52 x 10-2 = 0.0252)

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Figure 26 UHSU Groundwater Monitoring Locations Where Composite MCLs Were Exceeded

Figure 27 Estimated Sitewide Surface Soil Exceedance Area for Plutonium-239/240

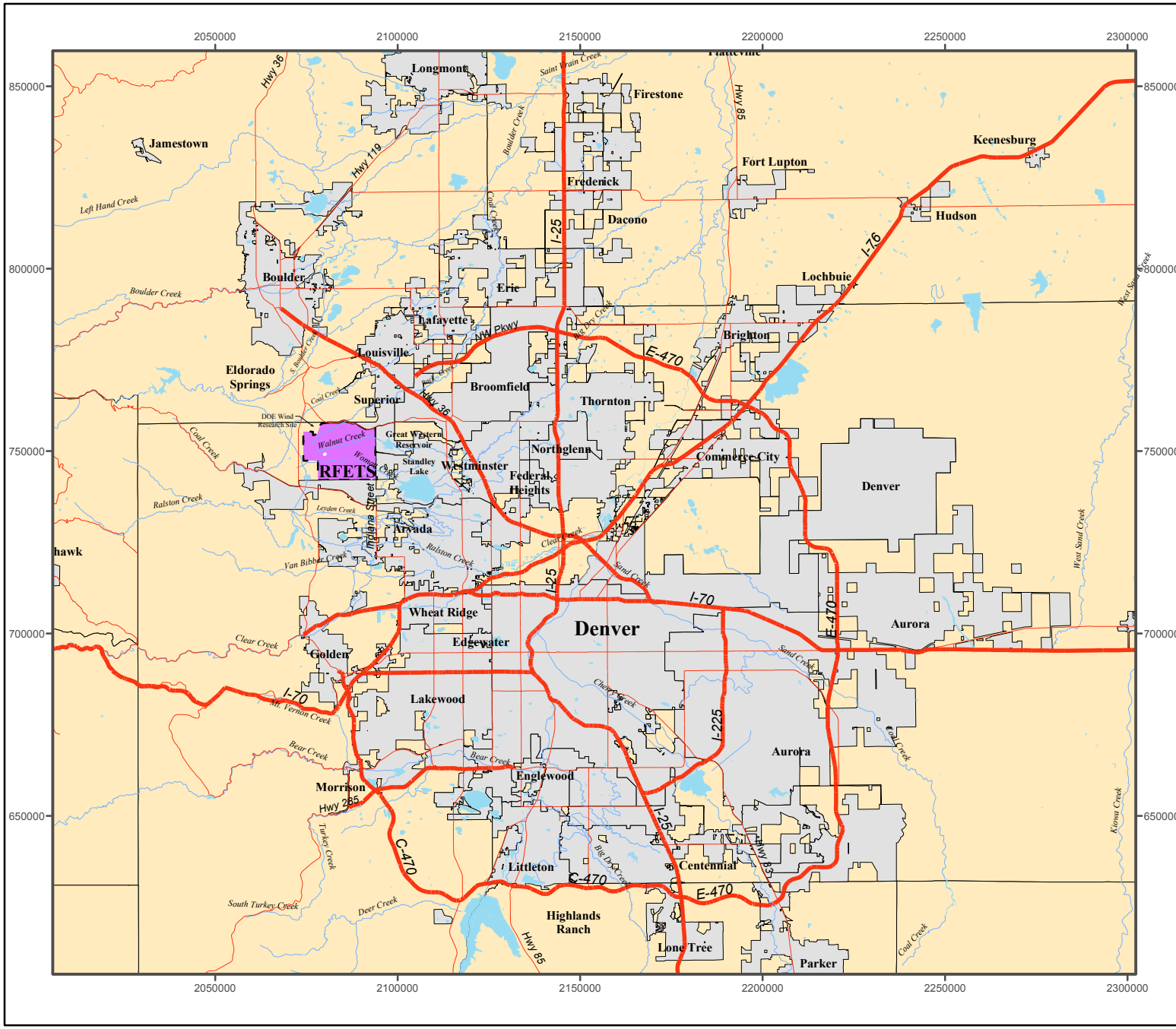
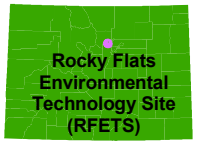


Figure 1
Location of
Rocky Flats Environmental
Technology Site (RFETS)

KEY

- Highway
- Interstate
- Streams
- Lakes and Ponds
- Site Boundary
- City Boundary
- County Boundary



Colorado

N
W E
S

0 3 6 Miles

Scale 1:480,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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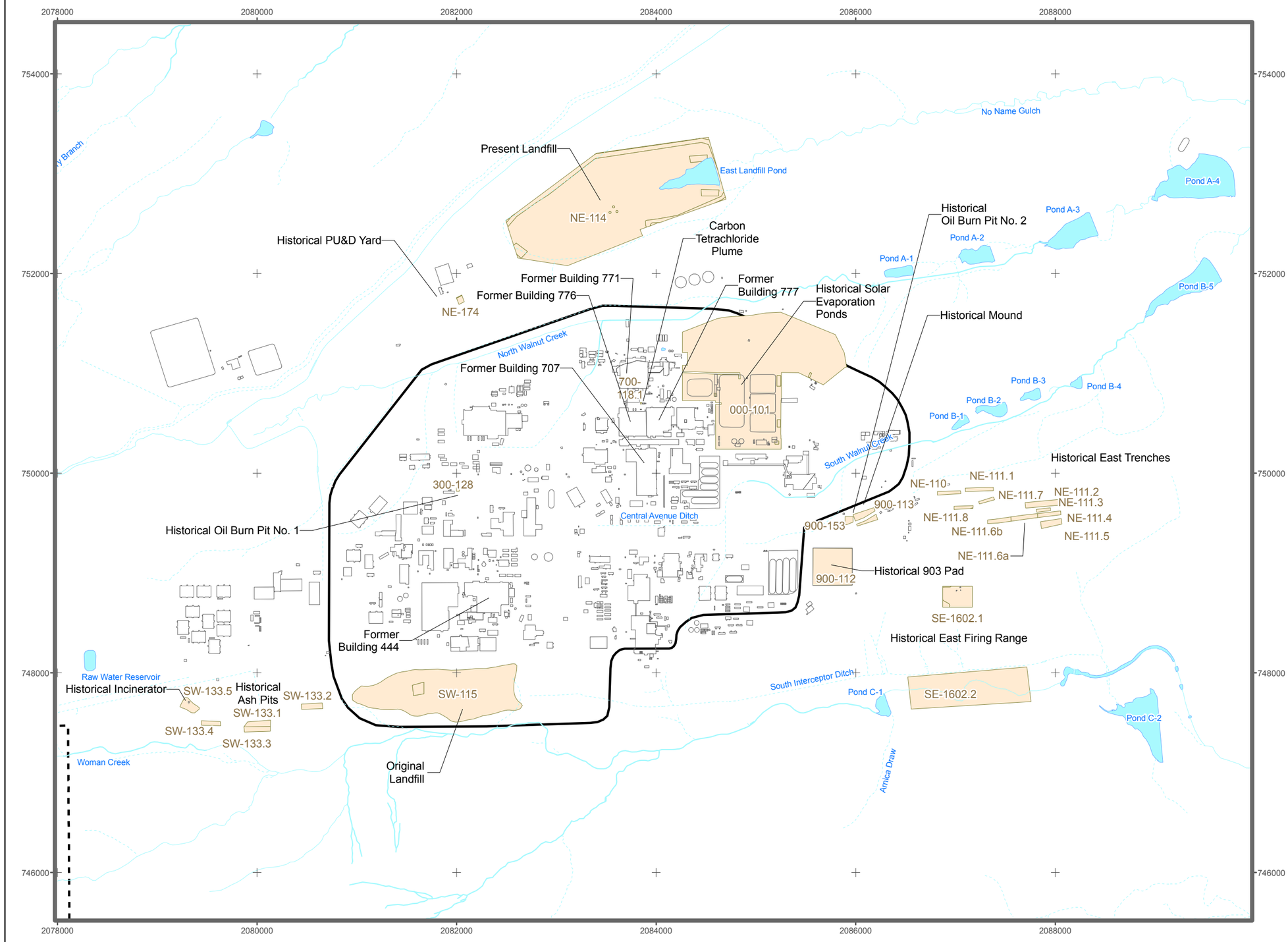
Denver_area_map_RIFS.mxd

Figure 2

Location of Select Historical IHSSs, PACs, and UBC Sites



KEY

- Removed building or structure
- Select historical IHSS, PAC, or UBC Sites

Standard Map Features

- IA OU boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 500 1,000 Feet

Scale 1:12,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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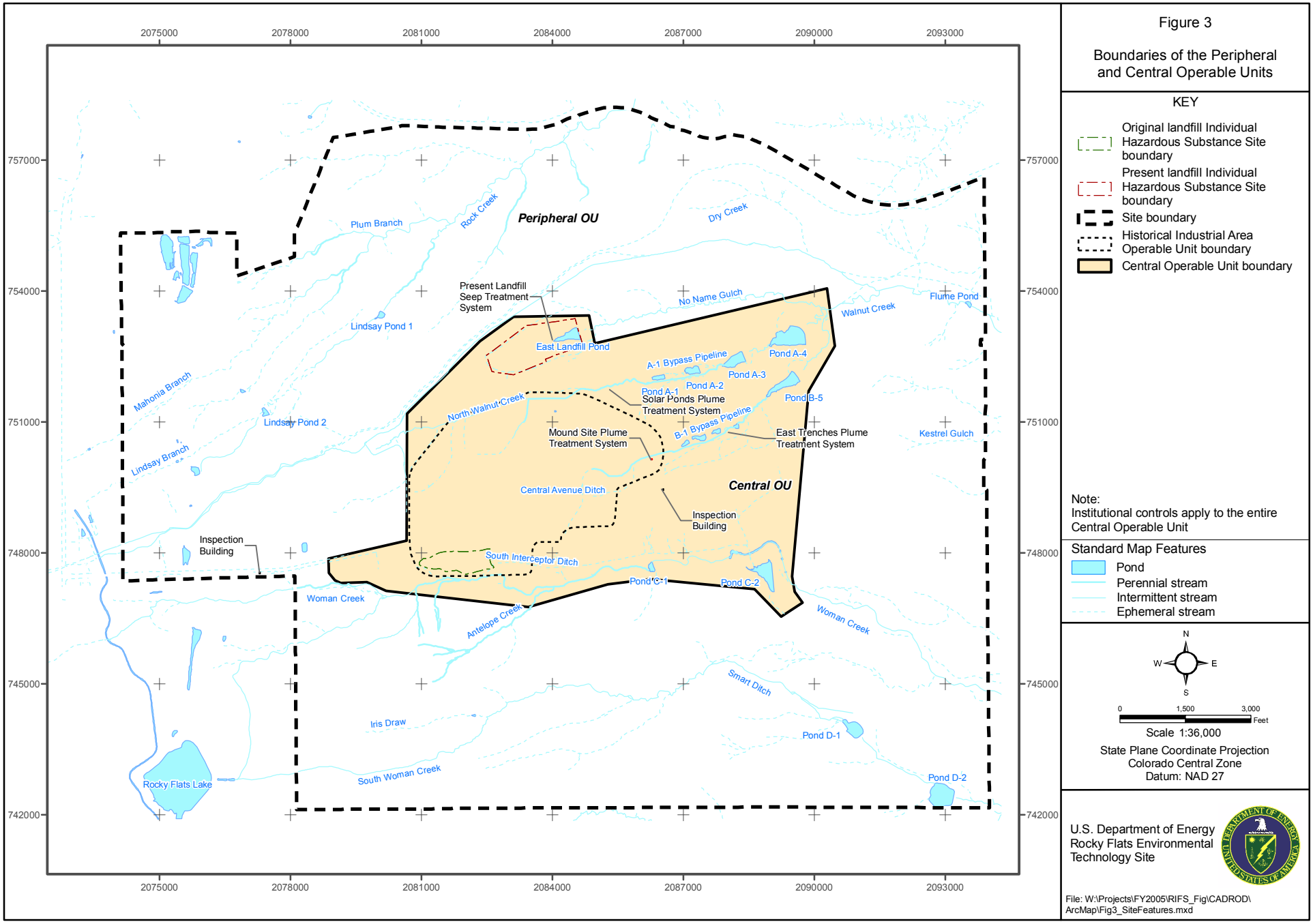

Figure 3

Boundaries of the Peripheral and Central Operable Units

KEY

- Original landfill Individual Hazardous Substance Site boundary
- Present landfill Individual Hazardous Substance Site boundary
- Site boundary
- Historical Industrial Area Operable Unit boundary
- Central Operable Unit boundary

Note:
Institutional controls apply to the entire Central Operable Unit

Standard Map Features

- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,500 3,000 Feet

Scale 1:36,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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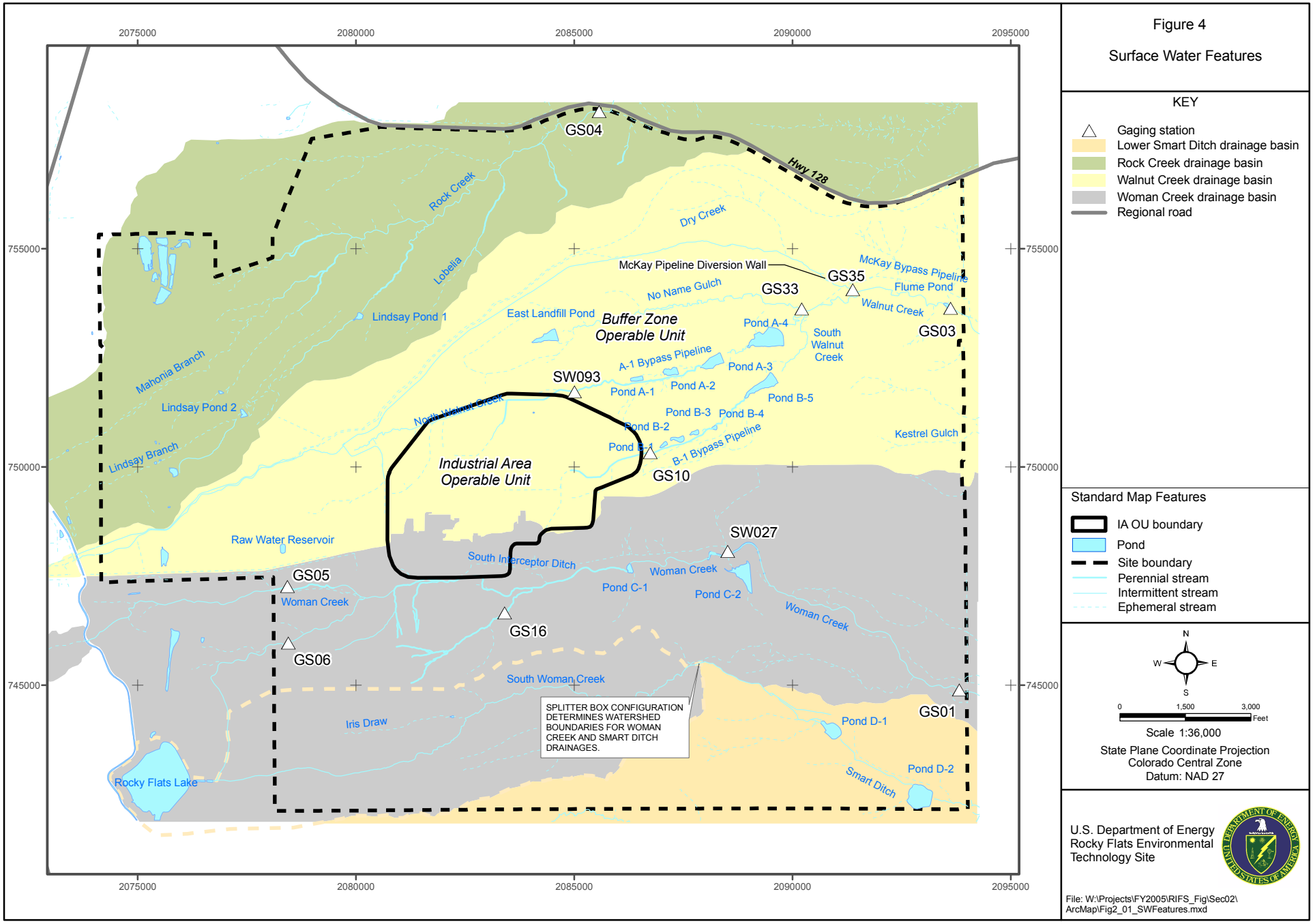

Figure 4

Surface Water Features

KEY

- Gaging station
- Lower Smart Ditch drainage basin
- Rock Creek drainage basin
- Walnut Creek drainage basin
- Woman Creek drainage basin
- Regional road

Standard Map Features

- IA OU boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,500 3,000 Feet

Scale 1:36,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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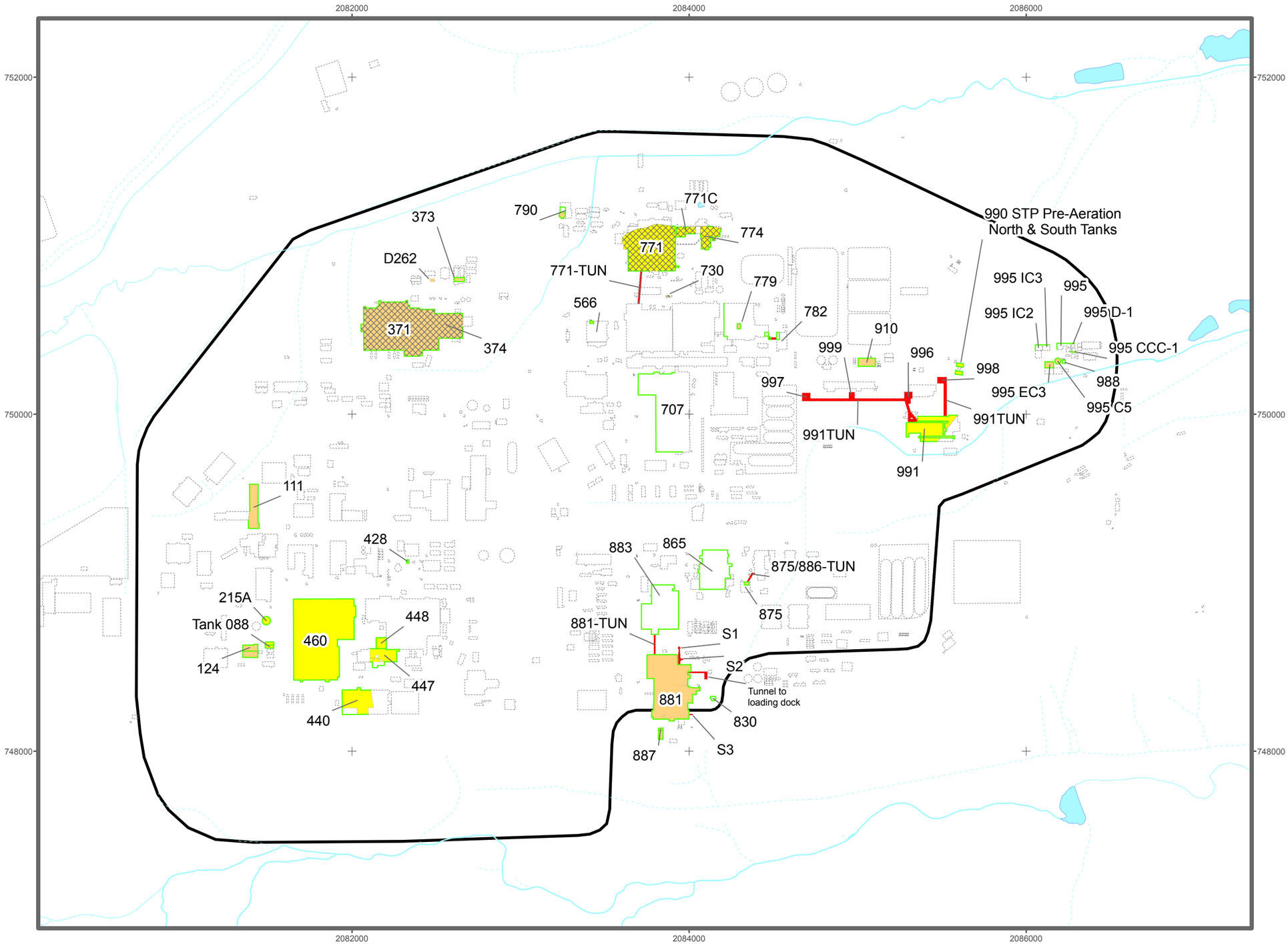
Figure 5

Subsurface Features After Accelerated Actions (Slabs, Building Foundations, and Tunnels)



KEY

- Slab remaining
- Basement slab remaining
- Tunnel Remaining (slab, walls, foundations, ceiling)
- Foundation Remaining (includes caissons and/or grade beams)
- Contaminated below 6 ft
- Removed buildings and structures

Standard Map Features

- IA OU boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 300 600 Feet

Scale 1:7,200

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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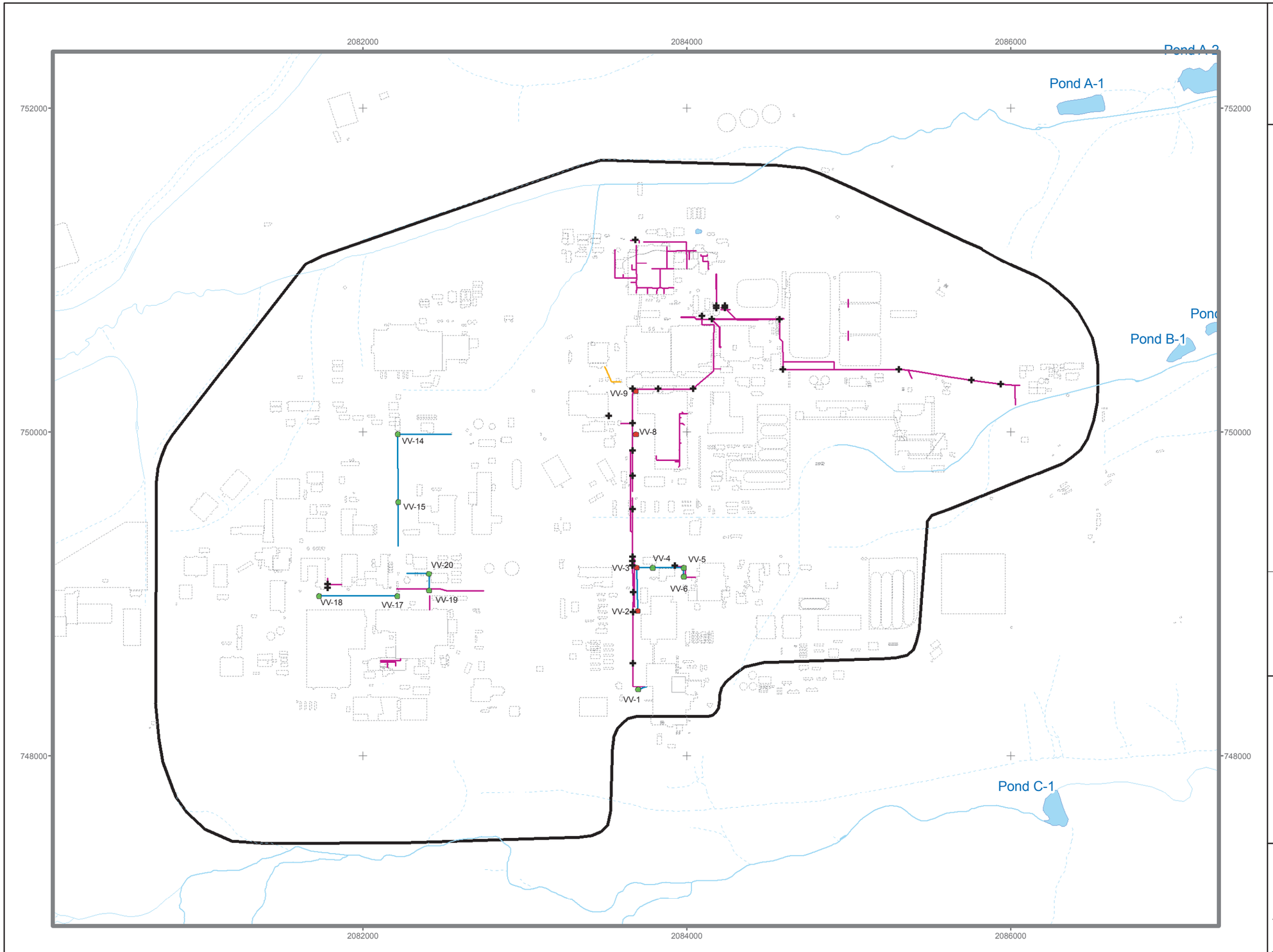
ArcMap\Fig2_05_SubsurfaceFeaturesSlabs.mxd

Figure 6

Subsurface Features After Accelerated Actions (Process Waste Lines and Valve Vaults)



KEY

Original Process Waste Lines (OPWL)

- OPWL grouted and left in place
- OPWL manway - removed

New Process Waste Lines (NPWL)

- NPWL grouted and left in place clean closed
- NPWL grouted and left in place not part of RCRA Unit 374.3
- NPWL valve vault (removed to below 6 feet from surface and backfilled; not contaminated)
- NPWL valve vault (removed to below 6 feet from surface and flowfilled/backfilled; radionuclide, contaminated)
- Removed buildings and structures

Standard Map Features

- IA OU boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 300 600 Feet

Scale 1:7,200

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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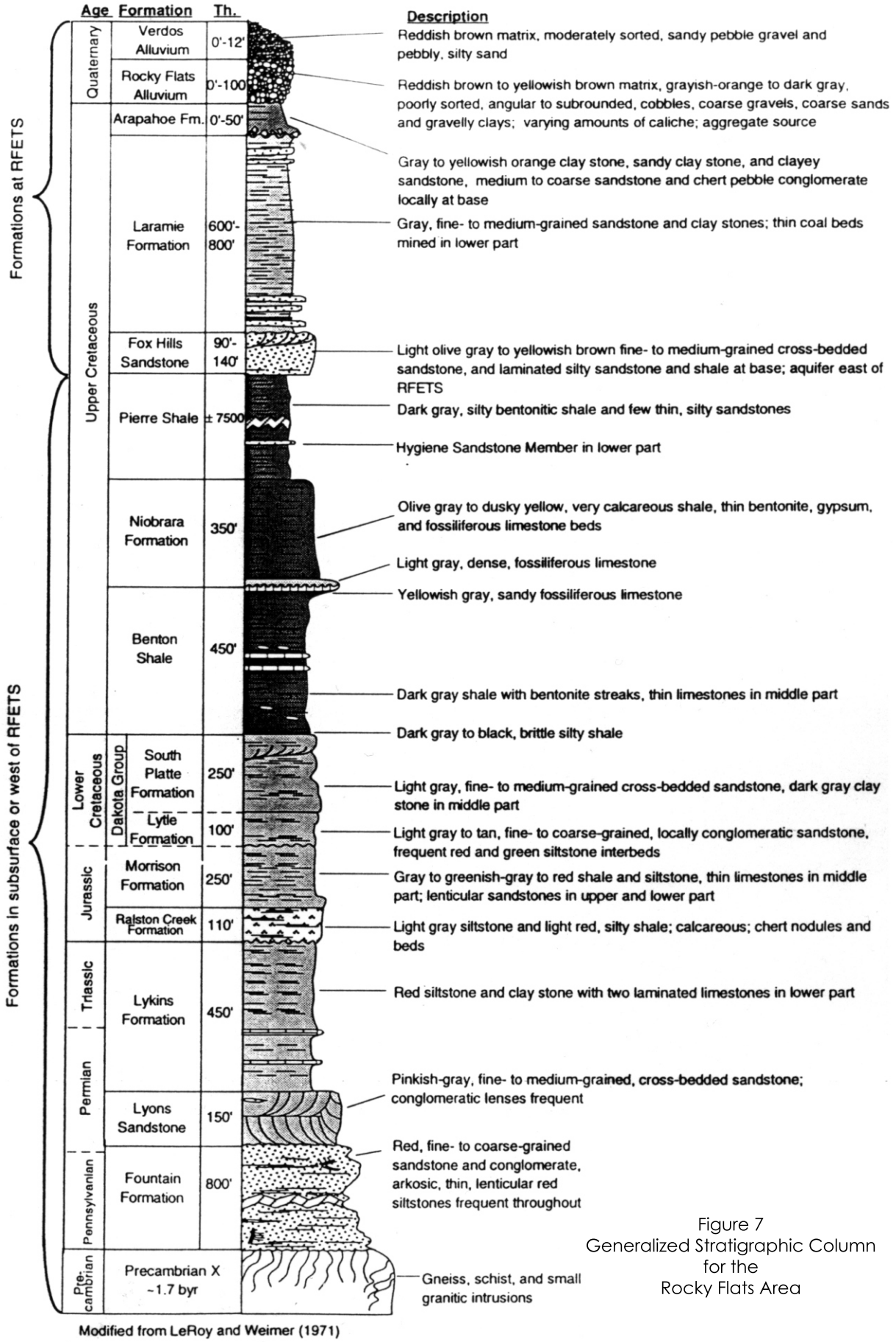

Modified from LeRoy and Weimer (1971)

Figure 7
Generalized Stratigraphic Column
for the
Rocky Flats Area

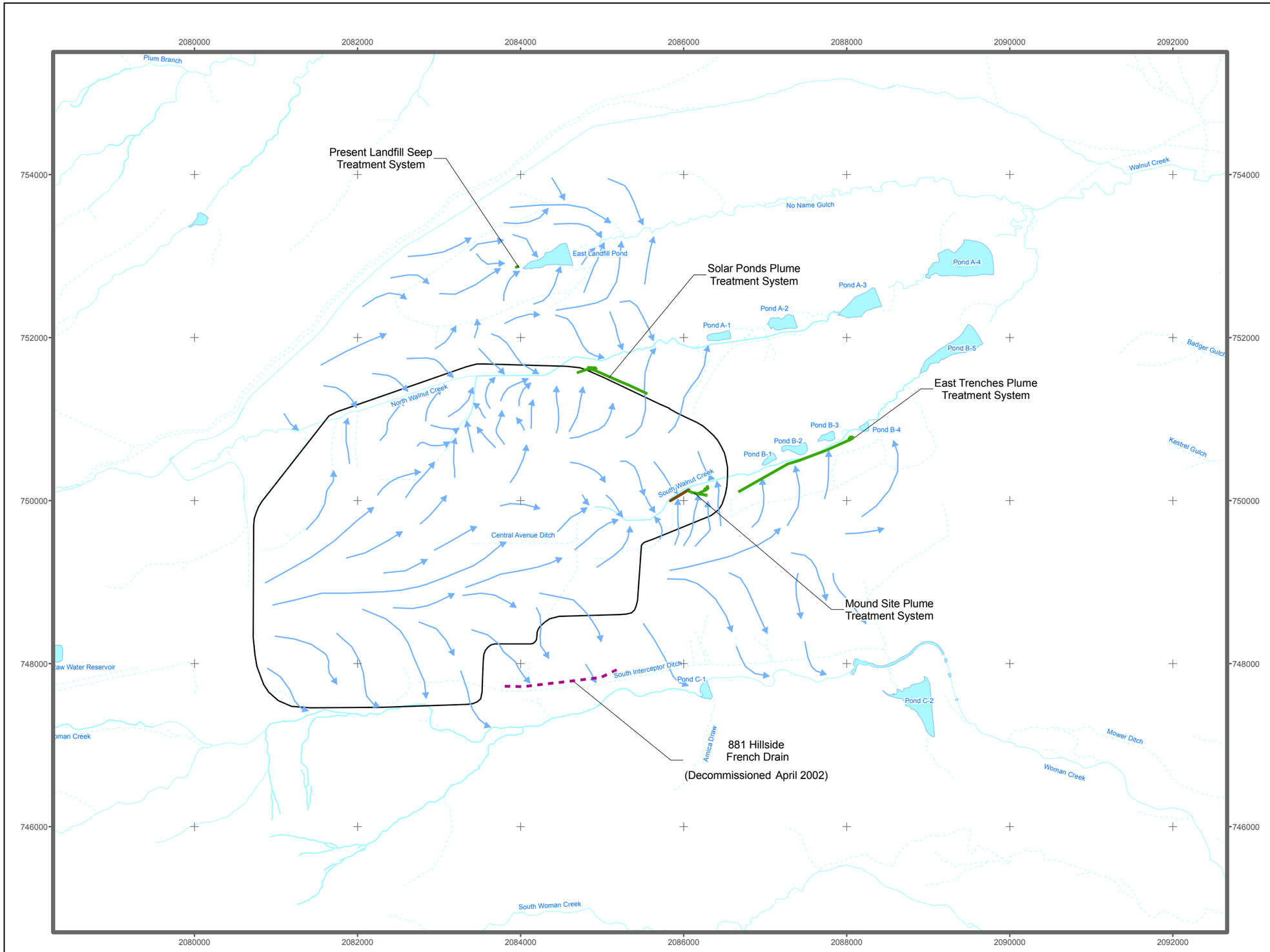

Figure 8

Predicted Groundwater Flow Directions

KEY

- Predicted groundwater flow direction
- Existing groundwater treatment system
- Decommissioned french drain
- Mound french drain
- IA OU boundary

Note:
The length of the arrow does not correspond to the groundwater velocity.

Standard Map Features

- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 600 1,200 Feet

Scale 1:14,400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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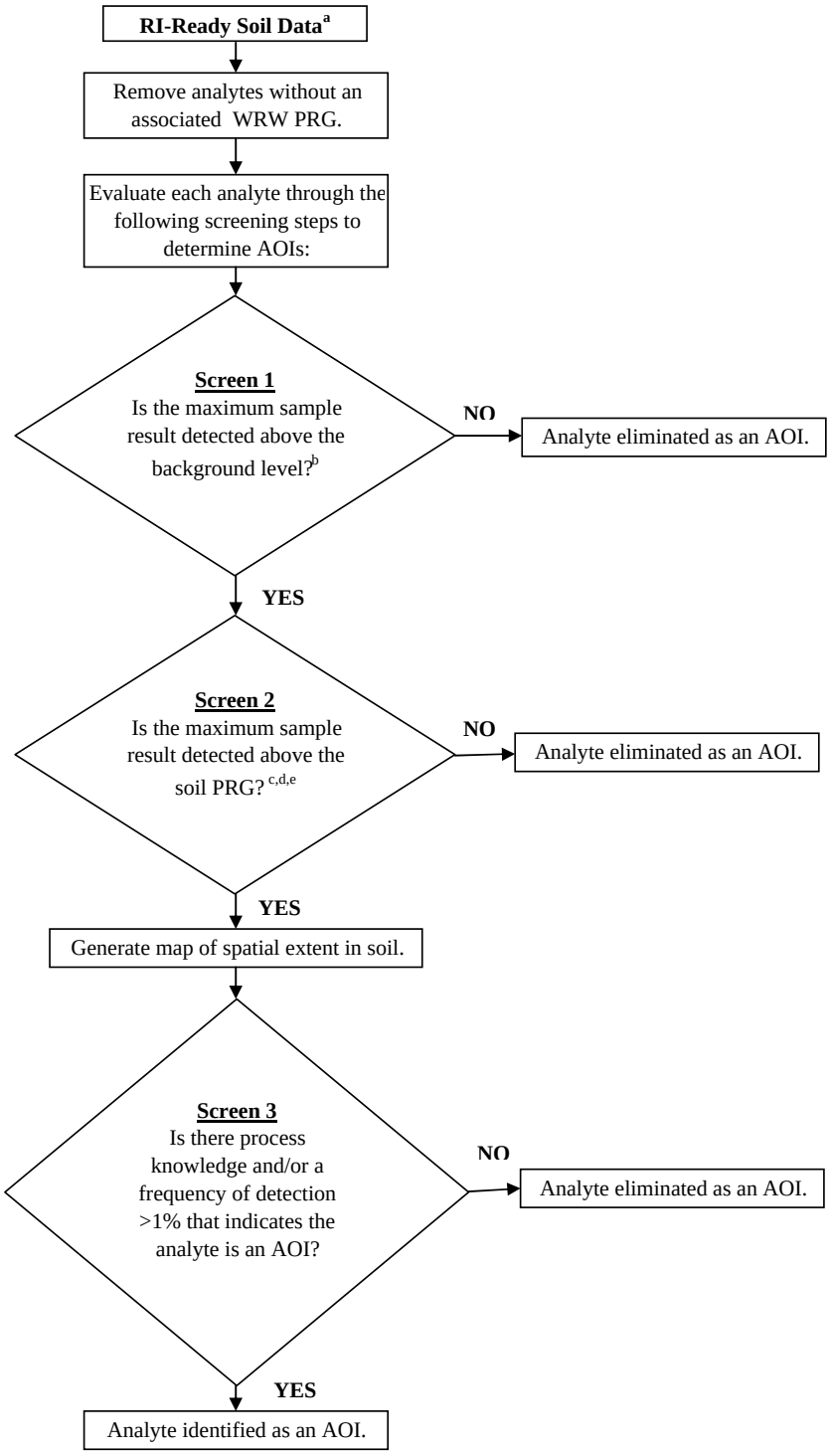
Figure 9
Soil Nature and Extent AOI Identification Process



[a] Soil "superset" for soil samples collected from June 28, 1991 through August 22, 2005.

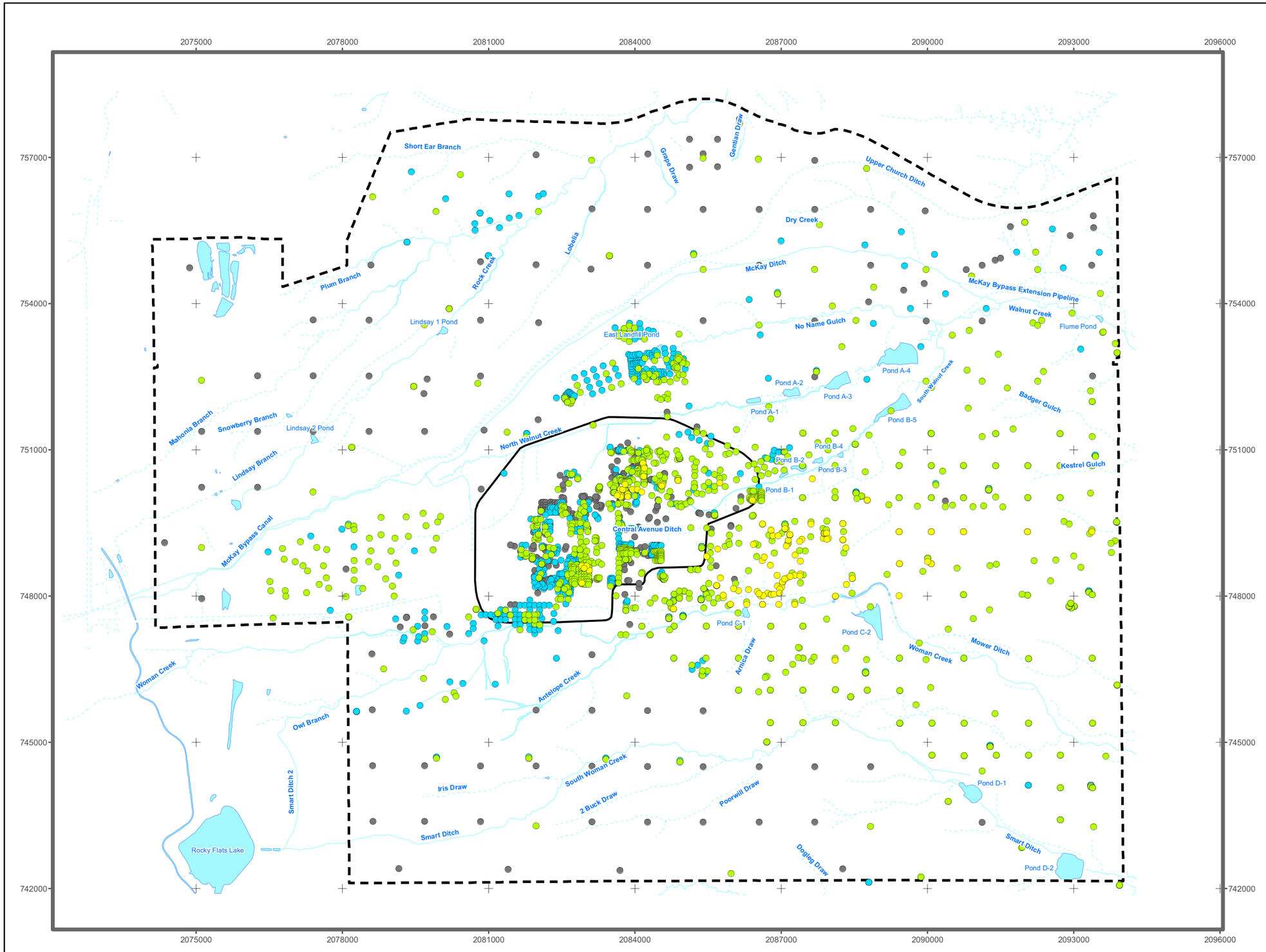
[b] Background level is defined as the background M2SD.

[c] Soil PRGs are defined as 1 x 10^{-6} WRW PRGs based on using an HI of 0.1 or a risk of 1 x 10^{-6} (the more conservative of the two values was used for the PRG).

[d] The PRG value for lead is not a calculated PRG, but rather is taken from the EPA guidance document Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Correction Action Facilities (1994).

[e] For surface soil (0 to 0.5 ft), WRW surface soil (0 to 0.5 ft) PRGs are used. For subsurface soil (0.5 ft to a maximum depth of 209 ft), WRW subsurface soil (0.5 to 8 ft) PRGs are used.

Figure 10
Plutonium-239/240 Activity in Surface Soil



KEY

- >= WRW PRG
- > Background M2SD and < WRW PRG
- Detected and <= Background M2SD
- Not detected

Minimum nondetect reported value = -0.078 pCi/g
Maximum nondetect reported value = 0.218 pCi/g
Background M2SD = 0.066 pCi/g
WRW PRG = 9.8 pCi/g

Notes:
- Data presented are the results from soil samples collected between 6/28/1991 and 8/22/2005.
- See Tables 3.1 and 3.13 for additional information.

Standard Map Features

- IA OU boundary
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1,000 2,000 Feet

Scale 1:24,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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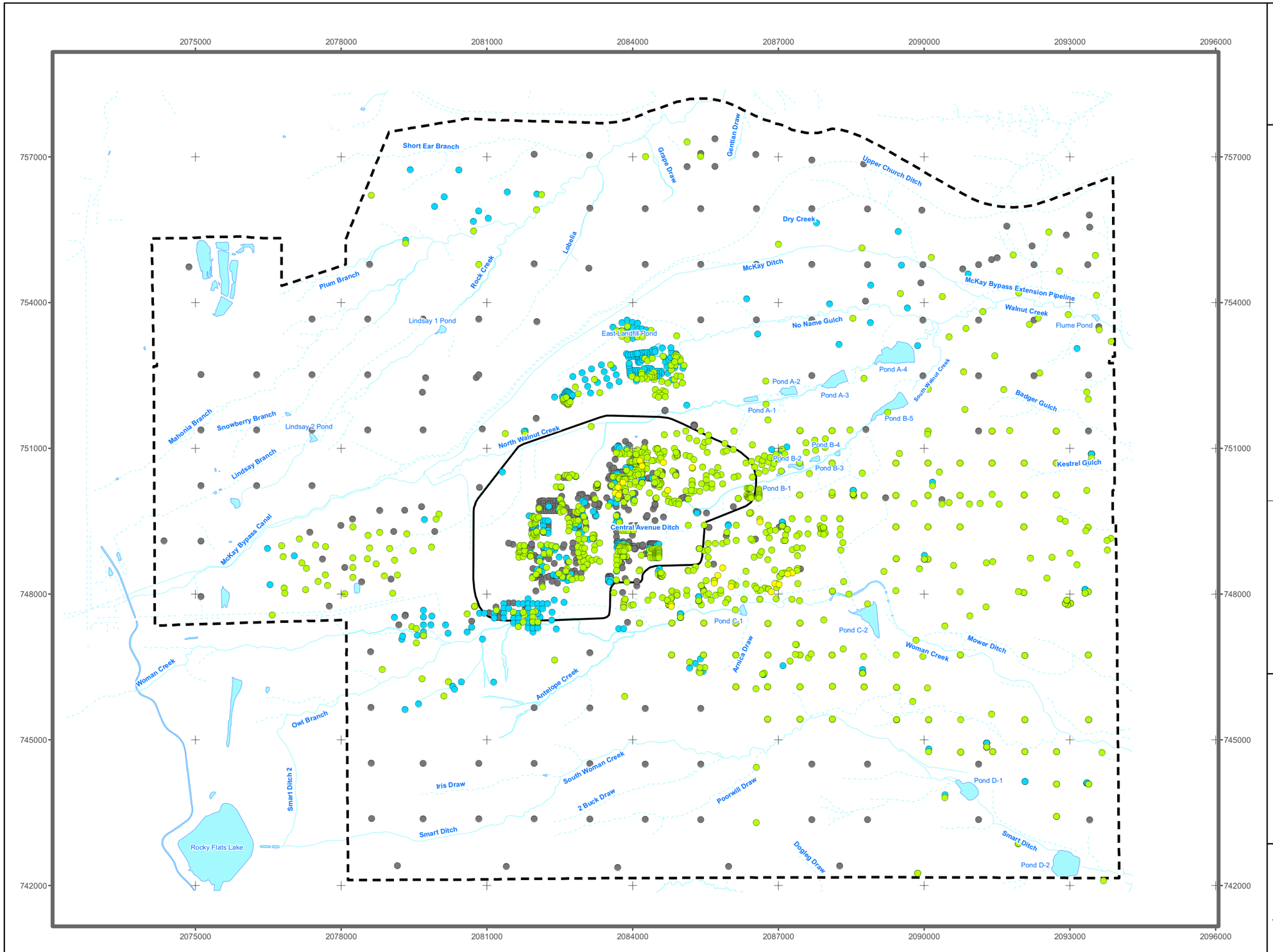
Figure 11
Americium-241 Activity in Surface Soil



KEY

- >= WRW PRG
- > Background M2SD and < WRW PRG
- Detected and <= Background M2SD
- Not detected

Minimum nondetect reported value = -0.082 pCi/g
Maximum nondetect reported value = 0.327 pCi/g
Background M2SD = 0.022 pCi/g
WRW PRG = 7.69 pCi/g

Notes:
- Data presented are the results from soil samples collected between 6/28/1991 and 8/22/2005.
- See Tables 3.1 and 3.13 for additional information.

Standard Map Features

- IA OU boundary
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1,000 2,000 Feet

Scale 1:24,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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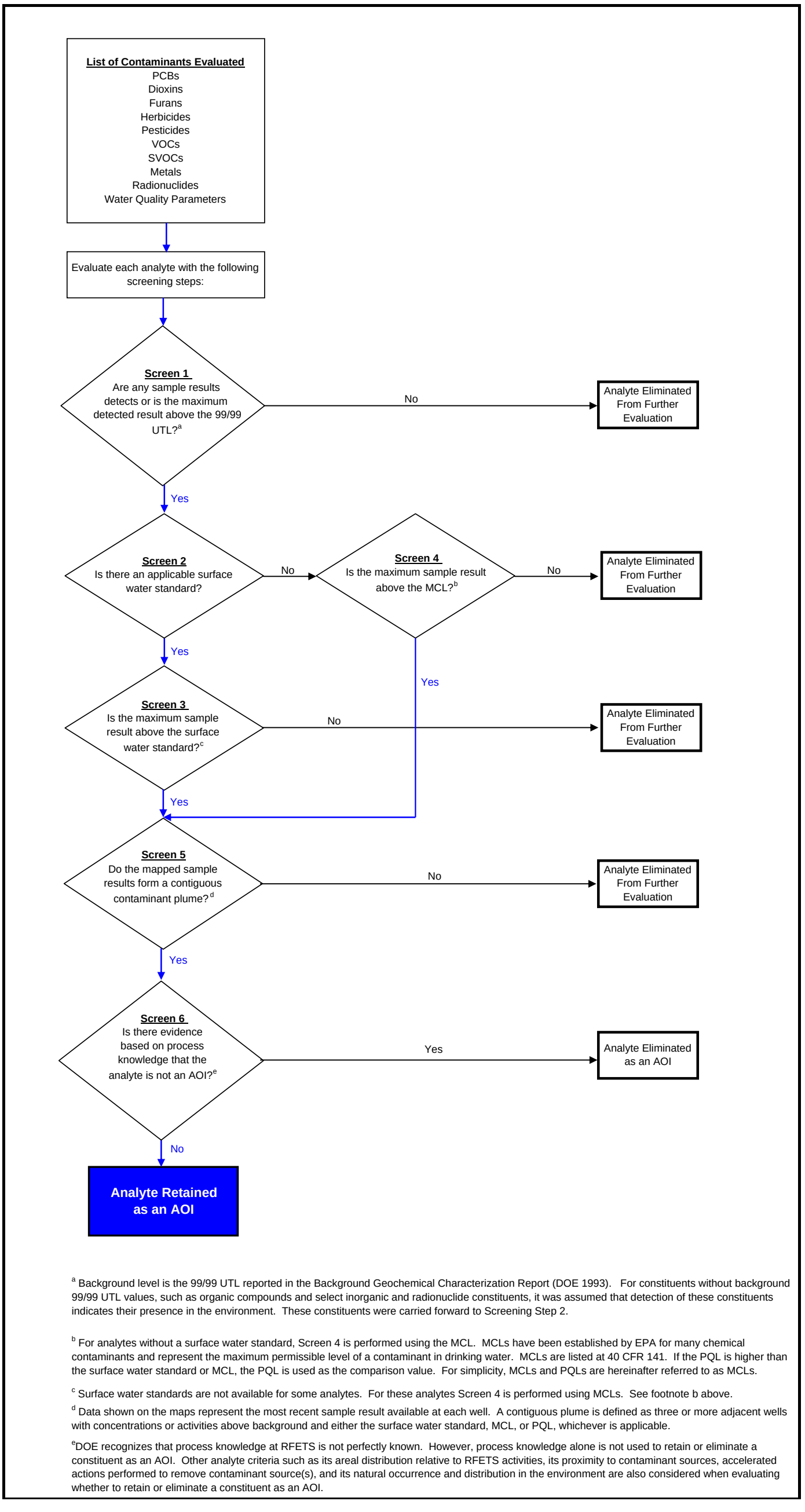
Figure 12
Groundwater AOI Screening Process



[a] Background level is the 99/99 UTL reported in the Background Geochemical Characterization Report (DOE 1993). For constituents without background 99/99 UTL values, such as organic compounds and select inorganic and radionuclide constituents, it was assumed that detection of these constituents indicates their presence in the environment. These constituents were carried forward to Screening Step 2.

[b] For analytes without a surface water standard, Screen 4 is performed using the MCL. MCLs have been established by EPA for many chemical contaminants and represent the maximum permissible level of a contaminant in drinking water. MCLs are listed at 40 CFR 141. If the PQL is higher than the surface water standard or MCL, the PQL is used as the comparison value. For simplicity, MCLs and PQLs are hereinafter referred to as MCLs.

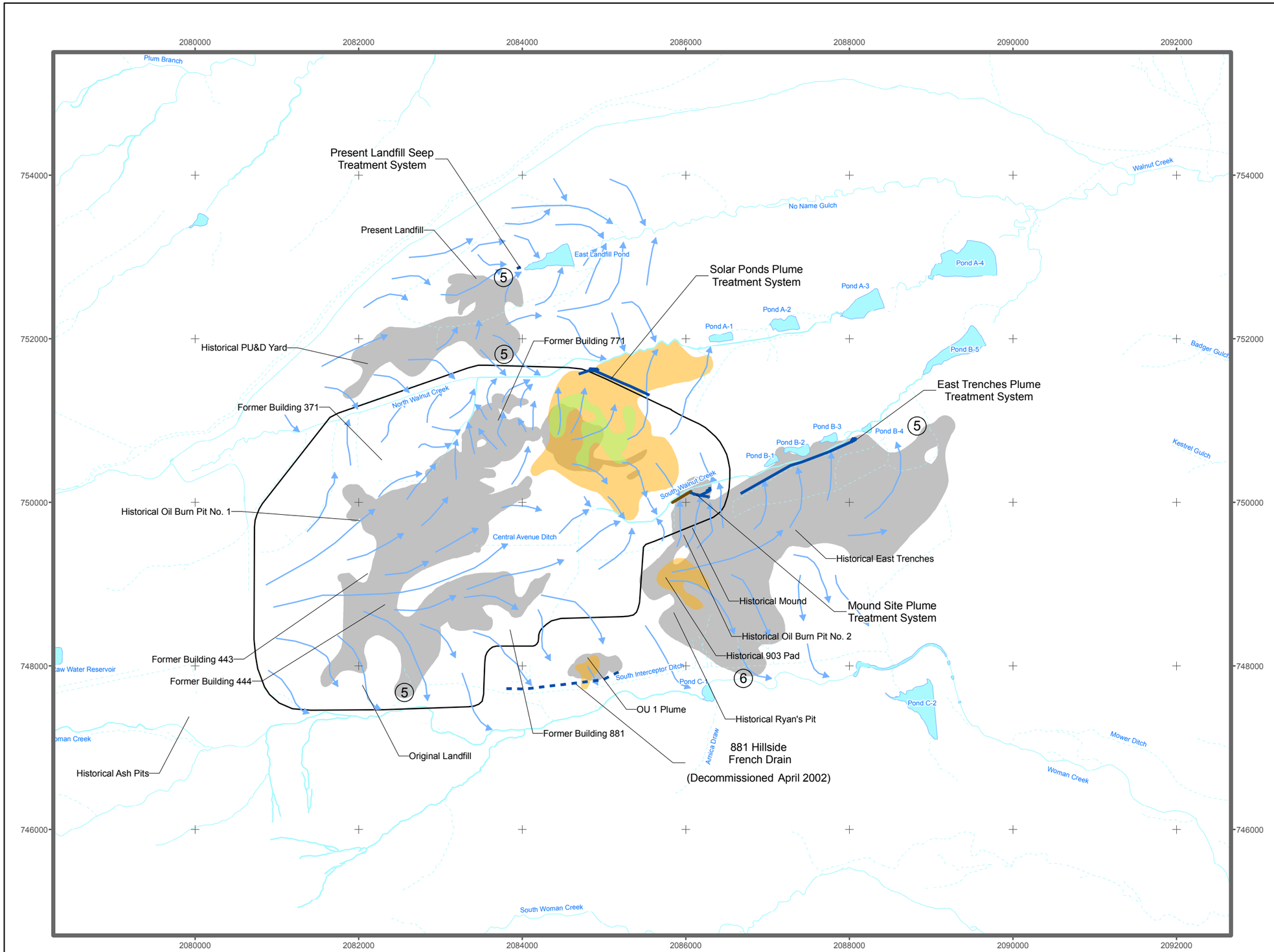
[c] Surface water standards are not available for some analytes. For these analytes Screen 4 is performed using MCLs. See footnote b above.

[d] Data shown on the maps represent the most recent sample result available at each well. A contiguous plume is defined as three or more adjacent wells with concentrations or activities above background and either the surface water standard, MCL, or PQL, whichever is applicable.

[e] DOE recognizes that process knowledge at RFETS is not perfectly known. However, process knowledge alone is not used to retain or eliminate a constituent as an AOI. Other analyte criteria such as its areal distribution relative to RFETS activities, its proximity to contaminant sources, accelerated actions performed to remove contaminant source(s), and its natural occurrence and distribution in the environment are also considered when evaluating whether to retain or eliminate a constituent as an AOI.

Figure 13

Composite Plume Map[1]



KEY

- Predicted groundwater flow direction (from figure 2.18)[2]
- Groundwater treatment system
- 881 Hillside French drain
- Mound French drain
- Nitrate exceeds the surface water standard
- Uranium (unfiltered) exceeds the surface water standard[3]
- VOC composite plume[4]

Notes:

1) No metals or flouride were included because of their dissimilar transport characteristics.
2) The length of the arrow does not correspond to the groundwater velocity.
3) There is no radionuclide filtered uranium standard and thus it has not been represented on the map. (Uranium that exceeded the metal filtered uranium standard is less than 1% of the data and is also not represented.)
4) The VOC composite plume is all VOC AOIs that exceed the surface water standard.
5) Modeling results indicate that groundwater discharge concentrations will be below surface water standards at these locations.
6) Groundwater in the area is in weathered bedrock and is only saturated during wet years, thus AOI transport is limited to wet years (high groundwater levels). See the Groundwater IM/IRA for details.

Standard Map Features

- IA OU boundary
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 600 1,200 Feet

Scale 1:14,400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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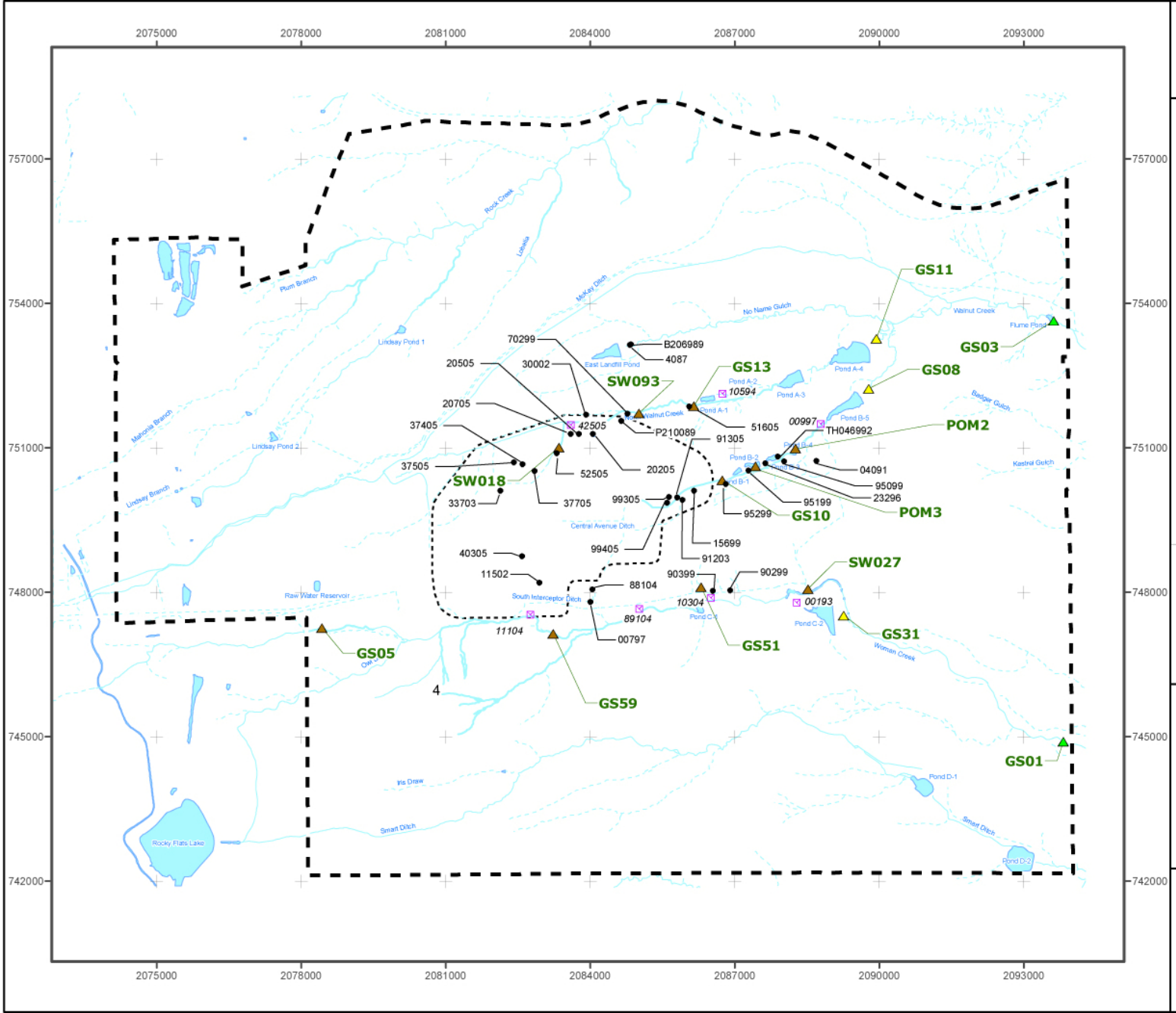


Figure 14

Representative Groundwater and Surface Water Monitoring Locations

KEY

- Area of concern well
- Sentinel well
- Surface water monitoring location representing segment 5
- Surface water monitoring location representing segments 4a and 4b
- Surface water monitoring location representing water quality upstream of the terminal ponds

Notes:
1) Groundwater monitoring in the Present Landfill and Original Landfill areas is defined in corresponding RFCA Decision Documents. This is defined and shown in the Fiscal Year 2005 Integrated Monitoring Plan (IMP).
2) Some of the wells shown on this figure and listed in the IMP will be replaced (with wells that have different identification numbers) and the IMP will be updated accordingly.

Standard Map Features

- Industrial Area Operable Unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

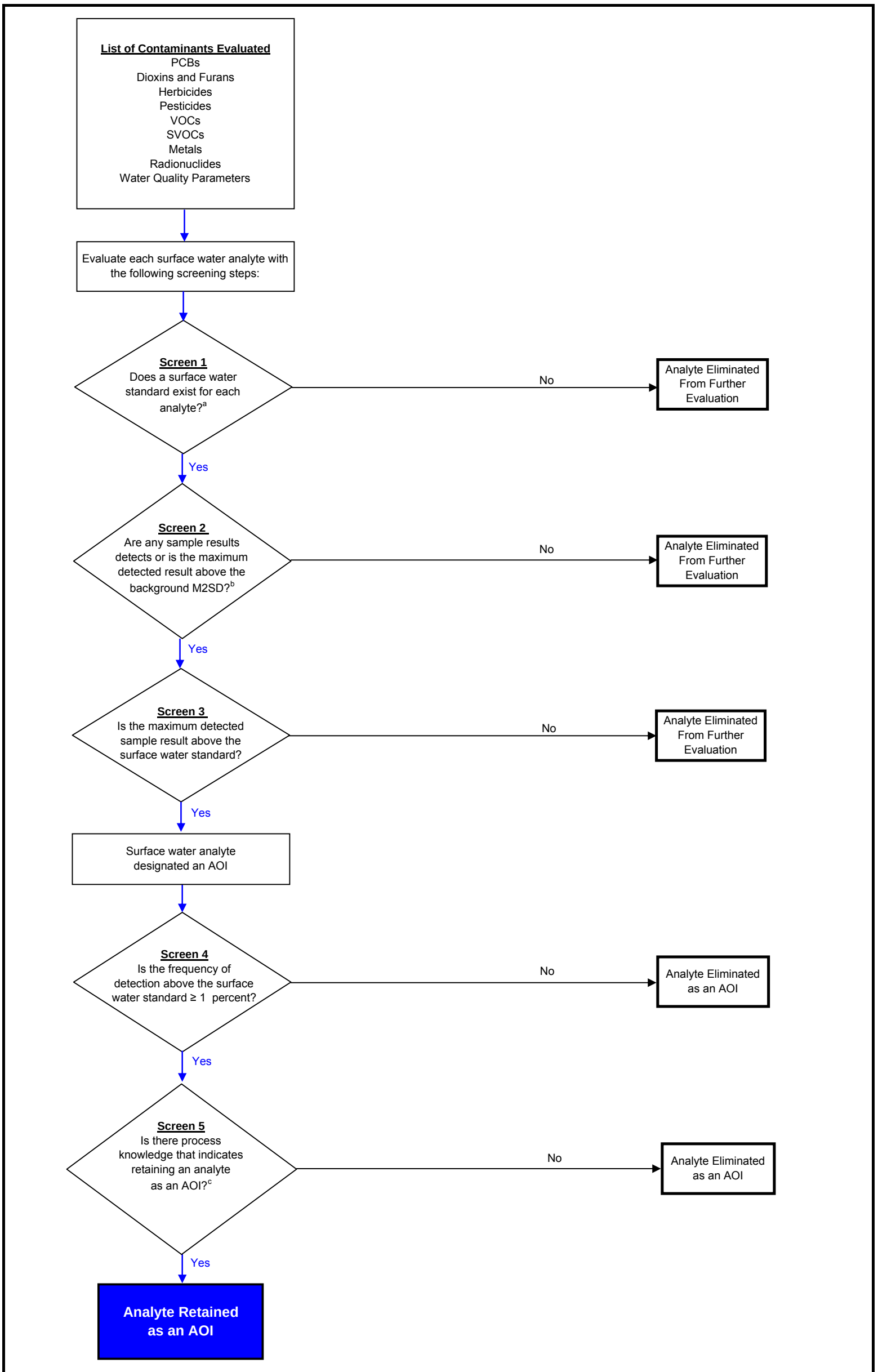
0 1,500 3,000 Feet

Scale 1:36,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

Figure 15
Surface Water AOI Screening Process



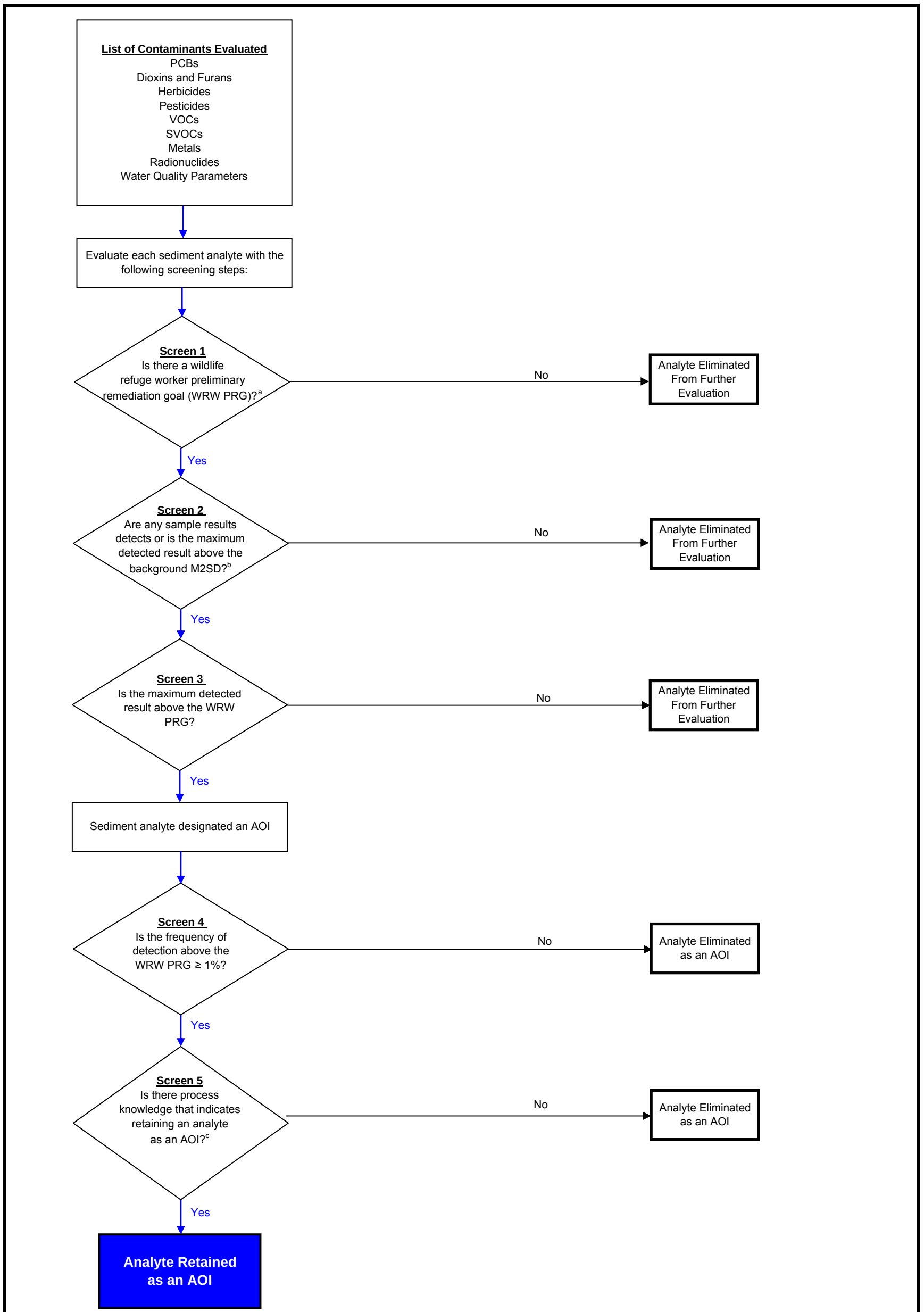
Notes:

[a]If the practical quantitation limit (PQL) is higher than the surface water standard, the PQL is used as the comparison value.

[b]Background mean + two standard deviation (M2SD) values used to evaluate surface water nature and extent were developed as part of the Comprehensive Risk Assessment (DOE 2005b). For constituents (organic compounds, some inorganic, and some radionuclides) that do not have background values, it was assumed that detection of these constituents indicates their presence in the environment.

[c]DOE recognizes that process knowledge at RFETS is not perfectly known. However, process knowledge alone is not used to retain or eliminate a constituent as an AOI. Other analyte criteria such as its areal distribution relative to RFETS activities, its proximity to contaminant sources, accelerated actions performed to remove contaminant source(s), and its natural occurrence and distribution in the environment are also considered when evaluating whether to retain or eliminate a constituent as an AOI.

Figure 16
Sediment AOI Screening Process



Notes:

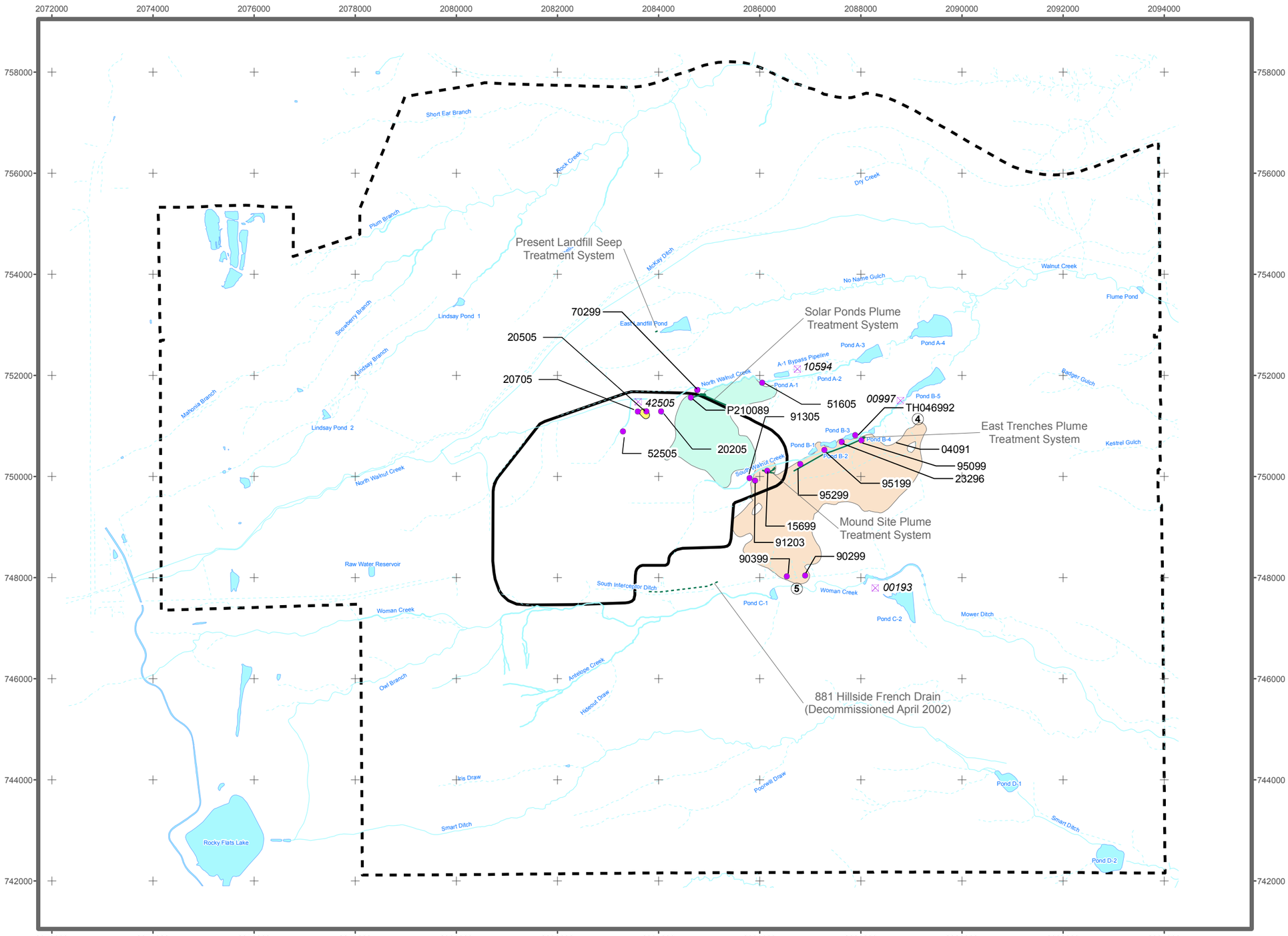
[a]Human health WRW PRG is based on a target excess carcinogenic risk of 1×10^{-6} or a hazard quotient (HQ) of 0.1.

[b]Background mean + two standard deviation (M2SD) values used to evaluate sediment nature and extent were developed as part of the Comprehensive Risk Assessment (DOE 2005). For constituents (organic compounds, some inorganic, and some radionuclides) that do not have background values, it was assumed that detection of these constituents indicates their presence in the environment.

[c]DOE recognizes that process knowledge at RFETS is not perfectly known. However, process knowledge alone is not used to retain or eliminate a constituent as an AOI. Other analyte criteria such as its areal distribution relative to RFETS activities, its proximity to contaminant sources, accelerated actions performed to remove contaminant source(s), and its natural occurrence and distribution in the environment are also considered when evaluating whether to retain or eliminate a constituent as an AOI.

Figure 17

Groundwater Areas with Sentinel Wells Above the Higher of the Surface Water Standard, Background, or PQL



KEY

- Area of concern well
- Sentinel well
- Groundwater treatment system
- Decommissioned French drain
- North of Former Building 771[1]
- Historical Solar Ponds Area and former 700 Area Northeast Plume[2]
- -Historical East Trenches
  -Historical 903 Pad/Ryan's Pit
  -Historical Mound/Oil Burn Pit No. 2[3]

Notes:

1) AOI associated with the area north of former Building 771: trichloroethene.
2) AOIs associated with the historical Solar Ponds area: nitrate/nitrite, sulfate, and uranium.
   AOI associated with the former 700 Area Northeast Plume: nitrate/nitrite.
3) AOIs associated with the historical East Trenches: carbon tetrachloride, chloroform, tetrachloroethene, trichloroethene, and cis-1,2-dichloroethene.
   AOIs associated with the historical 903 Pad/Ryan's Pit area (both northern and southern flow paths): carbon tetrachloride, chloroform, tetrachloroethene, trichloroethene, and cis-1,2-dichloroethene.
   AOIs associated with the historical Mound/Oil Burn Pit No. 2: chloroform, trichloroethene, cis-1,2-dichloroethene, 1,1-dichloroethene, methylene chloride, sulfate, carbon tetrachloride, and tetrachloroethene.
4) Modeling results indicate that groundwater discharge concentrations will be below surface water standards at these locations.
5) Groundwater in the area is in weathered bedrock and is only saturated during wet years, thus AOI transport is limited to wet years (high groundwater levels). See the Groundwater IM/IRA for details.

Standard Map Features

- IA OU boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,000 2,000 Feet

Scale 1:24,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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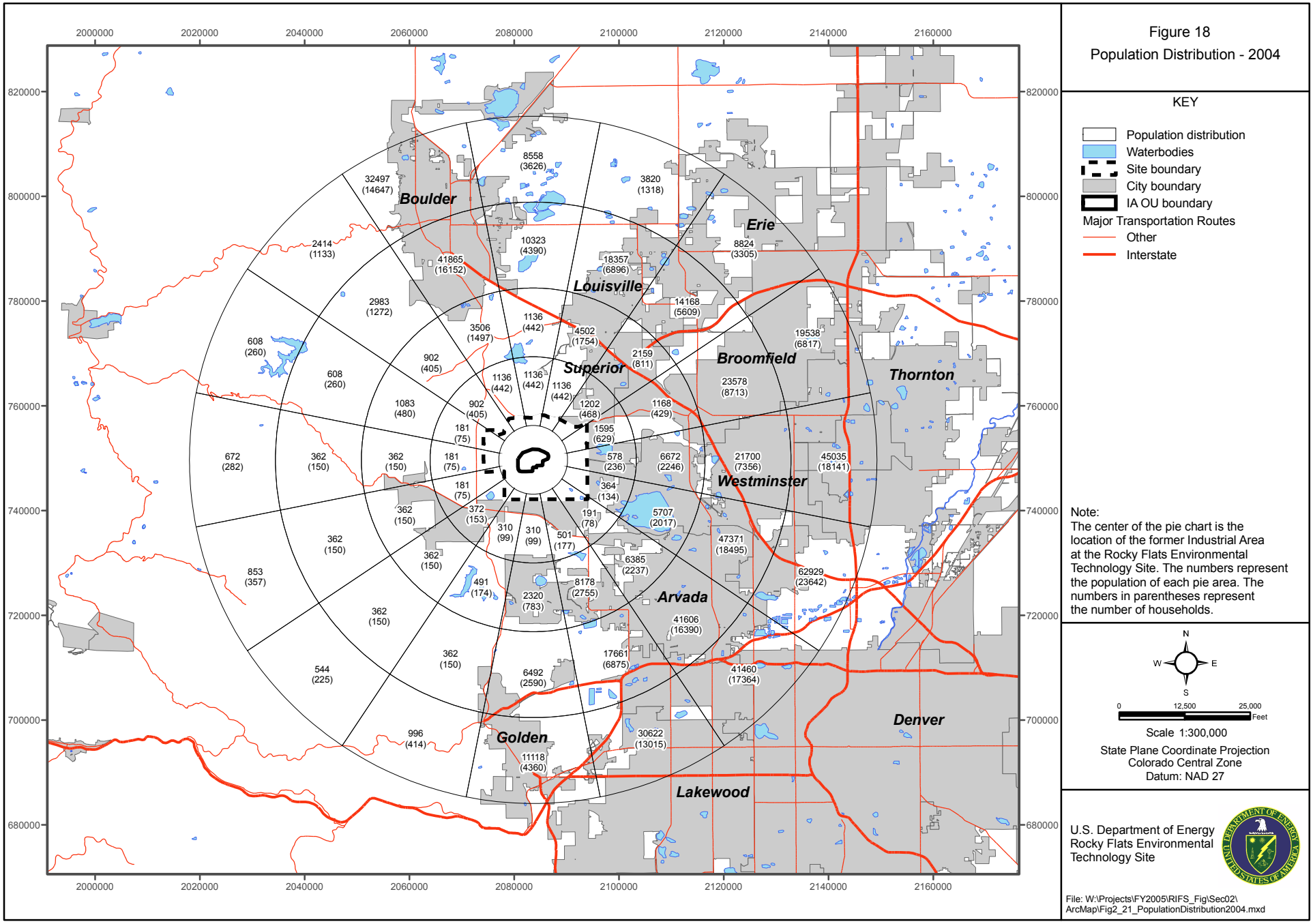

Figure 18
Population Distribution - 2004

KEY

- Population distribution
- Waterbodies
- Site boundary
- City boundary
- IA OU boundary

Major Transportation Routes

- Other
- Interstate

Note:
The center of the pie chart is the location of the former Industrial Area at the Rocky Flats Environmental Technology Site. The numbers represent the population of each pie area. The numbers in parentheses represent the number of households.

N
W E
S

0 12,500 25,000 Feet

Scale 1:300,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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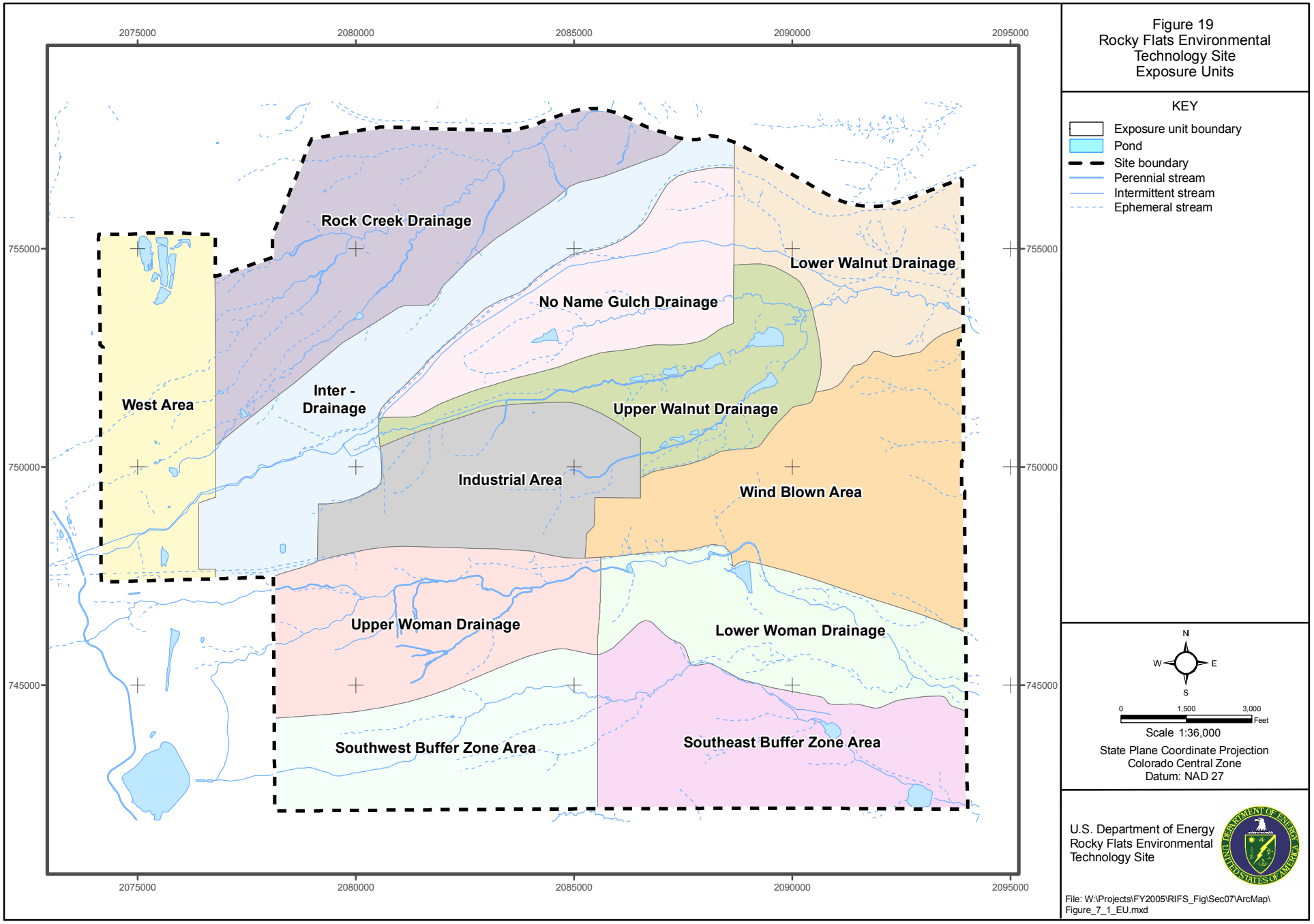

Figure 19
Rocky Flats Environmental
Technology Site
Exposure Units

KEY

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,500 3,000
Feet

Scale 1:36,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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Figure_7_1_EU.mxd

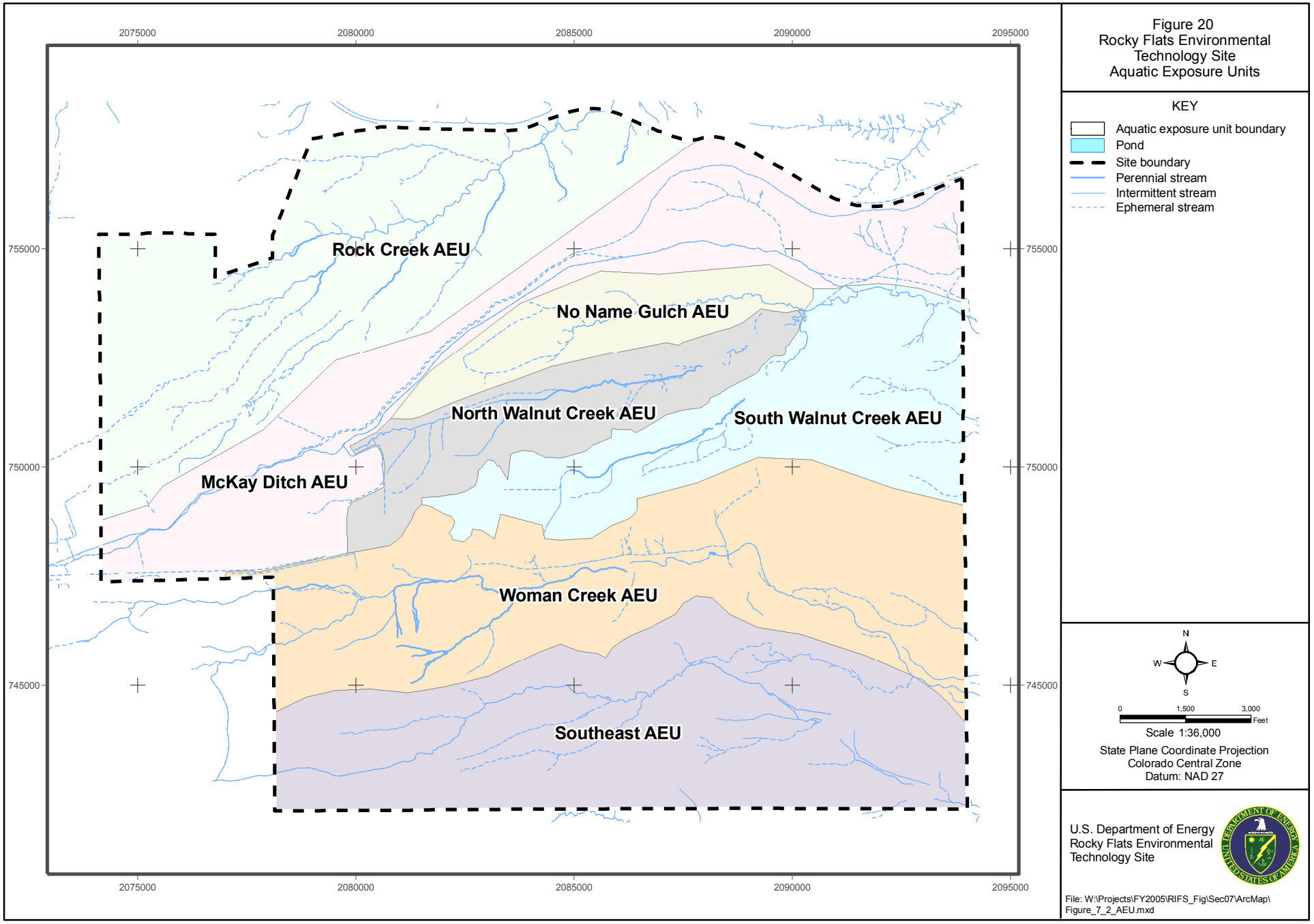

Figure 20
Rocky Flats Environmental Technology Site
Aquatic Exposure Units

KEY

- Aquatic exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,500 3,000 Feet

Scale 1:36,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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Figure 21. Human Health CRA COC Selection Process

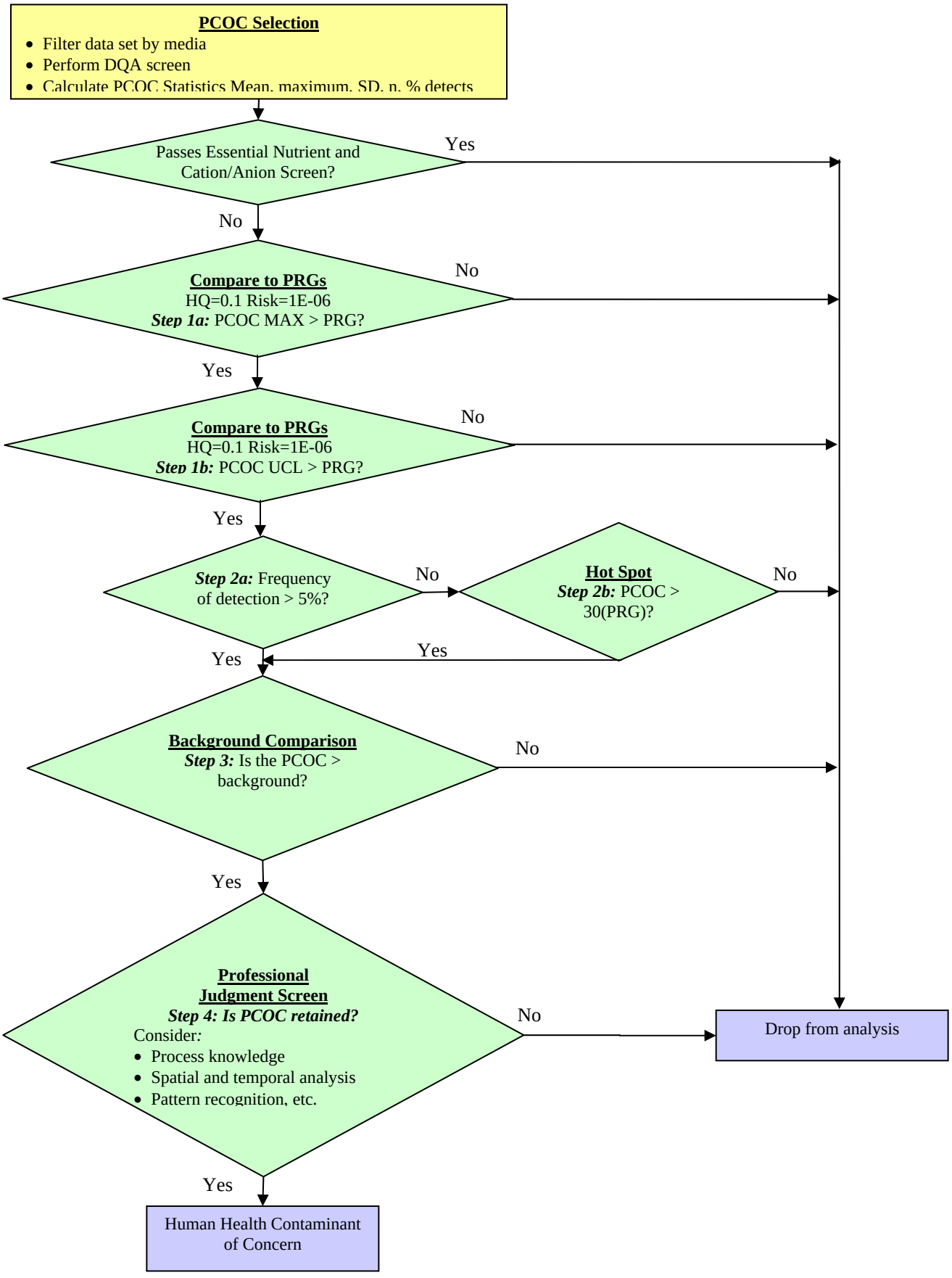


Figure 22 Human Health Site Conceptual Model

Primary Source	Primary Release Mechanism	Affected Media	Secondary Release Mechanism	Affected Media	Wildlife Refuge Worker Exposure Pathways	Wildlife Refuge Visitor Exposure Pathways
Surface Soil, Subsurface Soil, Sediment, and Building Rubble	Stormwater Runoff	Surface Water Streams/Seeps	Direct Contact		Oral (I) Dermal (I)	Oral (I) Dermal (I)
			Biotic Uptake	Fish	Oral (IC)	Oral (IC)
			Ingestion	Deer/Grazing Animals	Oral (IC)	Oral (I)
	Infiltration Percolation	UHSU Groundwater	Percolation	LHSU Groundwater	Oral (IC) Dermal (IC)	Oral (IC) Dermal (IC)
			Domestic Use		Oral (IC) Dermal (IC)	Oral (IC) Dermal (IC)
			Surface Water		Oral (I) Dermal (I)	Oral (I) Dermal (I)
	Volatilization	Groundwater Subsurface Soil	Volatilization	Indoor Air	Inhalation (I)	Inhalation (IC)
				Outdoor Air	Inhalation (I)	Inhalation (I)
		Surface Water	Volatilization	Outdoor Air	Inhalation (I)	Inhalation (I)
	Resuspension	Airborne Particulates		Indoor Air	Inhalation (S)	Inhalation (IC)
				Outdoor Air	Inhalation (S)	Inhalation (S)
			Deposition	Deer/Grazing Animals	Oral (IC)	Oral (I)
	Plant Uptake	Vegetation	Ingestion	Deer/Grazing Animals	Oral (IC)	Oral (I)
	Direct Contact	Surface Soil (0 to 0.5 foot)[a]			Oral (S) Dermal (S^b)	Oral (S) Dermal (S^c)
		Subsurface Soil (0.5 to 8 feet)			Oral (S) Dermal (S^b)	Oral (IC) Dermal (IC)
		Subsurface Soil (Below 8 feet)			Oral (IC) Dermal (IC)	Oral (IC) Dermal (IC)
		Sediment[a]			Oral (S) Dermal (S^b)	Oral (S^b) Dermal (S^b)
		Building Rubble			Oral (IC) Dermal (IC)	Oral (IC) Dermal (IC)
	Radioactive Decay	Surface Soil			External Irradiation (S)	External Irradiation (S)
		Subsurface Soil			External Irradiation (I)	External Irradiation (I)
		Sediment			External Irradiation (S)	External Irradiation (I)
		Building Rubble			External Irradiation (I)	External Irradiation (I)

a. Surface soil and sediments to a depth of 0.5 foot will be combined for the exposure assessment.

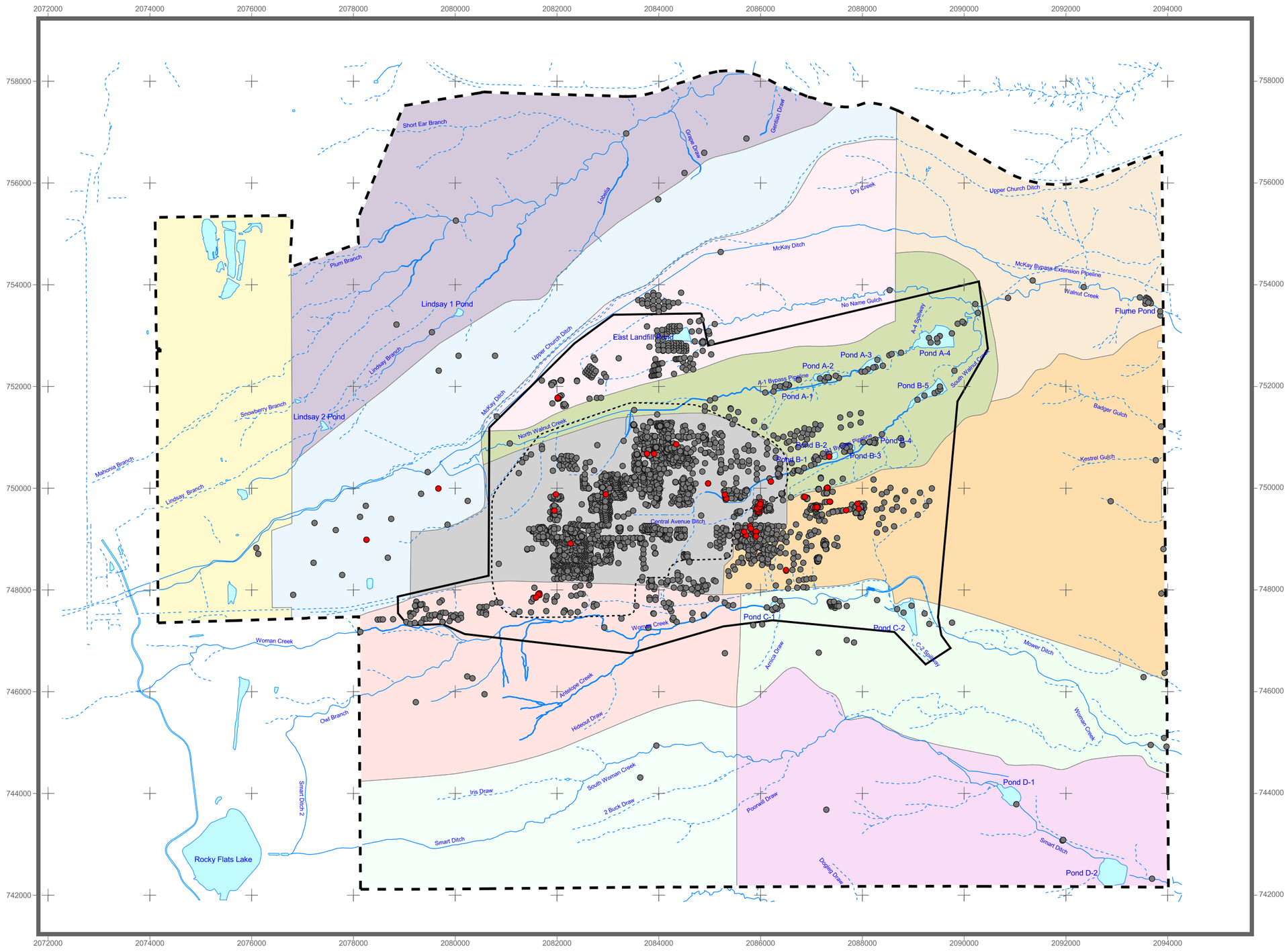
b. Dermal exposures will be assessed for organic COCs only.

UHSU - upper hydrostratigraphic unit
LHSU – lower hydrostratigraphic unit

Key to Exposure Pathways:
S – Significant
I – Insignificant
IC – Incomplete

Figure 23

Subsurface Soil Sampling Locations Where Volatilization PRGs Were Exceeded



KEY

- Exceeded volatilization PRGs
- Did not exceed volatilization PRGs

A location is classified as a PRG exceedance if any analyte was detected at a concentration exceeding its PRG since June 28, 1991.

Standard Map Features

- Central OU boundary
- IA OU boundary
- Site boundary
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream

Exposure Units

- Industrial Area
- Inter-Drainage
- Lower Walnut Drainage
- Lower Woman Drainage
- No Name Gulch Drainage
- Rock Creek Drainage
- Southeast Buffer Zone Area
- Southwest Buffer Zone Area
- Upper Walnut Drainage
- Upper Woman Drainage
- West Area
- Wind Blown Area

N
W E
S

0 1000 2000 Feet

Scale 1:24,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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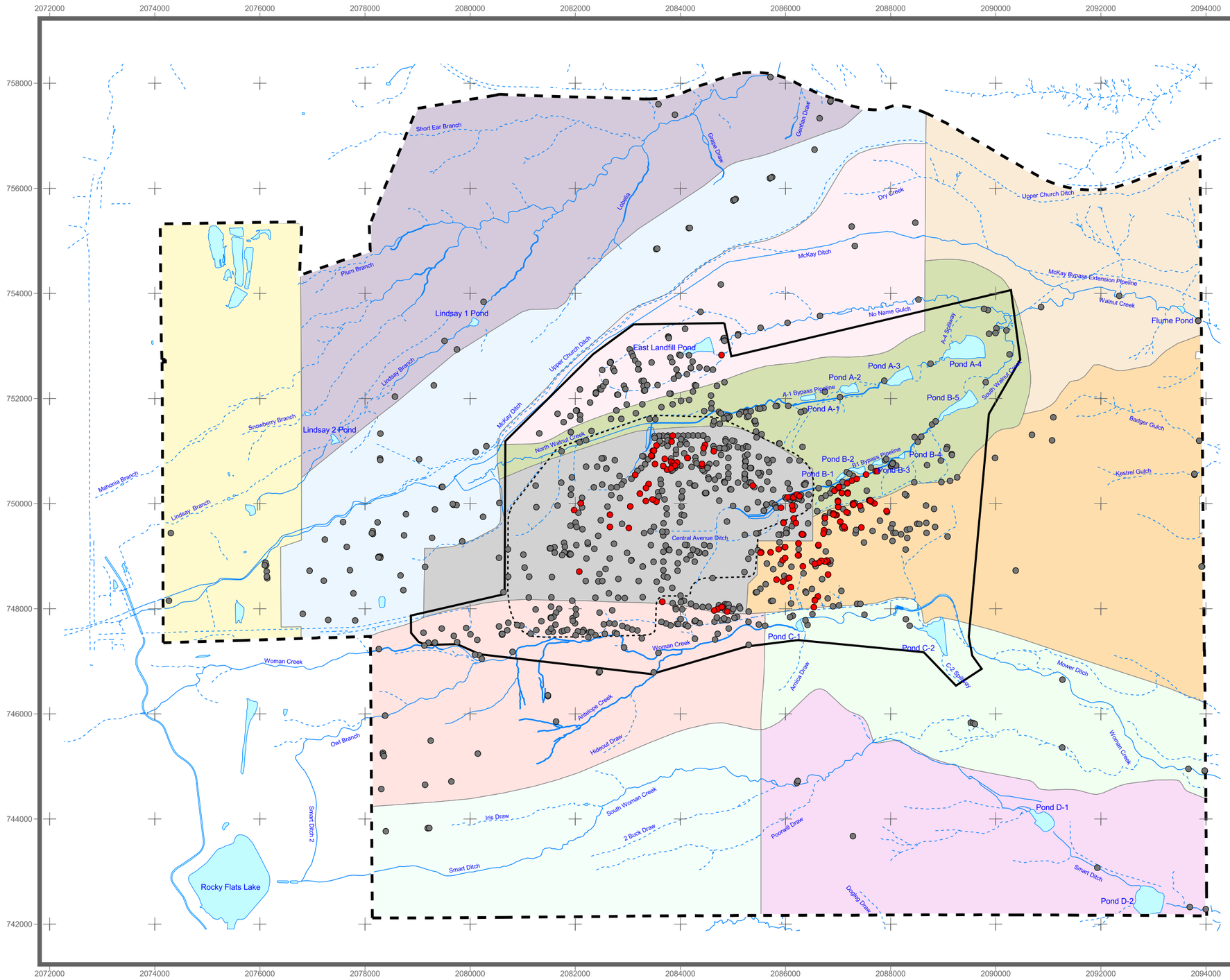
Figure 24

Groundwater Sampling Locations Where Volatilization PRGs Were Exceeded



KEY

- Exceeded volatilization PRGs
- Did not exceed volatilization PRGs

A location is classified as a PRG exceedance if any analyte was detected at a concentration exceeding its PRG since June 28, 1991.

Standard Map Features

- Central OU boundary
- IA OU boundary
- Site boundary
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream

Exposure Units

- Industrial Area
- Inter-Drainage
- Lower Walnut Drainage
- Lower Woman Drainage
- No Name Gulch Drainage
- Rock Creek Drainage
- Southeast Buffer Zone Area
- Southwest Buffer Zone Area
- Upper Walnut Drainage
- Upper Woman Drainage
- West Area
- Wind Blown Area

N
W E
S

0 1000 2000 Feet

Scale 1:24,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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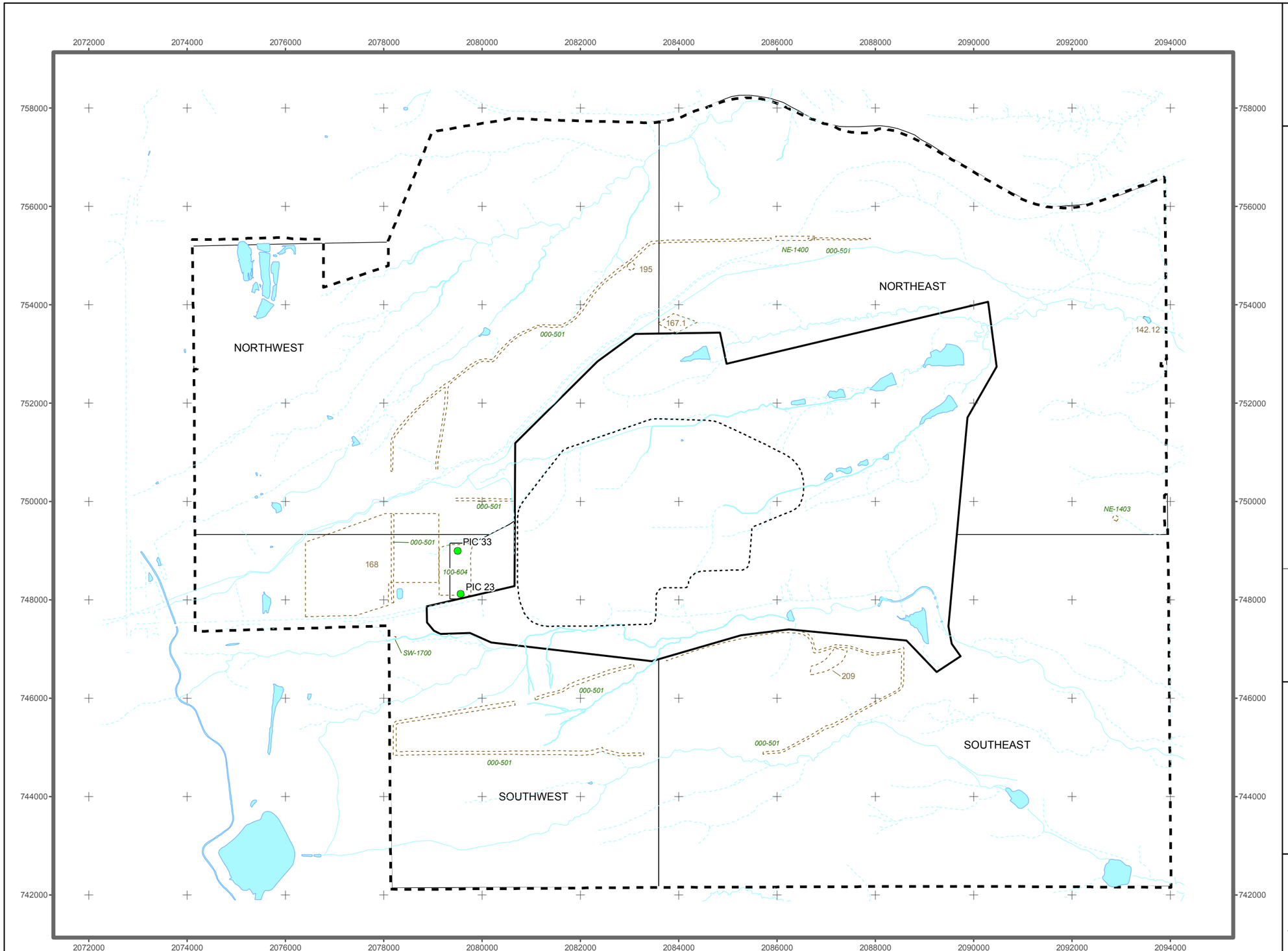
Figure 25

Historical IHSSs, PACs, and PICs in the Peripheral OU



KEY

- Historical PIC
- IA OU boundary
- Proposed Central OU boundary
- Historical IHSS and PAC areas
- Historical HRR area

Standard Map Features

- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,000 2,000 Feet

Scale 1:24,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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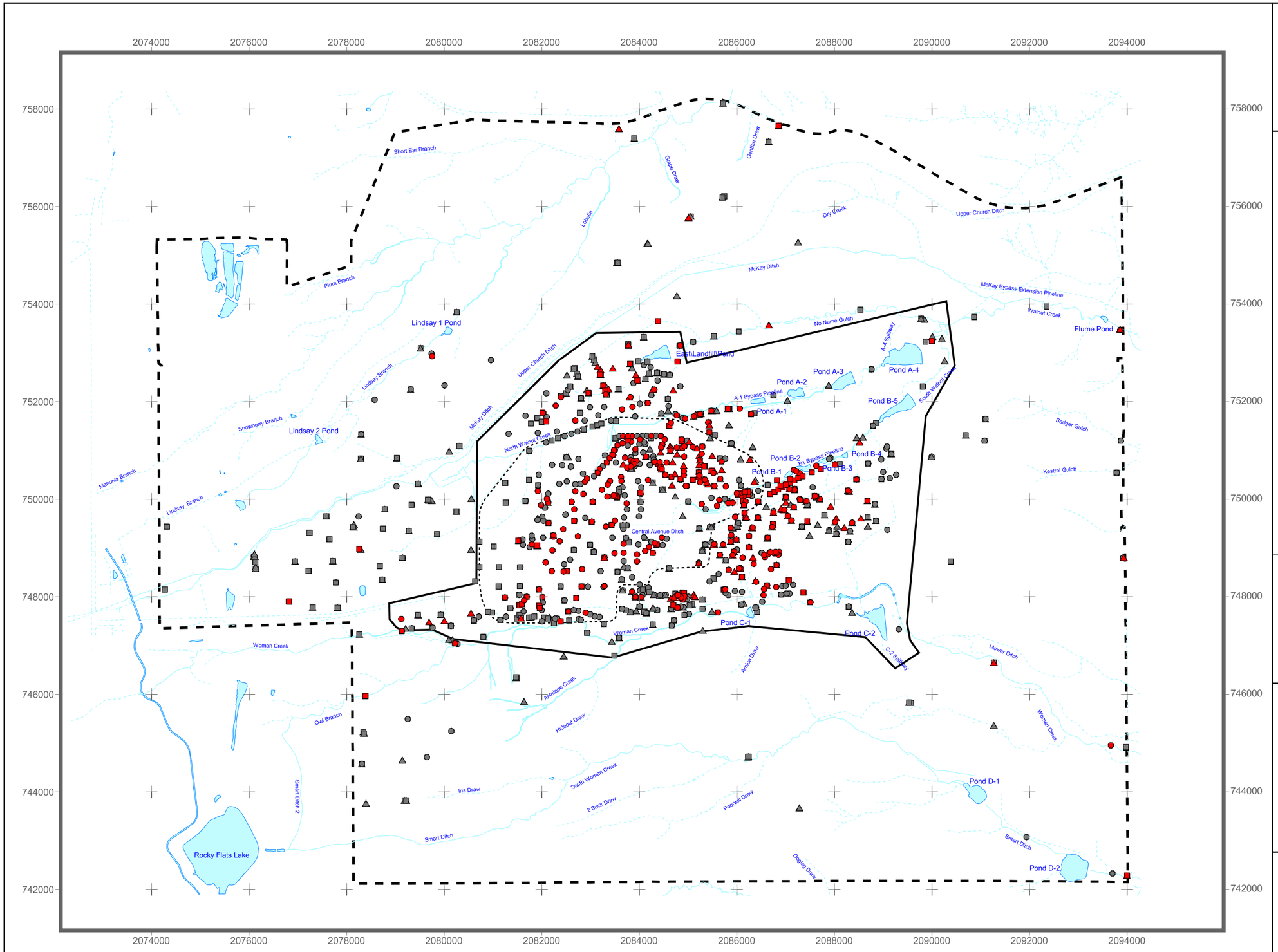
Figure 26

UHSU Groundwater Monitoring Locations Where Composite MCLs Were Exceeded



KEY

- ○ Sample collected since January 1, 2000
- □ Sample collected between January 1, 1995 and December 31, 1999
- △ Sample collected between June 28, 1991 and December 31, 1994
- ● Concentration > MCL
- ● Concentration <= MCL

Standard Map Features

- Central OU boundary
- IA OU boundary
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

N
W E
S

0 1000 2000 Feet

Scale 1:24,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

File: W:\Projects\FY2005\RIFS_Fig\CADROD\ArcView\Figure_26_Composite_MCL.apr

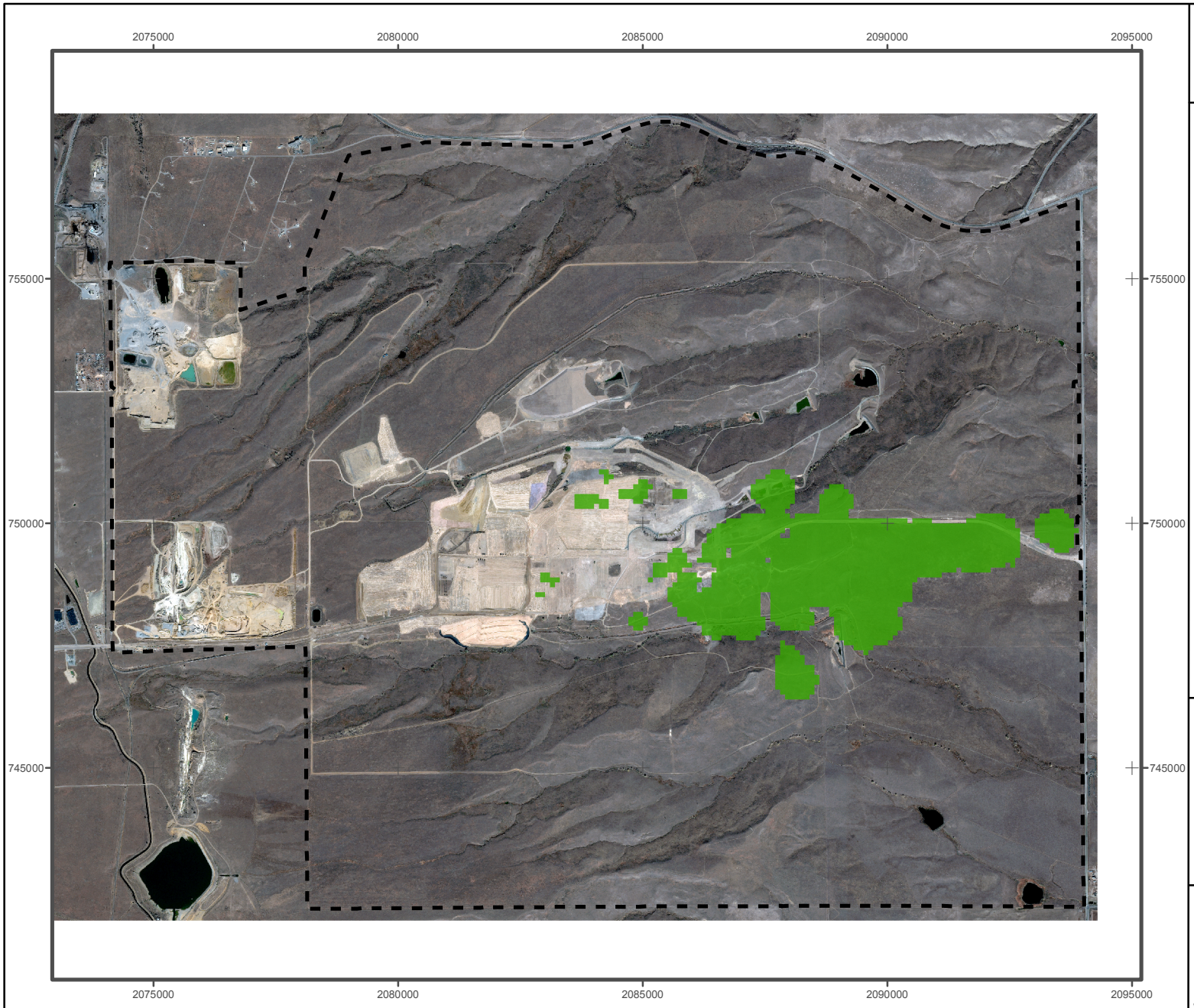


Figure 27
Estimated Sitewide Surface Soil Exceedance Area for Plutonium-239/240

KEY

Site boundary

Area exceeding 9.8 pCi/g based on Kriging results at 90% confidence level

N
W E
S

0 1,500 3,000 Feet

Scale 1:36,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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

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ATTACHMENT 1

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE ACTION LEVELS FOR SURFACE WATER, GROUNDWATER, AND SOIL

May 28, 2003

Table 1
Analytes of Interest in Rocky Flats Soil

Analyte Group	Analyte	Derived CAS No.	Unit	Number of Samples	Number of Detections	Frequency of Detection (%)	Arithmetic Mean Concentration	AOI Screen 1					AOI Screen 2		AOI Screen 3
								Maximum Concentration	Data Qualifier[a]	Background Mean + 2SD	Number Detections > Background Mean + 2SD	Percent Detections > Background Mean + 2SD	WRW PRG	Number Detections > WRW PRG	Percent Detections > WRW PRG
Radionuclide	Uranium-233/234		pCi/g	1901	1887	99.26	1.18	47.4833		2.25	100	5.26	25.3	2	0.11
Radionuclide	Uranium-235	15117-96-1	pCi/g	1900	1129	59.42	0.07	2.2385		0.095	231	12.16	1.05	3	0.16
Radionuclide	Uranium-238	7440-61-1	pCi/g	1901	1894	99.63	1.46	209.2773		2.00	152	8.00	29.3	5	0.26
Metal	Vanadium	7440-62-2	mg/kg	2622	2621	99.96	36.50	5300		43.1	304	11.59	111	16	0.61
Radionuclide	Americium-241	86954-36-1	pCi/g	2024	1551	76.63	0.54	51.2	B	0.022	1097	54.20	7.69	22	1.09
SVOC	Dibenz(a,h)anthracene	53-70-3	µg/kg	1217	164	13.48	258.00	9200	DJ			N/A	379	19	1.56
PCB	PCB-1260[b]	11096-82-5	µg/kg	838	144	17.18	163.00	7800				N/A	1,349	17	2.03
PCB	PCB-1254[b]	11097-69-1	µg/kg	842	151	17.93	199.00	8900	C			N/A	1,349	20	2.38
Metal	Arsenic[c]	7440-38-2	µg/kg	2613	2586	98.97	4.78	56.2		10.1	70	2.68	2.41	70	2.68
Metal	Aluminum	7429-90-5	mg/kg	2622	2620	99.92	11270.00	61000		16,715	450	17.16	24,774	105	4.00
Dioxins and Furans	2378-TCDD TEQ[d]		µg/kg	22	22	100.00	0.009	0.073883				N/A	0.025	1	4.55
Radionuclide	Plutonium-239/240		pCi/g	2336	1987	85.06	2.00	183	B	0.066	1289	55.18	9.80	128	5.48
Metal	Chromium (total)[e]	7440-47-3	mg/kg	2624	2604	99.24	15.40	210		16.8	675	25.72	28.4	147	5.60
SVOC	Benzo(a)pyrene	50-32-8	µg/kg	1235	509	41.21	392.00	43000	E			N/A	379	188	15.22

Note: The information presented in this table is listed in order of increasing frequency of detection greater than the WRW PRG.

	The frequency of detection of the analyte concentration above the WRW PRG is greater than (>) 0% and less than (<) 1%
	The frequency of detection of the analyte concentration above the WRW PRG is greater than or equal to (≥) 1% and less than (<) 5%
	The frequency of detection of the analyte concentration above the WRW PRG is greater than or equal to (≥) 5%

Note: The RI/FS Report represents site conditions immediately following completion of accelerated actions and prior to any soil backfilling or recontouring to match the surrounding geomorphology. Consequentl the RI/FS Report does not represent the final configuration of the site. This approach provides a conservative representation of contamination remaining in soil at RFETS because it does not take into account the additional protectiveness provided by the added clean soil.

AOI = Analyte of Interest
CAS = Chemical Abstract Service
2SD = Two Times Standard Deviation
WRW PRG = Wildlife Refuge Worker Preliminary Remediation Goal

[a] A key to data qualifier codes is provided in Table A2.2, Attachment 2 on CD ROM
[b] The PCBs identified above under the Analyte column are equivalent to Aroclors, for example PCB-1254 is the same as Aroclor-125
[c] For arsenic the Surface Background M2SD value is greater than the WRW PRG. Therefore, only those results greater than both the Surface Background M2SD and WRW PRG are reported under AOI Scree
[d] 2,3,4,8-TCDD TEQ is a calculated value that represents an equivalent 2,3,7,8-TCDD concentration based on the total concentration of 17 dioxin cogeners.The TEQ for 2,3,7,8-TCDD is calculated in Table A2.2 in Attachment
[e] Chromium (total) is conservatively compared to the chromium VI WRW PR(

Table 2
Analytes of Interest in Rocky Flats Subsurface Soil

Analyte Group	Analyte	Derived CAS No.	Unit	Number of Samples	Number of Detections	Frequency of Detection (%)	Arithmetic Mean Concentration	AOI Screen 1					AOI Screen 2		AOI Screen 3
								Maximum Concentration	Data Qualifier[a]	Background Mean + 2SD	Number Detections > Background Mean + 2SD	Percent Detections > Background Mean + 2SD	WRW PRG	Number Detections > WRW PRG	Percent Detections > WRW PRG
Depth Interval (>0.5 and ≤ 3.0 ft)															
Metal	Lead[b]	7439-92-1	mg/kg	1686	1685	99.94	26.60	8500		26.471	143	8.48	1,000	3	0.18
SVOC	Benzo(a)pyrene	50-32-8	µg/kg	584	143	24.49	493.00	35000				N/A	4,357	6	1.03
Depth Interval (>3.0 and ≤ 8.0 ft)															
Metal	Lead[b]	7439-92-1	mg/kg	1402	1399	99.79	17.60	5200		26.5	58	4.14	1,000	1	0.07
VOC	Tetrachloroethene	127-18-4	µg/kg	1793	195	10.88	547.00	197000	E			N/A	77,111	4	0.22
Metal	Chromium (total)[c]	7440-47-3	mg/kg	1397	1387	99.28	28.20	11000		42.2	43	3.08	327	4	0.29
Radionuclide	Uranium-235	15117-96-1	pCi/g	900	546	60.67	0.18	36.1169		0.162	59	6.56	12.1	3	0.33
Radionuclide	Uranium-238	7440-61-1	pCi/g	900	890	98.89	5.11	1130		1.77	79	8.78	337	3	0.33
Radionuclide	Americium-241	86954-36-1	pCi/g	872	521	59.75	1.64	410		0.010	337	38.65	88.4	3	0.34
SVOC	Benzo(a)pyrene	50-32-8	µg/kg	543	75	13.81	347.00	11000				N/A	4,357	5	0.92
Radionuclide	Plutonium-239/240		pCi/g	885	594	67.12	8.64	2450		0.022	372	42.03	112	9	1.02
Depth Interval (>8.0 and ≤ 12.0 ft)															
VOC	Tetrachloroethene	127-18-4	µg/kg	770	96	12.47	269.00	91000	E			N/A	77,111	1	1.04
Metal	Chromium (total)[c]	7440-47-3	mg/kg	568	560	98.59	29.70	8310		42.2	19	3.39	327	1	0.18
Radionuclide	Uranium-235	15117-96-1	pCi/g	394	288	73.10	0.23	37.68		0.162	24	8.33	12.1	2	0.69
Radionuclide	Uranium-238	7440-61-1	pCi/g	394	393	99.75	7.35	1160		1.77	49	12.47	337	2	0.51
Radionuclide	Plutonium-239/240		pCi/g	389	272	69.92	1.39	223		0.022	81	29.78	112	2	0.74
SVOC	Benzo(a)pyrene	50-32-8	µg/kg	259	15	5.79	477.00	43000				N/A	4,357	3	20.00
Depth Interval (>12.0 and ≤30.0 ft)															
VOC	Chloroform	67-66-3	µg/kg	1071	100	9.34	4078.00	3800000				N/A	90,270	1	1.00
VOC	Methylene Chloride	75-09-2	µg/kg	1071	281	26.24	5510.00	5500000	JB			N/A	3.13E+06	1	0.36
VOC	1,1,2,2-Tetrachloroethane	79-34-5	µg/kg	1055	4	0.38	6150.00	6100000	J			N/A	120,551	1	25.00
VOC	Trichloroethene	79-01-6	µg/kg	1070	148	13.83	1002.00	309000	JE			N/A	20,354	2	1.35
VOC	Tetrachloroethene	127-18-4	µg/kg	1071	192	17.93	3762.00	2800000	E			N/A	77,111	5	2.60
VOC	Carbon Tetrachloride	56-23-5	µg/kg	1070	115	10.75	161460.00	1.6E+08	E			N/A	97,124	7	6.09
PCB	PCB-1260[d]	11096-82-5	µg/kg	271	12	4.43	1109.00	70000				N/A	15,514	5	41.67

Table 2
Analytes of Interest in Rocky Flats Subsurface Soil

Note: The information presented in this table is listed in order of increasing frequency of detection greater than the WRW PRG, for each depth interval.

	The frequency of detection of the analyte concentration above the WRW PRG is greater than (>) 0% and less than (<) 1%
	The frequency of detection of the analyte concentration above the WRW PRG is greater than or equal to (≥) 1% and less than (<) 5%
	The frequency of detection of the analyte concentration above the WRW PRG is greater than or equal to (≥) 5%

Note: The RI/FS Report represents site conditions immediately following completion of accelerated actions and prior to any soil backfilling or recontouring to match the surrounding geomorphology. Consequently, the RI/FS Report does not represent the final configuration of the site. This approach provides a conservative representation of contamination remaining in soil at RFETS because it does not take into account the additional protectiveness provided by the added clean soil.

AOI = Analyte of Interest
CAS = Chemical Abstract Service
2SD = Two Times Standard Deviation
WRW PRG = Wildlife Refuge Worker Preliminary Remediation Goal

[a]A key to data qualifier codes is provided in Table A2.2, Attachment 2 on CD ROM.
[b]The PRG value for lead is not calculated, but is taken from EPA's Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (1994
[c]Chromium (total) is conservatively compared to the chromium (VI) WRW PRG
[d]PCB-1260 is equivalent to Aroclor 1260.

Table 3
Analytes of Interest in Rocky Flats Groundwater

Analyte Group	Total or Dissolved	Analyte	Derived CAS No.	Number of Samples	Number of Detects	Percent Detects	Arithmetic Mean Concentration	Maximum Concentration	Data Qualifier	Unit	AOI Screen 1 Comparison With Background				AOI Screen 2	AOI Screen 3 Comparison With Lowest Surface Water Standard						AOI Screen 4 Comparison With MCL					AOI Screen 5	AOI Screen 6	Is Constituent an AOI?
											99/99 UTL	Number of Detections Above 99/99 UTL	Frequency of Detection (%) Above the 99/99 UTL	Is the Maximum Concentration Above the 99/99 UTL ?	Appropriate Surface Water Standard Method? (that is, Total or Dissolved)	Site-Specific PQL	Lowest Surface Water Standard	Greater of Lowest Surface Water Standard or Site-Specific PQL	Number of Detections Above Surface Water Standard	Frequency of Detection (%) Above Surface Water Standard	Is the Maximum Concentration Above Lowest Surface Water Standard?	MCL	Greater of MCL or Site-Specific PQL	Number of Detections Above the MCL	Frequency of Detections (%) Above the MCL	Is the Maximum Concentration Above the MCL?	Are There Contiguous Plumes?	Eliminated By Process Knowledge?	
VOC	T	Chloromethane	74-87-3	7424	51	0.69	1.40E+01	1.80E+04	E	UG/L	-----	-----	-----	-----	Yes	1.00E+00	5.60E+00	5.60E+00	32	0.43	Yes	6.55E+00	6.55E+00	29	0.39	Yes	Yes	-----	Yes
VOC	T	Benzene	71-43-2	7478	193	2.58	8.48E+00	9.50E+02		UG/L	-----	-----	-----	-----	Yes	1.00E+00	2.20E+00	2.20E+00	48	0.64	Yes	5.00E+00	5.00E+00	30	0.40	Yes	Yes	-----	Yes
VOC	T	1,2-Dichloroethane	107-06-2	7401	151	2.04	8.93E+00	1.10E+03		UG/L	-----	-----	-----	-----	Yes	1.00E+00	3.80E-01	1.00E+00	72	0.97	Yes	5.00E+00	5.00E+00	41	0.55	Yes	Yes	-----	Yes
VOC	T	Vinyl Chloride	75-01-4	7457	228	3.06	1.38E+01	4.19E+03	D	UG/L	-----	-----	-----	-----	Yes	2.00E+00	2.30E-02	2.00E+00	147	1.97	Yes	2.00E+00	2.00E+00	147	1.97	Yes	Yes	-----	Yes
VOC	T	cis-1,2-Dichloroethene	156-59-2	5604	1595	28.46	2.63E+01	9.73E+03	D	UG/L	-----	-----	-----	-----	Yes	5.00E+00	7.00E+01	7.00E+01	215	3.84	Yes	7.00E+01	7.00E+01	215	3.84	Yes	Yes	-----	Yes
MET	D	Nickel	7440-02-0	4905	1638	33.39	2.50E+01	5.39E+03		UG/L	2.37E+01	405	8.26	Yes	Yes	2.00E+01	7.04E+01	7.04E+01	197	4.02	Yes	1.40E+02	1.40E+02	110	2.24	Yes	Yes	-----	Yes
MET	D	Arsenic	7440-38-2	4684	814	17.38	1.56E+00	8.80E+01		UG/L	-----	-----	-----	-----	Yes	5.00E+00	1.80E-02	5.00E+00	199	4.25	Yes	5.00E+01	5.00E+01	6	0.13	Yes	Yes	-----	Yes
VOC	T	Methylene Chloride	75-09-2	7422	1240	16.71	5.61E+01	4.30E+04	D	UG/L	-----	-----	-----	-----	Yes	1.00E+00	4.60E+00	4.60E+00	373	5.03	Yes	5.00E+00	5.00E+00	353	4.76	Yes	Yes	-----	Yes
VOC	T	1,1-Dichloroethene	75-35-4	7470	1254	16.79	2.65E+01	1.80E+04		UG/L	-----	-----	-----	-----	Yes	1.00E+00	7.00E+00	7.00E+00	487	6.52	Yes	7.00E+00	7.00E+00	487	6.52	Yes	Yes	-----	Yes
WQP	T	Fluoride	16984-48-8	3887	3748	96.42	8.27E+02	1.26E+04		UG/L	1.71E+03	401	10.32	Yes	Yes	5.00E+02	2.00E+03	2.00E+03	303	7.80	Yes	4.00E+03	4.00E+03	66	1.70	Yes	Yes	-----	Yes
MET	T	Nickel	7440-02-0	2062	1258	61.01	4.85E+01	6.46E+03		UG/L	3.27E+01	449	21.77	Yes	Yes	2.00E+01	1.00E+02	1.00E+02	172	8.34	Yes	1.40E+02	1.40E+02	126	6.11	Yes	Yes	-----	Yes
MET	T	Chromium	7440-47-3	2063	1200	58.17	5.34E+01	1.02E+04		UG/L	2.26E+01	539	26.13	Yes	Yes	2.00E+00	5.00E+01	5.00E+01	289	14.01	Yes	1.00E+02	1.00E+02	143	6.93	Yes	Yes	-----	Yes
WQP	T	Sulfate	14808-79-8	4557	4519	99.17	1.52E+05	6.50E+06		UG/L	4.93E+05	314	6.89	Yes	Yes	5.00E+03	2.50E+05	2.50E+05	663	14.55	Yes	5.00E+05	5.00E+05	308	6.76	Yes	Yes	-----	Yes
WQP	T	Nitrate/Nitrite (as N)	ConID 184	5894	5360	90.94	7.52E+04	1.76E+07		UG/L	5.26E+03	1682	28.54	Yes	Yes	5.00E+01	1.00E+04	1.00E+04	877	14.88	Yes	1.00E+04	1.00E+04	877	14.88	Yes	Yes	-----	Yes
VOC	T	Chloroform	67-66-3	7442	2168	29.13	8.87E+01	6.40E+04	E	UG/L	-----	-----	-----	-----	Yes	1.00E+00	3.40E+00	3.40E+00	1127	15.14	Yes	8.00E+01	8.00E+01	285	3.83	Yes	Yes	-----	Yes
VOC	T	Carbon Tetrachloride	56-23-5	7445	1840	24.71	3.33E+02	1.00E+05	D	UG/L	-----	-----	-----	-----	Yes	1.00E+00	2.30E-01	1.00E+00	1468	19.72	Yes	5.00E+00	5.00E+00	1205	16.19	Yes	Yes	-----	Yes
VOC	T	Trichloroethene	79-01-6	7471	2952	39.51	6.33E+02	2.20E+05	E	UG/L	-----	-----	-----	-----	Yes	1.00E+00	2.50E+00	2.50E+00	1972	26.40	Yes	5.00E+00	5.00E+00	1702	22.78	Yes	Yes	-----	Yes
VOC	T	Tetrachloroethene	127-18-4	7465	2916	39.06	1.88E+02	1.00E+05	BE	UG/L	-----	-----	-----	-----	Yes	1.00E+00	6.90E-01	1.00E+00	2201	29.48	Yes	5.00E+00	5.00E+00	1544	20.68	Yes	Yes	-----	Yes
RAD	T	Uranium Isotopes		1059	1059	100.00	3.52E+01	7.22E+03		PCI/L	1.14E+02	44	4.15	Yes	Yes	6.85E-01	1.00E+01	1.00E+01	399	37.68	Yes	2.06E+01	2.06E+01	237	22.38	Yes	Yes	-----	Yes

----- Not applicable

The frequency of detection of the analyte concentration above the surface water standard is greater than 0 percent and less than 1 percent.

The frequency of detection of the analyte concentration above the surface water standard is greater than or equal to 1 percent and less than 5 percent.

The frequency of detection of the analyte concentration above the surface water standard is greater than 5 percent.

Note: The information presented in this table is listed in order of increasing frequency of detection above the lowest surface water standard or PQL (whichever is higher).

Table 4
Summary of Surface Water Analytes of Interest by Drainage Basin

Drainage Basin	Surface Water AOI
Walnut Creek	Carbon Tetrachloride
Walnut Creek	Chloroform
Walnut Creek	cis-1,2-Dichloroethene
Walnut Creek	Methylene Chloride
Walnut Creek	Tetrachloroethene
Walnut Creek, Woman Creek	Trichloroethene
Walnut Creek	Vinyl Chloride
Walnut Creek	Dissolved Aluminum
Walnut Creek, Woman Creek	Total Beryllium
Walnut Creek, Woman Creek	Total Chromium
Walnut Creek, Woman Creek	Total Lead
Walnut Creek	Total Nickel
Walnut Creek, Woman Creek	Total Americium-241
Walnut Creek	Total Gross Alpha
Walnut Creek	Total Gross Beta
Walnut Creek, Woman Creek, Rock Creek	Total Plutonium-239/240
Walnut Creek, Woman Creek	Total Uranium Isotopes
Walnut Creek	Nitrate/Nitrite (as N)

Table 5
Analytes of Interest in Rocky Flats Surface Water

											AOI Screen 1	AOI Screen 2				AOI Screen 3				AOI Screen 4	AOI Screen 5		
Analyte Group	Analyte	Total or Dissolved	Derived CAS No.	Number of Samples	Number of Detections	Frequency of Detections (%)	Arithmetic Mean Concentration	Maximum Concentration	Data Qualifier	Unit	Is There a Surface Water Standard ?	Background M2SD	Number of Detections Above the Background M2SD	Frequency of Detection (%) Above the Background M2SD	Is the Maximum Concentration Above the Background M2SD ?	Lowest Surface Water Standard or PQL	Number of Detections Above the Lowest Surface Water Standard or PQL	Frequency of Detection (%) Above the Surface Water Standard or PQL	Is the Maximum Result Above the Surface Water Standard or PQL ?	Is the Frequency of Detection Above the Surface Water Standard ≥ 1% ?	Is Constituent Eliminated or Retained By Process Knowledge ?	Is Constituent an AOI ?	Drainage Basin(s) Where AOI Occurs
MET	Nickel	T	7440-02-0	960	923	96.15	1.13E+01	2.72E+02		ug/L	Yes	3.56E+01	61	6.35	Yes	100	11	1.15	Yes	Yes	-----	Yes	Wa
MET	Beryllium	T	7440-41-7	1309	887	67.76	5.34E-01	2.55E+01		ug/L	Yes	2.49E+00	53	4.05	Yes	5	16	1.22	Yes	Yes	-----	Yes	Wa,Wo
VOC	cis-1,2-Dichloroethene	T	156-59-2	151	25	16.56	4.15E+00	2.10E+02		ug/L	Yes	-----	-----	-----	-----	70	2	1.32	Yes	Yes	-----	Yes	Wa
VOC	Vinyl Chloride	T	75-01-4	207	23	11.11	1.13E+00	9.70E+00		ug/L	Yes	-----	-----	-----	-----	2	3	1.45	Yes	Yes	-----	Yes	Wa
VOC	Chloroform	T	67-66-3	207	56	27.05	2.82E+00	1.20E+02	D	ug/L	Yes	-----	-----	-----	-----	3.4	6	2.90	Yes	Yes	-----	Yes	Wa
VOC	Methylene Chloride	T	75-09-2	207	57	27.54	1.35E+00	1.50E+01	BD	ug/L	Yes	-----	-----	-----	-----	4.6	8	3.86	Yes	Yes	-----	Yes	Wa
MET	Chromium	T	7440-47-3	1318	1178	89.38	1.17E+01	3.48E+02		ug/L	Yes	5.64E+01	44	3.34	Yes	50	52	3.95	Yes	Yes	-----	Yes	Wa,Wo
MET	Aluminum	D		73	34	46.58	4.95E+01	1.33E+03		ug/L	Yes	4.30E+02	2	2.74	Yes	87	3	4.11	Yes	Yes	-----	Yes	Wa
RAD	Uranium Isotopes	T		1788	1788	100.00	3.08E+00	5.63E+01		pCi/L	Yes	7.89E+00	112	6.26	Yes	10	75	4.19	Yes	Yes	-----	Yes	Wa,Wo
VOC	Trichloroethene	T	79-01-6	207	28	13.53	1.70E+00	6.60E+01		ug/L	Yes	-----	-----	-----	-----	2.5	10	4.83	Yes	Yes	-----	Yes	Wa,Wo
MET	Lead	T	7439-92-1	954	748	78.41	1.19E+01	2.62E+02		ug/L	Yes	1.82E+01	173	18.13	Yes	50	49	5.14	Yes	Yes	-----	Yes	Wa,Wo
VOC	Tetrachloroethene	T	127-18-4	204	26	12.75	1.62E+00	4.40E+01		ug/L	Yes	-----	-----	-----	-----	1	12	5.88	Yes	Yes	-----	Yes	Wa
VOC	Carbon Tetrachloride	T	56-23-5	207	27	13.04	6.47E+00	3.10E+02	D	ug/L	Yes	-----	-----	-----	-----	1	22	10.63	Yes	Yes	-----	Yes	Wa
RAD	Gross Alpha	T	12587-47-2	32	13	40.63	2.55E+01	5.21E+02		pCi/L	Yes	1.83E+01	3	9.38	Yes	7	5	15.63	Yes	Yes	-----	Yes	Wa
WQP	Nitrate/Nitrite (as N)	T	ConID 184	636	603	94.81	9.26E+03	1.20E+06		ug/L	Yes	3.48E+03	270	42.45	Yes	10000	104	16.35	Yes	Yes	-----	Yes	Wa
RAD	Americium-241	T	86954-36-1	2078	881	42.40	2.66E-01	8.40E+01		pCi/L	Yes	2.33E-02	821	39.51	Yes	0.15	353	16.99	Yes	Yes	-----	Yes	Wa,Wo
RAD	Gross Beta	T	12587-46-1	32	24	75.00	2.00E+01	3.98E+02		pCi/L	Yes	1.50E+01	3	9.38	Yes	8	6	18.75	Yes	Yes	-----	Yes	Wa
RAD	Plutonium-239/240	T		2110	1015	48.10	8.31E-01	2.59E+02		pCi/L	Yes	1.87E-02	981	46.49	Yes	0.15	434	20.57	Yes	Yes	-----	Yes	Wa,Wo, R

----- Not Applicable

The frequency of detection of the analyte concentration above the lowest surface water standard or PQL, whichever is higher, is greater than or equal to 1 percent and less than 5 percent.

The frequency of detection of the analyte concentration above the lowest surface water standard or PQL, whichever is higher, is greater than 5 percent.

The results presented in this table are ordered by increasing frequency of detection above the surface water standard.

Wa = Walnut Creek; Wo = Woman Creek; R = Rock Creek

Table 6
Summary of Sediment Analytes of Interest by Drainage Basin

Drainage Basin	Sediment AOI
Walnut Creek, Woman Creek	Benzo(a)pyrene
Walnut Creek, Woman Creek, Rock Creek, Lower Smart Ditch	Arsenic
Walnut Creek, Woman Creek	Chromium
Walnut Creek	Americium-241
Walnut Creek, Woman Creek	Plutonium-239/240

Table 7
Analytes of Interest in Rocky Flats Sediments

Analyte Group	Analyte	Derived CAS No.	Number of Samples	Number of Detections	Frequency of Detection (%)	Arithmetic Mean Concentration	Maximum Concentration	Data Qualifier	Units	AOI Screen 1	AOI Screen 2				AOI Screen 3				AOI Screen 4		
										Is There a WRW PRG ?	Background M2SD	Number of Detections Above the Background M2SD	Frequency of Detection (%) Above the Background M2SD	Is the Maximum Concentration Above the Background M2SD ?	WRW PRG	Number of Detections Above the WRW PRG	Frequency of Detection (%) Above the WRW PRG	Is the Maximum Result Above the WRW PRG ?	Is Constituent Eliminated or Retained By Process Knowledge ?	Is Constituent an AOI ?	Drainage Basin(s) Where AOI Occurs
RAD	Americium-241	86954-36-1	461	339	73.54	5.79E-01	5.65E+01		pCi/g	Yes	4.27E-02	238	51.63	Yes	7.7	6	1.30	Yes	-----	Yes	Wa
RAD	Plutonium-239/240		481	400	83.16	1.81E+00	2.17E+02		pCi/g	Yes	5.09E-02	308	64.03	Yes	10	16	3.33	Yes	-----	Yes	Wa, Wo
MET	Chromium	7440-47-3	386	372	96.37	1.39E+04	1.40E+05		ug/kg	Yes	2.45E+04	39	10.10	Yes	28418	16	4.15	Yes	-----	Yes	Wa, Wo
SVOC	Benzo(a)pyrene	50-32-8	290	106	36.55	3.37E+02	1.30E+03		ug/kg	Yes	-----	-----	-----	---	379	28	9.66	Yes	-----	Yes	Wa, Wo
MET	Arsenic	7440-38-2	385	374	97.14	4.83E+03	2.79E+04		ug/kg	Yes	6.26E+03	98	25.45	Yes	2409	313	81.30	Yes	-----	Yes	Wa, Wo, R, L

----- Not Applicable

The frequency of detection of the analyte concentration above the PRG is greater than or equal to 1 percent and less than 5 percent.

The frequency of detection of the analyte concentration above the PRG is greater than 5 percent.

The results presented in this table are ordered by increasing frequency of detection above the WRW PRG.

Wa = Walnut Creek; Wo = Woman Creek; R = Rock Creek; L = Lower Smart Ditch

Table 8
Summary of Analytes of Interest by Environmental Medium

Analyte Group	AOI	Environmental Media					
		Surface Soil	Subsurface Soil	Ground - water[a]	Surface Water[a]	Sediment	Air[b]
Radionuclides	Americium-241	x	x	-	X	x	x
	Plutonium-239/240	x	x	-	X	x	x
	Uranium-233/234	x	-	-	-	-	x
	Uranium-235	x	x	-	-	-	x
	Uranium-238	x	x	-	-	-	x
	Uranium (sum of isotopes)	-	-	x	X	-	-
	Gross alpha	-	-	-	X	-	-
	Gross beta	-	-	-	X	-	-
VOCs	cis-1,2-Dichloroethene	-	-	x	X	-	-
	1,2-Dichloroethane	-	-	x	-	-	-
	1,1-Dichloroethene	-	-	x	-	-	-
	Benzene	-	-	x	-	-	-
	Carbon Tetrachloride	-	x	x	X	-	-
	Chloroform	-	x	x	X	-	-
	Chloromethane	-	-	x	-	-	-
	Methylene chloride	-	x	x	X	-	-
	Tetrachloro-ethene	-	x	x	X	-	-
	Trichloroethene	-	x	x	X	-	-
	1,1,2,2-Tetrachloro-ethane	-	x	-	-	-	-
	Vinyl chloride	-	-	x	X	-	-
Metals	Aluminum	x	-	-	x (dissolved)	-	-
	Arsenic	x	-	x (dissolved)	-	x	-
	Beryllium	-	-	-	X	-	-
	Chromium (total)	x	x	x	X	x	-
	Lead	-	x	-	X	-	-
	Nickel	-	-	x (total and dissolved)	X	-	-
	Vanadium	x	-	-	-	-	-

Table 8
Summary of Analytes of Interest by Environmental Medium

Analyte Group	AOI	Environmental Media					
		Surface Soil	Subsurface Soil	Ground - water[a]	Surface Water[a]	Sediment	Air[b]
SVOCs	Benzo(a)pyrene	**x**	**x**	-	-	**x**	-
	Dibenz(a,h)-anthracene	**x**	-	-	-	-	-
PCBs[c]	PCB-1254	**x**	-	-	-	-	-
	PCB-1260	**x**	**x**	-	-	-	-
Dioxins	2,3,7,8-TCDD TEQ	**x**	-	-	-	-	-
Water Quality Parameters	Fluoride	-	-	**x**	-	-	-
	Nitrate/Nitrite (as N)	-	-	**x**	**X**	-	-
	Sulfate	-	-	**x**	-	-	-

[a] Analytes in groundwater and surface water are "total" (unfiltered) unless noted as "dissolved" (filtered).
[b] Air AOIs are defined as those constituents that were modeled for airborne transport (plutonium-239/240, americium-241, uranium-233/234, uranium-235, and uranium-238), although the historic airborne concentrations of these radionuclides have been well below the allowable standard.
[c] The PCBs listed herein are equivalent to Aroclors, for example PCB-1254 is the same as Aroclor-1254.

Table 9
Contaminant Behavior and Persistence of Analytes of Interest in the Environment

Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
Americium-241 (Radionuclide)	<u>Surface Soil / Subsurface Soil</u> The strong tendency of americium hydroxides to sorb onto surfaces is a dominant and often controlling feature in americium geochemistry. Therefore, americium is generally transported with soil particles or colloids, carried by wind and water movement. The major reactions influencing the environmental fate of americium are formation of complexes with anions and natural organic matter, precipitation, and sorption. Americium migration in the environment can also occur due to its association with particles or colloids (pseudocolloids); pseudocolloids are present in nearly all waters and are formed as a result of the weathering of rocks, soil, and plant material. Am(III) ions are also prone to undergo polymerization reactions under environmental conditions to form colloidal polymers. Although americium can exist in multiple oxidation states, the most likely redox state of americium in soils is Am(III) (Bondietti et al. 1977; Nelson and Orlandini 1986), which forms relatively insoluble oxides and hydroxides. Leaching studies of surface-deposited americium-241 indicates it has low relative mobility. Three soils of widely differing characteristics found that 98 percent of the americium was retained in upper 2 centimeters of soil (Vyas and Mistry 1980). RFETS studies indicate the majority of americium-241 is confined to the top 20 centimeters (K-H 2002a). <u>Air</u> Although not an AOI americium-241 is a pollutant of potential concern in air. In the atmosphere, americium is associated with particulate matter, and the transport of americium in air will therefore be governed by that of its host particles (Bennett 1979). Dry deposition and precipitation remove americium from the air and deposit it on the ground or in water. Smaller or lighter particles will travel farther from their origin before being deposited than larger or denser particles. Once deposited on the land, the particles may be resuspended. <u>Surface Water / Sediment</u> In aerated waters, americium is invariably in the Am(III) state, in the absence of oxidants other than atmospheric oxygen (Bondietti et al. 1977; Nelson and Orlandini 1986). Americium hydroxide, resulting from rapid hydrolysis of americium in solution, is insoluble in both fresh and marine waters, precipitating as particulate matter or sorbing to suspended particulates (Warner and Harrison 1993, Chapter 1). The association of americium with particulate matter and sediments controls its behavior and distribution in the aquatic environment. The main processes by which americium becomes associated with solids are: • Adsorption of americium to solid surfaces of soils, sediments, and colloids; • Ion exchange of americium to charged sites on clay and mineral surfaces and humic material; • Precipitation of hydrolyzed americium as polyhydroxides and oxides; and • Coprecipitation and occlusion of americium with other precipitating minerals, such as oxides of aluminum, iron, and manganese. Americium released to water is rapidly depleted from the water column and deposited in surface sediment (Murray and Avogadro 1979). In sediments, the highest americium concentrations are generally associated with the smallest particle sizes.	The half-life of americium-241 is 432.2 years.	Americium-241 has been detected in surface soil above the WRW Preliminary Remediation Goal (PRG) in the former 700 Area of the former Industrial Area (IA) (particularly at the location of former Building 776), and the historical 903 Pad/Lip area. In subsurface soil, americium-241 exists above the WRW PRG in one area in the South Walnut Creek watershed, at the historical East Trenches at a depth interval from 3.0 to 8.0 ft. As discussed in the evaluation of americium-241 in surface soil (Section8.3.3.1), the dominant transport mechanism is via surface mechanisms (K-H 2002a). The subsurface mobility of americium-241 is extremely limited because of its low solubility and the strong tendency of americium hydroxides to sorb to surfaces. However, americium-241 historically may have been transported vertically into subsurface soil due to entrainment in a liquid, such as oil and/or solvent, that would have fostered limited downward transport (such as occurred at the historical 903 Pad). Americium-241 transport below the ground surface also could occur via a subsurface conduit that facilitated subsurface movement (this subsurface transport pathway, distinctly different than groundwater transport of a dissolved constitutent, occurred at the former Building 771 where americium-241 was transported to the surface via subsurface drains that were intact; these subsurface drains were subsequently disrupted). Americium-241 is defined as a sediment AOI in the nature and extent of surface water and sediment contamination (Section 5.0). Two locations exist with sediment sample results above the americium-241 WRW PRG value (7.69 pCi/g). These sampling locations are in Pond B-3 in South Walnut Creek. At RFETS, americium has been extensively studied in the AME. Americium at RFETS is almost entirely (around 99 percent) in solid forms, either bound to soil and sediment particles or precipitated as oxides and hydroxides (this percentage is essentially the same as that found worldwide) (K-H 2002a). The AME Pathway Analysis Report provides information indicating that the solubility of americium solids under the oxidizing environmental conditions most common at RFETS is very low, around 10^{-15} moles/liter. Although reducing conditions are likely to exist in the treatment ponds and in landfill locations, there is evidence that reducing conditions do not increase americium mobility at RFETS (K-H 2002a).

Table 9
Contaminant Behavior and Persistence of Analytes of Interest in the Environment

Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
			A result of the observations above is that subsurface mobility of americium is expected to be very low (K-H 2002a). Historic data demonstrate the fate and transport of americium is associated with the migration of soil and sediment particles it is associated with, via wind and water erosion (both are viable mechanisms). Surface water data demonstrate sedimentation is effective for removing americium from the water column in the RFETS ponds (K-H 2002a). While the removal of buildings and pavement makes more surface soil available for erosion, the amount of runoff and peak discharge rates will decrease significantly with the impervious surfaces removed. Since runoff drives soil erosion (and its associated contaminant transport), the migration of contaminants bound to surface soil is expected to be reduced. With respect to the ponds, during remediation and reconfiguration of the site, the ponds served to protect surface water quality; however, the ponds will not be relied on as part of the final remedy for the site.
Plutonium-239/240 (Radionuclide)	<u>Surface Soil / Subsurface Soil</u> Plutonium in the environment exists mostly as precipitated oxides (PuO_2) and in a strongly sorbed state to the organic and oxide fractions of surface soils and sediments (Livens et al. 1986). The strong tendency of the plutonium hydroxides to sorb onto surfaces is a dominant and often controlling feature in plutonium geochemistry. Therefore, plutonium is generally transported with soil particles or colloids, carried by wind and water movement. Plutonium can exist in four oxidation states: III, IV, V and VI (Allard and Rydberg 1983; Choppin et al. 1997). A fifth oxidation state Pu(VII) can be created, but is not found in nature (K-H 2002a). Pu(IV) hydrolyzes readily to form hydrolytic species with the general formula, $Pu(OH)_m^{(4-m)+}$ (m = 1, 2, 3, 4). For m = 1, 2 or 3, plutonium forms the cations $Pu(OH)^{3+}$, $Pu(OH)_2^{2+}$, and $Pu(OH)_3^{+}$, which can contribute significantly to the overall solubility of plutonium. However, the case of m = 4 leads to amorphous $Pu(OH)_4(s)$, which has very low solubility. Plutonium found in soils may undergo oxidation/reduction reactions in places where soil contacts water. In addition to oxidation/reduction reactions, plutonium can react with other ions in soil to form complexes. These complexes may then be absorbed by roots and move within plants; however, the relative uptake by plants is low. In plants, the complex can be degraded but the elemental plutonium will remain. <u>Air</u> Although not an AOI plutonium-239/240 is a pollutant of potential concern in air. In the atmosphere, plutonium is associated with particulate matter, and the transport of plutonium in air will therefore be governed by that of its host particles. Dry deposition and precipitation remove plutonium from the air and deposit it on the ground or in water. Smaller or lighter particles will travel farther from their origin before being deposited than larger or denser particles. Once deposited on the land, the particles may be resuspended. <u>Surface Water / Sediment</u> Plutonium dissolved in environmental waters tends to be progressively eliminated from the water as it encounters surfaces to which it can sorb and conditions that result in precipitation. Over 99 percent of plutonium released to arid environments ends up in soil and sediments (Warner and Harrison 1993, Chapter 4; Watters et al. 1983). In natural waters, plutonium solubility is generally limited by the formation of amorphous hydroxides or oxides. Sorption of hydrolyzed Pu(IV) in natural water on mineral surfaces and surfaces coated with organic material is often accountable for the very low observed concentrations of dissolved plutonium. The main processes by which plutonium becomes associated with solids are:	The half-life of plutonium-239 is 24,390 years, and the half-life of plutonium-240 is 6,537 years.	Plutonium-239/240 is defined as a surface and subsurface soil AOI in the nature and extent of soil contamination (Section 3.0) and a sediment AOI in the nature and extent of surface water and sediment contamination (Section 5.0). It is also defined as a COC for surface soil/sediment in the Wind Blown Area Exposure Unit. Similar to americium-241, plutonium-239/240 is detected in surface soil above the WRW PRG at several locations in the former IA (particularly in the former 700 and 400 Areas, and most notably at the location of former Building 776), and the historical 903 Pad/Lip area. In subsurface soil, plutonium-239/240 exists above the WRW PRG at three locations. These are in the North Walnut Creek watershed in the former 700 Area of the IA, in the South Walnut Creek watershed at the historical East Trenches, and at the historical 903 Pad, on the boundary of the South Walnut Creek and SID watersheds). Locations of Plutonium-239/240 above the WRW PRG value (9.80 pCi/g) include along the former Central Avenue Ditch, four locations in the North Walnut Creek drainage (in Pond A-1 and A-2), three locations in the South Walnut Creek drainage (in Pond B-4), and near the former shooting range south of the historical 903 Pad/Lip area. The dominant transport mechanism is via surface

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Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
	• Adsorption of plutonium to solid surfaces of soils, sediments, and colloids; • Ion exchange of plutonium to charged sites on clay and mineral surfaces and humic material; • Precipitation of hydrolyzed plutonium as polyhydroxides and oxides; • Coprecipitation and occlusion of dissolved plutonium with other precipitating minerals, such as oxides of aluminum, iron, and manganese; and • Polymerization of plutonium ions into colloidal solids with molecular weights up to about 10,000 Daltons. The estimated solubility of amorphous $Pu(OH)_4$ is around $10^{-9(\pm 2)}$ M and that of PuO_2(c) around $10^{-15(\pm 3)}$ M. The solubilities of the solid forms of plutonium impose an upper limit on the total amount of dissolved plutonium that can be present, even if Pu(V) or Pu(VI) is the more stable dissolved state. When $Pu(OH)_4$(am) and PuO_2(c) are present, they limit the concentrations of soluble plutonium species to about 10^{-8} M to 10^{-10} M (Langmuir 1997; Rai et al. 1980; Delegard 1987).		transport mechanisms. The subsurface mobility of plutonium-239/240 is extremely limited due to its strong tendency to form plutonium hydroxides/oxides which sorb to surfaces (K-H 2002a). The subsurface soil plutonium-239/240 is related to either subsurface plutonium placed below the ground surface (former 700 Area and historical East Trenches) or vertical transport caused by plutonium entrained in oil and/or solvent (historical 903 Pad) that is not reflective of plutonium environmental transport At RFETS, plutonium has been extensively studied in the AME. In environmental conditions common at RFETS, plutonium is in its least soluble oxidation state, Pu(IV). LANL studied the speciation of plutonium in contaminated soils from RFETS. The data from X-ray absorption spectroscopy (XANES, EXAFS) indicated that plutonium was present in the Pu(IV) state as expected and was structurally similar to the highly stable and immobile PuO_2 (K-H 2002a). Measurements of plutonium in RFETS soils from the 903 Pad and IA buildings support many earlier studies indicating that plutonium at RFETS is almost entirely present as PuO_2, generally accepted to be immobile in the subsurface, except for potential colloid-facilitated movement (K-H 2002a). Plutonium at RFETS is almost entirely (around 99 percent) in solid forms, either bound to soil and sediment particles or precipitated as oxides and hydroxides (this percentage is essentially the same as that found worldwide) (K-H 2002a). The solubility of plutonium solids under the oxidizing environmental conditions most common at RFETS is very low, around 10^{-15} moles/liter. Although reducing conditions are likely to exist in the treatment ponds and in landfill locations, there is evidence that reducing conditions do not increase plutonium mobility at RFETS (K-H 2002a). A result of the observations above is that subsurface mobility of plutonium is expected to be very low. Its transport mechanism is by water or wind erosion and sediment transport (K-H 2002a). Erosion (by both surface water and wind) can also cause transport plutonium in sediment. Surface water data demonstrate sedimentation is effective for removing plutonium from the water column in the RFETS ponds (K-H 2002a). While the removal of buildings and pavement makes more surface soil available for erosion, the amount of runoff and peak discharge rates will decrease significantly with the impervious surfaces removed.

Table 9
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Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
			Since runoff drives soil erosion (and its associated contaminant transport), the migration of contaminants bound to surface soil is expected to be reduced. With respect to the ponds, during remediation and reconfiguration of the site, the ponds served to protect surface water quality; however, the ponds will not be relied on as part of the final remedy for the site.
Uranium-233/234 Uranium-235 Uranium-238 Uranium (sum of isotopes) (Radionuclides)	<u>Surface Soil / Subsurface Soil</u> Uranium minerals in ore deposits are commonly found in association with carbonaceous matter (Breger 1974). It appears that mobile U(VI) sorbs to organic matter and is reduced to form solid phases like uraninite. Based on its mineralogy, in the absence of elevated concentrations of vanadate, orthophosphate, or silica, the mobility of uranium is high under oxidizing conditions (as uranyl carbonate and hydroxide complexes), but low under reducing conditions and/or in the presence of organic matter. Significant reactions of uranium in soil are formation of complexes with anions and ligands or humic acid, and reduction of soluble U(VI) to insoluble U(IV). Other factors that control the mobility of uranium in soil are the redox potential, the pH, and the sorbing characteristics of the sediments and soils (Allard et al. 1979, 1982; Brunskill and Wilkinson 1987; Herczeg et al. 1988; Premuzie et al. 1995). Retention of uranium by the soil may be due to adsorption, chemisorption, ion exchange, or a combination of mechanisms (Allard et al. 1982). The sorption of uranium in most soils is such that it may not leach readily from soil surface to groundwater, particularly in soils containing clay and iron oxide (Sheppard et al. 1987). Numerous investigators have measured K_d values under a wide range of experimental conditions for uranium sorption on various geologic materials including pure mineral phases, soils, sediments, clays, and crystalline rocks. A number of compilations and reviews of uranium K_ds have been published. EPA (1999) also compiled many of these published uranium K_ds and plotted them as a function of pH. <u>Air</u> Although not an AOI, uranium is a pollutant of potential concern in air. The transport of uranium particles in the atmosphere will depend on the particle size distribution and density. Dry deposition and precipitation remove uranium particles from the air and deposit them on the ground or in water. Smaller or lighter particles will travel farther from their origin before being deposited than larger or denser particles. Once deposited on the land, the particles may be resuspended. <u>Groundwater / Surface Water / Sediment</u> The transport of uranium in surface water and groundwater are affected by adsorption and desorption of uranium on aquatic sediments. In most waters, sediments act as a sink for uranium and the uranium concentrations in sediments and suspended solids are several orders of magnitude higher than in surrounding water (Brunskill and Wilkinson 1987; Swanson 1985). Uranium is a redox-sensitive element that can exist in the III, IV, V, and VI oxidation states under laboratory conditions. However, in groundwater and surface water, only the U(IV) and U(VI) valence states are important. U(VI) aqueous species predominate in oxic and moderately oxidizing groundwater, and in the pH range of 6 to 9 the major species are predicted to be $UO_2(CO_3)_2^{2-}$, $UO_2(CO_3)_3^{4-}$, $UO_2CO_3^0$, $(UO_2)_2CO_3(OH)_3^-$, and $UO_2(OH)_2^0$ (EPA 1999). The uncomplexed uranyl cation (UO_2^{2+}) is unimportant at pH >5.5. Uranyl phosphate complexes can be important if the water contains sufficient orthophosphate (i.e., total PO_4/CO_3 >0.1) (Langmuir 1978; EPA 1999). U(IV) aqueous species at pH >3 are mainly hydrolysis species like $U(OH)_3^+$ and $U(OH)_4^0$ (EPA 1999). U(IV) complexes with anions like sulfate, phosphate, chloride, and fluoride are not significant at normal groundwater pHs. Groundwater chemistry in terms of REDOX environment, pH, availability of ligands, and ionic strength will control the distribution of aqueous uranium species and the overall proportion in U(VI) versus U(IV) oxidation states. Numerous uranium-bearing minerals have been identified. Important U(VI) minerals in an oxidizing environment are associated with vanadium, or orthophosphate, or with silica (DeVoto 1978). U(IV) minerals form in a reducing environment. U(IV) minerals tend to be very insoluble, and may control dissolved uranium at very low concentrations in reducing groundwater. The concentration of uranium in contaminated groundwater, not associated with uranium ore deposits, may not be solubility-limited. If it is solubility-limited, the identity of the controlling solid phase is probably unknown at most contamination sites. Uranium K_ds are pH-dependent and for many different sorbents they appear to have a sorption maximum in the pH 6 to 7 range. For a given sorbent, uranium becomes more mobile in increasingly alkaline waters above pH 7.5, and more mobile in increasingly acidic waters below pH 5.5. Assuming a groundwater of pH 7, the log K_d data appear to span about 4 log units corresponding to uranium K_ds of approximately 100 mL/g to 1 million mL/g. At pH 8 the data span about 5 log units, or a K_d range of 1 to 100,000 mL/g. These large ranges suggest that site-specific uranium sorption data are necessary to predict the transport of uranium at a site such as RFETS.	U isotopes are persistent in the environment due to their long radioactive half-lives: uranium-234: 244,000 years, uranium-235: 704 million years, and uranium-238: 4.5 billion years.	Natural uranium is ubiquitous in the Front Range of Colorado and complicates studies of uranium contamination at RFETS. High uranium granites occur throughout the Front Range and uranium ore (utilized by the Schwartzwalder mine near Ralston Reservoir) is located in the headwaters of Ralston Creek within 10 miles of RFETS. Uranium-235 and Uranium-238 are defined as soil and subsurface soil AOIs in the nature and extent of soil contamination (Section 3.0). Uranium has been detected in surface soil is distributed in the former 700 Area, former Building 444, historical SEP, the Original Landfill, and in the historical Ash Pit area. In subsurface soil, uranium-235 and uranium-238 exist above the WRW PRG at one location, the historical Ash Pits. Uranium (sum of isotopes uranium-233/234, uranium-235, and uranium-238) is defined as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). Mappable, contiguous plumes of total uranium isotopes are displayed on Figure 4.20 in the nature and extent of groundwater contamination. This figure shows the plumes occurring at and downgradient of the historical SEP and the former 700 Area Northeast Plume. Although they did not meet the criteria for a contiguous, mappable plume, concentrations of total uranium (sum of isotopes) have been observed in groundwater at the historical Ash Pits above the surface water standard. However, unsaturated conditions exist here for much of the year and thereby limit the potential for uranium migration. An evaluation of the groundwater in this area concluded that the subsurface uranium from the historical Ash Pits has not impacted the partly saturated groundwater and surface water in the area (K-H 2005e). At RFETS, uranium has been extensively studied in the AME. Isotopic abundances (by weight) in uranium used at RFETS differ significantly from natural values (DOE 1997), and this may be useful in determining the fraction of uranium in on-site groundwater and surface water that represents RFETS contamination (anthropogenic). Some of the uranium used at RFETS for manufacture of nuclear weapons

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			components was enriched in uranium-234 and uranium-235 and some was depleted in uranium-234 and uranium-235 (K-H 2004b). Using appropriate analytical techniques, the isotopic signatures of anthropogenic uranium can be distinguished from natural uranium in water samples. The results of these analyses are provided in Attachment 4, and indicate the following: 1) less than 1 percent enriched uranium has been measured in water at RFETS; 2) anthropogenic uranium (mainly depleted U) is detected in groundwater from the historical SEP, historical Ryan's Pit, Original Landfill, historical T-1, historical East Trenches, and historical Mound areas; and 3) surface water shows a mixture of depleted and natural U, although it is greatly dominated by natural uranium (see Section 8.4.3 in main text and Attachment 3 for more details). Table TA-3-4 from the AME Pathway Analysis Report Technical Appendix (K-H 2002a) includes reported values for uranium empirical K_ds specific to RFETS. The values range from essentially 30 to 170 mL/g. These values are certainly within the range of K_ds reported for uranium worldwide.
Gross Alpha (Radionuclides)	<u>Surface Water</u> Gross alpha measurements are used to indicate the presence of specific radionuclides.	NA – Dependent on specific radioisotope.	At RFETS, AOI isotopes that decay primarily by alpha particle emissions include plutonium-239, plutonium-240, americium-241, uranium-234, uranium-235, and uranium-238. See entries for these specific isotopes.
Gross Beta (Radionuclides)	<u>Surface Water</u> Gross beta measurements are used to indicate the presence of specific radionuclides.	NA – Dependent on specific radioisotope.	Many isotopes detected at RFETS are beta emitters, including potassium-40, Cesium-137, and strontium-90. None of these are AOIs.
cis-1,2-Dichloroethene (VOCs)	<u>Groundwater / Surface Water</u> CAHs are a group of VOCs in which chlorine atoms have replaced one or more hydrogen atoms in an alkane or alkene hydrocarbon compound. The alkenes are distinguished by a carbon-to-carbon double bond. Because functional groups are not free to rotate about a double bond, "cis" and "trans" geometric isomers can be separately identified for some chlorinated alkenes, such as cis-1,2-dichloroethene. They are the anaerobic degradation products of trichloroethene (see Figure 8.6 for the full degradation chains). The relative mobility of certain CAHs in groundwater is estimated based on sorption and water solubility characteristics. cis-1,2-Dichloroethene has a K_d value less than 1 mL/g indicating very high mobility in groundwater. These K_{0c} values also suggest that adsorption to soil, sediment, and suspended solids in water is not a significant fate process. Without significant adsorption to soil, cis-1,2,-dichloroethene can leach into groundwater where very slow biodegradation should occur (HSDB 1995). Volatilization occurs from surface water but is relatively unimportant for groundwater, except for very shallow groundwater, perhaps less than 1 meter below the surface. The degree of volatilization of a chemical from water depends on its vapor pressure and water solubility and is best quantified by the Henry's Law constant (H) (Howard 1991). The larger the Henry's Law constant, the greater the CAH concentration in air relative to its aqueous concentration. A very important fate process for most CAHs is that under anoxic conditions, they undergo biodegradation, liberating chloride ion and forming simpler organic compounds. Numerous investigations have shown that microorganisms indigenous to groundwater environments can degrade a variety of manmade organic chemicals (EPA 1998a). This biologically mediated degradation is termed biodegradation and at many sites it is the most important process by which	Volatilization occurs rapidly from surface water, with an estimated half-life of 3 to 6 hours based on a model river (Thomas 1982). Experimental data indicate that anaerobic biodegradation in groundwater occurs with a half-life of about 13 to 48 weeks (Barrio-Lage et al. 1986).	cis-1,2-Dichloroethene is defined as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). Contiguous, mappable plumes of cis-1,2-dichloroethene in UHSU groundwater are primarily downgradient of the historical Mound site (refer to Figure 4.11 in the nature and extent of groundwater contamination). Ratios of the cis- and trans-stereoisomers of 1,2-dichloroethene have been used in the published literature as a qualitative indicator of biodegradation. Commercial solvents are a mixture of cis- and trans-1,2-dichloroethene. In contrast, biological processes (biodegradation) produce mainly cis-1,2-dichloroethene (EPA 1998a). The cis/trans ratio is typically greater than 25 to 1 in groundwater where biodegradation is actively occurring. The cis/trans ratio was computed for each well and sampling event at RFETS with detectable isomer concentrations. Although some wells have low ratios, most wells had

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Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
	CAHs in the environment are destroyed.		high ratios between 26 and 684, suggesting that CAH biodegradation is occurring in those areas (K-H 2004c). Estimates of the biodegradation half-life of cis-1,2-dichloroethene in RFETS groundwater fall in a wide range, starting with approximately 10 years, using the Buschek and Alcantar 1-dimensional estimation method (K-H 2004c) (considered to be at the low end of the range for half-life estimates). Based on data and numerical modeling at RFETS, it is likely that inferred VOC sources and associated downgradient groundwater concentrations will persist for decades to hundreds of years, if not longer, even with source removal (considered to be the upper range for half-life estimates) (see Attachment 1 for details). A range of sorption (K_d) values has been calculated based on published (EG&G 1995) ranges of RFETS-specific soil parameters (organic matter content [f_{oc}] and clay content) and VOC partitioning constants. A linear sorption isotherm was assumed. For cis-1,2-dichloroethene, the K_d values at RFETS are calculated to range from 2.6×10^{-8} to 2.3×10^{-6} L/mg (K-H 2004a).
1,2-Dichloroethane 1,1-Dichloroethene Chloromethane Vinyl chloride (clustered because of like properties) (VOCs)	<u>Groundwater</u> CAHs are a group of VOCs in which chlorine atoms have replaced one or more hydrogen atoms in an alkane or alkene hydrocarbon compound. The alkenes are distinguished by a carbon-to-carbon double bond, while the alkanes contain only single bonds. 1,2-Dichloroethane is the daughter product of 1,1,2-trichloroethane. 1,1-Dichloroethene is the degradation product of 1,1,1-trichloroethane or tetrachloroethene. Chloromethane is due to the degradation of methylene chloride. Vinyl chloride is the daughter product of tetrachloroethene → trichloroethene →cis- and trans-1,2-dichloroethene and 1,1-dichloroethene → vinyl chloride, 1,2-dichloroethane, or 1,1-dichloroethane. Refer to Figure 8.6 for descriptions of the full degradation chains. Both 1,1-dichloroethene and vinyl chloride have K_d values indicating high to very high mobility in groundwater. 1,2-Dichloroethane will also migrate relatively freely within groundwater (EPA 1982a). None of the compounds listed here is expected to adsorb to suspended solids or sediments (ATSDR 1994, 1998, 2004a). Volatilization is relatively unimportant from groundwater, except for very shallow groundwater, perhaps less than 1 meter below the surface. The degree of volatilization of a chemical from water depends on its vapor pressure and water solubility and is best quantified by the Henry's Law constant (H) (Howard 1991). The larger the Henry's Law constant, the greater the CAH concentration in air relative to its aqueous concentration. A very important fate process for certain CAHs is that under anoxic conditions, they undergo biodegradation, liberating chloride ion and forming simpler organic compounds. Numerous investigations have shown that microorganisms indigenous to groundwater environments can degrade a variety of manmade organic chemicals (EPA 1998a). This biologically mediated degradation is termed biodegradation and at many sites it is the most important process by which CAHs in the environment are destroyed. In groundwater, hydrolysis may be the only removal mechanism available to chloromethane; data regarding biodegradation of this compound are equivocal and biodegradation rates are thought to be highly variable (ATSDR 1998). Degradation of vinyl chloride occurs slowly in anaerobic groundwater; however, under certain reducing conditions, anaerobic degradation occurs more rapidly (ATSDR 2004a). <u>Surface Water</u> The primary transport process for vinyl chloride from natural water systems is volatilization into the atmosphere. The Henry's Law constant of vinyl chloride has been measured as 0.0278 atm-m^3/mol at 24.8 °C (Gossett 1987), which suggests that vinyl chloride should partition rapidly to the atmosphere. The half-life for vinyl chloride volatilization from a typical pond, river, and lake has been estimated to be 43.3, 8.7, and 34.7 hours, respectively. These values are based on an experimentally determined reaeration rate ratio of approximately 2 and assumed oxygen reaeration rates of 0.008, 0.04, and 0.01 per hour for a typical pond, river, and lake, respectively (EPA 1982a). Predicted half-lives should be considered rough estimates because the presence of various salts in natural water systems may affect the volatility of vinyl chloride significantly (EPA 1979). Many salts have the ability to form complexes with vinyl chloride and can increase its water solubility; therefore, the presence of salts in natural waters may significantly influence the amount of vinyl chloride remaining in the water	McCarty et al. (1986) found that 1,1-dichloroethene was reduced to vinyl chloride under anaerobic conditions after 108 days. In another study, reductive dechlorination of 1,1-dichloroethene by microorganisms in anoxic microcosms occurred after 1 to 2 weeks incubation (Barrio-Lage et al. 1996). In the field, the biodegradation half-life of 1,2-dichloroethane in groundwater can range from less than a year to 30 years depending on the conditions (Bosma et al. 1998). Chloromethane in groundwater has an estimated half-life of approximately 4 years, based on data concerning hydrolysis rates (Elliott and Rowland 1995; Mabey and Mill 1978). Experimental data regarding biodegradation of vinyl chloride are variable. In anaerobic aquifer microcosms supplemented with Fe(III) and held under Fe(III) reducing conditions, approximately 34 percent of vinyl chloride was mineralized in 84 hours; mineralization is expected to occur more slowly under other conditions (Bradley and Chapelle 1996). All of these compounds degrade to other CAHs as shown on Figure 8.6.	1,1-Dichloroethene is defined as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). The areal extent of contiguous, mappable plumes of 1,1-dichloroethene includes the historical Oil Burn Pit No. 2, the historical East Trenches, historical OU 1 (historical IHSS 119.1), north of the former Building 771, and the former IA Plume Sources (refer to Figure 4.5 in the nature and extent of groundwater contamination). 1,2-Dichloroethane is defined as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). The only 1,2-dichloroethane contiguous, mappable plume is associated with the Mound area (refer to Figure 4.6 in the nature and extent of groundwater contamination). Chloromethane is defined as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). Chloromethane is detected in groundwater in one isolated location, at the historical IHSS 118.1 area south of the former Building 771 (refer to Figure 4.10 in the nature and extent of groundwater contamination). Vinyl chloride is defined as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). The distribution of vinyl chloride is limited and occurs within known areas of VOC contamination. Contiguous, mappable plumes of vinyl chloride plume are located at the historical Oil Burn

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Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
	(EPA 1979). The half-life of vinyl chloride in bodies of water is also affected by depth and turbidity. The half-life of 1,2-dichloroethene is 3 to 6 hours in a model river.	The primary removal process for vinyl chloride from surface waters is volatilization into the atmosphere. Vinyl chloride in water does not absorb ultraviolet radiation above 218 nm; therefore, direct photolysis in the aquatic environment is expected to occur very slowly, if at all (EPA 1976). In sun-lit surface waters containing photosensitizers, such as humic materials, photodegradation may be more rapid. If so, in some waters, sensitized photodegradation may be an important removal mechanism (EPA 1976).	Pit No. 1 (historical IHSS 128), the historical Mound site, and at the Present Landfill (refer to Figure 4.15 in the nature and extent of groundwater contamination). The mean biodegradation half-life in groundwater at RFETS calculated using the Buscheck and Alcantar 1-dimensional method for chloromethane was 8.1 years and for 1,1-dichloroethene was 3.0 years (considered the low end of the range for half-life estimates). 1,2-Dichloroethane was never used at RFETS, but it is assumed to biodegrade at approximately the same rate as 1,1-dichloroethane, which for RFETS was calculated to be 30.3 years (K-H 2004c) (considered to be at the low end of the range for half-life estimates). 1,1-Dichloroethane was also never used at RFETS, but it is the degradation product of 1,1,1-trichloroethane (which was used at the site). Based on data and numerical modeling at RFETS, it is likely that inferred VOC sources and associated downgradient groundwater concentrations will persist for decades to hundreds of years, if not longer, even with source removal (considered to be the upper range for half-life estimates) (see Attachment 1 for details). A range of sorption (K_d) values has been calculated based on published (EG&G 1995) ranges of RFETS-specific soil parameters (organic matter content [f_{oc}] and clay content) and VOC partitioning constants. A linear sorption isotherm was assumed. For vinyl chloride, the maximum K_d values at RFETS were calculated to be 1.7×10^{-6} L/mg. For chloromethane, the K_d values at RFETS were calculated to range from 1.6×10^{-9} to 1.0×10^{-6} L/mg (K-H 2004a).
Benzene (VOCs)	<u>Groundwater</u> Benzene has a K_{oc} value of 60-83 (Karickhoff 1981; Kenaga 1980) and is considered highly mobile in groundwater. Benzene shows a tendency to adsorb to aquifer solids. Greater absorption was observed with increasing organic matter (Uchrin and Mangels 1987). Volatilization and leaching would be the principal factors in determining the persistence of benzene in sandy soils. Aerobic biodegradation is expected to be the primary mechanism for degradation of benzene in groundwater, with volatilization accounting for 5 to 10 percent of natural attenuation at most sites (McAllister and Chiang 1994). Within 1 to 1.5 years, biotransformation will remove 80 to 100 percent of benzene in groundwater plumes.	One study reported a half-life for benzene in groundwater of 28 days (ATSDR 1997a).	Benzene occurrences are mainly associated with the Present Landfill.
Carbon tetrachloride (VOCs)	<u>Subsurface Soil</u> CAHs are a group of VOCs in which chlorine atoms have replaced one or more hydrogen atoms in an alkane or alkene hydrocarbon compound. Carbon tetrachloride is a stable chemical that is degraded very slowly in the environment. It degrades under anaerobic conditions to its daughter product, chloroform (see Figure 8.6 for full carbon tetrachloride degradation chain). <u>Groundwater</u> Carbon tetrachloride exhibits moderate mobility in soil and groundwater. Chloroform and methylene chloride, both degradation products of carbon tetrachloride, are considerably more mobile than the parent solvent compound. The carbon atom in carbon tetrachloride is in its most oxidized state and is therefore much more likely to undergo reductive degradation than oxidative degradation. Carbon tetrachloride may undergo reductive dechlorination in aquatic systems in the presence of free sulfide and ferrous ions, or naturally occurring minerals providing those ions (Kreigman-King and Reinhard 1991). A	Most of the carbon tetrachloride released to soil evaporates within a few days (EPA 1991). The transformation rate of carbon tetrachloride to chloroform in simulated groundwater showed half-lives of 380 days for carbon tetrachloride alone, 2.9 to 4.5 days with minerals and sulfide ion present, and 0.44 to 0.85 days in the presence of natural iron sulfides (Kreigman-King and Reinhard 1991).	Carbon tetrachloride is defined as a subsurface soil AOI in the nature and extent of soil contamination (Section 3.0) and a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). Carbon tetrachloride is observed in subsurface soil at concentrations above the WRW PRG at seven sampling locations in the 12 to 30 ft depth interval at the historical IHSS 118.1 site south of the former Building 771. Carbon tetrachloride was detected above the WRW PRG in subsurface soil (refer to Section 8.4.2.2) and

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Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
	very important fate process for certain CAHs is that under anoxic conditions, they undergo biodegradation, liberating chloride ion and forming simpler organic compounds. Numerous investigations have shown that microorganisms indigenous to groundwater environments can degrade a variety of manmade organic chemicals (EPA 1998a). This biologically mediated degradation is termed biodegradation and at many sites it is the most important process by which CAHs in the environment are destroyed. Surface Water Carbon tetrachloride dissolved in water does not photodegrade or oxidize in any measurable amounts (Howard et al. 1991). The rate of hydrolysis is extremely slow, 1 to 2 orders of magnitude less than for other chlorinated alkanes (Haag and Yao 1992). Biodegradation occurs much more rapidly than hydrolysis, particularly under anaerobic conditions (Tabak et al. 1981). The degree of volatilization of a chemical from water depends on its vapor pressure and its water solubility and is best quantified by the Henry's Law constant (H) (Howard 1991). The larger the Henry's Law constant, the greater the CAH concentration in air relative to its aqueous concentration.	Figure 8.6 shows the degradation chain of carbon tetrachloride → chloroform → methylene chloride → chloromethane → methanol/methane. The aqueous aerobic half-life of carbon tetrachloride was estimated to be 6 to 12 months (Howard et al. 1991). The aqueous anaerobic half-life was estimated to be 7 to 28 days (Howard et al. 1991).	is a widespread constituent in groundwater. Mappable, contiguous carbon tetrachloride plumes are primarily found south of the former Building 771 (Carbon Tetrachloride Plume) (historical IHSS 118.1), the historical Mound Site/Oil Burn Pit No. 2, the historical East Trenches, the historical 903 Pad, the historical IA Plume Sources, historical 700 Area Northeast Plume Area, and at historical OU 1 (historical IHSS 119.1) (refer to Figure 4.8 in the nature and extent of groundwater contamination). Carbon tetrachloride occurrences above the surface water standard are primarily found at the former footing drain outfalls for former Buildings 771. A range of sorption (K_d) values has been calculated based on published (EG&G 1995) ranges of RFETS-specific soil parameters (organic matter content [f_{oc}] and clay content) and VOC partitioning constants. A linear sorption isotherm was assumed. For carbon tetrachloride, K_d values at RFETS were calculated to range from 1.8×10^{-7} to 4.0×10^{-6} L/mg (K-H 2004a). None of the RFETS carbon tetrachloride plumes were considered to be at steady-state. However, an approximate biodegradation rate can be estimated by averaging the rates for 10 nonsteady-state carbon tetrachloride plumes. This estimated carbon tetrachloride biodegradation rate is 0.163 per year, which is 760 times slower than carbon tetrachloride biodegradation at non-RFETS sites (K-H 2004c) (considered to be at the low end of the range for half-life estimates). Based on data and numerical modeling at RFETS, it is likely that inferred VOC sources and associated downgradient groundwater concentrations will persist for decades to hundreds of years, if not longer, even with source removal (considered to be the upper range for half-life estimates) (see Attachment 1 for details).
Chloroform (VOCs)	Subsurface Soil Because of its low soil adsorption and slight, but significant, water solubility, chloroform will readily leach from soil to groundwater. Based on data for degradation in water, chemical degradation in soil is not expected to be significant. The available data suggest that chloroform biodegradation rates in soil may vary, depending on conditions. Concentrations of chloroform above certain threshold levels may inhibit many bacteria (ATSDR 1997b). Groundwater Chloroform exhibits very high mobility. Volatilization is relatively unimportant from groundwater, except for very shallow groundwater, perhaps less than 1 meter below surface. The degree of volatilization of a chemical from water depends on its vapor pressure and water solubility and is best quantified by the Henry's Law constant (H) (Howard 1991). The larger the Henry's Law constant, the greater the CAH concentration in air relative to its aqueous concentration. Chemical hydrolysis is not a significant removal process. While microbial biodegradation can take place, such reactions are generally possible only at fairly low concentration levels because of chloroform's toxicity. Studies of natural waters and wastewaters yield a wide variety of results on the efficiencies of chloroform biodegradation. Under proper conditions, chloroform appears to be much more susceptible to anaerobic biodegradation, where it degrades to methylene chloride. These biodegradation reactions generally lead to mineralization of the chloroform to chlorides and carbon dioxide (Bouwer and McCarty 1983; Rhee and Speece 1992). Degradation under anaerobic conditions occurs faster at lower concentrations than at higher concentrations.	In the absence of toxicity from other solvents, chlorinated hydrocarbons, or heavy metals, and where chloroform concentrations can be held below approximately 100 ppb, both aerobic and anaerobic bacteria can biodegrade chloroform, with removal rates well over 80 percent in a period of 10 days (Long et al. 1993). It degrades to methylene chloride (see Figure 8.6). In surface water, chloroform will volatilize in a period of minutes to days (ATSDR 1997b).	Chloroform is defined as a subsurface soil AOI in the nature and extent of soil contamination (Section 3.0) and a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). The chloroform in subsurface soil is spatially similar to carbon tetrachloride, with concentrations above the WRW PRG at one sampling location at the historical IHSS 118.1 south of the former Building 771. A range of sorption (K_d) values has been calculated for chloroform based on published (EG&G 1995) ranges of RFETS-specific soil parameters (organic matter content [f_{oc}] and clay content) and VOC partitioning constants. A linear sorption isotherm was assumed. For chloroform, K_d values at RFETS were calculated to range from 1.9×10^{-8} to 2.5×10^{-6} L/mg

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Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
	Surface Water The dominant fate process for chloroform in surface water is volatilization. Chloroform is not expected to adsorb significantly to sediment or suspended organic matter in surface water (Sabljic 1984). Direct photolysis of chloroform will not be a significant degradation process because the compound does not absorb light at the necessary wavelengths (Hubrich and Stuhl 1980). Biodegradation in aerobic surface water is expected to be less than that under anaerobic conditions.		(K-H 2004a). An estimate of the biodegradation half-life of chloroform in RFETS groundwater is approximately 0.8 years, using the Buschek and Alcantar 1-dimensional estimation method (K-H 2004c) (considered to be at the low end of the range for half-life estimates). Based on data and numerical modeling at RFETS, it is likely that inferred VOC sources and associated downgradient groundwater concentrations will persist for decades to hundreds of years, if not longer, even with source removal (considered to be the upper range for half-life estimates) (see Attachment 1 for details).
Methylene chloride (VOC)	Subsurface Soil Methylene chloride is not strongly sorbed to soils or sediments (Dilling et al. 1975; Dobbs et al. 1989). Methylene chloride is likely to be highly mobile in soils and may be expected to leach from soils to groundwater. The rate of biodegradation of methylene chloride in soils was found to be dependent on soil type, substrate concentration, and redox state of the soil. Methylene chloride biodegradation has been reported to occur under both aerobic and anaerobic conditions (Davis and Madsen 1991). The biodegradation of methylene chloride appears to be accelerated by the presence of elevated levels of organic carbon (Davis and Madsen 1991). It degrades to acetic acid or chloromethane. Groundwater/Surface Water Methylene chloride undergoes slow hydrolysis in water. Both aerobic and anaerobic biodegradation may be important fate processes for methylene chloride in water (Brunner et al. 1980; Davis et al. 1981; EPA 1985; Stover and Kincannon 1983; Tabak et al. 1981). Methylene chloride tends to volatilize to the atmosphere from water. The half-life under experimental conditions is 21 minutes, although in natural water is dependent on the rate of mixing, temperature, and other factors.	Methylene chloride has been observed to undergo degradation at a rapid rate under aerobic conditions. Reported total methylene chloride loss was 100 percent after 7 days in a static culture flask biodegradability screening test (Tabak et al. 1981) and 92 percent after 6 hours in a mixed microbial system (Davis et al. 1981). Volatilization loss was not more than 25 percent (Tabak et al. 1981). It degrades to acetic acid or chloromethane.	Methylene chloride is defined as a subsurface soil AOI in the nature and extent of soil contamination (Section 3.0) and a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). The methylene chloride concentrations in subsurface soil are above the WRW PRG at one sampling location at the historical IHSS 118.1 south of the former Building 771. The one methylene chloride contiguous, mappable plume of methylene chloride is observed at the historical Carbon Tetrachloride Plume (historical IHSS 118.1 - refer to Figure 4.12 in the nature and extent of groundwater contamination). A range of sorption (K_d) values has been calculated based on published (EG&G 1995) ranges of RFETS-specific soil parameters (organic matter content [f_{oc}] and clay content) and VOC partitioning constants. A linear sorption isotherm was assumed. For methylene chloride, K_d values at RFETS were calculated to range from 2.8×10^{-9} to 1.7×10^{-6} L/mg (K-H 2004a). An estimate of the biodegradation half-life of methylene chloride in RFETS groundwater is approximately 0.8 years, using the Buschek and Alcantar 1-dimensional estimation method (K-H 2004c) (considered to be at the low end of the range for half-life estimates). Based on data and numerical modeling at RFETS, it is likely that inferred VOC sources and associated downgradient groundwater concentrations will persist for decades to hundreds of years, if not longer, even with source removal (considered to be the upper range for half-life estimates) (see Attachment 1 for details).
Tetrachloroethene Trichloroethene (VOCs)	Subsurface Soil CAHs are a group of VOCs in which chlorine atoms have replaced one or more hydrogen atoms in an alkane or alkene hydrocarbon compound. The alkenes are distinguished by a carbon-to-carbon double bond, while the alkanes contain only single bonds. Trichloroethene is the daughter product of the anaerobic degradation of tetrachloroethene (see Figure 8.6 for the full degradation of these CAHs). Both tetrachloroethene and trichloroethene have only low to moderate solubility in water and moderate to high mobility in soil. Because they are denser than	In soil, measured biodegradation rates have been variable; under methanogenic conditions, 100 percent transformation occurred after 10 days (Vogel and McCarty 1985). Measured and estimated volatilization half-	Trichloroethene and tetrachloroethene are defined as surface soil and subsurface soil AOIs in the nature and extent of soil contamination (Section 3.0), as groundwater AOIs in the nature and extent of groundwater contamination (Section 4.0), and as surface water AOIs in the nature and extent of surface

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	water, the amount that does not volatilize into the atmosphere may sink and be transported into groundwater. Both trichloroethene and tetrachloroethene on surface soil will readily volatilize into the atmosphere or leach into the subsurface, although volatilization is less rapid from soil than from water. Once in the soil, trichloroethene does not appear to undergo chemical transformation or covalent bonding with soil components. Sorption of trichloroethene to soil particles is dependent on soil moisture, because water molecules compete with trichloroethene for sorption sites (Petersen et al. 1994). Volatilization and movement in the gas phase accounts for a large portion of trichloroethene movement in soils (Gimmi et al. 1993). For tetrachloroethene, studies found a direct relationship between the concentration of the chemical in soil and rate of volatilization, which contrasts with results seen in water (Zytner et al. 1989). In soil, biodegradation of both trichloroethene and tetrachloroethene are favored only under limited conditions. Biodegradation of trichloroethene increases with the organic content of the soil (Barrio-Lage et al. 1987). Degradation occurs faster in vegetated than in nonvegetated soils. Trichloroethene may inhibit total soil biomass and fungi, thus slowing biodegradation processes (Kanazawa and Filip 1986). Aerobic biodegradation of trichloroethene occurs by cometabolism with aromatic compounds, such as phenol or toluene. Trichloroethene may also be broken down by methanotrophs. A possible reason for the persistence of trichloroethene in the environment lies in the sensitive balance that must be maintained between enough cosubstrate to induce degrading enzymes and too much cosubstrate, which may inhibit decomposition. Such balance may rarely be achieved in nature (Ensley 1991). Tetrachloroethene is probably degraded to some extent in aerobic soil environments (Freedman and Gossett 1989; Milde et al. 1988; Parsons et al. 1985; Wakeham et al. 1983) but only to a limited degree. Degradation rates appear to vary with soil type, temperature, and initial concentration of the chemical (Yagi et al. 1992). Groundwater / Surface Water Neither oxidation nor hydrolysis of trichloroethene in aquatic environments appears to be significant fate process. Chemical hydrolysis only occurs at elevated temperatures in a high pH environment and, even then, at a very slow rate. Biotransformation is strongly indicated as a factor in the degradation of trichloroethene in groundwater. Reductive dehalogenation is the primary reaction (Parsons et al. 1985; Wilson et al. 1986). Tetrachloroethene does not readily transform in water. Photolysis does not contribute substantially to the transformation of tetrachloroethene and chemical hydrolysis occurs only slowly at elevated temperatures in high pH environments, much like trichloroethene (Chodola et al. 1989). In natural waters, biodegradation may be the most important transformation process for tetrachloroethene; however, this occurs only slowly (Bouwer and McCarty 1982; Bouwer et al. 1981; Wakeham et al. 1983). Degradation occurs largely due to reductive dehalogenation by microorganisms. Since neither biodegradation nor hydrolysis occurs at a rapid rate, most trichloroethene and tetrachloroethene in surface waters can be expected to volatilize into the atmosphere.	lives of trichloroethene in water range from minutes to days. Volatilization from soil is somewhat slower, with experimental results showing 37 to 45 percent volatilization from soils after 7 days (Park et al. 1988). Tetrachloroethene also volatilizes rapidly. Volatilization half-lives from water ranged from 4.2 hours to 25 days in various studies (Dilling et al. 1975; Thomas 1982; Wakeham et al. 1983). Like trichloroethene, volatilization from soil is slower, with losses from soil between 10- and 100-fold slower than from water (Park et al. 1988; Zytner et al. 1989). It degrades to trichloroethene. Biodegradation of trichloroethene in water was measured at 80 to 90 percent after 1 to 4 weeks in various studies (Jensen and Rosenberg 1975; Tabak et al. 1981). Biodegradation in soils was highly variable and ranged from no degradation after 16 weeks (Wilson et al. 1983) to 100 percent transformation after 10 days (Vogel and McCarty 1985). Biodegradation of tetrachloroethene is described as “slow” in the literature and, at least for one aquifer in England, it has been estimated that tetrachloroethene will likely persist for decades (Lawrence et al. 1990). The RFETS estimate is that the VOCs could persist for decades to hundreds of years (see Attachment 1 for more details).	water and sediment contamination (Section 5.0). A range of sorption (K_d) values for tetrachloroethene has been calculated based on published (EG&G 1995) ranges of RFETS-specific soil parameters (organic matter content [f_{oc}] and clay content) and VOC partitioning constants. A linear sorption isotherm was assumed. For tetrachloroethene, K_d values at RFETS were calculated to range from 1.5×10^{-7} to 1.7×10^{-6} L/mg, and for trichloroethene, were calculated to range from 5.0×10^{-8} to 3.0×10^{-6} L/mg (K-H 2004a). An estimate of the biodegradation half-life of tetrachloroethene in RFETS groundwater is approximately 11 years, using the Buschek and Alcantar 1-dimensional estimation method (K-H 2004c) (considered to be at the low end of the range for half-life estimates). Based on data and numerical modeling at RFETS, it is likely that inferred VOC sources and associated downgradient groundwater concentrations will persist for decades to hundreds of years, if not longer, even with source removal (considered to be the upper range for half-life estimates) (see Attachment 1 for details). Estimates of the biodegradation half-life of trichloroethene in RFETS groundwater fall in a wide range, starting with approximately 22 years, using the Buschek and Alcantar 1-dimensional estimation method (K-H 2004c) (considered to be at the low end of the range for half-life estimates). Based on data and numerical modeling at RFETS, it is likely that inferred VOC sources and associated downgradient groundwater concentrations will persist for decades to hundreds of years, if not longer, even with source removal (considered to be the upper range for half-life estimates) (see Attachment 1 for details).
1,1,2,2-Tetrachloroethane (VOCs)	Subsurface Soil CAHs are a group of VOCs in which chlorine atoms have replaced one or more hydrogen atoms in an alkane or alkene hydrocarbon compound. The alkanes contain only single bonds. If released to soil, some of the 1,1,2,2-tetrachloroethane would be expected to volatilize, with the remainder leaching into the subsurface soil and possibly groundwater. 1,1,2,2-Tetrachloroethane will not adsorb appreciably to soil. Both hydrolysis and anaerobic biodegradation appear to be significant transformation processes in soil and sediments. Hydrolysis is sensitive to pH and occurs faster under neutral or basic conditions. 1,1,2,2-Tetrachloroethane slowly degrades by losing chlorine atoms. The resulting chemicals include 1,1,2-trichloroethane, 1,2-dichloroethane, and chloroethanol (K-H 2004c).	Limited information is available on the half-life of 1,1,2,2-tetrachloroethane in soil. One study showed between 34 percent and 74 percent transformation in a 6-day period, with the results varying with pH. In groundwater, the half-life is estimated at 13 weeks (ATSDR 1996). 1,1,2,2-Tetrachloroethane degrades to 1,1,2-trichloroethane (see Figure 8.6 for the full degradation chain).	1,1,2,2-Tetrachloroethane is defined as a subsurface soil AOI in the nature and extent of soil contamination (Section 3.0). 1,1,2,2-Tetrachloroethane is an AOI in subsurface soil only. 1,1,2,2-tetrachloroethane is detected in subsurface soil at concentrations above the WRW PRG at one location at the historical IHSS 118.1 site south of the former Building 771.
Aluminum (Al) (Metal)	Surface Soil The aluminum content of soils is strongly correlated with their clay content (Ma et al. 1997). Aluminum is present in many primary minerals. The weathering of these primary minerals over time results in the deposition of sedimentary clay minerals, such as the aluminosilicates kaolin and montmorillonite (ATSDR 1999). The adsorption of aluminum onto clay surfaces can be a significant factor in controlling aluminum mobility in the environment, and these adsorption reactions, measured in one study at pH 3.0-4.1, have been observed to be very rapid (Walker et al. 1988). However, clays may act either as a sink or a source	Aluminum is a stable metal; it does not degrade in the environment. Thus it will persist indefinitely. In addition, aluminum compounds occur in only one oxidation state, Al(+3). Aluminum	Aluminum is defined as a surface soil AOI in the nature and extent of soil contamination (Section 3.0). In surface soil, aluminum has been detected throughout the former IA (in the former 400 and 700 areas), and at limited locations throughout the BZ OU

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Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
	for soluble aluminum depending on the degree of aluminum saturation on the clay surface (Walker et al. 1988). Surface Water Aluminum partitions between solid and liquid phases by reacting and complexing with water molecules and anions such as chloride, fluoride, sulfate, nitrate, and phosphate, and negatively charged functional groups on humic materials and clay. In groundwater or surface water systems, an equilibrium with a solid phase or form is established that largely controls the extent of aluminum dissolution that can occur. Bioconcentration of aluminum has also been reported for several aquatic invertebrate species as well as for aquatic insects. Accumulation of aluminum in mayfly nymphs has been reported at low pH (4.5) (Frick and Herrmann 1990). Within the pH range of 5-6, aluminum complexes with phosphate and is removed from solution. Because phosphate is a necessary nutrient in ecological systems, this immobilization of both aluminum and phosphate may result in depleted nutrient states in surface water (Brusewitz 1984). In general, decreasing pH (acidification) results in an increase in mobility for monomeric forms of aluminum (Goenaga and Williams 1988).	can complex with electron-rich species that occur in the environment (ATSDR 1999).	(East Firing Range), although not necessarily at concentrations that are statistically higher than background concentrations (see Section 3, Nature and Extent of Soil Contamination). Dissolved aluminum occurrences above the surface water standard are primarily found at the former footing drain outfall (SW085) of former Building 779 and SW061 along South Walnut Creek below the former SEP Pond 207-C.
Arsenic (As) (Metals)	Surface Soil Arsenic in soil may be transported by wind or in runoff or may leach into the subsurface soil. However, because many arsenic compounds tend to partition to soil or sediment under oxidizing conditions, leaching usually does not transport arsenic to any great depth (EPA 1982b; Moore et al. 1988; Pantsar-Kallio and Manninen 1997; Welch et al. 1988). Arsenic is largely immobile in agricultural soils; therefore, it tends to concentrate and remain in upper soil layers indefinitely. Downward migration has been shown to be greater in a sandy soil than in a clay loam (Sanok et al. 1995). Terrestrial plants may accumulate arsenic by root uptake from the soil or by absorption of airborne arsenic deposited on the leaves, and certain species may accumulate substantial levels (EPA 1982b). Yet even when grown on highly polluted soil or soil naturally high in arsenic, the arsenic level taken up by the plants is comparatively low (Gebel et al. 1998; Pitten et al. 1999). The arsenic cycle in soils is complex, with many biotic and abiotic processes controlling its overall fate and environmental impact. Arsenic in soil exists in various oxidation states and chemical species, depending upon soil pH and redox potential (ATSDR 2000a). Groundwater Elemental arsenic is the least soluble in water and the least toxic. Arsenic may also be removed from water by coprecipitation with iron oxides or by isomorphic substitution with phosphorus in minerals. Arsenic in water can undergo a complex series of transformations, including oxidation-reduction reactions, ligand exchange, precipitation, and biotransformation (EPA 1979, 1984a; Sanders et al. 1994; Welch et al. 1988). Rate constants for these various reactions are not readily available, but the factors most strongly influencing fate processes in water include Eh (the oxidation-reduction potential), pH, metal sulfide and sulfide ion concentrations, iron concentrations, temperature, salinity, and distribution and composition of the biota (EPA 1979; Wakao et al. 1988). Sediment Most arsenic compounds are strongly sorbed by sediments and are relatively immobile. Adsorption on hydrous iron oxides (Pierce and Moore 1980), clays, aluminum hydroxides, manganese oxides, and organic materials or coprecipitation (EPA 1995), or combination with sulfide in reduced bottom sediments (Kobayashi and Lee 1978), appear to be the major inorganic factors that control arsenic concentrations under most environmental conditions. Because many arsenic compounds are strongly sorbed onto sediments, leaching by precipitation usually results in limited transport (EPA 1995).	Arsenic is a stable metal; it does not degrade in the environment. Thus it will persist indefinitely.	Arsenic is defined as a surface soil AOI in the nature and extent of soil contamination (Section 3.0) and as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). It is also defined as a COC for surface soil/sediment in the IAEU and WBEU. Arsenic is detected in surface soil throughout the former IA (in the former 400 and 700 areas and the former SEP area), in the three major RFETS watersheds that receive runoff from the former IA (North Walnut Creek, South Walnut Creek, and SID/Woman Creek drainages), reflecting the natural abundance of arsenic in soil. A contiguous, mappable dissolved arsenic plume in UHSU groundwater is shown on Figure 4.16 in the nature and extent of groundwater contamination and is present only at the Present Landfill. Because RFETS groundwater is generally oxic (i.e., well oxygenated), arsenate is likely the predominant dissolved arsenic species in site waters. However, under locally reducing conditions arsenite may dominate in groundwater contaminant plumes or surface water bottom sediments. Elemental arsenic and arsine are not expected in RFETS groundwater. If past arsenic releases occurred at RFETS, sorption or coprecipitation appears to be the predominant transport-control mechanism at RFETS since no discernable arsenic contaminant plumes are observed in groundwater. Arsenic associated with the historical PU&D Yard in groundwater may have been liberated upon insertion of HRC® at the historical PU&D Yard.
Beryllium (Be) (Metal)	Surface Water Beryllium metal is used as a hardener in alloys. There is little information available on the environmental fate of beryllium and its compounds. Beryllium compounds of very low water solubility appear to predominate in soils. Leaching and transport through soils to groundwater appears unlikely to be of concern. Water erosion and bulk transport of soil may bring beryllium to surface waters, but most likely in particulate rather than dissolved form (EPA 1998b, 2005). Beryllium exhibits only the +2 oxidation state in water. In the pH range of 6-8, typical of most waters, the speciation of beryllium is controlled by the formation solid beryllium hydroxide, $Be(OH)_2$, which has a very low solubility (solubility product, $K_{sp}=10^{-21}$).	Beryllium is stable and does not degrade in the environment.	In former Building 447 materials handled included beryllium. Beryllium was a primary material used in pit construction in former Building 707. In former Building 444, beryllium was chemically milled. On November 25, 2002, there was a spill of low-level mixed waste from the RCRA-regulated Tank T231A (located south of former Buildings 371/374) sludge removal operation. The spill did not contain any detectable levels of beryllium. However, original sampling data from the 231A tank indicated levels of

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Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
			0.2 to 0.3 ug/L of beryllium (K-H 2005c).
Total Chromium (Metal)	<u>Surface Soil / Subsurface Soil</u> Chromium in soil is present mainly as insoluble oxide (EPA 1984b), and is not very mobile in soil. A leachability study was conducted to study the mobility of chromium in soil. Due to different pH values, a complicated adsorption process was observed and chromium moved only slightly in soil. Chromium has a low mobility for translocation from roots to aboveground parts of plants (Cary 1982). However, depending on the geographical areas where the plants are grown, the concentration of chromium in aerial parts of certain plants may differ by a factor of 2 to 3 (Cary 1982). EPA (1999) concluded that Cr(III) concentrations in soils are controlled by precipitation and dissolution (mineral solubility), and adsorption reactions are not significant in soil Cr(III) chemistry. This seems to be at odds with Rai et al. (1984), who believe that Cr(III) is sorbed by soils because several important Cr(III) species are cations. The strength of Cr(VI) sorption on soils seems to decrease (smaller K_ds) with increasing pH (EPA 1999). Manganese oxides in soil can oxidize Cr(III) to Cr(VI) yielding lower Kd values, while iron oxides can reduce Cr(VI) to Cr(III) causing precipitation and high K_ds (EPA 1999). The fate of chromium in soil is greatly dependent upon the speciation of chromium, which is a function of redox potential and the pH of the soil. In most soils, chromium will be present predominantly in the Cr(III) state. This form has very low solubility and low reactivity resulting in low mobility in the environment and low toxicity in living organisms (Barnhart 1997). <u>Groundwater / Surface Water / Sediment</u> Under oxidizing conditions Cr(VI) may remain dissolved as the chromate anion, and may be highly mobile in groundwater for long periods of time. A number of Cr(VI) solid phases have been detected at sites having extensive chromate contamination in groundwater, including $CaCrO_4$, $PbCrO_4$ (crocoite), $K2CrO_4$ (tarapacaite), and $BaCrO_4$ (Palmer and Puls 1994). Cr(III) "is immobile under moderately alkaline to slightly acidic conditions" (EPA 1999, p. 5.18). Cr(VI) is sorbed by iron oxides in acidic waters and acidic soils, but is very mobile in neutral and alkaline waters (Rai et al. 1984; EPA 1999). Cr(VI) is more mobile because its aqueous species are anions which are less strongly sorbed on common minerals. Chromium speciation in groundwater depends on the redox potential and pH conditions in the aquifer. Cr(VI) predominates under highly oxidizing conditions, whereas Cr(III) predominates under reducing conditions. Oxidizing conditions are generally found in shallow aquifers, and reducing conditions generally exist in deeper groundwater. The reduction of Cr(VI) and the oxidation of Cr(III) in water have been investigated. The reduction of Cr(VI) by S^{-2} or Fe^{+2} ions under anaerobic conditions was fast, and the reduction half-life ranged from instantaneous to a few days. The reaction was generally faster under anaerobic than aerobic conditions. The reduction half-life of Cr(VI) in water with soil and sediment ranged from 4 to 140 days (Saleh et al. 1989). The fate of most chromium in rivers and lakes is believed to be deposition in sediments through precipitation and sorption processes (ATSDR 2000b).	Chromium is a stable metal; it does not degrade in the environment. Thus it will persist indefinitely.	Chromium is defined as a surface and subsurface soil AOI in the nature and extent of soil contamination (Section 3.0), a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0), and a sediment AOI in the nature and extent of surface water and sediment contamination (Section 5.0). Total (unfiltered) chromium in surface soil is distributed throughout the former IA (most notably in the former 400 and 700 Areas) at concentrations that exceed the WRW PRG. Total chromium has been identified as having contiguous, mappable plumes in the Carbon Tetrachloride Plume, the historical East Trenches, historical Ryan's Pit, and former OU 1 areas (refer to Figure 4.17 in the nature and extent of groundwater contamination). Numerous locations exist with sediment sample results above the chromium WRW PRG (28417.9 µg/kg), including locations across the former IA and in the North Walnut Creek drainage (at Ponds A-1, A-2, A-3), South Walnut Creek drainage (Pond B-4), and the Woman Creek drainage (Pond C-1). Chromium occurrences were observed in surface water background (above surface water standards) at station GS06 (Owl Branch to Woman Creek) and at SW134 (pumped water from gravel mining operations that is discharged to Rock Creek). However, it is also observed in background in surface water, suggesting that elevated chromium in surface water results from background concentrations in the soil. A portion of the chromium observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers (Boylan 2004a, 2004b) (see Figure 8.7). For groundwater transport of Cr(VI) at RFETS, the K_ds measured in the pH range 6.5 to 8.5 are most applicable. At these pHs, data indicate low K_ds near 1, or in the single digits, implying that Cr(VI) should exhibit high to moderate mobility (i.e., weak retardation). A chromic acid spill from the former Building 444 basement was contained in the B-Ponds and pumped to Upper Church Ditch where it was below surface water standards. Chromium was identified in ChemRisk reports and was evaluated for potential off-site impacts; none were found (K-H 2005c).

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Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
Lead (Metals)	Subsurface Soil Most lead is retained strongly in soil, and very little is transported into surface water or groundwater (EPA 1986). Plants and animals may bioconcentrate lead but biomagnification has not been detected. Although the bioavailability of lead in soil to plants is limited because of the strong absorption of lead to soil organic matter, the bioavailability increases as the pH and the organic matter content of the soil are reduced. Most lead is retained strongly in soil, and very little is transported into surface water or groundwater (EPA 1986; NSF 1977). Lead is strongly sorbed to organic matter in soil, and although not subject to leaching, it may enter surface waters as a result of erosion of lead-containing soil particulates. The fate of lead in soil is affected by the specific or exchange adsorption at mineral interfaces, the precipitation of sparingly soluble solid forms of the compound, and the formation of relatively stable organic-metal complexes or chelates with soil organic matter. These processes are dependent on such factors as soil pH, soil type, particle size, organic matter content of soil, the presence of inorganic colloids and iron oxides, cation exchange capacity (CEC), and the amount of lead in soil (NSF 1977; Reddy et al. 1995; Royer et al. 1992). Surface Water A significant fraction of lead carried by river water is expected to be in a solid form, which can consist of colloidal particles or larger particles of lead carbonate, lead oxide, lead hydroxide, or other lead compounds incorporated in other components of surface particulate matter from runoff. Lead may occur either as sorbed ions or surface coatings on sediment mineral particles, or it may be carried as a part of suspended living or nonliving organic matter in water. In most surface water and groundwater, the concentration of dissolved lead is low because the lead will form compounds with anions in the water such as hydroxides, carbonates, sulfates, and phosphates that have low water solubilities and will precipitate out of the water column (Mundell et al. 1989). The chemistry of lead in aqueous solution is highly complex because this element can be found in multiple forms. Lead has a tendency to form compounds of low solubility with the major anions found in natural waters. The amount of lead in surface waters is dependent on the pH and the dissolved salt content of the water. In water, tetraalkyl lead compounds are subject to photolysis and volatilization with the more volatile compounds being lost by evaporation. Degradation proceeds from trialkyl lead to dialkyl lead to inorganic lead. Tetraethyl lead is susceptible to photolytic decomposition in water. Triethyl and trimethyl lead are more water-soluble and therefore more persistent in the aquatic environment than tetraethyl or tetramethyl lead. The degradation of trialkyl lead compounds yields small amounts of dialkyl lead compounds.	Lead is a stable metal; it does not degrade in the environment. Thus it will persist indefinitely.	Lead is defined as a subsurface soil AOI in the nature and extent of soil contamination (Section 3.0). Lead in subsurface soil at concentrations above the WRW PRG is detected in the South Walnut Creek basin (former 400 Area) and Woman Creek basin (historical Ash Pits and historical firing ranges on the north and south sides of Woman Creek). Lead was used in the former plutonium operation buildings and at the former firing ranges. It was evaluated in the ChemRisk reports for off-site impacts; none were reported. Lead was identified in soil above ALs near former Building 441 and the firing ranges (K-H 2005c). Background lead above the surface water standard is primarily found at GS06 (Owl Branch to Woman Creek) and SW134 (pumped water from gravel mining operations that is discharged to Rock Creek).
Nickel (Metals)	Groundwater Nickel in most natural waters is predominantly divalent as the Ni^{2+} cation, although nickel forms aqueous complexes with hydroxide, sulfate, and bicarbonate (ATSDR 2003b). After Ni^{2+} the ion pair $NiSO_4^0$ is an important aqueous nickel species in sulfate-rich groundwater. Under aerobic conditions, solid nickel ferrite ($NiFe_2O_4$), and under anaerobic conditions millerite (NiS), may limit the solubility of nickel to low concentrations (Rai et al. 1984). Nickel can also coprecipitate with manganese oxides and iron oxides. Nickel removed from solution by coprecipitation can be remobilized by microbial action (ATSDR 2003a). Nickel is reportedly "strongly" sorbed by alkaline soils, and this sorption may be irreversible (Rai et al. 1984). Iron and manganese oxides (e.g., goethite) appear to be the most important adsorbents of nickel, followed by clay minerals (Rai et al. 1984). Competition for adsorption sites by cations (such as Ca^{2+} and Na^{+}) has been shown to reduce nickel sorption by soils and clays (Rai et al. 1984). The experimentally measured K_d values for sorption of nickel on various soil compositions are often very low, less than 1 mL/g. However, higher K_ds have been measured for nickel sorption in a range of sandy sediments in the Danish Beder aquifer (Larsen and Postma 1997). Those workers found that nickel is more strongly sorbed on manganese oxides than on iron oxides in sediments, and measured K_ds of 68, 160, and 212 mL/g at pH 6.75, 7.27, and 7.44, respectively. The K_d range of 1 to 212 mL/g is very wide in terms of mobility. Surface Water Nickel is a natural constituent of soil and is transported into streams and waterways in runoff either from natural weathering or from disturbed soil. Much of this nickel is associated with particulate matter. Gravitational settling governs the removal of large particles (>5 µm), whereas smaller particles are removed by other forms of dry and wet deposition (ATSDR 2003b). The fate of heavy metals in aquatic systems depends on partitioning between soluble and particulate solid phases. Adsorption, precipitation, coprecipitation, and complexation are processes that affect partitioning. These same processes, which are influenced by pH, redox potential, the ionic strength of the water, the concentration of complexing ions, and the metal concentration and type, affect the adsorption of heavy metals to soil (Richter and Theis 1980). Nickel is strongly adsorbed at mineral surfaces such as oxides and hydrous oxides of iron, manganese, and aluminum (Evans 1989; Rai et al. 1984). Such adsorption plays an important role in controlling the concentration of nickel in natural waters.	Nickel is a stable metal; it does not degrade in the environment. Thus it will persist indefinitely.	Nickel is defined as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). Contiguous, mappable plumes of dissolved nickel are present south of the historical Ryan's Pit and near former Building 850 (refer to Figure 4.18 in the nature and extent of groundwater contamination). Total nickel plumes are in the historical SEPs and historical Ryan's Pit areas. Nickel plating was conducted in the 700 Area buildings. It was evaluated by ChemRisk reports. The results indicate limited use of nickel on site and the material forms are not expected to have off-site releases (K-H 2005c). Assuming that the low organic carbon contents of soils are similar to the generally low carbon soils at RFETS, nickel mobility is expected to be high to very high in UHSU groundwater. A portion of the nickel observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers (Boylan 2004a, 2004b).
Vanadium (Metal)	Surface Soil Vanadium is a compound that occurs in nature as a white-to-gray metal, and is often found as crystals. Pure vanadium has no smell. It usually combines with other elements such as oxygen, sodium, sulfur, or chloride. Vanadium and vanadium compounds can be found in the earth's crust and in rocks, some iron ores, and crude petroleum deposits. Vanadium is mostly combined with other metals to make special alloys. Small amounts of vanadium are used in making rubber,	Vanadium is stable and does not degrade in the environment. Thus it will persist indefinitely.	Vanadium is defined as a surface soil AOI in the nature and extent of soil contamination (Section 3.0). It is also defined as a COC for surface soil/sediment in the No Name Gulch Drainage EU. Vanadium is identified as an AOI in surface soil only. Sampling

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	plastics, ceramics, and other chemicals. Studies suggest that vanadium is fairly immobile in soil. A field study conducted over 30 months examined movement of vanadium added to the top 7.5 centimeters of coastal plain soil and its availability to bean plants. Less than 3 percent of applied metal moved down the soil profile. Extractable concentrations decreased over the first 18 months of the study and remained constant thereafter (Martin and Kaplan 1998). In fresh water, vanadium is transported in solution and as particulate transport (dominant process) (WHO 1988).		locations above the WRW PRG are localized in the areas of the historical PU&D Yard and historical Oil Burn Pit No. 1. Pit construction in former Building 707 generally used plutonium, uranium, beryllium, aluminum, and stainless steel. However, in some instances more exotic materials such as vanadium were used. The metallurgical operations in former Building 865 involved the development of alloys in the 1970s, which included the use of vanadium. Vanadium was also identified as associated with metalworking in former Building 444. In former Building 447 materials handled included vanadium compounds (K-H 2005e).
PAHs: Benzo(a)anthracene Benzo(a)pyrene (SVOCs)	<u>Surface Soil / Subsurface Soil / Sediment</u> PAHs in soil can volatilize, undergo abiotic degradation (photolysis and oxidation), biodegrade, or accumulate in plants. PAHs in soil can also enter groundwater and be transported within an aquifer. The K_{oc} of a chemical is an indication of its potential to bind to organic carbon in soil and sediment. High-molecular-weight PAHs (such as the AOIs in RFETS surface soils) have K_{oc} values in the range of 105 to 106, which indicates stronger tendencies to adsorb to organic carbon (Southworth 1979). PAHs may volatilize from surface soil to air, although volatilization was not an important loss mechanism for benzo(b)fluoranthene, dibenz(a,h)anthracene, or benzo(a)pyrene (Park et al. 1990). Ratios of PAH concentrations in vegetation to those in soil have been reported to range from 0.001 to 0.18 for total PAHs and from 0.002 to 0.33 for benzo(a)pyrene (Edwards 1983).	Microbial metabolism is the major process for degradation of PAHs in soil environments. Photolysis, hydrolysis, and oxidation are generally unimportant processes for the degradation of PAHs in soils. Although differences exist in estimates of biodegradation half-lifes by different investigators, their results suggest the biodegradation half-lives of PAHs with more than three rings will be considerably longer (>20 days to hundreds of days) than PAHs with three or fewer rings.	Dibenz(a,h)anthracene is defined as a surface soil AOI in the nature and extent of soil contamination (Section 3.0). Dibenz(a,h)anthracene is detected as an AOI in surface soil only. Results above the WRW PRG are observed throughout the former IA (most notably in the former 700 Area and the former Oil Burn Pit No. 1 area) and in the Original Landfill area. Benzo(a)pyrene is defined as a surface soil AOI in the nature and extent of soil contamination (Section 3.0) and a sediment AOI in the nature and extent of soil contamination (Section 5.0). It is also defined as a COC for surface soil/sediment in the IA, Upper Woman Drainage, and Upper Walnut Drainage EUs. Benzo(a)pyrene is present in surface soil throughout the IA OU (most notably in the former 400 and 800 areas), along the hillside north of the SID (in the former Building 881 Hillside area), and in the areas of the Present Landfill and Original Landfill. Benzo(a)pyrene exist in sediment across the former IA and in the South Walnut Creek drainage with sediment sample results above the benzo(a)pyrene WRW PRG (378.9 µg/kg). For the specific PAH AOIs identified in RFETS soils, all having more than three rings, longer biodegradation half-lives (e.g., greater than 20 days to hundreds of days) are expected (ATSDR 1995).
PCBs (Aroclors): PCB-1254 PCB-1260	<u>Surface Soil / Subsurface Soil</u> PCBs are strongly sorbed to soils as a result of low water solubility and high K_{ow} (6.5 and 6.8 for PCB-1254 and PCB-1260, respectively), and will not leach extensively (Sklarew and Girvin 1987). The tendency to leach will be greatest among the least chlorinated congeners and is expected to be greatest in soil with low organic carbon (Sklarew and Girvin 1987). Leaching of PCBs in most soils should not be extensive, particularly for the more highly chlorinated congeners (e.g., PCB-1254 and PCB-1260).	PCBs tend to persist in the environment with half-lives on the order of months to years (Gan and Berthouex 1994; Kohl and Rice 1998). There is no abiotic process known that significantly degrades PCBs in soil and sediment. Biodegradation has been shown to occur under both aerobic and anaerobic conditions and is a major degradation process for PCBs in soil and sediment. Aerobic biodegradation of PCBs in the environment occurs mainly in soils	PCB-1254 and PCB-1260 are both defined as surface soil AOIs in the nature and extent of soil contamination (Section 3.0). Both PCBs that are surface soil AOIs, PCB-1254 and PCB-1260, are detected above the WRW PRG in localized areas in the former IA (most notably at the former Building 771 area, east of the former SEPs, as well as near former Buildings 444, 883, and 964) and in the BZ OU (at the Original Landfill and former PU&D Yard areas). PCB-1254 is an AOI in surface soil only. PCB-1260 is an AOI in surface and subsurface soil.

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		and surficial sediments. PCB congeners with five or more chlorines (major components in PCB-1254 and PCB-1260) are not readily degraded and considered to be persistent (EPA 1979). PCBs are slowly biodegraded in anaerobic environments by reductive dechlorination resulting in the formation of less toxic congeners, which are aerobically biodegradable (EPA 1983).	PCB-1260 is detected in subsurface soil above the WRW PRG in a localized portion of the former 700 Area, specifically in the area of former Building 776. PCBs are relatively nonsoluble and nonvolatile. In general, the higher the degree of chlorination, the less volatile the PCB congener. At RFETS, the Aroclors with more highly chlorinated congeners were largely used (e.g., PCB-1254 and PCB-1260). Therefore, volatilization is not likely to be significant.
2,3,7,8-TCDD TEQ (Dioxins/Furans)	Surface Soil "2,3,7,8-TCDD TEQ represents the total toxicity equivalency for the combined toxicity resulting from a mixture of dioxin-like compounds" (Kearney et al. 1971). Generally, dioxins are characterized by low vapor pressure, low aqueous solubility, and high hydrophobicity, suggesting that these compounds strongly adsorb to soil and that their vertical mobility in the terrestrial environment is low (Eduljee 1987). Because dioxins strongly adhere to soil and exhibit low solubility in water, leaching of dioxins would be unlikely if water were the only transporting medium. Instead, wind and water erosion can cause the mixing and transport of dioxin-contaminated soil. As a result of erosion, surface soil contaminated with dioxins is either blown away by wind or washed via surface water runoff into rivers, lakes, and streams, with burial in the sediments being the predominant fate of dioxins sorbed to soil (Hutzinger et al. 1985).	Degradation of dioxins in soil is relatively slow (e.g., half-lives on the order of 20 years). Measurements of 2,3,7,8-TCDD TEQ residues after 20, 40, 80, 160, and 350 days of incubation at 28 °C in foil-sealed beakers indicated a relatively slow degradation process in both soils. After 350 days, 56 percent of the initially applied 2,3,7,8-TCDD TEQ was recovered from the sandy soil, while 63 percent was recovered from the silty clay loam for all concentrations (Kearney et al. 1971).	At RFETS, the earlier soil samples identified with dioxin concentrations that exceeded the WRW PRG were located at the former incinerator, but after demolition are now buried approximately 20 ft below grade. Due to the very low mobility of dioxins, transport to other environmental media is not considered likely.
Fluoride (Water Quality Parameters)	Groundwater Fluoride is usually less abundant in natural waters than chloride. Fluoride concentrations in groundwater exist both as the uncomplexed fluoride ion (F^-), and in complexes with metals. Fluoride forms particularly strong complexes with dissolved aluminum (e.g., AlF_2^+ and AlF_3^0). These aluminum-fluoride complex ions may predominate in acid solution at pH values <5.5, while the fluoride anion dominates at neutral and alkaline pHs. The concentration of fluoride in groundwater may also be limited by the solubility of fluorite, or by coprecipitation with calcite, but no evidence of this was found in the literature. Most fluoride compounds are very soluble in water. Fluorite solubility has been shown to control fluoride concentrations in geothermal waters (Nordstrom and Jenne 1977). Fluorite is a widespread mineral in nature and it is known to precipitate in recent estuarine sediments (Krumgalz et al. 1990). The strength of fluoride sorption by soils is unclear. ATSDR (2003a, p. 215) states that "fluoride is strongly retained by soil leaching that removes only a small amount of fluorides from soils." However, Rai et al. (1984, p. 12-1) states that "fluoride is not strongly adsorbed by soils," but the maximum sorption takes place at pH 4 to 6.5. If the soil does not contain the mineral fluorite, then the aqueous fluoride concentration is still likely to be controlled by sorption-desorption reactions (Rai et al. 1984). The degree of sorption correlates with the Al oxide content of the soil. Maximum adsorption takes place at various pH values, which depend on the adsorbent. The greatest sorption of fluoride on goethite takes place at pH 3 to 4, while on montmorillonite clay the maximum is between pH 6 and 7 (Rai et al. 1984). The $Al(OH)_3$ mineral gibbsite has a high adsorption capacity for fluoride. The halide anions (chloride, fluoride, and iodide) share similar chemistry and may be assumed to have similar sorption behavior. In transport numerical modeling, chloride is usually treated as a conservative solute that does not undergo significant retardation. Thus chloride is assumed to have a K_d of 0.	Fluoride is quite persistent in the environment because it forms strong complexes with aluminum and its water chemistry is regulated by aluminum concentration and pH (ATSDR 2003a).	Fluoride is defined as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). Three small contiguous, mappable plumes of fluoride are observed in UHSU groundwater at locations south of former Building 707 area, at the historical OU 1, and south of historical SEP area (refer to Figure 4.21 in the nature and extent of groundwater contamination) though the data are at least 8 to 10 years old. New sources of residual fluoride are not expected at these locations and, based on the quasi-steady-state conditions found for other constituent plumes at the site, fluoride concentrations in groundwater should be currently stable or decreasing and thus are not considered a threat to surface water quality. An extensive literature search and summary of K_d values for sorption of iodide on smectite clays was performed by Lindberg and Henry (2000). Smectites are common clays with large CECs. The median K_d for iodide sorption on smectites was only 1.0 mL/g based on 41 measurements in the pH range 7 to 8.5 (similar to RFETS environment). This information implies high mobility for both iodide and fluoride in groundwater at RFETS.
Nitrate/Nitrite (as N) (Water Quality Parameters)	Groundwater / Surface Water Naturally occurring nitrates in soil, surface water, and groundwater result from the decomposition by microorganisms of organic nitrogenous material such as the protein in plants, animals, and animal excreta. The natural occurrence of nitrates and nitrites in the environment is a consequence of the nitrogen cycle. However, nitrites are generally only found in very low concentrations because most environments are oxic which favors the nitrate anion. Most nitrate-bearing salts and minerals are highly soluble in water. Therefore, nitrate concentrations in waters are generally not limited by solubility constraints (Freeze and Cherry	In groundwater at near-neutral pH, like at RFETS, nitrate is not typically attenuated and thus persists indefinitely unless there is a reduction in redox potential so that denitrification can occur (Canter 1997).	Nitrate/Nitrite is defined as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). Contiguous, mappable plumes of nitrate/nitrite (as N) exist in the North Walnut Creek drainage in the historical SEP area, former 700 Area Northeast Plume area, and above Pond A-1. In the

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Contaminant Behavior and Persistence of Analytes of Interest in the Environment

Analyte (Analyte Group)	General Behavior Characteristics for Affected Media at RFETS	Persistence in the Environment	Rocky Flats-Specific Characteristics
	1979). From a transport perspective, nitrate is considered a conservative constituent, like chloride, because it is not readily sorbed (i.e., retarded) and generally migrates at the same rate as groundwater flow with little attenuation (Freeze and Cherry 1979; Fetter 1988). As a result, nitrate in soil is expected to be highly soluble and nitrate in groundwater should have very high mobility. However, in heavily vegetated areas, nitrate is taken up by plants which effectively retards its transport in shallow groundwater (Drever 1988; Hem 1985).		South Walnut Creek drainage, contiguous, mappable plumes of nitrate/nitrite (as N) exist, at the historical 903 Pad and historical OU 1 areas (refer to Figure 4.22 in the nature and extent of groundwater contamination). Because RFETS UHSU groundwater is generally oxic (that is, well oxygenated) and nitrite is easily oxidized to nitrate, nitrate is likely the predominant dissolved nitrogen species in site waters. However, local areas of detectable nitrite may occur where the groundwater is anoxic and reducing conditions exist. It is noted that the applicable nitrate standard until December 31, 2009, is 100 mg/L, at which time the temporary modification, which applies to segment 5 only, expires and the 10-mg/L standard goes into effect.
Sulfate (Water Quality Parameters)	<u>Groundwater</u> Sulfur occurs in several oxidation states in natural groundwater systems ranging from S^{-2} to S^{+6}. Its chemical behavior is therefore strongly related to the redox properties of groundwater. The most highly oxidized form of sulfur is sulfate (SO_4^{-2}), which is the most likely aqueous sulfur species at RFETS given the highly oxygenated groundwater in the UHSU. The reduced ion, sulfide (S^{-2}), forms sulfide minerals of low solubility with most metals. Because iron is common and widely distributed, the iron sulfides have a substantial influence on sulfur geochemistry in highly reduced groundwater systems. Sulfate is a ubiquitous and important anion in natural waters. In natural waters above pH 4, it is the predominant form of aqueous sulfur (+6). Sulfate is itself a complex ion, but it displays a strong tendency to form other complex aqueous species. It forms ion pairs with many cations, such as $CaSO_4^0$, $MgSO_4^0$, $NaSO_4^-$, $FeSO_4^0$, and $AlSO_4^+$. As sulfate concentrations increase, an increasing proportion of the sulfate in solution forms ion pairs. Sulfate is very stable in oxidizing waters, although sulfate-reducing bacteria can reduce it to sulfide. However, if dissolved oxygen is present, aqueous sulfide species are not stable and are readily oxidized to sulfate. In groundwater at near-neutral pH, like at RFETS, sulfate is not typically attenuated. However, at low pH sorption becomes an important attenuation mechanism for sulfate (Rai et al. 1984). The greatest sulfate sorption is at low pH because of the positive charge on clay mineral surfaces, iron oxyhydroxides, and aluminum oxides. Chloride, nitrate and arsenite have little effect on sulfate sorption by soils under these conditions. However, fluoride, selenate, selenite, arsenate, and phosphate ions do compete with sulfate for sorption sites (Chao 1964) at low pH. Sulfate solubility-controlling solids are important in restricted environments as acid mine drainages or mine tailings impoundments. Gypsum ($CaSO_4 \cdot 2H_2O$) has typically been identified as a solubility control under oxidizing and alkaline conditions in poorly drained arid soils (Rai et al. 1984). Gypsum may also become a solubility control at sites with elevated sulfate concentrations in groundwater.	In groundwater at near-neutral pH, like at RFETS, sulfate is not typically attenuated and thus persists indefinitely unless there is a reduction in pH (Rai et al. 1984).	Sulfate is defined as a groundwater AOI in the nature and extent of groundwater contamination (Section 4.0). Contiguous, mappable plumes of sulfate in UHSU groundwater are found downgradient of the East Landfill Pond dam, the historical SEPs, and between Pond B-4 and B-5 (refer to Figure 4.23 in the nature and extent of groundwater contamination). Sulfate's chemical behavior is strongly related to the redox properties of groundwater. The most highly oxidized form of sulfur is sulfate (SO_4^{-2}), which is the most likely aqueous sulfur species at RFETS given the highly oxygenated groundwater in the UHSU. Sulfate is a ubiquitous and important anion in natural waters. In natural waters above pH 4, it is the predominant form of aqueous sulfur (+6).

Table 10
Summary of EU Characteristics

EU	Number of Acres	Topography	Predominant Vegetation Type	Number of PMJM Habitat Patchesa	Number of Historical IHSSs/PACs and UBCs[a]	Topographic and Hydrologic Location Relative to the IA
West Area	468	Upland	Xeric tallgrass prairie	3	1	Upgradient
Rock Creek Drainage	735	Drainage	Mesic mixed grassland and xeric tallgrass prairie	10	0	Upgradient
Inter-Drainage	596	Upland	Xeric tallgrass prairie	3	7	Upgradient
No Name Gulch Drainage	425	Drainage	Mesic mixed grassland, xeric tallgrass prairie, and disturbed reclaimed areas	2	21	Upgradient
Upper Walnut Drainage	403	Drainage	Mesic mixed and reclaimed grassland	5	25	Downgradient
Lower Walnut Drainage	390	Drainage	Mesic mixed grassland	3	1	Downgradient
Wind Blown Area	715	Upland	Mesic mixed grassland and xeric tallgrass prairie	1	46	Downgradient
Upper Woman Drainage	524	Drainage	Mesic mixed grassland and xeric tallgrass prairie	3	23	Crossgradient
Lower Woman Drainage	448	Drainage	Reclaimed and mesic mixed grasslands	7	6	Downgradient
Southwest Buffer Zone Area	476	Upland	Xeric tallgrass prairie and mesic mixed grasslands	3	1	Upgradient
Southeast Buffer Zone Area	579	Upland	Reclaimed and mesic mixed grasslands	3	1	Upgradient
Industrial Area	428	Upland	Disturbed	0	285	N/A

a Some IHSSs and PACs extend into more than one EU. Where this is the case, they are counted in each of the EUs in which they occur.
IHSS = Individual Hazardous Substance Site
PAC = Potential Area of Concern
UBC = Under Building Contamination

Table 11
Summary of Human Health COCs

Medium	COC	Exposure Unit[a]									
		No Name Gulch Drainage (Volume 6)		Upper Walnut Drainage (Volume 7)		Wind Blown Area (Volume 9)		Upper Woman Drainage (Volume 10)		Industrial Area (Volume 14)	
		Range[c]	Mean	Range[c]	Mean	Range[c]	Mean	Range[c]	Mean	Range[c]	Mean
Surface Soil/Surface Sediment[b]	**Inorganics**										
	Arsenic	-		-		1 - 11	5.2	-		0.440 - 56.2	4.34
	Vanadium	7.4 - 5,300	80.5	-		-		-		-	
	Organics										
	Benzo(a)pyrene	-		48 - 1,300	345	-		37 - 43,000	702	23 - 3,200	383
	2,3,7,8-TCDD TEQ	-		-		-		4.87E-08 - 0.0739	0.011	-	
	Radionuclides										
	Plutonium-239/240	-		-		-0.00292 - 49	9.19	-		-	

[a] No COCs were identified for any of the other EUs that are not listed here.

[b] No COCs were identified for any other media.

[c] Range of detected concentrations.

Table 12

Radionuclide Exposure Factors Used in Surface Soil/Surface Sediment Intake Calculations for the WRW

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source
Ingestion				
RI = Cs x IRwss x EFwss x EDw x CF_1				
Radionuclide Intake	RI	radionuclide-specific	pCi	calculated
Radionuclide concentration in soil	Cs	radionuclide-specific	pCi/g	Tier 1 or 2 EPC
Ingestion Rate of soil/sediment	IRwss	100	mg/day	EPA et al. 2002
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Conversion factor	CF_1	0.001	g/mg	1 g = 1000 mg
Outdoor Inhalation of Suspended Particulates				
RI = Cs x IRawss x EFwss x EDw x ETwss x ETFo x MLF x CF_2				
Radionuclide Intake	RI	radionuclide-specific	pCi	calculated
Radionuclide concentration in soil	Cs	radionuclide-specific	pCi/g	Tier 1 or 2 EPC
Inhalation Rate	Irawss	1.3	m^3/hr	EPA et al. 2002
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Exposure Time	ETwss	8	hr/day	EPA et al. 2002
Exposure Time Fraction, outdoor	ETFo	0.5	--	EPA et al. 2002
Mass loading, (PM 10) for inhalation[a]	MLF	6.70E-08	kg/m^3	EPA et al. 2002
Conversion factor	CF_2	1000	g/kg	1000 g = 1 kg
Indoor Inhalation of Suspended Particulates				
RI = Cs x IRawss x EFwss x EDw x ETwss x ETFi x DFi x MLF x CF_2				
Radionuclide Intake	RI	radionuclide-specific	pCi	calculated
Chemical concentration in soil	Cs	radionuclide-specific	pCi/g	Tier 1 or 2 EPC
Inhalation Rate	Irawss	1.3	m^3/hr	EPA et al. 2002
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Exposure Time	ETwss	8	hr/day	EPA et al. 2002
Exposure Time Fraction, indoor	ETFi	0.5	--	EPA et al. 2002
Dilution Factor, indoor inhalation	DFi	0.7	--	EPA et al. 2002
Mass Loading, (PM 10) for inhalation	MLF	6.70E-08	kg/m^3	EPA et al. 2002[a]
Conversion factor	CF_2	1000	g/kg	1000 g = 1 kg

Table 12

Radionuclide Exposure Factors Used in Surface Soil/Surface Sediment Intake Calculations for the WRW

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source
Outdoor External Radiation Exposure				
RE = Cs x Te_A x Te_Do x EDw x ACF x GSFo				
Radionuclide Exposure	RE	radionuclide-specific	(pCi-yr)/g	calculated
Radionuclide concentration in soil	Cs	radionuclide-specific	pCi/g	Tier 1 or 2 EPC
Gamma exposure factor (annual) surface soil	Te_A	0.630	--	EFwss / 365 day/yr
Gamma exposure factor (daily) outdoor	Te_Do	0.167	--	ETwss x ETFo / 24 hr/day
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Area Correction Factor	ACF	0.9	--	EPA et al. 2002
Gamma Shielding Factor (1-SE) outdoor	GSFo	1	--	EPA et al. 2002
Indoor External Radiation Exposure				
RE = Cs x Te_A x Te_Di x EDw x ACF x GSFi				
Radionuclide Exposure	RE	radionuclide-specific	(pCi-yr)/g	calculated
Radionuclide concentration in soil	Cs	radionuclide-specific	pCi/g	EPC
Gamma exposure factor (annual) surface soil	Te_A	0.630	--	EFwss / 365 day/yr
Gamma exposure factor (daily) outdoor	Te_Di	0.167	--	ETwss x ETFi / 24 hr/day
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Area Correction Factor	ACF	0.9	--	EPA et al. 2002
Gamma Shielding Factor (1-SE) outdoor	GSFi	0.4	--	EPA et al. 2002

[a] The mass loading value is the 95th percentile of the estimated mass loading distribution estimated in the RSALs Task 3 Report (EPA et al. 2002).

Table 13

Radionuclide Exposure Factors Used in Surface Soil/Surface Sediment Intake Calculations for the WRV

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source
Ingestion				
RI = Cs x IRagevss_r x EFvss x (EDav + EDcv) x CF_1				
Radionuclide Intake	RI	chemical-specific	pCi	calculated
Radionuclide concentration in soil	Cs	chemical-specific	pCi/g	Tier 1 or 2 EPC
Age-adjusted Soil Ingestion Rate for radionuclides	IRagevss_r	60	mg/day	EPA et al. 2002
Exposure Frequency	EFvss	100	days/year	EPA et al. 2002[a]
Exposure Duration - adult	EDav	24	yr	EPA et al. 2002
Exposure Duration - child	EDcv	6	yr	EPA et al. 2002
Conversion factor	CF_1	0.001	g/mg	1 g = 1000 mg
Outdoor Inhalation of Suspended Particulates				
RI = Cs x IRa_agevss_r x EFvss x (EDav + EDcv) x ETvss x MLF x CF_2				
Radionuclide Intake	RI	chemical-specific	pCi	calculated
Radionuclide concentration in soil	Cs	chemical-specific	pCi/g	EPC
Age-averaged Inhalation Rate for radionuclides	IRa_agevss_r	2.2	m^3/hr	Tier 1 or 2 EPC
Exposure Frequency	EFvss	100	days/year	EPA et al. 2002[a]
Exposure Duration - adult	EDav	24	yr	EPA et al. 2002
Exposure Duration - child	EDcv	6	yr	EPA et al. 2002
Exposure Time	ETvss	2.5	hr/day	EPA et al. 2002[b]
Mass loading, (PM 10) for inhalation	MLF	6.70E-08	kg/m^3	EPA et al. 2002[c]
Conversion factor	CF_2	1000	g/kg	1000 g = 1 kg
Outdoor External Radiation Exposure				
RE = Cs x Te_Av x Te_Dv x (EDav + EDcv) x ACF x GSFo				
Radionuclide Exposure	RE	chemical-specific	(pCi-yr)/g	calculated
Radionuclide concentration in soil	Cs	chemical-specific	pCi/g	EPC
Gamma exposure factor (annual) surface soil	Te_Av	0.274	--	EFv / 365 day/yr
Gamma exposure factor (daily) outdoor	Te_Dv	0.104	--	ETv / 24 hr/day
Exposure Duration - adult	EDav	24	yr	EPA et al. 2002
Exposure Duration - child	EDcv	6	yr	EPA et al. 2002
Area Correction Factor	ACF	0.9	--	EPA et al. 2002
Gamma Shielding Factor (1-SE) outdoor	GSFo	1	--	EPA et al. 2002

[a] Value is 95th percentile of visitation frequency for open space users (Jefferson County 1996).

[b] Value is 50th percentile of time spent for open space users (Jefferson County 1996).

[c] The mass loading value is the 95th percentile of the estimated mass loading distribution estimated in the RSALs Task 3 Report (EPA et al. 2002).

Table 14

Chemical Exposure Factors Used in Surface Soil/Surface Sediment Intake Calculations for the WRW

Exposure Route/Exposure Factor	Abbreviation	Value	Unit	Source
Ingestion				
CI = (Cs x IRwss x EFwss x EDw x CF_3) / (BW x [ATc_wss or ATn_wss]b)				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical Concentration in Soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Ingestion Rate of Soil/Sediment	IRwss	100	mg/day	EPA et al. 2002
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Conversion Factor	CF_3	1.00E-06	kg/mg	1 kg = 1.0E6 mg
Adult Body Weight	BW	70	kg	EPA 1991
Averaging Time-Carcinogenic	ATc_wss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATnc_wss	6,826	day	calculated
Outdoor Inhalation of Suspended Particulates				
CI = (Cs x IRawss x EFwss x EDw x ETwss x ETFo x MLF) / (BW x [ATc_wss or ATn_wss]b)				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical Concentration in Soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Inhalation Rate	IRawss	1.3	m3/hr	EPA et al. 2002
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Exposure Time	ETwss	8	hr/day	EPA et al. 2002
Exposure Time Fraction, outdoor	ETFo	0.5	--	EPA et al. 2002
Mass Loading, (PM 10) for inhalationa	MLF	6.70E-08	kg/m3	EPA et al. 2002
Adult Body Weight	BW	70	kg	EPA 1991
Averaging Time-Carcinogenic	ATc_wss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATnc_wss	6,826	day	calculated
Indoor Inhalation of Suspended Particulates				
CI = (Cs x IRawss x EFwss x EDw x ETwss x ETFi x DFi x MLF) / (BW x [ATc_wss or ATn_wss]b)				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical Concentration in Soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Inhalation Rate	IRawss	1.3	m3/hr	EPA et al. 2002
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Exposure Time	ETwss	8	hr/day	EPA et al. 2002
Exposure Time Fraction, indoor	ETFi	0.5	--	EPA et al. 2002
Dilution Factor, indoor inhalation	DFi	0.7	--	EPA et al. 2002

Table 14

Chemical Exposure Factors Used in Surface Soil/Surface Sediment Intake Calculations for the WRW

Exposure Route/Exposure Factor	Abbreviation	Value	Unit	Source
Mass Loading, (PM 10) for inhalationa	MLF	6.70E-08	kg/m3	EPA et al. 2002
Adult Body Weight	BW	70	kg/m3	EPA 1991
Averaging Time-Carcinogenic	ATc_wss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATnc_wss	6,826	day	calculated
Dermal Contact				
CI = (Cs x SAw x AFw x EFwss x EDw x ABS x EVw x CF_3) / (BW x [Atc_wss or Atn_wss]b)				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical Concentration in Soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Skin Surface Areac	SAw	3300	cm2	EPA 2001
Skin-Soil Adherence Factor	AFw	0.117	mg/cm2-event	EPA 2001
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Conversion Factor	CF_3	1.00E-06	kg/mg	1 kg = 1.0E6 mg
Absorption Fraction	ABS	chemical-specific		EPA 2001c
Event Frequency	EVw	1	events/day	EPA 2001
Adult Body Weight	BW	70	kg	EPA 1991
Averaging Time-Carcinogenic	ATc_wss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATnc_wss	6,826	day	calculated

a The mass loading value is the 95th percentile of the estimated mass loading distribution estimated in the RSALs Task 3 Report (EPA et al. 2002).

b Carcinogenic or noncarcinogenic averaging times (Atc and Atnc, respectively) are used in equations, depending on whether carcinogenic or noncarcinogenic intakes are being calculated.

c The skin surface area value is the EPA default for commercial/industrial exposures and is the average of the 50th percentile for men and women > 18 years old wearing a short-sleeved shirt, long pants, and shoes. The value was recommended by CDPHE for use in the WRW PRGs.

Table 15

Chemical Exposure Factors Used in Surface Soil/Surface Sediment Intake Calculations for the WRV

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source
Ingestion				
CI = (Cs x IRagevss x EFvss x CF_3) / [Atc_vss or Atnc]a where, IRageav = ((IRvss x EDav) / BW) + ((IRcvss x EDcv) / BWc)				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical Concentration in Soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Age-Adjusted Soil Ingestion Rate for Chemicals	IRagevss	57	mg-yr/kg-day	calculated
Exposure Frequency	EFvss	100	days/year	EPA et al. 2002b
Exposure Duration - adult	EDav	24	yr	EPA et al. 2002
Exposure Duration - child	EDcv	6	yr	EPA et al. 2002
Conversion Factor	CF_3	1.00E-06	kg/mg	1 kg = 1.0E6 mg
Soil Ingestion Rate - adult	IRvss	50	mg/day	EPA et al. 2002
Soil Ingestion Rate - child	IRcvss	100	mg/day	EPA et al. 2002
Adult Body Weight	BW	70	kg	EPA 1991
Child Body Weight	BWc	15	kg	EPA 1991
Averaging Time-Carcinogenic	ATc_vss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATn_vss	8,760	day	calculated
Averaging Time-Noncarcinogenic (child)	ATn_c_vss	2,190	day	calculated
Averaging Time-Noncarcinogenic (child+adult)	ATnc	10,950	day	calculated
Outdoor Inhalation of Suspended Particulates				
CI = (Cs x IRa_agevss x EFvss x MLF) / [Atc_vss or Atnc]a where, IRa_agevss = (((Ira_vss x EDav) / BW) + ((IRa_cvss x EDcv) / BWc)) x ET				
Chemical Intake	NRI	chemical-specific	mg/kg-day	calculated
Chemical Concentration in Soil	Cs	chemical-specific	mg/kg	EPC
Age-averaged Inhalation Rate for Chemicals	IRa_agevss	3.7	m3-yr/kg-day	EPA et al. 2002b
Exposure Frequency	EFvss	100	days/year	EPA et al. 2002b
Mass loading, (PM 10) for inhalation	MLF	6.70E-08	kg/m3	EPA et al. 2002
Exposure Duration - adult	EDav	24	yr	EPA et al. 2002
Exposure Duration - child	EDcv	6	yr	EPA et al. 2002
Adult Body Weight	BW	70	kg	EPA 1991
Child Body Weight	BWc	15	kg	EPA 1991
Air Inhalation Rate - adult	IRavss	2.4	m3/hr	EPA et al. 2002
Air Inhalation Rate - child	IRa_cvss	1.6	m3/hr	EPA et al. 2002
Exposure Time	Etvss	2.5	hr/day	EPA et al. 2002b
Averaging Time-Carcinogenic	ATc_vss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATn_vss	8,760	day	calculated
Averaging Time-Noncarcinogenic (child)	ATn_c_vss	2,190	day	calculated
Averaging Time-Noncarcinogenic (child+adult)	ATnc	10,950	day	calculated

Table 15

Chemical Exposure Factors Used in Surface Soil/Surface Sediment Intake Calculations for the WRV

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source
Dermal Contact				
CI = (Cs x SFSagav x EFvss x ABS x EVv x CF_3) /[ATc_vss or ATnc]a where, SFSagav = ((SAav x AFav xEDav) / BW) + ((SAcv x AFcv x EDcv) / BWc)				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical concentration in soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Exposure Frequency	EFvss	100	days/year	EPA et al. 2002b
Exposure Duration - adult	EDav	24	yr	EPA et al. 2002
Exposure Duration - child	EDcv	6	yr	EPA et al. 2002
Adult skin-soil adherence factor	AFav	0.07	mg/cm2-event	EPA 2001bc
Child skin-soil adherence factor	AFcv	0.2	mg/cm2-event	EPA 2001bd
Adult skin surface area (exposed)	SAav	5700	cm2	EPA 2001be
Child skin surface area (exposed)	SAcv	2800	cm2	EPA 2001bf
Age-averaged surface area/adherence factor	SFSagav	361	mg-yr/kg-event	EPA 2001b
Absorption Fraction	ABS	chemical-specific	[--]	EPA 2001b
Event frequency	EVv	1	events/day	EPA 2001
Conversion Factor	CF_3	0.000001	kg/mg	1 kg = 1.0E6 mg
Adult Body Weight	Bw	70	kg	EPA 1991
Child Body Weight	BWc	15	kg	EPA 1991
Averaging Time-Carcinogenic	ATc_vss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATn_vss	8,760	day	calculated
Averaging Time-Noncarcinogenic (child)	ATn_c_vss	2,190	day	calculated
Averaging Time-Noncarcinogenic (child+adult)	ATnc	10,950	day	calculated

a Carcinogenic or noncarcinogenic averaging times (Atc and Atnc, respectively) are used in the equations, depending on whether carcinogenic or noncarcinogenic intakes are being calculated.

b Value is the 50th percentile of time spent for open space users (Jefferson County 1996).

c The adult skin-soil adherence factor is the EPA residential default and the 50th percentile for gardeners. This is the value recommended by CDPHE for use in the WRW PRGs.

d The child skin-soil adherence factor is the EPA residential default and the 95th percentile for children playing in wet soil. This is the value recommended by CDPHE for use in the open space user PRGs.

e The adult skin-surface area value is the EPA default for residential exposures and the average of the 50th percentile for males and females > 18 years old wearing short-sleeved shirts, shorts, and shoes. The value was recommended by CDPHE for use in the WRW PRGs.

f The child skin-surface area value is the EPA default for residential exposures and the average of the 50th percentiles for males and females from <1 to <6 years old wearing short-sleeved shirts, shorts, and no shoes. The value was recommended by CDPHE for use in the WRW PRGs.

Table 16
Toxicity Criteria

COC	Cancer Slope Factor for Nonradionuclide Chemicals[a]		Cancer Slope Factor for Nonradionuclides[a]	Inhalation Slope Factor (Risk/pCi)	External Slope Factor (Risk/yr/pCi/g)	Reference Doses for Noncarcinogens[b]	
	Oral/Ingestion Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Soil Ingestion Oral Slope Factor (Risk/pCi)			Oral RfD (mg/kg-day)	Inhalation RfD (mg/kg-day)
Inorganics							
Arsenic	1.50E+00	1.51E+01	N/A	N/A	N/A	3.00E-04	n/a
Vanadium	N/A	N/A	N/A	N/A	N/A	1.00E-03	n/a
Organics							
Benzo(a)pyrene	7.30E+00	3.10E+00	N/A	N/A	N/A	n/a	n/a
2,3,7,8-TCDD	1.50E+05	1.50E+05	N/A	N/A	N/A	n/a	n/a
Radionuclides							
Plutonium-239	N/A	N/A	2.76E-10	3.33E-08	2.00E-10	n/a	n/a
Plutonium-240	N/A	N/A	2.77E-10	3.33E-08	6.98E-11	n/a	n/a

N/A = Not applicable; the chemical does not fall within this group.
n/a = Toxicity criterion for evaluating noncancer health effects of this chemical is not available.
mg/kg = milligrams per kilogram.
pCi = Picocuries.
pCi/g = Picocuries per gram.
RfD = Reference dose.

[a] Because the exposure estimate is multiplied by the slope factor to arrive at a risk, a larger slope factor indicates a greater carcinogenic potency.

[b] The exposure estimate is divided by the reference dose; therefore, the smaller the reference dose, the greater the toxicity.

Table 17

Summary of Human Health Risk Estimates[a]

EU	Surface Soil/Surface Sediment COC	WRW						WRV					
		Excess Lifetime Cancer Risk		Noncancer Hazard Quotient		Annual Dose Rate[b]		Excess Lifetime Cancer Risk		Noncancer Hazard Quotient		Annual Dose Rate[b]	
		Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2
No Name Gulch Drainage (Volume 6)	Vanadium	NC	NC	0.1	0.05	N/A	N/A	NC	NC	0.01	0.03	N/A	N/A
Upper Walnut Drainage (Volume 7)	Benzo(a)pyrene	1.00E-06	1.00E-06	NC	NC	N/A	N/A	2.00E-06	1.00E-06	NC	NC	N/A	N/A
Wind Blown Area (Volume 9)	Arsenic	2.00E-06	2.00E-06	0.02	0.01	N/A	N/A	2.00E-06	1.00E-06	0.01	0.008	N/A	N/A
	Plutonium-239/240	2.00E-06	9.00E-07	NC	NC	3.00E-01	2.00E-01	1.00E-06	6.00E-07	NC	NC	2E-01c	1E-01c
Upper Woman Drainage (Volume 10)	2,3,7,8-TCDD TEQ	2.00E-06	2.00E-06	NC	NC	N/A	N/A	2.00E-06	2.00E-06	NC	NC	N/A	N/A
	Benzo(a)pyrene	6.00E-06	2.00E-06	NC	NC	N/A	N/A	7.00E-06	2.00E-06	NC	NC	N/A	N/A
Industrial Area (Volume 14)	Arsenic	2.00E-06	2.00E-06	0.01	0.02	N/A	N/A	2.00E-06	2.00E-06	0.01	0.009	N/A	N/A
	Benzo(a)pyrene	1.00E-06	2.00E-06	NC	NC	N/A	N/A	1.00E-06	2.00E-06	NC	NC	N/A	N/A

TEQ = Toxicity equivalence.

TCDD = Tetrachlorodibenzo-p-dioxin.

NC = Not calculated. Appropriate toxicity criteria are not available.

N/A = This health effect is not applicable for the chemical.

COC = Contaminant of concern.

a Includes only EUs and media for which COCs have been identified.

b Annual dose rate is in millirems (mrem) per year.

c Child annual dose rate. Adult annual dose rate: Tier 1 = 7E-02; Tier 2 = 4E-02.

Table 18
Summary of Ecological Risk Conclusions

EUs	Non-PMJM Receptor	PMJM Receptor	Burrowing Receptor
West Area EU (Volume 3)	No ECOPCs. No risk is predicted.	PMJM habitat evaluated with RCEU and IDEU.	No ECOPCs. No risk is predicted.
Rock Creek Drainage EU (Volume 4)	No ECOPCs. No risk is predicted.	Risk from all ECOPCs is low.	No ECOPCs. No risk is predicted.
Inter-Drainage EU (Volume 5)	Risk from all ECOPCs is low to moderate.	No ECOPCs. No risk is predicted.	No ECOPCs. No risk is predicted.
No Name Gulch EU (Volume 6)	Risk from all ECOPCs is low to moderate.	Risk from all ECOPCs is low.	No ECOPCs. No risk is predicted.
Upper Walnut Creek Drainage EU (Volume 7)	Risk from all ECOPCs is low to moderate.	Risk from all ECOPCs is low.	No ECOPCs. No risk is predicted.
Lower Walnut Creek Drainage (Volume 8)	Risk is low from the ECOPC.	No ECOPCs. No risk is predicted.	No ECOPCs. No risk is predicted.
Wind Blown Area EU (Volume 9)	Risk from all ECOPCs is low.	PMJM habitat evaluated with UWNEU and LWOEU	No ECOPCs. No risk is predicted.
Upper Woman Creek EU (Volume 10)	Risk from all ECOPCs is low to moderate.	Risk from all ECOPCs is low.	No ECOPCs. No risk is predicted.
Lower Woman Creek EU (Volume 11)	Risk from all ECOPCs is low.	Risk from all ECOPCs is low.	No ECOPCs. No risk is predicted.
Southwest Buffer Zone Area EU (Volume 12)	No ECOPCs. No risk is predicted.	No ECOPCs. No risk is predicted.	No ECOPCs. No risk is predicted.
Southeast Buffer Zone EU Area (Volume 13)	No ECOPCs. No risk is predicted.	PMJM habitat evaluated with LWOEU and SWEU.	No ECOPCs. No risk is predicted.
Industrial Area Exposure Unit (Volume 14)	Risk from all ECOPCs is low to moderate.	PMJM habitat evaluated with UWNEU.	No ECOPCs. No risk is predicted.
Sitewide EU (Volume 15A)	Risk from all ECOPCs is low.	Not applicable.	Not applicable.
AEUs	**Surface Water**	**Sediment**	
Sitewide Aquatic ERA (Volume 15B)			
No Name Gulch AEU	Risk from all ECOPCs is low to moderate.	Risk from all ECOPCs is low.	
McKay Ditch AEU	Risk from all ECOPCs is low to moderate.	Risk from all ECOPCs is low.	
Rock Creek AEU	No ECOPCs. No risk is predicted.	No ECOPCs. No risk is predicted.	
Southeast AEU	No ECOPCs. No risk is predicted.	No ECOPCs. No risk is predicted.	
North Walnut AEU	Risk from all ECOPCs is low to moderate.	Risk from all ECOPCs is low to moderate.	
South Walnut AEU	Risk from all ECOPCs is low to moderate.	Risk from all ECOPCs is low to moderate.	
Woman Creek AEU	Risk from all ECOPCs is low.	Risk from all ECOPCs is low.	

Note: the level of uncertainty associated with the risk conclusions may range from low to high. The specific uncertainties for each EU and AEU are presented in Volumes 3-15 of Appendix A of the RI/FS Report

Table 19
Summary of Historical Individual Hazardous Substance Sites, Potential Areas of Concern, and Potential Incidents of Concern in the Peripheral Operable Unit

Historical Designation	Description	Investigation Results	No Further Action Determination
IHSS 142.12 (PAC NE 142.12)	Flume Pond (downstream of terminal ponds, known as Pond A-5)	Pond A-5 is located immediately west and upstream of Indiana St. It is a flowthrough pond that generally retains several thousand gallons of Walnut Creek drainage water. This drainage received RFETS discharges throughout RFETS history. Characterization sample concentrations do not exceed the criteria in the CDPHE Conservative Risk-Based Screen, allowing unlimited use and unrestricted exposure. Surface sediment characterization sample concentrations do not exceed ecological screening levels (ESLs) and present a low risk to aquatic populations.	Data Summary Report dated 10/27/05 (AR# BZ-A-0000899) Approved 10/18/05 (AR# BZ A-000933)
IHSS 167.1 (PAC NE 167.1)	Landfill North Area Spray Field	Water from the Present Landfill (IHSS 114; PAC NW 114) leachate and surface runoff was collected in the east and west retention ponds. Spray evaporation used to prevent release of water from the ponds. IHSS 167.1 received spray between 1974 and 1981. Footing drain water collected from Buildings 771/774 was also sprinkled in this area. The HHRA results showed no adverse noncancer health effects and negligible cancer risk. The ERA showed negligible risks to the small mammal receptor group. Refer to the Final Phase I RFI/RI Report, Walnut Creek Priority Drainage, Operable Unit 6, Volume III, February, 1996. (AR# OU06-A-000455).	1997 Update to Historical Release Report (HRR) (AR# SW-A-002435) Approved 7/9/99 (AR# SW-A-004157)
IHSS 168 (PAC 000-168)	West Spray Field	Water from the SEP (IHSS 101; PAC 000-101) Ponds 207B North and 207B Center was spray-evaporated in IHSS 168 between 1982 and 1985. Characterization sample concentrations do not exceed the criteria in the CDPHE Conservative Risk-Based Screen, allowing unlimited use and unrestricted exposure. The screening-level ERA showed no significant adverse ecological effects. Refer to the OU 11 Final Combined Phases RFI/RI Report, June, 1995. (AR# OU11-A-000109).	OU 11 CAD/ROD dated September 1995 (AR# OU11-A-000184)
IHSS 195 (PAC NW 195)	Nickel Carbonyl Disposal	The contents of cylinders of nickel carbonyl were disposed in 1971 by placing them in a dry well and then venting them with small arms fire. Nickel carbonyl is highly flammable and reactive (small arms fire will ignite it) and evaporates rapidly. Two emptied cylinders could not be removed from the drywell and were buried. This disposal method resulted in oxidation of nickel carbonyl, leaving very low concentrations of insoluble nickel oxide. Model analysis demonstrates that an exposure pathway for nickel oxide does not exist. This area is not a source of nickel carbonyl and was determined to not present any unacceptable risk to human health or the environment. Refer to the Final No Further Action Justification Document, OU16, Low-Priority Sites, October, 1992 (AR# OU16-A-000015).	OU 16 CAD/ROD dated August 1994 (AR# OU16-A-000164)

Table 19
Summary of Historical Individual Hazardous Substance Sites, Potential Areas of Concern, and Potential Incidents of Concern in the Peripheral Operable Unit

Historical Designation	Description	Investigation Results	No Further Action Determination
IHSS 209 (PAC SE 209)	Surface Disturbance Southeast of Building 881	This area was formerly a gravel borrow pit used in 1955 for construction activities. An area encompassing this IHSS and a surface disturbance 1,500 ft west of IHSS 209 were investigated to determine whether they may have been used as a disposal area. Characterization sample concentrations did not exceed the background mean plus two standard deviations criteria in the CDPHE Conservative Risk-Based Screen, with the possible exception of mercury in one surface soil sample, and the areas were excluded from further human health risk evaluation. Also, the ERA for the Woman Creek Watershed did not indicate that IHSS 209 was a source area. Refer to the Final Phase I RFI/RI Report, Woman Creek Priority Drainage, Operable Unit 5, April, 1996 (AR#OU05-A-000594).	1997 Update to HRR (AR# SW-A-002435) Approved 7/9/99 (AR# SW-A-004157)
PAC 000-501	Roadway Spraying	Waste oil, brine solution, and footing drain water were occasionally sprayed on unpaved roads in the BZ for dust suppression. Last spraying was in 1983. It is improbable that those contaminants from waste oil/brine would still be present. Refer to the letter, dated December 23, 1992, from M. Hestmark, EPA, to R. Schassburger, DOE (AR#OU2A-000672).	1992 HRR (AR# SW-A-000378 and -000379) Approved 2/14/02 (AR# SW-A-004766)
PAC 100-604	T130 Complex Sewer Line Leaks	Leaking sanitary sewer lines from Office Trailers (subsequently repaired) were determined not likely to contain any impacting contamination. Refer to the letter, dated December 23, 1992, from M. Hestmark, EPA, to R. Schassburger, DOE (AR# OU2A-000672).	1992 HRR (AR# SW-A-000378 and -000379) Approved 2/14/02 (AR# SW-A-004766)
PAC NE 1400	Tear Gas Powder Release	Five pounds of CS tear gas powder spilled on the roadway was hosed down by RFETS Fire Department personnel. The cleanup action was considered sufficient for this release. Refer to the letter, dated December 23, 1992, from M. Hestmark, EPA, to R. Schassburger, DOE (AR# OU2A-000672).	1992 HRR (AR# SW-A-000378 and -000379) Approved 2/14/02 (AR# SW-A-004766)
PAC NE 1403	Gasoline Spill – Building 920 Guard Post	One quart of gasoline spilled onto the parking lot. The spill was contained with oil dry and removed. The cleanup action was considered sufficient for this release. Refer to the letter, dated December 23, 1992, from M. Hestmark, EPA, to R. Schassburger, DOE (AR# OU2A-000672).	1992 HRR (AR# SW-A-000378 and -000379) Approved 2/14/02 (AR# SW-A-004766)
PAC SE 1601.2	Pond 8 - South (Cooling Tower Discharge Releases)	Pond 8 - south was constructed before October 1964 to receive Building 881 cooling tower water discharges. The pond may have also collected Building 881 footing drain water. It was used until the mid 1970s. The RFCA Parties working group reviewed location information and soil sampling results in an April 3, 2002, meeting. Using the consultative process, it was determined that OU 1 did not impact this area.	1992 HRR (AR# SW-A-000378 and -000379) Approved 9/26/02 (AR# BZ-A-000557)

Table 19
Summary of Historical Individual Hazardous Substance Sites, Potential Areas of Concern, and Potential Incidents of Concern in the Peripheral Operable Unit

Historical Designation	Description	Investigation Results	No Further Action Determination
PAC SW 1700	Fuel Spill – Woman Creek Drainage	An armored vehicle accidentally overturned and fuel from the fuel tank leaked into the creek on October 19, 1973. The vehicle was righted and removed from the area. Because of the time elapsed since the spill, the fuel has degraded and is no longer a concern. Refer to the letter, dated December 23, 1992, from M. Hestmark, EPA, to R. Schassburger, DOE (AR#OU2A-000672).	1992 HRR (AR# SW-A-000378 and -000379) Approved 2/14/02 (AR# SW-A-004766)
PIC 23	Antifreeze Leak – Building 123 Parking Lot	Approximately 2 gallons of automobile antifreeze spilled on the asphalt in 1991 and was cleaned up by the RFETS HAZMAT team. The RFCA Parties working group reviewed information related to this PIC in an April 3, 2002, meeting. Using the consultative process, it was determined the spill was on an asphalt surface, was cleaned up, and is not likely to impact soil or surface water.	1992 HRR (AR# SW-A-000378 and -000379) Approved 9/26/02 (AR# BZ-A-000557)
PIC 33	Gasoline Leak – T130 Parking Lot	Approximately 0.5 gallon of gasoline spilled on the asphalt in 1991 and was cleaned up by the RFETS HAZMAT team. The RFCA Parties working group reviewed information related to this PIC in an April 3, 2002, meeting. Using the consultative process, it was determined the spill was on an asphalt surface, was cleaned up, and is not likely to impact soil or surface water.	1992 HRR (AR# SW-A-000378 and -000379) Approved 9/26/02 (AR# BZ-A-000557)

Table 20
Groundwater Monitoring Locations Where Maximum Contaminant Levels
or Preliminary Remediation Goals Were Exceeded in the Peripheral Operable Unit

Location	Description	Analyte	Concentration	MCL or PRG[a]	Discussion
UHSU Groundwater Sampling Locations Where Composite MCLs Were Exceeded					
Well 0286 (installed in 1986)	Near the eastern site boundary and south of Kestrel Gulch	Total Chromium	248 µg/L	100 µg/L	With the presence of both chromium and nickel in this well, the concentration of chromium observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding chromium. There are two detected concentrations of chromium in this well (both occurring in 1992 and closely matching the nickel concentrations), since it was installed in 1986. The first detected concentration of chromium was below the MCL.
		Total Nickel	219 µg/L	140 µg/L	With the presence of both chromium and nickel in this well, the concentration of nickel observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding nickel. There are two detected concentrations of nickel in this well (both occurring in 1992 and closely matching the chromium concentrations), since it was installed in 1986. The first detected concentration of nickel was below the MCL.
Well 0486 (installed in 1986)	Near eastern site boundary, just southeast of the Flume Pond	Total Chromium	157 µg/L	100 µg/L	A chromic acid spill occurred from the former Building 444 basement and was contained in the B-Ponds and then pumped to Upper Church Ditch where it was below surface water standards. This well is located north of former Building 444 and north of Upper Church Ditch. A portion of the chromium observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding chromium. There are six detected concentrations of chromium in this well, since it was installed in 1986, with the highest concentration detected in 1992, which is the most recent concentration.

Table 20
Groundwater Monitoring Locations Where Maximum Contaminant Levels or Preliminary Remediation Goals Were Exceeded in the Peripheral Operable Unit

Location	Description	Analyte	Concentration	MCL or PRG[a]	Discussion
		Fluoride	5,500 µg/L	4,000 µg/L	Fluoride or fluorite was not identified in the ChemRisk Task 1 report as a chemical in inventory at RFETS (K-H 2005bb). See Section 8.0 for additional information regarding fluoride. There are only two detected concentrations for fluoride in this well (detected in 1992) since it was installed in 1986.
Well 0686 (installed in 1986)	North-central portion of the BZ OU, east of the Landfill Pond in No Name Gulch stream segment	Total Chromium	565 µg/L	100 µg/L	A chromic acid spill occurred from the former Building 444 basement and was contained in the B-Ponds and then pumped to Upper Church Ditch where it was below surface water standards. This well is located in No Name Gulch downgradient from the Present Landfill, northeast of former Building 444, and east of Upper Church Ditch. A portion of the chromium observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding chromium. There is only one detected concentration of chromium (in 1992) in this well, since it was installed in 1986.
		Total Nickel	211 µg/L	140 µg/L	Nickel plating was conducted in the former 700 Area of the site (K-H 2005b). This well is located north of the former 700 Area. A portion of the nickel observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding nickel. There is only one detected concentration (in 1992) of nickel in this well, since it was installed in 1986.
Well 5386 (installed in 1986 and abandoned in 8/02)	Southwestern portion of the BZ OU near the site boundary, in Owl Branch stream segment	Nitrate/Nitrite as N	31,977 µg/L	10,000 µg/L	Nitrate/nitrite is naturally occurring in soil, surface water, and groundwater. This location is not part of the on-site nitrate groundwater plume located in the area of the historical SEP. See Section 8.0 for specific information regarding nitrate/nitrite. There are three detected concentrations of nitrate/nitrite in this well, since it was installed in 1986, with the highest concentration detected in

Table 20
Groundwater Monitoring Locations Where Maximum Contaminant Levels or Preliminary Remediation Goals Were Exceeded in the Peripheral Operable Unit

Location	Description	Analyte	Concentration	MCL or PRG[a]	Discussion
					1995, which is the most recent concentration. Two of the three detected concentrations were orders of magnitude below the MCL.
Well 5686 (installed in Well 1986 and abandoned in 11/04)	Southeastern portion of the BZ OU, at the junction of Owl Branch and Woman Creek stream segments	Total Chromium	1100 µg/L	100 µg/L	A chromic acid spill occurred from the former Building 444 basement and was contained in the B-Ponds and then pumped to Upper Church Ditch where it was below surface water standards. This well is located southwest of former Building 444 and Upper Church Ditch in Mower Ditch. A portion of the chromium observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding chromium. There are seven detected concentrations of chromium in this well, since it was installed in 1986, with the highest concentration detected in 2001, which is also the most recent. Four of the seven concentrations were at or below the MCL. This well was abandoned in 2004.
Well 6486 (installed in 1986)	Southern portion of the BZ OU, west of Pond C-1	Dissolved Nickel	1160 µg/L	140 µg/L	Nickel plating was conducted in the former 700 Area of the site (K-H 2005b). This well is located southeast of the former 700 Area. A portion of the nickel observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding nickel. There are 14 detected concentrations of nickel in this well, since it was installed in 1986, with the highest concentration detected in 2002. The most recent concentration (detected in 2004) was below the highest detected concentration. Seven of the 14 detected concentrations were below the MCL.
Well 6686 (installed in 1986 and abandoned in 9/04)	Southeastern portion of the BZ OU, in Mower Ditch	Total Chromium	138 µg/L	100 µg/L	A chromic acid spill occurred from the former Building 444 basement and was contained in the B-Ponds and then pumped to Upper Church Ditch where it was below surface water standards. This well is located southeast of former Building 444 and Upper Church Ditch in Mower Ditch. A

Table 20
Groundwater Monitoring Locations Where Maximum Contaminant Levels or Preliminary Remediation Goals Were Exceeded in the Peripheral Operable Unit

Location	Description	Analyte	Concentration	MCL or PRG[a]	Discussion
					portion of the chromium observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding chromium. There are six detected concentrations of chromium in this well, since it was installed in 1986, with the highest concentration detected in 1992. This most recent concentration (collected in 1992) was below the highest concentration detected, also in 1992. Four of the six concentrations were below the MCL. This well was abandoned in 2004.
Well 10394 (installed in 1994)	Near the eastern site boundary, in the southeastern portion of the site, in Mower Ditch	Total Nickel	400 µg/L	140 µg/L	Nickel plating was conducted in the former 700 Area of the site (K-H 2005b). This well is located southeast of the former 700 Area. A portion of the nickel observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding nickel. There are nine detected concentrations of nickel in this well, since it was installed in 1994, with the highest concentration detected in 2003, which is the most recent concentration. Eight of the nine detected concentrations were an order of magnitude below the MCL.
Well 11694 (installed in 1994 and abandoned in 1/03)	North-central portion of the BZ OU, north of Upper Church Ditch and southeast of Grape Draw stream	Total Nickel	233 µg/L	140 µg/L	Nickel plating was conducted in the former 700 Area of the site (K-H 2005b). This well is located north of the former 700 Area. A portion of the nickel observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding nickel. There is only one detected concentration (in 1994) of nickel in this well, since it was installed in 1994 and abandoned in 2003.
		Total Chromium	179 µg/L	100 µg/L	A chromic acid spill occurred from the former Building 444 basement and was contained in the B-Ponds and then pumped to Upper Church Ditch where it was below surface water standards. This well is located north of former

Table 20
Groundwater Monitoring Locations Where Maximum Contaminant Levels or Preliminary Remediation Goals Were Exceeded in the Peripheral Operable Unit

Location	Description	Analyte	Concentration	MCL or PRG[a]	Discussion
					Building 444 and north of Upper Church Ditch. A portion of the chromium observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding chromium. There is only one detected concentration of chromium (in 1994) in this well, since it was installed in 1994 and abandoned in 2003.
Well 11794 (installed in 1994 and abandoned in 1/03)	North-central portion of the BZ OU, north of Upper Church Ditch and southeast of Grape Draw stream. Located in the same area as well 11694.	Total Chromium	110 µg/L	100 µg/L	A chromic acid spill occurred from the former Building 444 basement and was contained in the B-Ponds and then pumped to Upper Church Ditch where it was below surface water standards. This well is located north of former Building 444 and north of Upper Church Ditch. A portion of the chromium observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding chromium. There is only one detected concentration of chromium (in 1994) in this well, since it was installed in 1994 and abandoned in 2003.
Well 41091 (installed in 1991 and abandoned in 6/05)	Northeastern portion of the BZ OU and just northeast of Pond A-4	Total Chromium	147 µg/L	100 µg/L	With the presence of both chromium and nickel in this well, the concentration of chromium observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding chromium. There are eight detected concentrations of chromium in this well (closely matching the nickel concentrations), since it was installed in 1991, with the highest concentration detected in 1995, which is the most recent concentration. Seven of the eight detected concentrations were an order of magnitude below the MCL. This well was abandoned in 2003.
		Total Nickel	158 µg/L	140 µg/L	With the presence of both chromium and nickel in this well, the concentration of nickel observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional

Table 20
Groundwater Monitoring Locations Where Maximum Contaminant Levels
or Preliminary Remediation Goals Were Exceeded in the Peripheral Operable Unit

Location	Description	Analyte	Concentration	MCL or PRG[a]	Discussion
					information regarding nickel. There are eight detected concentrations of nickel in this well (closely matching the chromium concentrations), since it was installed in 1991, with the highest concentration detected in 1995, which is the most recent concentration. Seven of the eight detected concentrations were an order of magnitude below the MCL. This well was abandoned in 2005.
Well 50794 (installed in 1994 and abandoned in 7/02)	Southwestern portion of the BZ OU near the site boundary, north of Woman Creek	Nitrate/Nitrite as N	14,100 µg/L	10,000 µg/L	Nitrate/nitrite is naturally occurring in soil, surface water, and groundwater. This location is not part of the on-site nitrate groundwater plume located in the area of the historical SEP. See Section 8.0 for specific information regarding nitrate/nitrite. There are four detected concentrations of nitrate/nitrite in this well, since it was installed in 1994, with the highest concentration detected in 1995, which is the most recent concentration. Three of the four detected concentrations were at or below the MCL.
Well 51594 (installed in 1994 and abandoned in 7/02)	Western portion of the BZ OU, south of McKay Ditch	Nitrate/Nitrite as N	15,100 µg/L	10,000 µg/L	Nitrate/nitrite is naturally occurring in soil, surface water and groundwater. This location is not part of the on-site nitrate groundwater plume located in the area of the historical SEP. See Section 8.0 for specific information regarding nitrate/nitrite. There are four detected concentrations of nitrate/nitrite in this well, since it was installed in 1994, with the highest concentration detected in 1995, which is the most recent concentration. Two of the four detected concentrations were below the MCL.
Well 63895 (installed in 1995 and abandoned in 9/02)	Northwestern portion of the BZ OU, southwest of Lindsay 1 Pond	Tetrachloroethene	15.8 µg/L	5 µg/L	Tetrachloroethene was used at RFETS. See Section 8.0 for specific information regarding tetrachloroethene. There is only one detected concentration of tetrachloroethene (in 2002) since the well was installed in 1995 and abandoned in 2002.
Well 77192 (installed in 1992 and	North-central portion of the BZ OU, north of	Fluoride	6,070 µg/L	4,000 µg/L	Fluoride or fluorite was not identified in the ChemRisk Task 1 report as a chemical in inventory at RFETS (K-H 2005b). See Section 8.0 for additional information regarding

Table 20
Groundwater Monitoring Locations Where Maximum Contaminant Levels or Preliminary Remediation Goals Were Exceeded in the Peripheral Operable Unit

Location	Description	Analyte	Concentration	MCL or PRG[a]	Discussion
abandoned in 8/04)	East Landfill Pond				fluoride. There is only one detected concentration for fluoride in this well (detected in 1995), since it was installed in 1992 and abandoned in 2004.

Table 20
Groundwater Monitoring Locations Where Maximum Contaminant Levels or Preliminary Remediation Goals Were Exceeded in the Peripheral Operable Unit

Location	Description	Analyte	Concentration	MCL or PRG[a]	Discussion
Well B201189 (installed in 1989 and abandoned in 10/02)	Near northern site boundary, just east of Gentian Draw stream	Total Nickel	334 µg/L	140 µg/L	With the presence of both chromium and nickel in this well, the concentration of nickel observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding nickel. There are six detected concentrations of nickel in this well (closely matching the chromium concentrations), since it was installed in 1989, with the highest concentration detected in 1992, which is the most recent concentration. Five of the six detected concentrations were orders of magnitude below the MCL.
		Total Chromium	729 µg/L	100 µg/L	With the presence of both chromium and nickel in this well, the concentration of chromium observed in groundwater may be attributable to stainless-steel well casings, pump parts, and well tubing stabilizers. See Section 8.0 for additional information regarding chromium. There are six detected concentrations of chromium in this well (closely matching the nickel concentrations) since it was installed in 1989, with the highest concentration detected in 1992, which is also the most recent concentration. Five of the six detected concentrations were orders of magnitude below the MCL.
Well B201289 (installed in 1989 and abandoned in 10/02)	Near northern site boundary, just north of Lindsay Branch stream	Nitrate/Nitrite as N	11,000 µg/L	10,000 µg/L	Nitrate/nitrite is naturally occurring in soil, surface water, and groundwater. See Section 8.0 for specific information regarding nitrate/nitrite. This location is not part of the on-site nitrate groundwater plume located in the area of the historical SEP. There are seven detected concentrations of nitrate/nitrite in this well, since it was installed in 1989, with the highest concentration detected in 1991. This most recent concentration for nitrate/nitrite (detected in 1993) is lower than the concentration detected in 1991.

Table 20
Groundwater Monitoring Locations Where Maximum Contaminant Levels
or Preliminary Remediation Goals Were Exceeded in the Peripheral Operable Unit

Location	Description	Analyte	Concentration	MCL or PRG[a]	Discussion
Well B206989 (installed in 1989)	East of the East Landfill Pond at the headwaters to No Name Gulch stream	Nitrate/Nitrite as N	28,000 µg/L	10,000 µg/L	Nitrate/nitrite is naturally occurring in soil, surface water and groundwater. This location is not part of the on-site nitrate groundwater plume located in the area of the historical SEP. See Section 8.0 for specific information regarding nitrate/nitrite. There are 32 detected concentrations of nitrate/nitrite in this well, since it was installed in 1989, with the highest concentration detected in 1992. This most recent concentration for nitrate/nitrite (detected in 2005) is lower than the concentration detected in 1992. This well is located downstream from the Present Landfill.
Well B303089 (installed in 1989)	Near the eastern and southern corner of the site boundary	Fluoride	7,200 µg/L	4,000 µg/L	Fluoride or fluorite was not identified in the ChemRisk Task 1 report as a chemical in inventory at RFETS (K-H 2005b). See Section 8.0 for additional information regarding fluoride. There are eight detected concentrations of fluoride in this well, since it was installed in 1989, with the highest concentration detected in 1991. This most recent concentration for fluoride (detected in 1995) is lower than the concentration detected in 1991.
Subsurface Soil Sampling Locations Where Volatilization PRGs Were Exceeded					
46392	Located within the Inter-Drainage EU (IDEU) and is located further north	Chloroform	96 µg/kg	47.1 µg/kg	The maximum detected concentration (collected in 1992) is the same order of magnitude as the volatilization PRG. This sample was collected from an unusually large depth interval (0-60 ft), and almost all of the analytical data for the sample were either rejected ("R" qualified) or estimated ("J" qualified). Thirty-two of the results were rejected and two were designated as estimated. Chloroform was one of the two J-qualified analytical results. A second sample was collected beneath the above described sample, also at an unusually large depth interval (61-102 ft). The concentration of chloroform (6 µg/kg) at this depth interval was below the volatilization PRG and slightly above the detection limit (5

Table 20
Groundwater Monitoring Locations Where Maximum Contaminant Levels or Preliminary Remediation Goals Were Exceeded in the Peripheral Operable Unit

Location	Description	Analyte	Concentration	MCL or PRG[a]	Discussion
					µg/kg). Volatilization risks from chloroform are considered neglible since the concentration is only slightly higher than the PRG.
51494	Located within the IDEU farther south	Mercury	25.4 mg/kg	9.47 mg/kg	The maximum detected concentration (collected in 1994) is approximately twice the volatilization PRG. Fourteen subsurface soil samples were collected at this location to a depth of 60 ft in approximately 2-to-6 ft intervals. All of the samples (with the exception of this sample at the 4-to-6 ft depth interval) had concentrations of mercury at or below the detection limit (0.1 mg/kg). Because the volatilization PRG is based on a HQ of 0.1, the HQ estimate for mercury would be approximately 0.2. An HQ of 1 is considered to be protective of human populations, including sensitive subgroups.

[a] The PRGs identified here are the volatilization PRGs as identified in Appendix A, Volume 2, Attachment 4.

Table 21
ARARs

CLEAN AIR ACT (CAA) (42 U.S. Code [USC] 7401 et. seq.)			
Requirement	**Citation**	**Type[a]**	**Comment**
• National Emission Standard for Asbestos	40 CFR 61, Subpart M		
- Cover	61.151(a)(3)	A/L	The Present Landfill, IHSS 114, may contain regulated asbestos-containing waste material. Any asbestos-containing waste material was covered with at least 60 cm (2 ft) of compacted nonasbestos-containing material. The cover will be maintained to prevent exposure of the asbestos-containing waste material. The specific maintenance plan will be documented as part of the final remedy decision and other enforceable document. Subpart M is only an ARAR for the Present Landfill, IHSS 114.
- Signage	61.151(b)	A/L	Because there is no natural barrier to adequately deter access by the general public, installation and maintenance of warning signs and fencing will be complied with under 40 CFR 61.151(a)(3).
- Notification to Administrator in writing at least 45 days prior to excavating or otherwise disturbing any asbestos-containing waste material	61.151(d)	A	Requirements for notification will be included as part of the final remedy decision in the CAD/ROD and other enforceable document.
- Notation on Deed	61.151(e)	A	The environmental covenant will include a notation that the Present Landfill, IHSS 114, may have been used for the disposal of asbestos-containing waste material.

Table 21
ARARs

FEDERAL WATER POLLUTION CONTROL ACT (Clean Water Act [CWA]) (33 USC 1251 et. seq.)			
Requirement	**Citation**	**Type**	**Comment**
COLORADO BASIC STANDARDS AND METHODOLOGIES FOR SURFACE WATER	5 CCR 1002-31		
• Process for Assigning Standards and Granting, Extending, or Removing Temporary Modifications	31.7	C/L	Assessment and monitoring of surface water quality is described in the surface water remedial action. Monitoring requirements will be implemented pursuant to the final remedy decision in the CAD/ROD and the Rocky Flats Legacy Management Agreement.
• Mixing Zones	31.10		
• Basic Standards Applicable to Surface Waters of the State	31.11		
CLASSIFICATION AND NUMERIC STANDARDS SOUTH PLATTE RIVER BASIN, LARAMIE RIVER BASIN, REPUBLICAN RIVER BASIN, SMOKY HILL RIVER BASIN	5 CCR 1002-38		
• Classification Tables	38.6	C/L	This requirement lists use classifications and parameters for segments 4a, 4b, and 5 of Big Dry Creek (Woman and Walnut Creeks on RFETS).
COLORADO BASIC STANDARDS FOR GROUND WATER	5 CCR 1002-41	C/L	
• Point of Compliance	41.6	C/L	The POCs for assessment and monitoring of groundwater quality are the AOC wells.
SITE SPECIFIC WATER QUALITY CLASSIFICATIONS AND STANDARDS FOR GROUND WATER	5 CCR 1002-42		
• Rocky Flats Area, Jefferson and Boulder Counties	42.7(1)	C/L	The use classification for groundwater at RFETS is surface water protection. This classification recognizes that groundwater is not a current or potential source of drinking water, recognizing that controls to prohibit and prevent use of contaminated groundwater are and will be in place at RFETS.

Table 21
ARARs

FEDERAL WATER POLLUTION CONTROL ACT (Clean Water Act [CWA]) (33 USC 1251 et. seq.)			
Requirement	**Citation**	**Type**	**Comment**
PERMITS FOR DREDGED OR FILL MATERIAL; DISCHARGES OF DREDGED OR FILL MATERIAL INTO WATERS OF THE UNITED STATES	33 USC 1344; 33 CFR 323		
• Definitions • Discharges Requiring Permits	33 CFR 323.2 33 CFR 323.3	A/L	On-site remedial actions do not require permits, but remedies requiring discharge of dredge or fill material into waters of the United States (types of activities are defined in the regulation) must meet substantive requirements of any nationwide or regional permit or specific NPDES permit that may otherwise be required.
DOE COMPLIANCE WITH FLOODPLAIN/WETLANDS ENVIRONMENTAL REVIEW REQUIREMENTS	10 CFR 1022		
• Floodplain/Wetlands Determination • Floodplain/Wetlands Assessment • Applicant Responsibilities	10 CFR 1022.11 10 CFR 1022.12 10 CFR 1022.13	A/L	
NPDES	**33 USC 1342; 40 CFR 122**		
• Stormwater Permit for Construction Activities	40 CFR 122.26	A/L	On-site remedial actions do not require permits, but remedies that discharge pollutants from point sources or that involve stormwater discharges must meet substantive requirements for a site-specific or general NPDES permit. Substantive requirements for an NPDES permit are included in the Present Landfill IM/IRA. These requirements will be carried forward into the final CAD/ROD.
• General Permits	40 CFR 122.28	A/L	
• RCRA Subtitle C Hazardous Waste Landfill Effluent Limitations	40 CFR 445.11	A/C	Parameters that will be monitored for at the Present Landfill (IHSS 114) seep treatment system discharge are metals, VOCs, SVOCs, and nitrates. The effluent limits are the surface water standards applicable for the receiving water as listed in RFCA Attachment 5, Table 1.

Table 21
ARARs

NATURAL RESOURCE AND WILDLIFE PROTECTION LAWS			
Requirement	**Citation**	**Type**	**Comment**
ENDANGERED SPECIES ACT (ESA)	**16 USC 1531 et seq.**		
• Early Consultation	50 CFR 402.11	A/L	The objective is to identify and minimize early in the planning stage of an action any potential conflicts between the action and federally listed proposed species and designated and proposed critical habitat.
• Biological Assessment ➢ Purpose ➢ Preparation Requirements ➢ Request for Information ➢ Director's Response ➢ No Listed Species or Critical Habitat Present ➢ Listed Species or Critical Habitat Present ➢ Verification of Current Accuracy of Species List ➢ Contents ➢ Identical/Similar to Previous Action ➢ Permit Requirements ➢ Completion Time ➢ Submission of Biological Assessment ➢ Use of Biological Assessment	50 CFR 402.12	A/L	The objective is to evaluate the potential effects of the action on listed and proposed species and designated and proposed critical habitat and determine whether any such species or habitat are likely to be adversely affected in determining whether formal consultation or a conference is necessary.
• Interagency Cooperation	50 CFR 402		
• Informal Consultation	50 CFR 402.13	A/L	This step is an optional process that includes all discussions, correspondence, and so forth between the U.S. Fish and Wildlife Service (USFWS) and DOE to assist in determining whether formal consultation or a conference is required. If, during this step, it is determined by DOE, with the written concurrence of USFWS, that the action is not likely to adversely affect listed species or critical habitat, the consultation process is terminated and no further action is necessary. Otherwise, formal consultation shall occur.
• Formal Consultation	50 CFR 402.14	A/L	

Table 21
ARARs

NATURAL RESOURCE AND WILDLIFE PROTECTION LAWS			
Requirement	**Citation**	**Type**	**Comment**
MIGRATORY BIRD TREATY	16 USC 701-715		
• Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants	50 CFR 10	A/L	Where appropriate, DOE will consult with the USFWS to prevent or minimize contact with listed birds and nests.
COLORADO WILDLIFE STATUTES	**Colorado Revised Statutes (CRS) 33-1-101 to 33-6-209**		
• Compliance With the Colorado Wildlife Statutes, Including Nongame, Endangered, or Threatened Species Conservation Act and the State Statutes Regarding Illegal Possession	CRS 33-1-101 CRS 33-1-102(34) and (43) CRS 33-2-104 CRS 33-2-105 CRS 33-6-109	A/L	The state interprets "taking" as including contamination-induced deaths of individual members of a species. The assessment for the Preble's meadow jumping mouse (PMJM) in the CRA will address the potential for individual mice to be adversely affected by contact with ecological contaminants of potential concern (ECOPCs). For other species with stable or healthy populations, the assessment will focus on population-level effects where some individuals may suffer adverse effects, but the effects are not ecologically meaningful because the overall site population is not significantly affected.
FEDERAL NOXIOUS WEED ACT	Pub. L. 93-629; 7 USC 2814 et seq.		
• Management of Undesirable Plants on Federal Lands • Duties of Federal Agencies	7 USC 2814 (a)(3), (a)(4), (c)(1), (c)(2)	A	The Act requires control measures for undesirable plant species.
COLORADO NOXIOUS WEED ACT	CRS 35-5.5-101 et seq.		
• Duty to Manage Noxious Weeds	Section 104	L/A	DOE will manage noxious weeds if they are likely to be materially damaging to DOE property or the land of neighboring landowners.

Table 21
ARARs

NATURAL RESOURCE AND WILDLIFE PROTECTION LAWS			
Requirement	**Citation**	**Type**	**Comment**
• Cooperation with Federal and State Agencies	Section 111	L/A	The local governing bodies in Colorado are authorized to enter into cooperative agreements with federal and state agencies for the integrated management of noxious weeds within their respective territorial jurisdictions. The Jefferson County Noxious Weed Management Plan establishes the countywide strategy for the management, control, and eradication of noxious weeds in the County.
NATIONAL WILDLIFE REFUGE SYSTEM ADMINISTRATION ACT	16 USC 668dd(c)	L	This Act prohibits interference with natural growth or wildlife on national wildlife refuges administered by USFWS, unless permitted.

Table 21
ARARs

ATOMIC ENERGY ACT, 42 USC 2011, et seq.			
Requirement	**Citation**	**Type**	**Comment**
RADIATION PROTECTION STANDARDS AND DECOMMISSIONING US NUCLEAR REGULATORY COMMISSION LICENSED FACILITIES	6 CCR 1007-1 10 CFR		Colorado Division of Laboratory and Radiation Services regulations, 6 CCR 1007-1 (Radiation Health [RH]), are identified as ARARs. Comparable federal regulations are shown in parenthesis for reference.
• Completion Criteria – The criteria must include a determination that (1) radioactive materials have been properly disposed of and records of disposal have been forwarded to CDPHE, (2) regulatory requirements for license termination have been met, (3) long-term care warranty has been established, if required, and (4) institutional controls have been implemented to limit public doses, if required.	RH 3.16.7	A/L	Although license termination is not relevant to Rocky Flats, the substantive criteria in this regulation are relevant and appropriate to determining the endpoint for decommissioning at Rocky Flats. Subsection (1) is met by implementing the on-site remedial actions required under the final remedial decision in the CAD/ROD (off-site disposal is not subject to ARARs), and subsections (2) and (4) are addressed in RH 4.61.3 (10 CFR 20.1402) (discussed below). Subsection (3) is not required because DOE will retain control of the land.
• New Information – If, based on new or previously unknown information, the criteria in RH 4.61 are not met and residual radioactivity remaining at RFETS could result in a significant threat to public health and safety, additional cleanup can be required.	RH 3.16.8	L	This standard is generally consistent with the "imminent and substantial endangerment" standard under CERCLA. Present risk of future harm (for example, a risk of cancer due to long-term exposure) can be an "imminent" threat.
• Criteria for Restricted Use – Provisions were made for durable, legally enforceable institutional controls that provide reasonable assurance that TEDE to average member of the critical group will not exceed 25 mrem/yr, and, if institutional controls were no longer in effect, TEDE above background is ALARA and would not exceed either 100 mrem/yr or 500 mrem/yr if demonstrated that further reductions are not technically achievable, would be prohibitively expensive, or would result in net public or environmental harm.	RH 4.61.3.2 and .3 (20.1403[b] and [e])	A/L	The analysis was provided in the FS, and specific plans will be developed and implemented pursuant to the final remedy decision in the CAD/ROD.

Table 21
ARARs

SUBTITLE C: HAZARDOUS WASTE MANAGEMENT (CHWA [CRS § § 25-15-101 to -217]) SOLID WASTE DISPOSAL ACT (RCRA) (42 USC § 6901 et. seq.) CHWA/RCRA requirements are listed as ARARs, but they also apply independently.			
Requirement	**Citation**	**Type**	**Comment**
GENERAL	6 CCR 1007-3, Part 261, Subpart A (40 CFR 261, Subpart A)		
• Exclusions	.4(a)(2)	A	Industrial wastewater discharges that are point source discharges subject to regulation under Section 402 of the CWA are not considered solid wastes.
IDENTIFICATION AND LISTING OF HAZARDOUS WASTES	6 CCR 1007-3, 261 (40 CFR 261)	A	All remediation waste will be characterized to determine a hazardous waste classification.
GENERATOR STANDARDS	6 CCR 1007-3 Part 262 (40 CFR Part 262)		
• Hazardous Waste Determinations	.11	A/C	Persons who generate solid wastes are required to determine whether the wastes are hazardous according to 6 CCR 1007-3 Parts 261, 267, and 279 (40 CFR Parts 261, 266, and 279).
• Hazardous Waste Accumulation Areas	.34	A	Persons who accumulate hazardous waste in containers or tanks must manage the waste in a manner that protects human health and the environment.
GENERAL	6 CCR 1007-3, Part 265, Subpart A (40 CFR 265, Subpart A)		
• Purpose, Scope, and Applicability	.1(c)(10)	A	The requirements of Part 265 do not apply to elementary neutralization units or wastewater treatment units.
GENERAL FACILITY STANDARDS	6 CCR 1007-3 Part 265, Subpart B (40 CFR Part 265, Subpart B)		
• Security	.14	A/L	The owner/operator of a facility must prevent unauthorized access.
• General Inspection Requirements	.15	A/L	The owner/operator of a facility must inspect for malfunctions, deteriorations, and releases, and must remedy deficiencies.
• Personnel Training Requirements	.16	A/C	Personnel must be trained.

Table 21
ARARs

SUBTITLE C: HAZARDOUS WASTE MANAGEMENT (CHWA [CRS § § 25-15-101 to -217]) SOLID WASTE DISPOSAL ACT (RCRA) (42 USC § 6901 et. seq.) CHWA/RCRA requirements are listed as ARARs, but they also apply independently.			
Requirement	**Citation**	**Type**	**Comment**
• Requirements for Ignitable, Reactive or Incompatible Wastes	.17	A	
PREPAREDNESS AND PREVENTION	6 CCR 1007-3 Part 265, Subpart C (40 CFR 265, Subpart C)		
• Required Equipment	.32	A/C	Facilities must be equipped with specified equipment to mitigate incidents should they occur.
• Testing and Maintenance of Equipment	.33	A/C	Equipment must be maintained.
• Access to Communications or Alarm System	.34	A/L	Employees must have access to emergency communications when managing hazardous waste.
• Arrangement with Local Authorities	.37	A/L	The owner/operator must make arrangements with specified local emergency personnel.
CONTINGENCY PLAN AND EMERGENCY PROCEDURES	6 CCR 1007-3 Part 265, Subpart D (40 CFR Part 265, Subpart D)		
• Purpose and Implementation	.51	A/C	Emergencies such as fire, explosion, or release of hazardous waste must be mitigated immediately.
• Emergency Coordinator	.55	A	A designated employee is responsible for coordinating emergency response actions.
• Emergency Procedures	.56	A	The emergency procedures of the RFETS Emergency Response Plan will be followed.
GROUNDWATER PROTECTION (RELEASES FROM SWMUs)	6 CCR 1007-3 Part 264, Subpart F (40 CFR Part 264, Subpart F)		
• Applicability – Requires compliance with corrective action requirements for SWMUs, and for "regulated units" that received hazardous waste after July 26, 1982. SWMUs are subject to 264.101. Regulated units are subject to monitoring and response programs and groundwater protection standards for hazardous constituents that exceed specified standards at the POC (264.91 - 264.100).	264.90 – 264.100	A/C	The only regulated units are the historical SEP, IHSS 101, and the Present Landfill, IHSS 114, which were closed under Part 265 (Interim Status) requirements. The SEP, IHSS 101, was closed under 6 CCR 1007-3, section 265.110(d) and is not subject to post-closure monitoring because there are no hazardous constituents that exceed specified standards at

Table 21
ARARs

SUBTITLE C: HAZARDOUS WASTE MANAGEMENT (CHWA [CRS § § 25-15-101 to -217]) SOLID WASTE DISPOSAL ACT (RCRA) (42 USC § 6901 et. seq.) CHWA/RCRA requirements are listed as ARARs, but they also apply independently.			
Requirement	**Citation**	**Type**	**Comment**
			a groundwater POC. The Present Landfill, IHSS 114, was closed under 6 CCR 1007-3, section 265.111 and is subject to post closure monitoring, response, and groundwater protection standards for hazardous constituents that exceed specified standards at the POC under Part 264. A groundwater monitoring system was implemented under the Present Landfill IM/IRA and the IMP pursuant to 6 CCR 1007-3, section 264.93. A total of six (three upgradient and three downgradient) RCRA groundwater monitoring wells have been established. The constituents that will be monitored for are VOCs and metals. The purpose of the monitoring is to evaluate upgradient versus downgradient groundwater quality at the Present Landfill. These specific monitoring requirements and maintenance plans will be documented as part of the final remedy decision in the CAD/ROD and other enforceable document.
• Corrective Action for SWMUs	264.101	A/L	Each historical IHSS has been evaluated, and an accelerated action taken as necessary, in compliance with RFCA. RFCA paragraph 11 states that compliance with the requirements of this Agreement will be deemed to achieve compliance with (c) the corrective action requirements of CHWA, including 6 CCR 1007-3 sections 264.101 and 265.5, and (d) the closure requirements of CHWA for those hazardous waste management units identified in RFCA Attachment 3. The completion of the accelerated actions has completed the corrective action for soil at each IHSS (formerly SWMU) except for institutional

SUBTITLE C: HAZARDOUS WASTE MANAGEMENT (CHWA [CRS § § 25-15-101 to -217]) **SOLID WASTE DISPOSAL ACT (RCRA) (42 USC § 6901 et. seq.)** **CHWA/RCRA requirements are listed as ARARs, but they also apply independently.**			
Requirement	**Citation**	**Type**	**Comment**
			controls. In recognition that groundwater contamination could be caused by releases from multiple hazardous waste management units and/or from sources other than but around hazardous waste management units, corrective action for groundwater has been addressed on a sitewide basis. Two groundwater plume treatment systems (ETPTS and MSPTS) were installed as accelerated actions. These systems, combined with the source removal accelerated actions, are the corrective actions for groundwater. The O&M of the groundwater plume treatment systems will continue and be identified in the M&M Plans.
GROUNDWATER MONITORING	6 CCR 1007-3 Part 265, Subpart F (40 CFR Part 265, Subpart F)		
• Applicability – Monitoring applies to landfills, surface impoundments, and land treatment facilities ("regulated units"). Program must be capable of determining facility's impacts on groundwater in uppermost aquifer underlying the facility. Alternate groundwater monitoring system (265.90[d]) or alternative requirements (265.90[f]) may be approved for any of the requirements specified in Subpart F.	265.90	A/L/ C	This ARAR only applies to the Original Landfill. Alternate groundwater monitoring system may be approved if it is known that monitoring indicator parameters are already exceeded at required monitoring points. Alternative requirements that are protective of human health and the environment may be approved if a regulated unit is situated among SWMUs or AOC, a release has occurred, and the regulated unit and SWMU or AOC are likely to have contributed to the release. A groundwater monitoring system was implemented under the Original Landfill, IHSS 115, IM/IRA. A total of four (one upgradient and three downgradient) RCRA groundwater monitoring wells have been established. The constituents that will be monitored for are VOCs, SVOCs, pesticides,

Table 21
ARARs

SUBTITLE C: HAZARDOUS WASTE MANAGEMENT (CHWA [CRS § § 25-15-101 to -217]) SOLID WASTE DISPOSAL ACT (RCRA) (42 USC § 6901 et. seq.) CHWA/RCRA requirements are listed as ARARs, but they also apply independently.			
Requirement	**Citation**	**Type**	**Comment**
			and metals (including uranium). The purpose of the monitoring is to evaluate upgradient versus downgradient groundwater quality at the Original Landfill. These specific monitoring requirements and maintenance plans will be documented as part of the final remedy decision in the CAD/ROD.
• Groundwater Monitoring System – System must have at least one upgradient well to monitor water representative of background not affected by the facility. It must have at least three downgradient wells at the limit of the waste management area to immediately detect hazardous waste or constituents migrating from the waste management area to the uppermost aquifer. Alternate downgradient wells may be approved and the limit of the waste management area may encompass several waste management components.	265.91	A/L/ C	The rationale for monitoring well locations for the Original Landfill is described in the Original Landfill IM/IRA.
• Sampling and Analysis – A plan must be in place for obtaining and analyzing samples for concentrations of specified groundwater quality and contamination parameters at least annually and semiannually, respectively. This is for the periodic indicator evaluation of groundwater.	265.92	A/C	The rationale for monitoring well sampling and analysis parameters is described in the Original Landfill IM/IRA..
• Preparation, Evaluation, and Response – A groundwater quality assessment outline must describe a comprehensive groundwater monitoring program capable of determining whether hazardous waste and constituents have entered the groundwater and the extent, migration, and concentration of contamination. If evaluation is triggered by the periodic indicator evaluations, sampling and analysis frequency under this section will be at least quarterly. Annual evaluation of groundwater elevations must be made to determine whether well location requirements are satisfied.	265.93	A/C	The outline for groundwater quality assessment is described in the Original Landfill IM/IRA.
• Recordkeeping and Reporting	265.94	A	Recordkeeping and reporting protocols will be implemented pursuant to the final remedy decision in the CAD/ROD.
CLOSURE AND POST-CLOSURE	6 CCR 1007-3 Part 265, Subpart G (40 CFR Part 265, Subpart G)		This ARAR applies to the Present Landfill, IHSS 114, and the Original Landfill, IHSS 115.
• Applicability – Hazardous waste management facilities must meet	265.110	A	Alternate closure requirements may be

Table 21
ARARs

SUBTITLE C: HAZARDOUS WASTE MANAGEMENT (CHWA [CRS § § 25-15-101 to -217]) SOLID WASTE DISPOSAL ACT (RCRA) (42 USC § 6901 et. seq.) CHWA/RCRA requirements are listed as ARARs, but they also apply independently.			
Requirement	**Citation**	**Type**	**Comment**
closure requirements and, relevant to RFETS, hazardous waste disposal facilities and tank systems closed as landfills are subject to post-closure care requirements. Alternative requirements (265.110[d]) may be approved for any of the requirements specified in Subpart G.			approved if a "regulated unit" is situated among SWMUs or AOC, a release has occurred, and the regulated unit and SWMU or AOCs are likely to have contributed to the release. Closure must be protective of human health and the environment. Institutional controls for the SEP, IHSS 101, will be included in the environmental covenant.
• Closure Performance Standard	265.111		If alternate closure requirements are approved per 265.110(d), closure must meet 265.111(a) and (b).
• Disposal or Decontamination of Equipment, Structures, or Soils	265.114	A	
• Survey Plat – A plat prepared by a professional land surveyor must show the location of waste in relation to survey benchmarks.	265.116	L	A survey plat will be prepared and provided to third parties and retained by DOE as required by the final remedy decision.
• Post-Closure Care and Use of Property – A 30-year period for identified post-closure care monitoring, maintenance, and security requirements must be specified. Period may be shortened or extended, based on protection of human health and the environment.	265.117	A	The post-closure care period and any necessary restrictions on land use or disturbance was analyzed in the FS. The plan for post-closure care and use will be developed and implemented as required by the final remedy decision.
• Post-Closure Plan – For each hazardous waste management unit subject to the requirements of this section, the post-closure plan must identify the activities that will be carried on after closure of each disposal unit and the frequency of the activities.	265.118	A	

Table 21
ARARs

SUBTITLE C: HAZARDOUS WASTE MANAGEMENT (CHWA [CRS § § 25-15-101 to -217]) SOLID WASTE DISPOSAL ACT (RCRA) (42 USC § 6901 et. seq.) CHWA/RCRA requirements are listed as ARARs, but they also apply independently.			
Requirement	**Citation**	**Type**	**Comment**
• Post-Closure Notices – The plat should be filed with the local authority and the property deed (if any) annotated and recorded to include the plat.	265.119	A	A survey plat will be prepared and provided to third parties and retained by DOE as required by the final remedy decision.
• Certification of Completion of Post-Closure Care	265.120	A	Certification that the post-closure care period was performed in accordance with the approved post-closure plan will be submitted no later than 60 days after the completion of the established post-closure care period.
• Post-Closure Requirements for Facilities That Obtain Enforceable Documents in Lieu of Post-Closure Permits	265.121	A	
LANDFILLS	6 CCR 1007-3 Part 265, Subpart N (40 CFR Part 265, Subpart N)		
• Surveying and Recordkeeping	265.309		
• Closure and Post-Closure Care – Specifications for final cover construction and design, and the maintenance of monitoring and other components and benchmarks, must be identified.	265.310(a)(1),(2), (3), (4), and (5) 265.310(b)(1)-(6)	A/L	The Present Landfill, IHSS 114, and the Original Landfill, IHSS 115, are the only units that will have a cover that must attain this ARAR. The Original Landfill, IHSS 115, must attain only 265.310(a)(2), (3), and (4). 265.310(b) only applies to the Present Landfill.

Table 21
ARARs

Requirement	Citation	Type	Comment
Polychlorinated Biphenyl (PCB) STORAGE AND DISPOSAL	40 CFR 761 Subpart D		
• PCB Bulk Product Waste	761.62(c)	A/C	General PCB Disposal Requirements – Concrete painted with PCB-based paints may be left in place in the basements of demolished building, and concrete rubble containing PCB-based paints may be stored onsite and used as backfill, pursuant to the letter from Kerrigan Clough to Joe Legare, Approval of Risk-Based Approach for Polychlorinated Biphenyls (PCBs)-Based Painted Concrete, November 2001.
ENVIRONMENTAL COVENANTS	CRS 25-15-317 et seq.		
• Nature of Environmental Covenants	25-15-318		The purpose of the covenant is to provide an effective and enforceable means of ensuring the conduct of any required maintenance, monitoring, or operation, and restricting future uses of the land, including placing restrictions on drilling for or pumping groundwater for as long as any residual contamination remains hazardous.
• Contents	25-15-319		
• When Required	25-15-320		An environmental covenant shall be required where residual contamination remains at levels that have been determined to be safe for one or more specific uses, but not all uses, or an engineered feature or structure is incorporated that requires monitoring, maintenance, or operation or that will not function as intended if disturbed.
• Creation, Modification, and Termination of an Environmental Covenant	25-15-321		

[a] A - Action-Specific ARAR; C - Chemical-Specific ARAR; L - Location-Specific ARAR

Table 22
Analysis of Alternatives for the Central Operable Unit

	No Further Action With Monitoring (Alternative 1)		Institutional and Physical Controls (Alternative 2)		Targeted Surface Soil Removal (Alternative 3)
Alternative Description	Maintains and monitors the completed actions conducted at the Present and Original Landfills and the three groundwater treatment systems. Specific monitoring and O&M requirements for these five actions will continue. Alternative 1 also includes additional surface water, sediment, and ecological monitoring based on results of the ERA and surface and groundwater monitoring as described in the FY2005 IMP, dated September 8, 2005.		Includes Alternative 1 plus institutional and physical controls. Institutional controls include legally enforceable and administrative land use restrictions. Physical controls include signs.		Includes Alternative 2 plus targeted removal of surface soil within an EU to reduce the residual plutonium-239/240 contamination to below 9.8 pCi/g, which is the 1 x 10^{-6} WRW target risk concentration.
Evaluation Criteria					
Protection of Human Health and the Environment	This alternative is protective of human health and the environment in the current site land configuration because no unacceptable risks from residual contamination exist after completion of all planned accelerated actions. • The CRA shows that the incremental risk to the WRW falls within the acceptable range of 1 x 10^{-6} to 1 x 10^{-4} cancer risks and below an HI of 1 for noncarcinogenic effects. • The CRA predicts that there is no significant ecological risk from residual contamination within all environmental media across RFETS. • Actions at the Present and Original Landfills provide protection of human health and the environment. • Groundwater actions are operating as designed to remove contamination captured to meet appropriate surface water quality standards at surface water POCs. • Monitoring of groundwater, surface water, sediment, and ecology provides data to verify that RFETS continues to be protective of human health and the environment. The IMP also includes environmental monitoring of the Present and Original Landfills, the Present Landfill seep treatment system, and the three groundwater treatment systems. This alternative may not be protective of human health if the current site land configuration were to change. In particular: • Because the CRA does not evaluate an unrestricted scenario, but instead evaluates potential risk to the anticipated future user, the assumptions used in the CRA human health calculations, including the assumptions used in calculating the WRW PRGs, need to be embodied in an institutional control. • Residual soil contamination exists in the Central OU. If residual soil contamination is disturbed, the contamination could migrate to surface water via erosion which could result in some surface water sample results above surface water standards at some surface water monitoring locations. • Subsurface soil and groundwater contamination exists above the indoor air volatilization PRGs. • Groundwater contamination exists in the Central OU above MCLs. • Surface water quality standards are met at the surface water POCs. However, surface water sample results do not always meet Colorado surface water standards for some analytes at some on-site surface water monitoring locations upstream of the terminal ponds. • Institutional controls for the Original Landfill are not in place. • There are no prohibitions on affecting the engineered aspects of the remedy.		This alternative is protective of human health and the environment because: • See Alternative 1. • Alternative 2 increases the protectiveness of Alternative 1 because institutional controls will provide the following: - The construction and use of buildings that will be occupied on a permanent or temporary basis (such as for residences, offices, shops, break rooms, and so forth) is prohibited. The construction and use of storage sheds or other nonoccupied structures is permitted, consistent with the restrictions below, and provided such use does not impair any aspect of the response action at Rocky Flats. - Excavation, drilling, and other intrusive activities below a depth of 3 ft are prohibited, except for remedy-related purposes. - No grading, excavation, digging, tilling, or other disturbance of any kind of surface soils is permitted, except in accordance with an erosion control plan approved by CDPHE or EPA. Any such soil disturbance shall restore the soil surface to pre-existing grade. - Surface water above the terminal ponds may not be used for drinking water or agricultural purposes. - The construction or operation of groundwater wells is prohibited, except for remedy-related purposes. - Digging, drilling, tilling, grading, excavation, construction of any sort (including construction of any structures, paths, trails, or roads), and vehicular traffic are prohibited on the covers of the Present Landfill and the Original Landfill, except for authorized response actions. - Activities that may damage or impair the proper functioning of any engineered component of the response action, including but not limited to any treatment system, monitoring well, landfill cap, or surveyed benchmark, are prohibited. - Signs will be installed as a physical control along the perimeter of the Central OU to notify the WRW and WRV that they are at the boundary of the Refuge maintained by USFWS.		This alternative is protective of human health and the environment because: • See Alternatives 1 and 2. • Alternative 3 increases the protectiveness of Alternatives 1 and 2 because targeted surface soil removal will reduce plutonium-239/240 contamination to below 9.8 pCi/g. • Surface soil removal will result in short-term adverse impacts to ecological resources, including potential impacts to PMJM habitat. • Removal of surface soil increases the potential to mobilize residual contamination, particularly if a large area of soil is removed, or if the removal is on a steep slope or in close proximity to a stream segment. It also increases the potential for wind erosion.

Table 22
Analysis of Alternatives for the Central Operable Unit

	No Further Action With Monitoring (Alternative 1)		Institutional and Physical Controls (Alternative 2)		Targeted Surface Soil Removal (Alternative 3)
Compliance With ARARs and RAOs	This alternative complies with most ARARs; however, it does not meet all ARARs. This alternative does not meet all RAOs.		This alternative complies with all ARARs and meets all RAOs.		This alternative complies with all ARARs and meets all RAOs.
Long-Term Effectiveness and Permanence	• Most of the RFCA accelerated actions (except the landfills) included removal of contaminated structures and environmental media providing a high degree of long-term effectiveness and permanence. • Landfills have been closed in accordance with regulatory agency-approved closure plans as long-term solutions. • Remaining building structures either meet free release standards or have fixed contamination that is 6 ft or more below ground surface. • Groundwater treatment systems are permanent passive systems requiring limited operational attention. • Monitoring of groundwater and surface water provides additional assurance of permanence.		See Alternative 1 plus: • Institutional controls are designed to provide the mechanisms that permanently maintain the completed actions conducted at RFETS and the monitoring consistent with the requirements in all accelerated action decision documents. • In the very long term, institutional controls may fail. • An environmental covenant will increase the long-term permanence of institutional controls.		See Alternative 2 plus: • Removal of surface soil will permanently and effectively reduce plutonium-239/240 contamination to below 9.8 pCi/g. • Surface soil removal reduces remaining residual surface contamination that could be mobilized in the future if disturbed.
Reduction of Toxicity, Mobility, or Volume Through Treatment	• Groundwater treatment systems provide for a reduction of VOCs or uranium and nitrate reducing the overall volume of contaminants in the groundwater and protecting the adjacent surface water. • The Present Landfill seep treatment system provides treatment to remove the VOC contamination from the landfill seep.		See Alternative 1.		See Alternative 1.
Short-Term Effectiveness	Workers and the public are not at risk because no additional action is required in this alternative.		See Alternative 1 plus: • Institutional controls are effective immediately after the controls have been established.		See Alternative 2 plus: • Removal of surface soil will result in an incremental risk to the workers and the public through the removal and transportation operations. • Surface soil removal will result in short-term adverse impacts to ecological resources. • Removal of surface soil increases the potential to mobilize residual contamination, particularly if a large area of soil is removed, or if the removal is on a steep slope or in close proximity to a stream segment. It also increases the potential for wind erosion.
Implementability	• No further action is easily implemented because all accelerated actions are complete. • Post-accelerated action monitoring of the Present and Original Landfills is easily implemented because the monitoring systems are established. • Monitoring through the IMP is easily implemented because the monitoring network is established.		See Alternative 1 plus: • Institutional controls and an environmental covenant are easily implemented. • Physical controls, such as signage, are easily implemented.		See Alternative 2 plus: • Even though standard earthmoving and transportation equipment is readily available, implementing the alternative without impacting surface water quality is difficult. • Weather, wind, and precipitation will increase the potential for soil erosion and sediment loads to the RFETS drainages. • Major construction to support the long duration of the work would be required.

Table 22
Analysis of Alternatives for the Central Operable Unit

	No Further Action With Monitoring (Alternative 1)		Institutional and Physical Controls (Alternative 2)		Targeted Surface Soil Removal (Alternative 3)
Cost[a]	Capital Cost: $0 Annual O&M Cost: $2,530,000 Present Worth Cost: $41,350,000 Groundwater treatment system media replacement costs are estimated at $728,000 every 5 years. The estimated costs for preparing materials for the CERCLA periodic reviews is $153,000 every 5 years.		Capital Cost: $1,120,000 Annual O&M Cost: $45,000 (Alternative 2 only) Total Annual O&M Cost: $2,575,000 (includes Alternatives 1 and 2), less the periodic media replacement costs and CERCLA review costs Present Worth Cost: $43,170,000 (includes Alternatives 1 and 2)		Capital Cost: $222,340,000 (assumes up to approximately 368 acres for surface soil removal and disposal as low-level radionuclide-contaminated soil) Total Capital Cost: $223,460,000 (includes Alternatives 1, 2, and 3) Annual O&M Cost: Varies from $206,000 to $70,000 (Alternative 3 only) Total Annual O&M Cost: $2,781,000 to $2,645,000 (includes Alternatives 1, 2, and 3), less the periodic media replacement costs and CERCLA review costs Present Worth Cost: $265,510,000 (includes Alternatives 1, 2, and 3)
State Acceptance	Discussion of this criterion will be provided in the CAD/ROD.		Discussion of this criterion will be provided in the CAD/ROD.		Discussion of this criterion will be provided in the CAD/ROD.
Community Acceptance	Discussion of this criterion will be provided in the CAD/ROD.		Discussion of this criterion will be provided in the CAD/ROD.		Discussion of this criterion will be provided in the CAD/ROD.

[a] Capital costs are in 2005 dollars and O&M costs are calculated for 30 years at a discount rate of 5 percent.

ATTACHMENT 2

DETAILED COST ESTIMATES FOR THE SELECTED REMEDY/CORRECTIVE ACTION

Attachment 2
Alternative 1 Summary
Alternative 1 - No Further Action with Monitoring

No.	Monitoring Action	Cost
1	Present Landfill Cover System and Landfill Seep Treatment System	$150,000
2	Original Landfill Cover System	$110,000
3	Three Existing Groundwater Monitoring Systems	$140,000
4	RFETS IMP Monitoring	$2,130,000

Total $2,530,000

Present Value Analysis
Interest Rate: 5%
Period: 30 Years

	Type	Years	Cost/year	Factor	Present Value
1	Present Landfill Cover System and Landfill Seep Treatment System	1 - 30	$150,000	15.372	$2,305,868
2	Original Landfill Cover System	1 - 30	$110,000	15.372	$1,690,970
3	Three Existing Groundwater Monitoring Systems	1 - 30	$140,000	15.372	$2,152,143
4	RFETS IMP Monitoring	1 - 30	$2,130,000	15.372	$32,743,321

Total Present Value of Alternative (less media replacement) $38,892,301

	Type	Year	Cost/5 years	Factor	Present Value
1	Groundwater Treatment System Media Replacement	5	$728,000	0.784	$570,407
2	Groundwater Treatment System Media Replacement	10	$728,000	0.614	$446,929
3	Groundwater Treatment System Media Replacement	15	$728,000	0.481	$350,180
4	Groundwater Treatment System Media Replacement	20	$728,000	0.377	$274,376
5	Groundwater Treatment System Media Replacement	25	$728,000	0.295	$214,980
6	Groundwater Treatment System Media Replacement	30	$728,000	0.231	$168,443

Present Worth for Media Replacement $2,025,315

	Type	Year	Cost/5 years	Factor	Present Value
1	CERCLA 5 - Year Review	5	$153,000	0.784	$119,880
2	CERCLA 5 - Year Review	10	$153,000	0.614	$93,929
3	CERCLA 5 - Year Review	15	$153,000	0.481	$73,596
4	CERCLA 5 - Year Review	20	$153,000	0.377	$57,664
5	CERCLA 5 - Year Review	25	$153,000	0.295	$45,181
6	CERCLA 5 - Year Review	30	$153,000	0.231	$35,401

Present Worth for CERCLA 5-Year Reviews $425,650

Total Present Worth for Alternative 1 $41,343,266

Total Present Worth for Alternative 1(Rounded) $41,350,000

Attachment 2
PLF O&M Cost Sheet

Alternative 1

Cost Estimate Summary

Site: Present Landfill
Location:
Phase: Feasibility Study (-30% to +50%)
Base Year: 2005
Date: 6/27/2006

Description: This alternative consists of operations and maintenance of the montoring wells, vegetation, and sampling at the PLF.

Annual O&M Costs

Description	Quantity	Unit	Unit Cost	Total	Notes
Monitoring & Maintenance					
Quarterly PLF Site Inspection - Fieldwork	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Quarterly PLF Site Inspection - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Monitoring Well Sampling - Fieldwork	4	days	$1,200	$4,800	1 team x 1 day x 8 hours/day @ $150/hour
Monitoring Well Sampling - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Monitoring Well Sampling - Lab	24	samples	$500	$12,000	Qtrly VOCs and metals for 6 wells
Monitoring Well Maintenance	1	LS	$500	$500	Lock replacements/well cover & pad repairs
				$0	
				$0	
Weed Control	25	acres	$250	$6,250	$250 per acre/year for weed control
Vegetation maintenance/reseeding	5	acres	$30	$150	$30 per acre/year for reseeding
Vegetation monitoring - Fieldwork	4	days	$600	$2,400	1 ecologist x 1 day x 8 hours/day @$75/hour
Vegetation monitoring - Office	4	days	$600	$2,400	1 ecologist x 1 day x 8 hours/day @ $75/hour
Seep Treatment System/GWIS Sampling - Fieldwork	2	days	$1,200	$2,400	1 team x 1 day x 8 hours/day @ $150/hour
Seep Treatment System/GWIS Sampling - Office	2	days	$800	$1,600	1 engineer x 1 day x 8 hours/day @ $100/hour
Seep Treatment System Sampling - Lab	8	samples	$500	$4,000	Qtrly VOCs & Metals at seep influent & effluent
GWIS Sampling - Lab	8	samples	$3,000	$24,000	Qtrly Appendix 8 constiteunts at north & south GWIS
Seep Treatment System Maintenance	1	LS	$500	$500	annual allotment
East Pond Dam Monitoring - Fieldwork	2	days	$800	$1,600	1 engineer x 1 day x 8 hours/day @ $100/hour
East Pond Dam Monitoring - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Sampling & Office ODCs	4	QTRs	$1,000	$4,000	$1000 per quarter
Sample Handling & H&S Supplies	4	QTRs	$500	$2,000	$500 per quarter
Annual Report	20	days	$800	$16,000	1 engineer x 1 day x 8 hours/day @ $100/hour
SUBTOTAL				**$97,400**	
Contingency (Scope + Bid)	25%			$24,350	
SUBTOTAL				**$121,750**	
Project Management	8%			$9,740	Planning & Reporting
Technical Support	15%			$18,263	O&M Oversight, Manual Updates, Reviews
TOTAL ANNUAL O&M COST				**$149,753**	

TOTAL ANNUAL O&M COST (ROUNDED) **$150,000**

Attachment 2
OLF O&M Cost Sheet

Alternative 1

Cost Estimate Summary

Site:	Original Landfill	Description:	This alternative consists of operations and maintenance of the montoring wells, vegetation, and sampling at the OLF.
Location:			
Phase:	Feasibility Study (-30% to +50%)		
Base Year:	2005		
Date:	6/27/2006		

Annual O&M Costs

Description	Quantity	Unit	Unit Cost	Total	Notes
Monitoring & Maintenance					
Quarterly OLF Site Inspection - Fieldwork	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Quarterly OLF Site Inspection - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Monitoring Well Sampling - Fieldwork	4	days	$1,200	$4,800	1 team x 1 day x 8 hours/day @ $150/hour
Monitoring Well Sampling - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Monitoring Well Sampling - Lab	16	samples	$600	$9,600	Qtrly VOCs, SVOCs, metals and pesticides for 4 wells
Monitoring Well Maintenance	1	LS	$500	$500	Lock replacements/well cover & pad repairs
Surface Water Sampling - Fieldwork	4	days	$1,200	$4,800	1 team x 1 day x 8 hours/day @ $150/hour
Surface Water Sampling - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Surface Water Sampling - Lab	8	samples	$600	$4,800	Qtrly VOCs &
Surface Water Maintenance	1	LS	$500	$500	general repairs
Weed Control	25	acres	$250	$6,250	$250 per acre/year for weed control
Vegetation maintenance/reseeding	5	acres	$30	$150	$30 per acre/year for reseeding
Vegetation monitoring - Fieldwork	4	days	$600	$2,400	1 ecologist x 1 day x 8 hours/day @$75/hour
Vegetation monitoring - Office	4	days	$600	$2,400	1 ecologist x 1 day x 8 hours/day @ $75/hour
Sampling & Office ODCs	4	QTRs	$1,000	$4,000	$1000 per quarter
Sample Handling & H&S Supplies	4	QTRs	$500	$2,000	$500 per quarter
Annual Report	20	days	$800	$16,000	1 engineer x 1 day x 8 hours/day @ $100/hour
SUBTOTAL				**$71,000**	
Contingency (Scope + Bid)	25%			$17,750	
SUBTOTAL				**$88,750**	
Project Management	8%			$7,100	Planning & Reporting
Technical Support	15%			$13,313	O&M Oversight, Manual Updates, Reviews
TOTAL ANNUAL O&M COST				**$109,163**	

TOTAL ANNUAL O&M COST (ROUNDED) **$110,000**

Attachment 2
GW Systems O&M Cost Sheet

Alternative 1

Cost Estimate Summary

Site:	Groundwater Monitoring Systems	Description:	This alternative consists of operations and maintenance of the groundwater treatment systems at the Mound, East Trenches, and Solar Ponds.
Location:	Mound, East Trenches, & Solar Ponds		
Phase:	Feasibility Study (-30% to +50%)		
Base Year:	2005		
Date:	6/27/2006		

Annual O&M Costs

Description	Quantity	Unit	Unit Cost	Total	Notes
Monitoring & Maintenance					
Quarterly System Inspection - Fieldwork	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Quarterly System Inspection - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Monitoring Well Sampling - Fieldwork	8	days	$1,200	$9,600	1 team x 1 day x 8 hours/day @ $150/hour
Monitoring Well Sampling - Office	4	days	$800	$3,200	1 engineer x 1 day x 8 hours/day @ $100/hour
Monitoring Well Sampling - Lab	12	samples	$1,000	$12,000	12 wells for system specific consteunts
Monitoring Well Maintenance	1	LS	$500	$500	general repairs
Treatment System Effluent Sampling - Fieldwork	1	days	$1,200	$1,200	1 team x 1 day x 8 hours/day @ $150/hour
Treatment System Effluent Sampling - Office	2	days	$800	$1,600	1 engineer x 1 day x 8 hours/day @ $100/hour
Treatment System Effluent Sampling - Lab	3	samples	$1,000	$3,000	for system specific constiieunts
Routine System Maintenance - Fieldwork	6	days	$1,200	$7,200	3-person team at $150/hour
Routine System Maintenance - Equipment	6	days	$800	$4,800	Backhoe and pickup truck
Routine System Maintenance - ODCs	6	days	$500	$3,000	$500/day
Sampling & Office ODCs	4	QTRs	$1,000	$4,000	1000 per qtr
Sample Handling & H&S Supplies	4	QTRs	$500	$2,000	500 per qtr
				$0	
Annual Report	40	days	$800	$32,000	1 engineer x 1 day x 8 hours/day @ $100/hour
				$0	
SUBTOTAL				**$90,500**	
Contingency (Scope + Bid)	25%			$22,625	
SUBTOTAL				**$113,125**	
Project Management	8%			$9,050	Planning & Reporting
Technical Support	15%			$16,969	O&M Oversight, Manual Updates, Reviews
TOTAL ANNUAL O&M COST				$139,144	

TOTAL ANNUAL O&M COST (ROUNDED) **$140,000**

Attachment 2
Media Replacement

Alternative 1

Cost Estimate Summary

Site:	GW Treat Media Replacment	Description:	Replace the treatment media in the groundwater treatment units every five years
Location:	Central OU		Costs will vary between each system; however, this estimate is considered an average cost with a similar level of effort for all treatment systems.
Phase:	Feasibility Study (-30% to +50%)		
Base Year:	2005		
Date:	9/12/2005		

GW Treatment System Media Replacment (for one unit)

Activity	Item	# of Units	Units	Unit Rate	Cost	Assumptions
Monument Installation						
	Direct					
	Project Manager	120	hours	100	$12,000	3 weeks
	PM Support	60	hours	65	$3,900	
	Safety	40	hours	80	$3,200	
	Engineering Support	0	hours	80	$0	
	RTC Support	0	hours	37	$0	
	Waste Inspector/Generator Support	0	hours	42	$0	
	Misc. Support	40	hours	50	$2,000	
	Direct ODC's	1	months	500	$500	$500/month
	Subtotal				**$21,600**	
	Sampling and Analytical					
	Manager	0	hours	80	$0	
	Field Techs	0	hours	40	$0	
	Lab Expenses	0	days	0	$0	
	Subtotal				**$0**	
	Construction Contractor					
	LABOR					
	Superintendent	120	hours	70	$8,400	full time for 3 weeks
	H&S Officer	120	hours	70	$8,400	
	Labor Foreman	0	hours	65	$0	
	Equipment Foreman	120	hours	65	$7,800	full time for 3 weeks
	Laborers	360	hours	60	$21,600	3 full time for 3 weeks
	Equipment Operators	240	hours	60	$14,400	2 full time for 3 weeks
	Subtotal				**$60,600**	
	Equipment/Supplies					
	Forklift	0	months	8000	$0	
	Track Hoe	0	months	12000	$0	
	Rubber-tired Backhoe	1	months	5000	$5,000	1 month
	Water Truck	0	months	3000	$0	
	Pick-up Truck	2	months	500	$1,000	2 for 1 month
	Replacement Media	50	tons	1200	$60,000	$1200/ton
	Piping, slotted	20	feet	160	$3,200	$160/ft
	Piping, solid	50	feet	5	$250	$5/ft
	H&S Supplies	1	months	1000	$1,000	1 month for $1000/month
	Spent Media Disposal	75	tons	1150	$86,250	$900/ton disposal with $250/ton transportation
	Misc. Supplies	1	months	500	$500	1 month @ $500/mo
					$157,200	
	Erosion Control					
		1	acres	3000	$3,000	Soil preparation(if needed), seeding and erosion mating
					$3,000	
	Total Replacement Cost per Unit				**$242,400**	
	Total Replacment Cost for 3 Units				**$727,200**	
	Total Replacment Cost for 3 Units (Rounded)				**$728,000**	

Attachment 2
RFETS IMP O&M Cost Sheet

Alternative 1

Cost Estimate Summary

Site:	RFETS	Description:	This alternative consists of surface water monitoring, groundwater monitoring, air monitoring, ecological monitoring, and soil monitoring as defined in the IMP.
Location:			
Phase:	Feasibility Study (-30% to +50%)		
Base Year:	2005		
Date:	6/27/2006		

Annual O&M Costs

Description	Quantity	Unit	Unit Cost	Total	Notes
Monitoring & Maintenance					
Air Monitoring	1	LS	$90,228	$90,228	See separate cost detail
Groundwater + Surface Water Monitoring	1	LS	$993,195	$993,195	See separate cost detail
Ecological Monitoring	1	LS	$247,560	$247,560	See separate cost detail
SUBTOTAL				$1,330,983	
Contingency (Scope + Bid)	25%			$332,746	
SUBTOTAL				$1,663,729	
Project Management	8%			$133,098	Planning & Reporting
Technical Support	20%			$332,746	O&M Oversight, Manual Updates, Reviews
TOTAL ANNUAL O&M COST				**$2,129,573**	

TOTAL ANNUAL O&M COST (ROUNDED) **$2,130,000**

Attachment 2
CERCLA Reviews

Alternative 1

Cost Estimate Summary

Site:	5-year CERCLA Reviews	Description:	Prepare Reports/Materials for 5 year CERCLA Reviews
Location:	Central OU		
Phase:	Feasibility Study (-30% to +50%)		
Base Year:	2005		
Date:	9/12/2005		

5-year CERCLA Reviews

Activity	Item	# of Units	Units	Unit Rate	Cost	Assumptions
Monument Installation						
	Direct					
	Project Manager	300	hours	100	$30,000	2 months
	PM Support	300	hours	65	$19,500	2 months
	Safety	0	hours	80	$0	
	Engineering Support	300	hours	80	$24,000	2 months
	Misc. Support	200	hours	50	$10,000	1.5 months
	Direct ODC's	2	months	500	$1,000	$500/month
	Subtotal				**$84,500**	
	Data Base Management					
	Manager	300	hours	100	$30,000	2 months
	DB Support	300	hours	80	$24,000	2 months
	Misc. Support	200	days	50	$10,000	1.5 months
	DB ODCs	2	months	2000	$4,000	$2000/month
	Subtotal				**$68,000**	
	Total Cost				**$152,500**	
	Total Cost (Rounded)				**$153,000**	

Attachment 2
Alternative 2 Summary

Alternative 2 - Institutional & Physical Controls

No.	Action	Cost
1	Capital Costs	$1,120,000
2	O&M Costs	$45,000

Present Value Analysis
Interest Rate: 5%
Period: 30 Years

	Action	Year	Cost/year	Factor	Present Value
1	Capital Costs	0	$1,120,000	1.000	$1,120,000
2	O&M Costs	1-30	$45,000	15.372	$691,760

Total Present Value of Alternative 2 **$1,811,760**

Total Present Value of Alternative 2 (rounded) **$1,820,000**

Attachment 2
Capital Cost Sheet

Alternative 2

Cost Estimate Summary

Site:	Institutional & Physical Controls	Description:	Land use restrictions and signage around the IA OU
Location:	Central OU		
Phase:	Feasibility Study (-30% to +50%)		
Base Year:	2005		
Date:	9/12/2005		

Capital Costs

Description	Quantity	Unit	Unit Cost	Total	Notes
Mobilization/Demobilization					
Construction Equipment and Facilities	1	LS	$80,100	$80,100	15% constr. subtotal (includes work control docs.)
Site Preparation	1	LS	$80,100	$80,100	15% constr. subtotal
Signage Monuments	786	each	$500	$393,000	monument every 50 feet for 39,302 LF
Monument Installation	1	LS	$66,200	$141,000	See separate detail sheet
Subtotal				$534,000	
SUBTOTAL				**$614,100**	
Contingency (Scope + Bid)	50%			$307,050	
SUBTOTAL				**$921,150**	
Project Management	8%			$73,692	
Remedial Design	5%			$46,058	
Construction Management	5%			$46,058	
Institutional Controls					
Institutional Controls Plan/Filings	25	days	$1,200	$30,000	1 lawyer x 1 day x 8 hours/day @ $150/hour
Subtotal				**$30,000**	
TOTAL CAPITAL COST				**$1,116,957**	
TOTAL CAPITAL COST (rounded)				**$1,120,000**	

Attachment 2
Construction Cost

Alternative 2

Cost Estimate Summary

Site:	Institutional & Physical Controls	Description: Land use restrictions and signage around the IA OU
Location:	Central OU	
Phase:	Feasibility Study (-30% to +50%)	
Base Year:	2005	
Date:	9/12/2005	

Monument Construction/Installation Cost

Activity	Item	# of Units	Units	Unit Rate (Cost		Assumptions
Monument Installation						
	Direct					
	Project Manager	40	hours	80	$3,200	1 week
	Misc. Support	10	hours	80	$800	
	Direct ODC's	1	months	100	$100	$100/month
	Subtotal				**$4,100**	
	Construction Contractor					
	LABOR					
	Superintendent	100	hours	70	$7,000	1/2 time for 1 month
	H&S Officer	200	hours	70	$14,000	Full time for 1 month
	Labor Foreman	0	hours	65	$0	
	Equipment Foreman	200	hours	65	$13,000	Full time for 1 month
	Laborers	400	hours	60	$24,000	2 full time for 1 month
	Equipment Operators	200	hours	60	$12,000	Full time for 1 month
	Subtotal				**$70,000**	
	Equipment/Supplies					
	Forklift	0	months	8000	$0	
	Track Hoe	0	months	12000	$0	
	Rubber-tired Backhoe	1	months	5000	$5,000	1 month
	Water Truck	0	months	3000	$0	
	Pick-up Truck	2	months	500	$1,000	2 for 1 month
	Generator	0	months	900	$0	
	Light Tree	0	months	1100	$0	
	Mower/Disk	0	months	9000	$0	
	H&S Supplies	0	months	11500	$0	
	Conex Boxes	1	months	400	$400	1 for 1 month
	Intermodals (for soil disposal)	0	months	310000	0	
	Misc. Supplies	1	months	500	$500	1 month @ $500/mo
	Subtotal				**$6,900**	
	Erosion Control					
		20	acres	3000	$60,000	
	Subtotal				**$60,000**	
	Total Installation Cost				**$141,000**	
	Total Installation Cost (Rounded)				**$141,000**	

Attachment 2
O&M Cost Sheet

Alternative 2

Cost Estimate Summary

Site:	Institutional Controls Area	Description:	This estimate is for yearly inspection within the IA and legal fees if any violation of the institutional controls occurs.
Location:	Central OU		
Phase:	Feasibility Study (-30% to +50%)		
Base Year:	2005		
Date:	9/12/2005		

Annual O&M Costs

Description	Quantity	Unit	Unit Cost	Total	Notes
Monitoring & Maintenance					
Quarterly General Site Inspection of IA	20	days	$800	$16,000	1 engineer x 1 day x 8 hours/day @ $100/hour
Monument Maintenance	1	LS	6000	$6,000	Replacement of 5 monuments per year
Subtotal				$22,000	
SUBTOTAL				**$22,000**	
Contingency (Scope + Bid)	25%			$5,500	
SUBTOTAL				**$27,500**	
Project Management	25%			$6,875	Planning & Reporting
Technical Support	15%			$4,125	O&M Oversight & Reviews
Institutional Controls					
Institutional Controls Plan/Filings Updates	5	days	$1,200	$6,000	1 lawyer x 1 day x 8 hours/day @ $150/hour
SUBTOTAL				**$6,000**	
TOTAL ANNUAL O&M COST				**$44,500**	

TOTAL ANNUMAL O&M COST (ROUNDED) **$45,000**

ATTACHMENT 3

RESPONSIVENESS SUMMARY

Rocky Flats Stewardship Council Letter dated August 30, 2006

1. The Stewardship Council strongly believes DOE, EPA, and CDPHE cannot approve the Proposed Plan without duly considering and discussing the full suite of issues that comprise regulatory closure. For that reason, in discussing the Proposed Plan, the Stewardship Council is raising issues that will be addressed later in other, related decision documents.	The RFLMA will implement the remedy requirements outlined in the CAD/ROD and will undergo a public review and comment process, including a formal public comment period.

2. As the Local Stakeholder Organization for Rocky Flats, the Stewardship Council asks DOE to not simply reply to these issues in writing but to discuss as necessary and as appropriate these issues directly with the Board. Further, while the Stewardship Council represents a broad segment of the community, there are various perspectives in the community regarding the cleanup and Proposed Plan. The Stewardship Council encourages DOE, EPA, and CDPHE to continue to consider all points of view. The Stewardship Council supports Alternative 2…	DOE will continue to interact with all interested parties and stakeholders throughout the regulatory completion process.

3. While all four groundwater treatment systems have experienced a variety of maintenance needs ranging from minor maintenance to severe operational problems over the lifetime of the units, recent operational problems with the Solar Ponds groundwater treatment system calls into question its ability to function as described in the Proposed Plan. The Solar Ponds treatment system was installed in 1999 to treat both uranium and nitrate contamination in groundwater before it emerges as surface water in North Walnut Creek. Between 1999 and 2005 the treatment system effectively lowered nitrate and uranium concentrations in groundwater that passed through the treatment cells. In 2005 a series of operational problems began to degrade the effectiveness of the treatment system. System component failures were discovered which included both nitrate treatment media ineffectiveness and material failures (piping, valves, etc.).	The SPPTS has undergone substantial repair and maintenance in the summer and fall of 2006. These actions are expected to restore the system to its original operating condition, which has been shown to be effective in treating nitrate and uranium isotopes in shallow groundwater in the vicinity of the historic Solar Ponds. Continued maintenance of the system to ensure its long-term effectiveness is a requirement of the CAD/ROD.

4. Adding to our questions and concerns is a recent comment by DOE that the agency may petition the Colorado Water Quality Control Commission to raise the allowable level of nitrates in surface water at Rocky Flats. The current standard for nitrate, which is in force until 2009, is an interim standard of 100 milligrams/liter (mg/l) that the agencies adopted with the consent of the cities of Broomfield and Westminster. This interim standard was adopted with the recognition that the standard of 10 mg/l could not be met until the treatment system was installed and operating properly, so an interim cleanup standard was adopted. If the interim nitrate standard became permanent, this change would likely obviate the need to fix the Solar Ponds treatment system and/or treat all of the contaminated groundwater.	The repairs and maintenance provided for the SPPTS are expected to restore the system to a fully operational condition. When the collection trench for the SPPTS was constructed as part of the accelerated action for this area, it was recognized that a portion of the Solar Ponds groundwater contaminant plume could not be captured due to engineering constraints on the placement of the collection trench. The Groundwater IM/IRA revisited the groundwater contamination in the vicinity of the Solar Ponds, and concluded that there were no additional steps that could reasonably be taken to treat shallow groundwater contamination emanating from the historic Solar Ponds, apart from enhancement techniques such as phyto-remediation. This conclusion is incorporated into the CAD/ROD, which does not propose additional groundwater treatment at Rocky Flats. The CAD/ROD is based upon the underlying water quality standard for nitrate of 10 mg/l (as N) in the selection of the final remedy, which includes continued operation of the SPPTS.

5. The Stewardship Council strongly supports the decision to prohibit access to DOE-retained lands. The Board understands the RI/FS and Proposed Plan provide DOE will install a cattle fence along the boundary between United States Fish and Wildlife Service (USFWS) lands and DOE lands, with signs every 50' noting access to DOE-retained lands is prohibited. The Board further understands DOE and the regulatory agencies do not consider the fence to be part of the cleanup remedy; it is instead a land management tool USFWS and DOE will utilize to assist each agency in accomplishing their respective responsibilities. The Stewardship Council believes a fence is warranted. We further believe that as discussed at length in the Board's June 15, 2006, letter to USFWS, signage throughout the site remains critical. Taken together, the fence and signs will not deter those intent on disturbing the remedies, but should protect the remedies from those who would otherwise unintentionally wander into DOE lands.	A fence surrounding the Central OU is not required to protect human health or the environment, nor is it required to ensure effectiveness of the remedy. Therefore, a fence is not required in the CAD/ROD However, DOE and USFWS have agreed that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained as a best management practice. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU. In addition, DOE and the regulators have agreed to post signs at the main pedestrian and vehicle entrance gates into the Central OU outlining the specific institutional control restrictions from the CAD/ROD and

Yet, a boundary fence with signs is not alone sufficient, so following the recommendation of the National Research Council in its August 2000 report to DOE on long-term stewardship, long-term stewardship controls must be layered to protect the remedies. Layering could include signage or fencing around the two landfills, signage or fencing adjacent to or surrounding the A-, B- and C-series ponds, and signs around the three groundwater treatment systems reminding DOE personnel (including contractor personnel) that digging is prohibited. These types of controls are, importantly, designed to protect the remedies from people and not people from the remedies. The Stewardship Council is not prepared to specify at this time the remedy-specific controls that DOE, EPA, and CDPHE should adopt. Instead the Proposed Plan and/or other appropriate regulatory documents should identify the need for additional controls and DOE, EPA, and CDPHE should continue the ongoing public dialogue about the types of controls that are needed.	environmental covenant. The concept of layered controls is embodied within the selected remedy for the Central OU, however not in the form of layered fences. The layered controls include signs as a required physical control, ongoing ownership by DOE to prevent digging, water usage, and other prohibited activities, routine presence and observation by DOE and contractor staff, and an environmental covenant with the State of Colorado restricting use of the Central OU in perpetuity. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment.

6. In addition to physical controls (e.g., fences and signs) DOE, EPA, and CDPHE, along with USFWS, must also develop and implement legal controls (otherwise known as "institutional controls"). Towards this end, the RI/FS identifies the following prohibitions… The Stewardship Council believes these prohibitions are complete and as DOE, EPA, and CDPHE proceed with regulatory closure, the agencies must specify in detail how such restrictions will be legally enforced (e.g., regulatory closure documents, state environmental covenant) and how such information will be communicated to the appropriate people, including but not limited to both DOE and USFWS personnel (e.g., signage, staff training).	The Proposed Plan develops broad alternatives for remedial action. Approval of the CAD/ROD will select the alternative and establish the requirements to implement that alternative. More detailed information describing how the DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the Rocky Flats Legacy Management Agreement (RFLMA). The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

7. One shortfall of the Proposed Plan is that it only addresses	Per the Refuge Act the DOE may access any areas, whether in the

those areas the DOE will retain. Nevertheless, as we know DOE will be charged with managing monitoring stations on refuge lands. It is therefore imperative that the Proposed Plan and any other applicable regulatory documents specify that these controls also apply to those areas of the refuge that include these monitoring stations.	Central OU or Peripheral OU, which are required for monitoring or remedy purposes. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed.

8. Central to the development, implementation, and modification of the monitoring program is the Integrated Monitoring Plan (IMP). The IMP served two roles. First and most important, the IMP codifies the monitoring network and regulatory basis for making changes to the current surface water, air, ecological and groundwater monitoring systems. The IMP also establishes the frequency and process by which DOE notifies the community of problems with the system and potential changes. This process, which has also included collaborating with the community members on the establishment of the post-closure monitoring network, has been extremely valuable and the Stewardship Council wants to ensure this important dialogue continues post-closure.	The IMP is identified in the CAD/ROD as a key reference to identify the monitoring requirements. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment.

9. The Stewardship Council understands DOE, EPA, and CDPHE will likely use the Long-Term Surveillance and Monitoring Plan (LTSMP) to codify the post-closure monitoring requirements, but we do not know if the LTSMP will include the process established in the current IMP where local government and other community members actively participate in decision making. The Stewardship Council therefore strongly recommends DOE, EPA, and CDPHE continue the ongoing dialogue with the community that is currently the practice under the IMP.	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. Public participation will be described in an appendix to the RFLMA. The RFLMA will be released for public review and comment.

10. Specifically, water in the terminal ponds is only tested prior to releases – and yet, in some years there will be no discharges. Thus, in those years, water in the terminal ponds will not be	The CAD/ROD identifies surface water monitoring requirements which are adequate to ensure the continuing protectiveness of the remedy, and to ensure that water leaving Rocky Flats continues to

tested. The Stewardship Council strongly recommends that in the event water is not discharged in a given year, DOE should nevertheless test water in the terminal ponds no less than one time per year to measure water quality and thus determine remedy effectiveness. Such language should be captured in all applicable regulatory documents.	meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment.

11. The Stewardship Council feels confident that the Interim Surveillance and Maintenance Plan, which will be adopted as the LTSMP (with slight modifications) after approval of the CAD/ROD, is thorough and we urge its adoption.	The Interim Surveillance and Maintenance Plan was an internal working document. The IMP is identified in the CAD/ROD as a key reference to identify the monitoring requirements. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. An LTS&MP has not been issued and is not part of the Proposed Plan.

12. Currently the RI/FS and Proposed Plan include a map delineating the lands to be transferred to USFWS and the lands to be retained by DOE. The RI/FS notes that the boundaries may be adjusted and any such adjustments would be included in the CAD/ROD and not the Proposed Plan. The Stewardship Council is comfortable with this approach, but strongly believes that while the CAD/ROD is not a public document, DOE, EPA, and CDPHE must continue to brief and work with the Stewardship Council on the development of that important regulatory document.	The final Central OU boundary is on CAD/ROD Figure 3. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment, and thus will provide the opportunity for continued public involvement in the details of implementing the CAD/ROD requirements.

Letter from Greg Marsh, Rocky Flats Cleanup Commission dated August 30, 2006

1. Mr. Stone proposed long ago, construction of a trench down to bed rock filled with packed clays, and maybe the right membrane, upstream (west) of the remaining messes, and curved east on the north and south ends would properly drain and divert ground water around existing contamination and would prevent its contamination in the first place.	The Groundwater IM/IRA, released for public comment and approved by the regulators, considered a variety of groundwater treatment alternatives, including extensive use of barrier walls. The selected alternative (i.e., smaller and targeted treatment systems) were preferred due to consideration of greater overall effectiveness, CERCLA preference for treatment, and cost and

	time to construct. The RI/FS included the results of the Groundwater IM/IRA as part of the comprehensive analysis, and concluded that no additional remedial actions can reasonably be taken. Also, passage of the Rocky Flats National Wildlife Refuge Act in 2001 created additional considerations. The environmental impact to install the large-scale remedy suggested in this comment would be counter to one of the refuge purposes of restoring and preserving native ecosystems.

2. At the last public meeting in Arvada on 31/8, supposedly to gather public comments, it seemed that this was a charade required in their contract, put on for community appeasement at huge cost to the taxpayers.	The Public Hearing conducted on August 31, 2006 was to gather comment from the public on the Proposed Plan. It was a formal hearing conducted in accordance with regulatory guidance, including use of a facilitator and court reporter to ensure verbatim transcription of oral public comments.

Letter from Rocky Flats Cold War Museum dated August 31, 2006

1. The RFCWM proposes that DOE help fund and develop the museum as an "interpretive center" that becomes an integral part of the proposed remedy itself. What is envisioned is something similar to what is in place at the Weldon Spring, Missouri site (visitor center), the Hanford Reach site ("Gateway to the Hanford Reach National Monument") or the Atomic Testing Museum in Las Vegas (with respect to informing about the Nevada Test Site), or what is being considered for the Mound site in Ohio. DOE would help fund the initial construction of a building on the museum's donated property near the old West Gate entry to the Rocky Flats site. The RFCWM will raise the additional money needed for the building and other planned outdoor and indoor interpretive elements as part of a public/private capital campaign. In the process, the RFCWM would work cooperatively with DOE and US Fish & Wildlife Service (USF&WS) to develop thematic interpretive displays and exhibits that document: • the pre-history and period of early settlement and ranching	An interpretive center at Rocky Flats is not necessary to meet the remedy's objective to protect human health and the environment. However, DOE agrees that an interpretive center's role in educating the public about the history of Rocky Flats supports DOE's legacy management mission. DOE looks forward to working with the U.S. Fish & Wildlife Service, Rocky Flats Cold War Museum and other interested stakeholders in developing an interpretive center that mutually supports the sites' future use.

at the site • the natural and geological history and physical characteristics of the site • the development of the Rocky Flats plant and its history of weapons production in the context of the Cold War; and • the story of clean up and related remedial strategies and monitoring efforts designed to protect the long-term health and environment of the area. This would involve specific interpretive displays explaining the scientific and technical aspects of the on-site remedies, including educational programs and tours designed to help the public understand how they were developed, implemented, and monitored.	

Letter from Dayle Dodge, concerned citizen, dated August 28, 2006

1. I suggest a memorial to all who died at the plutonium factory at Rocky Flats both those who died from effects of the fire accidents as well as those who died later of radiation caused disease.	A plaque was dedicated by the Deputy Secretary of Energy for the Rocky Flats site on December 8, 2005. This plaque states: DEDICATED TO THE ROCKY FLATS WORKERS AND COMMUNITY IN COMMEMORATION OF THE CLEANUP AND CLOSURE OF THE ROCKY FLATS SITE AND FOR THE CRITICAL CONTRIBUTIONS MADE TO AMERICA'S NATIONAL AND ENVIRONMENTAL SECURITY

2. First of all I recommend that the grounds remain restricted and fenced off for the next 5,000 years at least, and that anyone who opens these grounds to access by humans and wildlife should be prosecuted for crimes against humanity and wildlife endangerment. A warning should be posted around Rocky Flats stating the following: WARNING!	A fence surrounding the Central OU is not required to protect human health or the environment, nor is it required to ensure effectiveness of the remedy. However, DOE and USFWS have agreed that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained as a best management practice. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land

Entering these grounds is hazardous to your health and may result in illness and death. Health effects include the following: Women – may be unable to conceive, or miscarry, or birth a baby with the following conditions: - an abnormally small head - mental retardation - mutations including improperly formed bones, and - leukemia or the development of cancerous tumors in its lifetime Men – may develop low sperm counts or sterility, and ALL PEOPLE of all ages will have an increased risk of leukemia or cancers of all kinds - both from low level radiation here and the interaction of that radiation with other chemicals or viruses that one has been exposed to such as human papillomary virus implicated in melanoma, or Hepatitis B, implicated in liver cancer. Besides these risks there may be others. The reproductive effects could still show up in your grandchildren or your great grandchildren even if you don't seem to be directly effected by the radiation. We recommend strongly that you visit either nearby Golden Gate or Eldora State Parks as shown on the following map. Show a Colorado State Parks map with Golden Gate and El Dorado on it.	retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU. The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. Signs and fencing on the outer boundary of the site, marking the future wildlife refuge (currently the Peripheral OU) boundary, are not a part of this decision and will be established as described in the Comprehensive Conservation Plan developed by the U.S. Fish & Wildlife Service.

Email from Hildegard Hix to Robert Darr dated September 6, 2006

1. On Aug. 31, 2006 I attended the "Public Hearing to submit comments on the Proposed Plan for Rocky Flats." I was pleased to note that there were three meetings planned with two on the 31st. I attended the three o'clock meeting at the Arvada Center. Once the moderator began the meeting and announced the ground rules, I realized that everyone connected with this farce had no real interest in hearing what the public had to say. This was an unbelievable display of bureaucratic arrogance, which immediately made it evident that the purpose of the meeting was not to consider what the public view was, rather to fulfill a mandate to hold a public meeting. It certainly in no way reflected holding a "hearing." When there are a great many speakers, it makes sense to have a three minute limit. Since I was the only speaker, this amount of time could have been expanded. However, I really did not have more to say as we were not allowed to comment on Stewardship issues. I find this very strange as the Proposed Plan has many comments about stewardship in it. Even more bizarre was the fact that we could not ask questions of those at the table, but had to ask questions to those in the back of the room. Who has EVER heard of a "hearing" where questions could not be asked?	The Public Hearing conducted on August 31, 2006 was to gather comment from the public on the Proposed Plan. It was a formal hearing conducted in accordance with regulatory guidance, including use of a facilitator and court reporter to ensure verbatim transcription of oral public comments.

2. Both the cities of Westminster and Broomfield have protected the citizens of the downstream communities through their active oversight role. This CAD/ROD document needs to be revised to include the same language as is found in the RFCA and the post closure RFCA.	The Rocky Flats Stewardship Council will facilitate communications between DOE and the public concerning its post-CAD/ROD responsibilities. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment.

3. I also wanted to ask why DOE cannot afford to fence the off site monitoring equipment which is so essential to protecting downstream communities. Surely money cannot be a concern.	Per the Refuge Act the DOE may access any areas, whether in the Central OU or Peripheral OU, which are required for monitoring or remedy purposes. DOE will be required to maintain and

With enough money to hire an outside firm to manage the bogus meetings, and the large sum paid to Kaiser-Hill for the early clean up, there must be money for a few fences to enclose vital equipment, which the federal government should be required to build and maintain! Why should this be a local expense? I couldn't ask that question at the meeting.	protect these locations to ensure that they continue to function as designed.

4. I would like to add that all fences should be given legal status and maintained by the federal government whether they are on COU or POU. You cannot prove with a certainty that the POU's are safe/free of contaminants.	A fence surrounding the Central OU is not required to protect human health or the environment, nor is it required to ensure effectiveness of the remedy. However, DOE and USFWS have agreed that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained as a best management practice. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU.

5. I was very disturbed when I read on page 2 of the Fact Sheet that "The Peripheral Operable Units is safe for all uses." This statement is OPINION, not fact! In fact the entire cleanup, out of necessity, is based on educated and in some cases, not so educated assumptions. Assumptions are NOT facts. Many citizens do not agree that the clean up is protective of human health and that wide spread use of the POU is safe for all activities. Even your own publication shows that the Remedial Action Objectives have not been met. On pages 18 and 19, of the Summary, we find that only one out of three of the objectives have been met. On page 18 under objective 2 you state that restoring contaminated groundwater to beneficial use will be done, "whenever practicable in a reasonable time frame." Had someone from the public wanted to know the definitions for	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. Signs and fencing on the outer boundary of the site, marking the future wildlife refuge (currently the Peripheral OU) boundary, are not a part of this decision and will be established as described in the Comprehensive Conservation Plan developed by the U.S. Fish & Wildlife Service. The remedial action objectives you describe relate to the Central OU, not the Peripheral OU. The selected remedy addresses the physical and institutional controls required in the Central OU to address the assumptions used and the remedial action objectives.

"reasonable time frame" or "practicable" they could not have asked. I would like a definition for both. Then, under "Status" DOE admits to not meeting the requirements at all Sentinel wells, and that no other action can be "reasonably" done.	

6. There are reports that the original landfill cap has seeps on the surface. Why weren't the recommendations in the Dwyer report followed?	No new seep areas have developed at the Original Landfill (OLF) that were not recognized during design and construction. Seep #7 did express itself at the surface a few months after construction, and now expresses itself higher on the hill. DOE is evaluating the need to extend the french drain system at Seep #7 to intercept this upper area. The design and construction of the OLF accommodate variable moisture/hydrologic conditions on and in the landfill with no compromise in performance. Required surveillance and monitoring are adequate to ensure appropriate evaluation of the landfill performance. The Dwyer report was considered by the DOE, EPA, and CDPHE prior to approval of the Original Landfill IM/IRA.

7. When the instituted protective measures used to date, are inoperable, how is the public supposed to believe that the area is safe now, or ever?	Several treatment systems have undergone routine maintenance and repairs. The SPPTS, in particular, has undergone substantial repair and maintenance in the summer and fall of 2006. These actions are expected to restore the system to its original operating condition, which has been shown to be effective in treating nitrate and uranium isotopes in shallow groundwater in the vicinity of the historic Solar Ponds. Continued maintenance of the system to ensure its long-term effectiveness is a requirement of the CAD/ROD.

8. Signs and the language on the signs should be a large part of the public discussion. I believe that all interested member of the public should be engaged in this discussion not only the LSO. I realize that this does not make the development community happy, but everyone needs to be made aware of the potential dangers. The public needs to know that what you cannot see may be dangerous to your health.	The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU. DOE and

	the regulators have agreed to post signs at the main pedestrian and vehicle entrance gates into the Central OU outlining the specific institutional control restrictions from the CAD/ROD and environmental covenant.

9. I have the feeling that if the public was aware of how the 10,000 samples that were taken was evaluated, they would be a good deal less confident about their safety. A lengthy brochure should include a history of the site as written in the Summary (p3), not the opinion piece in the Fact Sheet, plus an explanation of "averaging". The brochure should show the number of acres in the buffer zone and tell how many samples were taken in that area, followed by an explanation of how many acres are in the industrial site and how many samples were taken there. Then there needs to be an explanation of averaging.	The RI examined the topic of your comment in detail and found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. The CAD/ROD includes a more complete summary of the samples used in the analysis and how they were used, than that found in the Proposed Plan or various fact sheets.

10. There should be signs with all of this information at every trail head. Other signs should have warnings that say, "Plutonium has a half life of 24,000 years and can be inhaled."	DOE and the regulators have agreed to post signs at the main pedestrian and vehicle entrance gates into the Central OU outlining the specific institutional control restrictions from the CAD/ROD and environmental covenant.

11. There are many more warnings which should be posted every fifty feet, but as I said before, this needs to be a wide open public process with large participation. However, given your past performance at public meetings and the fact that you wish to wrap this up by September 30, I know that the sign discussion will not happen.	The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU. DOE and the regulators have agreed to post signs at the main pedestrian and vehicle entrance gates into the Central OU outlining the specific institutional control restrictions from the CAD/ROD and environmental covenant.

12. From the beginning RFCLOG meetings in 1999, it was made	The RI found that conditions in the Peripheral OU were suitable

clear to all that the entire area, both the OU and the POU would never be able to be cleaned up enough to allow any safe use. The Refuge Act of 2000 allowed for public hearings which also turned out to be a sham as plan "C" had already been decided on by the developers. The dangers were not allowed to be discussed, and the participants (non-political) were in favor of a far more restrictive use of the land.	for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. Signs and fencing on the outer boundary of the site, marking the future wildlife refuge (currently the Peripheral OU) boundary, are not a part of this decision and will be established as described in the Comprehensive Conservation Plan developed by the U.S. Fish & Wildlife Service.

Comments from Ms. Hix, Public Hearing August 31, 2006

1. I feel that the fence needs to be a regulatory mandate, and it should be identified in the post-RFCA articles. It should not be just best management practice.	A fence surrounding the Central OU is not required to protect human health or the environment, nor is it required to ensure effectiveness of the remedy. However, DOE and USFWS have agreed that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained as a best management practice. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU.

2. Along the same lines, I'm concerned about the Americium area that is down gradient from the 903 pad; and I think it should be part of the DOE retained land.	The former 903 Pad and areas down-gradient of the Pad are within the Central OU and are therefore part of the land that will be retained by DOE.

3. I think it probably would be rather dangerous to have people on horseback, hiking, or digging up. And I don't think-- I could be wrong, but I don't believe that there's anything that would restrict somebody from going in there and digging, and I don't think it's safe.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. The CAD/ROD selected Alternative 2 which requires use of institutional and physical controls for the Central OU. Digging, tilling, grading and other soil disturbance not consistent with the remedy are prohibited. Excavation and drilling, including for groundwater wells, is prohibited for other than remedy purposes, and surface

	water use is similarly restricted. Implementation of the institutional controls in the Central OU will be specifically detailed in the RFLMA, which will be subject to public comment.

4. The other is the sign language. I didn't see anything about it. How many signs, how far apart, and what they're going to say. I think we owe it to the public for people who have not lived here very long to know that it really could be dangerous. I really liked the McKinley bill. I thought it was fair, and I thought it was important. And I know this makes developers unhappy; but I really think that we need to be more concerned about the entire public, particularly since we know that Mother Nature will have her way, and we're going to have years and years and years of hard rain and wind and there could be things uncovered and people could be in danger. And I really feel they should be warned.	The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. The signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU. In addition, DOE and the regulators have agreed to post signs at the main pedestrian and vehicle entrance gates into the Central OU outlining the specific institutional control restrictions from the CAD/ROD and environmental covenant.

Letter from City of Arvada dated September 13, 2006

1. The issues and problems surrounding the Solar Ponds Groundwater Treatment System have been well documented and discussed in public forum. Arvada appreciates the steps that DOE, EPA, and CDPHE have taken to try to address and resolve these problems. However, we have serious concerns that, despite the fact that the treatment system has not demonstrated compliance with the requirements of the Rocky Flats Cleanup Agreement or the goals described in the Proposed Plan, it is still considered to be meeting all applicable regulation. It is imperative that DOE make a strong commitment to meeting the action levels set in the Rocky Flats Cleanup Agreement adopted to protect surface water quality on-site. Conversely, if it is not the intent of DOE to meet these requirements, this issue should be addressed in the Proposed Plan, not ignored. The City is confident that DOE will be making its best efforts to comply with all regulations; however, if the Solar Ponds Groundwater Treatment System is not currently working as intended, it does	The SPPTS has undergone substantial repair and maintenance in the summer and fall of 2006. These actions are expected to restore the system to its original operating condition, which has been shown to be effective in treating nitrate and uranium isotopes in shallow groundwater in the vicinity of the historic Solar Ponds. Continued maintenance of the system to ensure its long-term effectiveness is a requirement of the CAD/ROD.

not make sense for the Proposed Plan to imply otherwise.	

2. The City supports Alternative 2 of the Proposed Plan in which it is contemplated that the perimeter of the DOE retained land will be posted with signage to inform both wildlife refuge workers and visitors that they are at the boundary of the DOE property (Central OU). The City does support the use of a three-strand fence (also known as a cattle fence) to delineate between Refuge and DOE properties for land management purposes. In addition, a fence will add value as a tool for visitors and workers to more easily identify the property they are on.	Thank you for your comment.

3. The City of Arvada generally supports the Proposed Plan's outline of necessary physical and institutional controls. One issue that needs to be addressed in the Plan is the necessity for DOE to develop physical and institutional controls relative to monitoring stations outside of the DOE retained land. Although on Refuge land, these stations will be the responsibility of DOE and should be addressed in the Plan.	The CAD/ROD requires DOE to maintain and protect monitoring equipment to ensure that it continues to function as designed, regardless of location.

4. The City would like to acknowledge and support the position of the Woman Creek Reservoir Authority and its members as well as the Stewardship Council with regard to testing the water in the terminal ponds at least once per year, regardless of releases. The Proposed Plan indicates testing of water from the terminal ponds only upon a release of that water. With the strong possibility that water may not be discharged some years, it makes sense to test the water at least annually. This is a prudent practice to identify any problems associated with new flows into the pond or contaminants not captured by the upstream monitoring programs.	The CAD/ROD mandates that DOE continue surface water monitoring at the POCs at the discharge points from the three terminal ponds, and that DOE continue to monitor water entering the ponds at the existing POEs. In addition, DOE intends to continue its current best management practice of taking pre-discharge samples from the ponds prior to releasing water from them. DOE, CDPHE and EPA believe that the surface water monitoring outlined in the CAD/ROD is adequate to ensure the continuing protectiveness of the remedy and to ensure that water leaving Rocky Flats continues to meet water quality standards. Consequently, annual sampling is not a requirement of the CAD/ROD.

Comments from Mr. Johnson, City of Arvada, Public Hearing August 31, 2006

1. Well, because Westminster and Broomfield are here and	The CAD/ROD mandates that DOE continue surface water

speaking tonight, I just wanted to support them in their concerns related to ponds and discharge and the opportunity to sample once a year.	monitoring at the POCs at the discharge points from the three terminal ponds, and that DOE continue to monitor water entering the ponds at the existing POEs. In addition, DOE intends to continue its current best management practice of taking pre-discharge samples from the ponds prior to releasing water from them. DOE, CDPHE and EPA believe that the surface water monitoring outlined in the CAD/ROD is adequate to ensure the continuing protectiveness of the remedy and to ensure that water leaving Rocky Flats continues to meet water quality standards. Consequently, annual sampling is not a requirement of the CAD/ROD.

2. And we, the City of Arvada, supports a minimal fence such as cow fence for – for land retention demarcation between DOE and wildlife refuge; however, we do feel there may be a need for additional stronger fencing around – around various monitoring sites and treatment systems.	DOE and USFWS believe that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained around the Central OU as a best management practice. The CAD/ROD requires DOE to maintain and protect monitoring equipment to ensure that it continues to function as designed, regardless of location.

Letter from Carlson, Hammond & Paddock, LLC on behalf of the Woman Creek Reservoir Authority dated September 12, 2006

1. At the outset, the Authority wants specific assurances from DOE and the relevant regulators that a "No Action" determination for the "Peripheral Operable Unit" does not somehow preclude, or in any way prevent, DOE's ongoing obligations for operation and monitoring of the Indiana Street Point of Compliance in the future. "No Action" must not be interpreted to mean "no monitoring." DOE must continue to monitor water quality at the Indiana Street Point of Compliance indefinitely.	The CAD/ROD mandates that DOE retain POCs in surface water at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed. Specific monitoring requirements will be addressed in the RFLMA.

2. In addition to long term DOE monitoring at the Indiana Street Point of Compliance as contemplated under the current version of the RFCA, approval of a "No Action" determination must be conditioned upon appropriate institutional controls, including fencing, at the Indiana Street Point of Compliance.	The CAD/ROD requires DOE to maintain and protect monitoring equipment to ensure that it continues to function as designed, regardless of location.

3. Approval of a "No Action" determination, as contemplated in the "Proposed Plan", must be directly conditioned on requiring DOE's long term monitoring of Woman Creek flows at the Indiana Street Point of Compliance. A "No Action" determination for the "Peripheral Operable Unit" is not appropriate absent a specific requirement that DOE operate and maintain a monitoring station at the Indiana Street Point of Compliance on a long term basis, and thereby confirm that there are no exceedances of the relevant water quality standards at said point of compliance. These long term DOE monitoring obligations must be a requirement set forth in the final Corrective Action Decision/Record of Decision.	The CAD/ROD mandates that DOE retain POCs in surface water at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed.

4. In addition to Indiana Street Point of Compliance requirements, long term DOE monitoring obligations must include, at a minimum, annual sampling events at Pond C-2, regardless of whether releases have occurred from the pond in the past year. Any approval of a "No Action" determination must include such a requirement. Absent an annual sampling event at Pond C-2, a "No Action" determination is inappropriate. Any such long term DOE monitoring obligations must be a requirement set forth in the final Corrective Action Decision/Record of Decision.	The CAD/ROD mandates that DOE continue surface water monitoring at the POCs at the discharge points from the three terminal ponds, and that DOE continue to monitor water entering the ponds at the existing POEs. In addition, DOE intends to continue its current best management practice of taking pre-discharge samples from the ponds prior to releasing water from them. DOE, CDPHE and EPA believe that the surface water monitoring outlined in the CAD/ROD is adequate to ensure the continuing protectiveness of the remedy and to ensure that water leaving Rocky Flats continues to meet water quality standards. Consequently, annual sampling is not a requirement of the CAD/ROD.

5. The Authority joins in the comments submitted by the Cities of Broomfield, Northglenn and Westminster to the Proposed Plan.	Responses covered by responses to the cities of Broomfield, Westminster, and Northglenn.

Letter from U.S. Fish and Wildlife Service dated September 12, 2006

1. The U.S. Fish and Wildlife Service (Service) appreciates being able to work with the Rocky Flats Cleanup Agreement (RFCA) Parties on issues related to the Remedial Investigation/Feasibility Study, in particular, the Ecological Risk Assessment. We look forward to working with the RFCA Parties	Thank you for your comment.

on the Corrective Action Decision/Record of Decision (CAD/ROD) and the post-CAD/ROD agreement.	

2. The Service is pleased to know that the lands to be transferred for the Rocky Flats National Wildlife Refuge are unrestricted in their use and that the majority of the land is at or below the risk level that both the U.S. Environmental Protection Agency and the Colorado Department of Public Health and Environment require.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. DOE believes this determination will facilitate transition to the wildlife refuge.

3. The Service knows that there will be limited water in the drainages, especially the Walnut Creek Drainage. This combined with the fact that contaminated groundwater in Central Operable Unit (OU) and up-gradient of the terminal ponds is currently being captured and treated before entering the creeks. It is important that any quantity of water that leaves the terminal ponds meet water quality standards before entering future refuge property. We would like to continue to work with the Department of Energy (DOE) to keep water quality as good as technically possible and water quantity to maintain Preble's meadow jumping mouse habitat as much as possible.	DOE expects to continue to collaborate and work cooperatively with the Service as the Peripheral OU transitions to a wildlife refuge.

4. The Service supports the reconfiguration of OUs. The reconfiguration will make the administration and management of these parcels of land easier in the future. We appreciate that the DOE took our previous letter concerning the fence and signs into consideration. We request that the actual, "on-the-ground" location of the fence be a joint endeavor with the RFCA parties and the Service.	DOE expects to work cooperatively during fence installation to minimize impact to sensitive habitat areas and maximize the utility of the fence.

5. The signage that will be posted on the Central OU boundary is important. The Service has previously submitted a recommendation for wording on those signs. We would be willing to work on the language for those signs. We also recommend that DOE ensure the signs are made of durable materials. In the future, we would request that the Service and the DOE cooperatively work on site	DOE intends to install the required signs on the fence surrounding the Central OU. In addition, DOE and the regulators have agreed to post signs at the main pedestrian and vehicle entrance gates into the Central OU outlining the specific institutional control restrictions from the CAD/ROD and environmental covenant. DOE looks forward to working with the Service as interpretive

interpretation signs for the Refuge.	signs for the wildlife refuge are developed.

6. In addition, the letter recommending the fence and the signs also recommends installing permanent markers or monuments demarcating "special areas" such as areas of remaining subsurface contamination, subsurface structures (foundations and process lines), the present landfill, the original landfill, any ash pit or trench that was not totally removed. Nothing in the Proposed Plan addresses anything similar to this recommendation.	DOE looks forward to working with the Service to determine appropriate permanent markers or monuments for the Central OU consistent with the interpretive information in the refuge.

7. The Service agrees that the Ecological Risk Assessment tends to show that there is no unacceptable risk to ecological receptors at the site. However, there were areas of uncertainty that should be taken into account. The Service would like to recommend that minimal biological monitoring continue at the site and that if unexpected morbidity or mortality events occur, that they be reported and investigated.	The CAD/ROD states that additional environmental sampling is indicated to reduce the uncertainties from the Ecological Risk Assessment. More detailed information describing how the DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the Rocky Flats Legacy Management Agreement (RFLMA).

8. The Service supports the selection of Alternative 2. Alternative 1 is not protective of human health and the environment and Alternative 3 increases habitat disturbance with minimal risk reduction and a large cost to implement. We also believe that it is imperative that DOE implement a well-designed and unyielding operation and maintenance program.	DOE agrees with the comment.

9. The Service looks forward to working together to make Rocky Flats a genuine asset to the Denver metropolitan area.	Thank you for the comment.

Letter from Melody Flora, a concerned citizen, dated September 13, 2006

1. …It appears that there are still data collection efforts which have not been completed. Specifically, the Ecological Risk Assessment (ERA) repeatedly concludes that "there are no ecological contaminants of concern" … "because there are no significant risks to ecological receptors or high levels of uncertainty with the data." However, the ERA consistently highlights that "there is	The CRA follows a regulatory agency-approved methodology (DOE 2005) and EPA guidance for Superfund risk assessments (e.g. EPA 1989 and 1997). The data adequacy evaluation in Volume 2 of Appendix A presents the conclusion that the data are generally adequate for conducting the CRA using several lines of evidence (e.g., number of samples, chemicals included in the

considerable uncertainty (low confidence) in the default risk model," or "a high level of uncertainty associated with the use of the upper-bound BAF [bioaccumulation factor], " or "chemical-specific uncertainties." In fact, for most of the exposure units, the calculated hazard quotients using 'conservative' Tier 1 Exposure Point Concentrations (EPCs) and default exposure assumptions were substantially greater than the acceptable value of 1. However, at this stage, professional judgment was used to revise the EPCs and/or decide if contaminants with analytical detection limits above the Ecological Screening Level (ESL) are likely to exist in the surface soils of the exposure unit. This professional judgment determination is conducted after DOE has concluded with the ERA report that the data set available is suitable for use in evaluating potential risk to ecological receptors.	analyses, temporal and spatial coverage of the samples), and the risk managers from the regulatory agencies agreed with this conclusion. Therefore, the existing data set was the basis of the CRA. As stated in the ERA volumes, EPA risk assessment guidance (EPA 1997) recommends a tiered approach to ecological risk evaluations, and following the first tier of evaluation "the risk assessor should review the assumptions used (e.g., 100 percent availability) against values reported in the literature (e.g., only up to 60 percent for a particular compound) and consider how the hazard quotients (HQs) would change if more realistic conservative assumptions were used instead." The CRA followed this tiered approach for the ERA and therefore, HQs based on default assumptions and refined assumptions (i.e., using more reasonable estimates of exposure) are presented in the Risk Characterization sections. The HQs based on Tier 1 EPCs represent the most conservative calculations presented in the CRA and likely overestimate risk due to a heavy bias toward samples collected primarily from former source areas with few samples collected in the open spaces between these areas. The second tier of assessment uses an area weighting approach that is expected to more accurately represent the average exposure that a population of receptors may be exposed to throughout the exposure area. The 1997 EPA guidance also states "To ensure that the risk characterization is transparent, clear, and reasonable, information regarding the strengths and limitations of the assessment must be identified and described." Accordingly, each volume clearly presents the uncertainties associated with the risk assessment conclusions to aid risk managers in making decisions about the final remedy for the site. The CAD/ROD concluded that the results of the CRA supported the selection of Alternative 2 as the final remedy for the site in the Proposed Plan.

2. The professional judgment is further used to dismiss	The home range of the representative ecological receptors was

contaminants with limited numbers of detections, stating that the "population-level risk from a few detections in an area as large as the" exposure unit is highly unlikely. However, it is not the size of the exposure unit which should dictate the likelihood of risk but rather the home range of the species under consideration. In addition, limited numbers of detections does not automatically imply that the contaminant is not more widespread; but rather that the sampling program did not sample every square foot of soil to determine the exact extent of the contaminant. For example, if the home range of the species is ¼ acre, and 4 of the 6 detections occurred within the same ¼ acre, then there would likely be an impact on the individuals of the species, potentially enough to present a population-level risk if there are unique habitat conditions within the ¼ acre.	considered in the statistical approach for the exposure point concentrations (EPCs) used in the risk calculations of the ERA. For the non-threatened or endangered species receptors, the exposure area considered was equivalent to the exposure unit (EU) being evaluated. These receptors are representatives of the generic feeding guilds that may be present at the site. While some habitat preference may be noted within each EU, none of the representative receptors, nor the feeding guilds which they represent are strict habitat specialists and can be reasonably assumed to forage throughout the various habitats within each EU. Based on the hot-spot scenario presented in the comments, only the individuals that preferentially used the habitat within the small hot spot would have increased exposure but the level of risk to the population (identified as the assessment endpoints) would not be significantly affected. The special status species that was included in the CRA, the Preble's meadow jumping mouse (PMJM), does require a specialized habitat. Therefore, soil concentrations were evaluated on a habitat patch basis. The habitat patches were defined based on considerable study of the PMJM populations at the site and are representative of the home range of PMJM. Exposure point concentrations for the PMJM were based on the 95 UCL of the mean for each habitat patch that was evaluated in the Risk Characterization step of the CRA. As a means of estimating exposure based on the average home range size of individuals within each population of receptors, separate exposure point concentrations were used for small and large home range receptors. Both detected concentrations and non-detected concentrations are included in the EPC calculations. EPA guidance (2002) for calculating EPCs states: "Because of the uncertainty associated with estimating the true average concentration at a site, the 95 percent upper confidence limit (UCL) of the arithmetic mean should be used for this variable." The 95 UCL was used in the ERA for the exposure point concentration for

	large home-range receptors (i.e., receptors that are potentially exposed to soil throughout the designated exposure unit [EU]). For small home-range receptors a more conservative estimate of average exposure was used for the risk calculations, the 95 percent UCL of the 90th percentile of the EU data set for a particular chemical. This statistic is referred to as the upper tolerance limit (UTL) in the CRA. The UTL is used for small home-range terrestrial receptors and aquatic receptors.

3. It would seem that if DOE wants to know what contaminants are actually in the surface soil, then a sampling program which uses the appropriate analytes and detection limits should be implemented so that it can be assessed if there are concentrations of contaminants that exceed the ESL. The sampling program should include a consideration of home range considerations so that the frequency of the sampling is adequate to assess if there are 'hot spots' which may impact the health of species' populations. In addition, DOE should ensure that the analyte list incorporates the appropriate chemical analysis, i.e., chromium VI versus chromium III, so that the hazard quotient isn't calculated based on an assumed chemical composition of the surface soil as was done for the Industrial Area. This approach should allow DOE to more definitively assess the potential risks to ecological receptors due to exposure from residual contamination at Rocky Flats.	The data used in the CRA were collected under various RCRA/CERCLA investigations and site characterization sampling events. Each of those investigations and sampling events had data quality objectives (DQOs) specific to the particular event (e.g., detection limits, analytical suite, location and number of samples needed to answer the question identified through the DQO process). While not all historical data were specifically collected for the CRA, some more recent data were specifically collected for the CRA and were based on CRA-specific DQOs. The purpose of the Data Adequacy Report (presented in Volume 2, Attachment 3 of the CRA) was to review the data that were available from these various sampling events and determine if the data were adequate to support statistical, exposure, and risk calculations for the CRA. Although there were limitations and uncertainties associated with the data that were reviewed for the Data Adequacy Report, the overall conclusion was that the available data were adequate to conduct the CRA.

4. If DOE does not agree that additional data is needed to more definitively assess the ecological risk present at Rocky Flats before proceeding with the Record of Decision, it would seem that the monitoring to be included in Alternative 2 should be modified to incorporate each of the recommendations above so that additional action(s) can be taken if ecological risk concerns are identified by the empirical data collected rather than the assumptions currently used. In fact, the proposed plan should be revised to include a	DOE is currently working with EPA and CDPHE to determine specific monitoring that will be done to address the uncertainties identified in the CRA for the aquatic exposure units (AEUs). The CAD/ROD identifies the need for additional monitoring, and specific requirements will be included in the Rocky Flats Legacy Management Agreement (RFLMA).

contingency remedy that will address any future ecological concerns based on the ecological monitoring and site characterization to be performed.	

5. With regard to the 'Overall Protection of Human Health and the Environment' criteria, the Proposed Plan states that the incremental risk to the Wildlife Refuge Worker falls within the acceptable range of $1x10^{-6}$ to $1x10^{-4}$. However, this incremental risk is based upon the residual contamination currently left on-site and does not reflect the 'baseline' condition of Rocky Flats prior to initiating interim remedy actions. While, the National Contingency Plan (NCP) does indicate that risks within the $1x10^{-6}$ to $1x10^{-4}$ range are acceptable; this approach is based on the baseline site conditions which likely exceeded the $1x10^{-4}$ criterion. When the $1x10^{-4}$ criterion is exceeded, then the preferred approach for the remedy is to meet the $1x10^{-6}$ incremental risk concentrations. It would seem that DOE is skirting the NCP expectation for the degree of cleanup at a CERCLA site by using current data to support no additional soil excavation.	The selected remedy takes into account the accelerated actions completed under RFCA. The EPA memorandum entitled "Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions" (EPA 1991) states: "Once a decision has been made to made an action, the Agency has expressed a preference for cleanups achieving the more protective end of the range (i.e., 10^{-6}), although waste management strategies achieving reductions in site risks anywhere within the risk range may be deemed acceptable by the EPA risk manager." The decisions related to the need for accelerated actions (i.e., cleanups) were based on comparing site data for individual hazardous substance sites (IHSSs), potential areas of concern (PACs), and under building contamination (UBCs) to soil action levels (ALs) that were agreed to by the RFCA parties. These accelerated actions were conducted and the CRA was then conducted to evaluate risks associated with residual contamination that was not removed through the accelerated actions. The results of the human health risk assessment (HHRA) indicate that residual risks are in the 1×10^{-6} range (i.e., ranging from 1×10^{-6} for benzo(a)pyrene in the Upper Walnut Drainage Exposure Unit (EU) and the Industrial Area EU to 6×10^{-6} for benzo(a)pyrene in the Upper Woman Drainage EU). The selected remedy meets the expectations of the NCP.

6. For all the reasons cited above, the proposed plan for the Rocky Flats site, Alternative 2, does not meet the regulatory requirements for completing the cleanup of the site. Instead, the Record of Decision should be delayed until a sampling program is conducted (as recommended above) that provides additional information to truly calculate the ecological risk present at the site. If the Record of Decision is not delayed, then Alternative 3 should be modified to include a contingency alternative that allows for	The CAD/ROD concludes that, based on the results of the CRA, Alternative 2 meets the regulatory requirements for completing the cleanup of the site. As discussed in the response to Comment 4, DOE is currently working with EPA and CDPHE to determine specific monitoring that will be done to address the uncertainties identified in the CRA for the aquatic exposure units (AEUs). The CAD/ROD identifies the need for additional monitoring and specific requirements will be included in RFLMA.

future cleanup actions, if warranted by the results of an additional ecological investigation (as recommended above).	

Letter from the City and County of Broomfield dated September 13, 2006

1. We formally request that our comments in Attachment A be dispositioned specifically and individually and not generalized with other public comments.	All comments are being specifically and individually addressed.

2. We also formally request an individual meeting with the RFCA Parties to address our comments prior to the release of the CAD/ROD.	Any meetings that occur as a part of the CERCLA public comment process must occur for the general public's benefit. CERCLA does not allow meetings during the process with individual organizations.

3. It is very difficult to evaluate the Proposed Plan and the preferred alternative without knowing the technical and regulatory details of the post-RFCA. Previously, Broomfield has been asked to evaluate RFCA Party proposals prior to their release to the public. Draft documents have always been released to us prior to public review. We do not understand the need for concealment of this critical document, nor do we understand the change in policy to keep downstream asset holders from participating in drafting language that protects our communities and fiscally preserves our assets. We reserve the right to readdress our comments and concerns identified in this letter once we have an opportunity to evaluate the language in the post-RFCA. It is essential that the post-RFCA document be released to the public for comment with a minimum of 60 days for review. Past practice for formal review of the RFCA documents should justify a formal review of the final post-RFCA or any other post-closure document.	See specific responses to detailed comments below.

4. **1. Involvement with Downstream Asset Holders.** Municipalities impacted by surface water from the RFETS shall be part of the technical process to evaluate and develop monitoring specifications for the post closure monitoring and maintenance	See specific responses to detailed comments below.

plan. DOE will hold quarterly data exchange meetings to review data, evaluate trending, analyze sampling needs and/or discuss corrective actions with impacted municipalities.	

5. **2. Long-term Monitoring and Surveillance Plan.** **a. Groundwater**-Stationary groundwater plumes require continued periodic monitoring to demonstrate that they are remaining stationary and do not pose a risk. **b. Surface Water**-the RFCA states *following completion of active remediation, the surface water must be of sufficient quality to support any surface water use classification.* With active remediation completed, we expect DOE to adhere to the underlying stream standards when the temporary modifications expire in 2009. **c. Integrated Monitoring Plan Process** This critical process must continue post-closure to periodically reassess site conditions and revise the on-site and off-site monitoring systems accordingly.	See specific responses to detailed comments below.

6. **3. Institutional and Access Controls/Proposed Central Operable Unit Boundary.** The document is silent on physical controls and Institutional Controls for the Points of Compliance. The RFCA parties committed to generate a final map of the site after the completion of the closure project to reflect the remaining residual contamination at the site. These two items need to be addressed. A fence around the Central OU should be an enforceable control, not just a best-management practice.	See specific responses to detailed comments below.

7. **4. Original Landfill and Present Landfill.** Monitoring must continue until there is sufficient data to ensure both groundwater and surface water quality are not impacted from the Original Landfill and to confirm the integrity of the cover. Current seeps that have developed in the cover have the potential to release contaminants directly into Woman Creek. The Present Landfill is currently discharging contaminants into No Name Gulch that exceed the surface water standards. The Present landfill pond should not be in a pass-through mode if the water quality does not	See specific responses to detailed comments below.

meet the surface water standards.	

8. **5. 991 Area.** This area is experiencing severe subsidence. We disagree with the RFCA Parties' position that this unstable area is not a CERCLA issue. The area has groundwater wells located in it to monitor groundwater plumes. The functional channel is experiencing uplifting and we are very concerned with the potential for mass loading of sediments into South Walnut Creek.	See specific responses to detailed comments below.

9. **6. Treatment Units/Remedial Action Objectives.** **a. Treatment Units.** We disagree with the statement in the Proposed Plan and the RI/FS stating: *Continued operations of these four systems serves to protect surface water quality over short-and-long intermediate-term period by removing contaminant loading to surface water. This protection also serves to meet long-term goals for returning groundwater to its beneficial use of surface water protection.* The Solar Pond Treatment Unit and the Present Landfill Treatment Unit as of today do not meet all of the surface water standards. The temporary standard expires in 2009 and we do not have assurances from DOE that the standard will be obtained to minimize the nutrient mass loading to Walnut Creek. **b. Remedial Action Objectives.** The remedial action objectives are the foundation of the clean-up actions. We clearly understand if the objectives are not mechanisms such as institutional controls to ensure protection of public health and the environment. The plan lacks the details of the implementation, oversight, enforceability, and reporting of the controls effectiveness and/or deficiencies.	See specific responses to detailed comments below.

10. **7. Administrative Record and Reading Room** **a. Administrative Record.** The electronic version of the administrative record continues to have access problems. CERCLA, section 113 requires that an *administrative record be established "at or near the facility at issue." The record is to be*	See specific responses to detailed comments below.

complied contemporaneously and must be available to the public and include all information considered or relied on in selecting the remedy, including public comments on the proposed plan. We ask that all maps in the record be in color to be of value to our community. **b. Reading Room.** We request the Reading Room be maintained until we are assured the administrative record is accessible and functioning. Legacy Management has committed to work with us in the decision making process to determine the best location for the administrative record.	

11. **8. De-listing the Site, Land Transfer, and Natural Resource Damage Evaluation** **a. De-listing.** The Proposed Plan lacks the details of the process to de-list and certify the site prior to transferring lands to the Department of the Interior. **b. Land Transfer.** The proposed Plan lacks the details of the land transfer. Our concern with the land transfer is the application of institutional and physical controls in both operable units.	See specific responses to detailed comments below.

12. **9. Public Involvement Plan.** The City and County of Broomfield and Westminster were the only public members to comment on the Public Involvement Plan dated October 2006. We ask the document be revised to include the current notification process, communication process, and continuation of the quarterly data exchange meetings in addition to the LSO briefings.	See specific responses to detailed comments below.

13. **10. Post-Rocky Flats Clean-up Agreement and 5-year Review.** We expect language in the post-RFCA to maintain the current role DOE has with downstream communities. The post-RFCA should as a minimum include the details of the enforceability of the surface water standards, a continuation of the Water Working Group, Attachment 1 list of analytes, ICs, notification, public participation plan, and other key factors related to long-term stewardship.	See specific responses to detailed comments below.

14. We request that you disposition this document with us prior to the release of the final approved CAD/ROD.	See specific responses to detailed comments below.

15. There is not a clearly defined plan and procedure for institutional and physical controls.	See specific responses to detailed comments below.

16. The record and data management system has to be in place and functioning prior to delisting.	See specific responses to detailed comments below.

17. Language needs to be added to the plan as a commitment to downstream communities to provide a role for us post-closure regarding water management.	See specific responses to detailed comments below.

18. 1.1.1 For years the City and County of Broomfield and the City of Westminster have had an integral role with the development of monitoring criteria during technical group discussions to implement changes to the monitoring plans at the site. Our role was clearly delineated in the RFCA and detailed in the *Integrated Water Management Plan for the Rocky Flats Environmental Technology Site,* dated August 1996. The Water Working Group's purpose as stated in the RFCA, Appendix 5, is *to develop consensus recommendations to the decision-makers regarding decisions and actions related to water quality at, or downstream of RFETS.* These discussions identified the needs and changes in monitoring scope as dictated by changes in the Rocky Flats Environment Technology Site operations and infrastructure. In addition, the working group was tasked to work towards a long-term stewardship monitoring system that would continuously evaluate and support data quality objectives. Revise the Proposed Plan to include language that local municipalities impacted by surface water from the RFETS shall be part of the technical process to evaluate and develop monitoring specifications for the post-closure monitoring and maintenance plan and develop consensus recommendation to the decision-makers post-closure.	DOE appreciates the long history of public involvement at Rocky Flats. Implementing agreed-upon post-closure monitoring and maintenance will be addressed in the RFLMA, which will be subject to public review and comment.

19. 1.1.2 The Proposed Plan refers to the Long-term Surveillance and Maintenance Plan (LTSMP) as the document that identifies the long-term stewardship criteria. We were very disappointed when Legacy Management decided to not adhere to the Public Participation Plan that identified the Interim Long-term Surveillance and Maintenance Plan as a public document to be released for our review and evaluation. To this date we have not received justification from Legacy Management as to why they deviated from their document and the RFCA to include participation of the Water Working Group to *maintain and guide a long-term partnership between local governments, DOE, EPA, and CDPHE.* Revise the document to state the LTSMP will be reviewed annually with the current partnership between DOE, EPA, CDPHE, and downstream municipal water users.	An LTS&MP has not been issued and is not part of the Proposed Plan. Specifics of post-closure long-term surveillance and maintenance activities will be addressed in the RFLMA. The final IS&MP was released to the public in December, 2005 and is available on the Legacy Management website at http://www.lm.doe.gov/land/sites/co/rocky_flats/rocky.htm.

20. 1.1.3 The Plan is silent on the enforceability of the Points of Compliance at Indiana, the groundwater wells at Indiana, and the ability for the regulators to have an oversight role for the monitoring stations outside of the DOE retained lands. When lands are transferred from DOE to the Service, will the regulators have the ability to enforce surface water quality and groundwater quality in areas outside of their responsibility that are located within the outer peripheral unit?	The CAD/ROD mandates that DOE retain POCs in surface water at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed. The Refuge Act provides for continuing regulatory authority in the DOE retained lands and the refuge lands. Enforceability will be included in the RFLMA.

21. 1.2.1 The City and County of Broomfield and Westminster for years have teamed with the RFCA Parties to exchange data, evaluate trending, and develop data quality objectives. These crucial decisions and recommendation were developed within the framework of the Water Working Group. In addition, monitoring data generated by all involved parties were exchanged to evaluate the generated data and monitoring systems. It is very important to evaluate trends in data to determine the optimum locations for the	The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public. An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD states that the environmental monitoring, as well as the monitoring that will be

monitoring system post-closure. The City and County of Broomfield will continue to generate surface water data post-closure and evaluate the impacts to Walnut Creek and Big Dry Creek. The City of Westminster and Northglenn will also continue to evaluate the impacts to Woman Creek and Big Dry Creek. Westminster reserves the right to monitor surface water post-closure at the and at the site boundary.	included in RFLMA, is adequate to ensure continuing protectiveness of the remedy. Therefore, the CAD/ROD requires no additional sampling.

22. 1.2.2 We understand there may not be surface water discharges from the terminal ponds for several years, but quarterly monitoring will continue at the site and it will need to be reviewed and discussed. The Proposed Plan refers to the LTSMP. The LTSMP clearly excludes the continuation of the current process to discuss technical issues associated with the monitoring and surveillance systems at the site. Revise the Proposed Plan to specify quarterly data exchange meetings will be held with DOE, CDPHE, downstream municipalities, and EPA if they have an available representative, to review data, evaluate trending, analyze sampling needs, and/or discuss corrective actions. We expect the quarterly data exchange meetings to be in addition to any briefing by Legacy Management presented to the Local Stakeholder Organization.	The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public. An LTS&MP has not been issued and is not part of the Proposed Plan.

23. 1.2.3 We remind Legacy Management of their August 11, 2004 commitment made to downstream municipalities to continue the quarterly data exchange meetings with our communities for a minimum of two years. Based on this commitment, the language in the Plan should reflect, as a minimum, the commitment to downstream municipalities.	DOE intends to continue to interact with all interested parties and stakeholders. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public. An LTS&MP has not been issued and is not part of the Proposed Plan.

24. 1.2.4 On September 11, 2006, Mike Owen committed to open communication with local governments. This commitment is a confirmation by Legacy Management to continue the much-	DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The CAD/ROD requires that DOE prepare an annual report

needed quarterly data exchange meetings with downstream communities to continue to evaluate an integral monitoring plan.	discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public.

25. 1.3.1 Our short-term goals during the Quarterly Data Exchange meetings were to ensure a safe, timely cleanup while working toward protecting surface water quality. Our long-term goals were to have a detailed long-term stewardship plan to protect surface water quality that impacts us as downstream communities. The open communication process and the notification process also served to strengthen our ability to resolve issues. The document refers to the Public Involvement Plan and this involvement plan clearly does not maintain the current open communication and notification process. Rather than remaining silent on direct communication and notification with our communities, we ask the document be revised to incorporate the previous notification and communication process as identified in our letter to Audrey Berry, dated September 16, 2005.	DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public.

26. 1.3.2 The current communication process with downstream communities should not be intended to replace the public process with the Rocky Flats Stewardship Council (RFSC), but instead be in addition to the public involvement plan identified by Legacy Management.	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.
27. 1.3.3 The City and County of Broomfield and the City of Westminster have had several meetings with the RFCA Parties to address the importance of maintaining the same communication process and notification process with our municipalities. We have drafted several letters addressing the specifics of long-term	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the

stewardship and our role to fulfill our responsibilities to our citizens and businesses. Please refer to our most recent letters to Mike Owen dated December 6, 2005, letter to Audrey Berry dated September 16, 2005, and letter to John Rampe dated January 2004. In addition, we have been the only two communities that have individually commented on all the documents the RFCA Parties have released during the cleanup project. We have invested hundreds of hours evaluating remedy proposals and strived to bring forward resolutions to meet both our needs and Doe's needs. These letters reflect the importance of this project to our communities. Revise the Proposed Plan to reflect our role post-closure to ensure our future role is codified in Legacy Management post-closure documents.	CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

28. 2.1.1 Broomfield understands the specific groundwater plumes that were evaluated in the approved RI/FS and the basis for the potential pathway analysis for contaminants to impact human health and the environment. The items evaluated were: • *Five upper hydrostratigraphic unit groundwater areas where contaminated groundwater may impact surface water;* • *Upper hydrostratigraphic unit groundwater sampling locations where groundwater contamination exceeds maximum contaminant levels; and* • *Groundwater sampling locations where exceedances of volatilization PRGs in groundwater indicate a potential indoor air risk* What the document is lacking is the process to evaluate stationary groundwater plumes and their potential risk long into the future in the event they migrate or a new pathway is created. We understand the stationary plumes do not pose a risk based on current data, yet the RI/FS and the Proposed Plan do not take consider the need to continue monitoring stationary plumes post-closure in the event hydrological conditions change. The RI/FS states these plumes *do not require further studies to evaluate risk to human health and the*	The RI/FS evaluated all groundwater constituents to determine analytes of interest (AOIs). The AOIs that formed contiguous, mapable plumes were further evaluated to determine their potential to impact surface water. The potential impacts of groundwater discharge to surface water were evaluated at the Area of Concern (AOC) and Sentinel wells which were selected by the Water Working Group regardless of whether the groundwater plumes are retreating, migrating or stationary (i.e., at steady state). The evaluation results indicated that AOIs in five groundwater areas have the potential to impact surface water based on results at the AOC and Sentinel wells and/or contaminant transport model predictions. There is a process identified to evaluate steady-state groundwater plumes in the Fiscal Year 2005 Integrated Monitoring Plan, Revision 1, dated September 2005 (IMP), which identifies AOC, Sentinel, and Evaluation wells. These wells are located so that they will detect potential changes in the groundwater plume configurations at the site whether they are currently considered to be in steady state or migrating downgradient. If groundwater monitoring results show statistically increasing trends at the AOC,

environment and we agree with this statement based on current data. Revise the document to state in the event stationary plumes begin to migrate, a risk evaluation will be performed for the contaminant or contaminants of concern. Revise the document to also include the process to evaluate the risk. Include impacted communities in the process to determine the monitoring needs post-closure.	Sentinel, or Evaluation, the IMP requires more frequent monitoring and evaluations for action, if deemed necessary. Since the water quality standards used for evaluation are deemed to be protective of human health and the environment and statistically significant impacts to water quality will be evaluated per the IMP, it is not necessary to revise the document to include a risk evaluation. Post-closure monitoring, identified in the IMP, will be implemented through the RFLMA, which will be offered for public review and comment.

29. 2.1.2 Revise the documents to reflect language in the RFCA Attachment 5, C.2 stating: *Groundwater plumes that can be shown to be stationary and do not therefore present a risk to surface water, regardless of their contaminant levels, will not require remediation or management. They will require continued monitoring to demonstrate that they remain stationary.* Based on the changes to the topography and potential hydrology at the site, Broomfield and Westminster believe there needs to be sufficient monitoring to determine if the groundwater plumes remain stationary and do not pose a risk. The RI/FS does not address future evaluations for all identified groundwater plumes. The process outlined within the RI/FS does not evaluate impacts to the creeks holistically.	The IMP identifies sufficient monitoring for all groundwater plumes (whether they are in steady-state or migrating) and contains a systematic process for evaluations and potential actions if statistically increasing contaminant trends are observed. Where possible, the future impact of groundwater plumes on surface water were evaluated in the RI/FS using contaminant fate and transport modeling. Modeling was performed for the significant volatile organic compound plumes to predict their future impact on surface water quality. Contaminant fate and transport modeling was not conducted for the metal AOIs because the metal plumes are limited in areal extent and do not currently pose a threat to surface water. Uranium was also not modeled because the primary uranium plume at the site, which occurs in the area of the Solar Evaporation Ponds, is already entering North Walnut Creek and the water quality impacts are well known. A groundwater interception and treatment system is already installed in this area. Post-closure surveillance and maintenance activities will be addressed in the RFLMA, which will be subject to public review and comment.

30. 2.1.3 Revise the document to state all exceedances of groundwater action levels shall be reported to downstream communities once DOE becomes aware of the data. In addition, the data shall be reported quarterly and summarized annually to all parties, including downstream municipalities. Revise the document to add “downstream communities” to the notification and	The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public.

communication process identified in the Plan.	

31. 2.1.4 *All groundwater plumes that exceed action levels must continue to be monitored until the need for institutional controls is mitigated.* Revise the document to include the process on implementation of institutional controls. Define how institutional controls will be implemented, how they will be evaluated, how often they will be evaluated, and by whom. Any information associated with institutional controls should also be relayed to the public and downstream communities. Once again, with ICs in the outer peripheral unit, we are not clear on the regulatory process in this area.	The CAD/ROD states that institutional controls will be maintained until the concentrations of hazardous substances in soil and groundwater are at levels so as to allow for unrestricted use and unlimited exposure, and/or until such time as engineered components of the remedy are no longer needed. DOE will be responsible for maintaining institutional controls. DOE will inspect the site relative to institutional controls no less than annually, and the CAD/ROD contains specific timeframes for addressing and reporting activities that are inconsistent with the objectives of the institutional controls. Institutional controls will be addressed in the regular reporting that will be made available to the public and will be evaluated in CERCLA periodic reviews. Conditions in the Peripheral OU are such that they allow for unrestricted use and unlimited exposure. Therefore, no institutional controls are needed for the Peripheral OU.

32. 2.1.5 Any revisions or justifications to change the standard/action levels for groundwater shall be based on the surface water use classifications and not jeopardize surface water quality. Impacted municipalities should be part of the decision-making process to reevaluate any proposed changes. Per RFCA, the temporary modifications were developed *together with other stakeholders (i.e., the local municipalities that are impacted by surface water from the RFETS).* Without knowing the specific language in the post-closure document, we ask language be incorporated and codified in Proposed Plan to ensure municipalities are included with any decision made at the Rocky Flats site that may impact surface water. Any modification or changes to the stream standards shall include downstream municipalities.	All rulemakings held by the Colorado Water Quality Control Commission related to use classifications, standards, or temporary modifications in Big Dry Creek have included and in the future are expected to include downstream communities. The rulemaking process allows for participation in the rulemaking as parties or as non-parties, and for the submission of written or oral testimony.

33. 2.1.6 Broomfield and Westminster are concerned the Proposed Plan does not address any institutional controls to prevent siting groundwater wells in the refuge to be used for irrigation or	The Peripheral OU will be transferred from DOE to USFWS, and will become the Rocky Flats National Wildlife Refuge. The RI found that conditions in the Peripheral OU, including groundwater

for other uses. The Proposed Plan states: *the construction or operation of groundwater wells is prohibited; except for remedy related purposes.* Revise the document to clarify the process to site a groundwater well in the refuge in the event a well is needed to evaluate the potential migration of a groundwater plume.	quality, were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. Plans for use of groundwater by USFWS in the Refuge are beyond the scope of this CAD/ROD; however, information on Refuge management may be found in the CCP for the Rocky Flats National Wildlife Refuge prepared by USFWS. The Refuge Act allows siting monitoring wells in the refuge and provides for DOE's access. DOE will be required to maintain and protect any wells to ensure that they continue to function as designed. Requirements for monitoring wells will be included in the RFLMA.

34. 2.1.7 Figure 3 of the Proposed Plan identifies the Rocky Flats Operable Units, i.e., DOE-retained lands and the refuge area. Figure 2 of the Proposed Plan identifies the groundwater and surface water monitoring locations. Revise the document to include an overlaid map of the two above-mentioned maps to reflect the location of the monitoring stations in relation to the boundary.	Figure 10.1 of the RI/FS shows the relationship of the Central Operable Unit (OU) boundary relative to the IMP groundwater monitoring wells (AOC and sentinel wells) and surface water monitoring locations (Point of Compliance [POC], Point of Evaluation [POE], and Point of Measurement [POM]). All of the AOC, Sentinel, and Evaluation wells are located in the Central OU. The POCs located downgradient of terminal ponds (GS11, GS08, and GS31) are located adjacent to the eastern (downstream) edge of the Central OU. The background surface water monitoring station (GS05), the POCs at Indiana Street (GS01 and GS03), and the boundary wells (41691 and 10394) are located in the Peripheral OU.

35. 2.1.8 We are very concerned the document does not address if or how institutional controls would apply to boundary wells. Revise the document to state ICs will apply to the boundary wells. Revise Figure 3 to include a delineation of the groundwater boundary wells. The Plan should also include a statement that the land/area the wells are located in will be retained by DOE.	Boundary wells are not required by the CAD/ROD. Although boundary wells are not located within the DOE-retained lands, the Refuge Act provides for DOE's access to them, and DOE will be required to maintain and protect these wells to ensure that they continue to function as designed. Requirements for monitoring at the boundary wells will be included in the RFLMA.

36. 2.1.9 Revise the document to state how the groundwater wells will be secured and identified. We expect to have a fence	AOC, sentinel, and evaluation wells are located within the Central OU and are within the boundaries of the DOE-retained lands.

around the perimeter of the groundwater wells that are located outside of the DOE-retained lands. These wells have to be clearly marked and labeled to prevent public access and intrusion. As a minimum, a fence should be placed 10 feet out from the monitoring well. In addition, the fence should be legal control fence.	Monitoring wells that are outside the DOE-retained lands will be protected and maintained, which will be described in more detail in the RFLMA.

37. 2.1.10 Telemetry is not a sufficient tool to be used as an indicator that a well has been vandalized. Freezing conditions could impact the telemetry system. The telemetry could serve as a layering method to protect the groundwater wells in the event other controls fail to protect the monitoring systems.	DOE agrees that telemetry is not a sufficient tool to assess whether a well has been vandalized, or to indicate other types of failure at a well. There is not currently, nor has there historically been telemetry at any of the groundwater wells. Visual of the wells are conducted at least semi-annually during sampling events. DOE will continue to protect the functionality of the wells included in the LM post-closure monitoring system.

38. 2.1.11 The fence for the boundary wells should be identified as a legal control to protect the monitoring system for the remedy. Layering is of utmost importance in the event one control fails. The need to protect these wells is founded on the importance to gather groundwater data to evaluate the remedy.	DOE will be required to maintain and protect these locations to ensure that they continue to function as designed. Specific groundwater monitoring requirements, including any boundary wells, will be addressed in the RFLMA.

39. 2.1.12 The document refers to the Long-term Surveillance and Monitoring Plan. Revise the document to state all groundwater monitoring data and any changes in hydrologic conditions will be reported quarterly and summarized annually to all parties and impacted municipalities. Any exceedances of groundwater action levels will be reported to all parties and impacted municipalities concurrently. Once changes or physical conditions exist that could impact surface water quality, downstream municipalities should be notified via telephone or fax.	An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication.

40. 2.1.13 The RI/FS does not address the evaluation of groundwater that discharges directly to surface water as baseflow, specifically groundwater entering North Walnut Creek from the discharge gallery. The document is silent on direct impacts to the creeks and only addresses an evaluation of groundwater to surface	The potential impacts of contaminated groundwater on surface water quality were evaluated in the RI/FS and considered in the Proposed Plan. The effectiveness of the groundwater system is evaluated through discharge sampling and during periodic monitoring, inspections and maintenance activities. The remedy

water at the Points-of-Compliance. To measure impacts after dilution occurs at the Points-of-Compliance (POCs) may not be an accurate evaluation of direct impacts to the streams and human health and the environment. We understand the remedial action objectives are used to develop and evaluate remedial alternatives. However, we do not agree it is appropriate to use the creeks and ponds as a method to dilute/treat surface water. It may appear inaccurate to measure the effectiveness of the treatment units if the risks are evaluated at the terminal ponds and the POCs rather than measuring the water quality as it enters the creek or ponds.	does not assume that the creeks or ponds treat or dilute surface water.

41. 2.2.1 Temporary modifications were developed together with local municipalities that are impacted by surface water from the RFETS. Broomfield reminds DOE that RFCA states *following completion of active remediation, the surface water must be of sufficient quality to support any surface water use classification in both Segments 4a/4b and 5.* Revise the Proposed Plan to state any temporary modifications will revert to the stream standards once the final remedy has been completed. We expect DOE to adhere to the stream standards once the temporary standards expire in 2009. Our intent was to allow less stringent standards during the cleanup. DOE should be adhering to the stream standards now that the remedy has been completed. Revise the Proposed Plan to include language identifying the procedure and schedule DOE has in place to adhere to the surface water standards by 2009.	The remedy for groundwater is not complete. It will be complete when all three of the Groundwater RAOs and the Surface Water RAO are met. The remedy – in the form of groundwater treatment systems and continued monitoring – has been put in place. DOE will continue to monitor groundwater and surface water with the goal of achieving the underlying surface water standards when the temporary modifications expire in 2009. More information on the temporary modifications and completion of the remedy at Rocky Flats may be found in the docket of the 2004 Water Quality Control Commission's Rulemaking on Regulation No. 38, to which the Cities of Broomfield and Westminster were parties.

42. 2.2.2 Revise the document to state how the institutional controls will apply to the surface water monitoring stations inside and outside of the DOE retained lands.	DOE will be required to maintain and protect these locations to ensure that they continue to function as designed. Per the Refuge Act, DOE may access any areas, whether in the Central OU or Peripheral OU, that are required for monitoring or remedy purposes.

43. 2.2.3 Revise Figure 3 to include a delineation of the surface water monitoring stations. The Plan should also include a statement that the land/area the surface water stations are located in will be	DOE is developing a map or maps to address your comment. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed. Per the Refuge Act,

retained by DOE.	DOE may access any areas, whether in the Central OU or Peripheral OU, required for monitoring or remedy purposes.

44. 2.2.4 Define how the institutional controls will be implemented for the use of surface water, how they will be evaluated, how often they will be evaluated, and by whom. Any information associated with institutional controls should also be relayed to the public and downstream communities. We are specifically interested in the application of ICs at the POCs at the boundary.	Signage, federal ownership, and an environmental covenant issued to the State of Colorado are the specific physical and institutional controls to be used to ensure the protection of surface water from unauthorized uses. Implementation of the physical and institutional controls will be inspected periodically by DOE, corrected or repaired if required, and reported in an annual report. These control, inspection, and reporting actions are listed in the Proposed Plan for Alternative 2, the Preferred Alternative. Approval of the CAD/ROD will establish these proposed actions as binding regulatory requirements for DOE. More detailed information describing how DOE will meet the requirements of the CAD/ROD will be written in the RFLMA. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

45. 2.2.5 Broomfield is concerned the Proposed Plan does not address any institutional controls to prevent the use of surface water for drinking or irrigation in the refuge area. The Proposed Plan states: *surface water above the terminal ponds may not be use for drinking water or agricultural purposes.* Surface water is discharged into Walnut Creek and Woman Creek from the DOE retained land and eventually flows downstream to the POCs. It does not seem logical to enforce ICs in an area with no public access yet have no ICs where the public will have access to the drainages and monitoring stations outside of the DOE retained lands. The drainages and creeks could be an inviting water hole for horses when the refuge allows horseback riding on the south side of the site. We understand there will be designated trails for the horses, but there needs to be a legal control to prohibit the use of surface water flowing to the POCs. We strongly support the refuge	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. Future incidental use of surface water in the refuge area as you described similarly poses no threat and no controls are required. The CAD/ROD requires that DOE monitor surface water at POCs at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. The CAD/ROD requires DOE to maintain and protect these locations to ensure that they continue to function as designed, regardless of their location relative to the Central OU.

and its future activities, but we have reservations about the lack of application of the identified controls in the Proposed Plan. Revise the document to state the surface water monitoring stations outside of the DOE-retained lands will be managed consistently with the surface water monitoring stations within the DOE-retained lands.	

46. 2.2.6 Revise the document to identify how the institutional controls will be enforced and the schedule to implement corrective actions in the event a control fails.	The suggested revisions are inappropriate for the Proposed Plan, which develops broad alternatives for remedial action. Approval of the CAD/ROD will select the alternative and establish the requirements to implement that alternative. More detailed information describing how DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the RFLMA. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

47. 2.2.7 Revise the document to state a legally mandated fence will be constructed around the perimeter of the surface water monitoring stations outside of the DOE-retained lands. These surface water monitoring stations should be clearly marked and labeled to prevent public access and intrusion. As a minimum, a fence should be placed 10 feet out from the monitoring stations.	The CAD/ROD requires that DOE monitor surface water at POCs at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed, regardless of their location relative to the Central OU.

48. 2.2.8 The fence for the surface water monitoring stations outside of the DOE-retained lands and the fence around the DOE retained lands should be identified as a legal control in the Proposed Plan to protect the monitoring system for the remedy. Layering is of utmost importance in the event one control fails. The need to protect these surface water monitoring stations is founded on the importance to gather surface water data to evaluate the remedy and protect surface water quality downstream of Rocky Flats.	DOE will be required to maintain and protect surface water monitoring locations outside of the DOE-retained lands to ensure that they continue to function as designed. The concept of layered controls is embodied within the selected remedy for the Central OU, however not in the form of layered fences. The layered controls include a signs as a required physical control, ongoing ownership by DOE to prevent digging, water usage, and other prohibited activities, routine presence and observation by DOE and contractor staff, and an environmental covenant with the State of Colorado restricting use of the Central OU in perpetuity.

49. 2.2.9 The document refers to the Long-term Surveillance and Monitoring Plan. Revise the document to state all surface water monitoring data will be reported quarterly and summarized annually to all parties and impacted municipalities. Any changes in concentrations or exceedances of surface water action levels and/or standards should be relayed concurrently to impacted municipalities and the regulators. Once changes or physical conditions exist that could impact surface water quality DOE should notify downstream municipalities concurrently with the regulators.	An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public.

50. 2.2.10 The Long-term Surveillance and Monitoring Plan is referred to in the Proposed Plan as the document that identifies the monitoring and surveillance post-closure. As written in the LTS&M Plan, surface water quality in the terminal ponds will be measured only when there is a pond discharge. As identified in the LTS&M Plan, the ponds will be discharged when they are at 40% capacity. Based on modeling to predict the amount of surface water flowing at the site post-closure, there will be far less water entering the ponds. With the new configuration of the site, it could be years before the ponds would require a discharge. To effectively evaluate the remedy, the water quality in the terminal ponds or an identified location at the site should be performed annually as a minimum. Revise the document to state as a minimum the terminal ponds on Walnut Creek will be sampling annually for analytes identified in Attachment 5 of RFCA. Woman Creek is unique in that not all the runoff of surface water is captured in C-2, therefore language should be added to the Plan for Legacy Management to work with Westminster and the Woman Creek Reservoir Authority to identify a location that accurately reflects the effectiveness of the remedy on the south side of the site.	An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD. Regarding the commenter's request for a new monitoring location on Woman Creek, the RFCA parties worked with the communities in establishing the current monitoring locations. A primary purpose of the agreed upon monitoring network was to assure adequate information would be collected for remedy evaluation. No new location will be sited at this time. The entire monitoring system is subject to ongoing review so that locations and analytes can be dropped or added as conditions warrant.

51. 2.2.11 The City and County of Broomfield and the City of Westminster understand the potential for the ponds to require	The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA

additional discharges during wet seasons and wet years. Revise the Proposed Plan to include the following language: The Surface Water and Groundwater Working Group will be tasked to develop an Integrated Water Management Plan to develop a consensus recommendation to the decision-makers regarding decisions and actions related to water quality at, or downstream of RFETS. The group will identify actions necessary to protect water quality and the watershed and recommend programmatic activities to effectively manage water resources. The group will provide a comprehensive management tool to identify the actions to take regarding pond management. This tool will maintain and guide a long-term partnership between local governments, DOE, EPA, and CDPHE. The goal of the group will be to provide a comprehensive management tool to implement DOE's long-term commitment for protecting water and related ecological resources. It is imperative to include this language within the body of the Proposed Plan and the CAD/ROD to ensure a comprehensive water management plan is developed based on diminished flows, protection of ecological resources, and application of institutional controls necessary to protect water for all uses.	are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD. Therefore, a Surface Water and Groundwater Working Group and an Integrated Water Management Plan are not required.

52. 2.2.12 Revise the document to include language the City and County of Broomfield will sample surface water quality during a discharge into Walnut Creek and we reserve the right to sample surface water quality on an annual basis to determine surface water quality within the terminal ponds on Walnut Creek.	The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD.

53. 2.2.13 Revise the document to include language the City of Westminster and/or the Woman Creek Authority reserves the right to sample surface water quality on an annual basis to determine surface water quality within the C-2 terminal pond or specified location on Woman Creek.	The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a

	requirement of the CAD/ROD.

54. 2.2.14 Broomfield and Westminster have stated the need for a comprehensive long-stewardship plan since October 4, 1996. We are very disappointed that throughout the cleanup process the details of the long-term stewardship plan were deferred to numerous unwritten documents. We believed the Proposed Plan would be the critical document that would include the details and implementation of a long-term stewardship plan. The plan as a minimum was to identify the implementation and enforceability of institutional controls, have a clearly defined monitoring and surveillance plan that was developed with downstream municipalities input, include a statement identifying our role post-closure, and include a risk assessment based on effective engineered controls that were evaluated at the point effluent enters water of the state.	The purpose of the Proposed Plan was to identify DOE's preferred final remedy for RFETS and to provide the rationale for the preference. The preferred remedy for Alternative 2 includes clearly defined monitoring and surveillance requirements. These requirements are based on specific monitoring and O&M requirements for the 5 ongoing actions (that is, the Original and Present Landfills and the three groundwater treatment systems) as well as additional targeted ecological sampling based on results of the ERA and surface and groundwater monitoring as described in the FY2005 IMP, dated September 8, 2005. The FY2005 IMP was developed with downstream municipalities input. Institutional controls that are part of the preferred remedy are described in the Proposed Plan and are included in the CAD/ROD. The CAD/ROD identifies the RFLMA as the enforceable document for the institutional controls.

55. 2.2.15 We are also very disappointed that at the Public Hearing held on August 31, 2006 we were informed we could not address long-term stewardship issues. The statement in itself was in contradiction to the Proposed Plan that offered institutional and physical controls as two of the three identified alternatives. Without knowing the specifics of the final controls associated with the alternatives, we have reservations about the long-term effectiveness and enforceability of a long-term stewardship plan. If our comments are not considered, we may have to support Alternative 3 rather than Alternative 2 once the final CAD/ROD is released.	The Public Hearing conducted on August 31, 2006 was to gather comment from the public on the Proposed Plan. It was a formal hearing conducted in accordance with regulatory guidance, including use of a facilitator and court reporter to ensure verbatim transcription of oral public comments. Both the CAD/ROD and the Proposed Plan note that the CAD/ROD will be implemented through an enforceable agreement among DOE, EPA and CDPHE, known as RFLMA. RFLMA will contain additional details regarding long-term activities at Rocky Flats, and will be made available for formal public comment.

56. 2.2.16 The effectiveness of a long-term stewardship plan that protects surface water quality can only be strengthened through open communication among all affected parties. We have not been asked to participate in the drafting of the post-closure document to	DOE, EPA and CDPHE agree that open communications among all affected parties is important to the success of long-term activities at Rocky Flats. To that end, the communities and other stakeholders have been extensively involved in the remedy evaluation and

ensure an effective plan is drafted before it is finalized. Our participation would only serve to strengthen the success of a stewardship plan that our communities will accept and support.	selection process. As examples, the draft RI/FS report was released for public information in October 2005, and the agencies held several informational meetings with community representatives to discuss the report. Three informational meetings were held on the Proposed Plan itself, one prior to and two during the public comment period, in advance of the public hearing. Beyond that, DOE, EPA and CDPHE have engaged in extensive public dialogues over the years on long-term stewardship issues through a number of venues including the Stewardship Working Group, which was a joint effort between the Rocky Flats Citizens Advisory Board and the Rocky Flats Coalition of Local Governments, of which both Broomfield and Westminster were members. The agencies shared drafts of a long-term management agreement, the precursor of RFLMA, for Rocky Flats at these meetings for public information and input.

57. 2.2.17 If the regulators do not have enforceability responsibilities in the refuge area to ensure surface water quality, the City and County of Broomfield, city and Westminster, City of Northglenn, and the Woman Creek Reservoir Authority may seek to have the POCs, groundwater wells, and drainage measuring stations placed at the boundary between the DOE retained lands and the refuge.	The regulators have enforcement responsibilities at the surface water points of compliance at Indiana Street to ensure surface water quality. Surface water POCs at Indiana Street are part of the final remedy as documented in the CAD/ROD. The remaining surface water POCs are all within the Central OU boundary and are part of the final remedy as documented in the CAD/ROD. CAD/ROD requirements are implemented and enforced in the RFLMA. Contaminated groundwater is located within the Central OU boundary. Impacts or changes to water quality will be identified through the water monitoring network described in the FY2005 IMP. All AOC and Sentinel wells identified in the FY2005 IMP are located within the Central OU boundary. AOC wells are wells that are within a drainage and down-gradient of a contaminant plume or group of contaminant plumes. These wells are monitored to determine whether the plume(s) may be discharging to surface water. Sentinel wells are typically located near down-gradient contaminant plume edges, in drainages, and down-gradient of

	existing groundwater treatment systems. These wells are monitored to identify changes in groundwater quality. AOC and Sentinel wells are part of the final remedy described in the CAD/ROD. The CAD/ROD requirements are implemented and enforced through the RFLMA. Consequently, there is no need or regulatory requirement to have POCs, groundwater wells, and drainage measuring stations placed at the boundary between the DOE retained lands and the refuge.

58. 2.3.1 Broomfield and Westminster agree with the risk assessment for air contamination. Revise Figure 2 to include the location of the three current air monitoring stations.	Analysis of filters from the three current air monitoring stations will cease with this October's filter collection. DOE will continue to run the air monitors and collect the filters on a monthly basis and store them for future analysis in the event of significant erosion or slumping in areas of surface and/or subsurface residual radiological contamination.

59. 2.3.2 We understand the application of air modeling can be utilized in place of actual air monitoring. We ask to be apprised of DOE actions pertaining to the air stations. Communication with Legacy Management is vital if our staff and Council representatives are expected to effectively convey our assurances of the monitoring program to our citizens.	DOE will notify stakeholders and the public of actions pertaining to air monitoring.

60. 2.3.3 Any changes to the air monitoring criteria shall be made via the IMP process with input from our communities.	Air monitoring is not a regulatory requirement at this point or in the future.

61. 2.4.1 We appreciate the efforts the RFCA Parties made to evaluate the ecological risks in the RI/FS. The evaluation was very comprehensive.	Thank you for your comment.

62. 2.4.2 The *Rocky Flats, Colorado, Site Vegetation Management Plan,* dated May 2006 was revised without our review or knowledge. The recent changes to the Vegetation Management Plan should have been discussed during the IMP ecological meetings. The City and County of Broomfield and	The CAD/ROD does not contain specific requirements for vegetation management.

Westminster are very concerned we continually express our desires and justifications to maintain the current IMP process, communication process, and notification process.	

63. 2.4.2.1 Previous protocols with DOE and our governments were for DOE to notify us when chemicals were applied at the site for target pest control. This information is very valuable to us. The site had several applications this year, and we were not notified until well after the application at a Quarterly Data Exchange meeting. Please ensure the Proposed Plan has language to include us with any revisions to the Site Vegetation Plan. This Vegetation Plan should be evaluated annually and we expect to be part of the evaluation process.	The CAD/ROD does not contain specific requirements for vegetation management.

64. 2.4.2.2 The vegetation management plan is not clear if the plan is specific to the DOE-retained lands. This issue is crucial to the long-term stewardship application at the site.	The CAD/ROD does not contain specific requirements for vegetation management.

65. 2.4.2.3 The Vegetation Plan identifies prescribed burns and notes they have been on hold until the USFWS develops and implants their management plans for the refuge. Any prescribed burn will require extensive public input, and we ask to be informed if and when DOE begins to develop a plan for prescribed burns. We are concerned with the statement in the Vegetation Plan stating: *Currently, grazing is not permitted at the Site and prescribed burns have been suspended until USFWS takes over management of the Rocky Flats National Wildlife Refuge.* Clarify if this means prescribed burns will occur across the entire site. Will grazing be allowed within the DOE retained lands? If so, this raises concerns with erosion problems with the DOE retained lands. We ask these questions because they may have long-term stewardship implications. When the CCP was drafter, the City and County of Broomfield and the City of Westminster clearly understood there delineation between the roles of DOE and the Service. Recent documents are vague as to what document falls under the	The CAD/ROD does not contain specific requirements for vegetation management. Information on U.S. Fish & Wildlife Service refuge management is available in the Comprehensive Conservation Plan for the Rocky Flats National Wildlife Refuge.

jurisdiction of DOE or the Service. The Plan does not address how the lands will be managed, nor do they address how controls will be enforced and by whom.	

66. 2.4.3 The Preble's Meadow Jumping Mouse (PMJM) is a listed as a threatened species under the Endangered Species Act. The Vegetation Plan identifies controls to allow up to three acres of weed control within current PMJM areas within Rock Creek Reserve on an annual basis. Clarify how and if other controls for other areas at the site that are PMJM areas will be identified and managed.	The CAD/ROD does not contain specific requirements for vegetation management or PMJM habitat management.

67. 2.4.4 In the event the Solar Pond Treatment Unit has to be relocated to PMJM habitat, we ask to be involved in the evaluation process based on the impacts to Walnut Creek and Big Dry Creek.	Any proposed relocation of the Solar Pond Treatment Unit would trigger the consultative process under provisions of the RFLMA. The RFLMA will be offered for public review and comment.

68. 2.4.5 As the mouse controversy continues, we ask to be apprised on any potential impacts to the site. We also request that when a final decision is made pertaining to the mouse, the Water Working Group meet to evaluate the water and ecological impacts prior to revising the Site Vegetation Plan and the ecological section of the IMP.	The CAD/ROD does not contain specific requirements for vegetation management or PMJM habitat management.

69. 2.5.1 To assess the direction and magnitude of contaminant movement and groundwater migration, it is essential to evaluate data as generated to compare it against predetermined outcomes and identify whether reported concentrations are routine or indicative of worsening conditions. When our communities were first impacted by contamination leaving the site boundary, we were compelled to initiate a Water Working Group to develop a common vision with DOE to protect water quality. As the process evolved, there was a need to evaluate revisions to the site-wide water management plan and ecological impacts on an annual basis. The Integrated Monitoring Plan (IMP) served to:	The CAD/ROD contains monitoring and maintenance requirements that will be implemented by the RFLMA and includes the majority of attributes from the closure monitoring system as recommended by the IMP Water Working Group and contained in the 2005 and 2006 IMP. The monitoring data will continue to be provided to the public, cities and the LSO via the LM quarterly and annual reports. In addition, LM will present these data to the LSO, its constituents and the public for review, evaluation, discussion and comment. DOE does not anticipate any changes to the monitoring system in the near future.

• Develop data quality objectives with a goal to ensure compliance for surface water, • Developed objectives and monitored pond discharges, • Developed objectives and monitored discharges for the terminal detention pond discharges, • Developed objectives and monitored off-site discharges for community water supply management, • Developed objectives and monitored groundwater interactions, • Developed objectives and monitored special project activities such as D&D of buildings including close-in air monitoring and placement of groundwater wells to track migration or impacts of groundwater plumes near the buildings. • Developed objectives and monitored discharges from treatment units, • Developed objectives and monitored the Present Landfill and Original Landfill, • Developed objectives and monitored air, • Developed ecological objectives and monitored flora and fauna, and • Reviewed National Permit Discharge Elimination System (NPDES) proposed revisions.	

70. 2.5.2 It is imperative to maintain the IMP process to reassess site conditions and revise the monitoring systems to integrate on-site monitoring and off-site monitoring with downstream municipalities. Revise the language in the Proposed Plan to ensure the process continues post-closure. These meetings are highly technical and it is imperative to allow for discussion and exchange of data among those that generate data. Our goal is to evaluate the remedy. The data will verify if the remedy, which includes treatment, covers, caps, and removal, reduces toxicity and	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

mobility post-closure.	

71. 2.5.3 The Proposed Plan is silent on continuation of the IMP process and we are very concerned Legacy Management does not intend to continue this process with downstream municipalities. With the recent revision to the Vegetation Management Plan of May 2006 and associated review of the IMP ecological section, DOE's actions potentially reflect their intent to preclude us from a process that for years served to build trust and confidence with our local communities and the regulatory agencies. At the Public Hearing held on August 31, 2006, DOE stated our comments to the Proposed Plan would not be dispositioned with us prior to the release of the final CAD/ROD. This statement leaves us very concerned. Our previous communication process has been negated by this statement and does not give us the ability to discuss our concerns. We are left to rely on language in a post-closure document that we have not had an opportunity to comment on.	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

72. 2.5.4 We ask the RFCA Parties to work with us to ensure we continue the IMP process. To date, we have been willing to accommodate DOE's needs to concentrate on closure activities. We offer to host the meetings. We can have informal meetings to discuss data and exchange information, and we will try to meet the schedule of Legacy Management. Our justifications were conveyed to Legacy Management in 2004 and we only ask Legacy Management to adhere to their commitment made in 2004 to the City and County of Broomfield and to the City of Westminster. We ask that you work with our technical staff member to resolve this issue prior to the release of the final CAD/ROD.	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

73. 2.5.5 To minimize the need for several meetings post-closure, the city and County of Broomfield and Westminster recommended the Water Working Group and the Quarterly Data Exchange meetings be combined. During these meetings the monitoring plans could also be evaluated on an annual basis. We	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication

ask that you respond to our request.	between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

74. 3.1.1 The document states: *Because the parties had anticipated using institutional controls consistent with the anticipated future use of the site, CDPHE determined that a post-remediation analysis of residual risk on a release site basis was not necessary*. The document does not state how and if institutional controls will apply at the point-of-compliance monitoring stations, boundary groundwater wells, or other monitoring stations outside of the proposed boundary. Please refer to our previous comment in Section 2 related to implementation of institutional controls. Revise the document to state the justification for not performing the post-remediation analysis. With the 903 Americium, is the analysis solely performed for dose or was inhalation considered for visitors, including children?	CDPHE concluded that, with the application of institutional controls, the risk analysis contained in the CRA, which evaluated risk on an EU-by-EU basis, was sufficient to adequately characterize the risks posed by residual contamination at Rocky Flats. Per the CAD/ROD, institutional controls apply to the entire Central OU. The CAD/ROD requires that DOE monitor surface water at POCs at the discharge points from the three terminal ponds (A-4, B-5 and C-2) as well as at the points where Woman Creek and Walnut Creek cross the site boundary near Indiana Street. DOE will be required to protect and maintain these locations to ensure they continue to function as designed, regardless of their location relative to the Central OU. The analysis of risk posed by residual surface soil contamination to the anticipated future users (that is, the WRW and the WRV) included an evaluation of the inhalation pathway, which was noted in the Site Conceptual Model as being a potentially complete and significant pathway. This was done in for all the EUs including the Wind Blown EU, where the former 903 Pad was located. Both risk and dose were evaluated for surface soil contamination by radionuclides. The WRV evaluation was performed for both an adult and a child.

75. 3.1.2 The RFCA Parties committed to generate a final map of the site after the completion of the closure project to reflect the remaining residual contamination. This map was to assist the general public with a visual map of where residual contamination remained and where ICs would be applied. The RI/FS has several maps with considerable information, but this is not what the governments have been requesting. Revise the document to include an overlaid map identifying all the residual radioactive contamination in the soils, the remaining foundations, slabs, tanks, etc. and the groundwater contaminant plumes. This map should	DOE is developing a map or maps to address your comment. Institutional and physical controls will be required for the Central OU.

also include all the monitoring systems associated with the remedy. Institutional controls and access controls should apply to any area with residual contamination that needs to be protected from the public or contains a monitoring system to evaluate the remedy.	

76. 3.1.3 The document is silent on physical controls and Institutional Controls for the Points-of-Compliance (POCs). It is ironic that the only two enforceable surface water monitoring stations will not be secured and protected from the general public. Revise the document to include language that fencing as an enforceable control will secure the POCs. In the event the POCs have to be relocated, the RFCA Parties will work with the impacted communities during the relocation process.	The CAD/ROD requires that DOE monitor surface water at POCs at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed, regardless of their location relative to the Central OU.

77. 3.1.4 Revise the boundary map, Figure 3, to include stamped areas retained by DOE for the Points-of-Compliance.	DOE is developing a map or maps to address your comment.

78. 3.1.5 Revise the boundary map, Figure 3, to include stamped areas retained by DOE for the groundwater wells at the site boundary.	DOE is developing a map or maps to address your comment.

79. 3.1.6 Revised the boundary map, Figure 3, to include stamped areas retained by DOE for surface water stations located outside of the DOE retained lands.	DOE is developing a map or maps to address your comment.

80. 3.1.7 We understand the language in the post-closure document will have boundary signs mandated as a legal control. We do not understand the issue the RFCA Parties have with mandating the fence as a legal control.	A fence surrounding the Central OU is not required to protect human health or the environment, nor is it required to ensure effectiveness of the remedy. However, DOE and USFWS have agreed that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained as a best management practice. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with

	DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU. In addition, DOE and the regulators have agreed to post signs at the main pedestrian and vehicle entrance gates into the Central OU outlining the specific institutional control restrictions from the CAD/ROD and environmental covenant.
81. 3.2.1 The plan provides a map, Figure 3, delineating the Operable Unit (OU) boundaries. The RFCA Parties have decided to reconfigure the OU boundaries to consolidate all areas of the site that may require additional remedial actions into a final reconfigured Central OU. *The boundary of the new Central OU, also considers practicalities of future land management.* Broomfield understands the need Legacy Management (LM) has to establish a footprint that is as small a possible to reduce management cost and liability. We believe remedy evaluation and remedy protection have far greater justification to determine a boundary than the land management practicalities that were provided as justification for the proposed boundary.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. The boundary of the Central OU was determined based on data contained within the Proposed Plan as well as the RI/FS. The "practicalities of future land management" address minor adjustments to the boundary in consideration of sensitive habitats and surface topography. Remedy selection and protection is the driver behind the location of the boundary.
82. 3.2.2 Broomfield and the City of Westminster do not agree with the proposed boundary for the south side of the Original Landfill. There appears to be two choices for the south boundary. The proposed boundary is to site the boundary to the north of Woman Creek directly south of the Original landfill. Further east of the Original Landfill site, the boundary moves south of the creek. The rationale provided to us by the RFCA Parties for determining the boundary was to make it more practical for the Fish and Wildlife Service so that they would not have to access DOE retained land in this area and then exit the boundary to continue with land management operations outside of the DOE boundary. We were then provided another justification based on the need to protect the wetland area directly south of the Original Landfill. Based on a tour taken in July, we are in agreement with the placement of the boundary directly south of the Original Landfill.	There is no justification to expand the area of DOE retained lands for purpose of access. Per the Refuge Act DOE may access any area, whether in the Central OU or Peripheral OU, which is required for monitoring or remedy purposes. However, consultation with USFWS following direct field investigation indicated several concerns about encroachment on habitat and maintenance of the CAD/ROD physical controls. Based on these concerns, the boundary was expanded outward in a few areas, most notably south of the Original Landfill (see Figure 3). Land-use issues affecting Rocky Flats National Wildlife Refuge Lands are addressed in the U.S. Fish & Wildlife Service's Environmental Impact Statement. DOE will be required to maintain and protect any monitoring locations in the wildlife refuge to ensure that they continue to function as designed, regardless of their location relative to the Central OU. Specific monitoring requirements will be addressed in

We, however, do have concerns for the justification to exclude from the DOE retained lands the upgradient surface water monitoring station and the immediate downgradient surface monitoring station associated with the Original Landfill. We disagree with DOE that the two crucial surface water stations should be located outside of the DOE retained lands. There is no justification to exclude these water stations from DOE retained lands. Revise Figure 3 to expand the DOE retained lands to include GS-05 and GS-59. These stations are not located in steep areas, nor are they in riparian areas. The other alternative is to manage all the surface water stations consistently at the site and apply institutional and physical controls to these two stations associated with the Original Landfill. They would have to have additional layers of protection just as the POCs and the boundary wells at Indiana Street. All monitoring stations and wells should be maintained, operated, and funded by DOE.	the RFLMA, which will be made available for public comment.

83. 3.2.3 Groundwater from the Original Landfill is designed to flow underneath the buttress and migrate directly into Woman Creek. The Proposed Plan does not address the process to site groundwater wells or surface water monitoring stations within the refuge if warranted based on technical recommendations. Revise the Proposed Plan to address the process to potentially locate future monitoring systems outside of the DOE retained lands.	Locations of groundwater monitoring wells at the Original Landfill were chosen with the approval of CDPHE and EPA. Pursuant to RCRA/RFCA, one well is up-gradient and three wells are down-gradient of the OLF. If there is an increasing trend in down-gradient versus up-gradient monitoring wells, or if a selected percentage of the data exceed surface water standards, the RFCA parties must consult with each other. Surface water monitoring at the OLF proceeds in a similar manner. The Refuge Act permits DOE access to the refuge area to conduct operation and maintenance, and any other obligations it may have under RFCA or the Legacy Management Agreement. The Memorandum of Agreement between DOE and the Department of Interior will likely address details related to DOE's access to the refuge lands.
84. 3.2.4 These monitoring stations located outside of the DOE-retained lands provide crucial data. This data allows a proactive approach to identify a potential issue close to the source rather than a reactive approach that could impact water quality in the creeks or ponds. We cannot emphasize enough that the creek and the ponds	The remedy does not rely on or assume that the creeks or ponds treat or dilute surface water.

should never serve as a treatment method or serve as a unit to dilute contaminants prior to discharge into waters of the United States.	

85. 3.2.5 To assist with a final determination of the southern boundary, we prefer that one of our previous consultants or technical staff assist with identifying the final boundary on the south side of the site associated with Woman Creek.	There is no justification to expand the area of DOE retained lands for purpose of access. Per the Refuge Act, DOE may access any areas, whether in the Central OU or Peripheral OU, that are required for monitoring or remedy purposes. Boundaries of the operable units established in the CAD/ROD. However, consultation with USFWS following direct field investigation indicated several concerns about encroachment on habitat and maintenance of the CAD/ROD physical controls. Based on these concerns, the boundary was expanded outward in a few areas, most notably south of the Original Landfill (see Figure 3).

86. 3.2.6 Based on proposed activities identified in the Comprehensive Conservation Plan (CCP) drafted by the Fish and Wildlife Service the southern portion of the refuge will have much more activities than the north side. We have additional concerns activities such as hunting, horseback riding, and other off-trail activities could jeopardize the integrity of the monitoring stations near the Original Landfill.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. DOE will be required to maintain and protect monitoring equipment to ensure that they continue to function as designed.

87. 3.2.7 Just as the Preble's Meadow Jumping Mouse has a 300-foot protection area, we believe the remedy should also have an identified minimum protective area to protect the monitoring systems and the remedy from the public.	DOE will be required to maintain and protect monitoring equipment to ensure that they continue to function as designed.

88. 3.2.8 Revise the map, Figure 3, to move the boundary north of the Present landfill at least 300 feet from landfill boundary. It may be practical to follow the road north of the landfill, but the area northeast of the landfill should be pushed further north to protect the cap based on the proximity to the road and the cap.	The boundary of the Central OU was determined based on data contained within the Proposed Plan as well as the RI/FS. The OU boundary established in the Proposed Plan fully encompasses the Present Landfill and is protective.

89. 3.2.9 We would like to emphasize our concern is not the risk associated with the landfills, but rather the potential of public	DOE fully agrees with this comment. DOE will be required to maintain and protect monitoring and remedy locations to ensure

damage to the remedies and the monitoring stations that evaluate the remedy.	that they continue to function as designed.

90. 3.2.10 It is germane to identify the above mentioned POCs, surface water monitoring stations, and boundary wells on the map, Figure 3. Language for implementation of ICs and access controls shall be included in the Proposed Plan. We ask to participate with the development of the controls prior to the release of the final CAD/ROD. If sufficient controls are in place, we support Alternative 2. If clear controls are not defined, implemented, or enforced, we would therefore support Alternative 3.	DOE is developing a map or maps to address your comment. Early draft efforts have shown that including all the information listed in your comment on a single map makes it so cluttered that it is unreadable. The suggested revisions are inappropriate for the Proposed Plan, which develops broad alternatives for remedial action. Approval of the CAD/ROD will select the alternative and establish the requirements to implement that alternative. More detailed information describing how DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the RFLMA. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

91. 3.2.11 A fence around the Central OU should be more than a best-management practice. Revise the document to state the fence will be an enforceable control associated with the remedy and placed around the DOE-retained lands and monitoring systems outside of the DOE retained lands. In addition, the fence should be legally enforceable for these stations. This language in the CAD/ROD should support the enforceability of the fence in the post-Rocky Flats document as a regulatory mandated physical control. We expect the fence to be a legal control that is enforceable and will have identified maintenance and surveillance schedules. Corrective actions pertaining to the physical condition of the fences should also be identified in a Standard Operating Procedure for inspections of the site boundary and include signage.	A fence surrounding the Central OU is not required to protect human health or the environment, nor is it required to ensure effectiveness of the remedy. However, DOE and USFWS have agreed that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained as a best management practice. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU.

92. 3.2.12 Broomfield is concerned the proposed boundary does not include the 903 Americium Area. To state: *These levels of radioactivity are also far below the 231 pCi/g activity level for an*	The Peripheral OU will be transferred from DOE to USFWS (in large part), and will become the Rocky Flats National Wildlife Refuge. The RI found that conditions in the Peripheral OU were

adult rural resident that equates to the 25 mrem/year dose criterion specified in the Colorado Standard for Protection Against Radiation may be simplifying the risk based on dose. The issue with this area is to prevent digging to prevent dust dispersion and to control erosion to protect surface water quality. Not including this area within the Central OU (DOE retained lands) will have no associated ICs with this area. It would be irresponsible to allow digging or installation of groundwater wells for irrigation or other domestic use in this area. Activities in this area should not be allowed, especially horseback riding, trails, or any activity that could generate additional dust or increase the potential for erosion.	suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. Plans for use of groundwater by USFWS in the Refuge are beyond the scope of this CAD/ROD; however, information on Refuge management may be found in the CCP for the Rocky Flats National Wildlife Refuge prepared by USFWS.

93. 3.3 Based on the Independent Verification and Validation review by ORISE in the 903 pad and Inner Lip Area, there were additional hot spots that were identified in the 903 pad and Inner Lip area. We therefore question the potential for hot spots in the Americium Area. Revise the map to include the Americium Area in the DOE retained lands.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. The Central OU includes the historical 903 Pad and much of the wind blown area. While a small portion of the Peripheral OU may contain plutonium-239/240 above background in surface soil, the RI determined that from a risk perspective that portion of the site is acceptable for all uses.

94. 3.3.2 We would also be concerned if grazing were allowed in the Americium Area. Erosion would increase in this area and there would be a potential to impact Woman Creek. The runoff in this area would not be captured in C-2 and could potentially leave the site without being monitored. Clarify the basis for figure 3 in the Proposed Plan (Attachment 1) versus the proposed boundary in the Comprehensive Conservation Plan as identified below.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. The Central OU includes the historical 903 Pad and much of the wind blown area. While a small portion of the Peripheral OU may contain plutonium-239/240 above background in surface soil, the RI analyzed and modeled erosion and windblown exposure scenarios, and determined that from a risk perspective that portion of the site is acceptable for all uses.

95. 4.1.1 There are also two outcrops directly south of the creek that may one day need to be evaluated for surface water quality. Until we have sufficient data to ensure both groundwater and surface water quality are not impacted from the Original Landfill,	Locations of groundwater monitoring wells at the Original Landfill were chosen with the approval of CDPHE and EPA. Pursuant to RCRA/RFCA, one well is up-gradient and three wells are down-gradient of the OLF. If there is an increasing trend in down-

we need the ability to monitor in Woman Creek or directly south of Woman Creek if warranted. ICs would only apply to the DOE retained lands and the ability to add additional monitoring stations in the refuge could be very difficult if the refuge does not manage any lands associated with ICs. It is premature to assume there is sufficient data to evaluate the remedy for the Original Landfill. Revise the Proposed Plan to include language to allow for adding to the monitoring system outside of DOE retained lands if warranted by an evaluation of the RFCA Parties and the Water Working Group.	gradient versus up-gradient monitoring wells, or if a selected percentage of the data exceed surface water standards, the RFCA parties must consult with each other. Surface water monitoring at the OLF proceeds in a similar manner. The Refuge Act permits DOE access to the refuge area to conduct operation and maintenance, and any other obligations it may have under RFCA or the Legacy Management Agreement. The Memorandum of Agreement between DOE and the Department of Interior will likely address details related to DOE's access to the refuge lands. The Legacy Management Agreement will incorporate the requirements for monitoring at the Original Landfill that are found in the OLF Monitoring and Maintenance Plan.

96. 4.1.2 With current data, we do not question the risk of the Original Landfill to human health and the environment. We do question the integrity of the cover on the landfill and the ability to keep the buried waste segregated from groundwater infiltration and infiltration from precipitation. Our concern is with the current seeps on the cover that now have a higher potential to release contaminants directly into Woman Creek that previously were not mobile or at the surface to flow directly into Woman Creek.	The potential for the Original Landfill to impact Woman Creek as a result of the seeps, surface runoff, or ground water was a primary consideration of the design and construction. The locations of ground water and surface water monitoring will monitor any impacts to the creek as well as changes in the ground water that might impact the creek. The intent of the remedial action was to stabilize the hillside. Protecting the buried waste from precipitation infiltration is not one of the functions of the cover. The landfill cover will also be monitored for integrity to ensure long-term performance.

97. 4.1.3 Per the document, the cover is effective and protective based on the identified pathways that were evaluated. With the current seeps we now have a pathway that was not evaluated. We question the integrity of the cover and the numerous seeps that have developed since the placement of the cover. See Attachment 2.	No new seep areas have developed at the Original Landfill (OLF) that were not recognized during design and construction. Seep #7 did express itself at the surface a few months after construction, and now expresses itself higher on the hill. DOE is evaluating the need to extend the french drain system at Seep #7 to intercept this upper area. The design and construction of the OLF accommodate variable moisture/hydrologic conditions on and in the landfill with no compromise in performance. Required surveillance and monitoring are adequate to ensure appropriate evaluation of the landfill performance.

98. 4.1.4 The water in Attachment 2 could have been sampled to provide additional data to document the quality of the groundwater surfacing as a seep. Westminster, the City and County of Broomfield, and our Professional Consultants voiced their concerns with the placement of a shallow cover to prevent groundwater passing through the waste and surfacing at the cover. There was nothing in the landfill closure document to prevent the groundwater from passing through the waste and into Woman Creek. We voiced our concern with groundwater being allowed to directly enter Woman Creek without being monitored. Now the remedy has exacerbated the situation by causing the groundwater to seep to the top of the cover and potentially have a new pathway that was not evaluated.	The potential impacts of all runoff water from the Original Landfill are monitored by the surface water monitoring locations in Woman Creek near the landfill. The landfill cover was not designed to prevent infiltration. Prior to design and construction when far more infiltration, active seepage, and uncontrolled runoff occurred than now, monitoring data never indicated any impact of the landfill on Woman Creek. The current surveillance and monitoring will continue to evaluate the remedy.

99. 4.1.5 We are very concerned the Original Landfill IM/IRA states monitoring of the Original Landfill will consist of quarterly monitoring until the first CERCLA review. We understand the next 5-year review will be in spring of 2007 and with the current status of the integrity of the cover, DOE would not show due diligence if they did not continue to monitor quarterly until the next review in 2012. We ask this because there would be sufficient data to evaluate remedy and the changes to hydrology in this area.	As stated in this comment, and per the CAD/ROD, the next CERCLA periodic review will take place in 2007, to coordinate this review with the schedule for periodic reviews already established at Rocky Flats. At this time, DOE does not anticipate that the review will result in major changes to the monitoring programs established pursuant to the CAD/ROD. However, that determination will be made in the context of the data analysis as part of the periodic review.

100. 4.1.6 The City of Westminster also reserves the right to ask for periodic sampling of the South Interceptor Ditch if warranted.	The CAD/ROD states that the environmental monitoring, as well as the monitoring that will be included in RFLMA, is adequate to ensure continuing protectiveness of the remedy. Therefore, the CAD/ROD requires no additional sampling.

101. 4.1.7 We agree with the list of analytes to be evaluated at the Original Landfill are the full set of analytes identified in Attachment 5, Table 1. We understand the sampling as recent as February 2006 triggered monthly sampling per the decision rule. Arsenic and thallium were above the RFCA standard. The City of Westminster expects to be kept apprised of the results of the monthly sampling. This is once again justification for the need of a	Recent detections of arsenic and thallium occurred at the Present Landfill Pond, not at the Original Landfill. The CAD/ROD requires DOE to report environmental data on a quarterly basis, and that these reports be made available to the public.

Water Working Group to implement a strategic water management plan for the site.	

102. 4.1.8 We question the success of the restoration effort on the cover and areas still do not have established growth. We are very concerned without a successful restoration effort; Woman Creek will be vulnerable to mass loading of sediment. (Attachment 3)	While the vegetation on the OL appears sparse this year, it has done extremely well considering the weather conditions. RFETS has had only had about 1/3 of our normal precipitation for the entire year so far in 2006, so considering the weather, what DOE is seeing is actually quite good. The EPA and their expert consultant toured the OL during the summer to evaluate the health of the vegetation cover. The EPA expert thought the OL area looked great, especially considering the drought conditions. A large amount of new grass has sprouted since the site began receiving effective precipitation in late June. Mats and other erosion controls are effectively controlling sediment loss. The remaining seed is still in the ground awaiting more favorable conditions. Time and patience is the key for a native revegetation project such as this. The dry spring and early summer conditions have actually allowed more seed to sprout prior to any substantial precipitation events. Had such an event occurred in the spring when the area was less vegetated, it would have caused extensive erosion and resultant deposition. Future precipitation events will be buffered by the existing and developing ground cover and will cause less detrimental effects.

103. 4.2.1 We agree based on the current data, there is minimal risk at the Present Landfill. The risk assessment was based on previous data. With the new sampling and monitoring plan, Attachment 5 of the current RFCA lists the analytes to be monitored at the treatment unit. It was not until this sampling plan was revised that the effluent was sampled for a full suite of analytes. The last analytes identified above the stream standards were boron and manganese. The RFCA standard for boron is 750 µg/L and the result was 1,930 µg/L. Manganese standard was 1,858 µg/L and the result was 5,650 µg/L. Monthly sampling was	Per the CAD/ROD, the requirements for monitoring and maintenance at the Present Landfill will be derived from the approved Monitoring and Maintenance Plan for the Present Landfill, which addresses water quality issues in the Present Landfill Pond. These requirements are part of the selected remedy, and will be incorporated into RFLMA.

initiated for these two analytes. The sampling events were triggered and the quarterly monitoring was increased to monthly sampling for three consecutive months. We are very concerned water is allowed to discharge from the Present Landfill Pond into No Name Gulch knowing the effluent exceeds surface water standards. How can DOE be allowed to discharge water that exceeds the surface water standard and have the approval of the regulators? Once again, we understand the risk is minimal, but the standards are regulatory mandated and we do not understand the application of the discharge versus the stringent standard our waste water facilities have to adhere to prior to discharge.	

104. 4.2.2 We are very concerned with the language in the Present Landfill IM/IRA that states the pond will be sampled based on a "decision rule." We have no role in the decision, yet the City and County of Broomfield may be directly impacted.	Per the CAD/ROD, the requirements for monitoring and maintenance at the Present Landfill will be derived from the approved Monitoring and Maintenance Plan for the Present Landfill, which addresses water quality issues in the Present Landfill Pond. These requirements are part of the selected remedy, and will be incorporated into RFLMA. The CAD/ROD requires that RFLMA, in which substantive requirements for monitoring and maintenance of the Present Landfill will be incorporated, be subjected to formal public comment. The CAD/ROD also requires that water quality data be reported by DOE on a quarterly basis, and that these reports be made available to the public.

105. 4.2.3 The objective of the treatment system at the Present Landfill is to *demonstrate compliance with surface water standards.* The risk assessment evaluated risk, yet there seems to be a diminishing of the need to demonstrate compliance with RCRA regulated unit. Revise the document to provide justification for allowing a release of surface water without demonstrating compliance.	Per the CAD/ROD, the requirements for monitoring and maintenance at the Present Landfill will be derived from the approved Monitoring and Maintenance Plan for the Present Landfill, which addresses water quality issues in the Present Landfill Pond. These requirements are part of the selected remedy, and will be incorporated into RFLMA.

106. 4.2.4 We do not agree with measuring compliance with the Present Landfill at the POC at Indiana. The POC for the Present Landfill should be at the outfall of the treatment unit before it is	The CAD/ROD requires that POCs remain at the outfalls of the Rocky Flats terminal ponds, as well as in Walnut Creek and Woman Creek at Indiana Street. Per the CAD/ROD, the

released to waters of the state.	requirements for monitoring and maintenance at the Present Landfill will be derived from the approved Monitoring and Maintenance Plan for the Present Landfill, which addresses water quality issues in the Present Landfill Pond. These requirements are part of the selected remedy, and will be incorporated into RFLMA.

107. 4.2.5 There appears to be subsidence on the northeast face of the cap on the steep slope north of the treatment unit/pond. The Proposed Plan states the remedy is functioning per design. The document does not address the subsidence. We are concerned about slippage of the hillside in this area and it was addressed in our Present landfill comments in the IM/IRA. Please respond as to how this issue will be addressed.	At this time, DOE is unaware of any subsidence north of the treatment system in the landfill cover as suggested by the commenter. Surveillance and monitoring requirements for the Present Landfill result in a very comprehensive on-going evaluation of the remedy. If at any time slope movements or subsidence are observed, the conditions are documented and the situation is monitored and evaluated. If any actions are required to assure remedy performance, those actions will be developed through the consultative process among the RFCA parties.

108. 4.2.6 We observed a discoloration of the water in the treatment unit during our tour on August 21. Please clarify the reason for the discoloration in the unit.	The orange discoloration observed in water at the Present Landfill treatment system is typical of water containing dissolved iron when it is exposed to oxygen in the air.

109. 5.1 During remediation of the Industrial Area, both the City of Westminster and the City and County of Broomfield voiced their concern about the specifications pertaining to compaction at the site. Since regarding the 991 area there is severe subsidence and cracking in the area. (Attachment 4). We were lead to believe this instability in the area was due to lubrication from an outfall of a French drain. SW056 was in this area to measure water quality. At the end of September 2005, the outfall of the drain was removed and the east-west portion of the drain was interrupted. Sentinel well 45605 was installed upgradient (west) of the interruption and downgradient (north) of the remaining portion of the drain. There still continues to be a problem in this area. The outfall eliminated the flow into FC-4, but the cracks continued to increase in depth and width. We are very concerned the floor of FC-4 is experiencing extreme uplift. This area has a high potential to have both	The area of slope instability mentioned (in the vicinity of old SW056) is undergoing detailed and ongoing surveillance. At this time, there is no adverse impact on the surface water quality by VOCs or radionuclides as a result of the instability. VOCs are known to be present in the ground water in the vicinity of the slump while uranium (mostly naturally occurring) is known be present in the ground water site-wide. Ongoing surface water monitoring will occur to determine if there are any adverse effects from the unstable area. Regarding the deformation of functional channel FC-4 resulting from the slope instability, ongoing observation will continue and if the functionality of the channel is compromised, repairs will be made.

radioactive and VOC contamination that was not adequately characterized. Based on the risk analysis of the contamination, there was not pathway for the radioactive contamination. The area has massive cracks and now may have a pathway that was not analyzed in the risk analysis.	

110. 5.2 We commend DOE for having a geotechnical engineer inspect the areas and suggest actions that could stabilize the slope. We have yet to see a schedule or plan to correct this situation. We are very concerned of mass sediment loading into Southern Walnut Creek. We strongly disagree with DOE and the regulators that this *is not a CERCLA issue* because we do have groundwater monitoring stations in this area and this area flows directly into South Walnut Creek. We have GS-10 directly downgradient of this area and we continue to have elevated concentrations at this station. To state *Well 45605 will continue to be monitored in accordance with the IMP for as long as that is feasible,* in itself speaks of the need to monitor this area because of residual contamination.	As the commenter points out, the surface water POE GS-10 is directly down-gradient of the area of slope instability and any erosion related sedimentation. Any adverse water quality impacts that could occur will be observed. To date, there have been none. The relevant question is not whether there is a stability problem or how to fix it; it is whether the remedy is adversely impacted by site conditions. As there is no adverse impact to the remedy at this time and there is no reason to believe there will be, the parties will continue to observe and monitor. (Also, see response to 5.1 above)

111. 5.3 We ask for justification as to why the area is not being stabilized. The reasoning provided by the RFCA Parties is: *to repair it would be fairly significant and stabilization would entail surface grading and backfilling as well as loading the toe of the slope. Both of these activities would cause considerable damage to the newly-graded ground in this area, and could require the establishment of new roads to the bottom of the slope. The regulators came to a consensus to continue to observe condition in this area. When conditions have stabilized, LM will develop a plan to regrade to meet general aesthetic and safety objectives.*	The RFCA parties believe the current approach of surveillance and monitoring is appropriate and protective. The site remedy has not been adversely impacted by the slope conditions. It is not unexpected that after so much dirt moving on the site that some slope adjustments will naturally occur. DOE will continue to observe the entire site for signs of instability and evaluate any conditions for impact to the remedy. (Also, see responses to 5.1 and 5.2 above)
112. 5.4 When on the tour in June of 2006, technical staff asked when and how well 45605 would be replaced and the response was the issues would be discussed through the RFCA consultative process. There was no mention of discussing this issue via the Water Working Group. This statement confirms, as does the	Well 45605 is still operational and has not been replaced. Should the well become non-functional, a new well will be installed.

language in the Quarterly Report for June 2006, that the RFCA Parties do not support the spirit of RFCA to include the downstream municipalities with decisions that could impact their communities.	

113. 6.1 We disagree with the statement in the Proposed Plan and the RI/FS that *Continued operations of these four systems serves to protect surface water quality over short-and-long intermediate-term period by removing contamination loading to surface water. This protection also serves to meet long-term goals for returning groundwater to its beneficial use of surface water protection.* We agree the systems should serve as a final remedy, but they currently do not function effectively as per design.	The RFCA Parties believe that the groundwater treatment systems are functioning as designed and are part of the final remedy. Continued operation of these systems serves to protect surface water by reducing the groundwater contaminant loads that would be discharged to surface water. As part of DOE's commitment to maintain these systems so that they continue to function as designed, the Solar Ponds Plume Treatment System was recently repaired to improve its treatment efficiency.

114. 6.2 Broomfield understands when the treatment units were sited, some sections of the groundwater plumes were downgradient of the units, and therefore, we had sacrificial zones and expected to see degradation of the contaminant as loading was diminished. Data for some of the units are sporadic and leave us to question if the contamination in the groundwater is from the plume bypassing the unit or from a separate source that has yet to be identified.	As indicated in the Groundwater Interim Measure/Interim Remedial Action (IM/IRA), these groundwater systems were not intended to capture all of the groundwater contamination but to intersect the down-gradient portion of the plume, thus reducing the groundwater contaminant load discharging to surface water. DOE recognizes that portions of the contaminant plumes exist down-gradient of the treatment systems as constructed, which will be slowly removed over time as the groundwater contaminant load is diminished. However, based on the extensive site characterization and historical release evaluations, the RFCA Parties have concluded that it is unlikely that significant unidentified sources of contamination exist that could impact groundwater. The RFCA Parties believe that monitoring currently conducted at the treatment systems is sufficient to evaluate their efficiency and long-term performance.

115. 6.3 Based on GEI's report on the evaluation of the Groundwater IM/IRA, they were concerned there was an adequate evaluation of all the groundwater plumes at the site. GEI was concerned with the statement made by DOE that all the treatment units were functioning per design, yet there were insufficient data	Based on the extensive site characterization conducted at the site and the subsequent modeling results presented in the Groundwater IM/IRA and the Summary of Hydrologic Flow and Fate and Transport Modeling Conducted at RFETS, Golden, Colorado, dated September 2005, the RFCA Parties believe that all of the

sets to verify modeling of the contaminants. The Solar Pond Treatment Unit for years has been a concern to our staff and DOE cannot confirm they will be able to meet the nitrate standard of 10mg/L in 2009 when the temporary standard expires. We ask that in your disposition to our comments you provide a plan and assurances that you will be able to meet the 10mg/L standard at the effluent of the Solar Ponds treatment unit and at the discharge point of the Discharge gallery for the Solar Pond Unit.	groundwater plumes at the site have been sufficiently evaluated. Furthermore, groundwater conditions at the site continue to be evaluated. As indicated, in response to Broomfield/Westminster Comment 6.1, the groundwater treatment systems are functioning as designed, especially with the recent repairs to the Solar Pond Plume Treatment System which have increased its throughput and overall efficiency. DOE will continue to monitor groundwater and surface water with the goal of achieving the nitrate standard of 10 mg/L by 2009.

116. 6.4 GEI recommended a more robust sampling program to provide an additional layer to the monitoring program. This additional evaluation of data would also serve to provide additional protection to offsite receptors.	The RFCA Parties believe that the current sampling program is very robust and no additional sampling is needed for an additional layer to the monitoring program. This would not serve as additional protection to offsite receptors since all the impacted groundwater discharges to surface water up-gradient of the terminal ponds and does not leave the site above water quality standards.

117. 6.5 Walnut Creek should not be used as a treatment method to dilute nitrates or uranium and we expect to have the standard met prior to entry into Walnut Creek.	The Solar Ponds Plume Treatment System goal (and the associated monitoring identified in the IMP) is to meet the surface water standard upon entry of groundwater into Walnut Creek. It should be noted that the majority of the uranium in North Walnut Creek is from natural sources and not man-made sources.

118. 6.6 We argue that the objective of the treatment unit at the Solar Pond has been met. We question the length of time DOE took to evaluate the mechanical and operational aspects of the effectiveness of the unit. We thank DOE for taking action to determine the performance issue with the treatment unit. We also applaud DOE for performing a treatability study. Our concern is the study will be performed within the unit. We ask that the RFCA parties perform a bench-scale treatability test prior to using the treatment unit as a scientific experiment. With closure of the site, the unit is to be a final remedy, not an interim remedy.	The SPPTS has undergone substantial repair and maintenance in the summer and fall of 2006. These actions are expected to restore the system to its original operating condition, which has been shown to be effective in treating nitrate and uranium isotopes in shallow groundwater in the vicinity of the historic Solar Ponds. Continued maintenance of the system to ensure its long-term effectiveness is a requirement of the CAD/ROD.

119. 6.6.1 We ask to be informed on a weekly basis of the status of the unit based in the impact of the contaminants to Walnut Creek.	The CAD/ROD requires that water quality data be reported by DOE on a quarterly basis, and that these reports be made available to the public.

120. 6.6.2 We are concerned that the new proposed media may not work and there will be a need to expend additional resources to remove the overburden and remove the experimental media. This action would result in the generation of additional waste and additional risk to the workers.	The SPPTS has undergone substantial repair and maintenance in the summer and fall of 2006. These actions are expected to restore the system to its original operating condition, which has been shown to be effective in treating nitrate and uranium isotopes in shallow groundwater in the vicinity of the historic Solar Ponds. Continued maintenance of the system to ensure its long-term effectiveness is a requirement of the CAD/ROD.

121. 6.6.3 When the treatability study has been completed, we request a copy of the results for our review and evaluation.	Treatability study results will be contained in either the annual or quarterly DOE reports that are required by the CAD/ROD. These reports will be made available to the public.

122. 6.6.4 DOE has argued that the nitrate results in the discharge gallery are higher than the effluent from the treatment unit because sections of the groundwater plume were down-gradient from the sited treatment unit. After more than six years we have not seen a significant decrease in nitrates in the discharge gallery.	The CAD/ROD recognizes that, while groundwater accelerated actions performed under RFCA will ultimately lead to improvements in groundwater quality, contamination will remain in the UHSU in the Central OU for some period of time. The CAD/ROD also references the Groundwater IM/IRA, which found that there are no additional, practical steps that can be taken to improve groundwater quality at Rocky Flats. The CAD/ROD also notes that the areas of surface water affected by contaminated groundwater, such as in North Walnut Creek, are limited. The SPPTS has undergone substantial repair and maintenance in the summer and fall of 2006. These actions are expected to restore the system to its original operating condition, which has been shown to be effective in treating nitrate and uranium isotopes in shallow groundwater in the vicinity of the historic Solar Ponds. Continued maintenance of the system to ensure its long-term effectiveness is a requirement of the CAD/ROD.

123. 6.6.5 Revise the document to state once all the treatment units are meeting their remediation action objectives, DOE will	EPA, not DOE, files the Notice of Intention to delete a site from the NPL. Deletion from the NPL is not an area that is

propose to de-list the site.	appropriately addressed in the Proposed Plan, and will be considered later during site close-out activities.

124. 6.7.1 Remedial action objectives are clearly developed to provide the foundation of cleanup actions at a site for all impacted media such as groundwater, surface water, soil, and environmental protection. It is clearly understood if the objectives are not met, there are specific mechanisms such as institutional controls to ensure protection of human health and the environment. Of the seven remedial action objectives that were evaluated for the feasibility study, not one objective is completely met. Mechanisms have to be put in place to prevent use, prevent exposure, or statements are made such as: *At this time, no other additional actions can reasonably be taken* are used as reasoning as to why the RAOs were not met. The RAO for exposures that results in an unacceptable risk to the Wildlife refuge worker is identified in Soil RAO Objective 3 for the WBEU. The contaminant of concern is plutonium-239/240 in soils. We understand the risk is still within the acceptable range of $2x10^{-6}$. We are concerned there are no controls in place to prevent digging within this area. Controls need to be in place for the life of the contaminant as long as it poses a risk. Impacts to Woman Creek also have to be considered as soils enter the creek.	The preferred remedy (Alternative 2) meets all RAOs. The Central OU includes the historical 903 Pad and much of the wind blown area. While a small portion of the Peripheral OU may contain plutonium-239/240 above background in surface soil, the RFCA parties have agreed that this portion of the site is acceptable for all uses.

125. 6.7.2 We are not asking for additional removal, but we do believe there should be a control to prevent digging in this area. Erosion control measures also have to be implemented and adhered to protect surface water quality.	The Central OU includes the historical 903 Pad and much of the wind blown area. While a small portion of the Peripheral OU may contain plutonium-239/240 above background in surface soil, the RFCA parties have agreed that this portion of the site is acceptable for all uses.

126. 6.7.3 Alternative 2 and Alternative 3 add the implementation of institutional and physical control. The seven controls are identified, yet the Proposed Plan states the controls will be embodied in a post-RFCA enforceable document and an environmental covenant. What is missing are the details of how the	The institutional and physical controls that are part of the final remedy, as documented in the CAD/ROD, were identified in the Proposed Plan. The public's opportunity to provide input into the development of the controls is by commenting on the Proposed Plan. The CAD/ROD requirements are implemented and enforced

controls will be implemented, what will be enforced, who will enforce the controls, public input into the development of the controls, and how corrective actions will be mandated. We have concerns as the document states: *plans will be developed once evidence that violates the restrictions or damage of the controls are found.* There may not be time to draft a plan or have it reviewed. We are being asked to review a document and evaluate the proposal yet significant details are excluded from the document.	through the RFLMA.

127. 6.7.4 Revise the Plan to state an annual report to the regulatory agencies and communities will include language pertaining to the failure of controls. Notification of any failure of controls should be made to the regulatory agencies and impacted communities as soon as DOE becomes aware of the failure. Any corrective action should also be reported to the regulatory agencies and the impacted communities and identified in quarterly and annual reports.	The CAD/ROD and the RFLMA specify reporting requirements to the agencies. These reports will be shared with the communities.

128. 6.7.5 If the details of the controls are to be addressed in the post-RFCA document, we ask for a 60-day comment period for time to evaluate the details of the long-term stewardship plan and controls.	Implementation and enforcement of institutional and physical controls will be described in the RFLMA. The RFLMA will be available for a 30-day public comment period.

129. 7.1.1 The City and County of Broomfield and Westminster continue to have problems accessing information on the electronic administrative record. We are very concerned the site will be de-listed and we will not have access to vital information. This information per CERCLA, section 113 *requires that an administrative record be established "at or near the facility at issue." The record is to be complied contemporaneously and must be available to the public and include all information considered or relied on in selecting the remedy, including public comments on the proposed plan.* We understand new guidance calls for an electronic version of the administrative record. If the record is not accessible, it is not available. Provide a schedule of when DOE	The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

anticipates the record will be available and functioning electronically. We also ask for assurances to have public input as to what document should be in the record.	

130. 7.1.2 Most of the maps in the electronic version of the administrative record are in black and white. The maps and associated legends do not add any value to the record. Based on a $7 billion cleanup, it would have behooved DOE to enter the information into the system so that the community could access information that is of value and can be understood and evaluated.	The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR or that have yet to be entered electronically may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

131. 7.1.3 The City and County of Broomfield and the City of Westminster continually voice concerns about the availability of the record. We do not understand why the regulators do not enforce the regulation to meet the needs of the community.	The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR or that have yet to be entered electronically may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

132. 7.1.4 We were disappointed to have a regulatory representative state *the record has to be available electronically, but the regulation does not state it has to be operable.* This statement is in direct contrast to the requirement of the law.	The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR or that have yet to be entered electronically may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

133. 7.2.1 The Rocky Flats Reading Room located at the College Hill Library has served as a valuable tool to the community. We have been able to retrieve documents at the reading room that were not even available at the site.	The future of maintaining the reading room at the College Hill Library at the Front Range Community College will be determined during the upcoming 5-year CERCLA review of the Site.

134. 7.2.2 We ask the reading room be maintained until we have assurances the electronic version of the administrative record	The future of maintaining the reading room at the College Hill Library at the Front Range Community College will be determined

is fully functioning.	during the upcoming 5-year CERCLA review of the Site. The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR or that have yet to be entered electronically may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

135. 7.2.3 Legacy Management has committed to work with us when it is decided to disposition the documents in the reading room. To date, we have not been involved with any decisions pertaining to the reading room.	The future of maintaining the reading room at the College Hill Library at the Front Range Community College will be determined during the upcoming 5-year CERCLA review of the Site.

136. 7.2.4 We understand the reading room was to be maintained until the end of the fiscal year. We now have heard unofficially the room will be maintained until next spring. Clarify the status of the reading room. We ask that the community be part of the decision process associated with the reading room and its records.	The future of maintaining the reading room at the College Hill Library at the Front Range Community College will be determined during the upcoming 5-year CERCLA review of the Site.

137. 8.1.1 Clarify the delisting process. How will the de-listing process differ from the certification process? We have asked for the criteria for certification, but still have not received the information.	EPA, not DOE, files the Notice of Intention to delete a site from the NPL. Deletion from the NPL is not an area that is appropriately addressed in the Proposed Plan, and will be considered later during site close-out activities.

138. 8.1.2 How will the Covenant's Bill be enforced if the state has no jurisdiction in the refuge outer perimeter associated with the monitoring system?	The Covenant with the state is not applicable to the refuge. The refuge act provides DOE the right to access to monitoring systems on refuge lands.

139. 8.1.3 The site should clearly have a time frame identified to determine when cleanup levels will be achieved for groundwater. It is assumed if the cleanup of the soils was adequate for radionuclides, we will have near term data to verify if the soil remediation was adequate.	The site will have 5-year reviews mandated by CERCLA. These 5-year reviews will look at data and determine whether remediation is working sufficiently. The outcome of 5-years reviews range from requiring additional or alternative remediation to canceling any follow-on 5-year reviews.

140. 8.1.4 Prior to delisting the site, we expect to see an identification of deficiencies and any corrective measures regarding work products if there were any identified. We specifically ask for a description of the deficiency for the Solar Pond Treatment Unit, the 991 area, and the cover at the Original Landfill. We ask the RFCA Parties prepare a plan as to how these issues will be resolved and a schedule of when actions will be taken to mitigate the issues prior to approval of the CAD/ROD.	EPA, not DOE, files the Notice of Intention to delete a site from the NPL. Deletion from the NPL is not an area that is appropriately addressed in the Proposed Plan, and will be considered later during site close-out activities.

141. 8.2.1 The document lacks the details of how the land transfer from DOE to the Service will occur.	The Proposed Plan is written to guidance under CERCLA, which does not call for outlining the transfer to the USFWS.

142. 8.2.2 The remedial action objectives were met if institutional controls were in place. There are several monitoring systems outside of the DOE lands that are within the Service boundary that will not comply with Applicable or relevant and appropriate requirement (ARARs).	The ARARs (surface water standards) are met in the Peripheral OU.

143. 8.2.3 Community acceptance criterion should be addressed in the CAD/ROD. Without having the opportunity to evaluate the language in the final CAD/ROD, we are interested in the evaluation process the RFCA parties will utilize when reviewing community acceptance based on comments received in writing and at the public meeting held on August 31.	Community acceptance criteria is addressed in the CAD/ROD. The process under CERCLA is for the Proposed Plan to be available for public review and comment. All comments received are addressed in this comment response document and attached to the CAD/ROD. The CAD/ROD will be available to the public upon approval by the regulators.

144. 8.2.4 We ask for a closeout meeting to discuss how the site will be maintained. We also want to discuss how the fences and warning signs will be properly installed and maintained.	Any meetings that occur as a part of the CERCLA public comment process must occur for the general public's benefit. CERCLA does not allow meetings during the process with individual organizations.

145. 8.3.1 We understand funding has been made available to purchase mineral rights. The plan is lacking the evaluation process to determine the dollar amount assigned to the natural resource	An assessment of natural resources damages is not required as part of the Proposed Plan. The recently passed legislation providing funding for DOE to purchase mineral rights settles natural

damages.	resources damages claims arising from hazardous substances releases identified in the Rocky Flats Administrative Record as of the date of the Act. As such, there is no need to evaluate natural resources damages at Rocky Flats and consequently, no evaluation will be prepared.

146. 8.3.2 Provide the City and County of Broomfield and the City of Westminster with a copy of the evaluation of the damages.	An assessment of natural resources damages is not required as part of the Proposed Plan. The recently passed legislation providing funding for DOE to purchase mineral rights settles natural resources damages claims arising from hazardous substances releases identified in the Rocky Flats Administrative Record as of the date of the Act. As such, there is no need to evaluate natural resources damages at Rocky Flats and consequently, no evaluation will be prepared.

147. 8.3.3 We also question the ability of the bill to waive future liabilities for DOE in the event there are further damages.	An assessment of natural resources damages is not required as part of the Proposed Plan. The recently passed legislation providing funding for DOE to purchase mineral rights settles natural resources damages claims arising from hazardous substances releases identified in the Rocky Flats Administrative Record as of the date of the Act. As such, there is no need to evaluate natural resources damages at Rocky Flats and consequently, no evaluation will be prepared.

148. 9.1 The City and County of Broomfield and the City of Westminster were the only public members that took the time to comment on the Rocky Flats Site Post-Closure Public Involvement Plan, dated October 2006. We were very disappointed to see our comments were not given any weight, nor were they even dispositioned to allow for a fruitful discussion.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats

	Stewardship Council. Post-closure public involvement is addressed in the LM Post-closure Public Involvement Plan, which is dated Oct. 2005. As noted in the PCPIP, future updates to the plan will be made as needed, but no more frequent than annually.

149. 9.2 We once again ask the document be revised to incorporate the needs of the downstream municipalities.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council. Post-closure public involvement is addressed in the LM Post-closure Public Involvement Plan. As noted in the PCPIP, future updates to the plan will be made as needed, but no more frequent than annually.

150. 9.3 The Public Involvement Plan should be evaluated on an annual basis with the input from local governments. Based on a recent court decision in the *Moses Lake case,* the court recognized that it would need to dispute what the phrase "*participate in the planning and selection of the remedial action"* found in CERCLA truly means. We understand the decision recognizes the local government statutory right to participate in the cleanup decision-making process beyond the current public participation process currently implemented by DOE. Long-term stewardship is a key aspect of the cleanup process and we expect DOE to extend the policy to our governments, especially impacted governments. We are asking to be involved and kept apprised of the long-term stewardship controls applicable to the site.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council. Post-closure public involvement is addressed in the LM Post-closure Public Involvement Plan. As noted in the PCPIP, future updates to the plan will be made as needed, but no

	more frequent than annually.

151. 9.4 Please refer to our several letters regarding long-term stewardship and our role as downstream communities.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council. Post-closure public involvement is addressed in the LM Post-closure Public Involvement Plan. As noted in the PCPIP, future updates to the plan will be made as needed, but no more frequent than annually.

152. 9.5 We anticipate the post-closure document will be released for review these upcoming months for our evaluation and input.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

153. 10.1 We ask to be kept apprised of the drafting of the post-RFCA.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which

	will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

154. 10.2 We ask the language pertaining to downstream communities and their role with water management be included in the post-closure document.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

155. 10.3 The post-RFCA should, as a minimum, include the details of the enforceability of the surface water standards, a continuation of the Water Working Group, Attachment 1 list of analytes, ICs, notifications, public participation plan, and other key factors related to long-term stewardship.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

156. 10.4 We ask to be kept apprised of the upcoming 5-year review. We ask to have sufficient time to review and evaluate the information related to the review.	An appendix to the RFLMA will describe the public involvement roles and processes. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

157. 10.5 We ask to accompany the team during the physical tour of the remedy for the 5-year review.	An appendix to the RFLMA will describe the public involvement roles and processes. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

Comments from Ms. Garcia, City and County of Broomfield, Public Hearing August 31, 2006

1. … the fence. We also believe that that needs to be a regulatory driver. Our concern is, as a best management practice, we need to have something that'll actually serve as layering and protect the remedy itself, the life of the contaminants.	A fence surrounding the Central OU is not required to protect human health or the environment, nor is it required to ensure effectiveness of the remedy. However, DOE and USFWS have agreed that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained as a best management practice. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU. In addition, DOE and the regulators have agreed to post signs at the main pedestrian and vehicle entrance gates into the Central OU outlining the specific institutional control restrictions from the CAD/ROD and environmental covenant.

2. As far as the institutional controls, I believe-- I'm really concerned about the map that was proposed. Our community for over a year has been trying to get a map – a draft map, and institutional controls do not include the points of compliance. They don't include two of the surface water monitoring stations	The CAD/ROD mandates that DOE retain POCs in surface water at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to

that we're concerned about. And, most importantly, they're not identified as the two AOC wells in the boundary or boundary wells. I've asked what the controls will be on those because, most important of all, the POCs are truly important to downstream communities, and we need to have controls on those. I would ask that they put a stamped area around those areas if they have controls that apply to them. If not, it doesn't serve a purpose to have points of compliance without the controls.	function as designed.

3. And I also would like to see we have physical controls around them. It doesn't cost much to put a fence around those at the boundary of Indiana.	The CAD/ROD mandates that DOE retain POCs in surface water at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed.

4. And also in regards to the institutional controls, we also have a concern that the controls only apply to the ponds themselves. They do not apply in the refuge area, which we understand; but our concern is we question the ability to have groundwater wells in the refuge area. I know that's a water right issue, but that also needs to be addressed or at least usage needs to be included in the document as to if groundwater wells or surface water usage will be allowed downstream of our ponds.	The Peripheral OU will be transferred from DOE to USFWS (in large part), and will become the Rocky Flats National Wildlife Refuge. The RI found that conditions in the Peripheral OU, including groundwater quality, were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. Plans for use of groundwater by USFWS in the Refuge are beyond the scope of this CAD/ROD; however, information on Refuge management may be found in the CCP for the Rocky Flats National Wildlife Refuge prepared by USFWS.

5. Another concern that we have, I know it doesn't deal with that also is with less water in the ponds. When we're talking about discharging post closure, we may go years without any water in the ponds. So we're asking-- again, this is a stewardship issue-- that at least annually they support us in monitoring the ponds even without a discharge so we can actually have data to reflect the actual physical status of the site. We continually get calls from citizens, and it always helps if we have data to do that.	The CAD/ROD mandates that DOE continue surface water monitoring at the POCs at the discharge points from the three terminal ponds, and that DOE continue to monitor water entering the ponds at the existing POEs. In addition, DOE intends to continue its current best management practice of taking pre-discharge samples from the ponds prior to releasing water from them. These samples will continue to be split with CDPHE, and results will be shared with downstream communities, consistent with current practice.

6. And we also would like language added to that that Broomfield, also in conjunction, would also like to perform sampling at the same time. That's all I have for now.	The CAD/ROD states that the environmental monitoring, as well as the monitoring that will be included in RFLMA, is adequate to ensure continuing protectiveness of the remedy. Therefore, the CAD/ROD requires no additional sampling.

7. On Slide 7, Institutional Controls, O&M and monitoring embodied in a post-RFCA enforceable agreement will be addressed; and I support Shelley on her comments. And I just want to ensure – be assured that the post-RFCA will be a public comment document. We haven't – that hasn't been confirmed with us and that truly is a concern with the city, especially the downstream communities.	The RFLMA will undergo a public review and comment process, including a formal public comment period.

8. And previously for several years, especially the state, has always committed that in the final document we would have a map of the site showing where residual contamination was remaining. And the plan was silent on that, and we still have yet to see that, specifically to identify where no residual contamination is including the basements that were left in place and areas over by 779 and-- processed lines. The processed lines is what she said. Basically that's a digital contamination that's known. It would be very helpful for us in the future postclosure in case there are any issues, at least we'd have a map we'd be able to go to.	DOE is developing a map or maps to address your comment.

9. Again, the administrative record still isn't operating, and we'd just like confirmation that the College Hill Reading Room will be open until we can be assured that it is available electronically. We, for months, have been informing the RCRA parties it's not working. And one of the key issues of that is the older documents have been scanned in, and the documents are in black and white, and they're of no value to us if we can't read them; so if you could work with us on that.	The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR or that have yet to be entered electronically may be obtained by contacting the LM public affairs office for the Rocky Flats Site. The future of maintaining the reading room at the College Hill Library at the Front Range Community College will be determined during the

	upcoming 5-year CERCLA review of the Site.

Letter from the City of Westminster dated September 13, 2006

1. We formally request that our comments in Attachment A be dispositioned specifically and individually and not generalized with other public comments.	All comments are being specifically and individually addressed.

2. We also formally request an individual meeting with the RFCA Parties to address our comments prior to the release of the CAD/ROD.	Any meetings that occur as a part of the CERCLA public comment process must occur for the general public's benefit. CERCLA does not allow meetings during the process with individual organizations.

3. It is very difficult to evaluate the Proposed Plan and the preferred alternative without knowing the technical and regulatory details of the post-RFCA. Previously, Broomfield has been asked to evaluate RFCA Party proposals prior to their release to the public. Draft documents have always been released to us prior to public review. We do not understand the need for concealment of this critical document, nor do we understand the change in policy to keep downstream asset holders from participating in drafting language that protects our communities and fiscally preserves our assets. We reserve the right to readdress our comments and concerns identified in this letter once we have an opportunity to evaluate the language in the post-RFCA. It is essential that the post-RFCA document be released to the public for comment with a minimum of 60 days for review. Past practice for formal review of the RFCA documents should justify a formal review of the final post-RFCA or any other post-closure document.	See specific responses to detailed comments below.

4. **1. Involvement with Downstream Asset Holders.** Municipalities impacted by surface water from the RFETS shall be part of the technical process to evaluate and develop monitoring specifications for the post closure monitoring and maintenance plan. DOE will hold quarterly data exchange meetings to review data, evaluate trending, analyze sampling needs and/or discuss corrective actions with impacted municipalities.	See specific responses to detailed comments below.

5. **2. Long-term Monitoring and Surveillance Plan.** **a. Groundwater**-Stationary groundwater plumes require continued periodic monitoring to demonstrate that they are remaining stationary and do not pose a risk. **b. Surface Water**-the RFCA *states following completion of active remediation, the surface water must be of sufficient quality to support any surface water use classification.* With active remediation completed, we expect DOE to adhere to the underlying stream standards when the temporary modifications expire in 2009. **c. Integrated Monitoring Plan Process** This critical process must continue post-closure to periodically reassess site conditions and revise the on-site and off-site monitoring systems accordingly.	See specific responses to detailed comments below.

6. **3. Institutional and Access Controls/Proposed Central Operable Unit Boundary.** The document is silent on physical controls and Institutional Controls for the Points of Compliance. The RFCA parties committed to generate a final map of the site after the completion of the closure project to reflect the remaining residual contamination at the site. These two items need to be addressed. A fence around the Central OU should be an enforceable control, not just a best-management practice.	See specific responses to detailed comments below.

7. **4. Original Landfill and Present Landfill.** Monitoring must continue until there is sufficient data to ensure both groundwater and surface water quality are not impacted from the Original Landfill and to confirm the integrity of the cover. Current seeps that have developed in the cover have the potential to release contaminants directly into Woman Creek. The Present Landfill is currently discharging contaminants into No Name Gulch that exceed the surface water standards. The Present landfill pond should not be in a pass-through mode if the water quality does not meet the surface water standards.	See specific responses to detailed comments below.

8. **5. 991 Area.** This area is experiencing severe subsidence.	See specific responses to detailed comments below.

We disagree with the RFCA Parties' position that this unstable area is not a CERCLA issue. The area has groundwater wells located in it to monitor groundwater plumes. The functional channel is experiencing uplifting and we are very concerned with the potential for mass loading of sediments into South Walnut Creek.	

9. **6. Treatment Units/Remedial Action Objectives.** **a. Treatment Units.** We disagree with the statement in the Proposed Plan and the RI/FS stating: Continued operations of these four systems serves to protect surface water quality over short-and-long intermediate-term period by removing contaminant loading to surface water. This protection also serves to meet long-term goals for returning groundwater to its beneficial use of surface water protection. The Solar Pond Treatment Unit and the Present Landfill Treatment Unit as of today do not meet all of the surface water standards. The temporary standard expires in 2009 and we do not have assurances from DOE that the standard will be obtained to minimize the nutrient mass loading to Walnut Creek. **b. Remedial Action Objectives.** The remedial action objectives are the foundation of the clean-up actions. We clearly understand if the objectives are not mechanisms such as institutional controls to ensure protection of public health and the environment. The plan lacks the details of the implementation, oversight, enforceability, and reporting of the controls effectiveness and/or deficiencies.	See specific responses to detailed comments below.

10. **7. Administrative Record and Reading Room** **a. Administrative Record.** The electronic version of the administrative record continues to have access problems. CERCLA, section 113 requires that an administrative record be established "at or near the facility at issue." The record is to be complied contemporaneously and must be available to the public and include all information considered or relied on in selecting the remedy, including public comments on the proposed plan. We ask that all maps in the record be in color to be of value to our	See specific responses to detailed comments below.

community. **b. Reading Room.** We request the Reading Room be maintained until we are assured the administrative record is accessible and functioning. Legacy Management has committed to work with us in the decision making process to determine the best location for the administrative record.	

11. **8. De-listing the Site, Land Transfer, and Natural Resource Damage Evaluation** **a. De-listing.** The Proposed Plan lacks the details of the process to de-list and certify the site prior to transferring lands to the Department of the Interior. **b. Land Transfer.** The proposed Plan lacks the details of the land transfer. Our concern with the land transfer is the application of institutional and physical controls in both operable units.	See specific responses to detailed comments below.

12. **9. Public Involvement Plan.** The City and County of Broomfield and Westminster were the only public members to comment on the Public Involvement Plan dated October 2006. We ask the document be revised to include the current notification process, communication process, and continuation of the quarterly data exchange meetings in addition to the LSO briefings.	See specific responses to detailed comments below.

13. **10. Post-Rocky Flats Clean-up Agreement and 5-year Review.** We expect language in the post-RFCA to maintain the current role DOE has with downstream communities. The post-RFCA should as a minimum include the details of the enforceability of the surface water standards, a continuation of the Water Working Group, Attachment 1 list of analytes, ICs, notification, public participation plan, and other key factors related to long-term stewardship.	See specific responses to detailed comments below.

14. We request that you disposition this document with us prior to the release of the final approved CAD/ROD.	See specific responses to detailed comments below.

15. There is not a clearly defined plan and procedure for institutional and physical controls.	See specific responses to detailed comments below.

16. The record and data management system has to be in place and functioning prior to delisting.	See specific responses to detailed comments below.

17. Language needs to be added to the plan as a commitment to downstream communities to provide a role for us post-closure regarding water management.	See specific responses to detailed comments below.

18. 1.1.1 For years the City and County of Broomfield and the City of Westminster have had an integral role with the development of monitoring criteria during technical group discussions to implement changes to the monitoring plans at the site. Our role was clearly delineated in the RFCA and detailed in the *Integrated Water Management Plan for the Rocky Flats Environmental Technology Site,* dated August 1996. The Water Working Group's purpose as stated in the RFCA, Appendix 5, is *to develop consensus recommendations to the decision-makers regarding decisions and actions related to water quality at, or downstream of RFETS.* These discussions identified the needs and changes in monitoring scope as dictated by changes in the Rocky Flats Environment Technology Site operations and infrastructure. In addition, the working group was tasked to work towards a long-term stewardship monitoring system that would continuously evaluate and support data quality objectives. Revise the Proposed Plan to include language that local municipalities impacted by surface water from the RFETS shall be part of the technical process to evaluate and develop monitoring specifications for the post-closure monitoring and maintenance plan and develop consensus recommendation to the decision-makers post-closure.	DOE appreciates the long history of public involvement at Rocky Flats. Implementing agreed-upon post-closure monitoring and maintenance will be addressed in the RFLMA, which will be subject to public review and comment.

19. 1.1.2 The Proposed Plan refers to the Long-term Surveillance and Maintenance Plan (LTSMP) as the document that identifies the long-term stewardship criteria. We were very	An LTS&MP has not been issued and is not part of the Proposed Plan. Specifics of post-closure long-term surveillance and maintenance activities will be addressed in the RFLMA. The final

disappointed when Legacy Management decided to not adhere to the Public Participation Plan that identified the Interim Long-term Surveillance and Maintenance Plan as a public document to be released for our review and evaluation. To this date we have not received justification from Legacy Management as to why they deviated from their document and the RFCA to include participation of the Water Working Group to *maintain and guide a long-term partnership between local governments, DOE, EPA, and CDPHE.* Revise the document to state the LTSMP will be reviewed annually with the current partnership between DOE, EPA, CDPHE, and downstream municipal water users.	IS&MP was released to the public in December, 2005 and is available on the Legacy Management website at http://www.lm.doe.gov/land/sites/co/rocky_flats/rocky.htm .

20. 1.1.3 The Plan is silent on the enforceability of the Points of Compliance at Indiana, the groundwater wells at Indiana, and the ability for the regulators to have an oversight role for the monitoring stations outside of the DOE retained lands. When lands are transferred from DOE to the Service, will the regulators have the ability to enforce surface water quality and groundwater quality in areas outside of their responsibility that are located within the outer peripheral unit?	The CAD/ROD mandates that DOE retain POCs in surface water at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed. The Refuge Act provides for continuing regulatory authority in the DOE retained lands and the refuge lands. Enforceability will be included in the RFLMA.

21. 1.2.1 The City and County of Broomfield and Westminster for years have teamed with the RFCA Parties to exchange data, evaluate trending, and develop data quality objectives. These crucial decisions and recommendation were developed within the framework of the Water Working Group. In addition, monitoring data generated by all involved parties were exchanged to evaluate the generated data and monitoring systems. It is very important to evaluate trends in data to determine the optimum locations for the monitoring system post-closure. The City and County of Broomfield will continue to generate surface water data post-closure and evaluate the impacts to Walnut Creek and Big Dry Creek. The City of Westminster and Northglenn will also continue to evaluate the impacts to Woman Creek and Big Dry Creek.	The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public. An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD states that the environmental monitoring, as well as the monitoring that will be included in RFLMA, is adequate to ensure continuing protectiveness of the remedy. Therefore, the CAD/ROD requires no additional sampling.

Westminster reserves the right to monitor surface water post-closure at the site and at the site boundary.	

22. 1.2.2 We understand there may not be surface water discharges from the terminal ponds for several years, but quarterly monitoring will continue at the site and it will need to be reviewed and discussed. The Proposed Plan refers to the LTSMP. The LTSMP clearly excludes the continuation of the current process to discuss technical issues associated with the monitoring and surveillance systems at the site. Revise the Proposed Plan to specify quarterly data exchange meetings will be held with DOE, CDPHE, downstream municipalities, and EPA if they have an available representative, to review data, evaluate trending, analyze sampling needs, and/or discuss corrective actions. We expect the quarterly data exchange meetings to be in addition to any briefing by Legacy Management presented to the Local Stakeholder Organization.	The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public. An LTS&MP has not been issued and is not part of the Proposed Plan.

23. 1.2.3 We remind Legacy Management of their August 11, 2004 commitment made to downstream municipalities to continue the quarterly data exchange meetings with our communities for a minimum of two years. Based on this commitment, the language in the Plan should reflect, as a minimum, the commitment to downstream municipalities.	DOE intends to continue to interact with all interested parties and stakeholders. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public. An LTS&MP has not been issued and is not part of the Proposed Plan.

24. 1.2.4 On September 11, 2006, Mike Owen committed to open communication with local governments. This commitment is a confirmation by Legacy Management to continue the much-needed quarterly data exchange meetings with downstream communities to continue to evaluate an integral monitoring plan.	DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public.

25. 1.3.1 Our short-term goals during the Quarterly Data Exchange meetings were to ensure a safe, timely cleanup while working toward protecting surface water quality. Our long-term goals were to have a detailed long-term stewardship plan to protect surface water quality that impacts us as downstream communities. The open communication process and the notification process also served to strengthen our ability to resolve issues. The document refers to the Public Involvement Plan and this involvement plan clearly does not maintain the current open communication and notification process. Rather than remaining silent on direct communication and notification with our communities, we ask the document be revised to incorporate the previous notification and communication process as identified in our letter to Audrey Berry, dated September 16, 2005.	DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public.

26. 1.3.2 The current communication process with downstream communities should not be intended to replace the public process with the Rocky Flats Stewardship Council (RFSC), but instead be in addition to the public involvement plan identified by Legacy Management.	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

27. 1.3.3 The City and County of Broomfield and the City of Westminster have had several meetings with the RFCA Parties to address the importance of maintaining the same communication process and notification process with our municipalities. We have drafted several letters addressing the specifics of long-term stewardship and our role to fulfill our responsibilities to our citizens and businesses. Please refer to our most recent letters to Mike Owen dated December 6, 2005, letter to Audrey Berry dated September 16, 2005, and letter to John Rampe dated January 2004. In addition, we have been the only two communities that have	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield,

individually commented on all the documents the RFCA Parties have released during the cleanup project. We have invested hundreds of hours evaluating remedy proposals and strived to bring forward resolutions to meet both our needs and Doe's needs. These letters reflect the importance of this project to our communities. Revise the Proposed Plan to reflect our role post-closure to ensure our future role is codified in Legacy Management post-closure documents.	Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

28. 2.1.1 Broomfield understands the specific groundwater plumes that were evaluated in the approved RI/FS and the basis for the potential pathway analysis for contaminants to impact human health and the environment. The items evaluated were: • *Five upper hydrostratigraphic unit groundwater areas where contaminated groundwater may impact surface water;* • *Upper hydrostratigraphic unit groundwater sampling locations where groundwater contamination exceeds maximum contaminant levels; and* • *Groundwater sampling locations where exceedances of volatilization PRGs in groundwater indicate a potential indoor air risk* What the document is lacking is the process to evaluate stationary groundwater plumes and their potential risk long into the future in the event they migrate or a new pathway is created. We understand the stationary plumes do not pose a risk based on current data, yet the RI/FS and the Proposed Plan do not take consider the need to continue monitoring stationary plumes post-closure in the event hydrological conditions change. The RI/FS states these plumes *do not require further studies to evaluate risk to human health and the environment* and we agree with this statement based on current data. Revise the document to state in the event stationary plumes begin to migrate, a risk evaluation will be performed for the contaminant or contaminants of concern. Revise the document to also include the process to evaluate the risk. Include impacted	The RI/FS evaluated all groundwater constituents to determine analytes of interest (AOIs). The AOIs that formed contiguous, mapable plumes were further evaluated to determine their potential to impact surface water. The potential impacts of groundwater discharge to surface water were evaluated at the Area of Concern (AOC) and Sentinel wells which were selected by the Water Working Group regardless of whether the groundwater plumes are retreating, migrating or stationary (i.e., at steady state). The evaluation results indicated that AOIs in five groundwater areas have the potential to impact surface water based on results at the AOC and Sentinel wells and/or contaminant transport model predictions. There is a process identified to evaluate steady-state groundwater plumes in the Fiscal Year 2005 Integrated Monitoring Plan, Revision 1, dated September 2005 (IMP), which identifies AOC, Sentinel, and Evaluation wells. These wells are located so that they will detect potential changes in the groundwater plume configurations at the site whether they are currently considered to be in steady state or migrating downgradient. If groundwater monitoring results show statistically increasing trends at the AOC, Sentinel, or Evaluation, the IMP requires more frequent monitoring and evaluations for action, if deemed necessary. Since the water quality standards used for evaluation are deemed to be protective of human health and the environment and statistically significant impacts to water quality will be evaluated per the IMP, it is not

communities in the process to determine the monitoring needs post-closure.	necessary to revise the document to include a risk evaluation. Post-closure monitoring, identified in the IMP, will be implemented through the RFLMA, which will be offered for public review and comment.

29. 2.1.2 Revise the documents to reflect language in the RFCA Attachment 5, C.2 stating: *Groundwater plumes that can be shown to be stationary and do not therefore present a risk to surface water, regardless of their contaminant levels, will not require remediation or management. They will require continued monitoring to demonstrate that they remain stationary.* Based on the changes to the topography and potential hydrology at the site, Broomfield and Westminster believe there needs to be sufficient monitoring to determine if the groundwater plumes remain stationary and do not pose a risk. The RI/FS does not address future evaluations for all identified groundwater plumes. The process outlined within the RI/FS does not evaluate impacts to the creeks holistically.	The IMP identifies sufficient monitoring for all groundwater plumes (whether they are in steady-state or migrating) and contains a systematic process for evaluations and potential actions if statistically increasing contaminant trends are observed. Where possible, the future impact of groundwater plumes on surface water were evaluated in the RI/FS using contaminant fate and transport modeling. Modeling was performed for the significant volatile organic compound plumes to predict their future impact on surface water quality. Contaminant fate and transport modeling was not conducted for the metal AOIs because the metal plumes are limited in areal extent and do not currently pose a threat to surface water. Uranium was also not modeled because the primary uranium plume at the site, which occurs in the area of the Solar Evaporation Ponds, is already entering North Walnut Creek and the water quality impacts are well known. A groundwater interception and treatment system is already installed in this area. Post-closure surveillance and maintenance activities will be addressed in the RFLMA, which will be subject to public review and comment.

30. 2.1.3 Revise the document to state all exceedances of groundwater action levels shall be reported to downstream communities once DOE becomes aware of the data. In addition, the data shall be reported quarterly and summarized annually to all parties, including downstream municipalities. Revise the document to add "downstream communities" to the notification and communication process identified in the Plan.	The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public.
31. 2.1.4 *All groundwater plumes that exceed action levels must continue to be monitored until the need for institutional controls is mitigated.* Revise the document to include the process on implementation of institutional controls. Define how institutional	The CAD/ROD states that institutional controls will be maintained until the concentrations of hazardous substances in soil and groundwater are at levels so as to allow for unrestricted use and unlimited exposure, and/or until such time as engineered

controls will be implemented, how they will be evaluated, how often they will be evaluated, and by whom. Any information associated with institutional controls should also be relayed to the public and downstream communities. Once again, with ICs in the outer peripheral unit, we are not clear on the regulatory process in this area.	components of the remedy are no longer needed. DOE will be responsible for maintaining institutional controls. DOE will inspect the site relative to institutional controls no less than annually, and the CAD/ROD contains specific timeframes for addressing and reporting activities that are inconsistent with the objectives of the institutional controls. Institutional controls will be addressed in the regular reporting that will be made available to the public and will be evaluated in CERCLA periodic reviews. Conditions in the Peripheral OU are such that they allow for unrestricted use and unlimited exposure. Therefore, no institutional controls are needed for the Peripheral OU.

32. 2.1.5 Any revisions or justifications to change the standard/action levels for groundwater shall be based on the surface water use classifications and not jeopardize surface water quality. Impacted municipalities should be part of the decision-making process to reevaluate any proposed changes. Per RFCA, the temporary modifications were developed *together with other stakeholders (i.e., the local municipalities that are impacted by surface water from the RFETS).* Without knowing the specific language in the post-closure document, we ask language be incorporated and codified in Proposed Plan to ensure municipalities are included with any decision made at the Rocky Flats site that may impact surface water. Any modification or changes to the stream standards shall include downstream municipalities.	All rulemakings held by the Colorado Water Quality Control Commission related to use classifications, standards, or temporary modifications in Big Dry Creek have included and in the future are expected to include downstream communities. The rulemaking process allows for participation in the rulemaking as parties or as non-parties, and for the submission of written or oral testimony.

33. 2.1.6 Broomfield and Westminster are concerned the Proposed Plan does not address any institutional controls to prevent siting groundwater wells in the refuge to be used for irrigation or for other uses. The Proposed Plan states: *the construction or operation of groundwater wells is prohibited; except for remedy related purposes.* Revise the document to clarify the process to site a groundwater well in the refuge in the event a well is needed to evaluate the potential migration of a groundwater plume.	The Peripheral OU will be transferred from DOE to USFWS, and will become the Rocky Flats National Wildlife Refuge. The RI found that conditions in the Peripheral OU, including groundwater quality, were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. Plans for use of groundwater by USFWS in the Refuge are beyond the scope of this CAD/ROD; however, information on Refuge management may be found in the CCP for the Rocky Flats National Wildlife Refuge prepared by USFWS.

	The Refuge Act allows siting monitoring wells in the refuge and provides for DOE's access. DOE will be required to maintain and protect any wells to ensure that they continue to function as designed. Requirements for monitoring wells will be included in the RFLMA.

34. 2.1.7 Figure 3 of the Proposed Plan identifies the Rocky Flats Operable Units, i.e., DOE-retained lands and the refuge area. Figure 2 of the Proposed Plan identifies the groundwater and surface water monitoring locations. Revise the document to include an overlaid map of the two above-mentioned maps to reflect the location of the monitoring stations in relation to the boundary.	Figure 10.1 of the RI/FS shows the relationship of the Central Operable Unit (OU) boundary relative to the IMP groundwater monitoring wells (AOC and sentinel wells) and surface water monitoring locations (Point of Compliance [POC], Point of Evaluation [POE], and Point of Measurement [POM]). All of the AOC, Sentinel, and Evaluation wells are located in the Central OU. The POCs located downgradient of terminal ponds (GS11, GS08, and GS31) are located adjacent to the eastern (downstream) edge of the Central OU. The background surface water monitoring station (GS05), the POCs at Indiana Street (GS01 and GS03), and the boundary wells (41691 and 10394) are located in the Peripheral OU.

35. 2.1.8 We are very concerned the document does not address if or how institutional controls would apply to boundary wells. Revise the document to state ICs will apply to the boundary wells. Revise Figure 3 to include a delineation of the groundwater boundary wells. The Plan should also include a statement that the land/area the wells are located in will be retained by DOE.	Boundary wells are not required by the CAD/ROD. Although boundary wells are not located within the DOE-retained lands, the Refuge Act provides for DOE's access to them, and DOE will be required to maintain and protect these wells to ensure that they continue to function as designed. Requirements for monitoring at the boundary wells will be included in the RFLMA.

36. 2.1.9 Revise the document to state how the groundwater wells will be secured and identified. We expect to have a fence around the perimeter of the groundwater wells that are located outside of the DOE-retained lands. These wells have to be clearly marked and labeled to prevent public access and intrusion. As a minimum, a fence should be placed 10 feet out from the monitoring well. In addition, the fence should be legal control fence.	AOC, sentinel, and evaluation wells are located within the Central OU and are within the boundaries of the DOE-retained lands. Monitoring wells that are outside the DOE-retained lands will be protected and maintained, which will be described in more detail in the RFLMA.

37. 2.1.10 Telemetry is not a sufficient tool to be used as an indicator that a well has been vandalized. Freezing conditions could impact the telemetry system. The telemetry could serve as a layering method to protect the groundwater wells in the event other controls fail to protect the monitoring systems.	DOE agrees that telemetry is not a sufficient tool to assess whether a well has been vandalized, or to indicate other types of failure at a well. There is not currently, nor has there historically been telemetry at any of the groundwater wells. Visual of the wells are conducted at least semi-annually during sampling events. DOE will continue to protect the functionality of the wells included in the LM post-closure monitoring system.

38. 2.1.11 The fence for the boundary wells should be identified as a legal control to protect the monitoring system for the remedy. Layering is of utmost importance in the event one control fails. The need to protect these wells is founded on the importance to gather groundwater data to evaluate the remedy.	DOE will be required to maintain and protect these locations to ensure that they continue to function as designed. Specific groundwater monitoring requirements, including any boundary wells, will be addressed in the RFLMA.

39. 2.1.12 The document refers to the Long-term Surveillance and Monitoring Plan. Revise the document to state all groundwater monitoring data and any changes in hydrologic conditions will be reported quarterly and summarized annually to all parties and impacted municipalities. Any exceedances of groundwater action levels will be reported to all parties and impacted municipalities concurrently. Once changes or physical conditions exist that could impact surface water quality, downstream municipalities should be notified via telephone or fax.	An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication.

40. 2.1.13 The RI/FS does not address the evaluation of groundwater that discharges directly to surface water as baseflow, specifically groundwater entering North Walnut Creek from the discharge gallery. The document is silent on direct impacts to the creeks and only addresses an evaluation of groundwater to surface water at the Points-of-Compliance. To measure impacts after dilution occurs at the Points-of-Compliance (POCs) may not be an accurate evaluation of direct impacts to the streams and human health and the environment. We understand the remedial action objectives are used to develop and evaluate remedial alternatives. However, we do not agree it is appropriate to use the creeks and	The potential impacts of contaminated groundwater on surface water quality were evaluated in the RI/FS and considered in the Proposed Plan. The effectiveness of the groundwater system is evaluated through discharge sampling and during periodic monitoring, inspections and maintenance activities. The remedy does not assume that the creeks or ponds treat or dilute surface water.

ponds as a method to dilute/treat surface water. It may appear inaccurate to measure the effectiveness of the treatment units if the risks are evaluated at the terminal ponds and the POCs rather than measuring the water quality as it enters the creek or ponds.	

41. 2.2.1 Temporary modifications were developed together with local municipalities that are impacted by surface water from the RFETS. Broomfield reminds DOE that RFCA states *following completion of active remediation, the surface water must be of sufficient quality to support any surface water use classification in both Segments 4a/4b and 5.* Revise the Proposed Plan to state any temporary modifications will revert to the stream standards once the final remedy has been completed. We expect DOE to adhere to the stream standards once the temporary standards expire in 2009. Our intent was to allow less stringent standards during the cleanup. DOE should be adhering to the stream standards now that the remedy has been completed. Revise the Proposed Plan to include language identifying the procedure and schedule DOE has in place to adhere to the surface water standards by 2009.	The remedy for groundwater is not complete. It will be complete when all three of the Groundwater RAOs and the Surface Water RAO are met. The remedy – in the form of groundwater treatment systems and continued monitoring – has been put in place. DOE will continue to monitor groundwater and surface water with the goal of achieving the underlying surface water standards when the temporary modifications expire in 2009. More information on the temporary modifications and completion of the remedy at Rocky Flats may be found in the docket of the 2004 Water Quality Control Commission's Rulemaking on Regulation No. 38, to which the Cities of Broomfield and Westminster were parties.

42. 2.2.2 Revise the document to state how the institutional controls will apply to the surface water monitoring stations inside and outside of the DOE retained lands.	DOE will be required to maintain and protect these locations to ensure that they continue to function as designed. Per the Refuge Act, DOE may access any areas, whether in the Central OU or Peripheral OU, required for monitoring or remedy purposes.

43. 2.2.3 Revise Figure 3 to include a delineation of the surface water monitoring stations. The Plan should also include a statement that the land/area the surface water stations are located in will be retained by DOE.	DOE is developing a map or maps to address your comment. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed. Per the Refuge Act, DOE may access any areas, whether in the Central OU or Peripheral OU, required for monitoring or remedy purposes.

44. 2.2.4 Define how the institutional controls will be implemented for the use of surface water, how they will be evaluated, how often they will be evaluated, and by whom. Any information associated with institutional controls should also be	Signage, federal ownership, and an environmental covenant issued to the State of Colorado are the specific physical and institutional controls to be used to ensure the protection of surface water from unauthorized uses. Implementation of the physical and institutional

relayed to the public and downstream communities. We are specifically interested in the application of ICs at the POCs at the boundary.	controls will be inspected periodically by DOE, corrected or repaired if required, and reported in an annual report. These control, inspection, and reporting actions are listed in the Proposed Plan for Alternative 2, the Preferred Alternative. Approval of the CAD/ROD will establish these proposed actions as binding regulatory requirements for DOE. More detailed information describing how DOE will meet the requirements of the CAD/ROD will be written in the RFLMA. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

45. 2.2.5 Broomfield is concerned the Proposed Plan does not address any institutional controls to prevent the use of surface water for drinking or irrigation in the refuge area. The Proposed Plan states: *surface water above the terminal ponds may not be use for drinking water or agricultural purposes.* Surface water is discharged into Walnut Creek and Woman Creek from the DOE retained land and eventually flows downstream to the POCs. It does not seem logical to enforce ICs in an area with no public access yet have no ICs where the public will have access to the drainages and monitoring stations outside of the DOE retained lands. The drainages and creeks could be an inviting water hole for horses when the refuge allows horseback riding on the south side of the site. We understand there will be designated trails for the horses, but there needs to be a legal control to prohibit the use of surface water flowing to the POCs. We strongly support the refuge and its future activities, but we have reservations about the lack of application of the identified controls in the Proposed Plan. Revise the document to state the surface water monitoring stations outside of the DOE-retained lands will be managed consistently with the surface water monitoring stations within the DOE-retained lands.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. Future incidental use of surface water in the refuge area as you described similarly poses no threat and no controls are required. The CAD/ROD requires that DOE monitor surface water at POCs at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. The CAD/ROD requires DOE to maintain and protect these locations to ensure that they continue to function as designed, regardless of their location relative to the Central OU.

46. 2.2.6 Revise the document to identify how the institutional	The suggested revisions are inappropriate for the Proposed Plan,

controls will be enforced and the schedule to implement corrective actions in the event a control fails.	which develops broad alternatives for remedial action. Approval of the CAD/ROD will select the alternative and establish the requirements to implement that alternative. More detailed information describing how DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the RFLMA. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

47. 2.2.7 Revise the document to state a legally mandated fence will be constructed around the perimeter of the surface water monitoring stations outside of the DOE-retained lands. These surface water monitoring stations should be clearly marked and labeled to prevent public access and intrusion. As a minimum, a fence should be placed 10 feet out from the monitoring stations.	The CAD/ROD requires that DOE monitor surface water at POCs at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed, regardless of their location relative to the Central OU.

48. 2.2.8 The fence for the surface water monitoring stations outside of the DOE-retained lands and the fence around the DOE retained lands should be identified as a legal control in the Proposed Plan to protect the monitoring system for the remedy. Layering is of utmost importance in the event one control fails. The need to protect these surface water monitoring stations is founded on the importance to gather surface water data to evaluate the remedy and protect surface water quality downstream of Rocky Flats.	DOE will be required to maintain and protect surface water monitoring locations outside of the DOE-retained lands to ensure that they continue to function as designed. The concept of layered controls is embodied within the selected remedy for the Central OU, however not in the form of layered fences. The layered controls include a signs as a required physical control, ongoing ownership by DOE to prevent digging, water usage, and other prohibited activities, routine presence and observation by DOE and contractor staff, and an environmental covenant with the State of Colorado restricting use of the Central OU in perpetuity.

49. 2.2.9 The document refers to the Long-term Surveillance and Monitoring Plan. Revise the document to state all surface water monitoring data will be reported quarterly and summarized annually to all parties and impacted municipalities. Any changes in concentrations or exceedances of surface water action levels and/or standards should be relayed concurrently to impacted	An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made

municipalities and the regulators. Once changes or physical conditions exist that could impact surface water quality DOE should notify downstream municipalities concurrently with the regulators.	available to the public.

50. 2.2.10 The Long-term Surveillance and Monitoring Plan is referred to in the Proposed Plan as the document that identifies the monitoring and surveillance post-closure. As written in the LTS&M Plan, surface water quality in the terminal ponds will be measured only when there is a pond discharge. As identified in the LTS&M Plan, the ponds will be discharged when they are at 40% capacity. Based on modeling to predict the amount of surface water flowing at the site post-closure, there will be far less water entering the ponds. With the new configuration of the site, it could be years before the ponds would require a discharge. To effectively evaluate the remedy, the water quality in the terminal ponds or an identified location at the site should be performed annually as a minimum. Revise the document to state as a minimum the terminal ponds on Walnut Creek will be sampling annually for analytes identified in Attachment 5 of RFCA. Woman Creek is unique in that not all the runoff of surface water is captured in C-2, therefore language should be added to the Plan for Legacy Management to work with Westminster and the Woman Creek Reservoir Authority to identify a location that accurately reflects the effectiveness of the remedy on the south side of the site.	An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD. Regarding the commenter's request for a new monitoring location on Woman Creek, the RFCA parties worked with the communities in establishing the current monitoring locations. A primary purpose of the agreed upon monitoring network was to assure adequate information would be collected for remedy evaluation. No new location will be sited at this time. The entire monitoring system is subject to ongoing review so that locations and analytes can be dropped or added as conditions warrant.

51. 2.2.11 The City and County of Broomfield and the City of Westminster understand the potential for the ponds to require additional discharges during wet seasons and wet years. Revise the Proposed Plan to include the following language: The Surface Water and Groundwater Working Group will be tasked to develop an Integrated Water Management Plan to develop a consensus recommendation to the decision-makers regarding decisions and actions related to water quality at, or downstream of	The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD. Therefore, a Surface Water and Groundwater Working Group and an Integrated Water Management Plan are not required.

RFETS. The group will identify actions necessary to protect water quality and the watershed and recommend programmatic activities to effectively manage water resources. The group will provide a comprehensive management tool to identify the actions to take regarding pond management. This tool will maintain and guide a long-term partnership between local governments, DOE, EPA, and CDPHE. The goal of the group will be to provide a comprehensive management tool to implement DOE's long-term commitment for protecting water and related ecological resources. It is imperative to include this language within the body of the Proposed Plan and the CAD/ROD to ensure a comprehensive water management plan is developed based on diminished flows, protection of ecological resources, and application of institutional controls necessary to protect water for all uses.	

52. 2.2.12 Revise the document to include language the City and County of Broomfield will sample surface water quality during a discharge into Walnut Creek and we reserve the right to sample surface water quality on an annual basis to determine surface water quality within the terminal ponds on Walnut Creek.	The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD.

53. 2.2.13 Revise the document to include language the City of Westminster and/or the Woman Creek Authority reserves the right to sample surface water quality on an annual basis to determine surface water quality within the C-2 terminal pond or specified location on Woman Creek.	The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD.

54. 2.2.14 Broomfield and Westminster have stated the need for a comprehensive long-stewardship plan since October 4, 1996. We are very disappointed that throughout the cleanup process the details of the long-term stewardship plan were deferred to numerous unwritten documents. We believed the Proposed Plan	The purpose of the Proposed Plan was to identify DOE's preferred final remedy for RFETS and to provide the rationale for the preference. The preferred remedy for Alternative 2 includes clearly defined monitoring and surveillance requirements. These requirements are based on specific monitoring and O&M

would be the critical document that would include the details and implementation of a long-term stewardship plan. The plan as a minimum was to identify the implementation and enforceability of institutional controls, have a clearly defined monitoring and surveillance plan that was developed with downstream municipalities input, include a statement identifying our role post-closure, and include a risk assessment based on effective engineered controls that were evaluated at the point effluent enters water of the state.	requirements for the 5 ongoing actions (that is, the Original and Present Landfills and the three groundwater treatment systems) as well as additional targeted ecological sampling based on results of the ERA and surface and groundwater monitoring as described in the FY2005 IMP, dated September 8, 2005. The FY2005 IMP was developed with downstream municipalities input. Institutional controls that are part of the preferred remedy are described in the Proposed Plan and are included in the CAD/ROD. The CAD/ROD identifies the RFLMA as the enforceable document for the institutional controls.

55. 2.2.15 We are also very disappointed that at the Public Hearing held on August 31, 2006 we were informed we could not address long-term stewardship issues. The statement in itself was in contradiction to the Proposed Plan that offered institutional and physical controls as two of the three identified alternatives. Without knowing the specifics of the final controls associated with the alternatives, we have reservations about the long-term effectiveness and enforceability of a long-term stewardship plan. If our comments are not considered, we may have to support Alternative 3 rather than Alternative 2 once the final CAD/ROD is released.	The Public Hearing conducted on August 31, 2006 was to gather comment from the public on the Proposed Plan. It was a formal hearing conducted in accordance with regulatory guidance, including use of a facilitator and court reporter to ensure verbatim transcription of oral public comments. Both the CAD/ROD and the Proposed Plan note that the CAD/ROD will be implemented through an enforceable agreement among DOE, EPA and CDPHE, known as RFLMA. RFLMA will contain additional details regarding long-term activities at Rocky Flats, and will be made available for formal public comment.

56. 2.2.16 The effectiveness of a long-term stewardship plan that protects surface water quality can only be strengthened through open communication among all affected parties. We have not been asked to participate in the drafting of the post-closure document to ensure an effective plan is drafted before it is finalized. Our participation would only serve to strengthen the success of a stewardship plan that our communities will accept and support.	DOE, EPA and CDPHE agree that open communications among all affected parties is important to the success of long-term activities at Rocky Flats. To that end, the communities and other stakeholders have been extensively involved in the remedy evaluation and selection process. As examples, the draft RI/FS report was released for public information in October 2005, and the agencies held several informational meetings with community representatives to discuss the report. Three informational meetings were held on the Proposed Plan itself, one prior to and two during the public comment period, in advance of the public hearing. Beyond that, DOE, EPA and CDPHE have engaged in extensive

	public dialogues over the years on long-term stewardship issues through a number of venues including the Stewardship Working Group, which was a joint effort between the Rocky Flats Citizens Advisory Board and the Rocky Flats Coalition of Local Governments, of which both Broomfield and Westminster were members. The agencies shared drafts of a long-term management agreement, the precursor of RFLMA, for Rocky Flats at these meetings for public information and input.

57. 2.2.17 If the regulators do not have enforceability responsibilities in the refuge area to ensure surface water quality, the City and County of Broomfield, city and Westminster, City of Northglenn, and the Woman Creek Reservoir Authority may seek to have the POCs, groundwater wells, and drainage measuring stations placed at the boundary between the DOE retained lands and the refuge.	The regulators have enforcement responsibilities at the surface water points of compliance at Indiana Street to ensure surface water quality. Surface water POCs at Indiana Street are part of the final remedy as documented in the CAD/ROD. The remaining surface water POCs are all within the Central OU boundary and are part of the final remedy as documented in the CAD/ROD. CAD/ROD requirements are implemented and enforced in the RFLMA. Contaminated groundwater is located within the Central OU boundary. Impacts or changes to water quality will be identified through the water monitoring network described in the FY2005 IMP. All AOC and Sentinel wells identified in the FY2005 IMP are located within the Central OU boundary. AOC wells are wells that are within a drainage and down-gradient of a contaminant plume or group of contaminant plumes. These wells are monitored to determine whether the plume(s) may be discharging to surface water. Sentinel wells are typically located near down-gradient contaminant plume edges, in drainages, and down-gradient of existing groundwater treatment systems. These wells are monitored to identify changes in groundwater quality. AOC and Sentinel wells are part of the final remedy described in the CAD/ROD. The CAD/ROD requirements are implemented and enforced through the RFLMA. Consequently, there is no need or regulatory requirement to have POCs, groundwater wells, and drainage measuring stations placed at the boundary between the

	DOE retained lands and the refuge.

58. 2.3.1 Broomfield and Westminster agree with the risk assessment for air contamination. Revise Figure 2 to include the location of the three current air monitoring stations.	Analysis of filters from the three current air monitoring stations will cease with this October's filter collection. DOE will continue to run the air monitors and collect the filters on a monthly basis and store them for future analysis in the event of significant erosion or slumping in areas of surface and/or subsurface residual radiological contamination.

59. 2.3.2 We understand the application of air modeling can be utilized in place of actual air monitoring. We ask to be apprised of DOE actions pertaining to the air stations. Communication with Legacy Management is vital if our staff and Council representatives are expected to effectively convey our assurances of the monitoring program to our citizens.	DOE will notify stakeholders and the public of actions pertaining to air monitoring.

60. 2.3.3 Any changes to the air monitoring criteria shall be made via the IMP process with input from our communities.	Air monitoring is not a regulatory requirement at this point or in the future.

61. 2.4.1 We appreciate the efforts the RFCA Parties made to evaluate the ecological risks in the RI/FS. The evaluation was very comprehensive.	Thank you for your comment.

62. 2.4.2 The *Rocky Flats, Colorado, Site Vegetation Management Plan,* dated May 2006 was revised without our review or knowledge. The recent changes to the Vegetation Management Plan should have been discussed during the IMP ecological meetings. The City and County of Broomfield and Westminster are very concerned we continually express our desires and justifications to maintain the current IMP process, communication process, and notification process.	The CAD/ROD does not contain specific requirements for vegetation management.

63. 2.4.2.1 Previous protocols with DOE and our governments were for DOE to notify us when chemicals were applied at the site for target pest control. This information is very valuable to us. The	The CAD/ROD does not contain specific requirements for vegetation management.

site had several applications this year, and we were not notified until well after the application at a Quarterly Data Exchange meeting. Please ensure the Proposed Plan has language to include us with any revisions to the Site Vegetation Plan. This Vegetation Plan should be evaluated annually and we expect to be part of the evaluation process.	

64. 2.4.2.2 The vegetation management plan is not clear if the plan is specific to the DOE-retained lands. This issue is crucial to the long-term stewardship application at the site.	The CAD/ROD does not contain specific requirements for vegetation management.

65. 2.4.2.3 The Vegetation Plan identifies prescribed burns and notes they have been on hold until the USFWS develops and implants their management plans for the refuge. Any prescribed burn will require extensive public input, and we ask to be informed if and when DOE begins to develop a plan for prescribed burns. We are concerned with the statement in the Vegetation Plan stating: *Currently, grazing is not permitted at the Site and prescribed burns have been suspended until USFWS takes over management of the Rocky Flats National Wildlife Refuge.* Clarify if this means prescribed burns will occur across the entire site. Will grazing be allowed within the DOE retained lands? If so, this raises concerns with erosion problems with the DOE retained lands. We ask these questions because they may have long-term stewardship implications. When the CCP was drafter, the City and County of Broomfield and the City of Westminster clearly understood there delineation between the roles of DOE and the Service. Recent documents are vague as to what document falls under the jurisdiction of DOE or the Service. The Plan does not address how the lands will be managed, nor do they address how controls will be enforced and by whom.	The CAD/ROD does not contain specific requirements for vegetation management. Information on U.S. Fish & Wildlife Service refuge management is available in the Comprehensive Conservation Plan for the Rocky Flats National Wildlife Refuge.

66. 2.4.3 The Preble's Meadow Jumping Mouse (PMJM) is a listed as a threatened species under the Endangered Species Act. The Vegetation Plan identifies controls to allow up to three acres of	The CAD/ROD does not contain specific requirements for vegetation management or PMJM habitat management.

weed control within current PMJM areas within Rock Creek Reserve on an annual basis. Clarify how and if other controls for other areas at the site that are PMJM areas will be identified and managed.	

67. 2.4.4 In the event the Solar Pond Treatment Unit has to be relocated to PMJM habitat, we ask to be involved in the evaluation process based on the impacts to Walnut Creek and Big Dry Creek.	Any proposed relocation of the Solar Pond Treatment Unit would trigger the consultative process under provisions of the RFLMA. The RFLMA will be offered for public review and comment.

68. 2.4.5 As the mouse controversy continues, we ask to be apprised on any potential impacts to the site. We also request that when a final decision is made pertaining to the mouse, the Water Working Group meet to evaluate the water and ecological impacts prior to revising the Site Vegetation Plan and the ecological section of the IMP.	The CAD/ROD does not contain specific requirements for vegetation management or PMJM habitat management.

69. 2.5.1 To assess the direction and magnitude of contaminant movement and groundwater migration, it is essential to evaluate data as generated to compare it against predetermined outcomes and identify whether reported concentrations are routine or indicative of worsening conditions. When our communities were first impacted by contamination leaving the site boundary, we were compelled to initiate a Water Working Group to develop a common vision with DOE to protect water quality. As the process evolved, there was a need to evaluate revisions to the site-wide water management plan and ecological impacts on an annual basis. The Integrated Monitoring Plan (IMP) served to: • Develop data quality objectives with a goal to ensure compliance for surface water, • Developed objectives and monitored pond discharges, • Developed objectives and monitored discharges for the terminal detention pond discharges, • Developed objectives and monitored off-site discharges for	The CAD/ROD contains monitoring and maintenance requirements that will be implemented by the RFLMA and includes the majority of attributes from the closure monitoring system as recommended by the IMP Water Working Group and contained in the 2005 and 2006 IMP. The monitoring data will continue to be provided to the public, cities and the LSO via the LM quarterly and annual reports. In addition, LM will present these data to the LSO, its constituents and the public for review, evaluation, discussion and comment. DOE does not anticipate any changes to the monitoring system in the near future.

community water supply management, • Developed objectives and monitored groundwater interactions, • Developed objectives and monitored special project activities such as D&D of buildings including close-in air monitoring and placement of groundwater wells to track migration or impacts of groundwater plumes near the buildings. • Developed objectives and monitored discharges from treatment units, • Developed objectives and monitored the Present Landfill and Original Landfill, • Developed objectives and monitored air, • Developed ecological objectives and monitored flora and fauna, and • Reviewed National Permit Discharge Elimination System (NPDES) proposed revisions.	

70. 2.5.2 It is imperative to maintain the IMP process to reassess site conditions and revise the monitoring systems to integrate on-site monitoring and off-site monitoring with downstream municipalities. Revise the language in the Proposed Plan to ensure the process continues post-closure. These meetings are highly technical and it is imperative to allow for discussion and exchange of data among those that generate data. Our goal is to evaluate the remedy. The data will verify if the remedy, which includes treatment, covers, caps, and removal, reduces toxicity and mobility post-closure.	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

71. 2.5.3 The Proposed Plan is silent on continuation of the IMP process and we are very concerned Legacy Management does not intend to continue this process with downstream municipalities. With the recent revision to the Vegetation Management Plan of	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as

May 2006 and associated review of the IMP ecological section, DOE's actions potentially reflect their intent to preclude us from a process that for years served to build trust and confidence with our local communities and the regulatory agencies. At the Public Hearing held on August 31, 2006, DOE stated our comments to the Proposed Plan would not be dispositioned with us prior to the release of the final CAD/ROD. This statement leaves us very concerned. Our previous communication process has been negated by this statement and does not give us the ability to discuss our concerns. We are left to rely on language in a post-closure document that we have not had an opportunity to comment on.	the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

72. 2.5.4 We ask the RFCA Parties to work with us to ensure we continue the IMP process. To date, we have been willing to accommodate DOE's needs to concentrate on closure activities. We offer to host the meetings. We can have informal meetings to discuss data and exchange information, and we will try to meet the schedule of Legacy Management. Our justifications were conveyed to Legacy Management in 2004 and we only ask Legacy Management to adhere to their commitment made in 2004 to the City and County of Broomfield and to the City of Westminster. We ask that you work with our technical staff member to resolve this issue prior to the release of the final CAD/ROD.	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

73. 2.5.5 To minimize the need for several meetings post-closure, the city and County of Broomfield and Westminster recommended the Water Working Group and the Quarterly Data Exchange meetings be combined. During these meetings the monitoring plans could also be evaluated on an annual basis. We ask that you respond to our request.	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

74. 3.1.1 The document states: *Because the parties had anticipated using institutional controls consistent with the*	The water monitoring stations outside of the DOE-retained lands are necessary to evaluate compliance with surface water standards,

anticipated future use of the site, CDPHE determined that a post-remediation analysis of residual risk on a release site basis was not necessary. The document does not state how and if institutional controls will apply at the point-of-compliance monitoring stations, boundary groundwater wells, or other monitoring stations outside of the proposed boundary. Please refer to our previous comment in Section 2 related to implementation of institutional controls. Revise the document to state the justification for not performing the post-remediation analysis. With the 903 Americium, is the analysis solely performed for dose or was inhalation considered for visitors, including children?	and thus will have physical and institution controls consistent with those within DOE-retained land. Although this was not explicit in the Proposed Plan, the CAD/ROD will clarify this requirement. No post-remediation analysis is required at release sites because no additional remediation is proposed, thus conditions will not change and any post-remediation analysis would be evaluating the same conditions. The CAD/ROD will include a statement to clarify this point. Regarding the 903 Pad americium, the RI included americium as an Analyte of Interest (AOI) for the air pathway, however no AOIs were identified in the contaminant fate and transport section as having a complete pathway to a receptor, which included a child Wildlife Refuge Visitor (WRV). The pathway is incomplete because physical and institutional controls will be used to limit access to the Central OU, which includes the former 903 Pad area, to only Wildlife Refuge Workers. Analysis of americium in the Peripheral OU, including the area east of the former 903 Pad, concluded that a complete pathway for inhalation existed to a WRV, adult or child, but contaminant levels were sufficiently low that the Peripheral OU posed no current or potential future threat to human health or the environment.

75. 3.1.2 The RFCA Parties committed to generate a final map of the site after the completion of the closure project to reflect the remaining residual contamination. This map was to assist the general public with a visual map of where residual contamination remained and where ICs would be applied. The RI/FS has several maps with considerable information, but this is not what the governments have been requesting. Revise the document to include an overlaid map identifying all the residual radioactive contamination in the soils, the remaining foundations, slabs, tanks, etc. and the groundwater contaminant plumes. This map should also include all the monitoring systems associated with the remedy. Institutional controls and access controls should apply to any area with residual contamination that needs to be protected from the public or contains a monitoring system to evaluate the remedy.	DOE is developing a map or maps to address your comment. Institutional and physical controls will be required for the Central OU.

76. 3.1.3 The document is silent on physical controls and Institutional Controls for the Points-of-Compliance (POCs). It is ironic that the only two enforceable surface water monitoring stations will not be secured and protected from the general public. Revise the document to include language that fencing as an enforceable control will secure the POCs. In the event the POCs have to be relocated, the RFCA Parties will work with the impacted communities during the relocation process.	The CAD/ROD requires that DOE monitor surface water at POCs at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed, regardless of their location relative to the Central OU..

77. 3.1.4 Revise the boundary map, Figure 3, to include stamped areas retained by DOE for the Points-of-Compliance.	DOE is developing a map or maps to address your comment.

78. 3.1.5 Revise the boundary map, Figure 3, to include stamped areas retained by DOE for the groundwater wells at the site boundary.	DOE is developing a map or maps to address your comment.

79. 3.1.6 Revised the boundary map, Figure 3, to include stamped areas retained by DOE for surface water stations located outside of the DOE retained lands.	DOE is developing a map or maps to address your comment.

80. 3.1.7 We understand the language in the post-closure document will have boundary signs mandated as a legal control. We do not understand the issue the RFCA Parties have with mandating the fence as a legal control.	A fence surrounding the Central OU is not required to protect human health or the environment, nor is it required to ensure effectiveness of the remedy. However, DOE and USFWS have agreed that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained as a best management practice. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU. In addition, DOE and the regulators have agreed to post signs at the main pedestrian and vehicle entrance gates into the

	Central OU outlining the specific institutional control restrictions from the CAD/ROD and environmental covenant.

81. 3.2.1 The plan provides a map, Figure 3, delineating the Operable Unit (OU) boundaries. The RFCA Parties have decided to reconfigure the OU boundaries to consolidate all areas of the site that may require additional remedial actions into a final reconfigured Central OU. *The boundary of the new Central OU, also considers practicalities of future land management.* Broomfield understands the need Legacy Management (LM) has to establish a footprint that is as small a possible to reduce management cost and liability. We believe remedy evaluation and remedy protection have far greater justification to determine a boundary than the land management practicalities that were provided as justification for the proposed boundary.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. The boundary of the Central OU was determined based on data contained within the Proposed Plan as well as the RI/FS. The "practicalities of future land management" address minor adjustments to the boundary in consideration of sensitive habitats and surface topography. Remedy selection and protection is the driver behind the location of the boundary.

82. 3.2.2 Broomfield and the City of Westminster do not agree with the proposed boundary for the south side of the Original Landfill. There appears to be two choices for the south boundary. The proposed boundary is to site the boundary to the north of Woman Creek directly south of the Original landfill. Further east of the Original Landfill site, the boundary moves south of the creek. The rationale provided to us by the RFCA Parties for determining the boundary was to make it more practical for the Fish and Wildlife Service so that they would not have to access DOE retained land in this area and then exit the boundary to continue with land management operations outside of the DOE boundary. We were then provided another justification based on the need to protect the wetland area directly south of the Original Landfill. Based on a tour taken in July, we are in agreement with the placement of the boundary directly south of the Original Landfill. We, however, do have concerns for the justification to exclude from the DOE retained lands the upgradient surface water monitoring station and the immediate downgradient surface monitoring station associated with the Original Landfill. We	There is no justification to expand the area of DOE retained lands for purpose of access. Per the Refuge Act DOE may access any areas, whether in the Central OU or Peripheral OU, that are required for monitoring or remedy purposes. However, consultation with USFWS following direct field investigation indicated several concerns about encroachment on habitat and maintenance of the CAD/ROD physical controls. Based on these concerns, the boundary was expanded outward in a few areas, most notably south of the Original Landfill (see Figure 3). Land-use issues affecting Rocky Flats National Wildlife Refuge Lands are addressed in the U.S. Fish & Wildlife Service's Environmental Impact Statement. DOE will be required to maintain and protect any monitoring locations in the wildlife refuge to ensure that they continue to function as designed, regardless of their location relative to the Central OU. Specific monitoring requirements will be addressed in the RFLMA, which will be made available for public comment.

disagree with DOE that the two crucial surface water stations should be located outside of the DOE retained lands. There is no justification to exclude these water stations from DOE retained lands. Revise Figure 3 to expand the DOE retained lands to include GS-05 and GS-59. These stations are not located in steep areas, nor are they in riparian areas. The other alternative is to manage all the surface water stations consistently at the site and apply institutional and physical controls to these two stations associated with the Original Landfill. They would have to have additional layers of protection just as the POCs and the boundary wells at Indiana Street. All monitoring stations and wells should be maintained, operated, and funded by DOE.	

83. 3.2.3 Groundwater from the Original Landfill is designed to flow underneath the buttress and migrate directly into Woman Creek. The Proposed Plan does not address the process to site groundwater wells or surface water monitoring stations within the refuge if warranted based on technical recommendations. Revise the Proposed Plan to address the process to potentially locate future monitoring systems outside of the DOE retained lands.	Locations of groundwater monitoring wells at the Original Landfill were chosen in compliance with the Integrated Monitoring Plan (IMP) and with the approval of CDPHE and EPA. Pursuant to RCRA/RFCA, one well is up-gradient and three wells are down-gradient of the OLF. If there is an increasing trend in down-gradient versus up-gradient monitoring wells, or if a selected percentage of the data exceed surface water standards, the RFCA parties must consult with each other. Surface water monitoring at the OLF proceeds in a similar manner. The Refuge Act permits DOE access to the refuge area to conduct operation and maintenance, and any other obligations it may have under RFCA or the Legacy Management Agreement. The Memorandum of Agreement between DOE and the Department of Interior will likely address details related to DOE's access to the refuge lands.
84. 3.2.4 These monitoring stations located outside of the DOE-retained lands provide crucial data. This data allows a proactive approach to identify a potential issue close to the source rather than a reactive approach that could impact water quality in the creeks or ponds. We cannot emphasize enough that the creek and the ponds should never serve as a treatment method or serve as a unit to dilute contaminants prior to discharge into waters of the United States.	The remedy does not rely on or assume that the creeks or ponds treat or dilute surface water.

85. 3.2.5 To assist with a final determination of the southern boundary, we prefer that one of our previous consultants or technical staff assist with identifying the final boundary on the south side of the site associated with Woman Creek.	There is no justification to expand the area of DOE retained lands for purpose of access. Per the Refuge Act, DOE may access any areas, whether in the Central OU or Peripheral OU, that are required for monitoring or remedy purposes. Boundaries of the operable units established in the CAD/ROD. However, consultation with USFWS following direct field investigation indicated several concerns about encroachment on habitat and maintenance of the CAD/ROD physical controls. Based on these concerns, the boundary was expanded outward in a few areas, most notably south of the Original Landfill (see Figure 3).

86. 3.2.6 Based on proposed activities identified in the Comprehensive Conservation Plan (CCP) drafted by the Fish and Wildlife Service the southern portion of the refuge will have much more activities than the north side. We have additional concerns activities such as hunting, horseback riding, and other off-trail activities could jeopardize the integrity of the monitoring stations near the Original Landfill.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. DOE will be required to maintain and protect monitoring equipment to ensure that they continue to function as designed.

87. 3.2.7 Just as the Preble's Meadow Jumping Mouse has a 300-foot protection area, we believe the remedy should also have an identified minimum protective area to protect the monitoring systems and the remedy from the public.	DOE will be required to maintain and protect monitoring equipment to ensure that they continue to function as designed.

88. 3.2.8 Revise the map, Figure 3, to move the boundary north of the Present landfill at least 300 feet from landfill boundary. It may be practical to follow the road north of the landfill, but the area northeast of the landfill should be pushed further north to protect the cap based on the proximity to the road and the cap.	The boundary of the Central OU was determined based on data contained within the Proposed Plan as well as the RI/FS. The OU boundary established in the Proposed Plan fully encompasses the Present Landfill and is protective.

89. 3.2.9 We would like to emphasize our concern is not the risk associated with the landfills, but rather the potential of public damage to the remedies and the monitoring stations that evaluate the remedy.	DOE fully agrees with this comment. DOE will be required to maintain and protect monitoring and remedy locations to ensure that they continue to function as designed.

90. 3.2.10 It is germane to identify the above mentioned POCs, surface water monitoring stations, and boundary wells on the map, Figure 3. Language for implementation of ICs and access controls shall be included in the Proposed Plan. We ask to participate with the development of the controls prior to the release of the final CAD/ROD. If sufficient controls are in place, we support Alternative 2. If clear controls are not defined, implemented, or enforced, we would therefore support Alternative 3.	DOE is developing a map or maps to address your comment. Early draft efforts have shown that including all the information listed in your comment on a single map makes it so cluttered that it is unreadable. The suggested revisions are inappropriate for the Proposed Plan, which develops broad alternatives for remedial action. Approval of the CAD/ROD will select the alternative and establish the requirements to implement that alternative. More detailed information describing how DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the RFLMA. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

91. 3.2.11 A fence around the Central OU should be more than a best-management practice. Revise the document to state the fence will be an enforceable control associated with the remedy and placed around the DOE-retained lands and monitoring systems outside of the DOE retained lands. In addition, the fence should be legally enforceable for these stations. This language in the CAD/ROD should support the enforceability of the fence in the post-Rocky Flats document as a regulatory mandated physical control. We expect the fence to be a legal control that is enforceable and will have identified maintenance and surveillance schedules. Corrective actions pertaining to the physical condition of the fences should also be identified in a Standard Operating Procedure for inspections of the site boundary and include signage.	A fence surrounding the Central OU is not required to protect human health or the environment, nor is it required to ensure effectiveness of the remedy. However, DOE and USFWS have agreed that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained as a best management practice. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU.

92. 3.2.12 Broomfield is concerned the proposed boundary does not include the 903 Americium Area. To state: *These levels of radioactivity are also far below the 231 pCi/g activity level for an adult rural resident that equates to the 25 mrem/year dose criterion specified in the Colorado Standard for Protection Against Radiation* may be simplifying the risk based on dose. The issue	The Peripheral OU will be transferred from DOE to USFWS (in large part), and will become the Rocky Flats National Wildlife Refuge. The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. Plans for use of groundwater by USFWS in the Refuge are beyond the

with this area is to prevent digging to prevent dust dispersion and to control erosion to protect surface water quality. Not including this area within the Central OU (DOE retained lands) will have no associated ICs with this area. It would be irresponsible to allow digging or installation of groundwater wells for irrigation or other domestic use in this area. Activities in this area should not be allowed, especially horseback riding, trails, or any activity that could generate additional dust or increase the potential for erosion.	scope of this CAD/ROD; however, information on Refuge management may be found in the CCP for the Rocky Flats National Wildlife Refuge prepared by USFWS.

93. 3.3 Based on the Independent Verification and Validation review by ORISE in the 903 pad and Inner Lip Area, there were additional hot spots that were identified in the 903 pad and Inner Lip area. We therefore question the potential for hot spots in the Americium Area. Revise the map to include the Americium Area in the DOE retained lands.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. The Central OU includes the historical 903 Pad and much of the wind blown area. While a small portion of the Peripheral OU may contain plutonium-239/240 above background in surface soil, the RI determined that from a risk perspective that portion of the site is acceptable for all uses.

94. 3.3.2 We would also be concerned if grazing were allowed in the Americium Area. Erosion would increase in this area and there would be a potential to impact Woman Creek. The runoff in this area would not be captured in C-2 and could potentially leave the site without being monitored. Clarify the basis for figure 3 in the Proposed Plan (Attachment 1) versus the proposed boundary in the Comprehensive Conservation Plan as identified below.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. The Central OU includes the historical 903 Pad and much of the wind blown area. While a small portion of the Peripheral OU may contain plutonium-239/240 above background in surface soil, the RI analyzed and modeled erosion and windblown exposure scenarios, and determined that from a risk perspective that portion of the site is acceptable for all uses.

95. 4.1.1 There are also two outcrops directly south of the creek that may one day need to be evaluated for surface water quality. Until we have sufficient data to ensure both groundwater and surface water quality are not impacted from the Original Landfill, we need the ability to monitor in Woman Creek or directly south of Woman Creek if warranted. ICs would only apply to the DOE retained lands and the ability to add additional monitoring stations in the refuge could be very difficult if the refuge does not manage	Locations of groundwater monitoring wells at the Original Landfill were chosen with the approval of CDPHE and EPA. Pursuant to RCRA/RFCA, one well is up-gradient and three wells are down-gradient of the OLF. If there is an increasing trend in down-gradient versus up-gradient monitoring wells, or if a selected percentage of the data exceed surface water standards, the RFCA parties must consult with each other. Surface water monitoring at the OLF proceeds in a similar manner. The Refuge Act permits

any lands associated with ICs. It is premature to assume there is sufficient data to evaluate the remedy for the Original Landfill. Revise the Proposed Plan to include language to allow for adding to the monitoring system outside of DOE retained lands if warranted by an evaluation of the RFCA Parties and the Water Working Group.	DOE access to the refuge area to conduct operation and maintenance, and any other obligations it may have under RFCA or the Legacy Management Agreement. The Memorandum of Agreement between DOE and the Department of Interior will likely address details related to DOE's access to the refuge lands. The Legacy Management Agreement will incorporate the requirements for monitoring at the Original Landfill that are found in the OLF Monitoring and Maintenance Plan.

96. 4.1.2 With current data, we do not question the risk of the Original Landfill to human health and the environment. We do question the integrity of the cover on the landfill and the ability to keep the buried waste segregated from groundwater infiltration and infiltration from precipitation. Our concern is with the current seeps on the cover that now have a higher potential to release contaminants directly into Woman Creek that previously were not mobile or at the surface to flow directly into Woman Creek.	The potential for the Original Landfill to impact Woman Creek as a result of the seeps, surface runoff, or ground water was a primary consideration of the design and construction. The locations of ground water and surface water monitoring will monitor any impacts to the creek as well as changes in the ground water that might impact the creek. The intent of the remedial action was to stabilize the hillside. Protecting the buried waste from precipitation infiltration is not one of the functions of the cover. The landfill cover will also be monitored for integrity to ensure long-term performance.

97. 4.1.3 Per the document, the cover is effective and protective based on the identified pathways that were evaluated. With the current seeps we now have a pathway that was not evaluated. We question the integrity of the cover and the numerous seeps that have developed since the placement of the cover. See Attachment 2.	No new seep areas have developed at the Original Landfill (OLF) that were not recognized during design and construction. Seep #7 did express itself at the surface a few months after construction, and now expresses itself higher on the hill. DOE is evaluating the need to extend the french drain system at Seep #7 to intercept this upper area. The design and construction of the OLF accommodate variable moisture/hydrologic conditions on and in the landfill with no compromise in performance. Required surveillance and monitoring are adequate to ensure appropriate evaluation of the landfill performance.

98. 4.1.4 The water in Attachment 2 could have been sampled to provide additional data to document the quality of the groundwater surfacing as a seep. Westminster, the City and County of Broomfield, and our Professional Consultants voiced their	The potential impacts of all runoff water from the Original Landfill are monitored by the surface water monitoring locations in Woman Creek near the landfill. The landfill cover was not designed to prevent infiltration. Prior to design and construction when far more

concerns with the placement of a shallow cover to prevent groundwater passing through the waste and surfacing at the cover. There was nothing in the landfill closure document to prevent the groundwater from passing through the waste and into Woman Creek. We voiced our concern with groundwater being allowed to directly enter Woman Creek without being monitored. Now the remedy has exacerbated the situation by causing the groundwater to seep to the top of the cover and potentially have a new pathway that was not evaluated.	infiltration, active seepage, and uncontrolled runoff occurred than now, monitoring data never indicated any impact of the landfill on Woman Creek. The current surveillance and monitoring will continue to evaluate the remedy.

99. 4.1.5 We are very concerned the Original Landfill IM/IRA states monitoring of the Original Landfill will consist of quarterly monitoring until the first CERCLA review. We understand the next 5-year review will be in spring of 2007 and with the current status of the integrity of the cover, DOE would not show due diligence if they did not continue to monitor quarterly until the next review in 2012. We ask this because there would be sufficient data to evaluate remedy and the changes to hydrology in this area.	As stated in this comment, and per the CAD/ROD, the next CERCLA periodic review will take place in 2007, to coordinate this review with the schedule for periodic reviews already established at Rocky Flats. At this time, DOE does not anticipate that the review will result in major changes to the monitoring programs established pursuant to the CAD/ROD. However, that determination will be made in the context of the data analysis as part of the periodic review.

100. 4.1.6 The City of Westminster also reserves the right to ask for periodic sampling of the South Interceptor Ditch if warranted.	The CAD/ROD states that the environmental monitoring, as well as the monitoring that will be included in RFLMA, is adequate to ensure continuing protectiveness of the remedy. Therefore, the CAD/ROD requires no additional sampling.

101. 4.1.7 We agree with the list of analytes to be evaluated at the Original Landfill are the full set of analytes identified in Attachment 5, Table 1. We understand the sampling as recent as February 2006 triggered monthly sampling per the decision rule. Arsenic and thallium were above the RFCA standard. The City of Westminster expects to be kept apprised of the results of the monthly sampling. This is once again justification for the need of a Water Working Group to implement a strategic water management plan for the site.	Recent detections of arsenic and thallium occurred at the Present Landfill Pond, not at the Original Landfill. The CAD/ROD requires DOE to report environmental data on a quarterly basis, and that these reports be made available to the public.

102. 4.1.8 We question the success of the restoration effort on	While the vegetation on the OL appears sparse this year, it has

the cover and areas still do not have established growth. We are very concerned without a successful restoration effort; Woman Creek will be vulnerable to mass loading of sediment. (Attachment 3)	done extremely well considering the weather conditions. RFETS has had only had about 1/3 of our normal precipitation for the entire year so far in 2006, so considering the weather, what DOE is seeing is actually quite good. The EPA and their expert consultant toured the OL during the summer to evaluate the health of the vegetation cover. The EPA expert thought the OL area looked great, especially considering the drought conditions. A large amount of new grass has sprouted since the site began receiving effective precipitation in late June. Mats and other erosion controls are effectively controlling sediment loss. The remaining seed is still in the ground awaiting more favorable conditions. Time and patience is the key for a native revegetation project such as this. The dry spring and early summer conditions have actually allowed more seed to sprout prior to any substantial precipitation events. Had such an event occurred in the spring when the area was less vegetated, it would have caused extensive erosion and resultant deposition. Future precipitation events will be buffered by the existing and developing ground cover and will cause less detrimental effects.

103. 4.2.1 We agree based on the current data, there is minimal risk at the Present Landfill. The risk assessment was based on previous data. With the new sampling and monitoring plan, Attachment 5 of the current RFCA lists the analytes to be monitored at the treatment unit. It was not until this sampling plan was revised that the effluent was sampled for a full suite of analytes. The last analytes identified above the stream standards were boron and manganese. The RFCA standard for boron is 750 µg/L and the result was 1,930 µg/L. Manganese standard was 1,858 µg/L and the result was 5,650 µg/L. Monthly sampling was initiated for these two analytes. The sampling events were triggered and the quarterly monitoring was increased to monthly sampling for three consecutive months. We are very concerned water is allowed to discharge from the Present Landfill Pond into No Name	Per the CAD/ROD, the requirements for monitoring and maintenance at the Present Landfill will be derived from the approved Monitoring and Maintenance Plan for the Present Landfill, which addresses water quality issues in the Present Landfill Pond. These requirements are part of the selected remedy, and will be incorporated into RFLMA.

Gulch knowing the effluent exceeds surface water standards. How can DOE be allowed to discharge water that exceeds the surface water standard and have the approval of the regulators? Once again, we understand the risk is minimal, but the standards are regulatory mandated and we do not understand the application of the discharge versus the stringent standard our waste water facilities have to adhere to prior to discharge.	

104. 4.2.2 We are very concerned with the language in the Present Landfill IM/IRA that states the pond will be sampled based on a "decision rule." We have no role in the decision, yet the City and County of Broomfield may be directly impacted.	Per the CAD/ROD, the requirements for monitoring and maintenance at the Present Landfill will be derived from the approved Monitoring and Maintenance Plan for the Present Landfill, which addresses water quality issues in the Present Landfill Pond. These requirements are part of the selected remedy, and will be incorporated into RFLMA. The CAD/ROD requires that RFLMA, in which substantive requirements for monitoring and maintenance of the Present Landfill will be incorporated, be subjected to formal public comment. The CAD/ROD also requires that water quality data be reported by DOE on a quarterly basis, and that these reports be made available to the public.

105. 4.2.3 The objective of the treatment system at the Present Landfill is to *demonstrate compliance with surface water standards.* The risk assessment evaluated risk, yet there seems to be a diminishing of the need to demonstrate compliance with RCRA regulated unit. Revise the document to provide justification for allowing a release of surface water without demonstrating compliance.	Per the CAD/ROD, the requirements for monitoring and maintenance at the Present Landfill will be derived from the approved Monitoring and Maintenance Plan for the Present Landfill, which addresses water quality issues in the Present Landfill Pond. These requirements are part of the selected remedy, and will be incorporated into RFLMA.

106. 4.2.4 We do not agree with measuring compliance with the Present Landfill at the POC at Indiana. The POC for the Present Landfill should be at the outfall of the treatment unit before it is released to waters of the state.	The CAD/ROD requires that POCs remain at the outfalls of the Rocky Flats terminal ponds, as well as in Walnut Creek and Woman Creek at Indiana Street. Per the CAD/ROD, the requirements for monitoring and maintenance at the Present Landfill will be derived from the approved Monitoring and Maintenance Plan for the Present Landfill, which addresses water quality issues in the Present Landfill Pond. These requirements are

	part of the selected remedy, and will be incorporated into RFLMA.

107. 4.2.5 There appears to be subsidence on the northeast face of the cap on the steep slope north of the treatment unit/pond. The Proposed Plan states the remedy is functioning per design. The document does not address the subsidence. We are concerned about slippage of the hillside in this area and it was addressed in our Present landfill comments in the IM/IRA. Please respond as to how this issue will be addressed.	At this time, DOE is unaware of any subsidence north of the treatment system in the landfill cover as suggested by the commenter. Surveillance and monitoring requirements for the Present Landfill result in a very comprehensive on-going evaluation of the remedy. If at any time slope movements or subsidence are observed, the conditions are documented and the situation is monitored and evaluated. If any actions are required to assure remedy performance, those actions will be developed through the consultative process among the RFCA parties.

108. 4.2.6 We observed a discoloration of the water in the treatment unit during our tour on August 21. Please clarify the reason for the discoloration in the unit.	The orange discoloration observed in water at the Present Landfill treatment system is typical of water containing dissolved iron when it is exposed to oxygen in the air.

109. 5.1 During remediation of the Industrial Area, both the City of Westminster and the City and County of Broomfield voiced their concern about the specifications pertaining to compaction at the site. Since regarding the 991 area there is severe subsidence and cracking in the area. (Attachment 4). We were lead to believe this instability in the area was due to lubrication from an outfall of a French drain. SW056 was in this area to measure water quality. At the end of September 2005, the outfall of the drain was removed and the east-west portion of the drain was interrupted. Sentinel well 45605 was installed upgradient (west) of the interruption and downgradient (north) of the remaining portion of the drain. There still continues to be a problem in this area. The outfall eliminated the flow into FC-4, but the cracks continued to increase in depth and width. We are very concerned the floor of FC-4 is experiencing extreme uplift. This area has a high potential to have both radioactive and VOC contamination that was not adequately characterized. Based on the risk analysis of the contamination, there was not pathway for the radioactive contamination. The area	The area of slope instability mentioned (in the vicinity of old SW056) is undergoing detailed and ongoing surveillance. At this time, there is no adverse impact on the surface water quality by VOCs or radionuclides as a result of the instability. VOCs are known to be present in the ground water in the vicinity of the slump while uranium (mostly naturally occurring) is known be present in the ground water site-wide. Ongoing surface water monitoring will occur to determine if there are any adverse effects from the unstable area. Regarding the deformation of functional channel FC-4 resulting from the slope instability, ongoing observation will continue and if the functionality of the channel is compromised, repairs will be made.

has massive cracks and now may have a pathway that was not analyzed in the risk analysis.	

110. 5.2 We commend DOE for having a geotechnical engineer inspect the areas and suggest actions that could stabilize the slope. We have yet to see a schedule or plan to correct this situation. We are very concerned of mass sediment loading into Southern Walnut Creek. We strongly disagree with DOE and the regulators that this *is not a CERCLA issue* because we do have groundwater monitoring stations in this area and this area flows directly into South Walnut Creek. We have GS-10 directly downgradient of this area and we continue to have elevated concentrations at this station. To state *Well 45605 will continue to be monitored in accordance with the IMP for as long as that is feasible,* in itself speaks of the need to monitor this area because of residual contamination.	As the commenter points out, the surface water POE GS-10 is directly down-gradient of the area of slope instability and any erosion related sedimentation. Any adverse water quality impacts that could occur will be observed. To date, there have been none. The relevant question is not whether there is a stability problem or how to fix it; it is whether the remedy is adversely impacted by site conditions. As there is no adverse impact to the remedy at this time and there is no reason to believe there will be, the parties will continue to observe and monitor. (Also, see response to 5.1 above)

111. 5.3 We ask for justification as to why the area is not being stabilized. The reasoning provided by the RFCA Parties is: *to repair it would be fairly significant and stabilization would entail surface grading and backfilling as well as loading the toe of the slope. Both of these activities would cause considerable damage to the newly-graded ground in this area, and could require the establishment of new roads to the bottom of the slope. The regulators came to a consensus to continue to observe condition in this area. When conditions have stabilized, LM will develop a plan to regrade to meet general aesthetic and safety objectives.*	The RFCA parties believe the current approach of surveillance and monitoring is appropriate and protective. The site remedy has not been adversely impacted by the slope conditions. It is not unexpected that after so much dirt moving on the site that some slope adjustments will naturally occur. DOE will continue to observe the entire site for signs of instability and evaluate any conditions for impact to the remedy. (Also, see responses to 5.1 and 5.2 above)
112. 5.4 When on the tour in June of 2006, technical staff asked when and how well 45605 would be replaced and the response was the issues would be discussed through the RFCA consultative process. There was no mention of discussing this issue via the Water Working Group. This statement confirms, as does the language in the Quarterly Report for June 2006, that the RFCA Parties do not support the spirit of RFCA to include the downstream municipalities with decisions that could impact their	Well 45605 is still operational and has not been replaced. Should the well become non-functional, a new well will be installed.

communities.	

113. 6.1 We disagree with the statement in the Proposed Plan and the RI/FS that *Continued operations of these four systems serves to protect surface water quality over short-and-long intermediate-term period by removing contamination loading to surface water. This protection also serves to meet long-term goals for returning groundwater to its beneficial use of surface water protection.* We agree the systems should serve as a final remedy, but they currently do not function effectively as per design.	The RFCA Parties believe that the groundwater treatment systems are functioning as designed and are part of the final remedy. Continued operation of these systems serves to protect surface water by reducing the groundwater contaminant loads that would be discharged to surface water. As part of DOE's commitment to maintain these systems so that they continue to function as designed, the Solar Ponds Plume Treatment System was recently repaired to improve its treatment efficiency.

114. 6.2 Broomfield understands when the treatment units were sited, some sections of the groundwater plumes were downgradient of the units, and therefore, we had sacrificial zones and expected to see degradation of the contaminant as loading was diminished. Data for some of the units are sporadic and leave us to question if the contamination in the groundwater is from the plume bypassing the unit or from a separate source that has yet to be identified.	As indicated in the Groundwater Interim Measure/Interim Remedial Action (IM/IRA), these groundwater systems were not intended to capture all of the groundwater contamination but to intersect the down-gradient portion of the plume, thus reducing the groundwater contaminant load discharging to surface water. DOE recognizes that portions of the contaminant plumes exist down-gradient of the treatment systems as constructed, which will be slowly removed over time as the groundwater contaminant load is diminished. However, based on the extensive site characterization and historical release evaluations, the RFCA Parties have concluded that it is unlikely that significant unidentified sources of contamination exist that could impact groundwater. The RFCA Parties believe that monitoring currently conducted at the treatment systems is sufficient to evaluate their efficiency and long-term performance.

115. 6.3 Based on GEI's report on the evaluation of the Groundwater IM/IRA, they were concerned there was an adequate evaluation of all the groundwater plumes at the site. GEI was concerned with the statement made by DOE that all the treatment units were functioning per design, yet there were insufficient data sets to verify modeling of the contaminants. The Solar Pond Treatment Unit for years has been a concern to our staff and DOE cannot confirm they will be able to meet the nitrate standard of	Based on the extensive site characterization conducted at the site and the subsequent modeling results presented in the Groundwater IM/IRA and the Summary of Hydrologic Flow and Fate and Transport Modeling Conducted at RFETS, Golden, Colorado, dated September 2005, the RFCA Parties believe that all of the groundwater plumes at the site have been sufficiently evaluated. Furthermore, groundwater conditions at the site continue to be evaluated. As indicated, in response to Broomfield/Westminster

10mg/L in 2009 when the temporary standard expires. We ask that in your disposition to our comments you provide a plan and assurances that you will be able to meet the 10mg/L standard at the effluent of the Solar Ponds treatment unit and at the discharge point of the Discharge gallery for the Solar Pond Unit.	Comment 6.1, the groundwater treatment systems are functioning as designed, especially with the recent repairs to the Solar Pond Plume Treatment System which have increased its throughput and overall efficiency. DOE will continue to monitor groundwater and surface water with the goal of achieving the nitrate standard of 10 mg/L by 2009.

116. 6.4 GEI recommended a more robust sampling program to provide an additional layer to the monitoring program. This additional evaluation of data would also serve to provide additional protection to offsite receptors.	The RFCA Parties believe that the current sampling program is very robust and no additional sampling is needed for an additional layer to the monitoring program. This would not serve as additional protection to offsite receptors since all the impacted groundwater discharges to surface water up-gradient of the terminal ponds and does not leave the site above water quality standards.

117. 6.5 Walnut Creek should not be used as a treatment method to dilute nitrates or uranium and we expect to have the standard met prior to entry into Walnut Creek.	The Solar Ponds Plume Treatment System goal (and the associated monitoring identified in the IMP) is to meet the surface water standard upon entry of groundwater into Walnut Creek. It should be noted that the majority of the uranium in North Walnut Creek is from natural sources and not man-made sources.

118. 6.6 We argue that the objective of the treatment unit at the Solar Pond has been met. We question the length of time DOE took to evaluate the mechanical and operational aspects of the effectiveness of the unit. We thank DOE for taking action to determine the performance issue with the treatment unit. We also applaud DOE for performing a treatability study. Our concern is the study will be performed within the unit. We ask that the RFCA parties perform a bench-scale treatability test prior to using the treatment unit as a scientific experiment. With closure of the site, the unit is to be a final remedy, not an interim remedy.	The SPPTS has undergone substantial repair and maintenance in the summer and fall of 2006. These actions are expected to restore the system to its original operating condition, which has been shown to be effective in treating nitrate and uranium isotopes in shallow groundwater in the vicinity of the historic Solar Ponds. Continued maintenance of the system to ensure its long-term effectiveness is a requirement of the CAD/ROD.

119. 6.6.1 We ask to be informed on a weekly basis of the status of the unit based in the impact of the contaminants to Walnut Creek.	The CAD/ROD requires that water quality data be reported by DOE on a quarterly basis, and that these reports be made available to the public.

120. 6.6.2 We are concerned that the new proposed media may not work and there will be a need to expend additional resources to remove the overburden and remove the experimental media. This action would result in the generation of additional waste and additional risk to the workers.	The SPPTS has undergone substantial repair and maintenance in the summer and fall of 2006. These actions are expected to restore the system to its original operating condition, which has been shown to be effective in treating nitrate and uranium isotopes in shallow groundwater in the vicinity of the historic Solar Ponds. Continued maintenance of the system to ensure its long-term effectiveness is a requirement of the CAD/ROD.

121. 6.6.3 When the treatability study has been completed, we request a copy of the results for our review and evaluation.	Treatability study results will be contained in either the annual or quarterly DOE reports that are required by the CAD/ROD. These reports will be made available to the public.

122. 6.6.4 DOE has argued that the nitrate results in the discharge gallery are higher than the effluent from the treatment unit because sections of the groundwater plume were down-gradient from the sited treatment unit. After more than six years we have not seen a significant decrease in nitrates in the discharge gallery.	The CAD/ROD recognizes that, while groundwater accelerated actions performed under RFCA will ultimately lead to improvements in groundwater quality, contamination will remain in the UHSU in the Central OU for some period of time. The CAD/ROD also references the Groundwater IM/IRA, which found that there are no additional, practical steps that can be taken to improve groundwater quality at Rocky Flats. The CAD/ROD also notes that the areas of surface water affected by contaminated groundwater, such as in North Walnut Creek, are limited. The SPPTS has undergone substantial repair and maintenance in the summer and fall of 2006. These actions are expected to restore the system to its original operating condition, which has been shown to be effective in treating nitrate and uranium isotopes in shallow groundwater in the vicinity of the historic Solar Ponds. Continued maintenance of the system to ensure its long-term effectiveness is a requirement of the CAD/ROD.

123. 6.6.5 Revise the document to state once all the treatment units are meeting their remediation action objectives, DOE will propose to de-list the site.	EPA, not DOE, files the Notice of Intention to delete a site from the NPL. Deletion from the NPL is not an area that is appropriately addressed in the Proposed Plan, and will be considered later during site close-out activities.

124. 6.7.1 Remedial action objectives are clearly developed to provide the foundation of cleanup actions at a site for all impacted media such as groundwater, surface water, soil, and environmental protection. It is clearly understood if the objectives are not met, there are specific mechanisms such as institutional controls to ensure protection of human health and the environment. Of the seven remedial action objectives that were evaluated for the feasibility study, not one objective is completely met. Mechanisms have to be put in place to prevent use, prevent exposure, or statements are made such as: *At this time, no other additional actions can reasonably be taken* are used as reasoning as to why the RAOs were not met. The RAO for exposures that results in an unacceptable risk to the Wildlife refuge worker is identified in Soil RAO Objective 3 for the WBEU. The contaminant of concern is plutonium-239/240 in soils. We understand the risk is still within the acceptable range of $2x10^{-6}$. We are concerned there are no controls in place to prevent digging within this area. Controls need to be in place for the life of the contaminant as long as it poses a risk. Impacts to Woman Creek also have to be considered as soils enter the creek.	The preferred remedy (Alternative 2) meets all RAOs. The Central OU includes the historical 903 Pad and much of the wind blown area. While a small portion of the Peripheral OU may contain plutonium-239/240 above background in surface soil, the RFCA parties have agreed that this portion of the site is acceptable for all uses.

125. 6.7.2 We are not asking for additional removal, but we do believe there should be a control to prevent digging in this area. Erosion control measures also have to be implemented and adhered to protect surface water quality.	The Central OU includes the historical 903 Pad and much of the wind blown area. While a small portion of the Peripheral OU may contain plutonium-239/240 above background in surface soil, the RFCA parties have agreed that this portion of the site is acceptable for all uses.

126. 6.7.3 Alternative 2 and Alternative 3 add the implementation of institutional and physical control. The seven controls are identified, yet the Proposed Plan states the controls will be embodied in a post-RFCA enforceable document and an environmental covenant. What is missing are the details of how the controls will be implemented, what will be enforced, who will enforce the controls, public input into the development of the controls, and how corrective actions will be mandated. We have	The institutional and physical controls that are part of the final remedy, as documented in the CAD/ROD, were identified in the Proposed Plan. The public's opportunity to provide input into the development of the controls is by commenting on the Proposed Plan. The CAD/ROD requirements are implemented and enforced through the RFLMA.

concerns as the document states: *plans will be developed once evidence that violates the restrictions or damage of the controls are found.* There may not be time to draft a plan or have it reviewed. We are being asked to review a document and evaluate the proposal yet significant details are excluded from the document.	

127. 6.7.4 Revise the Plan to state an annual report to the regulatory agencies and communities will include language pertaining to the failure of controls. Notification of any failure of controls should be made to the regulatory agencies and impacted communities as soon as DOE becomes aware of the failure. Any corrective action should also be reported to the regulatory agencies and the impacted communities and identified in quarterly and annual reports.	The CAD/ROD and the RFLMA specify reporting requirements to the agencies. These reports will be shared with the communities.

128. 6.7.5 If the details of the controls are to be addressed in the post-RFCA document, we ask for a 60-day comment period for time to evaluate the details of the long-term stewardship plan and controls.	Implementation and enforcement of institutional and physical controls will be described in the RFLMA. The RFLMA will be available for a 30-day public comment period.

129. 7.1.1 The City and County of Broomfield and Westminster continue to have problems accessing information on the electronic administrative record. We are very concerned the site will be de-listed and we will not have access to vital information. This information per CERCLA, section 113 *requires that an administrative record be established "at or near the facility at issue." The record is to be complied contemporaneously and must be available to the public and include all information considered or relied on in selecting the remedy, including public comments on the proposed plan.* We understand new guidance calls for an electronic version of the administrative record. If the record is not accessible, it is not available. Provide a schedule of when DOE anticipates the record will be available and functioning electronically. We also ask for assurances to have public input as to what document should be in the record.	The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

130. 7.1.2 Most of the maps in the electronic version of the administrative record are in black and white. The maps and associated legends do not add any value to the record. Based on a $7 billion cleanup, it would have behooved DOE to enter the information into the system so that the community could access information that is of value and can be understood and evaluated.	The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR or that have yet to be entered electronically may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

131. 7.1.3 The City and County of Broomfield and the City of Westminster continually voice concerns about the availability of the record. We do not understand why the regulators do not enforce the regulation to meet the needs of the community.	The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR or that have yet to be entered electronically may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

132. 7.1.4 We were disappointed to have a regulatory representative state *the record has to be available electronically, but the regulation does not state it has to be operable.* This statement is in direct contrast to the requirement of the law.	The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR or that have yet to be entered electronically may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

133. 7.2.1 The Rocky Flats Reading Room located at the College Hill Library has served as a valuable tool to the community. We have been able to retrieve documents at the reading room that were not even available at the site.	The future of maintaining the reading room at the College Hill Library at the Front Range Community College will be determined during the upcoming 5-year CERCLA review of the Site.

134. 7.2.2 We ask the reading room be maintained until we have assurances the electronic version of the administrative record is fully functioning.	The future of maintaining the reading room at the College Hill Library at the Front Range Community College will be determined during the upcoming 5-year CERCLA review of the Site. The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is

	undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR or that have yet to be entered electronically may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

135. 7.2.3 Legacy Management has committed to work with us when it is decided to disposition the documents in the reading room. To date, we have not been involved with any decisions pertaining to the reading room.	The future of maintaining the reading room at the College Hill Library at the Front Range Community College will be determined during the upcoming 5-year CERCLA review of the Site.

136. 7.2.4 We understand the reading room was to be maintained until the end of the fiscal year. We now have heard unofficially the room will be maintained until next spring. Clarify the status of the reading room. We ask that the community be part of the decision process associated with the reading room and its records.	The future of maintaining the reading room at the College Hill Library at the Front Range Community College will be determined during the upcoming 5-year CERCLA review of the Site.

137. 8.1.1 Clarify the delisting process. How will the de-listing process differ from the certification process? We have asked for the criteria for certification, but still have not received the information.	EPA, not DOE, files the Notice of Intention to delete a site from the NPL. Deletion from the NPL is not an area that is appropriately addressed in the Proposed Plan, and will be considered later during site close-out activities.

138. 8.1.2 How will the Covenant's Bill be enforced if the state has no jurisdiction in the refuge outer perimeter associated with the monitoring system?	The Covenant with the state is not applicable to the refuge. The refuge act provides DOE the right to access to monitoring systems on refuge lands.

139. 8.1.3 The site should clearly have a time frame identified to determine when cleanup levels will be achieved for groundwater. It is assumed if the cleanup of the soils was adequate for radionuclides, we will have near term data to verify if the soil remediation was adequate.	The site will have 5-year reviews mandated by CERCLA. These 5-year reviews will look at data and determine whether remediation is working sufficiently. The outcome of 5-years reviews range from requiring additional or alternative remediation to canceling any follow-on 5-year reviews.

140. 8.1.4 Prior to delisting the site, we expect to see an identification of deficiencies and any corrective measures regarding	EPA, not DOE, files the Notice of Intention to delete a site from the NPL. Deletion from the NPL is not an area that is

work products if there were any identified. We specifically ask for a description of the deficiency for the Solar Pond Treatment Unit, the 991 area, and the cover at the Original Landfill. We ask the RFCA Parties prepare a plan as to how these issues will be resolved and a schedule of when actions will be taken to mitigate the issues prior to approval of the CAD/ROD.	appropriately addressed in the Proposed Plan, and will be considered later during site close-out activities.

141. 8.2.1 The document lacks the details of how the land transfer from DOE to the Service will occur.	The Proposed Plan is written to guidance under CERCLA, which does not call for outlining the transfer to the USFWS.

142. 8.2.2 The remedial action objectives were met if institutional controls were in place. There are several monitoring systems outside of the DOE lands that are within the Service boundary that will not comply with Applicable or relevant and appropriate requirement (ARARs).	The ARARs (surface water standards) are met in the Peripheral OU.

143. 8.2.3 Community acceptance criterion should be addressed in the CAD/ROD. Without having the opportunity to evaluate the language in the final CAD/ROD, we are interested in the evaluation process the RFCA parties will utilize when reviewing community acceptance based on comments received in writing and at the public meeting held on August 31.	Community acceptance criteria is addressed in the CAD/ROD. The process under CERCLA is for the Proposed Plan to be available for public review and comment. All comments received are addressed in this comment response document and attached to the CAD/ROD. The CAD/ROD will be available to the public upon approval by the regulators.

144. 8.2.4 We ask for a closeout meeting to discuss how the site will be maintained. We also want to discuss how the fences and warning signs will be properly installed and maintained.	Any meetings that occur as a part of the CERCLA public comment process must occur for the general public's benefit. CERCLA does not allow meetings during the process with individual organizations.

145. 8.3.1 We understand funding has been made available to purchase mineral rights. The plan is lacking the evaluation process to determine the dollar amount assigned to the natural resource damages.	An assessment of natural resources damages is not required as part of the Proposed Plan. The recently passed legislation providing funding for DOE to purchase mineral rights settles natural resources damages claims arising from hazardous substances releases identified in the Rocky Flats Administrative Record as of the date of the Act. As such, there is no need to evaluate natural

	resources damages at Rocky Flats and consequently, no evaluation will be prepared.

146. 8.3.2 Provide the City and County of Broomfield and the City of Westminster with a copy of the evaluation of the damages.	An assessment of natural resources damages is not required as part of the Proposed Plan. The recently passed legislation providing funding for DOE to purchase mineral rights settles natural resources damages claims arising from hazardous substances releases identified in the Rocky Flats Administrative Record as of the date of the Act. As such, there is no need to evaluate natural resources damages at Rocky Flats and consequently, no evaluation will be prepared.

147. 8.3.3 We also question the ability of the bill to waive future liabilities for DOE in the event there are further damages.	An assessment of natural resources damages is not required as part of the Proposed Plan. The recently passed legislation providing funding for DOE to purchase mineral rights settles natural resources damages claims arising from hazardous substances releases identified in the Rocky Flats Administrative Record as of the date of the Act. As such, there is no need to evaluate natural resources damages at Rocky Flats and consequently, no evaluation will be prepared.

148. 9.1 The City and County of Broomfield and the City of Westminster were the only public members that took the time to comment on the Rocky Flats Site Post-Closure Public Involvement Plan, dated October 2006. We were very disappointed to see our comments were not given any weight, nor were they even dispositioned to allow for a fruitful discussion.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council. Post-closure public involvement is addressed in the LM Post-closure Public Involvement Plan, which is dated

	Oct. 2005. As noted in the PCPIP, future updates to the plan will be made as needed, but no more frequent than annually.

149. 9.2 We once again ask the document be revised to incorporate the needs of the downstream municipalities.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council. Post-closure public involvement is addressed in the LM Post-closure Public Involvement Plan. As noted in the PCPIP, future updates to the plan will be made as needed, but no more frequent than annually.

150. 9.3 The Public Involvement Plan should be evaluated on an annual basis with the input from local governments. Based on a recent court decision in the *Moses Lake case,* the court recognized that it would need to dispute what the phrase "*participate in the planning and selection of the remedial action"* found in CERCLA truly means. We understand the decision recognizes the local government statutory right to participate in the cleanup decision-making process beyond the current public participation process currently implemented by DOE. Long-term stewardship is a key aspect of the cleanup process and we expect DOE to extend the policy to our governments, especially impacted governments. We are asking to be involved and kept apprised of the long-term stewardship controls applicable to the site.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council. Post-closure public involvement is addressed in the LM Post-closure Public Involvement Plan. As noted in the PCPIP, future updates to the plan will be made as needed, but no more frequent than annually.

151. 9.4 Please refer to our several letters regarding long-term stewardship and our role as downstream communities.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council. Post-closure public involvement is addressed in the LM Post-closure Public Involvement Plan. As noted in the PCPIP, future updates to the plan will be made as needed, but no more frequent than annually.

152. 9.5 We anticipate the post-closure document will be released for review these upcoming months for our evaluation and input.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

153. 10.1 We ask to be kept apprised of the drafting of the post-RFCA.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and

	comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

154. 10.2 We ask the language pertaining to downstream communities and their role with water management be included in the post-closure document.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

155. 10.3 The post-RFCA should, as a minimum, include the details of the enforceability of the surface water standards, a continuation of the Water Working Group, Attachment 1 list of analytes, ICs, notifications, public participation plan, and other key factors related to long-term stewardship.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

156. 10.4 We ask to be kept apprised of the upcoming 5-year review. We ask to have sufficient time to review and evaluate the	An appendix to the RFLMA will describe the public involvement roles and processes. The RFLMA will be made available for

information related to the review.	public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

157. 10.5 We ask to accompany the team during the physical tour of the remedy for the 5-year review.	An appendix to the RFLMA will describe the public involvement roles and processes. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

Letter from City of Northglenn, dated September 13, 2006

1. It is difficult to evaluate the Proposed Plan and the preferred alternative without knowing the details of the technical and regulatory aspects of the post-RFCA. We do not understand the need for concealment, nor do we understand the change in policy to keep downstream communities from participating in language that protects our communities and preserves our assets in a fiscally and environmental manner. We reserve the right to readdress our comments and concerns identified in this letter once we have an opportunity to evaluate the language in the post-RFCA. It is relevant that the post-RFCA document be released to the public for comment with a minimum of 60 days for review. Past practice for formal review of the RFCA document should justify a formal review of the final post-RFCA or any other post-closure document.	Approval of the CAD/ROD will select the alternative and establish the requirements to implement that alternative. More detailed information describing how DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the RFLMA. The RFLMA will be made available for 30 days for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

2. With remaining residual contamination on-site, Northglenn wants sufficient reassurance that the site will remain in a safe configuration to protect human health and the environment for the life of the contaminants. Given the lack of detail on several key, post-closure management issues, Northglenn is hesitant to fully endorse the Proposed Plan without additional commitments to ensure the downstream communities will not be affected.	The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD to ensure the protection of human health and the environment. The RFLMA will be released for public review and comment.

3. Revise the Proposed Plan to include language that local	DOE appreciates the long history of public involvement at Rocky

municipalities impacted by surface water from the RFETS shall be part of the technical process to evaluate and develop monitoring specifications for the post-closure monitoring and maintenance plan and develop consensus recommendation to the decision-makers post-closure. For years, downstream communities have had an integral role with the development of monitoring criteria during technical group discussions to implement changes to the monitoring plans at the site. Their role was clearly delineated in the RFCA and detailed in the *Integrated Water Management Plan for the Rocky Flats Environmental Technology Site*, dated August 1996. The Water Working Group's purpose as stated in the RFCA, Appendix 5, is *to develop consensus recommendations to the decision-makers regarding decisions and actions related to water quality at, or downstream of RFETS.* These discussions identified the needs and changes in monitoring scope as dictated by changes in the Rocky Flats Environment Technology Site operations and infrastructure. In addition the working group was tasked to work towards a long-term stewardship monitoring system that would continuously evaluate and support data quality objectives.	Flats. Implementing agreed-upon post-closure monitoring and maintenance will be addressed in the RFLMA, which will be subject to public review and comment.

4. Revise the Long-Term Surveillance and Maintenance Plan (LTSMP) document to state the LTSMP will be reviewed annually with the current partnership between DOE, EPA, CDPHE, and downstream municipal water users. The Proposed Plan refers to the Long-term Surveillance and Maintenance Plan (LTSMP) as the document that identifies the long-term stewardship criteria. The LTSMP clearly excludes the continuation of the current process to discuss technical issues associated with the monitoring and surveillance systems at the site. Northglenn was disappointed when Legacy Management decided to not adhere to the Public Participation Plan that identified the Interim Long-term Surveillance and Maintenance Plan as a public document to be released for our review and evaluation. To this date we have not received justification from	An LTS&MP has not been issued and is not part of the Proposed Plan. Specifics of post-closure long-term surveillance and maintenance activities will be addressed in the RFLMA. The final IS&MP, an internal working document, was released to the public in December, 2005 and is available on the Legacy Management website at http://www.lm.doe.gov/land/sites/co/rocky_flats/rocky.htm .

Legacy Management as to why they deviated from their document and the RFCA to include participation of the Water Working Group *to maintain and guide a long-term partnership between local governments, DOE, EPA, and CDPHE.*	

5. Revise the Proposed Plan to specify quarterly data exchange meetings will be held with DOE, CDPHE, downstream municipalities, and EPA, to review data, evaluate trending, analyze sampling needs, and/or discuss corrective actions. We understand there may not be surface water discharges from the terminal ponds for several years, but quarterly monitoring will continue at the site and it will need to be reviewed and discussed. Legacy Management is reminded of their August 11, 2004 commitment made to downstream municipalities to continue the quarterly data exchange meetings with our communities for a minimum of 2 years. On September 11, 2006, at the Rocky Flats Stewardship Council meeting, Mike Owen committed to open communication with local governments. This commitment is a confirmation by Legacy Management to continue the much needed quarterly data exchange meetings with downstream communities to continue to evaluate an integral monitoring plan. The current communication process with downstream communities, is not intended to replace the public process with the Rocky Flats Stewardship Council (RFSC) but instead be in addition to the public involvement plan identified by Legacy Management.	The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public.

6. Northglenn asks that the document be revised to incorporate the previous notification and communication process as identified in Broomfield's letter to Audrey Berry, dated September 16, 2005.	DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public**.**

7. Revise the LTMSP and IMP to state: In the event stationary plumes begin to migrate, a risk evaluation will be performed for the contaminant or contaminants of concern. The document is lacking the means to evaluate stationary groundwater plumes and their potential risk long into the future in the event they migrate or create a new pathway. The RI/FS and the Proposed Plan do not consider the need to continue monitoring stationary plumes post-closure in the event hydrological conditions change. The RI/FS states these plumes *do not require further studies to evaluate risk to human health and the environment* and Northglenn agrees with this statement based on current data.	An LTS&MP has not been issued and is not part of the Proposed Plan. The RI/FS evaluated all groundwater constituents to determine analytes of interest (AOIs). The AOIs that formed contiguous, mapable plumes were further evaluated to determine their potential to impact surface water. The potential impacts of groundwater discharge to surface water were evaluated at the Area of Concern (AOC) and Sentinel wells which were selected by the Water Working Group regardless of whether the groundwater plumes are retreating, migrating or stationary (i.e., at steady state). The evaluation results indicated that AOIs in five groundwater areas have the potential to impact surface water based on results at the AOC and Sentinel wells and/or contaminant transport model predictions. There is a process identified to evaluate steady-state groundwater plumes in the Fiscal Year 2005 Integrated Monitoring Plan, Revision 1, dated September 2005 (IMP), which identifies AOC, Sentinel, and Evaluation wells. These wells are located so that they will detect potential changes in the groundwater plume configurations at the site whether they are currently considered to be in steady state or migrating downgradient. If groundwater monitoring results show statistically increasing trends at the AOC, Sentinel, or Evaluation, the IMP requires more frequent monitoring and evaluations for action, if deemed necessary. Since the water quality standards used for evaluation are deemed to be protective of human health and the environment and statistically significant impacts to water quality will be evaluated per the IMP, it is not necessary to revise the document to include a risk evaluation. Post-closure monitoring, identified in the IMP, will be implemented through the RFLMA, which will be offered for public review and comment.

8 Revise the document to reflect language in the RFCA Attachment 5,C,2 that reads: *Groundwater plumes that can be shown to be stationary and do not therefore present a risk to surface water, regardless of their contaminant levels, will not*	The IMP identifies sufficient monitoring for all groundwater plumes (whether they are in steady-state or migrating) and contains a systematic process for evaluations and potential actions if statistically increasing contaminant trends are observed. Where

require remediation or management. They will require monitoring to demonstrate that they remain stationary. Based on the changes to the topography and potential hydrology at the site, there needs to be sufficient monitoring to determine if the groundwater plumes remain stationary and do not pose a risk. The RI/FS does not address future evaluations for all identified groundwater plumes. The process outlined within the RI/FS does not evaluate impacts to the creeks holistically.	possible, the future impact of groundwater plumes on surface water were evaluated in the RI/FS using contaminant fate and transport modeling. Modeling was performed for the significant volatile organic compound plumes to predict their future impact on surface water quality. Contaminant fate and transport modeling was not conducted for the metal AOIs because the metal plumes are limited in areal extent and do not currently pose a threat to surface water. Uranium was also not modeled because the primary uranium plume at the site, which occurs in the area of the Solar Evaporation Ponds, is already entering North Walnut Creek and the water quality impacts are well known. A groundwater interception and treatment system is already installed in this area. Post-closure surveillance and maintenance activities will be addressed in the RFLMA, which will be subject to public review and comment.

9. Revise the document to state all exceedances of groundwater action levels shall be reported to downstream communities once DOE becomes aware of the data. In addition, the data shall be reported quarterly and summarized annually to all parties, including downstream municipalities.	The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public.

10. Revise the document to add "downstream communities" to the notification and communication process identified in the Plan.	DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public.

11. Revise the document to include the process on implementation of institutional controls. Define how institutional controls will be implemented, how they will be evaluated, how	The CAD/ROD states that institutional controls will be maintained until the concentrations of hazardous substances in soil and groundwater are at levels so as to allow for unrestricted

often they will be evaluated, and by whom.	use and unlimited exposure, and/or until such time as engineered components of the remedy are no longer needed. DOE will be responsible for maintaining institutional controls. DOE will inspect the site relative to institutional controls no less than annually, and the CAD/ROD contains specific timeframes for addressing and reporting activities that are inconsistent with the objectives of the institutional controls. Institutional controls will be addressed in the regular reporting that will be made available to the public and will be evaluated in CERCLA periodic reviews. Conditions in the Peripheral OU are such that they allow for unrestricted use and unlimited exposure. Therefore, no institutional controls are needed for the Peripheral OU.

12. Incorporate language and codify it to ensure municipalities are included with any decision made at the Rocky Flats site that may impact surface water quality. Impacted municipalities should be part of the decision making process to reevaluate any proposed changes.	All rulemakings held by the Colorado Water Quality Control Commission related to use classifications, standards, or temporary modifications in Big Dry Creek have included and in the future are expected to include downstream communities. The rulemaking process allows for participation in the rulemaking as parties or as non-parties, and for the submission of written or oral testimony.

13. State in the document that any revisions or justifications to change the standard/action levels for groundwater shall be based on the surface water use classifications and not jeopardize surface water quality. Per RFCA, the temporary modifications were developed *together with other stakeholders (i.e., the local municipalities that are impacted by surface water from the RFETS).* This collaboration should continue post-closure.	All rulemakings held by the Colorado Water Quality Control Commission related to use classifications, standards, or temporary modifications in Big Dry Creek have included and in the future are expected to include downstream communities. The rulemaking process allows for participation in the rulemaking as parties or as non-parties, and for the submission of written or oral testimony.

14. Revise the Long-term Monitoring and Surveillance Plan and Integrated Monitoring Plan to clarify the process to site a groundwater well in the refuge in the event a well is needed to evaluate the potential migration of a groundwater plume.	The Peripheral OU will be transferred from DOE to USFWS, and will become the Rocky Flats National Wildlife Refuge. The RI found that conditions in the Peripheral OU, including groundwater quality, were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary

	for the Peripheral OU. Plans for use of groundwater by USFWS in the Refuge are beyond the scope of this CAD/ROD; however, information on Refuge management may be found in the CCP for the Rocky Flats National Wildlife Refuge prepared by USFWS. The Refuge Act allows siting monitoring wells in the refuge and provides for DOE's access. DOE will be required to maintain and protect any wells to ensure that they continue to function as designed. Requirements for monitoring wells will be included in the RFLMA.

15. Revise the Proposed Plan to include an overlaid map of the DOE retained lands and the refuge area maps to reflect the location of the monitoring stations in relation to the boundary. Also revise the maps identifying surface and groundwater monitoring locations.	Figure 10.1 of the RI/FS shows the relationship of the Central Operable Unit (OU) boundary relative to the IMP groundwater monitoring wells (AOC and sentinel wells) and surface water monitoring locations (Point of Compliance [POC], Point of Evaluation [POE], and Point of Measurement [POM]). All of the AOC, Sentinel, and Evaluation wells are located in the Central OU. The POCs located downgradient of terminal ponds (GS11, GS08, and GS31) are located adjacent to the eastern (downstream) edge of the Central OU. The background surface water monitoring station (GS05), the POCs at Indiana Street (GS01 and GS03), and the boundary wells (41691 and 10394) are located in the Peripheral OU.

16. Revise the Proposed Plan to state ICs will apply to the boundary wells. Revise maps and figures to include a delineation of the groundwater boundary wells. The Plan should also include a statement that the land/area the wells are located in will be retained by DOE. Northglenn is concerned the Proposed Plan does not address any institutional controls to prevent siting groundwater wells in the refuge to be used for irrigation or for other uses. The Proposed Plan states: *the construction or operation of groundwater wells is prohibited; except for remedy related purposes.*	Boundary wells are not required by the CAD/ROD. Although boundary wells are not located within the DOE-retained lands, the Refuge Act provides for DOE's access to them, and DOE will be required to maintain and protect these wells to ensure that they continue to function as designed. Requirements for monitoring at the boundary wells will be included in the RFLMA.

17. Revise the document to clarify how groundwater wells will be secured and identified. We expect to have a fence around the perimeter of the groundwater wells that are located outside of the DOE-retained lands. These wells have to be clearly marked and labeled to prevent public access and intrusion.	AOC, sentinel, and evaluation wells are located within the Central OU and are within the boundaries of the DOE-retained lands. Monitoring wells that are outside the DOE-retained lands will be protected and maintained, which will be described in more detail in the RFLMA.

18. The fence for the boundary wells should be identified as a legal control to protect the monitoring system for the remedy. Layering is of utmost importance in the event one control fails. The need to protect these wells is founded on the importance to gather groundwater data to evaluate the remedy.	AOC, sentinel, and evaluation wells are located within the Central OU and are within the boundaries of the DOE-retained lands. Monitoring wells that are outside the DOE-retained lands will be protected and maintained, which will be described in more detail in the RFLMA.

19. Revise the document to state all groundwater monitoring data and any changes in hydrologic conditions will be reported quarterly and summarized annually to all parties and impacted municipalities. Any exceedances of groundwater action levels will be reported to all parties and impacted municipalities concurrently. The document refers to the Long-term Surveillance and Monitoring Plan. Once changes or physical conditions exist that could impact surface water quality, downstream municipalities should be notified via telephone or fax.	An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring data. Reports provided pursuant to the CAD/ROD will be made available to the public. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication.

20. Revise the Proposed Plan to state that any temporary modifications will revert to the stream standards once the final remedy has been completed. Temporary modifications were developed together with local municipalities that are impacted by surface water from the RFETS. RFCA states: *following completion of active remediation, the surface water must be of sufficient quality to support any surface water use classification in both Segments 4a/4b and 5.* Stream standards must be met at the point of discharge, once the temporary standards expire in 2009.	The remedy for groundwater is not complete. It will be complete when all three of the Groundwater RAOs and the Surface Water RAO are met. The remedy – in the form of groundwater treatment systems and continued monitoring – has been put in place. DOE will continue to monitor groundwater and surface water with the goal of achieving the underlying surface water standards when the temporary modifications expire in 2009. More information on the temporary modifications and completion of the remedy at Rocky Flats may be found in the docket of the 2004 Water Quality Control Commission's Rulemaking on Regulation No. 38, to which the Cities of Broomfield and Westminster were parties.

21. Revise the document to state how the institutional controls	DOE will be required to maintain and protect these locations to

will apply to the surface water monitoring stations inside and outside of the DOE retained lands.	ensure that they continue to function as designed, regardless of their location relative to the Central OU. Per the Refuge Act, DOE may access any areas, whether in the Central OU or Peripheral OU, that are required for monitoring or remedy purposes.

22. Define how the institutional controls will be implemented for the use of surface water, how they will be evaluated, how often they will be evaluated, and by whom. Any information associated with institutional controls should also be relayed to the public and downstream communities. The application of ICs at the Indiana Street POCs are of particular concern to downstream communities.	Signage, federal ownership, and an environmental covenant issued to the State of Colorado are the specific physical and institutional controls to be used to ensure the protection of surface water from unauthorized uses. Implementation of the physical and institutional controls will be inspected periodically by DOE, corrected or repaired if required, and reported in an annual report. These control, inspection, and reporting actions are listed in the Proposed Plan for Alternative 2, the Preferred Alternative. Approval of the CAD/ROD will establish these proposed actions as binding regulatory requirements for DOE. More detailed information describing how DOE will meet the requirements of the CAD/ROD will be written in the RFLMA. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

23. Revise the document to identify how the institutional controls will be enforced and the schedule to implement corrective actions in the event a control fails.	The suggested revisions are inappropriate for the Proposed Plan, which develops broad alternatives for remedial action. Approval of the CAD/ROD will select the alternative and establish the requirements to implement that alternative. More detailed information describing how DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the RFLMA. The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

24. Revise the document to state the surface water monitoring stations outside of the DOE-retained land will be managed	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any

consistently with the surface water monitoring stations within the DOE-retained lands.	kind are necessary for the Peripheral OU. Future incidental use of surface water in the refuge area as you described similarly poses no threat and no controls are required. The CAD/ROD requires that DOE monitor surface water at POCs at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. The CAD/ROD requires DOE to maintain and protect these locations to ensure that they continue to function as designed, regardless of their location relative to the Central OU.
25. Revise the document to state a legally mandated fence will be constructed around the perimeter of the surface water monitoring stations outside of the DOE-retained lands. These surface water monitoring stations should be clearly marked and labeled to prevent public access and intrusion.	The CAD/ROD requires that DOE monitor surface water at POCs at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed, regardless of their location relative to the Central OU.
26. The fence for the surface water monitoring stations outside of the DOE-retained lands and the fence around the DOE retained lands should be identified as a legal control in the Proposed Plan to protect the monitoring system for the remedy. Layering is of utmost importance in the event one control fails. The need to protect these surface water monitoring stations is founded on the importance to gather surface water data to evaluate the remedy and protect surface water quality downstream of Rocky Flats.	DOE will be required to maintain and protect surface water monitoring locations outside of the DOE-retained lands to ensure that they continue to function as designed, regardless of their location relative to the Central OU. The concept of layered controls is embodied within the selected remedy for the Central OU, however not in the form of layered fences. The layered controls include a signs as a required physical control, ongoing ownership by DOE to prevent digging, water usage, and other prohibited activities, routine presence and observation by DOE and contractor staff, and an environmental covenant with the State of Colorado restricting use of the Central OU in perpetuity
27. Revise the document to state all surface water monitoring data will be reported quarterly and summarized annually to all parties and impacted municipalities. The document refers to the Long-term Surveillance and Monitoring Plan. Any changes in concentrations or exceedances of surface water action levels and/or	An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD requires that DOE prepare an annual report discussing remedy performance and site conditions; this annual report will include environmental monitoring data. DOE will also prepare quarterly reports that include environmental monitoring

standards should be relayed concurrently to impacted municipalities and the regulators. Once changes or physical conditions exist that could impact surface water quality DOE should notify downstream communities concurrently with the regulators.	data. Reports provided pursuant to the CAD/ROD will be made available to the public.

28. Revise the LTSM Plan to state as a minimum the terminal ponds on Walnut Creek will be sampled annually for analytes identified in Attachment 5 of RFCA. The Long-term Surveillance and Monitoring Plan (LTSM Plan) is referred to in the Proposed Plan as the document that identifies the monitoring and surveillance post closure. As written in the LTS&M Plan, surface water quality in the terminal ponds will be measured only when there is a pond discharge. To effectively evaluate the remedy, the water quality in the terminal ponds or an identified location at the site should be performed annually as a minimum. Woman Creek is unique in that not all the runoff of surface water is capture in C-2, therefore language should be added to the Plan for Legacy Management to work with Westminster and the Woman Creek Reservoir Authority to identify a location that accurately reflects the effectiveness of the remedy on the south side of the site.	An LTS&MP has not been issued and is not part of the Proposed Plan. The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD. Regarding the commenter's request for a new monitoring location on Woman Creek, the RFCA parties worked with the communities in establishing the current monitoring locations. A primary purpose of the agreed upon monitoring network was to assure adequate information would be collected for remedy evaluation. No new location will be sited at this time. The entire monitoring system is subject to ongoing review so that locations and analytes can be dropped or added as conditions warrant.

29. Revise the Proposed Plan to include the following language: The Surface Water and Groundwater Working Group will be tasked to develop an Integrated Water Management Plan to develop a consensus recommendation to the decision-makers regarding decisions and actions related to water quality at, or downstream of RFETS. The group will identify necessary actions necessary to protect water quality and the watershed and recommend programmatic activities to effectively manage water resources. The group will provide a comprehensive management tool to identify the actions to take regarding pond management. This tool will maintain and guide a long-term partnership between local governments, DOE, EPA, and CDPHE. The goal of the group will be to provide a comprehensive management tool to implement	The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD. Therefore, a Surface Water and Groundwater Working Group and an Integrated Water Management Plan are not required.

DOE's long-term commitment for protecting water and related ecological resources. It is imperative to include this language within the body of the Proposed Plan and the CAD/ROD to ensure a comprehensive water management plan is developed based on diminished flows, protection of ecological resources, and application of institutional controls necessary to protect water for all uses.	

30. Include language stating that the City of Westminster and/or the Woman Creek Authority reserves the right to sample surface water quality on an annual basis to determine surface water quality within the C-2 terminal pond or specified location on Woman Creek.	The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD.

31. Include language that the City & County of Broomfield will sample surface water quality during a discharge into Walnut Creek and they reserve the right to sample surface water quality on an annual basis to determine surface water quality within the terminal ponds on Walnut Creek. If the regulators do not have enforceability responsibilities in the refuge area to ensure surface water quality, the City & County of Broomfield, City of Westminster, City of Northglenn, and the Woman Creek Reservoir Authority may seek to have the POCs, groundwater wells, and drainage measuring stations placed at the Central OU boundary.	The CAD/ROD states that the surface water monitoring requirements outlined and those that will be contained in RFLMA are adequate to ensure the protectiveness of the remedy and that water leaving Rocky Flats continues to meet water quality standards. Consequently, sampling of the terminal ponds is not a requirement of the CAD/ROD.

32. Revise the language in the Proposed Plan to ensure the IMP/Water Working Group process continues post-closure. To assess the direction and magnitude of contaminant movement and groundwater migration, it is essential to evaluate data as generated to compare it against predetermined outcomes and identify whether reported concentrations are routine or indicative of worsening conditions. The Integrated Monitoring Plan (IMP) served to: • Develop data quality objectives with a goal to ensure compliance for surface water,	The CAD/ROD contains monitoring and maintenance requirements that will be implemented by the RFLMA and includes the majority of attributes from the closure monitoring system as recommended by the IMP Water Working Group and contained in the 2005 and 2006 IMP. The monitoring data will continue to be provided to the public, cities and the LSO via the LM quarterly and annual reports. In addition, LM will present these data to the LSO, its constituents and the public for review, evaluation, discussion and comment. DOE does not anticipate any changes to the monitoring system in	

• Develop objectives and monitored pond discharges, • Develop objectives and monitored discharges for the terminal detention pond discharges, • Develop objectives and monitored off-site discharges for community water supply management, • Develop objectives and monitored groundwater interactions, • Develop objectives and monitored special project activities such as D&D of buildings including close-in air monitoring and placement of groundwater wells to track migration or impacts of groundwater plumes near the buildings, • Develop objectives and monitored discharges from treatment units, • Develop objectives and monitored the Present Landfill and Original Landfill, • Develop objectives and monitored air, • Develop ecological objectives and monitored flora and fauna, and • Review National Permit Discharge Elimination System (NPDES) proposed revisions. To minimize the need for several meetings post closure, we recommended the Water Working Group and the Quarterly Data Exchange meetings be combined. During these meetings the monitoring plans could also be evaluated annually.	the near future.	

33. Revise the document to include language that fencing as an enforceable control and will be used to secure the POCs. The document does not state how and if institutional controls will apply at the point-of-compliance monitoring stations, boundary groundwater wells, or other monitoring stations outside of the proposed boundary. The document is silent on physical controls and Institutional Controls for the Points-of-Compliance (POCs). We understand the language in the post-closure document will have boundary signs mandated as a legal control. We do not understand the issue the RFCA Parties have with mandating the fence as a	The CAD/ROD requires that DOE monitor surface water at POCs at the discharge points from the three terminal ponds (A-4, B-5 and C-2), as well as at the points where Walnut Creek and Woman Creek cross the site boundary near Indiana Street. DOE will be required to maintain and protect these locations to ensure that they continue to function as designed, regardless of their location relative to the Central OU.	

legal control. It is ironic that the only two enforceable surface water monitoring stations will not be secured and protected from the general public. In the event the POCs have to be relocated, the RFCA Parties will work with the impacted communities during the relocation process.	

34. Revise the boundary map to include stamped areas retained by DOE for the Points-of-Compliance, stamped areas retained by DOE for the groundwater wells at the site boundary, and stamped areas retained by DOE for surface water stations located outside of the DOE retained lands.	DOE is developing a map or maps to address your comment.

35. It is Northglenn's position that all monitoring stations and wells be maintained, operated, and funded by DOE. We believe remedy evaluation and remedy protection have far greater justification to determine a boundary than the land management practicalities that were provided as justification for the proposed boundary.	Approval of the CAD/ROD will select the alternative and establish the requirements to implement that alternative. More detailed information describing how DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the Rocky Flats Legacy Management Agreement (RFLMA). The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA. DOE will be required to maintain and protect any monitoring or remedy locations to ensure that they continue to function as designed, regardless of their location relative to the Central OU.

36. Revise Plan maps to expand the DOE retained lands to include GS-05 and GS-09. Revise the Proposed Plan to address the process to potentially locate future monitoring systems outside of the DOE retained lands. There is no justification to exclude GS-05 and GS-09 water stations from DOE retained lands. They are not located in steep areas, nor are they in riparian areas. These monitoring stations, located outside of the DOE-retained lands, provide crucial data. This data allows a proactive approach to identify a potential issue close to the source rather than a reactive approach that could impact water quality in the creeks or ponds.	There is no justification to expand the area of DOE retained lands for purpose of access. Per the Refuge Act DOE may access any areas, whether in the Central OU or Peripheral OU, that are required for monitoring or remedy purposes. However, consultation with USFWS following direct field investigation indicated several concerns about encroachment on habitat and maintenance of the CAD/ROD physical controls. Based on these concerns, the boundary was expanded outward in a few areas, most notably south of the Original Landfill (see Figure 3). Land-use issues affecting Rocky Flats National Wildlife Refuge Lands are addressed in the

	U.S. Fish & Wildlife Service's Environmental Impact Statement. DOE will be required to maintain and protect any monitoring locations in the wildlife refuge to ensure that they continue to function as designed. Specific monitoring requirements will be addressed in the RFLMA, which will be made available for public comment.

37. Allow the downstream communities consultant or technical staff to assist with a final determination of the southern boundary. Based on proposed activities identified in the Comprehensive Conservation Plan (CCP) drafted by the Fish and Wildlife Service, the southern portion of the refuge will have much more activities than the north side. Activities such as hunting, horseback riding, and other off-trail activities could jeopardize the integrity of the monitoring stations near the Original Landfill. Our concern is the potential of public damage to the remedies and the monitoring stations that evaluate the remedy.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. DOE will be required to maintain and protect monitoring equipment to ensure that they continue to function as designed.

38. Revise the document to state the fence around the Central OU will be an enforceable control associated with the remedy and placed around DOE-retained lands and monitoring systems outside of the DOE retained lands. Include the 903 Americium area within DOE retained lands. Revise associated maps. To state: *These levels of radioactivity are also far below the 231 pCi/g activity level for an adult rural resident that equates to the 25 mrem/year dose criterion specified in the Colorado Standard for Protection Against Radiation* may be simplifying the risk based on dose. The issue with this area is to prevent digging, to prevent dust dispersion and to control erosion to protect surface water quality. As this area is not within the Central OU, no IC's will be associated with this area. It would be irresponsible to allow digging or installation of groundwater wells for irrigation or other domestic use in this area. Activities in this area should not be allowed, especially horseback riding, trails, or any activity that could generate additional dust or increase the potential for erosion.	A fence surrounding the Central OU is not required to protect human health or the environment, nor is it required to ensure effectiveness of the remedy. However, DOE and USFWS have agreed that a four-strand barbed wire cattle fence would facilitate land management and therefore the fence will be installed and maintained as a best management practice. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. These signs will be required along the perimeter of the Central OU at an interval consistent with DOE standards for land management and CHWA requirements. DOE intends to install these signs on the fence surrounding the Central OU.

Based on the Independent Verification and Validation review by ORISE in the 903 Pad and Inner Lip Area, there were additional hot spots that were identified in the 903 Pad and Inner Lip area. We therefore question the potential for hot spots in the Americium Area. Revise the map to include the Americium Area in the DOE retained lands. We are also concerned that if grazing were allowed in the Americium Area, erosion would increase. This could potentially impact water quality in Woman Creek. The runoff in this area would not be captured in C-2 and could potentially leave the site without being monitored.	

39. Revise the Proposed Plan to include language to allow for adding to the monitoring system outside of DOE retained lands if warranted by an evaluation of the RFCA Parties and the Water Working Group. It is premature to assume there is sufficient data to evaluate the remedy for the Original Landfill. Northglenn questions the integrity of the cover on the landfill and the ability to keep the buried waste segregated from groundwater infiltration and infiltration from precipitation. Our concern is with the current seeps on the cover that now have a higher potential to release contaminants directly into Woman Creek that previously were not mobile or at the surface to flow directly into Woman Creek. Per the document, the cover is effective and protective based on the identified pathways that were evaluated. With the current seeps we now have a pathway that was not evaluated. We question the integrity of the cover and the numerous seeps that have developed since the placement of the cover. Westminster, the City and County of Broomfield, and their Professional Consultants voiced concerns with the placement of a shallow cover to prevent groundwater passing through the waste and surfacing at the cover. There was nothing in the landfill closure document to prevent the groundwater from passing through the waste and into Woman Creek. The remedy has exacerbated the situation by causing the groundwater to seep to the top of the cover and potentially have a new pathway that was not evaluated. Northglenn is concerned with the Original	Locations of groundwater monitoring wells at the Original Landfill were chosen with the approval of CDPHE and EPA. Pursuant to RCRA/RFCA, one well is up-gradient and three wells are down-gradient of the OLF. If there is an increasing trend in down-gradient versus up-gradient monitoring wells, or if a selected percentage of the data exceed surface water standards, the RFCA parties must consult with each other. Surface water monitoring at the OLF proceeds in a similar manner. The Refuge Act permits DOE access to the refuge area to conduct operation and maintenance, and any other obligations it may have under RFCA or the Legacy Management Agreement. The Memorandum of Agreement between DOE and the Department of Interior will likely address details related to DOE's access to the refuge lands. The Legacy Management Agreement will incorporate the requirements for monitoring at the Original Landfill that are found in the OLF Monitoring and Maintenance Plan.

Landfill IM/IRA statement: monitoring of the Original Landfill will consist of quarterly monitoring until the first CERCLA review. We understand the next 5-year review will be in spring of 2007 and with the current status of the integrity of the cover, DOE would not show due diligence if they did not continue to monitor quarterly until the next review in 2012. At this later time, there would be sufficient data to evaluate the remedy and assess effects from hydrologic changes in this area. Northglenn supports the City of Westminster's right to ask for periodic sampling of the South Interceptor Ditch if warranted. Northglenn agrees with the list of analytes to be evaluated at the Original Landfill identified in Attachment 5, table 1. Northglenn questions the success of the restoration effort on the cover as areas still do not have established growth. We are concerned that without a successful restoration effort; Woman Creek will be vulnerable to mass loading of sediment.	

40. Revise the document to provide justification for allowing a release of surface water without demonstrating compliance. The effluent from the treatment facility is not meeting stream standards for boron and manganese. The RFCA standard for boron is 750 µg/L and the result was 1,930 µg/L. Manganese standard was 1,858 µg/L and the result was 5,650 µg/L. Northglenn is concerned that water is allowed to discharge from the Present Landfill Pond into No Name Gulch knowing the effluent exceeds surface water standards. Northglenn is concerned with the language in the Present Landfill IM/IRA that states the pond will be sampled based on a "decision rule". We have no role in the decision, yet the City and County of Broomfield may be directly impacted. Northglenn supports all actions that are protective of the City and County of Broomfield's water supply. Northglenn does not agree with measuring compliance with the Present Landfill at the POC at Indiana. The POC for the Present Landfill should be at the outfall of the treatment unit before it is released to waters of the State. This is	Per the CAD/ROD, the requirements for monitoring and maintenance at the Present Landfill were derived from the approved Monitoring and Maintenance Plan for the Present Landfill, which addresses water quality issues in the Present Landfill Pond. These requirements are part of the selected remedy, and will be incorporated into RFLMA.

consistent with CDPHE policy and regulations	

41. The constituents causing discoloration and foam observed at the August 21, 2006 field trip need to be identified.	The orange discoloration observed in water at the Present Landfill treatment system is typical of water containing dissolved iron when it is exposed to oxygen in the air.

42. Northglenn recommends DOE have a geotechnical engineer inspect the areas and suggest actions that could stabilize the slope. There is severe subsidence and cracking in the 991 area. We are concerned that the floor of FC-4 is experiencing uplift. This area has a high potential to have both radioactive and VOC contamination that was not adequately characterized. Based on the risk analysis of the contamination, there was no pathway for the radioactive contamination. The area has massive cracks and now may have a pathway that was not analyzed in the risk analysis. We strongly disagree with DOE and the regulators that this <u>is not a CERCLA issue</u> as there is no longer functioning groundwater monitoring stations in this area. Any groundwater or surface water from this area flows directly into South Walnut Creek. GS-10 is directly down-gradient of this area. Elevated concentrations continue to be measured at this station. To state: *To state: <u>Well 45605 will continue to be monitored in accordance with the IMP for as long as that is feasible,</u>* in itself speaks of the need to monitor this area because of residual contamination.	The area of slope instability mentioned (in the vicinity of old SW056) is undergoing detailed and ongoing surveillance. At this time, there is no adverse impact on the surface water quality by VOCs or radionuclides as a result of the instability. VOCs are known to be present in the ground water in the vicinity of the slump while uranium (mostly naturally occurring) is known be present in the ground water site-wide. Ongoing surface water monitoring will occur to determine if there are any adverse effects from the unstable area. Regarding the deformation of functional channel FC-4 resulting from the slope instability, ongoing observation will continue and if the functionality of the channel is compromised, repairs will be made. As the commenter points out, the surface water POE GS-10 is directly down-gradient of the area of slope instability and any erosion related sedimentation. Any adverse water quality impacts that could occur will be observed. To date, there have been none. The relevant question is not whether there is a stability problem or how to fix it; it is whether the remedy is adversely impacted by site conditions. As there is no adverse impact to the remedy at this time and there is no reason to believe there will be, the parties will continue to observe and monitor.

43. Revise the document to state: once all the treatment units are meeting their remediation action objectives, DOE will propose to de-list the site.	EPA, not DOE, files the Notice of Intention to delete a site from the NPL. Deletion from the NPL is not an area that is appropriately addressed in the Proposed Plan, and will be considered later during site close-out activities.

44. We ask that DOE provide a plan and assurances that the	Based on the extensive site characterization conducted at the site

10mg/L standard will be met by 2009 as measured at both the effluent of the Solar Ponds treatment unit and at the discharge point of the Discharge gallery for the Solar Pond Unit. The Solar Pond Treatment Unit is unable to meet the temporary modification nitrate standard. Northglenn remains concerned that the treatment facility will not be able to meet the more stringent standard of 10mg/L in 2009 when the temporary modification expires. Northglenn expects the standard to be met prior to mixing with waters of the State. Northglenn disagrees with the statement in the Proposed Plan and the RI/FS that *Continued operations of these four systems serves to protect surface water quality over short-and-long intermediate-term period by removing contaminant loading to surface water. This protection also serves to meet long-term goals for returning groundwater to its beneficial use of surface water protection.* We agree the systems should serve as a <u>final remedy</u>, but they currently do not function as per design.	and the subsequent modeling results presented in the Groundwater IM/IRA and the Summary of Hydrologic Flow and Fate and Transport Modeling Conducted at RFETS, Golden, Colorado, dated September 2005, the RFCA Parties believe that all of the groundwater plumes at the site have been sufficiently evaluated. Furthermore, groundwater conditions at the site continue to be evaluated. As indicated, in response to Broomfield/Westminster Comment 6.1, the groundwater treatment systems are functioning as designed, especially with the recent repairs to the Solar Pond Plume Treatment System which have increased its throughput and overall efficiency. DOE will continue to monitor groundwater and surface water with the goal of achieving the nitrate standard of 10 mg/L by 2009.

45. Revise the Plan to state an annual report to the regulatory agencies and communities will include language pertaining to the failure of controls. Notification of any failure of controls should be made to the regulatory agencies and impacted communities as soon as DOE becomes aware of the failure. Any corrective action should also be reported to the regulatory agencies and the impacted communities and identified in quarterly and annual reports. Remedial action objectives are clearly developed to provide the foundation of clean-up actions at a site for all impacted media such as groundwater, surface water, soil, and environmental protection. It is clearly understood if the objectives are not met there are specific mechanisms such as institutional controls to ensure protection of human health and the environment. Of the seven remedial action objectives that were evaluated for the feasibility study, not one objective is completely met. Northglenn is concerned there are no controls in place to prevent digging within	The CAD/ROD and the RFLMA specify reporting requirements to the agencies. These reports will be shared with the communities.

the Wind Blown Area, a potential Pu 239/240 source. Controls need to be in place for the life of the contaminant as long as it poses a risk. Impacts to Woman Creek also have to be considered as soils enter the creek. If the details of the controls are to be addressed in the post RFCA document, we ask for a 60 day comment period for time to evaluate the details of the long-term stewardship plan and controls.	

46. Provide a schedule of when DOE anticipates the record will be available and functioning electronically. Northglenn also asks for assurances to have public input as to what document should be in the record. Accessing information on the electronic administrative record continues to be problematic. Northglenn is concerned that the site will be de-listed prior to resolution of the problem resulting in lack of access to vital information. This information, per CERCLA, section 113, *requires that an administrative record be established "at or near the facility at issue." The record is to be complied contemporaneously and must be available to the public and include all information considered or relied on in selecting the remedy, including public comments on the proposed plan.* If the record is not accessible, it is not available. Most of the maps in the electronic version of the administrative record are in black and white. The maps and associated legends do not add any value to the record. Based on a $7 billion dollar clean-up, it would have behooved DOE to enter the information into the system so that the community could access information that is of value and can be understood and evaluated. Northglenn is disappointed to have a regulatory representative state *the record has to be available electronically, but the regulation does not state it has to be operable.* This statement is in direct contrast to the requirement of the law.	The online version of the Administrative Record, available at http://12.17.223.12/index.htm , is currently operational and is undergoing continual improvements. The AR meets the requirements of Section 113 of CERCLA. Copies of documents that are difficult to read in the online AR or that have yet to be entered electronically may be obtained by contacting the LM public affairs office for the Rocky Flats Site.

47. Northglenn requests the reading room be maintained until the	The future of maintaining the reading room at the College Hill

electron version of the administrative record is fully functioning, that the status of the reading room be clarified, and that the clarification process be public. The Rocky Flats Reading Room, located at the College Hill Library, has served as a valuable tool to the community. Legacy Management has committed to work with the downstream communities regarding the disposition of the documents in the reading room. This commitment has not been met.	Library at the Front Range Community College will be determined during the upcoming 5-year CERCLA review of the Site.

48. Clarify the delisting process. Answer, how the de-listing process differs from the certification process. Answer: How will the Covenant's Bill be enforced if the state has no jurisdiction in the refuge outer perimeter associated with the monitoring system?	EPA, not DOE, files the Notice of Intention to delete a site from the NPL. Deletion from the NPL is not an area that is appropriately addressed in the Proposed Plan, and will be considered later during site close-out activities.

49. Prior to delisting the site, identify deficiencies and any corrective measures regarding work products. Northglenn specifically asks for a description of the deficiency for the Solar Pond Treatment Unit, the 991 area, and the cover at the Original Landfill. We ask the RFCA Parties prepare a plan as to how these issues will be resolved and a schedule of when actions will be taken to mitigate the issues prior to approval of the CAD/ROD.	EPA, not DOE, files the Notice of Intention to delete a site from the NPL. Deletion from the NPL is not an area that is appropriately addressed in the Proposed Plan, and will be considered later during site close-out activities.

50. Identify the evaluation process the RFCA parties will utilize when reviewing community acceptance based on comments received in writing and at the public meeting held on August 31st. The document lacks the details of how the land transfer from DOE to the Fish and Wildlife Service will occur. Community acceptance criterion should be addressed in the CAD/ROD.	Community acceptance criteria are addressed in the CAD/ROD. The process under CERCLA is for the Proposed Plan to be available for public review and comment. All comments received are addressed in this comment response document and attached to the CAD/ROD. The CAD/ROD will be available to the public upon approval by the regulators.

51. Northglenn requests a closeout meeting to discuss site maintenance and fence/sign installation and maintenance.	Any meetings that occur as a part of the CERCLA public comment process must occur for the general public's benefit. CERCLA does not allow meetings during the process with individual organizations. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public

	concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

52. Northglenn requests that the Rocky Flats Site Post-Closure Public involvement Plan, dated October 2006, be revised to incorporate the needs of the downstream communities. The Public Involvement Plan should be evaluated on an annual basis with the input from local governments. Long-term stewardship is a key aspect of the cleanup process and the downstream communities expect DOE to extend the policy to our governments. Northglenn requests that we be involved and kept apprised of the long-term stewardship controls applicable to the site. Northglenn expects that the Post-closure document will be released for review for evaluation and input.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council. Post-closure public involvement is addressed in the LM Post-closure Public Involvement Plan, which is dated Oct. 2005. As noted in the PCPIP, future updates to the plan will be made as needed, but no more frequent than annually.

53. Northglenn expects to be kept apprised of the drafting of the post-RFCA. Northglenn requests that language pertaining to downstream communities and their role with water management be included in the post-closure document. The post-RFCA should include the details of the enforceability of the surface water standards, a continuation of the Water Working Group, Attachment 1 list of analytes, ICs, notifications, public participation plan, and other key factors related to long-term stewardship. Northglenn requests to be kept apprised of the upcoming 5-year review and to have sufficient time to review and evaluate the information related to the review. Northglenn requests that their technical staff be allowed to accompany the team during the physical tour of the remedy for the 5-year review.	DOE appreciates the long history of public involvement at Rocky Flats. DOE intends to continue to interact with all interested parties and stakeholders regarding issues of notification and communication. The RFLMA is the regulatory agreement which will describe implementation of the requirements from the CAD/ROD. The RFLMA will be released for public review and comment. The Rocky Flats Stewardship Council has been established by law as the public organization charged with facilitating communication between DOE and the public concerning its post-closure responsibilities. Broomfield, Westminster and Northglenn are members of the Rocky Flats Stewardship Council.

54. Northglenn wanted to provide you with our views of outstanding issues and a sense of what we expect to have identified in a strong, enforceable stewardship plan: • The document is silent on several key issues including the implementation and oversight of the regulatory requirements. • There is not a clearly defined plan and procedure for institutional and physical controls. • The record and data management system has to be in place and functioning prior to delisting. • Language needs to be added to the plan as a commitment to downstream communities to provide a post-closure role regarding water management.	Approval of the CAD/ROD will select the alternative and establish the requirements to implement that alternative. More detailed information describing how DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the Rocky Flats Legacy Management Agreement (RFLMA). The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.

Comments from Ms. Stanley, City of Northglenn and Woman Creek Authority, Public Hearing August 31, 2006

1. A proposed plan is silent on the involvement of downstream municipalities and their role postclosure. We are requesting that our representatives be part of the drafting and review of post closure documents. Furthermore, we request disposition to our comments prior to the release of the final CAD/ROD and a meeting well in advance of its release.	The purpose of the Proposed Plan is to provide the public a reasonable opportunity to participate in the decision-making process for the proposed final remedy. The final remedy will be documented in the CAD/ROD, which will be signed by DOE, EPA and CDPHE. The CAD/ROD outlines the requirements of the remedy that DOE must meet in the future. The Rocky Flats Legacy Management Agreement (RFLMA), a legally binding agreement between DOE and regulators, implements the remedy to ensure its protectiveness of public health and the environment. This agreement has been under development by the parties for several years and supersedes the RFCA. Although the CAD/ROD is not subject to public comment, the RFMLA will undergo a public review and comment process, including a formal public comment period.

Comments from Ms. Elofson-Gardine, Public Hearing August 31, 2006

1. We have several concerns about this plan and the clean up, as you guys want to call it. There's quite a bit that's left over, and we would prefer to see a combination of alternatives two and three with the institutional physical controls in charge of the surface soil removed. I think it's important to create a hybrid of those two alternatives simply because there is so much left with the old and the new landfills and the 903 lip area.	The Central OU encompasses not only the former industrial area, but also the 903 lip, the two landfills, the ponds and all monitoring wells except for the two at the site boundary along Indiana Avenue. As stated in the CAD/ROD, the central OU will be fenced off, for land management, but will have signs delineating the DOE lands with restrictions clearly posted by the gates into the Central OU. Alternative 3 was not selected due to the increased cost and difficulty, and increased short-term impact to the environment, with only minimal reduction in long-term risk.

2. I think it's important to also consider rerouting groundwater for dewatering of the site. Greg Marsh will be sending in a more detailed email comment about that if you haven't gotten it already.	The Groundwater IM/IRA, released for public comment and approved by the regulators, considered a variety of groundwater treatment alternatives, including extensive use of barrier walls. The selected alternative (i.e., smaller and targeted treatment systems) were preferred due to consideration of greater overall effectiveness, CERCLA preference for treatment, and cost and time to construct. The RI/FS included the results of the Groundwater IM/IRA as part of the comprehensive analysis, and concluded that no additional remedial actions can reasonably be taken. Also, passage of the Rocky Flats National Wildlife Refuge Act in 2001 created additional considerations. The environmental impact to install the large-scale remedy suggested in this comment would be counter to one of the refuge purposes of restoring and preserving native ecosystems..

3. And the water [monitoring] turning [sic] has been grossly deficient, and it should have been maintained at a minimum of a weekly, not a quarterly level.	DOE, EPA and CDPHE believe water monitoring has been adequate to ensure that the remedy will be protective of human health and the environment.

4. Public access should be barred with clear signage detouring trespassing and noting that public tours are inappropriate for this site.	The CAD/ROD mandates the posting of signs at the Central OU boundary, notifying the WRW and the WRV that they are at the boundary of lands retained by DOE and prohibiting trespassing. The Peripheral OU is suitable for unrestricted use and unlimited exposure. Plans for management of the Refuge areas in the Peripheral OU, including public access, are beyond the scope of the CAD/ROD, but may be found in the CCP for the Rocky Flats National Wildlife Refuge prepared by USFWS.

Email from LeRoy Moore, Rocky Mountain Peace and Justice Center, to Robert Darr dated September 14, 2006
(Note that this email was received after the close of the public comment period, however DOE has chosen to include a response.)

1. The overall conclusions of the Ecological Risk Assessment indicate that site conditions due to residual contamination do not represent significant risk of adverse ecological effects to receptors from exposure to site-related residual contamination. We strongly disagree with this assessment for two reasons. It seems to assume that near-term conditions at the site will remain unchanged, including both physical conditions and institutional or governmental systems or mechanisms of control. In the long term related to the 24,400-year half-life of plutonium-239 it is impossible to predict future physical conditions, and it is folly to assume that current governmental or institutional entities and systems of control will endure for anything like the period of potential harm resulting from residual contamination at the site. Second, entirely too little is known about genetic effects of radiological exposure to draw the conclusion that there is no significant risk of adverse effects either in the short term or the long term. Genetic specialist Dietard Tautz asserts that it may take several generations for the effects of radiation exposure to be readily apparent in some species, by which time the damage may be irreversible. He calls this a "genetic uncertainty principle" (*Trends in Genetics*, vol. 16, no. 11, Nov. 2000, p. 475). His work	EPA guidance which was developed based on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires decisions to be made regarding risks and appropriate remedies based on the best knowledge available at the time. The long-term uncertainties described in this comment are not unique to Rocky Flats or even DOE sites, rather they are found at almost every site covered by CERCLA. Contaminants found at commercial mining sites, for example, may include uranium-238 with a 4,500,000 year half-life and metals which essentially remain forever. To address the uncertainties models are used to predict impacts and risks into the future, using very conservative assumptions. Use of these models leads to conservative remediation decisions. Ongoing monitoring of the site conditions and a recurring 5-year review process provide information of changes or other unforeseen conditions, so that corrective actions can be taken. The 5-year review process also includes a review of new technologies which may have application to the site.

suggests the possibility of unexpected adverse effects from residual contamination on wildlife at Rocky Flats, effects that over time could extend both beyond the bounds of the site and to other organisms.	

2. Air emissions present no health or environmental concerns at present and anticipated future levels. Air, therefore, was not evaluated in the Feasibility Study. DOE here effectively fails to consider the most important pathway by which minuscule particles of plutonium can be taken into the body of humans, namely, via inhalation. For as long as any particle remains lodged in the body, it continues to bombard surrounding tissue with radiation. Because of its long half-life, prudence dictates that we assume that any plutonium-239 left in the environment is likely some day to surface and be resuspended as airborne particles. Particles of 10 micrograms (10/millionths of a gram) or smaller may be inhaled. As early as 1945 the government recognized that the tolerance level for plutonium in the body of workers was one microgram (DOE, *Closing the Circle on the Splitting of the Atom* {1995], p. 38); a standard text in this field calls a single microgram "a potentially lethal dose" (Cotton and Wilkinson, *Advanced Inorganic Chemistry* [1966], p. 1102). Research on Rocky Flats workers with internal plutonium deposits as low as 5% of DOE's purportedly safe permissible lifetime body burden developed a variety of cancers in excess of what was normal for workers who had not been exposed (Wilkinson, *American Journal of Epidemiology*, vol. 125, no. 2, 1987, pp. 231-250). Interestingly, DOE's data on plutonium particles remains classified. In 2004 the British Committee Examining Radiation Risks of Internal Emitters concluded that cancer risk from very low doses of plutonium may be ten or more times more dangerous than allowed for by existing exposure standards (www.cerrie.org). There is no guarantee that the standards for permissible exposure on which DOE and the regulators rely for cleanup and closure of Rocky Flats adequately protect the most vulnerable members of	Monitoring programs and other studies were conducted during both the production era and cleanup phase at Rocky Flats. These data show that contaminant emissions and resulting ambient airborne concentrations during both the weapons production era and cleanup phase were always compliant with all regulatory requirements. In fact, compliance monitoring at the facility fence line showed maximum airborne radionuclide concentrations of no more than three per cent of the limiting standard during the entire cleanup phase. With completion of all accelerated actions and the attendant removal of all historical air emissions sources except for wind erosion of the minor, remnant contamination in surface soils, future air emissions from the site will be less than those in the past. Air modeling conducted for radionuclide parameters predict that, even for scenarios involving a fire in the historic 903 Pad area, emissions will be much lower than the EPA's ten millirem benchmark level for an airborne exposure pathway. None of the other potential air contaminants is regarded as having a significant environmental effect at Rocky Flats.

the population who are likely in the future to venture onto the Rocky Flats site (see the discussion of risk and alpha emitters in my "Rocky Flats: The Bait and Switch Cleanup," *Bulletin of the Atomic Scientists*, Jan./Feb. 2005, pp. 54-56 [http://www.rmpjc.org/2005/Rocky Flats/AtomicScientists/]).	

3. Because the Remedial Investigation concluded that the Peripheral OU poses no current or potential future threat to human health or the environment, a Feasibility Study for this OU was not required and no remedial alternatives were evaluated. DOE is proposing that no remedial action be taken in the Peripheral OU. This conclusion is highly dubious for the simple reason that the site, especially the "peripheral" buffer zone, was never adequately characterized. Though many samples were collected in this large area, many of them were done by the kriging method by which samples in very large plots were composited to produce average readings, a method that is likely to miss or to average away hot spots.	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. No use restrictions of any kind are necessary for the Peripheral OU. The sampling populations and statistical analysis techniques used were consistent with commonly-used EPA guidance, in most cases providing more than the minimum requirements. The conservative exposure and risk assessment models used consider the natural variability of contaminants within soil or other media, and also recognize that exposure by selectively contacting only the relatively higher contaminant areas is not credible. Thus use of averaging and other statistical methods provides for conservative, but still credible exposure scenarios.

4. Of the three alternatives DOE says it will consider it prefers Alternative 2, which entails the implementation of institutional and physical controls. The foregoing comments already indicate that we find this approach wholly inadequate both for the near term and especially for the long term. We need say no more. Alternative 3, "Targeted Surface Soil Removal," by means of which the top 6 inches of soil would be cleaned to a plutonium concentration of 9.8 picocuries per gram, is hardly better. In commenting on the final draft Rocky Flats Cleanup Agreement we at the Rocky Mountain Peace and Justice Center recommended that the Rocky Flats site be cleaned to a level of 10 or less picocuries of plutonium per gram of soil without respect to depth. RFCA as finally revised and implemented allows up to 50 picocuries per gram of soil in the top three feet and much higher concentrations at deeper levels. DOE's Alternative 3 would be an improvement but would still leave high quantities of plutonium	The RI found that conditions in the Peripheral OU were suitable for unrestricted use and unlimited exposure. This included analysis of pathways by which contaminants currently buried at depths of 30 feet or more, might impact human or ecological receptors. The physical control identified in the selected CAD/ROD alternative (Alternative 2) is for signs to be posted that state that the Central OU is land retained by DOE and trespassing is forbidden. In addition, the CAD/ROD requires DOE to maintain institutional controls and issue the State of Colorado an environmental covenant to ensure the controls remain with the land in perpetuity. The RFCA values mentioned relate to interim levels used during remedial actions to guide the scope of those remedial actions while underway. The RI analyzed exposure and risk based on sampling data and final conditions. In the Peripheral OU

behind. Because, as stated above, any plutonium remaining in the place may some day surface and be resuspended, DOE's Alternative 3, while not as problematic as Alternative 2, is also totally unsatisfactory.	plutonium concentration is less than 9.8 picocuries per gram except for a few isolated locations, with the highest reading at 20 picocuries per gram. Alternative 3 proposed to remove surface contamination above 9.8 picocuries per gram.

5. Finally, on p. 24 DOE says it will consider "community acceptance" in deciding which of its proposed alternatives to adopt. But DOE has already effectively shut out the [public] pubic [sic]. In 1995 the broadly representative Rocky Flats Future Site Use Working Group recommended by consensus that Rocky Flats be cleaned to average background levels as soon as it is technologically and fiscally possible to do this in an environmental responsible manner. The Citizens Advisory Board, the Local Impacts Initiative and other groups and individuals quickly adopted this proposal, making it the single most widely supported cleanup recommendation for Rocky Flats. Yet DOE and the regulators rejected it in favor of the Rocky Flats Cleanup Agreement as officially adopted in 1996 and modified in 2003, a plan rejected by 86% of the parties from the public that commented on it (see attachment). DOE has proceeded with a cleanup that enjoys very scant public support. Having done what many in the public regard as an inadequate cleanup, DOE now wants the public to say "yes" to an inadequate closure plan.	"Community Acceptance" is one of the two modifying criteria required for consideration by EPA regulations, the other being State Acceptance. The cited recommendations from 1995 were used by the DOE and the regulators to guide creation of the RFCA, which was also released for public review and comment. Much has changed in ten years, including completion of substantial remediation, designation of the site as a Wildlife Refuge through legislation, and increased knowledge of site conditions. The Draft RI/FS was released for public comment in October 2005 and was discussed in several public forums. The RI/FS and Proposed Plan were released for public review and comment in 2006 and included analysis of the latest information and conditions. Three information meetings were held in May, July, and August 2006 on the final RI/FS and Proposed Plan. Approval of the CAD/ROD will select the alternative based on current conditions and establish the requirements to implement that alternative. More detailed information describing how the DOE will meet the requirements of the CAD/ROD, including the topics in your comment, will be written in the Rocky Flats Legacy Management Agreement (RFLMA). The RFLMA will be made available for public comment, and once approved by the EPA and CDPHE, will replace the current RFCA as the enforceable agreement to ensure compliance with CERCLA, RCRA, and the CHWA.