1.0 Introduction

This Remedial Investigation (RI) Addendum/Focused Feasibility Study (FFS) report updates the 1998 final RI and presents the results of a FFS conducted for Operable Unit (OU) III, contaminated surface water and ground water, of the Monticello Mill Tailings Site (MMTS). These documents are combined to promote better reference between the updated RI information and the remedy comparisons of the FFS. This document is prepared by the U.S. Department of Energy (DOE) Grand Junction, Colorado, to fulfill its obligations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Executive Order 12580, "Superfund Implementation." The information presented in this report will be the primary basis for a Record of Decision (ROD), which will document the selected remedy for OU III surface water and ground water.

MMTS is located in southeastern Utah, in and near the city of Monticello (2000 census population about 1,900) in San Juan County (Figure 1–1). The former Millsite (OU I) is a 110-acre tract of land previously owned by DOE or its predecessor agencies. Mill tailings and associated contaminated material generated during Millsite operations from the early 1940s until 1960 were the primary source of contamination in soil and sediment, the shallow alluvial aquifer underlying the site, and Montezuma Creek, a small creek that flows through the study area. Private and DOE-owned properties adjacent to the Millsite and downstream from the Millsite ("peripheral properties") that were contaminated by windblown or stream-deposited tailings were designated as OU II.

MMTS was included on the National Priorities List (NPL) in 1989 and is being remediated by DOE in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Pursuant to the ROD for MMTS (DOE 1990) for surface remediation, contaminated materials from OU I and OU II were excavated and placed in an on-site repository designed for their permanent storage. The excavation and disposal of tailings and contaminated soil and debris and Millsite restoration were completed in 2001.

The 1990 ROD for MMTS designated a third OU (OU III) that encompassed contaminated surface water, ground water, soil, and sediment contamination on peripheral properties along Montezuma Creek. The ROD for MMTS also stipulated that a ROD for OU III would be prepared when sufficient data were gathered to select a permanent remedy through a focused RI/FS.

The RI for OU III began with site characterization activities in the fall of 1992; data collection for the purposes of completing the RI report (DOE 1998a) and preparing a draft Feasibility Study (FS) report (DOE 1998b) continued through June 1996. In 1998, DOE implemented a non-time-critical removal action for the contaminated soil and sediment along Montezuma Creek (DOE 1998c). Montezuma Creek was divided into three segments (upper, middle, and lower) based on its topographic features and current and expected future land use (Figure 1–2). Under the auspices of OU III, 20,935 cubic yards (yd^3) of contaminated soil and sediment were removed from the Montezuma Creek floodplain. Hot-spot removal occurred in Upper and Lower Montezuma Creek, and no removal action was performed in Middle Montezuma Creek. During the spring of 1999, subsequent to remediation of the contaminated peripheral properties, a decision was made to address the final remedy selection of the soil and sediment area in Upper,

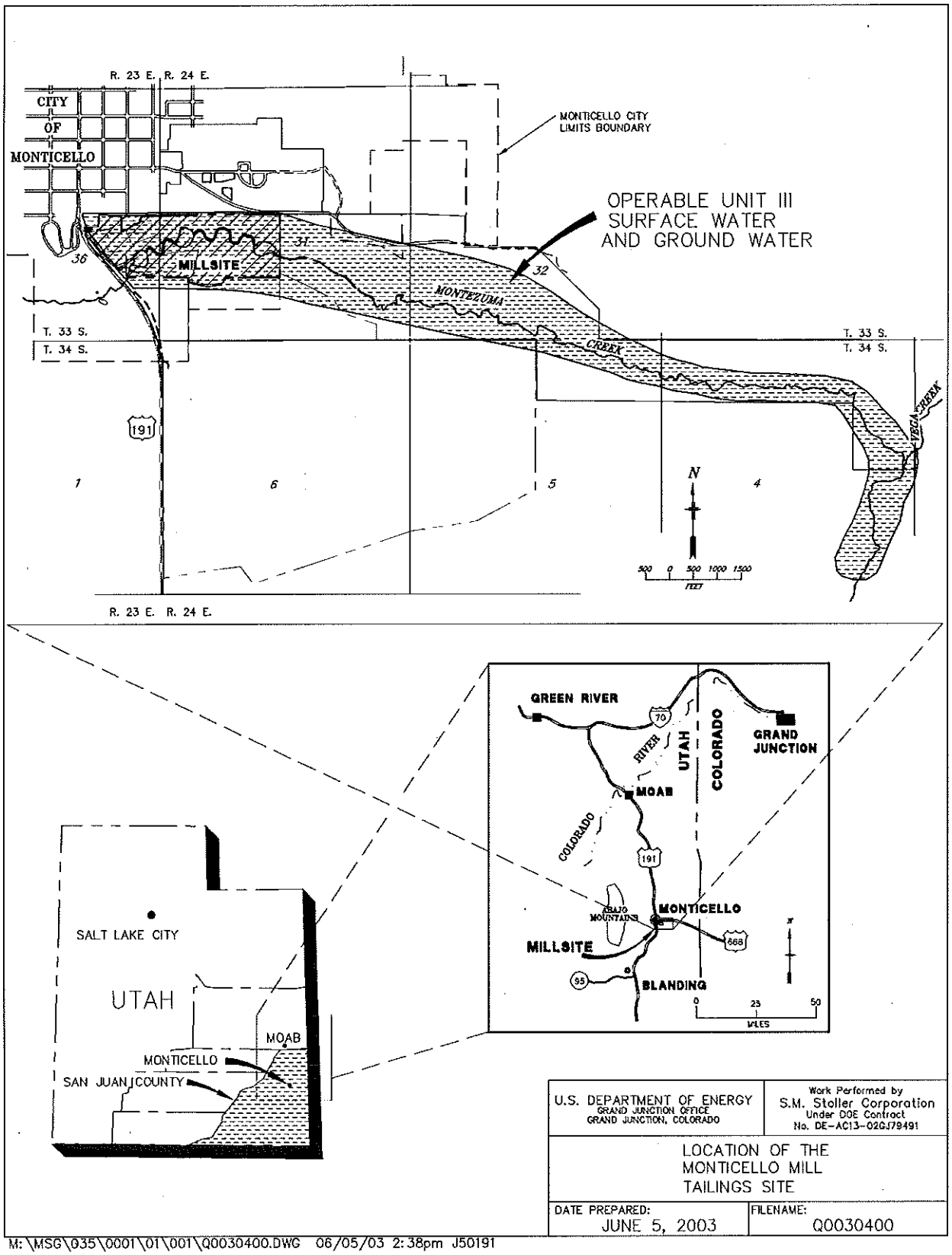


Figure 1–1. Monticello Mill Tailings Site, San Juan County, Utah

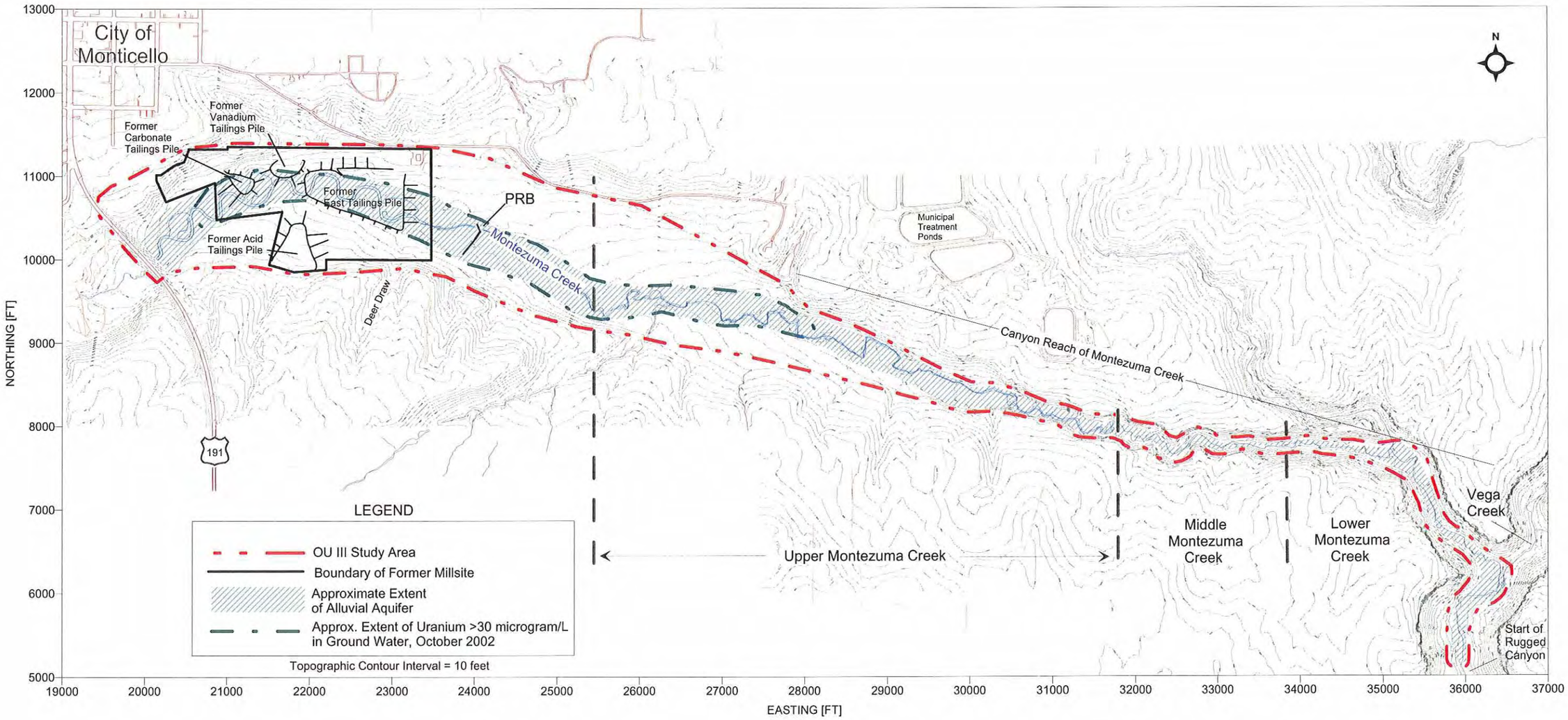


Figure 1–2. Operable Unit III Site Features

This page intentionally left blank

Middle, and Lower Montezuma Creek as part of OU II of the MMTS. This left OU III to include only surface water and ground water on and downgradient of the Millsite.

During development of the draft FS report in the summer of 1997, DOE, the U.S. Environmental Protection Agency (EPA), and the Utah Department of Environmental Quality (UDEQ) jointly agreed that it was not possible at that time to definitively predict the effects that Millsite remediation would have on the ground water and surface water systems. To address those and other site uncertainties, a decision was made to conduct an interim remedial action (IRA) and complete the FS at a later date. In September 1998, an IRA ROD for OU III (DOE 1998d) was signed by EPA and UDEQ. Also in September 1998, the *Monticello Mill Tailings Site, Operable Unit III, Remedial Investigation* report (DOE 1998a) was finalized. The draft FS report (DOE 1998b) was not finalized. The 1998 final RI and draft FS reports were prepared prior to significant remedial and administrative actions undertaken to mitigate potential health risks associated with mill-tailings-related contamination at the site. Significant actions taken since 1998 include

- Remediation of 2.5 million yd^3 of tailings, soils, and debris on the Millsite, including residual source material below the water table (OU I remediation).
- Restoration of the Millsite, including aquifer and wetlands reconstruction along Montezuma Creek (OU I remediation).
- Remediation of hot-spot contamination on peripheral properties in the floodplain of Montezuma Creek (OU III non-time-critical removal action).
- Implementation of institutional controls to prevent domestic use of the contaminated alluvial aquifer (OU III IRA).
- Implementation of restrictive easements on peripheral properties in the floodplain of Montezuma Creek to prohibit the building of habitable structures within areas where supplemental standards were applied (OU II Supplemental Standards Application).
- Installation of a permeable reactive barrier (PRB), an innovative treatment technology, in the alluvial aquifer (OU III IRA).

Fundamental changes to site conditions as a result of those actions are

- Primary and secondary sources of ground water and surface water contamination were removed, causing the concentrations of most contaminants to decrease in surface water and ground water (this decrease is predicted to continue in the future).
- Ground water flow dynamics changed over significant portions of the site and stabilized to a new set of conditions.
- Contaminants such as arsenic, molybdenum, selenium, uranium, and vanadium have been immobilized in the PRB, reducing their transport in the ground water.

1.1 Report Purpose and Organization

The purpose of this RI Addendum/FFS report is to provide risk managers with the information necessary to support an informed risk management decision concerning the most appropriate remedy for OU III surface water and ground water.

The changed site conditions since the 1998 RI report was prepared required development of (1) a new ground water flow and transport model to predict future ground water concentrations, and (2) review and re-evaluation where necessary of the 1998 human health and ecological risk assessments. Therefore, this report provides the following information:

- The ground water flow and transport model developed for Millsite post-remediation conditions.
- An updated OU III human health risk assessment (HHRA) using current contaminant concentration data and toxicity information.
- An updated OU III ERA for receptors and pathways that were identified as a possible concern in the 1998 RI.
- A feasibility study focused on the remaining media originally addressed by the IRA (surface water and ground water).

Results of ground water and surface water monitoring conducted since the 1998 RI document, and since completion of surface remediation, are also presented. RI information that was not affected by activities since 1998 and information that is included in other documents is addressed by reference. The main components of this document and location within are

- Site activities since 1998 RI/FS documents that affect contaminant distribution in soil, surface water, and ground water (Section 2.0).
- Contaminants of concern (COCs) (Section 2.7.1).
- Nature and extent of ground water and surface water contamination (Sections 2.7.2 and 2.7.3).
- Ground water conceptual model, numerical ground water model, and uranium transport model (Section 3.0).
- Human health risk assessment update (Section 4.1).
- Ecological risk assessment update (Section 4.2).
- Focused feasibility study (Section 5.0).

The remainder of Section 1.0 provides a brief description of the site, the administrative history, the main conclusions of the 1998 RI, and federal or state standards, requirements, or criteria that are applicable or relevant and appropriate requirements (ARARs).

1.2 Site Description

OU III encompasses ground water and surface water at and downgradient of the Monticello Millsite. Figure 1–2 shows OU III and commonly referenced landmarks in the vicinity of the MMTS. On the former Millsite, the northern, western, and southern boundaries of OU III are set approximately at the former boundaries of the Millsite (Figure 1–2). The northern boundary is set along Northing (N) 11,400 (coordinates based on the Monticello Project Coordinate System). The western boundary is set at U.S. Highway 191. The southern boundary is set at N 9900. To the east of the former Millsite, OU III roughly corresponds to the upslope boundaries of the valley formed by Montezuma Creek. Relative to the project coordinate system, the eastern boundary of OU III is at about N 5000, which is approximately 1,500 feet (ft) downstream of the

Vega Creek confluence. This downstream portion of OU III ends where the physical features become more rugged (i.e., large boulders are present and access is difficult, the valley narrows, and the stream gradient steepens); significant measurable Millsite-related contamination does not extend beyond this "rugged canyon" area (DOE 1998a).

The area delineated by the boundaries described in the previous paragraph encompasses the OU III study area. Montezuma Creek and the shallow water table aquifer, which consists of unconsolidated stream-deposited silt, sand, and gravel (alluvium) are affected by radioactive and nonradioactive inorganic contaminants. The actual extent of the saturated alluvium (alluvial aquifer) within OU III is shown schematically on Figure 1–2. It is located within the valley of Montezuma Creek, which flows west to east through the center of the study area. Natural flow in Montezuma Creek has been interrupted by a man-made reservoir on its primary upstream tributary (South Creek), and by the municipal water treatment plant on its other upstream tributary (North Creek). The valley and aquifer are laterally bounded by low permeability bedrock or fine-grained colluvium and vertically by competent bedrock. The creek valley in the west half of the study area is about 1,500 ft wide. Progressing east, the valley narrows into a steep-walled canyon that is only about 150 ft wide in places. The width of the aquifer (north and south) varies by location between about 150 and 500 ft. Depth to bedrock is generally less than 15 ft below ground surface in the valley floor. The saturated thickness of the aquifer varies by location from about 2 to 8 ft. Important sources of recharge to the aquifer include prolific seepage along much of the northern margin of the Millsite, and discharge from a bedrock aquifer in portions of the canyon reach of Montezuma Creek (Figure 1–2). The present extent of uranium contamination exceeding the Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) of 30 micrograms per liter (μg/L) in ground water is illustrated in Figure 1–2.

Montezuma Creek is a small, generally perennial stream that has its headwaters in the Abajo Mountains about 5 miles west of Monticello. Low-flow conditions usually prevail during late summer, fall, and winter months. Base flow in the creek is usually maintained year-round by ground water discharge and seepage from Loyd's Lake, located 1 mile west of U.S. Highway 191 on South Creek. Since 1993, measured flows in Montezuma Creek ranged from no flow conditions to about 0.5 cubic foot per second (cfs) (approximately 225 gallons per minute [gpm]) in the study area. Summer thunderstorms can cause flows in Montezuma Creek to exceed 300 cfs. During the last several years, drought conditions have existed in the region, and during 2002 Montezuma Creek was dry in several reaches for nearly half the year. Ground water and surface water hydrology is discussed more fully in Section 3.2.

Volume 1, Section 2.0 of the 1998 RI contains a complete description of the physical characteristics of the site (Table 1–1). Section 2.0 of this document describes the changes to physiography, hydrology, and wetlands that have occurred since 1998. Except as noted in Table 1–1, the remaining site characteristics remain largely unchanged since the 1998 RI was finalized.

Table 1–1. Contents of Volume I Section 2, Physical Characteristics of the Site (1998 RI)

Section	Title	Section	Title
2.1	Physiography	2.7	Wetlands
2.2	Meteorology	2.8	Demography[c]
2.3	Geology	2.9	Land Use and Ownership
2.4	Soils and Vegetation	2.10	Scenic, Historic, and Cultural Resources
2.5	Hydrology[a]	2.11	Noise
2.6	Wildlife[b]		

[a]The hydrologic conceptual model has since been updated and is presented in Section 3.2 of this report.
[b]The peregrine falcon is no longer a federally listed endangered species (although it is still protected by the Migratory Bird Treaty Act and is listed as a State-sensitive species).
[c]The population of the city of Monticello has since decreased from 2,200 to 1,900 people.
[d]Noise levels have decreased due to completion of construction activities associated with Millsite remediation.

1.3 Administrative History

The administrative history of OU III is coupled with the histories of OU I and OU II, the other operable units of the MMTS. OU I addresses excavation of mill tailings and other contaminated materials (soils and debris) from the Millsite and their containment in a permanent repository; OU II addresses the remediation of peripheral properties that are contaminated by radioactive material from the Millsite. In February 1989, DOE, EPA, and the State of Utah (the State) entered into a Federal Facilities Agreement (FFA) (DOE 1989), pursuant to Section 120 of CERCLA, for the MMTS. A Hazard Ranking System score was developed that led to the inclusion of MMTS on EPA's NPL on November 16, 1989. As stated in the FFA, DOE serves as the federal lead agency and provides the principal staff and resources to plan, direct, and implement remedial action at MMTS. EPA and the State share the responsibility for oversight of MMTS activities performed under the FFA. However, EPA has the ultimate responsibility and authority for program oversight. UDEQ performs oversight for the State.

In addition to MMTS, the FFA also defines roles and responsibilities of the parties for the Monticello Vicinity Properties (MVP) Site that was also listed in the NPL. The MVP Site consisted of 424 properties in eight OUs. An estimated 152,000 yd^3 of contaminated material were removed from the vicinity properties. MVP remediation was completed in September 1999, and deletion from the NPL became effective February 28, 2000.

In 1990, the FFA parties signed a ROD for the MMTS (DOE 1990), which stipulated that contaminated materials from OUs I and II would be excavated and placed in an on-site repository. The ROD for MMTS also stipulated that a ROD for OU III would be produced when sufficient data were gathered to make a remedial action decision through a focused RI/FS. Remediation of OUs I and II was completed in August 1999. Also in August 1999, DOE and the city of Monticello entered into a Cooperative Agreement wherein the city would be responsible for completing restoration of the former Millsite[1] with support from DOE. A Covenant Deferral Request (DOE 2000a) was prepared by DOE for transfer of ownership of the Millsite and several adjacent properties to the city prior to completion of all remedial action in accordance with CERCLA. The request was approved by the Governor of Utah and the EPA Regional Administrator. In June 2000, ownership was transferred to the city of Monticello under the Federal Lands-to-Parks Program administered by the National Park Service. Restoration of the

[1] Throughout the remainder of this document the "former Millsite" is simply referred to as the "Millsite."

Millsite was completed on August 31, 2001, although issues remain with regard to the stability and permanency of the efforts to restore the Millsite area and convert it into a park.

Data collection for the OU III RI began in November 1992 and continued through 1996. The OU III RI and FS reports were prepared concurrently. For the OU III RI, draft, draft-final, and final versions were prepared. However, during review of the draft OU III FS report in the summer of 1997, DOE, EPA, and UDEQ agreed that the effects of Millsite remediation and restoration on the ground water setting were uncertain. It was also agreed that the ground water flow and transport model, presented in the 1998 RI and draft FS, could not be relied upon to definitively predict future concentrations of contaminants in ground water. The uncertainties were based mainly on the effectiveness of source removal, remobilization of constituents, and alteration of the dynamics of the ground water system. Also, the draft FS evaluated a permeable reactive treatment (PeRT) wall[2] as a remedial alternative; this alternative was not acceptable to EPA or UDEQ without site-specific data demonstrating its effectiveness for removing the contaminants of concern. To address each of these issues, a decision was made to not finalize the draft FS, but to conduct an interim remedial action instead. It was agreed that, after a period of surface water and ground water stabilization following Millsite remediation and restoration, an addendum to the 1998 RI would be prepared and the FS would be completed.

As stated in the IRA ROD, the major components of the IRA include

- Using institutional controls to restrict use of contaminated ground water.
- Continuing ground water extraction and treatment during excavation and dewatering of the Millsite and continuing, if necessary, after Millsite excavation in areas of concentrated contamination.
- Continuing monitoring efforts, including surface water and ground water sampling, to better understand effects of Millsite remediation on water quality.
- Installing a pilot-scale treatability study (PRB wall) downgradient (east) of the Millsite to assess its effectiveness in reducing contaminant levels in OU III surface water and ground water.

Figure 1–3 depicts the documents and activities necessary to make the remediation decision for OU III surface water and ground water. The figure also depicts the documents and activities completed for the soil and sediment removal action in Upper, Middle, and Lower Montezuma Creek.

1.4 Conclusions from the 1998 Remedial Investigation

This section summarizes the conclusions that were reached in the 1998 RI (DOE 1998a). They provide a basic understanding of the nature and extent of contamination as it existed in 1996, a forecast for aquifer restoration based on 1996 site conditions and contaminant concentrations, and a summary of human health and ecological risk assessment findings. Additional details concerning 1996 conditions are presented in the Executive Summary to the 1998 RI, which is reproduced in Appendix A in this Addendum. The 1998 Executive Summary has been annotated to reference volume and section of the RI where the material was originally presented.

[2] Since preparation of the ROD for the IRA, PeRT walls have become generally referred to as permeable reactive barriers (PRBs) in the scientific literature. The remainder of this document will refer to the Monticello PeRT wall as the PRB.

1.4.1 Nature and Extent of Contamination Based on 1992–1996 Site Conditions

Ground water samples collected from wells completed in the alluvial aquifer contain elevated concentrations (relative to background) of various metals, uranium-decay-series radionuclides, sulfate, and nitrate. The COCs identified on the basis of human health and ecological concerns are listed in Table 1–2. Generally, the highest concentrations were detected in samples collected in the eastern two-thirds of the Millsite, indicating that leachate from the Acid, Carbonate, Vanadium, and East tailings piles was the primary source of contamination to the aquifer.

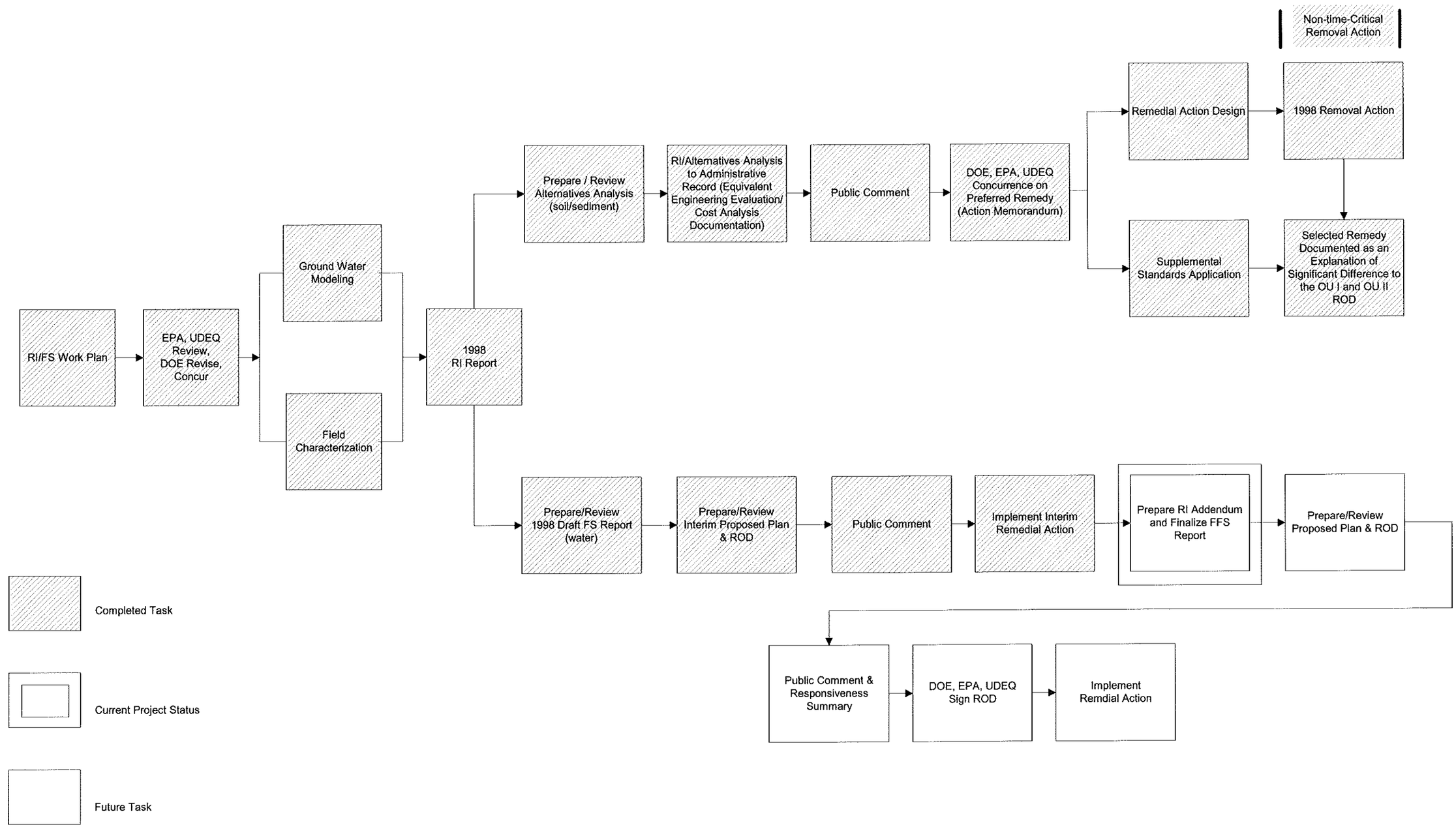
Table 1–2. Contaminants of Concern

Chemical Toxicants			
Arsenic	Cobalt	Copper	Manganese
Molybdenum	Nitrate	Lead	Selenium
Sodium	Sulfate	Uranium	Vanadium
Zinc			
Radionuclides			
Lead-210	Radium-226	Radon-222	
Thorium-230	Uranium-234	Uranium-236	
Uranium-238	gross alpha	gross beta	
external gamma			

Arsenic, manganese, molybdenum, selenium, vanadium, uranium, and lead-210 (Pb-210) concentrations were elevated in the alluvial aquifer on the Millsite and at downgradient locations on private property east of the Millsite. Contaminant concentrations generally decreased with increasing distance from the Millsite. Uranium concentrations from October 1995 are shown on Figure 1–4. Selenium, nitrate, and radium-226/228 (Ra-226/228) were detected in concentrations above regulatory standards on the Millsite only. Sorption is believed to account for the following observed order in which concentrations of contaminants in ground water decreased as a function of distance from the Millsite (from most to least mobile): uranium, molybdenum, selenium, arsenic, vanadium, and radium. Section 5.1, page 5-1, in the RI (DOE 1998a) provides additional discussion on contaminant fate. The concentrations of several constituents fluctuated consistently and inversely with the water level of the aquifer, that is, dilution was observed during seasonal periods of high flow (spring), and maximum concentrations occur during fall and winter (low-flow periods).

Ground water in the Burro Canyon Formation (Fm.) was not contaminated. The overlying Mancos Shale and Dakota Sandstone appear to be adequate aquitards that limit downward flow from the alluvial aquifer. Beginning approximately 1 mile east of the Millsite, the alluvial aquifer is in direct contact with the Burro Canyon Fm. aquifer. In this eastern area, the Burro Canyon aquifer is under artesian conditions, and alluvial aquifer ground water quality is strongly affected by influx from the Burro Canyon aquifer. Upward flow from the Burro Canyon to the alluvial aquifer prevents contaminant movement into the Burro Canyon aquifer.

Figure 1–5 is a conceptual cross section of the alluvial aquifer and underlying bedrock units east of the Millsite and shows the upward flow potential. Among the bedrock units in the OU III study area, only the Burro Canyon Fm. is regarded as having a viable ground water resource. Contaminant concentrations in surface water generally decreased during periods of high flow (March through June) and increased during base-flow periods (July through February). Adsorption (and/or precipitation) and dilution are the primary processes affecting contaminant fate in surface water.



k:\engr\tcwp6\gw-mont\035-0001-01-001\Q0029500\FIGURES\Fig1-3

Figure 1–3. OU III Flow Diagram

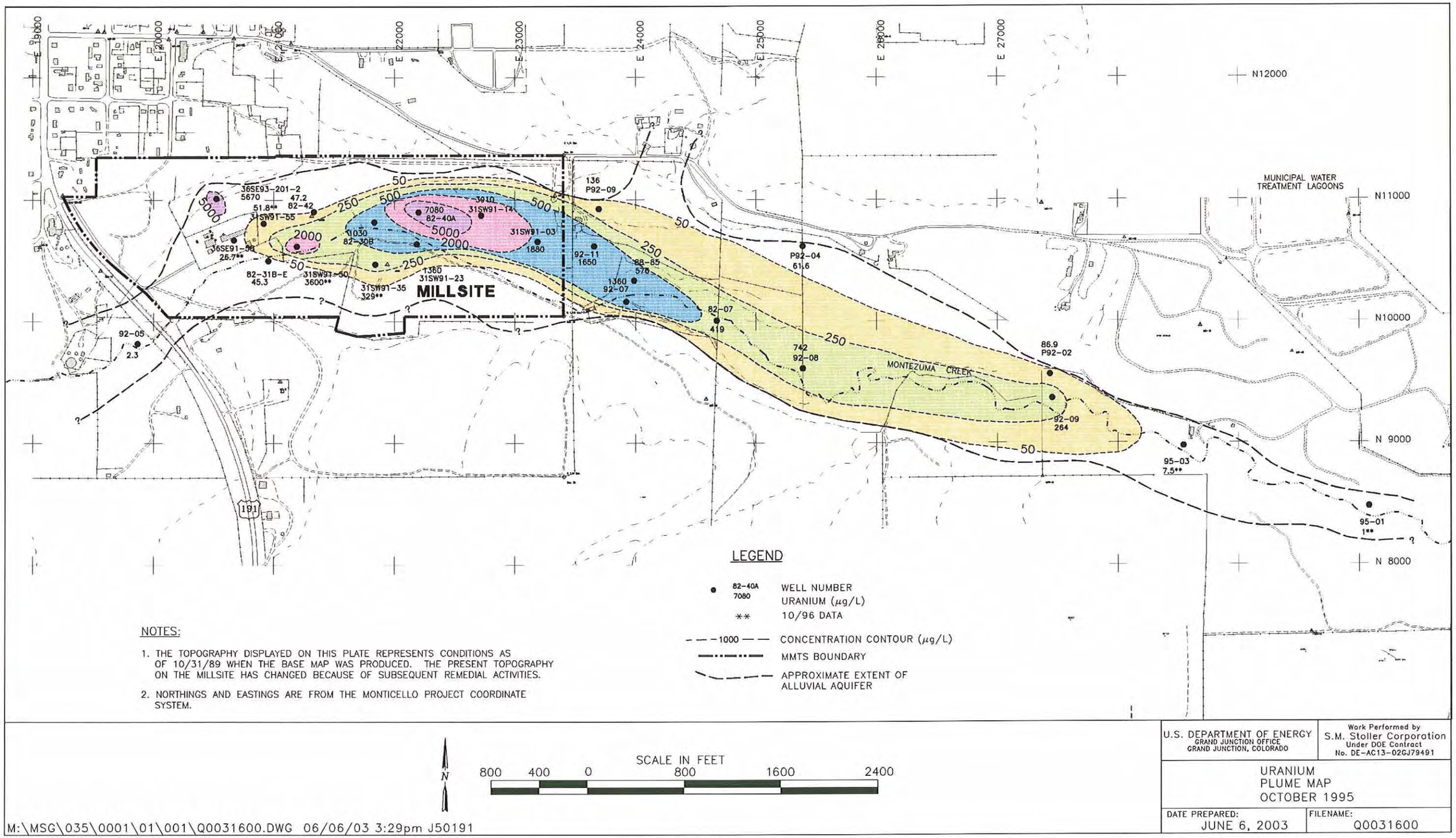


Figure 1–4. Uranium Plume Map—October 1995 Site Conditions

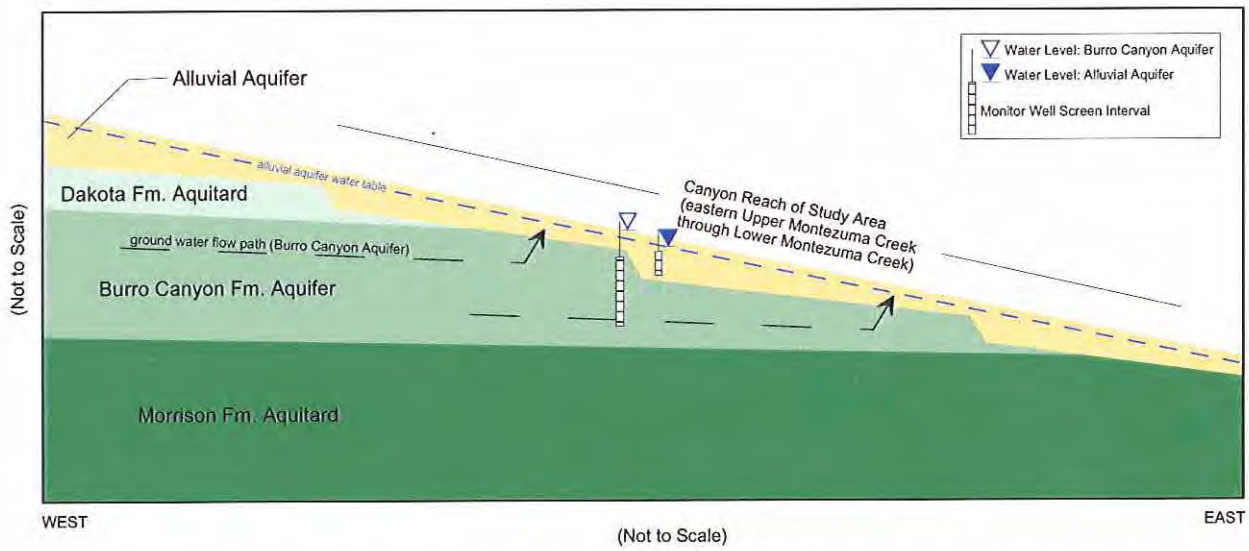


Figure 1–5. Conceptual Cross Section of the Hydrostratigraphy East of the Millsite

Samples collected from former tailings pile seeps on the Millsite had the highest concentrations of metals and radionuclides; concentrations of most analytes ranged from one to two orders of magnitude greater than concentrations measured in samples from Montezuma Creek. Montezuma Creek surface water data indicated that the more highly concentrated contaminants in the seeps were rapidly diluted as they flowed into the creek.

Elevated concentrations (with respect to background) of arsenic, copper, selenium, nitrate, and sulfate in Montezuma Creek were generally limited to the Millsite or just downstream from the Millsite boundary. Molybdenum, radon-222 (Rn-222), and vanadium were detected at elevated concentrations farther downstream but generally reached background concentrations near the confluence with Vega Creek. Elevated manganese concentrations approximately 1 mile downstream from the Millsite were attributed to discharge of Burro Canyon ground water, which is naturally high in manganese.

Uranium concentrations were elevated at all locations (except background locations) throughout the surface water monitoring network. Uranium concentrations increased in the reach between one-half and 1 mile downstream of the Millsite. Peak concentrations in this area are probably due to alluvial ground water discharge and may in part be due to local sources of uranium contamination in soils and sediments near or upgradient of the sampling site. Concentrations of all contaminants either remained relatively stable or decreased in the canyon reach, which indicated that there was no significant leaching from any soil and sediment source within this portion of the canyon. Uranium concentrations decreased to an average of 85 picocuries per liter (pCi/L) at the monitoring site located about 1,500 ft in creek distance below the confluence of Vega and Montezuma Creek.

1.4.2 Summary of 1998 Ground Water Model

Transport in the alluvial aquifer of several OU III COCs was predicted by ground water modeling. The computer code MODFLOW (McDonald and Harbaugh 1988) was used to

simulate steady-state flow within the alluvial aquifer. Transport of arsenic, Pb-210, manganese, Ra-226, and uranium was simulated using the computer program MT3D (Zheng 1996) in conjunction with the calibrated flow model. Natural attenuation of these analytes was simulated for a period of 100 years (yr). Model description and results are summarized below.

Description of 1998 Ground Water Model

- Geochemical properties of OU III COCs as they affect transport in ground water are described in Volume 1, Section 5.1, page 5–1, of the 1998 RI report.
- The flow model was calibrated to the average hydraulic head, in each OU III monitor well, as observed from November 1992 to April 1996.
- Initial concentrations in the transport models were the average concentration, per analyte, per monitor well, as measured from November 1992 to April 1996.
- Mill tailings were not represented as a contaminant source, because it was assumed Millsite remediation would remove all source.
- Separate transport models were developed to evaluate potential effects of subpile vadose zone soil (referred to as residual vadose zone in the 1998 RI) as a residual source of ground water contamination.
- Chemical reaction in the transport models was represented by linear equilibrium-controlled sorption. Values for the parameter (distribution coefficient [K_d]) used to represent sorption for the analytes were determined from site-specific data and model calibration.

Results of 1998 Ground Water Model (summarized in Table ES–6 of the Executive Summary; see Appendix A of this Addendum)

- Elevated uranium concentrations were the most persistent among the modeled analytes; uranium transport generally determined the overall time frame for natural attenuation (model results for manganese are disregarded because its fate and transport is probably influenced to a greater degree by oxidation/reduction than sorption).
- With or without a residual vadose zone source, uranium concentrations in ground water remained above the Uranium Mill Tailings Radiation Control Act (UMTRCA) standard (30 pCi/L; the 1998 preliminary remediation goal [PRG]) on the Millsite for over 100 yr.
- With a residual vadose zone source, uranium concentrations downgradient of the Millsite exceeded the UMTRCA standard for greater than 100 yr.
- Without a residual vadose zone source, uranium concentrations downgradient of the Millsite decreased to less than the UMTRCA standard in 80 yr.

1.4.3 Summary of 1998 RI Baseline Risk Assessment

On the basis of comparison of observed levels of metals and radionuclides to naturally occurring (background) levels, and a screening level assessment of potential risks to human health and the environment, a list of COCs was identified. The 1998 RI COCs for the HHRA and the ERA are presented in Table 1–3 and Table 1–4, respectively.

Table 1–3. Summary of 1998 RI Human Health Contaminants of Concern

Contaminant[a]	Alluvial Aquifer Ground Water	Montezuma Creek Surface Water	Montezuma Canyon Soils In the Top 6 Inches
Chemical Toxicants			
Arsenic	X	X	X
Manganese	X		
Selenium	X		
Sodium	X[b]	X[b]	
Sulfate	X[b]	X[b]	
Uranium	X	X	X
Vanadium	X		
Radionuclides			
Pb-210 (γ, β)	X	X	X
Ra-226 (α, γ)	X	X	X
Rn-222 (α)	X		
Thorium-230 (α, γ)			X
Uranium (U)-234 (α)	X	X	X
U-235 (neutrons)	X	X	X
U-238 (α)	X	X	X
Gross Alpha	X[c]	X[c]	
Gross Beta	X[c]		
External Gamma			X

[a] Radioactive decay modes are shown in parenthesis for the radionuclides (α = alpha, β = beta, γ = gamma).
[b] Included as default COCs and will be addressed qualitatively. No toxicity or regulatory information is available from standard EPA sources (e.g., Health Effects Summary Tables) to support the risk assessment.
[c] Gross alpha and beta are indicators of contamination and will not be quantitatively evaluated. They are significant from a regulatory perspective.

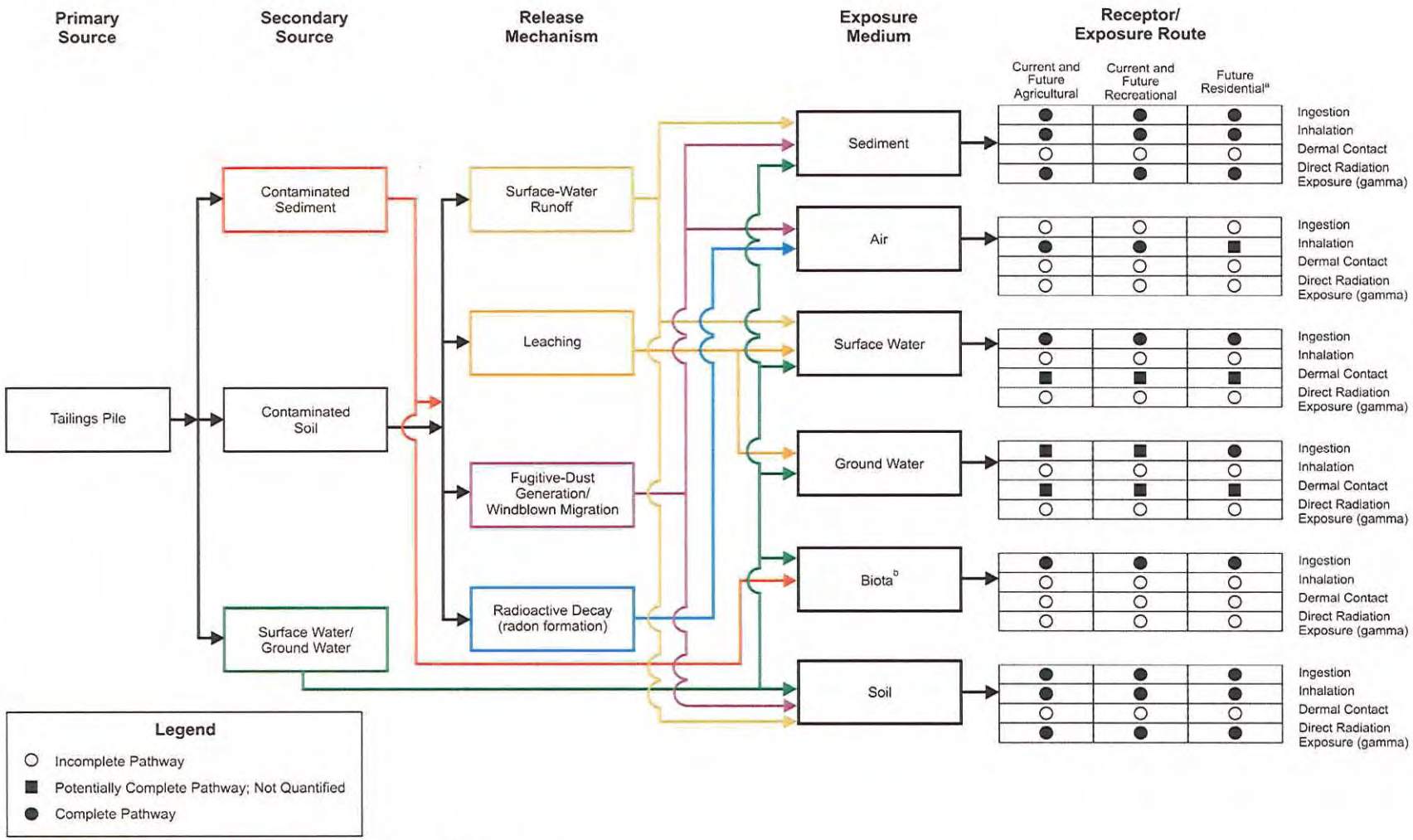
Table 1–4. 1998 RI Ecological Risk Assessment Contaminants of Concern

Chemical Toxicants			
Arsenic	Cobalt	Copper	Molybdenum
Nitrate	Lead	Selenium	Elemental Uranium
Vanadium	Zinc		
Radionuclides			
Lead-210	Radium-226	Thorium-230	Uranium-234
Uranium-235	Uranium-238		

1.4.4 Summary of 1998 RI Human Health Risk Assessment

The baseline HHRA completed in 1998 evaluated risks to human health from all sources of OU III contamination using standard EPA guidance documents (e.g., EPA 1989a). Figure 1–6 depicts the 1998 human health conceptual site model (CSM) for OU III. The CSM identifies three major categories of potential receptors: (1) current and future agricultural workers, (2) current and future recreational users, and (3) future residents.

The primary current (1998) populations exposed to contaminants within OU III were nearby residents who used the land along Montezuma Creek for agricultural (e.g., cattle grazing, elk ranching, growing alfalfa) or recreational (e.g., hunting) uses. In 1998, the assumed future use of the Montezuma Creek valley from the eastern Millsite boundary to the area where the canyon narrows in upper Montezuma Creek was considered (for slightly more intensive use) an



[a]Residential land use is assumed to occur only in upper Montezuma Creek.
[b]Includes terrestrial animals (e.g., cattle, deer), farm-grown crops, and garden vegetables.

Figure 1–6. Human Health Conceptual Site Model (1998 RI)

"extended backyard" for future nearby residents. East of this area to the downstream end of OU III, the 1998 uses (i.e., cattle grazing, occasional hunting, and recreation [recreational/agricultural scenario]) were thought to continue in the future because the more rugged nature of the terrain and the narrow valley floor would continue to prevent use as an extended backyard.

Exposure pathways included incidental ingestion of soil and water, inhalation of dust, and direct exposure to gamma radiation. The exposure pathway analysis developed for the 1998 RI (DOE 1998a) is summarized in Section 4, "Baseline Risk Assessment Update." Site-specific exposure factors were developed by DOE, EPA, and UDEQ in 1998 and were based on existing and anticipated future land use scenarios. Exposures were determined using both the reasonable maximum exposures (RMEs) and central tendency (CT) exposure parameters. RME is defined as exposure well above average but still within the range of possible values; it is analogous to "high-end" exposure estimates. CT uses exposure assumptions that result in average or best-estimate exposures, with a tendency to still be somewhat conservative. The major conclusions from the 1998 assessment of exposure were

- Future ground water ingestion results in the largest theoretical, but unlikely, exposure.
- Inhalation is a minor contributor to total risk.
- Intakes of contaminants from muscle tissue (beef/game) are much smaller than potential intakes from future ingestion of ground water. The comparatively low intakes by ingestion of beef and deer were confirmed in a sampling study conducted by EPA and UDEQ (Henningson 1997).

Carcinogenic risks were compared to the NCP acceptable cancer risk range of 10^{-6} to 10^{-4} (Title 40 *Code of Federal Regulations* Part 300 [40 CFR 300]). For noncarcinogens, hazard quotients (HQs) were summed to produce a hazard index (HI). An HI that exceeds 1.0 is a numerical indication of unacceptable exposure levels (EPA 1989b). An aggregate dose assessment was also conducted in which effective dose equivalent (EDE) was estimated by summing external gamma plus inhalation and ingestion of radionuclides that emit radiation to internal organs. EDE was compared to existing radiation protection benchmarks established by the U.S. Nuclear Regulatory Commission (NRC) of 25 millirem per year (mrem/yr) (NRC 1997) or Utah's dose limit for individual members of the public of 100 mrem/yr (R313-15-301, *Utah Administrative Code* [U.A.C.]).

Table 1–5 presents a summary of the results from the 1998 RI for the future-use residential exposure scenario (ground water ingestion, beef ingestion, and exposure from recreation and agricultural use of the contaminated area along Montezuma Creek); if this scenario occurs, it would result in the highest human health risks.

Table 1–5. Risk Characterization Summary: Future-Use Residential Scenario[a] (1998 RI)

Assessment	OU III Setting[b]		Background		Increment Above Background[c]		OU III Setting/ Background[g]	
	RME	CT	RME	CT	RME	CT	RME	CT
Added Cancer Risk, Nonradionuclides[d]	4.3×10^{-4}	7.0×10^{-5}	3.2×10^{-5}	5×10^{-6}	4×10^{-4}	6.5×10^{-5}	13	14
Added Cancer Risk, Radionuclides[e]	4.5×10^{-4}	9.0×10^{-5}	6.4×10^{-5}	9.0×10^{-6}	3.9×10^{-4}	8.1×10^{-5}	7.0	10
Hazard Index[f]	10.4	5.5	0.3	0.13	10.1	5.4	35	42
EDE (mrem/yr)	15.8	8.3	4.4	2.0	11.3	6.3	3.6	4.2

[a]The future-use residential scenario assumes the unlikely use of contaminated ground water as the sole drinking water source. This scenario also assumes exposure will occur from recreational/agricultural activities. Risks listed for background were estimated with the same exposure assumptions used for the OU III setting except background concentrations were used as the exposure point concentrations.
[b]Ingestion of ground water accounts for most of the total risk. For example, for added cancer risk, radionuclides for the RME and CT cases, ingestion of ground water accounts for 81.5 percent and 91.1 percent of the total risk, respectively.
[c]Example using added cancer risk, nonradionuclides: $4.3 \times 10^{-4} - 3.2 \times 10^{-5} = 4 \times 10^{-4}$.
[d]All of the risks in this category are attributable to arsenic.
[e]The risk drivers in this category are Pb-210, uranium-234, and uranium-238.
[f]For noncarcinogenic compounds, the risk drivers are uranium and vanadium.
[g]Example using added cancer risk, nonradionuclides: $4.3 \times 10^{-4} \div 3.2 \times 10^{-5} = 13$. Overall, this value provides a relative comparison between risks associated with site conditions versus background conditions. As this value increases, the relative site risks compared to background also increase.

Conclusions from Table 1–5:

- For the RME case for OU III, the added cancer risk estimates for nonradionuclides and radionuclides are within EPA's 10^{-6} to 10^{-4} risk range. The HI for noncarcinogens exceeds both the RME and CT cases. The excess is directly related to the unlikely assumption of future ground water ingestion.
- For the background setting, assuming RME and CT exposure factors, cancer risk estimates are within EPA's 10^{-6} to 10^{-4} risk range; the HI is less than 1.0.
- Incremental risks (i.e., the increase above background) are of the same order of magnitude as the risks associated with OU III.
- EDEs for OU III, background, and increment above background are below 25 mrem/yr, the 1998 benchmark.

Table 1–6 presents a similar summary from the 1998 RI for the current and future-use recreational and agricultural exposure scenario (this use is the same as the previous use except that it does not include ground water ingestion).

Table 1–6. Risk Characterization Summary: Current- and Future-Use Recreational and Agricultural Scenario (1998 RI)

Assessment	OU III Setting		Background		Increment Above Background[a]		OU III Setting/ Background	
	RME	CT	RME	CT	RME	CT	RME	CT
Added Cancer Risk, Nonradionuclides[b]	2.9×10^{-6}	1.5×10^{-7}	2.0×10^{-6}	1.1×10^{-7}	9×10^{-7}	4×10^{-8}	1.5	1.4
Added Cancer Risk, Radionuclides[c]	8.3×10^{-5}	8.1×10^{-6}	3.7×10^{-5}	3.6×10^{-6}	4.6×10^{-5}	4.5×10^{-6}	2.2	2.3
Hazard Index[d]	0.43	0.04	0.02	0.003	0.41	0.04	22	13
EDE (mrem/yr)	5.7	1.8	2.5	0.8	3.2	1.0	2.3	2.3

[a]Example using added cancer risk, nonradionuclides: $2.9 \times 10^{-6} - 2.0 \times 10^{-6} = 9 \times 10^{-7}$
[b]All of the risks in this category are attributable to arsenic.
[c]The risk driver in this category is external gamma.
[d]For noncarcinogenic compounds, the risk driver is uranium.

Conclusions from Table 1–6:

- For the RME and CT case for OU III and background, the added cancer risks for radionuclides are within or less than EPA's 10^{-6} to 10^{-4} risk range.
- HI is less than 1.0; EDE is less than 25 mrem/yr in all cases.

1.4.5 Summary of 1998 RI Ecological Risk Assessment

The ERA provided an evaluation of the potential risks to the environment associated with exposure to COCs. Evaluation of ecological data was guided primarily by EPA's *Framework for Ecological Risk Assessment* (EPA 1992a), and *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA 1997), and the OU III Ecological Technical Assistance Group (ETAG), which was formed under the direction of EPA Region 8.

The 1998 ecological CSM (Figure 1–7) identified soil, sediment, and surface water as contaminated media. Ground water and air were determined to be of negligible concern. Potential exposure routes included ingestion, direct contact, and inhalation, the last of which was considered to be unimportant. Potential ecological receptors selected were the deer mouse, mule deer, muskrat, southwestern willow flycatcher, spotted bat, peregrine falcon, and aquatic organisms. The southwestern willow flycatcher is a federally listed endangered species, and the spotted bat is considered a State-sensitive species. The peregrine falcon was federally listed at the time of the RI (DOE 1998a) but has since been removed from this list; however, the peregrine falcon is still protected by the Migratory Bird Treaty Act and is listed as a State-sensitive species.

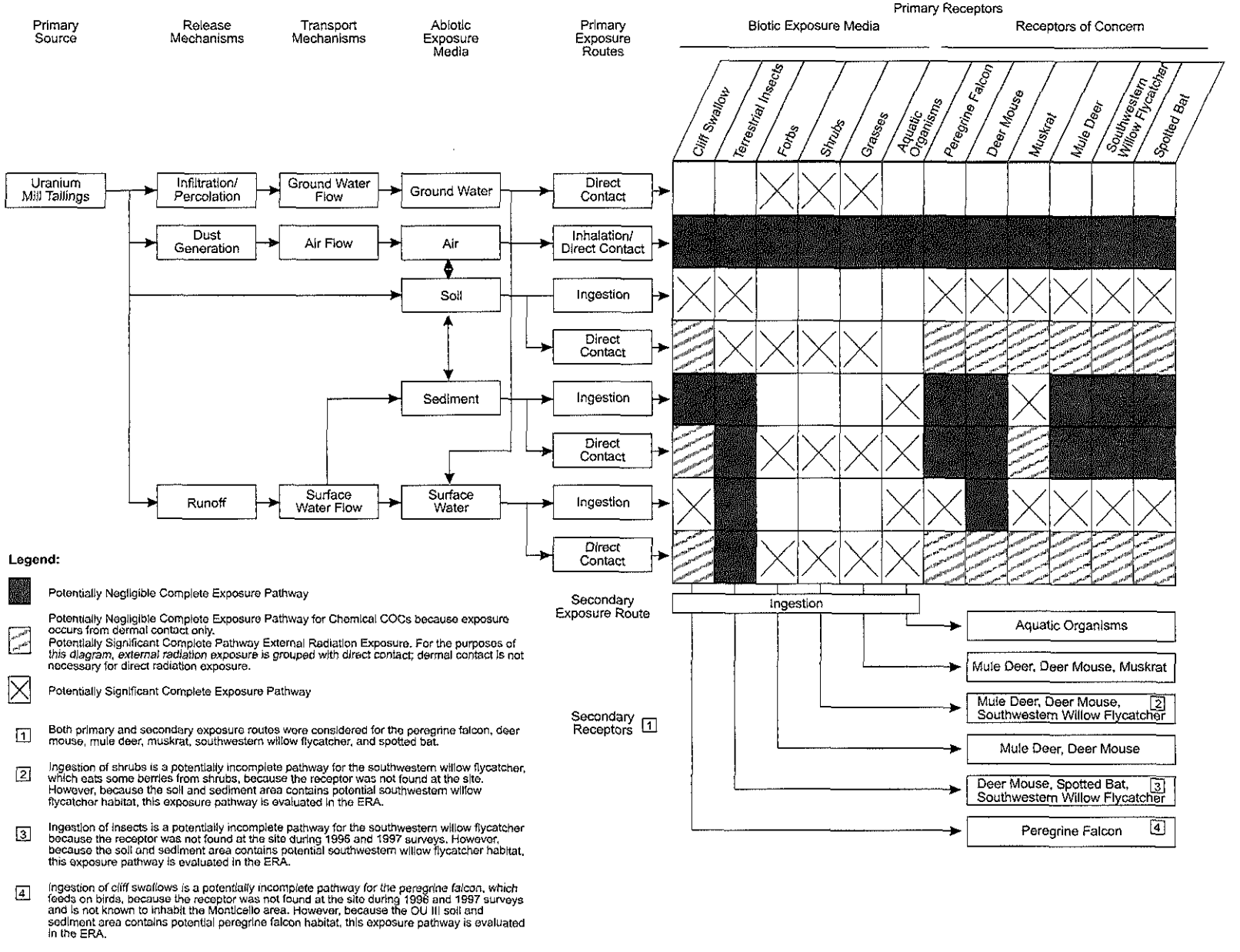


Figure 1–7. Ecological Conceptual Site Model (1998 RI)

Estimated doses to each receptor were compared to selected ecological benchmark values to identify the risk-driving exposure pathways and COCs for each receptor (Table 1–7). Risk-driving exposure pathways are those pathways that resulted in an HI greater than 1.0. Risk-driving COCs are those COCs with HQs greater than 1.0. For aquatic organisms, HQs were less than 1.0, indicating that neither surface water nor sediment are risk-driving exposure pathways.

Table 1–7. Risk-Driving Exposure Pathways and COCs (1998 ERA)

Receptor	Risk-Driving Exposure Pathway	Risk-Driving COCs[a]
Deer mouse	Invertebrate ingestion	Arsenic, copper, and vanadium
	Soil ingestion	Copper and vanadium
	Grass ingestion	Arsenic and copper
Mule deer	No single exposure pathway resulted in a hazard index (HI) > 1.0[b]	No individual COC resulted in a hazard quotient (HQ) > 1.0
Muskrat	Grass ingestion	Arsenic, copper, and vanadium
	Soil ingestion	Vanadium
	Sediment ingestion	Vanadium
Spotted bat	Invertebrate ingestion	Arsenic, copper, selenium, and vanadium
	Soil ingestion	Vanadium
Southwestern willow flycatcher	Invertebrate ingestion	Copper, selenium, and uranium
	Soil ingestion	Uranium
Peregrine falcon	No single exposure pathway resulted in an HI > 1.0	No individual COC resulted in an HQ >1.0
Aquatic organisms	Not applicable[c]	No individual COC resulted in an HQ > 1.0[d]

[a]HQs were calculated for individual COCs within an exposure pathway.
[b]The total HI (RME-based) for mule deer is greater than 1.0, but no one exposure pathway has an HI greater than 1.0. The HI for Montezuma Creek is equal to the HI for the reference area (Verdure Creek).
[c]Surface water and sediment ingestions (intakes) are not typically calculated for aquatic animals in ERAs. Instead, exposure point concentrations were compared to ambient water-quality criteria and to sediment-quality criteria to arrive at HQs. All comparisons to these benchmarks produce HQs less than 1.0, indicating that surface water and sediment are not risk-driving media for aquatic organisms.
[d]Cobalt was the only COC that had an HQ greater than 1.0; however, cobalt was not detected in any surface water sample. HQs greater than 1.0 for cobalt result from detection limits greater than the toxicity benchmark.

Predicted risk was compared with observed effects data from histopathological analyses, chemical analyses of tissue samples, and population surveys (for benthic macroinvertebrates) to validate or contradict findings from the modeled estimates of risk.

Receptor-specific risk was characterized as follows:

Deer Mouse

HIs for radiation exposure indicated that the deer mouse is not expected to be at risk from radiation exposure. HQ and HI calculations show that the deer mouse may be a possible concern. However, because of the conservative assumptions and uncertainties that bias toward overestimation of risk, the ERA concluded that the actual potential for adverse effects is expected to be low.

Mule Deer

Chemical analyses from tissue samples did not indicate that the mule deer was concentrating COCs in its tissues. The HIs were less than 1.0 for both radiation and chemical exposure, indicating that the potential for adverse effects to mule deer is considered to be of no concern.

Muskrat

The muskrat is not expected to be at risk from radiation exposure because the HIs were less than 1.0. Risk to muskrat through ingestion of grass and sediments is acceptable based on lowest observed adverse effects level toxicity values. Therefore, population risks through these pathways are expected to be of no concern. Because the ERA is biased toward overestimation of risks to the muskrat, it was concluded that the potential for adverse effects to the muskrat is expected to be low and of no concern.

Spotted Bat

The spotted bat is not expected to be at risk from radiation exposure because calculations of radiation exposure to the deer mouse, muskrat, and mule deer (the receptors that receive the highest dose) resulted in HIs less than 1.0. Based on lowest observed adverse effects level toxicity values, all pathways result in acceptable population risks.

Because of the conservative assumptions and uncertainties that bias toward overestimation of risk, the ERA concluded that the actual potential for adverse effects is expected to be low.

Southwestern Willow Flycatcher

The southwestern willow flycatcher is not expected to be at risk from radiation exposure because calculations of radiation exposure to the deer mouse, muskrat, and mule deer (the receptors that receive the highest radiation dose) resulted in HIs less than 1.0.

Because histopathologic analyses from a surrogate species (the cliff swallow) did not indicate any COC-related lesions, and chemical analyses of surrogate species' liver and kidney tissues did not indicate that the surrogate was concentrating COCs in its tissues, it is inferred that the dose modeling effort and resulting HIs that indicated a possible concern were overly conservative. Therefore, risk to the southwestern willow flycatcher is considered to be of no concern.

Peregrine Falcon

The peregrine falcon is not expected to be at risk from radiation exposure because calculations of radiation exposure to the deer mouse, muskrat, and mule deer (the receptors that receive the highest radiation dose) resulted in HIs less than 1.0. The peregrine falcon is not expected to be at risk from chemical COCs because HIs were also less than 1.0. Risk to the peregrine falcon is considered to be of no concern. In addition, the peregrine falcon has not been observed in OU III.

Benthic Macroinvertebrates

Risks to benthic macroinvertebrates may be of possible concern because analysis of benthic macroinvertebrate samples showed uptake of arsenic, molybdenum, uranium, and vanadium.

However, where aquatic benchmarks were available for these COCs, the HQs were less than 1.0, which indicates that the uptake should not produce an adverse effect. Differences in benthic community structure observed during population surveys can be attributed to differences in habitat between OU III and the reference area.

The ERA concluded that, by using a weight-of-evidence approach, all receptors chosen for evaluation in the ERA appear to be at no significant risk from exposure to surface water, soil, and sediment contamination.

1.5 Applicable or Relevant and Appropriate Requirements

The CERCLA response action for OU III surface water and ground water must comply with chemical-, location-, and action-specific ARARs and attain a degree of cleanup that ensures protection of human health and the environment. ARARs compliance must be met during the response as well as at its completion. Remedial actions that leave any hazardous substance, pollutant, or contaminant on site must meet a level or standard of control that at least attains standards, requirements, limitations, or criteria that are identified as applicable or relevant and appropriate for the site. Only substantive requirements must be met for on-site CERCLA activities; both substantive and administrative requirements must be met for off-site activities.

For OU III, chemical-specific ARARs set health- or risk-based concentration limits for the COCs in surface water and ground water. Location-specific ARARs establish additional requirements on the basis of unique characteristics of a site that could be affected as a result of remedial action. These ARARs may be used to restrict or preclude certain activities or remedial actions on the basis of location or characteristics of a site. Action-specific ARARs are performance, design, and other requirements that control remedial activities or actions. These requirements are not concerned with contaminants present or with site characteristics at the location but address how a selected remedial action alternative must be achieved. Action-specific requirements may specify particular performance levels, actions, or technologies, as well as specific levels (or a method for setting specific levels) for discharged or residual contaminants.

ARARs for MMTS were initially identified in the 1990 MMTS ROD. The 1990 MMTS ARARs were evaluated, and potential OU III ARARs were presented in Appendix A of the 1998 RI. These 1998 OU III ARARs have been reviewed and updated annually during the IRA and presented in the IRA progress reports. The following sections and tables represent the current analysis of potential OU III ARARs. Section 1.5.1 addresses potential federal ARARs for OU III surface water and ground water, and Section 1.5.2 addresses potential State ARARs for OU III surface water and ground water. Whether an ARAR is applicable or relevant and appropriate will depend on the specific remedy considered (see Section 5.6, "Detailed Analysis of Alternatives").

1.5.1 Federal ARARs

Potential federal ARARs for OU III surface water and ground water are discussed below. Only those federal requirements that are considered applicable or relevant and appropriate for OU III surface water and ground water are listed in
Table 1–8.

Table 1–8. Federal ARARs for OU III Surface Water and Ground Water

Standard, Requirement, Criterion, or Limitation	Citation	Description	Status	Comment
Safe Drinking Water Act National Primary and Secondary Drinking Water Standards	Title 42 *United States Code* Part 300(g) (42 U.S.C. 300[g]) 40 CFR Part 141 40 CFR Part 143	Establishes health-based standards for public water systems (maximum contaminant levels [MCLs]).	Relevant and appropriate through the State of Utah standards as a chemical-specific requirement.	Because the quality of water in the alluvial aquifer could allow it to be used as a drinking water aquifer, the MCLs may apply as cleanup standards.
Clean Water Act *Water Quality Criteria*	33 U.S.C. 1251–1376 40 CFR Part 131 "Quality Criteria for Water"	Criteria for states to set water quality standards on the basis of toxicity to aquatic organisms and human health.	Applicable through the State of Utah standards as a chemical-, location-, and action-specific requirement.	Addresses Montezuma Creek contamination.
National Pollutant Discharge Elimination System	40 CFR Parts 122 through 125	Establishes standards for discharges of pollutants into waterways and through the use of underground injection wells.	Applicable through the State of Utah standards as an action-specific requirement.	Potential storm-water discharges into Montezuma Creek must be controlled.
Dredge or Fill Requirements (Section 404)	40 CFR Parts 230 and 231 33 CFR Part 323 40 CFR Part 404	Regulates the discharge of dredged or fill material into navigable waters and manages wetland areas.	Applicable as location- and action-specific requirement.	Dredged or fill material requirements applicable through the State of Utah standards. EPA has jurisdiction over wetlands at CERCLA sites in the state.
Clean Air Act National Primary and Secondary Ambient Air Quality Standards	42 U.S.C. 7401–7462 40 CFR Part 50	Establishes standards for ambient air quality to protect public health and welfare.	Applicable through the State of Utah standards as a location- and action-specific requirement.	Fugitive dust could be generated through clearing of land or use of construction equipment.
Resource Conservation and Recovery Act	42 U.S.C. 40 CFR Parts 260–279	Regulates the generation, treatment, storage, and disposal of hazardous waste.	Applicable through the State of Utah standards as a chemical- and action-specific requirement.	Hazardous waste is not known to exist within OU III. However, these regulations will apply if hazardous waste is generated during the decommissioning of the PRB.

Table 1–8. Federal ARARs for OU III Surface Water and Ground Water (continued)

Standard, Requirement, Criterion, or Limitation	Citation	Description	Status	Comment
Uranium Mill Tailings Radiation Control Act (UMTRCA)	42 U.S.C. 2022, 42 U.S.C. 7901–7942	Establishes health-based ground water remediation standards for inactive uranium processing sites.	Relevant and appropriate chemical- and action-specific requirement.	Although the cleanup standards apply only to certain specifically designated sites where uranium was processed, the ground water cleanup standards are relevant and appropriate to the OU III selected remedy because uranium and vanadium were processed at this site.
Fish and Wildlife Coordination Act	16 U.S.C. 661–666 40 CFR 6.302(g)	Requires consultation when a federal department or agency proposes or authorizes any modification of any stream or other water body; requires adequate provisions for protection of fish and wildlife resources.	Relevant and appropriate as a location- and action-specific requirement.	The Montezuma Creek channel may be modified during OU III remedial activities, which may result in temporary habitat loss for wildlife species.
Endangered Species Act	16 U.S.C. 1531–1543 50 CFR Parts 17 and 402 40 CFR 6.302(h)	Requires that Federal agencies ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.	Applicable as a location- and action-specific requirement.	Although threatened and endangered species have not been identified in OU III, the MMTS is within the possible range of some of these species.
Floodplain/Wetlands Environmental Review	40 CFR Part 6, Appendix M	Establishes agency policy and guidance for carrying out the provisions of Executive Orders 11988, "Floodplain Management," and 11990, "Protection of Wetlands."	Applicable as a location- and action-specific requirement.	Remediation could affect site floodplains and wetlands.
National Environmental Policy Act (NEPA)	40 CFR 1500 10 CFR 1021	Requires that all federally undertaken actions be assessed for potential environmental impacts. All potential environmental impacts must be properly mitigated.	Relevant and appropriate as a location- and action-specific requirement.	NEPA values have been and will be incorporated in the CERCLA documentation.

Safe Drinking Water Act

The requirements of this act and its corresponding regulations address public water systems. The requirements are implemented by the State of Utah through the federally approved program under the SDWA. See the discussion in Section 1.5.2, "Drinking Water" for an ARARs determination.

Federal Water Pollution Control Act, as Amended by the Clean Water Act

Water Quality Criteria

The water quality criteria of this act and its corresponding regulations set water quality standards on the basis of toxicity to aquatic organisms and human health, and manage storm-water discharges. The requirements are implemented by the State of Utah through federally approved programs under the Clean Water Act. See the corresponding discussions in Section 1.5.2 (Water Quality Rules, Standards of Quality for Waters of the State, Ground Water Quality Protection, Underground Injection Control Program, and Utah Pollutant Discharge Elimination System [UPDES]) for ARARs determinations.

Dredge or Fill Requirements (Section 404)

The provisions of 40 CFR 230 and 231 and 33 CFR 323 regulate activities associated with discharging dredged or fill material into waters of the U.S. Navigable waters and isolated wetlands are protected under the jurisdiction of the U.S. Army Corps of Engineers (USACE); a general permit (GP–40) was issued by the Corps of Engineers to the State authorizing the State Engineer to regulate the discharge of dredged or fill material into Utah streams. See the discussion in Section 1.5.2 for an ARARs determination.

The discharge of dredged or fill materials into waters of the U.S. (including wetland areas) is regulated by EPA rather than the Corps of Engineers for CERCLA sites. Wetland areas have been identified and delineated throughout OU III. Guidelines of the Monticello Wetlands Master Plan (DOE 1996), which was developed to adhere to these applicable location- and action-specific requirements, and which has been approved by EPA, will be followed for any wetland area disturbance, remediation, and restoration activities that occur in association with the selected OU III surface water and ground water remedy.

Clean Air Act

The requirements of this act and its corresponding regulations seek to protect and enhance the quality of the nation's air resources in order to promote public health and welfare and the productive capacity of the nation's population. The requirements are implemented by the State of Utah through the federally approved program under the Clean Air Act. See the discussion in Section 1.5.2 (Air Quality) for an ARARs determination.

Resource Conservation and Recovery Act

The requirements of this act and its corresponding regulations address the generation and management of hazardous waste (RCRA Subpart C), and the management of underground

storage tanks (USTs) containing regulated substances (RCRA Subpart I). The requirements are implemented by the State of Utah through the federally approved program under the Resource Conservation and Recovery Act (RCRA), as amended. None of the alternatives considered for detailed evaluation in the FFS (Section 5.6) are expected to generate a hazardous waste; the zero-valent iron (ZVI) when removed from the PRB should not be considered a characteristic waste because the contaminants concentrated within the ZVI are by-product material excluded from RCRA according to 40 CFR 261.4(a)(4), and no USTs are present within OU III. However, the reactive media (ZVI) in the PRB will be characterized when the PRB is decommissioned to determine a suitable disposal facility. See discussion in Section 1.5.2 for an ARARs determination.

Uranium Mill Tailings Radiation Control Act

The requirements of this act and its corresponding regulations, promulgated at 40 CFR 192, are not applicable because the site does not meet the statutory or jurisdictional prerequisites that apply only to 24 specifically identified inactive uranium mills and mill tailings sites. However, these requirements are "relevant and appropriate" for the selected OU III surface water and ground water remedy because mill tailing contaminants have been dispersed into the environment. Included in these requirements are the cleanup standards for remedial actions at inactive uranium-ore processing sites with ground water contamination and the process for determining and implementing alternate concentration limits (alternate cleanup standards). Therefore, these federal requirements are relevant and appropriate chemical- and action-specific requirements for the selected OU III surface water and ground water remedy.

National Historic Preservation Act

This act (16 U.S.C. 470) and its corresponding regulations require federal agencies to take into account the effect of any federally assisted undertaking or licensing on a structure or object that is included on or eligible to the National Register of Historic Places. Because no structures or objects exist near OU III for which a determination of eligibility could be made, these federal requirements are not applicable location- and action-specific requirements for the selected OU III surface water and ground water remedy.

Archaeological and Historical Preservation Act

This act and its corresponding regulations establish procedures to provide for the preservation of historical and archaeological resources that may be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. Although archaeological survey results identify regulated resources near OU III, none of the alternatives considered for evaluation in the FFS (Section 5.6) would occur near the identified areas, and there would be no impact to archaeological or historical resources. Therefore, these federal regulations are not considered applicable or relevant and appropriate action-and location-specific requirements for remedial activities associated with the selected OU III surface water and ground water remedy.

Fish and Wildlife Coordination Act

This act and its corresponding regulations require consultation with the U.S. Fish and Wildlife Service whenever a federal department or agency proposes or authorizes modification of any stream or other body of water and requires adequate provisions for the protection of fish and wildlife resources. Flora and fauna surveys identified no fish in Montezuma Creek within OU III but showed that a short-term loss of habitat for wildlife may result if the Montezuma Creek channel is modified. Because the Montezuma Creek channel may be temporarily disturbed during implementation of the selected remedial alternative, these federal requirements are relevant and appropriate location- and action-specific requirements for the selected OU III surface water and ground water remedy.

Endangered Species Act

This act and its corresponding regulations require federal agencies to ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat required for the continued existence of that species. None of the alternatives considered for detailed evaluation in the FFS (Section 5.6) would cause a reduction in Montezuma Creek flow volumes, which may have affected endangered fish in the San Juan River. Although results of surveys conducted by DOE indicate that threatened and endangered species are not present in or near Montezuma Creek within OU III or at or near MMTS, the Monticello area is considered to be within the range of some threatened and endangered species. Therefore, these federal requirements are applicable requirements for the OU III selected remedy.

Bald and Golden Eagle Protection Act

This act and its corresponding regulations, which are administered by the U.S. Fish and Wildlife Service, provide for the preservation of bald and golden eagles through the protection of the individual raptor and its progeny. On the basis of survey information, neither bald nor golden eagles reside at or near the MMTS. Therefore, these federal requirements are not applicable or relevant and appropriate to the OU III selected remedy.

Executive Orders 11988—Floodplain Management, and 11990—Protection of Wetlands

These presidential orders and their corresponding regulations require federal agencies to evaluate actions they may take to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain or wetland. The 10 CFR 1022 "Compliance with Floodplain/Wetlands Environmental Review Requirements" was issued to implement the requirements of Executive Orders 11988 and 11990. Activities associated with the OU III remedy may affect site floodplains and wetlands. Therefore, these orders and their corresponding regulations are applicable federal location- and action-specific requirements.

Farmland Protection Policy Act

The purpose of this act and its corresponding regulations is to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of prime, unique, or

important farmlands to nonagricultural uses. This requirement is administered through the National Resource Conservation Service. Because prime, unique, or important farmlands are not located within OU III, these federal requirements are not applicable or relevant and appropriate to the selected OU III surface water and ground water remedy.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) and its corresponding regulations are relevant and appropriate location- and action-specific federal requirements for all federally funded projects and programs, including any activities associated with the selected OU III surface water and ground water remedy. Additional guidance that would be considered under NEPA includes the Council on Environmental Quality regulations, 40 CFR 1500; DOE NEPA regulations, 10 CFR 1021; DOE Order 451.1, Implementation of NEPA; and Secretarial Policy Statement on the National Environmental Policy Act (issued June 1994). NEPA values have been and will be incorporated into the CERCLA documentation.

1.5.2 State of Utah ARARs

Because MMTS is in Utah, compliance with all state-specific environmental rules, regulations, standards, criteria, or limitations that are applicable or relevant and appropriate to the selected OU III surface water and ground water remedy is mandatory. This section addresses State of Utah requirements and identifies how each may pertain to OU III surface water and ground water. The authorization process for allowing a state to implement a federal program is generally a phased process. Because of this, the state may not have adopted a specific rule or portion of a regulatory program. In such instances, if a nonadopted rule or regulation in a state-implemented program is an ARAR, the federal standards will apply. A list of applicable or relevant and appropriate State of Utah requirements for OU III surface water and ground water is presented in Table 1–9.

Drinking Water

Drinking Water Rules—These rules represent the State's implemented version of the federal Safe Drinking Water Act's National Primary and Secondary Drinking Water Regulations, which contain criteria and procedures to ensure a supply of drinking water that dependably complies with maximum contaminant levels. They include quality control and testing procedures that ensure proper operation and maintenance of a potable public water supply system, specify the minimum quality of water that may be taken into the system, and provide siting requirements for new facilities for public water systems. They also establish maximum contaminant levels that may be considered when establishing cleanup standards. In December 2000, EPA promulgated standards for radionuclides, including uranium. These new standards limit the amount of radionuclides allowed in drinking water. The new rules, which have not yet been adopted by Utah, become effective in December 2003.

Because the alluvial aquifer is not used as a public water supply system, these requirements are not applicable. However, because the alluvial aquifer is of a quality that would allow it to be used as a drinking water source, the Utah Drinking Water Rules are relevant and appropriate chemical-specific requirements for the selected OU III surface water and ground water remedy.

Table 1–9. State ARARs for OU III Surface Water and Ground Water

Department/Division	Subject	Statute	Rule	Comments
Department of Environmental Quality, Division of Drinking Water	Safe Drinking Water Rules	Title 19, Chapter 4, Utah Code Annotated (U.C.A.)	R309, Utah Administrative Code (U.A.C.)	This is the State-implemented Safe Drinking Water Act program. The quality of the alluvial aquifer could allow it to be used as a drinking-water aquifer. Relevant and appropriate chemical-specific requirement.
Department of Environmental Quality, Division of Water Quality	Definitions and General Requirements	Title 19, Chapter 5, U.C.A.	R317-1, U.A.C.	Applicable chemical-, location-, and action-specific requirement.
	Standards for Quality for Waters of the State	Title 19, Chapter 5, U.C.A.	R317-2, U.A.C.	These rules are specific to Utah waters, though *they are derived in part by using federal criteria.* See particularly the nondegradation policy in R317-2-3. Applicable chemical-, location-, and action-specific requirement.
	Groundwater Quality Protection	Title 19, Chapter 5, U.C.A.	R317-6, U.A.C.	There is no corresponding federal program. Applicable chemical-, location-, and action-specific requirement.
	Utah Underground Injection Control	Title 19, Chapter 5, U.C.A.	R317-7, U.A.C.	Applicable chemical- and action-specific requirement if Class V injection wells are used in association with the selected ground water remedy.
	Utah Pollutant Discharge Elimination System	Title 19, Chapter 5, U.C.A.	R317-8, U.A.C.	Applicable location- and action-specific requirement for controlling storm-water runoff into Montezuma Creek associated with construction activities.
Department of Environmental Quality, Division of Air Quality	Utah Air Conservation Rules	Title 19, Chapter 2, U.C.A.	R307-1 and R307-12, U.A.C.	This is the State-implemented National Primary and Secondary Ambient Air Quality Standards program. These rules are applicable through the State of Utah standards as a location- and action-specific requirement for controlling fugitive dust emissions from OU III.

Table 1–9. State ARARs for OU III Surface Water and Ground Water (continued)

Department/Division	Subject	Statute	Rule	Comments
Department of Environmental Quality, Division of Solid and Hazardous Waste	Hazardous Waste Management Rules (RCRA Subpart C)	Title 19, Chapter 6, Part 1, U.C.A.	R315, U.A.C.	The rules are applicable chemical- and action-specific requirements through the State of Utah standards; hazardous waste is not known to exist within OU III. However, these regulations will apply if hazardous waste is generated during the decommissioning of the PRB.
Department of Environmental Quality, Division of Radiation Control	Radioactive Material Management	Title 19, Chapter 3, U.C.A.	R313-12, R313-15-301, R313-19 through R313-22, and R313-25-18 through R313-25-22, U.A.C.	These provisions address the safe management, including disposal, of radioactive material. They also address standards for protection against radiation and licensing requirements. These State requirements are applicable chemical- and action-specific requirements.
Department of Environmental Quality, Division of Environmental Response and Remediation	Corrective Action Cleanup Standards Policy for CERCLA and Underground Storage Tank Sites	Title 19, Chapter 6, Part 1, U.C.A.	R311B211, U.A.C.	Remediation strategy must achieve compliance with this policy that sets forth criteria for establishing cleanup standards and requires source control or removal, and prevention of further degradation. This policy is an applicable chemical-, location-, and action-specific State requirement.
Department of Natural Resources, Division of Water Rights	Well-drilling standards (standards for drilling and abandonment of wells)	73B3B25(2)(b), U.C.A.	R655B4, U.A.C.	Includes such requirements as performance standards for casing joints and requirements for abandoning a well. Also included are water rights issues associated with consumptive use. This law is applicable to all drilling anticipated for any of the alternatives and for any planned water use. Applicable action- and location-specific requirement.
	Dredge or fill requirements, including stream channel alteration.	73–3–29, U.C.A.		Applicable location- and action-specific requirement.

Water Quality

This is the State-implemented version of the federal Clean Water Act program.

Water Quality Rules

The definitions for water pollution and the general requirements are applicable chemical-, location-, and action-specific requirements for the selected OU III surface water and ground water remedy.

Standards of Quality for Waters of the State

The Clean Water Act provides criteria for states to set water quality standards on the basis of toxicity to aquatic organisms and human health. These rules are specific to Utah waters and are applicable chemical-, location-, and action-specific requirements for the selected OU III surface water and ground water remedy.

Ground Water Quality Protection

This rule addresses Utah-specific ground water protection standards. It identifies ground water classes and protection levels and requires the use of discharge permits for facilities that discharge pollutants into ground water. An equivalent federal program does not exist. These ground water rules are applicable chemical-, location-, and action-specific state requirements for the selected OU III surface water and ground water remedy.

Utah Underground Injection Control

This regulation addresses the use of Class V injection wells (i.e., underground discharges of water). The rules associated with this regulation are applicable chemical- and action-specific State requirements if aquifer reinjection is included in the selected OU III surface water and ground water remedy.

Utah Pollutant Discharge Elimination System

The UPDES rules address point-source discharges of pollutants and storm-water discharges into Utah waterways. No point-source discharge into Montezuma Creek will occur with any of the alternatives considered for evaluation in the FFS (Section 5.6); however, storm-water runoff associated with construction activities may occur. Therefore, these rules are applicable location- and action-specific State requirements for the selected OU III surface water and ground water remedy.

Dredge or Fill Requirements (Section 404)

These rules, which are implemented by the State Engineer, are applicable location- and action-specific requirements for any dredge or fill activities in Montezuma Creek, including stream channel alterations, associated with the selected OU III surface water and ground water remedy.

Air Quality

The Utah Air Conservation Rules address the prevention and control of air pollution sources in Utah and establish air quality emission standards and monitoring requirements. Air emissions will not occur as part of any of the OU III alternatives considered for evaluation in the FFS (Section 5.6) but fugitive dust could be generated through the clearing of land and use of construction equipment. Therefore, the State-implemented version of the federal National Primary and Secondary Ambient Air Quality Standards program, which establish standards for ambient air quality are applicable location- and action-specific state requirements for the selected OU III surface water and ground water remedy.

Utah Hazardous Waste and Underground Storage Tank Management

Subpart C of RCRA addresses the generation, treatment, storage, disposal, and transportation of hazardous waste. Part 261.4 (a)(4) of 40 CFR excludes mill tailings (source, special nuclear, or by-product material, as defined by the Atomic Energy Act of 1954) from meeting the definition of a hazardous waste. Subpart I of RCRA regulates USTs that are used to store regulated substances. On the basis of historical land-use knowledge and field investigations, hazardous waste or USTs are not present within OU III. All of the alternatives considered for detailed evaluation in the FFS (Section 5.6) include decommissioning of the PRB. The PRB material will be characterized during decommissioning to determine disposal requirements. Therefore, the hazardous waste rules and UST requirements are applicable chemical- and action-specific State requirements to the selected OU III surface water and ground water remedy.

Corrective Action Cleanup Standards Policy for CERCLA and Underground Storage Tank Sites

This policy is a Utah-specific requirement that establishes a cleanup standards policy for CERCLA and UST sites. The policy sets forth criteria for establishing cleanup standards and requires source control or removal, and prevention of further degradation. This policy is an applicable chemical-, location-, and action-specific state requirement for the selected OU III surface water and ground water remedy.

Radioactive Material Management

These State rules address the management, including disposal and transportation, of radioactive materials. They also address licensing requirements and standards for protection against radiation. These rules are applicable chemical- and action-specific state requirements for the selected OU III surface water and ground water remedy.

Utah State History

These requirements address the protection of archaeological, anthropological, and paleontological resources on State lands and lands associated with projects conducted or approved by State agencies. Disturbance of the land associated with the remedial alternatives being considered for OU III would only occur in areas already remediated by OU I or OU II.

Therefore, OU III activities could not uncover a resource previously unknown. These location- and action-specific state requirements are not applicable to activities associated with the selected OU III surface water and ground water remedy.

Water Rights

These requirements, which include well-drilling and abandonment standards and consumptive use of water not already permitted to OU I, are applicable action- and location-specific State requirements for the selected OU III surface water and ground water remedy.

1.5.3 To Be Considered

This section discusses guidance, advisories, or criteria that are not promulgated, and therefore cannot be considered ARARs, but that may be used to establish protective CERCLA remedies for the OU III surface water and ground water.

Implementation Guidance for Radionuclides

EPA addresses monitoring of radionuclides in drinking water in the draft Implementation Guidance for Radionuclides (EPA 2000). This guidance discusses circumstances that could require monitoring of radionuclides at the point of entry to the distribution system instead of at the tap. Thus, the quality criteria would apply to the raw water (within the ground water system) instead of the water potentially treated by the public drinking water treatment system.

EPA Region III Risk-Based Concentration Table

The EPA Region III Risk-Based Concentration Table (EPA 2003) is pertinent guidance for OU III because it uses established toxicity factors, combined with standard exposure scenarios, to calculate chemical concentrations in water and soil that correspond to fixed levels of risk for humans. The Risk-Based Concentration Table is available on the Internet at **http://www.epa.gov/reg3hwmd/risk/index.htm.**