1 of 2

DOE/EA-0339

ENVIRONMENTAL ASSESSMENT OF REMEDIAL ACTION AT THE SLICK ROCK URANIUM MILL TAILINGS SITES SLICK ROCK, COLORADO

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DISCLAIMER

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ASSP	alternate-site selection process
BLM	Bureau of Land Management
EA	environmental assessment
μR/hr	microröentgens per hour
MCL	maximum concentration limit
mg/L	milligrams per liter
MSL	mean sea level
NC	North Continent
NEPA	National Environmental Policy Act
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/m^{2}s	picocuries per square meter per second
PMP	probable maximum precipitation
POC	point of compliance
ppm	parts per million
Ra-226	radium-226
RAC	Remedial Action Contractor
Rn-222	radon-222
SHPO	State Historic Preservation Office
TDS	total dissolved solids
Th-230	thorium-230
TSP	total suspended particulates
UC	Union Carbide
UMTRA	Uranium Mill Tailings Remedial Action
WLM	working level month

1.0 SUMMARY

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) authorized the U.S. Department of Energy (DOE) to clean up two uranium mill tailings processing sites near Slick Rock, Colorado, in San Miguel County. The purpose of the cleanup is to reduce the potential health effects associated with the radioactive materials remaining on the sites and on vicinity properties (VP) associated with the sites. The U.S. Environmental Protection Agency (EPA) promulgated standards for the UMTRCA that contained measures to control the contaminated materials and to protect the groundwater from further degradation. Remedial actions at the Slick Rock sites must be performed in accordance with these standards and with the concurrence of the U.S. Nuclear Regulatory Commission (NRC).

Contaminated materials cover an estimated 55 acres (ac) [22 hectares (ha)] of the Union Carbide (UC) processing site and 12 ac (4.9 ha) of the North Continent (NC) processing site. The sites are within 1 mile (mi) [1.6 kilometers (km)] of each other and are adjacent to the Dolores River. The sites contain concrete foundations of mill buildings, tailings piles, and areas contaminated by windblown and waterborne radioactive tailings materials. The total estimated volume of contaminated materials is approximately 620,000 cubic yards (yd^3) [470,000 cubic meters (m^3)]. In addition to the contamination in the two processing site areas, four VPs were found to contain contamination. Contamination associated with the UC and NC sites has leached into the groundwater. The closest residence is approximately 0.3 air mi (0.5 km) from either site.

The proposed action is to remediate the UC and NC sites. Remediation would be performed by the DOE's Uranium Mill Tailings Remedial Action (UMTRA) Project. Remediation would consist of removing all contaminated materials within the designated site boundaries or otherwise associated with the sites and stabilizing them at a location approximately 5 road mi (8 km) northeast of the sites on land administered by the Bureau of Land Management (BLM). All contaminated materials would be buried under 5 feet (ft) [1.5 meters (m)] of rock and soil materials. The proposed disposal site area is currently used by ranchers for cattle grazing over a 7-month period. The closest residence to the proposed disposal site is 2 air mi (3 km). An estimated 65 ac (26 ha) would be permanently transferred from the BLM to the DOE and restricted from future uses.

The materials would be transported via existing roads. An estimated 2 mi (3 km) of the roads would need to be upgraded. The remainder of the route would use an existing two-lane state highway.

Adverse impacts associated with the proposed action would include the temporary and permanent loss of wildlife habitat. No known Federally listed wildlife or plant species would be directly affected by project activities. Remedial action would require use of water from the Dolores River that would result in a cumulative effect due to water use in other parts of the river. The cumulative impact may affect four endangered fish species. Formal consultation would be initiated with the Fish and Wildlife Service to mitigate this

impact. Although there are two known sites with potential cultural resource significance within the boundaries of the proposed disposal site, appropriate mitigation would be used to protect the sites or retrieve data prior to any disturbance.

Positive impacts associated with the proposed action would include a reduction in potential health effects related to the presence of contaminated materials and increases in local expenditures and employment related to the remedial action.

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2.0 INTRODUCTION

In response to concern over the potential public health hazards related to uranium mill tailings and the associated contaminated materials left abandoned or otherwise uncontrolled at inactive processing sites throughout the United States, Congress enacted Public Law 95-604, the UMTRCA, on November 8, 1978. In the UMTRCA, Congress acknowledged that potential health hazards are associated with uranium mill tailings and identified a number of sites that are in need of remedial actions. The UC and NC processing sites near Slick Rock, Colorado, are two of these sites (Figure 2.1). The DOE, through the UMTRA Project Office, is responsible for ensuring that all proposed remedial actions comply with the intent of the UMTRCA.

Uranium mill tailings are the residues of uranium ore processing operations. They consist of finely ground rock, similar to sand. The principal potential hazard associated with the tailings results from the production of radon, a radioactive gas formed by the radioactive decay of the radium contained within the tailings. Radon can move through the tailings into the air. Increased exposure to radon and its decay products over a long period of time increases the probability that health effects (*e.g.,* cancers) may develop in persons living and working near the tailings. Another hazard is associated with the radioactive and other hazardous elements in the tailings leaching through the underlying soils and rock and contaminating the groundwater.

If the tailings and associated contaminated materials are not properly stabilized, natural processes such as wind and water erosion, burrowing by animals, or removal of the materials by humans could spread the contamination and increase the potential for public health hazards. To protect public health, the EPA promulgated the standards for remedial actions under the UMTRCA in 40 CFR Part 192, *Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings*.

On September 3, 1985, the U.S. Court of Appeals for the Tenth Circuit remanded the EPA groundwater standards portion of 40 CFR Part 192 [(40 CFR 192.20(a)(2) and (3)]. The EPA subsequently proposed new groundwater standards that, although not final at the time of this writing, are nonetheless applicable to the remedial action at the UC and NC sites near Slick Rock. Compliance with the proposed standards is evaluated in this environmental assessment (EA); however, the need for groundwater restoration at the UC and NC sites will be evaluated after the proposed EPA groundwater standards are final as part of a separate National Environmental Policy Act (NEPA) process.

2.1 DESCRIPTION OF THE PROCESSING AND DISPOSAL SITES

Table 2.1 shows the estimated volume of contaminated materials at the UC and NC processing sites. These sites are described in Sections 2.1.1 and 2.1.2.

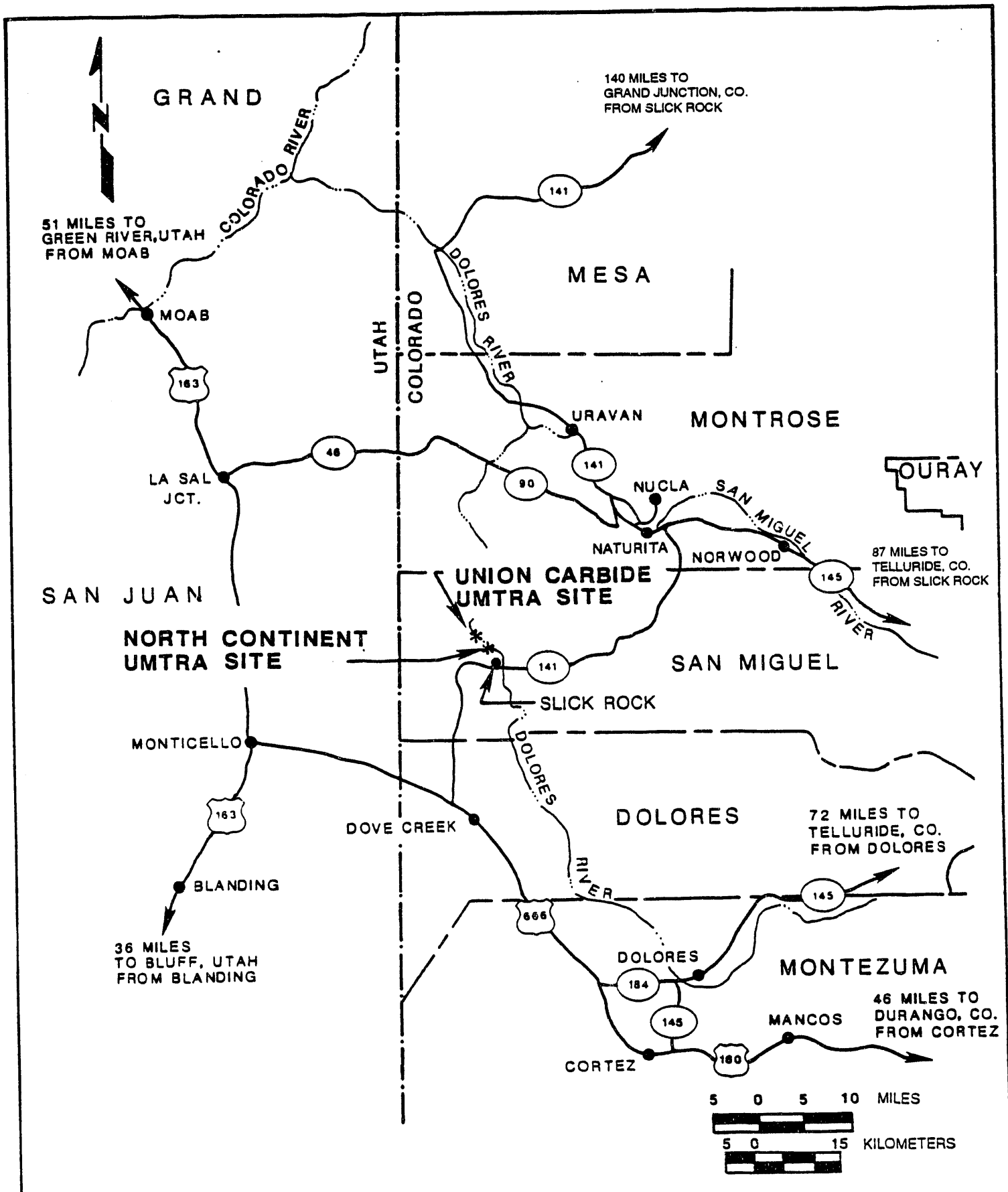


FIGURE 2.1
LOCATIONS OF THE UNION CARBIDE AND NORTH CONTINENT UMTRA SITES NEAR SLICK ROCK, COLORADO

Table 2.1 Estimated volume of contaminated material at the Slick Rock processing sites

Site/type of material	Volume	
	yd^3	m^3
UC site		
Tailings	342,000	262,000
Soil below tailings	104,000	79,500
Windblown or waterborne soil	88,000	67,000
	534,000	408,500
NC site		
Tailings	31,700	24,200
Soil below tailings	18,800	14,400
Windblown or waterborne soil	34,300	26,200
	84,800	64,800

Ref: MK Corporation, 1993.

2.1.1 Union Carbide processing site

The UC processing site is immediately south of the Dolores River and about 2 road mi (5 km) northwest of the Slick Rock, Colorado, post office (Figures 2.2 and 2.3). Due to the sharp bends in the Dolores River, the distance from the tailings pile to the river ranges from 15 to 150 ft (4.6 to 46 m). The UC processing site covers an estimated 55 ac (22 ha).

The mill became operational in September 1957 and ceased operations in December 1961. Ore containing uranium and vanadium was mined in the Slick Rock area and trucked to the mill. The ore was upgraded, then trucked to a UC mill in Rifle, Colorado (FBDU, 1981).

After the mill closed in 1961, the tailings pile was covered with 6 inches (in) [15 centimeters (cm)] of soil obtained from areas adjacent to the pile and vegetated. The pile has vegetation covering 20 percent of the surface (FBDU, 1981). All of the mill buildings have been removed from the site, although concrete foundations remain. San Miguel County has constructed a volunteer fire station on the UC site. The former recreational building and dormitory remain off the site. Mobile homes have been removed from a trailer park area off the site, near the tailings pile; an off-site gas sweetener plant is currently unoccupied. Windblown contamination from tailings left on the site extends downriver and across the mesa from the UC site. Seepage from the UC tailings pile has contaminated the groundwater in the alluvium beneath the pile.

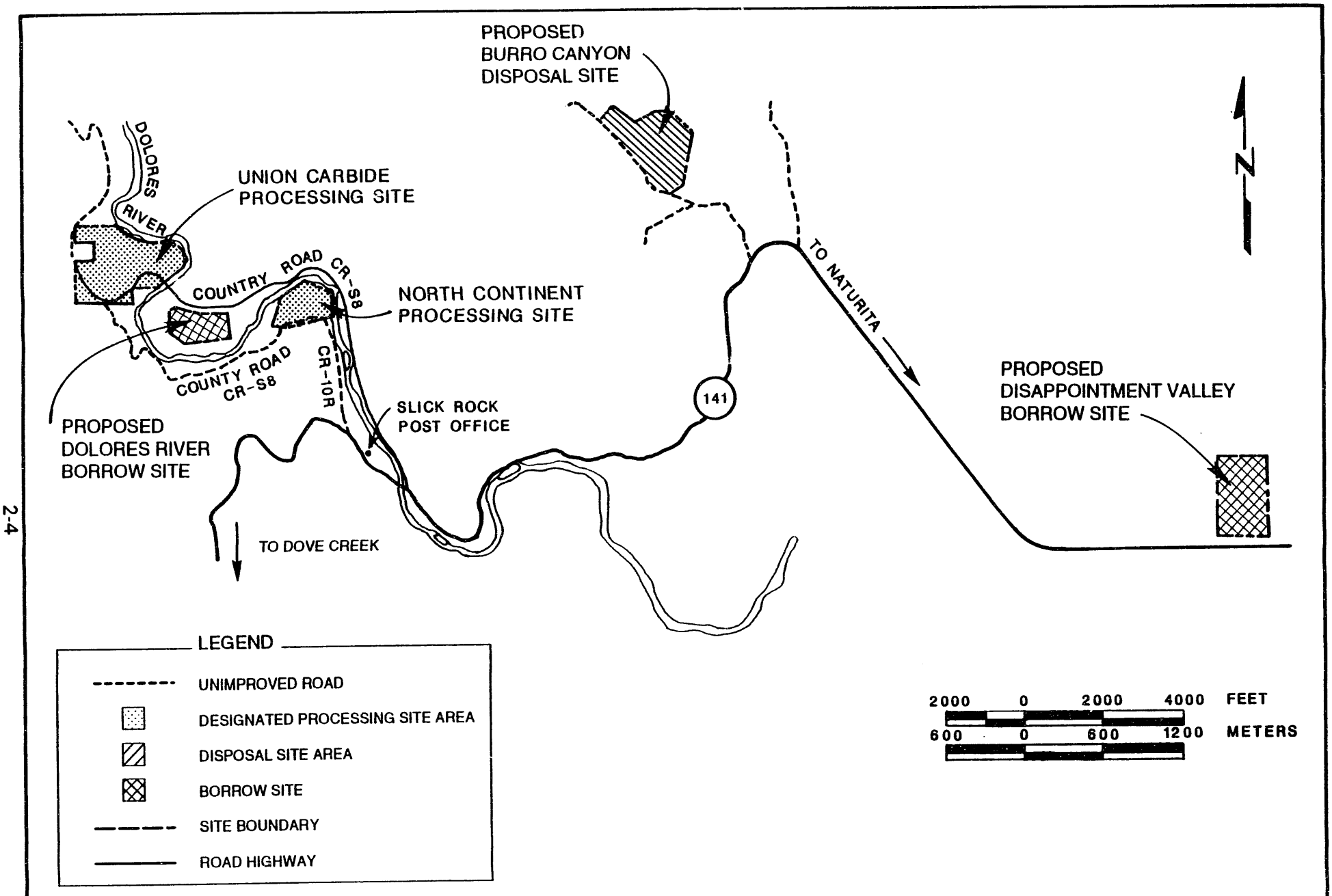


FIGURE 2.2
LOCATIONS OF THE UMTRA PROCESSING, DISPOSAL, AND BORROW SITES NEAR SLICK ROCK, COLORADO

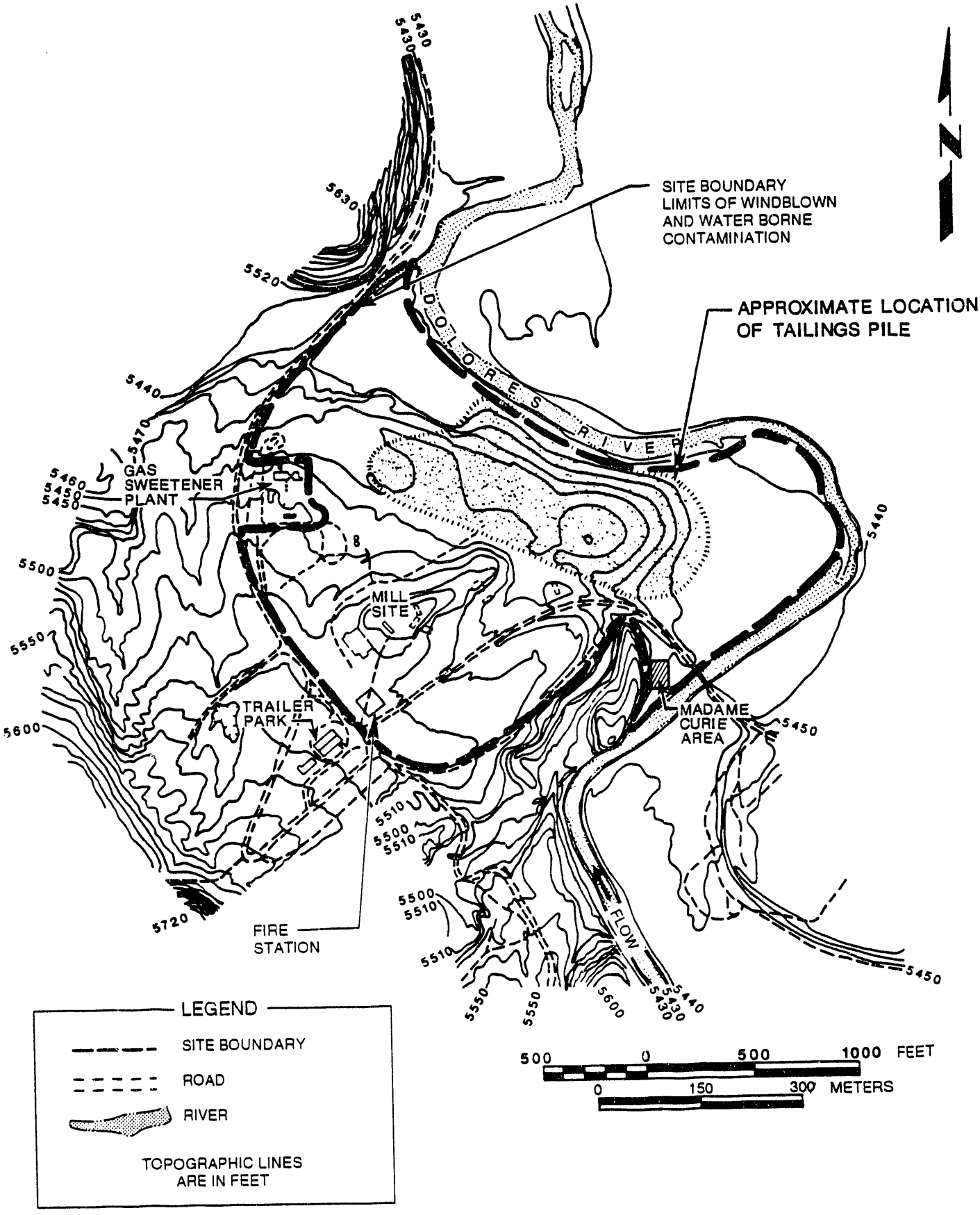


FIGURE 2.3
LOCATION OF THE UNION CARBIDE
UMTRA SITE NEAR SLICK ROCK, COLORADO

2.1.2 North Continent processing site

The NC site is located on approximately 12 ac (4.9 ha) and is adjacent to the Dolores River, approximately 1 road mi (1.6 km) east of the UC site and approximately 1 road mi (1.6 km) northwest of the Slick Rock, Colorado, post office (Figure 2.4). The original owner of the site, Shattuck Chemical Company, began operations in 1931. North Continent Mines Inc. acquired the site in 1934. Title was subsequently passed to several other companies, including Union Carbide, the current owner, in 1957. The NC site also received uranium- and vanadium-bearing ore that was mined near Slick Rock.

After milling operations were discontinued in the early 1960s, the pile was covered with 6 in (15 cm) of soil and vegetation. Seepage from the NC tailings pile has contaminated the groundwater in the alluvium beneath the site. There are no structures on the NC site.

2.1.3 Burro Canyon disposal site

The proposed Burro Canyon disposal site is located on BLM-administered land approximately 5.7 mi (9.1 km) east of the NC site. The area is used by ranchers for grazing cattle about 7 months of the year. The surrounding area [INSERT INFORMATION HERE] and is primarily used for grazing, with occasional mineral development as market conditions warrant.

2.2 ISSUES OF CONCERN

The proposed action would not violate any known Federal, state, or local regulations. A cultural resource concern relates to a large and extensive lithic site that has been recorded immediately adjacent to the Burro Canyon disposal site (CASA, 1992). The design of the Burro Canyon disposal cell overlaps one corner boundary of this site. Prior to ground-disturbing activities, necessary mitigation would be identified and performed. Mitigation activities would receive concurrence from the Colorado State Historic Preservation Office (SHPO), the BLM, and the DOE.

Additionally, the DOE proposes to apply supplemental standards to one area located across the Dolores River from the UC mill site (refer to Section 3.2). The current evaluation of activities that would be required to remove the contamination from those areas indicates that greater environmental damage would be created by the cleanup than would occur if the contamination were left in place. The area is bounded by steep cliffs with no vehicular or foot access to the site. Remedial action would result in destruction of scarce riparian habitat in the area.

Another issue of concern is the possible need to relocate the San Miguel County volunteer fire station.

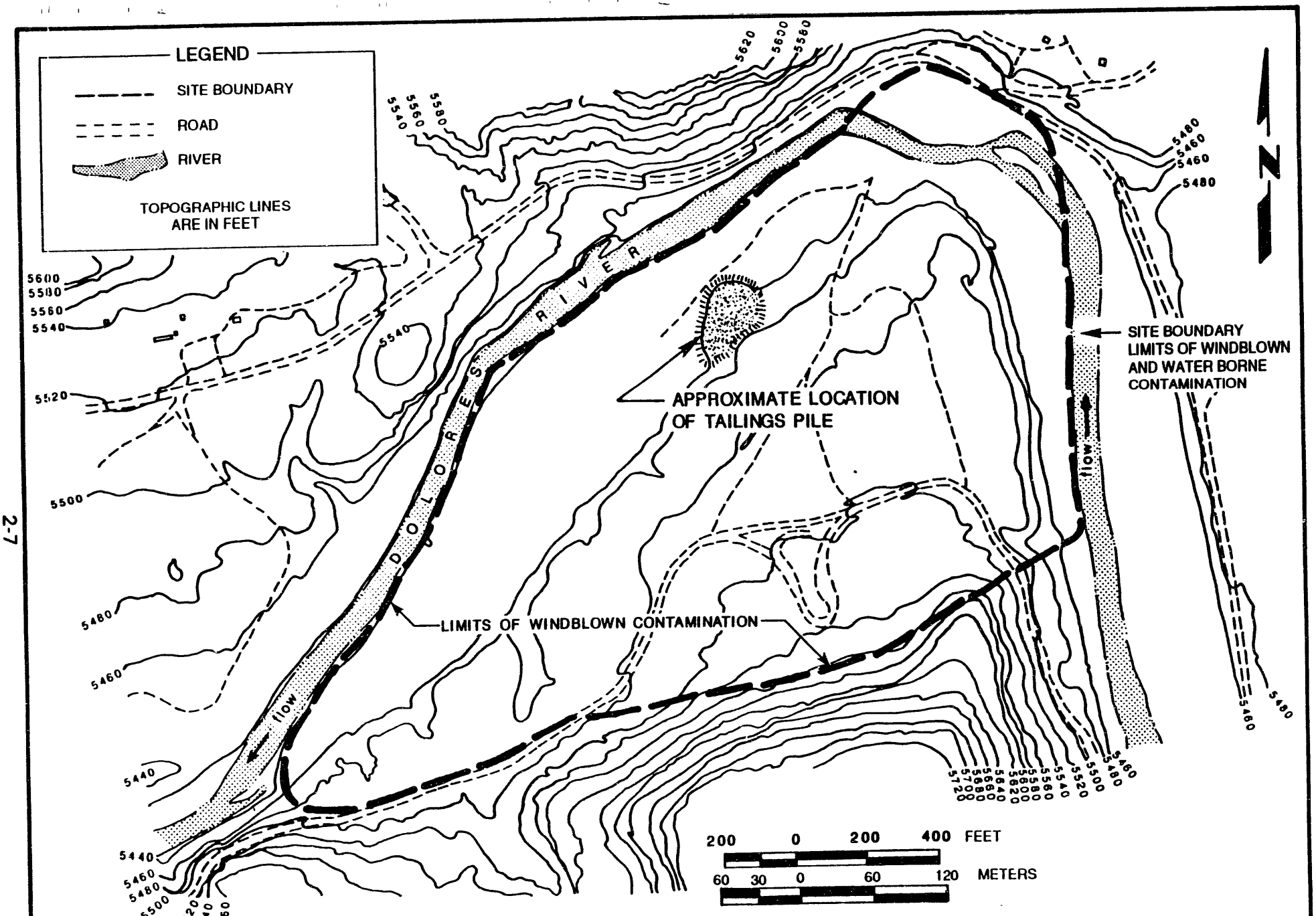


FIGURE 2.4
LOCATION OF THE NORTH CONTINENT
UMTRA SITE NEAR SLICK ROCK, COLORADO

2.3 ALTERNATIVES TO THE PROPOSED ACTION

2.3.1 Alternative disposal sites

No alternative disposal sites have been located that would provide the conditions necessary for safe disposal. Potential disposal sites, including on-site disposal at UC, were identified and evaluated under a DOE-approved alternate-site selection process (ASSP) (DOE, 1986). Disposal at the UC site was found to be technically unsuitable and was dropped from further consideration. The other potential sites were also eliminated for technical or financial reasons. The proposed Burro Canyon disposal site was selected based on the results of the ASSP.

2.3.2 No action

The no action alternative consists of taking no steps to clean up the processing sites. No public lands would be disturbed. The tailings piles and associated contaminated materials would remain where they are. This alternative would not be consistent with the intent of Congress in the UMTRCA and would not result in compliance with the proposed EPA groundwater standards.

3.0 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is to remove and consolidate all contaminated materials associated with the UC and NC sites in a disposal cell at Burro Canyon (Figure 3.1). The disposal cell would be excavated and prepared for the contaminated materials. The UC and NC sites would be excavated to remove contaminated materials, and the materials would be transported by truck to the disposal cell. The disposal cell would be covered with a radon protective cover.

The disposal cell would hold approximately 620,000 yd^3 (470,000 m^3) of contaminated material, and cover an area approximately 610 ft (186 m) wide and 905 ft (276 m) long along the southwest face of the mesa. The height of the cell would range from 30 ft (9 m) to 50 ft (15 m) above the existing ground surface. The base of the cell would be excavated and compacted to prepare for emplacement of the contaminated materials. An 8-ft (2.4-m) clay liner would be placed on the sideslopes of the excavated cell to act as a seepage barrier. Some of the excavated materials would be used as fill along the embankment sides and for the upper portion of the cover. The remaining excavated material would be left on the site.

Contaminated materials from the NC and UC sites would be removed from the land surface and excavated to a depth that would be protective of the environment. In addition to contaminated soils, contaminated materials at the NC and UC sites that would be placed in the disposal cell include concrete, building materials (including wood), and steel scrap. Haul trucks would travel on State Highway 141 and turn north onto County Road S8. Tailings from the NC site would be moved approximately 4 mi (6.4 km) to the Burro Canyon site, south onto a dedicated haul road, east on State Highway 141, and north onto the dedicated access road to the disposal site. Tailings from the UC site would be moved approximately 5 mi (8 km) to the Burro Canyon site, down County Road S8, east on State Highway 141, and north on the dedicated access road to the disposal site. The roads that would be upgraded are the dedicated haul road to the NC site, the disposal site access road, and a section of County Road S8. A section of County Road S8 would be relocated 400 ft (122 m) south of its present location to allow for cleanup and debris removal at the UC site. Materials from the NC site would be placed in the disposal cell first, then materials from the UC site would be placed in the cell.

All contaminated materials would be covered with a 2-ft (0.6-m) thick layer of fine-grained materials that would constitute a radon barrier to prevent release of radon into the atmosphere (Figure 3.2). A 2-ft (0.6-m) thick frost protection layer of fine-grained material would be placed over the radon barrier, then a 6-in (15-cm) sand and gravel bedding layer. The top of the cover would consist of riprap ranging in depth from 8 in to 12 in (20 cm to 30 cm). The disposal cell would have a 2 percent topslope and 25 percent sideslopes.

The completed disposal cell would occupy an area of 12 ac (4.8 ha). A buffer area of 53 ac (21 ha) would bring the total to 65 ac (26 ha) removed from future uses. The DOE would be responsible for scheduled monitoring and surveillance of the disposal site area. A detailed description of the engineering design is being prepared in the remedial action plan.

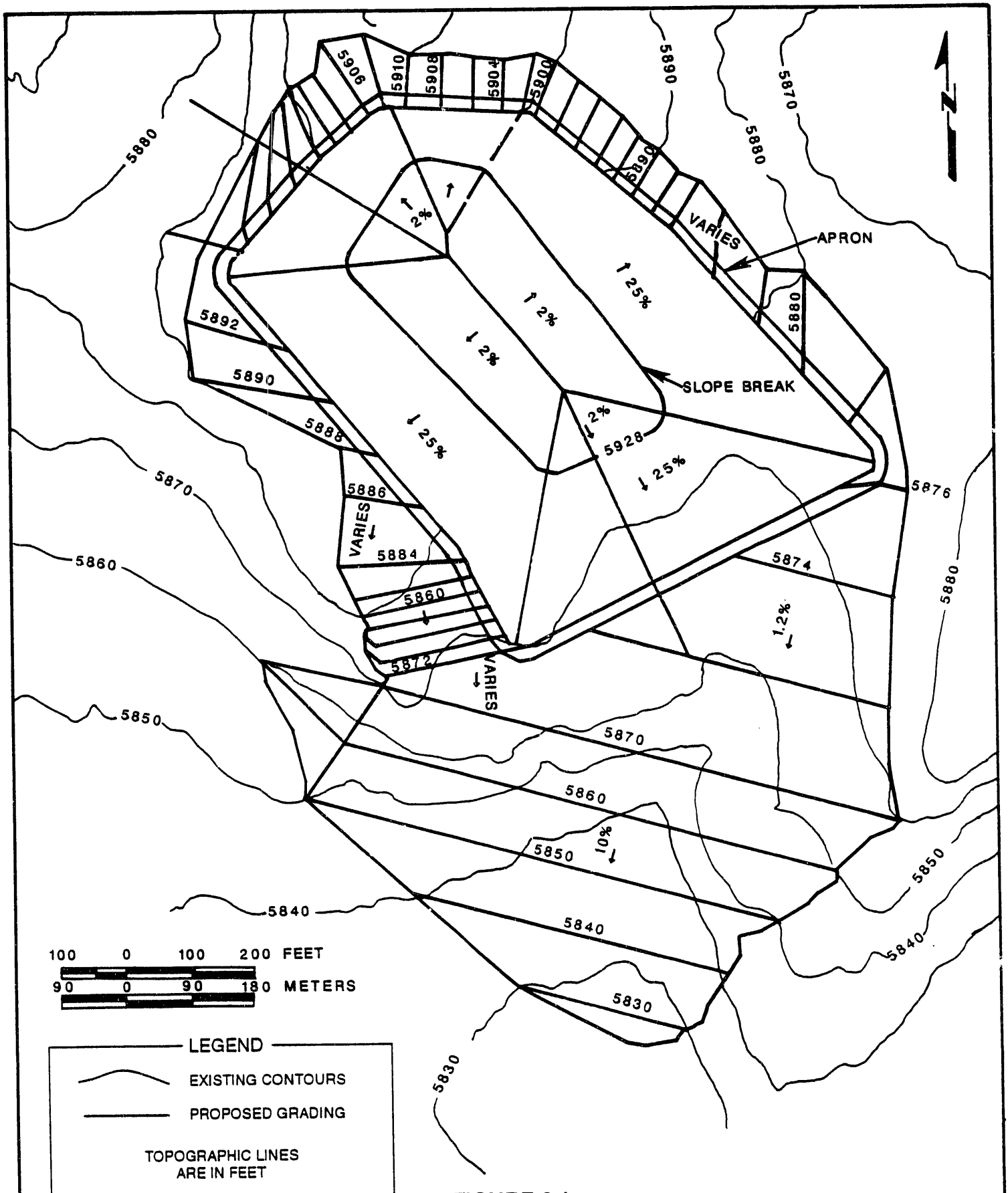
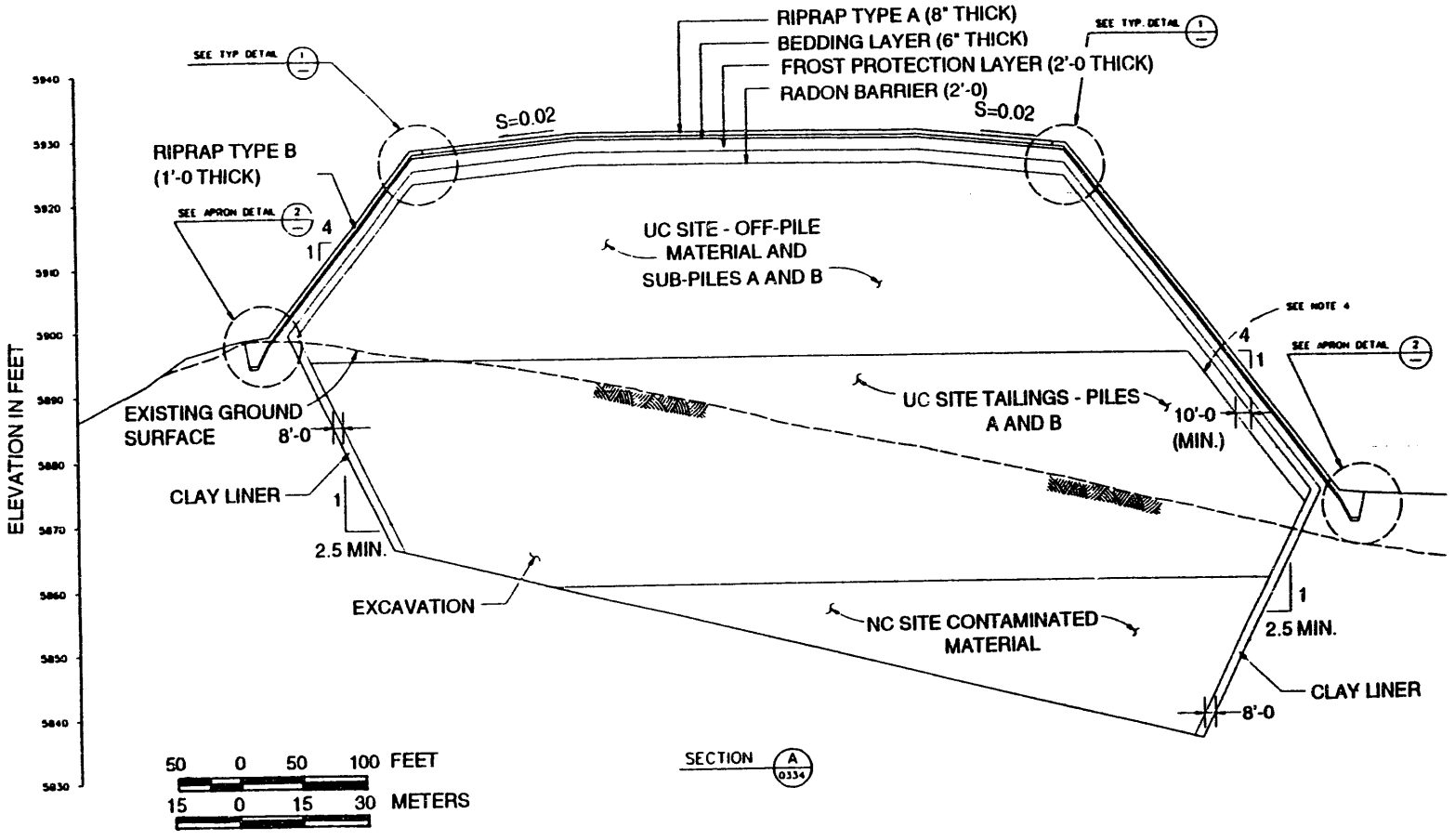
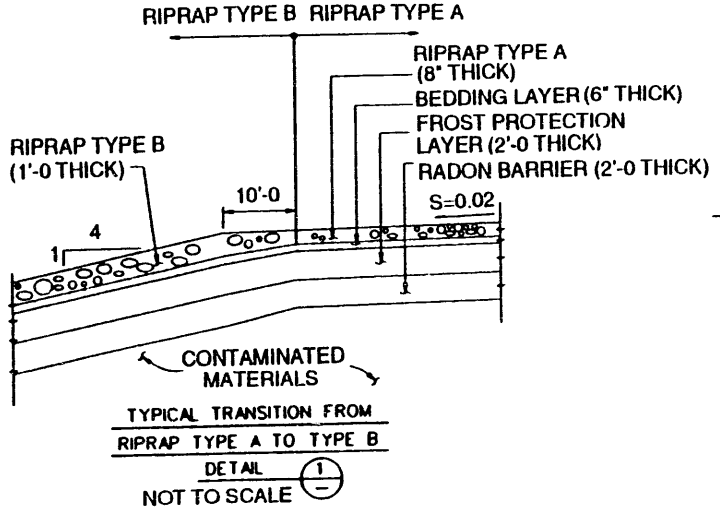


FIGURE 3.1
LOCATION OF DISPOSAL CELL AT THE PROPOSED BURRO CANYON DISPOSAL SITE NEAR SLICK ROCK, COLORADO





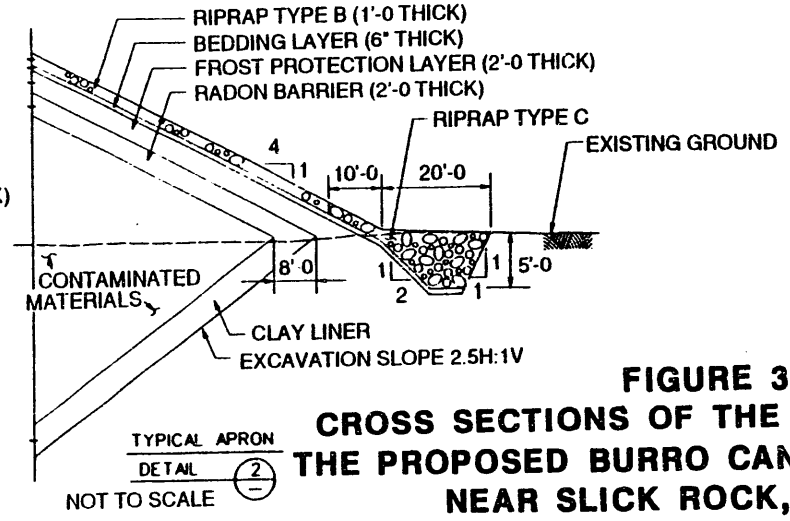


FIGURE 3.2
CROSS SECTIONS OF THE DISPOSAL CELL AT THE PROPOSED BURRO CANYON DISPOSAL SITE NEAR SLICK ROCK, COLORADO

After completion of the remedial action, the UC and NC processing sites would be graded and seeded with seed mixtures recommended by the Soil Conservation Service.

Restoration of the contaminated aquifer beneath the sites will be evaluated during the groundwater restoration phase of the UMTRA Project.

The remedial action is expected to take 19 months. The summer of the first year would include site preparation, upgrading of the existing dirt road, disposal cell excavation, demolition of existing foundations, construction of the clay liner, and excavation and placement of contaminated materials from the UC and NC sites. A 5-month winter shutdown would be scheduled. The second-summer activities would include collection of cover materials from the Dolores River and Disappointment Valley borrow sites and construction of the cover system. Final site grading and site restoration would also be performed.

During the haul phase, the work, on average, would be performed 8 hours per day, 5 days per week. The construction season is estimated to be 8 months for each of the 2 years. The actual length of the construction season would depend on the weather. The number of construction workers would range from [TO BE INSERTED].

Background levels of total suspended particulates (TSP), radionuclides, and noise would be established before implementing the proposed action. Monitoring programs to ensure compliance with applicable standards or regulations would be developed and carried out by the Remedial Action Contractor (RAC). All necessary local permits would also be secured by the RAC.

The proposed action includes the incorporation of the contaminated materials recovered from the four identified VPs associated with the UC or NC sites. VPs are properties located outside a designated UMTRA Project site boundary that have been contaminated by tailings naturally dispersed by wind or water or removed by people before the potential hazards of the tailings were known. Cleanup of VPs is scheduled for April 1994 and should be completed during 1994. The DOE is currently preparing guidelines to address any VP material identified subsequent to the remedial action. The impacts associated with VP cleanups were evaluated in a separate document (DOE, 1985a) and are not discussed further in this EA.

3.1 BORROW SITES

Construction of the proposed disposal cell at Burro Canyon would require the use of clay for the cell and earth, gravel, and rock materials for the protective cover. The preferred source of the clay liner and frost protection materials would be the material excavated from the disposal cell. If the excavated material is unsuitable, the Disappointment Valley borrow site would be the proposed source of clay liner materials. The Disappointment Valley borrow site would also be the proposed source of earthen materials that would be used for the radon barrier (see Figure 2.2). This source is approximately 4.4 road mi

(7.1 km) from the disposal site. Erosion protection materials would be excavated from the Dolores River borrow source (see Figure 2.2), located on a terrace above the Dolores River and between the UC and NC sites.

3.2 AREAS UNDER SUPPLEMENTAL STANDARD CONSIDERATION

One area that contains contaminated materials is located within the Dolores River floodplain across from the UC mill site (Figure 3.3). This area comprises 17 ac (7 ha) on a floodplain across the river from the UC tailings site. It is bounded by a steep 200-ft (60-m) sandstone cliff to the east and the Dolores River to the west. Based on 19 samples from this area, the radium-226 (Ra-226) concentration ranged from 1 to 25 picocuries per gram (pCi/g), with an average and standard error of 7.4 ± 1.4 pCi/g, respectively. The mean Ra-226 concentration is statistically indistinguishable from the cleanup standard of 6.4 pCi/g.

The ratio of Ra-226 to uranium-238 (U-238) in 11 soil samples collected from this area was determined to be 4.2 ± 0.6. This indicates the presence of mill tailings that have been deposited from the UC and NC piles by water or wind. Despite the presence of uranium mill tailings in this area, supplemental standards would be applied for the following reasons:

- The average Ra-226 concentration of 7.4 pCi/g is close to the cleanup standard of 6.4 pCi/g (5 pCi/g above the background Ra-226 concentration of 1.4 pCi/g).
- Remedial action would result in the destruction of the scarce riparian habitat in the area.
- There is no vehicular or foot access to the site and limited probability of human exposure.
- Remedial action would be very costly because it would be necessary to construct a temporary bridge across the Dolores River.
- There is a low probability of health effects anticipated from radon emission, particulate inhalation, or ingestion of contaminated materials due to the Ra-226 concentration and remoteness of the area.
- Existing low levels of contamination in this area will be dispersed with time by natural erosional forces following stabilization of source materials at the UC and NC tailings sites.

3.3 COMPLIANCE WITH EPA STANDARDS

The purpose of the proposed remedial action is to stabilize contaminated materials associated with the UC and NC UMTRA Project sites in a manner that complies with the EPA standards in 40 CFR 192. Consistent with this purpose

LEGEND

- SITE BOUNDARY
- ROAD
- INDICATES CLIFF
- CONTAMINATION

TOPOGRAPHIC LINES ARE IN FEET

500 0 500 FEET

150 0 150 METERS

FIGURE 3.3
AREA UNDER SUPPLEMENTAL STANDARDS CONSIDERATION

and the EPA standards, the following proposed action design objectives provide for control of radon emissions, long-term stability, and groundwater protection.

- Levels of Ra-226 would be reduced to levels consistent with the EPA standards in areas released for unrestricted use (the UC and NC processing sites). The concentration of Ra-226 in soil averaged over any area of 100 square meters (m^2) would not exceed the background level by more than 5 pCi/g averaged over the first 15 cm of soil below the surface, and 15 pCi/g averaged over 15-cm-thick layers of soil more than 15 cm below the surface. If residual radionuclides other than Ra-226 and its decay products are present in sufficient quantities and concentrations to pose a significant radiation hazard, supplemental standards would be developed and applied with NRC concurrence. Remedial action would reduce other residual radioactivity to levels that are as low as reasonably achievable.

- Radon emissions from the disposal cell would be controlled by the construction of a cover system over the tailings and other contaminated materials. The radon emissions would meet EPA standards. The thickness of the earth barrier was estimated using data on the distribution of radium in the tailings pile, data on the physical properties of the earth cover material, and a computer model, RAECOM.

- The principal features affecting the long-term stability of the disposal cell include erosion from a major rainfall event, flooding, and slope stability. The cell's design would withstand the erosive forces of a probable maximum precipitation (PMP) event; that is, the DOE would construct an 8- to 12-in (20- to 30-cm) rock cover and contour the cover with a maximum 2 percent topslope and 4:1 (4 horizontal to 1 vertical) sideslopes. Protection against slope failure would be provided by constructing the disposal cell partially below grade and by constructing the tailings embankment with gentle slopes. Additional protection against slope failure would be provided by the rock-filled apron at the toe of the disposal cell. The disposal cell has been designed to withstand a maximum credible earthquake.

- The engineering design controls would be effective for up to 1000 years to the extent reasonably achievable and, in any case, for at least 200 years.

In addition, the disposal cell design must comply with the proposed EPA groundwater protection standards for inactive uranium mill sites, in Subparts A and C of 40 CFR 192. The DOE has designed a cover system that would meet the radiation protection standard, reduce the amount of infiltration from precipitation, and maintain protection of the radon barrier from frost and biointrusion. The cover system would achieve compliance with the proposed EPA standards for groundwater protection.

Protection of the groundwater would be provided by the pre-existing low-permeability layer at the bottom of the disposal cell that would inhibit the downward migration of contaminated water from the emplaced tailings. In

addition, the disposal cell cover system would inhibit infiltration of rainfall and runoff through the tailings pile.

The need for aquifer restoration at the processing sites will be evaluated by the DOE in separate NEPA, risk assessment, and engineering documentation.

3.4 HEALTH AND SAFETY

A health physics monitoring plan would be established for site construction at both the UC and NC processing sites and the proposed Burro Canyon disposal site. Monitoring stations would be installed and maintained throughout the proposed action activities to monitor off-site radiation and airborne transport of radon and particulates. The soundness of the monitoring program to safeguard public health and the environment and the reliability of the monitoring equipment have been well established on the UMTRA Project.

3.5 CONFORMANCE WITH LAND USE PLANS

The proposed action is consistent with existing San Miguel County or BLM land use plans for the area. A resource management plan developed for the area by the BLM emphasizes livestock management and does not preclude the use of a small area for other purposes, such as a disposal site (Bulinski, 1993; Alexander, 1993). The *Dolores River Corridor Management Plan* (BLM, 1990) classifies the stretch of river that includes Slick Rock as one being favored over three other sections for location of rights-of-way, utility corridors, management facilities, and other surface-disturbing activities.

4.0 AFFECTED ENVIRONMENT

4.1 WEATHER AND AIR QUALITY

The UC and NC sites are in a topographically complex area consisting of the Dolores River Valley and surrounding steep canyon walls and hillsides. The Burro Canyon disposal site, approximately 2 air mi (3.2 km) from the NC site, is outside of the Dolores River Canyon in an adjacent broad synclinal valley positioned on top of a small mesa. The region has an arid, continental climate with low precipitation and humidity, large temperature variations, and high evaporation. Topographic channeling of winds affects the climate and dispersion potential at the two processing sites. Because of the high plateau of the Dolores Anticline immediately overlooking the UC, NC, and Burro Canyon sites from the south and east, the climate is typically drier and warmer than the nearby communities of Egnar, Dove Creek, Monticello, and Cortez that lie on this plateau (Shawe *et al.*, 1968). There are no weather stations near these sites. Due to the canyon topography in which these sites are located, weather data from Montrose or Paradox, Colorado, are not relevant.

High-intensity thunderstorms occur in the general area and in the past have resulted in erosion of the tailings piles at the UC and NC sites. The average annual precipitation has been estimated at 7 inches (18 cm) per year. Thunderstorm activity and precipitation are greatest during August and September (FBDU, 1981).

Wind flow data are not available for the UC, NC, and Burro Canyon sites. The average wind speed in the Slick Rock area is estimated to be 3.4 mi per hour (5.5 km per hour) (FBDU, 1981).

No air quality data are available that would be relevant to the UC or NC areas. San Miguel County meets Federal particulate standards for air quality. Since the area is rural, there are few industries to affect air quality (BLM, 1990).

4.2 GEOLOGY

The UC, NC, and Burro Canyon sites are in the northeastern part of the Colorado Plateau physiographic province, near its boundary with the Southern Rocky Mountains province (Shawe *et al.*, 1968). The Slick Rock region is in the Canyonlands Province between the collapsed salt anticlines and a folded belt that has been dissected by the entrenched meanders of the Dolores River. From the high plains of the Dolores Anticline, southwest of the three sites, the land surface drops to a relatively low elevation along the Dolores River Valley and the synclinal Disappointment Valley. Structurally, the sites are at the south boundary of the Paradox folded and faulted belt. The land surface is deeply incised by the antecedent, generally north-flowing Dolores River, and deeply

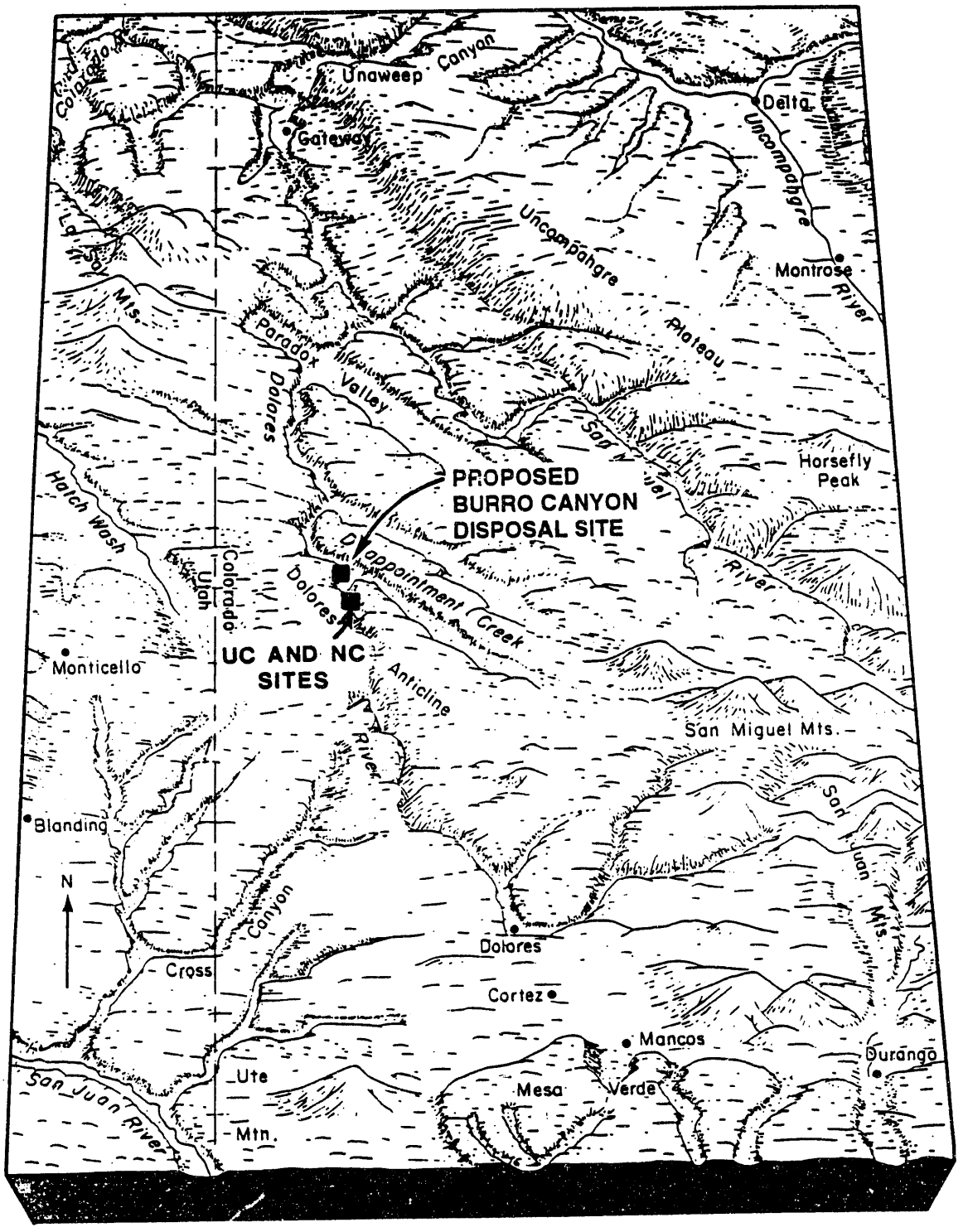
dissected by tributary stream canyons. Principal physiographic elements within the study area include the Dolores Anticline, the San Miguel Mountains, and the Uncompahgre Plateau (Figure 4.1).

Lithologic units underlying the Slick Rock region range from a Precambrian basement complex [2000 to 4000 ft (600 to 1200 m) below mean sea level (MSL)] to a thick sequence of marine and continental rocks of Cambrian to Cretaceous age, overlain by igneous rocks of Tertiary age and unconsolidated Quaternary deposits. Unconsolidated sediments in the region consist of terrace gravels, mud flows, landslides, alluvial fans, soil, colluvium, talus, and floodplain deposits.

The geologic formations underlying the UC and NC sites are the Dolores River alluvium, the Entrada Sandstone, and the Navajo Sandstone. The Dolores River alluvium is 15 to 30 ft (4.6 to 9 m) thick beneath the sites. The alluvial deposit under the UC site has lateral dimensions of 2400 by 600 ft (730 by 180 m), while the deposit under the NC site is 2400 by 300 ft (730 by 90 m). The Entrada Sandstone, which dips toward the northeast, underlies the river alluvium and outcrops in the area of both tailings piles. It persists to depths of 55 to 155 ft (17 to 47.2 m) below land surface. The Navajo Sandstone, which is the regional aquifer, is fine-grained and relatively homogeneous and underlies the Entrada Formation at depths between 53 and 170 ft (16 and 52 m). It also outcrops upslope of the UC site (Shawe *et al.*, 1968).

The geologic formation that forms the foundation for the Burro Canyon disposal site comprises shale with thin sandstone beds of the lower half of the Dakota Sandstone. This is underlain by the Burro Canyon Formation, which contains low-permeability mudstone strata interbedded with saturated sandstone units at depth. The uppermost aquifer at the Burro Canyon disposal site is the upper sandstone unit of the Burro Canyon Formation. Approximately 50 to 65 ft (15 to 20 m) of interbedded mudstone and siltstone will separate the base of the disposal cell from the upper sandstone unit. Groundwater flow in the upper sandstone unit is semiconfined and hydrogeologically isolated from the underlying water-bearing units, the middle and lower units of the Burro Canyon Formation. The site lies atop a small mesa of approximately 18 ac (7 ha) and consequently is not affected by runoff of adjacent drainages.

Known economically important mineral resources in the region are limited to uranium and vanadium ores and oil and gas deposits. The Slick Rock area has been extensively mined for uranium and vanadium, and ore bodies are still present in the area. The principal mine in the area has been the Umetco mine in Burro Canyon, which lies between the NC site and the Burro Canyon disposal site. Mining was discontinued and dewatering of the mine halted in 1983 when the mine was sold. Uranium and vanadium ore occurred in a thin zone usually less than 2 ft (0.6 m) thick at the base of the Salt Wash member of the Morrison Formation. The mine tunnel's nearest approach to the disposal site is 2300 ft (700 m). The depth to the ore zone based on the mine tunnel and values reported in core holes by Umetco is approximately 910 ft (277 m) below



REF: HUNT, 1974.

FIGURE 4.1
PHYSIOGRAPHIC FEATURES IN THE REGION OF THE DOLORES RIVER DRAINAGE BASIN

the site. Mining of these resources has not taken place in the Slick Rock area in recent years. No known oil or gas deposits occur in the area of the UC or NC sites.

4.2.1 Seismicity

The UC, NC, and Burro Canyon sites are near the northeast edge of the Colorado Plateau physiographic province. Earthquakes are rare in this province, and seismicity of the interior portion of the province has been characterized as very low (Wong, 1984). The largest instrumentally recorded earthquake ranged from 4.5 to 5.0 on the Richter scale. A detailed analysis showed that there are no indications of any capable faults in the area of the sites. No faults pass through the existing tailings piles or the proposed disposal site. The closest mapped fault lies 0.6 mi (1.0 km) from the sites and has shown no indication of Quaternary movement. Geologic and geomorphic evidence indicates no potential for on-site fault rupture for at least 1000 years.

4.2.2 Soils

The surficial deposits at the Burro Canyon disposal site consist mostly of sandy clay and are derived from weathering and erosion of the shale and sandstone of the underlying Dakota Sandstone Formation. Thicknesses observed in test pits range from zero at the perimeter of the small mesa top to 1.5 ft (0.45 m) in the middle and average less than 1.0 ft (0.3 m). The soil is locally underlain both by sandstone and by dark gray organic shale. The western slopes of the mesa, which will underlie a portion of the disposal cell, consist of a thin cover, less than 0.5 ft (0.2 m), of colluvial deposits with no topsoil development.

The soils at the UC and NC sites are derived from floodplain terrace deposits along the side of the Dolores River canyon. The soils are thin at the NC site, similar to the Burro Canyon site, and rest on an eroded bedrock surface. The soils at the UC site below the tailings pile area range from 2 to 3 ft (0.6 to 0.9 m) thick and grade into the generally fine-grained unconsolidated floodplain sediments.

4.2.3 Borrow sites

The Dolores River borrow site is on an alluvial terrace of the Dolores River. Deposits of gravels, cobbles, and boulders are structurally similar to the modern channel gravels. This site is underlain by the Entrada and Navajo Sandstones.

The Disappointment Valley borrow site consists of loose, brown, dry, sandy, silty clay overlying hard, dark green-gray, and fissile Mancos Shale. The depth of this overlying material ranges from 1 ft (0.3 m) at the north-central end of the site to 12 or 13 ft (3.7 or 4.0 m) in the southwest portion of the site. The northwest corner of the site also exhibits up to 10 ft (3 m) of this sandy clay.

4.3 SURFACE WATER AND FLOOD HAZARD

4.3.1 Regional conditions

The Dolores River originates in the western San Juan Mountains near Hermosa Peak. Elevations in the basin vary from 5400 ft (1600 m) above MSL at the tailings sites to over 12,000 ft (3700 m) above MSL at the headwaters near Hermosa Peak. Major tributaries to the Dolores River include the West Dolores River, Lost Canyon Creek, and Disappointment Creek upstream of the tailings sites and the San Miguel River downstream of the sites. The Dolores River drains into the Colorado River 10 mi (16 km) west of the Colorado-Utah state line. Most major flow events on the Dolores River occur during the spring or early summer as a result of snowmelt or the combination of snowmelt and rainfall events.

Since March 1984, the McPhee Reservoir, 55 river miles (88 km) upstream of the sites, has regulated the flow on the river. Maximum release from the dam typically occurs from March through June. Average maximum release is 4000 ft^3/s (100 m^3/s) with a peak release of 4400 ft^3/s (130 m^3/s) in May 1986. The required minimum release from McPhee Reservoir is 80 ft^3/s (2 m^3/s), which usually begins during the late summer and continues into the winter.

4.3.2 Union Carbide and North Continent sites

The UC and NC sites are in the modern floodplain of the Dolores River. Both sites are within large meander loops of the river. A rock-covered earthen dike was placed along the base of the NC pile next to the river to prevent erosion.

Ephemeral drainages near the UC pile include the Summit Canyon Wash, which joins the Dolores River 650 ft (200 m) downstream of the pile, and Corral Draw, which flows into the Dolores River 1000 ft (300 m) south of the pile. Ephemeral flows of Corral Draw are constrained within the main channel by banks composed of well-cemented terrace gravels overlying sandstone bedrock. An ephemeral gully between the mill site and the gas sweetener plant drains a small area of Poverty Flat. The area west of the former UC mill site and north of Poverty Flat drains to a small ephemeral channel that flows 250 ft (76 m) west of County Road S8 and joins the Summit Canyon Wash 600 ft (200 m) north of the inactive gas sweetener plant. The UC tailings pile is gently rolling and sparsely vegetated. Some rill formation is evident on the surface of the pile.

The closest ephemeral stream to the NC site flows out of Hanks Pocket and drains into the Dolores River 1000 ft (300 m) downstream of the tailings pile. Surface runoff across the site is limited to overland flow resulting from precipitation events occurring on or immediately above the site. The tailings pile is undergoing erosion from surface runoff, wind, downhill creep, and flooding of the Dolores River. The surface of the pile is partially vegetated and strongly gullied.

A 100-year flow of 84,200 ft^3/s (2380 m^3/s) was determined for the Dolores River at Slick Rock using methods described in Attachment 2, Floodplain/ Wetlands Assessment. The results of this analysis indicate that the bases of the UC and NC piles are within the 100-year floodplain.

The water quality of the Dolores River has not been affected by the two tailings piles. No significant increases or decreases in constituent concentrations have been detected in the Dolores River from upstream of the NC tailings pile to downstream of the UC tailings pile. Ephemeral waters sampled near the tailings piles were high in calcium and bicarbonate and had elevated levels of Ra-226, uranium, and vanadium (DOE, 1983).

4.3.3 Burro Canyon disposal site

The Burro Canyon site is on top of a stable low-lying mesa 1.5 mi (2.4 km) north and approximately 400 ft (122 m) higher than the Dolores River. Flooding is not a concern because the site is 60 ft (18 m) higher in elevation than the ephemeral tributary north of the site. The 100-ft (30-m) buffer zone shows the area where the upper layers of the Dakota Formation outcrop and provide protection from encroachment by scarp retreat.

The only drainage that crosses the Burro Canyon site is a shallow swale that originates on the mesa. No runoff except that which falls directly on the mesa would affect the disposal cell.

4.3.4 Borrow sites

The Dolores River borrow site lies in the modern floodplain of the Dolores River. No ephemeral channels cross the site or drain into the river near the site. Runoff across the site is limited to overland flow resulting from precipitation on the site and flows draining from the cliffs northeast of the site to the Dolores River.

The Disappointment Valley borrow site lies adjacent to an ephemeral tributary to Disappointment Creek. Discharge in the 1.5-mi^2 (3.9-km^2) drainage area of this ephemeral wash is primarily a result of summer thunderstorm events. Disappointment Creek has no flow at most times of the year. Most flow occurs from precipitation associated with summer thunderstorms. There are several small reservoirs and ponds along Disappointment Creek, as well as small diversions for irrigation.

The quality of surface water in the vicinity of the Dolores River borrow site is similar to the water quality near the tailings sites. Surface waters in the ephemeral washes near the Disappointment Valley borrow site are generally poor in quality and are not potable due to high concentrations of total dissolved solids (TDS) and chlorides.

4.3.5 Surface water uses, classifications, and standards

Public water reserve withdrawals from the Dolores River for agricultural purposes are minimal downstream from the Slick Rock sites to Bedrock, Colorado [45 mi (72 km)], and upstream to the McPhee Reservoir [55 mi (88 km)]. The state of Colorado has classified the Dolores River in the area of the Slick Rock sites as suitable for domestic water supply and for agricultural purposes. In addition, the state has rated the Dolores River as Class 1 recreational waters (*i.e.*, suitable for rafting) and as Class 1 for cold water aquatic life (CDH, 1986).

Agricultural use of Disappointment Creek consists of several small ponds and limited diversions for irrigation. There are no users of the waters in the ephemeral wash that occurs near the Disappointment Valley borrow site. Based on the state of Colorado classification, Disappointment Creek and its tributaries are Class 2 recreational waters (*i.e.*, water suitable for activities that do not require primary contact) and are Class 2 warm water aquatic habitat (CDH, 1986).

4.4 GROUNDWATER

Groundwater conditions at the Slick Rock processing sites are highly dependent on local structural, stratigraphic, and topographic features. Canyon cutting, tectonic fracturing, and discontinuities between the geologic formations have caused distinct stratigraphic units to become hydraulically connected.

The uppermost aquifer at the UC and NC sites consists of Dolores River alluvium, underlain by Entrada Sandstone (Slick Rock and Dewey Bridge Members) and Navajo Sandstone. These three hydrostratigraphic units are unconfined to semiconfined, have variable permeabilities, and are believed to be hydraulically connected.

Groundwater flow is unconfined in the Dolores River alluvium and is expected to be semiconfined in the underlying Entrada and Navajo Sandstone Formations. Groundwater elevations in the alluvium, Entrada Sandstone, and the Navajo Sandstone remain relatively constant, regardless of the time of year. Table 4.1 provides additional information on the groundwater below the UC and NC processing sites.

4.4.1 Description of local hydrogeology

The Dolores River alluvium is composed of unconsolidated clayey sands, sandy gravels, and cobbles from the ground surface to an approximate depth of 20 ft (6 m) at both the UC and NC sites. Jurassic Entrada Sandstone underlies the alluvium in the Dolores River floodplain to depths ranging from 20 to 160 ft (6 to 49 m). Two members of the Entrada Sandstone are present: the Slick Rock Member and the Dewey Bridge Member. The erosive Slick Rock Member is composed of light brown, fine-grained sand that is generally not well

Table 4.1 Processing sites groundwater data

Characteristic	Dolores River alluvium	Entrada Sandstone	Navajo Sandstone
Average hydraulic conductivity (UC)	14 ft/day ($5x10^{-3}$ cm/s)	Not determined	$2x10^{-2}$ ft/day ($8x10^{-6}$ cm/s)
Average hydraulic conductivity (NC)	23 ft/day ($8x10^{-3}$ cm/s)	Not determined	Not determined
Average linear groundwater velocity (UC)	150 ft/yr ($2.4x10^{-4}$ cm/s)	Not determined	1 ft/yr ($1x10^{-6}$ cm/s)
Average linear groundwater velocity (NC)	1000 ft/yr ($1.5x10^{-4}$ cm/s)	Not determined	Not determined
Background pH	Near neutral (6.9 to 7.7)	Slightly alkaline (7.8 to 8.0)	Neutral 7.2 to 7.8
Background TDS	622 mg/L to 1180 mg/L	147 mg/L to 1990 mg/L	229 mg/L to 1530 mg/L

cm/s = centimeters per second
mg/L = milligrams per liter

cemented. The Dewey Bridge Member consists of reddish-brown clayey siltstone, very fine-grained sandstone, and shale and is more impermeable than the Slick Rock Member. Consisting of light-brown to reddish-brown fine-grained sandstone, the Navajo Sandstone underlies the Entrada Sandstone at depths ranging from 53 to 170 ft (16 to 52 m). The thickness of the Navajo Sandstone has not been determined at the Slick Rock processing sites.

The occurrence of groundwater in the alluvium at the processing sites is limited to the recent channel and paleochannels of the Dolores River. The depth to groundwater at both processing sites ranges from 10 to 20 ft (3 to 6 m) in wells screened in the alluvium and is approximately the same as the surface water levels of the Dolores River. Groundwater flow in the alluvium is generally to the northwest.

In monitoring wells screened in the Entrada Sandstone, the depth to groundwater is approximately 27 to 45 ft (8 to 14 m). Groundwater movement is generally to the north and northeast in the Entrada Formation. The static groundwater elevations are higher in the Entrada Sandstone than in the overlying alluvium, suggesting that an upward vertical gradient may exist locally.

In monitoring wells screened in the Navajo Sandstone, depths to groundwater vary from approximately 40 to 75 ft (12 to 23 m) at the UC site and from 25 to 60 ft (8 to 18 m) at the NC site. The direction of groundwater flow in the Navajo Sandstone is generally to the north. Preferential flowpaths may exist locally from differences in subsurface material permeability in and adjacent to the ancient buried channel of the Dolores River. The static groundwater elevations are lower in the Navajo Sandstone than in the overlying Entrada Sandstone, and some static groundwater elevations are roughly the same as for wells screened in the Dolores River alluvium. These static water levels suggest that groundwater in the Navajo Sandstone is unconfined to semiconfined, depending upon the permeability and thickness of the overlying hydrostratigraphic units. Paleochannels have cut through the Entrada Formation into the Navajo Sandstone. These alluvial paleochannels are filled with up to 50 ft (15 m) of highly permeable gravel. The Navajo Sandstone is expected to be unconfined in areas where the Entrada Sandstone has eroded away.

The alluvial aquifer is recharged by seepage from the Dolores River upstream and by precipitation. Groundwater discharges from the alluvium into the Dolores River downgradient.

4.4.2 Groundwater quality

Background groundwater quality is defined as the quality of groundwater that would be expected at the site if uranium processing had not occurred. Concentrations or activities of chromium, molybdenum, uranium, and Ra-226 and -228 have exceeded the maximum concentration limits (MCL) listed in 40 CFR 192 and in Appendix IX of 40 CFR 264 in one or more background alluvial monitor wells.

Baseline groundwater quality is defined as the representative water quality in a monitor well that has been influenced by uranium processing activities (DOE, 1989). In general, the pH of the baseline alluvial groundwater remains neutral, with an average pH of 7.

Two hazardous constituents, selenium and Ra-226 and -228, have exceeded their respective MCLs in groundwater samples collected from Entrada Sandstone background monitor wells. Concentrations or activities of chromium, molybdenum, Ra-226 and -228, selenium, silver, and uranium in the Navajo Sandstone have equaled or exceeded their respective MCLs on one or more occasions in groundwater samples collected from the Navajo Sandstone background monitor wells.

The chemical characteristics of the tailings were evaluated by pore fluid sampling with suction lysimeters. Five lysimeters were placed in the NC tailings materials and nine lysimeters were placed in the UC tailings materials. The pH of the tailings pore fluid solutions is near neutral, ranging from 6.2 to 7.8. TDS in the tailings pore fluid average 6600 milligrams per liter (mg/L). Average concentrations of arsenic, cadmium, molybdenum, selenium, and uranium

exceeded the MCLs in lysimeter samples collected from the NC site. At the UC site, the average pore fluid concentrations of cadmium, molybdenum, nitrate, selenium, and uranium exceeded the MCLs. In addition, concentrations of regulated constituents without MCLs were compared to the statistical maximums of background groundwater quality for the upper Burro Canyon sandstone unit at the disposal site. The average tailings pore fluid concentrations of antimony, copper, tin, vanadium, and zinc exceeded the corresponding background statistical maximum concentrations.

Average TDS concentrations in baseline alluvial groundwater are approximately three times those of background. The primary regulated hazardous constituents of concern in the Dolores River alluvium are molybdenum, nitrate, selenium, and uranium at the UC processing site and selenium and uranium at the NC processing site. The baseline water quality of the Entrada Sandstone also appears to be affected by the uranium processing activities for the following reasons:

- The average concentrations of TDS in baseline Entrada Sandstone monitor wells are approximately three times those observed in background Entrada Sandstone monitor wells.

- Concentrations of selenium exceed the MCL and background.

Baseline water quality in the Navajo Sandstone does not appear to be affected by the tailings processing activities. TDS, pH, and the regulated constituents show minimal variation between background and baseline water quality.

4.4.3 Groundwater use

There are 11 registered domestic wells in the general vicinity of the Slick Rock tailings sites. Nine of these wells are no longer in use. Of the other two, one well, which has supplied drinking water to the gas sweetener plant and the former Slick Rock trailer park, is potentially available for use. This well is completed in the Navajo Sandstone, the Entrada Sandstone, and the alluvium. The other is an active well that is completed in the Navajo Sandstone and supplies water for the Slick Rock post office and cafe. An unregistered well is completed in the Navajo Sandstone and supplies water for a local resident. Both of these wells are hydrologically upgradient from the UC tailings site. The active registered well is also upgradient of the NC tailings site. The active unregistered well is expected to be hydrologically separated from the NC tailings by the groundwater flow boundary that follows the course of the Dolores River. Groundwater quality data from these active wells indicate that neither is expected to be affected by the tailings materials at either site.

4.4.4 Burro Canyon disposal site

One unsaturated unit and three saturated units are present below the Burro Canyon disposal site. The unsaturated unit immediately underlying the site consists of the Dakota Sandstone and the Burro Canyon mudstone. The three saturated sandstone units begin at approximate depths of 100, 200, and 300 ft (30, 60, and 90 m). These units are described as the upper, middle, and lower units, respectively. Each unit is composed of fine- to medium-grained sandstone layers and is 25 to 75 ft (7.6 to 23 m) thick. The units are hydrogeologically separated from each other by unsaturated interbedded mudstone and siltstone sequences. Table 4.2 provides additional information on the groundwater below the proposed Burro Canyon disposal site.

Table 4.2 Proposed disposal site groundwater data

Characteristic	Dakota Sandstone	Burro Canyon Sandstone	Burro Canyon Formation sandstone units		
			Upper	Middle	Lower
Hydraulic conductivity	$4x10^{-1}$ ft/day ($2x10^{-4}$ cm/s)	$7x10^{-3}$ ft/day ($2x10^{-6}$ cm/s)	$4x10^{-2}$ ft/day ($1x10^{-5}$ cm/s)	$9x10^{-2}$ ft/day ($3x10^{-5}$ cm/s)	$5x10^{-3}$ ft/day ($2x10^{-6}$ cm/s)
Average linear groundwater velocity (UC)	NA	NA	5.5 ft/yr ($5x10^{-6}$ cm/s)	2.5 ft/yr ($2x10^{-6}$ cm/s)	1.0 ft/yr ($1x10^{-6}$ cm/s)

The Dakota Sandstone (immediately underlying the site) and the Burro Canyon mudstone are not water-bearing. The hydraulic conductivities of the unsaturated Dakota Sandstone bedrock and the unsaturated Burro Canyon mudstones were determined by field packer tests. The packer tests indicate that the saturated horizontal hydraulic conductivity of the sandstone in the Dakota Formation is moderate and is several orders of magnitude greater than that of the Burro Canyon Formation. The hydraulic conductivity decreases with depth in the Burro Canyon mudstone, reflecting decreased fracture permeability with depth.

The upper sandstone unit of the Burro Canyon Formation is the first saturated unit and is the uppermost aquifer at the Burro Canyon disposal site. The upper sandstone unit has Class III groundwater, meaning that groundwater is not a current or potential source of drinking water because the quantity of water available is less than 150 gallons per day (gpd) [$7x10^{-3}$ liters per second (L/s)]. Pumping tests were conducted in wells screened in the upper sandstone unit. However, the wells could not sustain the 150-gpd (7×10^{-3} L/s) rate for an extended period of time. The top of the upper sandstone unit occurs from 77 to 99 ft (23 to 30 m) below ground surface, and the saturated zone ranges from 6 to 19 ft (2 to 6.0 m) in thickness.

The top of the middle sandstone unit of the Burro Canyon Formation occurs at a depth between 170 and 191 ft (52 and 58 m) below the ground surface in the vicinity of the disposal cell footprint. The middle sandstone unit is a confined aquifer approximately 53 ft (16 m) thick. Because the middle sandstone unit is confined by approximately 140 ft (43 m) of overlying mudstone, claystone, and fine-grained sandstone, there is a substantial upward hydraulic potential. Monitor wells screened in the middle Burro Canyon Sandstone unit have groundwater (potentiometric surface) levels that average 42 ft (13 m) above the top of this unit.

The lower water-bearing sandstone unit beneath the disposal cell is 39 ft (12 m) thick, and the top of the unit is located approximately 305 ft (93 m) below the ground surface. Groundwater in this unit is confined by the thick sequence of overlying low-permeability mudstones and siltstones of the Burro Canyon Formation. Because of the extremely low velocity and well yield in the lowermost sandstone unit, the lower sandstone unit is not an aquifer.

Vertical recharge to and discharge from the Burro Canyon Sandstone units are restricted because the low-permeability interbedded claystone and siltstone strata impede infiltration into the water-bearing units. The source of recharge to the uppermost aquifer is approximately 0.25 to 0.75 mi (0.40 to 1.21 km) northeast of the site, where the sandstone beds outcrop along the east limb of the Disappointment syncline, intercepting tributaries to the Nicholas Wash drainage system. Groundwater then flows to the south-southeast and eventually dissipates (discharges) into the surrounding geologic strata south of the Burro Canyon disposal site.

Background groundwater quality in each hydrostratigraphic unit within the Burro Canyon Formation was determined from monitoring groundwater in wells completed in each unit. In general, groundwater pH is fairly neutral, and concentrations of TDS tend to decrease with depth; the average TDS concentration was 766 mg/L in the upper sandstone, 575 mg/L in the middle sandstone, and 332 mg/L in the lower sandstone. The only naturally occurring hazardous constituents exceeding the proposed EPA MCLs are selenium and Ra-226 and -228 in the upper sandstone unit and Ra-226 and -228 in the middle sandstone unit. These exceedences have occurred in one or more wells in 1991 and 1992.

There are no known registered wells or private water uses within the uppermost aquifer (upper sandstone unit of the Burro Canyon Formation) in a 2-mi (3-km) radius of the Burro Canyon disposal site.

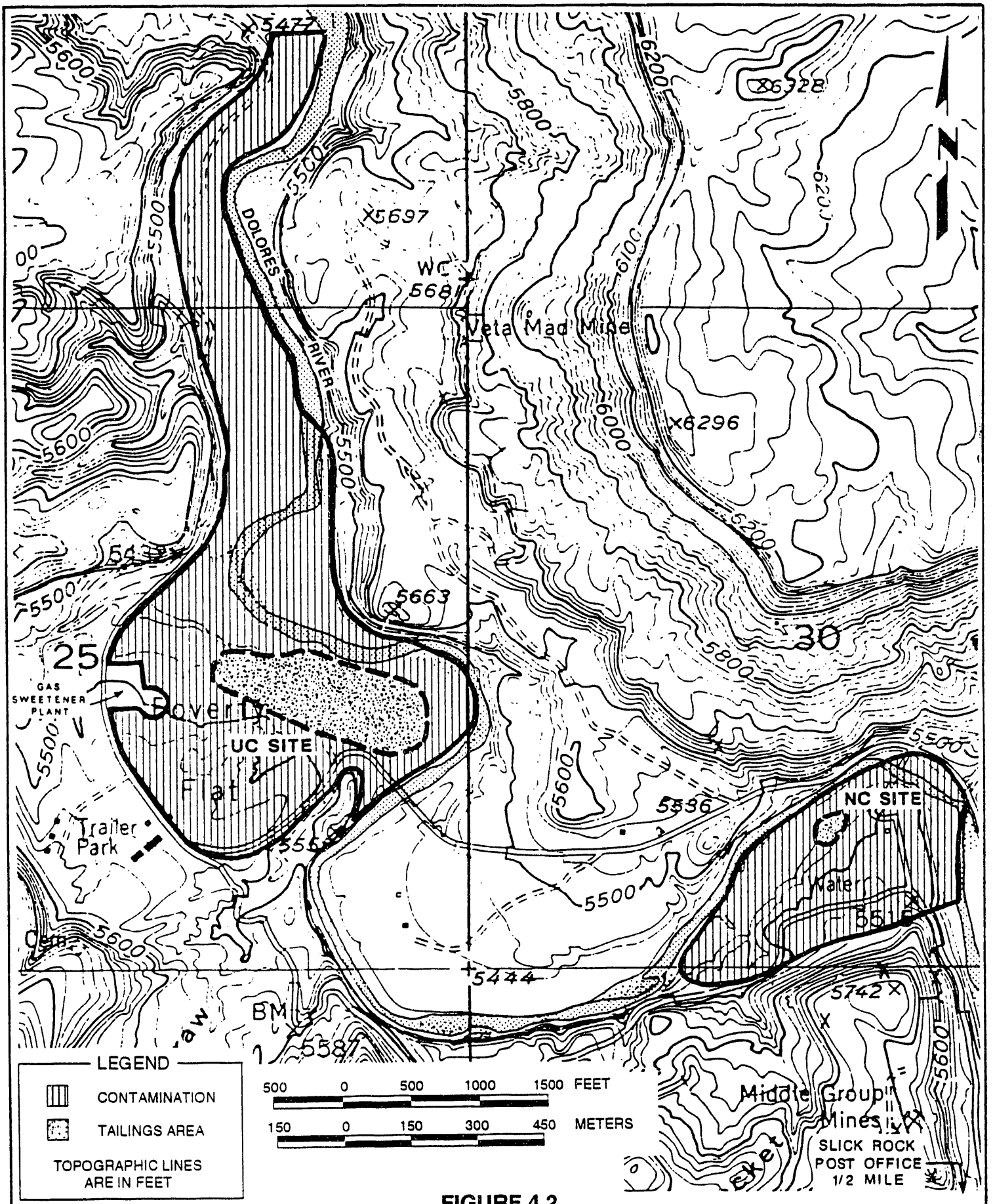


FIGURE 4.2
AREAL EXTENT OF Ra-226 SOIL CONCENTRATIONS EXCEEDING 5 pCi/g AT SLICK ROCK TAILINGS SITES, SLICK ROCK, COLORADO

4.5 RADIATION

Figure 4.2 shows the locations of the UC and NC sites and soil concentrations of Ra-226 that exceed 5 pCi/g. Table 4.3 summarizes the characteristics of the radiologically contaminated materials located at the Slick Rock site.

Table 4.3 Characteristics of the contaminated materials at the Slick Rock, Colorado, UMTRA site

Pile	Area (ac)(ha)	Average depth (ft) (m)	Volume (yd^3) (m^3)	Average[a] Ra-226 concentration (pCi/g)	Exposure rates (μR/hr)	Range and (average) radon flux (pCi/m^2s)
UC pile and subpile	17 (6.9)	16.3 (4.97)	400,100 (305,900)	86	76 to 113	<1 to 130 (70)
UC off-pile	74.5 (30.1)	0.7 (0.2)	87,500 (66,900)	28	9 to 526	1 to 2.6
NC pile and subpile	6 (2)	5.2 (1.6)	50,500 (38,600)	208	13 to 467	1 to 700 (240)
NC off-pile	40.4 (16.3)	0.5 (0.2)	34,300 (26,200)	740	12 to 1384	NA

[a]Volume-weighted average.
NA: not available.
Source: FBDU, 1981.
μR/hr - microröentgens per hour.
pCi/m^2s - picocuries per square meter per second.

The average background soil radionuclide concentration in the Slick Rock area is 1.4 pCi/g of Ra-226, 2.5 pCi/g of thorium-230 (Th-230), and 3 parts per million (ppm) total uranium (BFEC, 1986). The background radiation exposure rate at the Slick Rock site ranges from 10 to 20 microröentgens per hour (μR/hr) at 3 ft (0.9 m) above the ground, with an average exposure rate of 13 μR/hr (BFEC, 1986; EG&G, 1982). The annual average outdoor background radon-222 (Rn-222) concentration was measured to be 0.5 picocuries per liter (pCi/L) around the Slick Rock area (TAC, 1990), and 0.6 pCi/L at the proposed disposal site at Burro Canyon (TAC, 1991).

4.6 FLORA AND FAUNA

The UC, NC, Burro Canyon, and borrow sites are located in the Great Basin sagebrush habitat of the Colorado Plateau. The two tailings piles and the Dolores River borrow site are in the Dolores River valley, with its dense growth of riparian vegetation along the river flanked by steep juniper and desert

shrub-covered slopes. The Burro Canyon disposal site and Disappointment Valley borrow site are in desert shrub plant communities.

4.6.1 Union Carbide and North Continent sites

Vegetation

Six plant community types were observed in the area of the UC and NC sites: disturbed grassland, desert shrub, and four riparian plant communities.

Disturbed grassland is found on the tailings piles and in other disturbed areas. Grass is the dominant cover type, while scattered shrubs such as fourwing saltbush and rabbitbrush also occur in these areas. The shrub density is greatest on the NC tailings pile.

The desert-shrub plant community type is characterized by scattered sagebrush, rabbitbrush, and broom snakeweed. Patches of grass and herbs are the predominant ground cover.

The riparian plant communities are along the Dolores River. The dense willow/saltcedar shrub community grows in bands next to the river. The upper riparian grasslands, farther back from the river, are dominated by grass and scattered shrubs such as big sagebrush, greasewood, New Mexico privet, squawbush, saltcedar, and Russian olive. The upper riparian shrub community has a much higher frequency of shrubs than the upper riparian grassland type; it also has a dense ground cover mostly of grass. The remaining riparian plant community is dominated by fairly large cottonwood. The ground cover (mostly grass) is dense, and shrubs such as squawbush, big sagebrush, and box elder are scattered throughout. These riparian plant communities are described in greater detail in Attachment 2, Floodplain/Wetlands Assessment.

Fisheries and wildlife

Twelve species of fish inhabit the Dolores River, and native species such as the flannelmouth sucker and roundtail chub are common. However, nonnative fish species, including the red shiner and flathead minnow, are also common. The majority of fish in the river are nonnative species. The flow characteristics of the river have been drastically altered by the irrigation withdrawals from McPhee Reservoir upstream of the site. This has resulted in lowered flows and warmer water temperatures, which have promoted the increase of nonnative fish species at the expense of native species.

Wildlife that occur at this site are a mixture of species that occur in riparian and desert-shrub habitats. The sagebrush lizard and whiptail are common reptiles observed on the site. A total of 66 species of birds have been observed; the yellow-breasted chat, yellow warbler, and blue grosbeak are common species in the riparian zone. The only birds of prey observed in this area were the kestrel and the red-tailed hawk. Approximately 32 species of mammals may occur at

or near the tailings site. Beaver signs (cuttings) have been observed along the river, and mule deer occur in the area. The desert bighorn sheep also occurs along the steep slopes of the Dolores River valley. More details regarding the fisheries and wildlife at and near the tailings sites appear in Attachments 1 and 2.

4.6.2 Burro Canyon site

The Burro Canyon disposal site area is in an upland area above the Dolores River Valley. The site itself is grass-dominated, with widely scattered herbs such as scarlet globe mallow also observed. Widely scattered shrubs occur in the area, with fourwing saltbush being the most common species observed. Prickly pear is also fairly common. The disposal site area is surrounded by low ridges covered with pinon pine/juniper woods. Big sagebrush, black sagebrush, and broom snakeweed are common shrubs. Species of cactus observed in these woods are claret cup, Simpson bell cactus, and Whipple's claw cactus.

The western meadowlark and the horned lark are the most common nesting bird species recorded. Other species observed are the magpie, pinon jay, and chipping sparrow. No birds of prey have been observed in this area. Deer and elk droppings have been widely scattered throughout this area, and the desert bighorn sheep also uses the area.

4.6.3 Borrow sites

The plant community types at the Dolores River borrow site are cleared pasture dominated by grass and desert shrub dominated by species such as big sagebrush and rabbitbrush. Clumps of grass are the most common ground cover in the desert-shrub habitat. The Disappointment Valley borrow site is on relatively flat terrain in the desert-shrub habitat. Black greasewood is the most common species, with widely scattered fourwing saltbush and rabbitbrush also observed.

Wildlife typical of desert-shrub habitat occurs at these borrow sites. The mule deer is the most abundant game species at the Dolores River borrow site. The mule deer and an occasional pronghorn antelope and elk (in winter) may occur at the Disappointment Valley borrow site.

4.6.4 Threatened and endangered species

Through consultation with the Fish and Wildlife Service and the Colorado Division of Wildlife, 11 species were determined to have the potential to occur at or near the sites (refer to Table 3.1 of Attachment 1). A detailed description of T&E species appears in Attachment 1; below is a summary.

The endangered humpback chub, bonytail chub, and razorback sucker have not been found in the Dolores River. The Colorado squawfish occurs near the mouth of the river 120 mi (193 km) downriver from the sites. The bald eagle occurs in the area of the tailings site sporadically during the winter, and a winter

roost site is approximately 1.5 mi (2.4 km) south of the Disappointment Valley borrow site. Two nest sites of the peregrine falcon are active along the Dolores River, both of which are approximately 8 miles (13 km) from the tailings sites. The black-footed ferret is associated with prairie dog towns; since there are no prairie dog towns at the tailings, disposal, and Dolores River borrow sites, the black-footed ferret would not occur in these areas. A survey for prairie dog towns at and near the Disappointment Valley borrow site would be conducted to determine if potential black-footed ferret habitat occurs at this site.

The remaining four species are Federal candidate species. The white-faced ibis and black tern or their nesting habitat were not observed at or near the sites. The southwestern willow flycatcher has not been recorded near the sites, but due to the presence of nesting habitat, this species may use the site in the future. The river otter was reintroduced to the Dolores River in 1988; this species uses the Dolores River at and near the tailings sites and Dolores River borrow site.

4.6.5 Wetlands

Riparian plant communities along the Dolores River include the dense growth of willow and saltcedar next to the river. This plant community type is classified as wetlands by the U.S. Army Corps of Engineers. A more detailed description of the riparian plant communities along the Dolores River appears in Attachment 2.

4.7 LAND USE

The UC and NC processing sites, the Burro Canyon disposal site, and the Dolores River and Disappointment Valley borrow sites are in west-central San Miguel County, Colorado, less than 10 miles (16 km) east of the Colorado-Utah state line. The majority of western San Miguel County is rangeland and woodland used primarily for livestock grazing and timber production. Dry and irrigated croplands comprise 7 and 2 percent of the land, respectively. Mineral exploration, extraction, and milling, primarily for uranium and vanadium, have been an important land use in western San Miguel County. The amount of land devoted to mineral activities fluctuates with market conditions (FBDU, 1981).

4.7.1 Processing sites

The UC and NC sites are on land owned by the Union Carbide Corporation. Almost all of the surrounding land is administered by the BLM and is used for low-density livestock grazing. Sixty acres (24 ha) of cleared land and irrigated cropland adjacent to the Dolores River between the UC and NC sites are used for pasture and growing hay. There are some scattered residences in the area. The nearest residence to either site is approximately 0.3 air mi (0.5 km). The unincorporated town of Slick Rock, Colorado, is approximately 1 road mi (1.6 km) southeast of the NC site and 1.5 mi (2.4 km) southeast of the UC site.

A gas sweetener plant immediately adjacent to the UC site is not currently occupied or in use. In recent years, a fire station, operated by volunteers, was constructed near the UC tailings pile.

Area recreational use includes rafting on the Dolores River. The river segment between Cohone and Bedrock, Colorado, is a popular and frequently used portion of the Dolores River. In the past, the Dolores River has been studied and proposed for Wild and Scenic River status, although the status has not been given to the river (BLM, 1990).

The only commercial complex is a single structure, which contains a restaurant, liquor store, service station, post office, and sheriff's office, along State Highway 141 in Slick Rock. There are numerous mines and gravel pits in the area; however, none of the mines or gravel pits are operating at this time.

4.7.2 Disposal site

The Burro Canyon disposal site area is part of a 61,515-ac (24,895-ha) grazing allotment (Disappointment Creek) managed by the BLM. This large allotment is used by cattle for grazing between November 1 and May 31 of each year. Due to the sparse vegetation in the area of the proposed disposal site, only limited grazing occurs there (Werkmeister, 1993).

The Burro Canyon disposal site area has portions of seven mining claims. The existing access trail proposed as a haul road alignment from the highway to the site is covered by portions of five other claims.

4.7.3 Borrow sites

The Dolores River borrow site is on private land in pasture and desert-shrub habitat adjacent to the Dolores River between the tailings sites. The land uses at and around the Dolores River borrow site are the same as those described for the UC and NC sites.

The Disappointment Valley borrow site is on land administered by the BLM. The land immediately west of the site is privately owned; land on all other sides of the site is administered by the BLM. State Highway 141 is immediately south of the site, and the private land west of the site contains a dirt landing strip and a natural gas pipeline that runs northeast-southwest and connects with the gas sweetener plant adjacent to the UC tailings site (Flinn, 1985). Two 40-ac (16-ha) parcels just outside the site to the north and southeast have been withdrawn by the BLM for public water reserves (Bulinski, 1985).

The land at and around the site is within the Disappointment Creek grazing allotment and is used for low-density livestock grazing. There are multiple unpatented mining claims at the site, and the site is within an existing BLM oil and gas lease (Werkmeister, 1993); however, there are currently no mineral or oil and gas activities at the site.

None of the potentially disturbed areas contain critical areas of environmental concern, wild and scenic rivers, or prime or unique farmlands. Under the current resource management plan, the main emphasis for these areas is livestock management (Bulinski, 1993; Alexander, 1993).

4.8 HISTORIC AND CULTURAL RESOURCES

People first entered the Slick Rock area in the Proto-Historic Period, which ranged from 12,000 to 7500 years before the present. The people of this time were nomadic game hunters who are now known for their distinctive weapons. The post-glacial Archaic Period replaced the Proto-Historic. The people of this time were hunters and gatherers, who also grew corn and made pottery. This period lasted into historic times until the Ute Indian Tribe left the area in the 1880s (BLM, 1982).

Settlers entered the region after the Utes were removed to reservations in 1881. The history of the area is influenced by ranching, farming, and mining. In addition, the later rise and fall of the uranium and vanadium industry also influenced the region (BLM, 1982).

A Class III cultural resource survey of approximately 260 ac (105 ha), conducted near the UC and NC sites, identified a lithic scatter site, an historic site, and two isolated finds (CASA, 1987). The historic site is eligible for nomination to the NRHP.

Surveys of a 121-ac (49-ha) area that includes the Burro Canyon disposal site identified two sites that fall directly within the proposed disposal site and cannot be avoided during the use of the disposal site (CASA, 1987). These surveys identified projectile points, lithic scatters, and isolated finds (CASA, 1992; 1990). A 1993 site evaluation further characterized the two sites and concluded that neither is eligible for nomination to the NRHP (CASA, 1993).

A third site immediately adjacent to the Burro Canyon disposal site is a large and extensive lithic site with possible hearths (CASA, 1992). The design of the Burro Canyon disposal cell overlaps one corner boundary of the site.

Cultural resource field clearances conducted for test pit locations did not identify any cultural sites at the borrow sites (CASA, 1986).

4.9 SOCIOECONOMIC CHARACTERISTICS

The UC and NC processing sites, the Burro Canyon disposal site, and the Dolores River and Disappointment Valley borrow sites are in the sparsely populated southwestern corner of Colorado, less than 10 mi (16 km) east of the Utah-Colorado state line. The town of Slick Rock, which consists of a combination post office/restaurant/general store, is 1.5 road mi (2.4 km) southeast of the UC site and 1 mi (1.6 km) southeast of the NC site. No one is currently living at or close to [within 0.25 mi (0.40 km)] the UC or NC sites.

About 10 people, including the residents in two trailers adjacent to the post office, live within 10 mi (16 km) of the UC and NC sites.

Most towns in southwestern Colorado are small, with populations of between 500 and 1000 people. Farming, mining, and other energy-related developments have historically provided a source of livelihood for residents. Commuting large distances to work opportunities in adjacent towns is also a characteristic of life in isolated, rural areas such as this.

The 1990 population of San Miguel County was estimated by the Colorado Division of Local Affairs at 4314 people; growth is anticipated to occur at around 2 percent per year until the year 2000, when the population of the county is projected to reach 5300 people. The largest town, and also the county seat of San Miguel County, is Telluride, located in the mountains in the eastern part of the county. Telluride is an historic mining town now known as a world-class ski resort; it also attracts tourists year-round. The estimated population of Telluride is 1300 residents (2400 including outlying areas), and can peak to 20,000 during festivals (Barnes, 1993). The eastern part of San Miguel County is geographically separate from western areas such as Slick Rock. Adjacent counties are similarly rural and sparsely populated.

Dryland farming, ranching, and uranium mining have occurred historically throughout the western portions of San Miguel, Dolores, Montezuma, and Montrose counties and the eastern portion of San Juan County in Utah. The more mountainous eastern portions of San Miguel, Montezuma, and Montrose counties have different employment bases, although ranching and farming have also provided a consistent source of livelihood in unincorporated areas.

Unemployment patterns show that in southwestern Colorado, unemployment is occurring at about the 1989 state average of 5.8 percent. The unemployment rate in 1989 for San Miguel County was 6.4 percent (Picasso, 1990). The unemployment categories of greatest supply are likely to be in the construction and mining industries, which have been depressed for the past several years. There are no proposed large-scale future projects in San Miguel or the adjacent counties.

Out-migration of workers and families occurred following the uranium and energy market declines in 1981 and 1984, respectively. It is likely that vacant housing is available within commuting distance of the sites.

Emergency medical treatment for the Slick Rock area is under the jurisdiction of the San Miguel County Sheriff's Department. The closest medical clinics are in Dove Creek, Naturita, and Norwood. As necessary, the Dolores County Sheriff's Department assists with medical emergencies until the San Miguel County Sheriff's Department is able to provide assistance. Air evacuation to Grand Junction, the closest city of size, is also available.

Since it is unlikely that a large work force would come from any single area or have an effect on a specific town, county finances are not included in this discussion, although the general positive impacts are addressed in Section 5.10.

4.10 TRANSPORTATION

Remedial action workers would access the tailings piles and all borrow sites by use of State Highway 141. In the vicinity of Slick Rock, this is a paved, secondary, two-lane highway rated at level of service A. This level of service means that State Highway 141 could safely carry between 4000 and 6000 vehicles per day. At Slick Rock, the 1988 average daily traffic was recorded at 190 vehicles of all kinds. Peak hourly traffic is estimated at 24 vehicles (Tenney, 1990).

Remedial action traffic would exit northwest from State Highway 141 onto County Road S8. This paved, two-lane road would provide direct access to the UC and NC tailings piles and Dolores River borrow site. Existing traffic is minimal; an estimated five to six vehicles per day use County Road S8. The pavement is considered in adequate condition for current use (Horner, 1986).

Haul trucks would travel on State Highway 141 and turn north onto County Road S8. Tailings from the NC site would be moved approximately 4 mi (6.4 km) to the Burro Canyon site, south onto a dedicated haul road, east on State Highway 141, and north onto the dedicated access road to the disposal site. Tailings from the UC site would be moved approximately 5 mi (8 km) to the Burro Canyon site, down County Road S8, east on State Highway 141, and north on the dedicated access road to the disposal site. The roads that would be upgraded are the dedicated haul road to the NC site, the disposal site access road, and a section of County Road S8. A section of County Road S8 would be relocated 400 ft (122 m) south of its present location to allow for cleanup and debris removal at the UC site.

5.0 ENVIRONMENTAL IMPACTS

5.1 INTRODUCTION AND ASSUMPTIONS

The environmental impacts of the proposed remedial action are discussed in this section. The following impacts are based on a 19-month construction schedule, with one 5-month winter shutdown for weather reasons. It is anticipated that most of the work force would come from area towns and that any new workers would reside in area towns. Other UMTRA Project sites have averaged 80 percent local employment. Due to the remoteness of the Slick Rock area, it is likely that fewer local workers would be available.

5.2 NO ACTION

Under the no action alternative, the general public would continue to be exposed to radon and radon progeny from the existing uranium tailings piles and associated contaminated materials. Under the current conditions, it is estimated that 0.00005 excess health effects would occur each year in the surrounding population. For an individual in the exposed population of 10 people within 10 mi (16 km) of the sites, 0.00005 annual excess health effects implies a chance of one in 113,360 of developing a fatal cancer. This does not consider the unavoidable effect of wind and water that would tend to disperse the contaminated materials and increase the potential for excess health effects. Also, population growth and unauthorized removal and use of the tailings could lead to more excess health effects than those calculated.

5.3 RADIATION

The principal pathways by which individuals could be exposed to radiological hazards during remedial action include the inhalation of radon decay products and airborne radioactive particulate matter; direct exposure to gamma radiation; ingestion of groundwater and surface water contaminated with radioactive materials; and ingestion of food products produced in areas contaminated by tailings. For the calculation of health effects, only those pathways that would result in the largest radiological doses were considered in detail; these include the inhalation of radon decay products and direct exposure to gamma radiation.

Excess health effects are the number of fatal cancers estimated to occur in a population exposed to radioactive contaminants associated with the processing and disposal sites and remedial action activities. To interpret excess health effects in perspective, an individual in the United States has a 16 percent lifetime chance of developing a fatal cancer, or one chance in six, due to all other causes in the society.

Since radon decay products are the predominant cause of excess health effects in the general public, the methodology used to analyze their health effects is summarized below:

- Processing site characterization data are analyzed to delineate the magnitude and limits of the processing site contamination to be excavated, hauled, and stabilized.

- Radon diffusion parameters are measured for contaminated soil and tailings.

- The surface radon flux is calculated for a given area and construction scenario using these input parameters and a DOE/NRC-approved radon diffusion computer model, RAECOM, for multilayered media.

- Radon concentrations at selected off-site receptor locations are calculated by using local meteorological parameters and standard atmospheric dispersion models.

- Outdoor and indoor radon decay product concentrations are estimated assuming 70 percent plate-out of radon decay products formed during transport from source to receptor location, and a 50 percent indoor equilibrium between calculated receptor radon concentrations and the decay products. It is assumed that people spend 100 percent of their time at home—25 percent outdoors and 75 percent indoors.

- Excess health effects due to this scenario were calculated using a risk factor of 0.00035 excess health effects (fatal cancers) per person—working level month (WLM). A WLM is defined as 170 hours of continuous exposure to an atmosphere containing the assumed fraction of short-lived radon progeny (50 percent) in equilibrium with 100 pCi/L radon.

Currently, a radon flux is emanating from the unstable tailings piles and contaminated areas. Consequently, the general public is being exposed to the resulting radon decay products. The general public is not exposed to gamma radiation from the contaminated materials because no residences are located close enough to the sites to be affected by direct radiation. In addition, there are no effective barriers to prevent the continued dispersion and unauthorized removal of tailings, which could increase the public's exposure to radon decay products and gamma radiation.

During implementation of the proposed action, the exposure to the general population from all radiological pathways would decrease as the contaminated materials are excavated from the processing site and transported to the Burro Canyon disposal cell. Remedial action workers' exposure to contaminated material during site remediation would be minimized by adherence to health and safety plans and procedures and by operational and institutional control measures. These include wetting the work area or temporarily stopping work to keep airborne radioactive particulate matter concentrations below harmful levels.

During remediation, the radon flux at the disposal site would increase from background levels to a maximum value when all contaminated materials have been excavated and stabilized in the disposal cell. The radon flux would linearly

decrease to or below the design value (20 pCi/m^2s) as the radon barrier and frost protection layers are placed.

Population exposure from material transport during remediation is considered negligible because the contaminated material in the trucks would be either covered with a tarp or treated with a special surfactant to prevent atmospheric dispersion of the material; gamma exposure would be attenuated by the truck body and material being hauled and limited to the transit time to the disposal site; and radon emanation during truck transport would be significantly diluted by the ambient air.

Any tailings spillage on roadways would be immediately cleaned up and therefore would produce only a potential short-term exposure to persons nearby. Contractors working for the DOE would be required to establish and implement procedures for responding to and cleaning up spills.

The only transportation spill that could not be cleaned up readily would be one that occurs as a truck crosses a perennial stream or flowing ephemeral drainage. If such a spill occurred, the concentration of radioactive elements and metals would be diluted rapidly by the flowing water. Emergency response plans would immediately be implemented to ensure that health effects would be negligible.

Prompt recovery of spilled material in wetland areas would be initiated. Efforts would be implemented to either rehabilitate areas disturbed by the cleanup process or obtain regulatory approval for the acquisition of replacement areas in the event the impacted wetlands were adversely affected.

After completion of the remedial action, the radon release at the disposal site would not exceed the limits allowed by the EPA standards (EPA, 1990). Radon flux measurements would verify that the 20-pCi/m^2s standard is met according to 40 CFR 61, *National Standards for Hazardous Air Pollutants* (EPA, 1990). Radon concentrations at the site boundary would be measured to demonstrate that they do not exceed 0.5 pCi/L above local background concentrations. Similar measurements of the disposal cell surface radon flux and boundary radon concentrations at other, complete UMTRA Project sites were indistinguishable from corresponding background measurements. Gamma exposure rates from encapsulated material would be essentially at background levels.

During remedial action activity, an estimated 0.00044 excess health effects in the general population would occur due to exposure to radon decay products. Zero excess health effects are estimated to occur to the general public from exposure to gamma radiation originating from the site's contaminated material. The excess health effects in the remedial action worker population, due to exposure to radon decay products, are estimated to be 0.00092; whereas, 0.0054 excess health effects are estimated to occur in the remedial action worker population due to exposure to gamma radiation.

The total estimated excess health effects (radon decay products and gamma exposure) for the general public during remedial action would be 0.00044. This compares to the estimated 0.00012 excess health effects if there were no remedial action for an equivalent period of time.

During remediation, the estimated excess health effects for the no action alternative are less than those of the proposed action; however, the no action alternative becomes undesirable as the time following remedial action increases. This occurs because under the no action alternative, the general public would continue to be exposed to radiation from the contaminated materials for an indefinite period of time. For example, assuming constant population and no dispersion of the tailings, 0.00025 excess health effects could be estimated to occur in 5 years under the no action alternative. This compares with 0.0000002 excess health effects occurring in the 5 years following the proposed action. In 1000 years, 0.00004 excess health effects are estimated following the proposed action, compared to 0.05 excess health effects projected under the no action alternative.

5.4 SURFACE WATER

The excavation of the contaminated materials at the UC and NC sites would result in surface disturbance and runoff from the disturbed areas. Also, contaminated wastewater would be generated by activities such as equipment washing. The remedial action design provides for construction of drainage and erosion controls, including wastewater retention ponds, to prevent the discharge of contaminated water from the sites. These control measures would be constructed according to applicable regulations. The contaminated water would be retained for evaporation or for dust control on the tailings piles; sediments from the ponds would be consolidated with the tailings during the final reshaping of the Burro Canyon disposal cell. Following remedial action, all disturbed areas would be recontoured to promote drainage and revegetated. Excavation would be scheduled for the dry summer months to reduce the impact of runoff caused by precipitation. Silt fences would be constructed to protect the river from exposure to excavated materials.

Appropriate drainage and erosion controls would be used at the disposal and borrow sites to minimize or prevent erosion and any corresponding surface water impacts. After remedial action, disturbed areas would be graded to promote drainage and revegetated.

Erosion control features incorporated into the disposal cell would prevent excessive rainfall from damaging the cell. These include limiting the sideslopes of the cell to 25-percent slopes and the top of the cell to a 2-percent slope to promote drainage from the cell with nonerosive flow velocities, and placing a rock erosion protection barrier on the sideslopes of the cell to resist the erosive forces of severe rainfall events such as a PMP.

5.5 MINERAL RESOURCES AND SOILS

The proposed action would result in the consumption of local borrow materials, such as earth, gravel, and rock. Borrow materials exist in large quantities in the Slick Rock and Disappointment Valley areas. The proposed action would not have an impact on other mineral resources in the area. The UC and NC processing sites, Burro Canyon disposal site, and borrow sites are underlain by geologic formations that contain noncommercial concentrations of minerals at current market values.

Remedial action activities at Burro Canyon would result in the disturbance of soils on 65 ac (26 ha). These impacts would result from surface disturbances caused by the excavation of the disposal cell, construction and upgrading of access roads, and construction of staging and stockpiling areas. Soil from the disposal cell excavation would be used as a rooting medium for the cell's vegetative cover. Any remaining soils would be stockpiled and left on the site. Soil compacted as a result of remedial action activities around the disposal cell would be loosened up and revegetated.

Soil on 107 ac (43.3 ha) would be disturbed at the UC and NC sites. Soil from the UC and NC sites totaling 67 ac (27 ha) is contaminated and would be permanently placed in the disposal cell. The soil on the remaining acreage would be redistributed but not removed. All 107 ac (43.3 ha) would be recontoured (where necessary) and revegetated.

Approximately 25 ac (10 ha) would be disturbed at the Dolores River borrow site to obtain 72,700 yd^3 (55,600 m^3) of rock and gravel. The topsoil would be stockpiled and used for restoration of the borrow site. A total of 68,200 yd^3 (52,100 m^3) of soil covering approximately 65 ac (26 ha) would be excavated from the Disappointment Valley borrow site for radon/infiltration barrier material. The topsoil at this site would be stockpiled for use during borrow site restoration. Use of these materials would not impact mineral resources since none are present at or near the borrow sites.

5.6 GROUNDWATER

5.6.1 Union Carbide and North Continent processing sites

Relocation of all contaminated materials to the Burro Canyon disposal site would remove the source of contamination from the UC and NC site areas. Following removal of the contaminated materials, the aquifer would continue to flush itself of contaminants naturally. The rate at which this flushing would occur depends on the mobility of specific contaminants within the aquifer and the effective hydraulic conductivity. More mobile contaminants, such as uranium and selenium, would move at approximately the same rate as groundwater and be discharged to the Dolores River in a period of a few years to decades, depending on groundwater velocities. However, contaminants existing as sorbed species or as solid precipitates would have to desorb or be dissolved before being

flushed from the aquifer. Contaminants that are less mobile, such as radium, would require a longer period of time to flush naturally to surface water.

During remedial action, groundwater quality at the processing sites would be monitored semiannually to assess the impacts, if any, of construction on the groundwater quality beneath and downgradient of the processing sites. If the semiannual groundwater analyses at the UC or NC sites show statistically significant rises in an element(s) or a compound(s), the situation would be assessed and appropriate action would be taken at that time.

5.6.2 Burro Canyon disposal site

The DOE has assessed the performance of the designed disposal system, and has shown that the disposal cell would minimize and control the release of hazardous constituents to groundwater and surface water, and radon emanations to the atmosphere, to the extent necessary to protect human health and the environment.

The groundwater compliance strategy for the Burro Canyon site is the application of supplemental standards, based on Class III (limited use) groundwater in the uppermost aquifer (upper sandstone unit of the Burro Canyon Formation) because of low yield (less than 150 gpd). The appropriate method for compliance monitoring of the disposal site will be determined and described in the long-term surveillance plan. A type of monitoring at the point of compliance (POC) is envisioned. The POC is a vertical plane that extends downward into the uppermost aquifer along the downgradient hydraulic limit of the disposal cell.

The proposed remedial action design features, in conjunction with favorable hydrogeological and geochemical conditions, would ensure protection of human health and the environment. There are no known registered wells or private water uses within the uppermost aquifer (upper sandstone unit of the Burro Canyon Formation) in a 2-mi (3-km) radius of the Burro Canyon disposal site. Permeability testing in the laboratory and aquifer performance testing on the site indicate that vertical hydraulic conductivities are very low in the Dakota Sandstone and Burro Canyon mudstone units, ranging from 10^{-9} to 10^{-11} cm/s. Although not a productive aquifer, the upper sandstone unit of the Burro Canyon Formation is the first zone of saturation and would be the first groundwater affected by any potential seepage of leachate from the disposal cell. Furthermore, the middle sandstone unit is protected by hydrogeologic isolation provided by the mudstone units and upward vertical gradients. Low to moderate hydraulic conductivities have been measured in the Burro Canyon sandstone units, ranging from 10^{-5} to 10^{-7} cm/s. The confined potentiometric conditions in the middle and sandstone units of the Burro Canyon Formation create significant upward hydraulic gradients that would prevent tailings seepage from moving into the middle sandstone unit. The potentiometric surface lies approximately 42 ft (13 m) above the top of the middle sandstone unit.

The Burro Canyon mudstone unit overlying the upper sandstone has a low to moderate reactivity with respect to molybdenum, selenium, and uranium. Cadmium is strongly attenuated to the mudstone. These hazardous constituents would be retarded as they slowly flow through the mudstone, and dilution with groundwater underflow would enhance compliance with the groundwater protection standards. Analyses of groundwater samples from the three Burro Canyon sandstone units indicate differences in water quality types and characteristics, substantiating the lack of existing hydraulic interconnection between the sandstone units.

5.7 FLORA AND FAUNA

Flora and fauna would be affected directly and indirectly by remedial action. Direct impacts would include the loss of habitat, loss of less mobile wildlife species, and displacement of other species. Indirect impacts would arise from increased fugitive dust, noise levels, and human activity levels. The duration of the direct impacts would depend on the level of restoration efforts, while most indirect impacts would be short-term (for the life of the Project or less).

Stabilization of the tailings and other contaminated materials at the Burro Canyon site would result in clearing or disturbance of an estimated 262 ac (106 ha) of land. Table 5.1 lists plant community types that would be affected by remedial action activities. The majority of the disturbance would occur in the desert-shrub plant community, although the most productive and diverse wildlife habitat that would be impacted is the riparian habitat along the Dolores River. This habitat contains wildlife species found only in riparian areas and is also important to upland wildlife species. The riparian habitat at the UC and NC sites is a diverse mosaic of types. The upper riparian shrub type contains the largest impacted riparian area. The upper riparian shrub and riparian shrub types have the greatest diversity in habitat structure and wildlife use; more details regarding riparian plant communities are provided in Attachment 2 of this EA, Floodplain/Wetlands Assessment.

Important concentration areas for game species, such as critical deer winter range, do not occur in the areas to be impacted along the Dolores River or at Burro Canyon, although mule deer use of the riparian zone along the river appears to be greater than in the surrounding uplands. The desert bighorn sheep uses the riparian zone along the Dolores River and the upland plant communities near the Burro Canyon site. Remedial action activities would have very little impact on this species, given its wide range and the large amount of available habitat elsewhere in the area. Mule deer and pronghorn antelope occur in the area of the Disappointment Valley borrow site; Project-related impacts on these two species would be minimal.

T&E and Federal candidate species may occasionally occur at the Slick Rock sites. However, remedial action would be expected to result in no direct effect on these species. There are no wintering eagle concentration areas along the section of river valley to be impacted, although occasional birds would be

Table 5.1 Plant community types cleared or disturbed during the remedial action at the Slick Rock UMTRA sites near Slick Rock, Colorado

	Plant community type (ac) (ha)						
				Riparian			
Work area	Desert shrub	Desert grassland	Early successional (disturbed areas)	Dense riparian shrub	Upper riparian shrub	Upper riparian grassland	Total
UC tailings site	40.3 (16.3)	0.0	14.0 (5.6)	8.6 (3.5)	8.7 (3.5)	8.4 (2.6)	80.0 (32)
NC tailings site	10.1 (4.09)	0.0	0.0	6.3 (2.5)	10.6 (4.29)	0.0	27.0 (11)
Burro Canyon disposal site	0.0	65.0 (26)	0.0	0.0	0.0	0.0	65.0 (26)
Disappointment Valley borrow site	65.0 (26)	0.0	0.0	0.0	0.0	0.0	65.0 (26)
Dolores River borrow site	0.0	25.0 (10)	0.0	0.0	0.0	0.0	25.0 (10)
Total	115.4 (46.4)	90.0 (36)	14.0 (5.6)	14.9 (6.0)	19.3 (7.8)	8.4 (2.6)	262 (105)

expected during daily feeding activities. The peregrine falcons, at two aeries 8 mi (10 km) from the construction zone, would not be impacted due to the relatively long distance and availability of other feeding areas. Listed fish species would not be directly affected, since these species do not occur in the Dolores River. However, depletion of water from the upper Colorado River Basin (which includes water needed for remedial action from the Dolores River) may have cumulative effects on these species. Formal consultation with the Fish and Wildlife Service would be initiated to mitigate potential cumulative impacts that withdrawal of water would have on listed fish species. Water removed from the Dolores River would be subject to a one-time contribution to the Fish and Wildlife Service. Approximately 93 acre-feet of water would be required during the 19-month remedial action period. The annual water use would be approximately 59 acre-feet and would be subject to the $11.98 per acre-foot contribution.

The river otter occurs occasionally in the river near the two tailings sites, but impacts on this species would be minimal because no remedial activities would take place in the river. The white-faced ibis and black tern do not occur near the sites and would not be impacted. The southwestern willow flycatcher was not observed at or near the sites in 1990 and 1991 surveys. However, appropriate nesting habitat does occur at the sites, and a survey for this species will be conducted in 1993 to assess its current status near the site. If the species is determined to nest at or near the construction zones, a mitigation plan to prevent or reduce potential impacts would be prepared in consultation with the Fish and Wildlife Service. Attachment 1, Biological Assessment, provides more details regarding T&E species.

5.8 HISTORIC AND CULTURAL RESOURCES

No archaeological resources that are eligible for inclusion on the NRHP would be impacted near the UC or NC processing sites. One historic site eligible for the NRHP could be impacted; further evaluation of the site would be completed prior to any ground-disturbing activities.

Two cultural resource sites were identified in the immediate area of the proposed Burro Canyon disposal site. However, no evidence was found to show that the sites are eligible for nomination to the NRHP (CASA, 1993).

The borrow sites and access road have not been completely surveyed for cultural resources. Prior to surface disturbances in these areas, a Class III cultural resource survey would be conducted. A data recovery plan, approved by the Colorado SHPO, the BLM, and the DOE, would be implemented if eligible sites were identified.

In the event an unexpected discovery of cultural resources is made during the proposed action, work would stop in the area of discovery and the appropriate state and Federal agencies would be contacted to inspect and evaluate the discovery.

5.9 LAND USE

The final restricted disposal site area containing the tailings would encompass approximately 65 ac (26 ha). This area would be under the direct control of the Federal government and would be restricted from public entry or development. The current access to grazing cattle from November to May would be forgone. Approximately 700 cattle graze in a 62,000-acre (25,000-ha) BLM area that includes the 65 ac (26 ha) that would be restricted from further use (Werkmeister, 1993). The DOE would be required to compensate the current land users for any losses incurred by the proposed remedial action.

The proposed action would not affect future recovery or development of mineral resources beneath the disposal site. The disposal site is on land administered by the BLM and has several mineral claims. Because of the depth of the ore, exploration and development of the deposits would not be excluded by the withdrawal of the disposal site from the BLM to the DOE. Also, calculations indicate that mines at this depth would have no impact on the site. Public Law 95-604 requires that the mineral rights for the disposal site be transferred to the Federal government along with the disposal site. It also authorizes the Secretary of the Interior, with the concurrence of the Secretary of Energy and the NRC, to dispose "of any subsurface mineral rights by sale or lease...if the Secretary of the Interior takes such action as the Commission deems necessary pursuant to the license issued by the Commission to assure that the residual radioactive materials will not be disturbed by reason of any activity carried on following such disposition." Any recovery of mineral resources from beneath the Burro Canyon disposal site would, therefore, be governed by license conditions to prevent any disturbance of the disposal cell.

The proposed action would have little effect on existing land uses at the UC and NC processing sites. An existing volunteer fire station may need to be relocated, but it would not be directly impacted by remedial action activities.

The removal of borrow materials at the proposed borrow sites would unavoidably impact the existing grazing uses. Prior to any ground-disturbing remedial action activities, the DOE would need to compensate existing users for lost grazing privileges. The removal of borrow materials would be planned and conducted to avoid encroachment on the public water reserve withdrawal area near the Disappointment Valley borrow site.

After completion of the remedial action, all disturbed areas would be reclaimed in accordance with landowner requirements. Reclamation would include grading (including filling where necessary) and seeding plant seeds recommended by the Soil Conservation Service.

Although recreational values along the Dolores River are considered high for river rafting, there would not be a direct impact on river users due to the remedial action. Recreationists would be able to observe remedial action at the UC and NC sites as they floated by. Site fencing and warning signs would be

placed along all site boundaries, including the river bank, to keep the construction site secure. There would be no anticipated adverse health effects to the rafters.

5.10 SOCIOECONOMICS

Impacts on population and employment in the Slick Rock area were assessed by evaluating the effects of the average and peak remedial action labor requirements on the available work force and local populations. It is anticipated that the temporary housing and other infrastructure services required for the work force would be available in the surrounding five-county area (Dolores, Montezuma, Montrose, San Juan, and San Miguel). No impact on area housing supplies or other infrastructure services would be expected to occur.

The primary employment needs would be for experienced truck drivers and heavy equipment operators and supervisors. Specialized employment needs, such as health physicists or construction management, likely would be filled from outside the area. A local work force could be assembled from area towns, such as Naturita and Dove Creek, that are approximately 30 minutes from the work sites.

The number of construction workers is estimated to be [TO BE INSERTED]. The short-term employment associated with this project would have a negligible but positive effect on area unemployment.

The remedial action would have a positive impact on area economies through wages and salaries paid to remedial action workers and expenditures for materials, supplies, and equipment. There would be additional indirect positive benefits on local economies as these wages, salaries, and other expenditures are respent locally on other goods and services.

The estimated cost of the remedial action is [TO BE INSERTED].

5.11 TRANSPORTATION

The proposed action would use approximately 15 mi (24 km) of area roads for transporting the tailings, contaminated soils, and borrow materials. The haul road to the NC site, the disposal site access road, and a section of County Road S8 would be upgraded. A section of County Road S8 would be relocated 400 ft (122 m) south of its present location to allow for cleanup and debris removal from the UC site. Worker commute trips would constitute a negligible impact to the existing traffic in the area. Existing traffic on County Road S8 and State Highway 141 is very light due to the remoteness of the area. The most transportation activity would occur for 6 months when the contaminated materials are transported from the UC and NC sites to the Burro Canyon site.

6.0 MITIGATIVE MEASURES

The following mitigative measures were incorporated into the design and approach for the proposed remedial action alternatives in order to reduce the environmental impacts:

- Apply water or chemical dust suppressants to disturbed areas and graveled haul roads to inhibit dust emissions.
- Backfill, grade, and revegetate the areas disturbed during the proposed action to stabilize further damage to the land surface.
- Decontaminate equipment used before release to prevent the spread of contaminated materials.
- Use local labor whenever possible to enhance beneficial employment and economic impacts.
- Conduct operations during normal work hours to minimize noise disturbance to local residents.

Mitigative measures necessary to ensure the protection of remedial action workers and the long-term stability of the tailings are described in the *UMTRA Project Environmental, Health, and Safety Plan* (DOE, 1985b), the *Remedial Action Plan* (DOE, 1987), and the *Guidance for Implementing the UMTRA Project Long-term Surveillance Program* (DOE, 1992).

A mitigation plan to reduce negative impacts to archaeological sites will be developed and implemented after archaeological site evaluations are completed and concurrence of the BLM and Colorado SHPO is received.

7.0 CONSULTATION, COORDINATION, AND LIST OF PREPARERS

7.1 CONSULTATION AND COORDINATION

The DOE has informed the local managing entities, through informal meetings, as to the proposed action and areas under evaluation. The following state and Federal agencies have been instrumental in providing information on their resources.

- Bureau of Land Management, U.S. Department of the Interior, Montrose District Office, San Juan Resource Area Office
- Colorado Department of Health
- Colorado Division of Wildlife, Colorado Department of Natural Resources
- U.S. Department of the Interior, Fish and Wildlife Service
- U.S. Army Corps of Engineers, U.S. Department of the Interior

7.2 LIST OF PREPARERS

The engineering design, including transportation routes, was developed by MK-Ferguson Company, the RAC to the DOE.

This EA was prepared by the Jacobs Engineering Group, the Technical Assistance Contractor to the DOE, based on the design provided by the RAC.

Numerous individuals assisted in the production of this EA. The following individuals provided key expertise and were instrumental in the analysis of the project.

- Malu Gawthrop Cooper: EA document coordinator.
- Sandra Beranich: EA document coordinator, land use, socioeconomics, transportation, cultural resources.
- Chuck Burt: wildlife, wetlands, T&E species, climate.
- Jim Crain: conceptual design, surface water and flood analysis.
- Gerry Lindsey: geology and soils.
- Kathy Monks: groundwater.
- Gerry Simiele: radiation.
- Desiree Thalley: editing and document production.
- Mary Beth Leaf: cultural resources.

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ATTACHMENT 1

BIOLOGICAL ASSESSMENT

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ac	acre
CDOW	Colorado Division of Wildlife
DDT	dichlorodiphenyltrichloroethane
DOE	U.S. Department of Energy
ft	feet
ft^3/s	cubic feet per second
FWS	Fish and Wildlife Service
ha	hectare
km	kilometer
m	meter
m^3	cubic meter
mi	mile
NC	North Continent
T&E	threatened and endangered
UC	Union Carbide
UMTRA	Uranium Mill Tailings Remedial Action
yd^3	cubic yard

1.0 INTRODUCTION

Pursuant to the Uranium Mill Tailings Radiation Control Act of 1978, the U.S. Department of Energy (DOE) is conducting a remedial action program designed to clean up the residual radioactive materials at two sites near Slick Rock, Colorado (Figure 1.1). An important part of the environmental assessment of the remedial action is the consideration of threatened and endangered (T&E) flora and fauna that may be affected by the project. This biological assessment includes communications with the Fish and Wildlife Service (FWS) to ascertain their concerns regarding T&E species. In February 1986, the FWS provided a list of species that may occur near the Slick Rock sites. This list was updated in December 1988, April 1990, and December 1992 (Appendix A). This assessment addresses the species listed in the December 1992 letter and includes descriptions of the proposed action, the ecological setting at the Slick Rock tailings sites, the historical and current status of the species of concern at the site, and a finding as to whether the remedial action will impact the species.

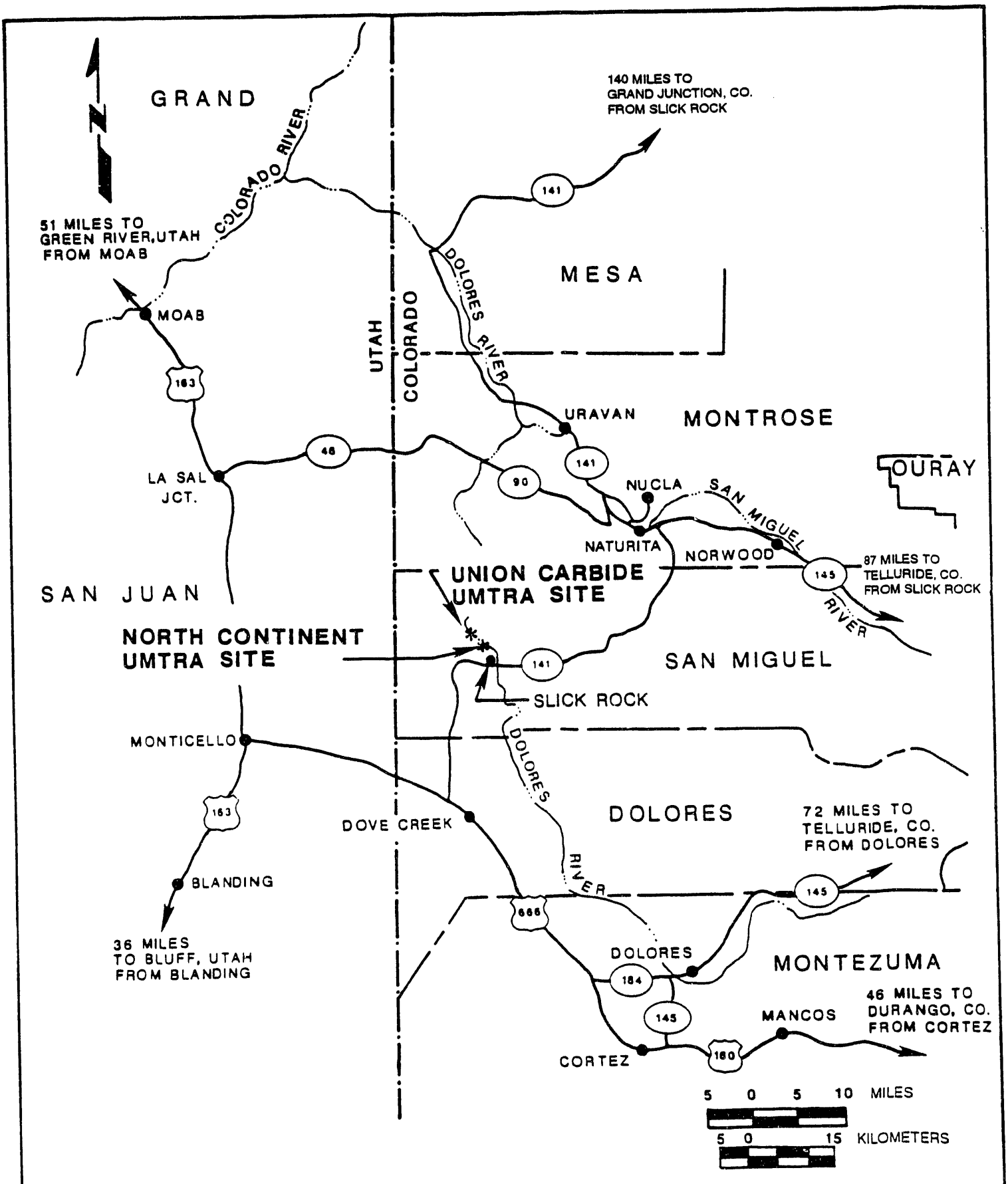

FIGURE 1.1
LOCATIONS OF THE UNION CARBIDE AND NORTH CONTINENT UMTRA SITES NEAR SLICK ROCK, COLORADO

2.0 DESCRIPTIONS OF THE PROPOSED ACTION AND STUDY AREA

2.1 PROPOSED ACTION

The proposed action is to stabilize all contaminated materials at the Union Carbide (UC) and North Continent (NC) Uranium Mill Tailings Remedial Action (UMTRA) sites at the Burro Canyon disposal site. The materials to be stabilized are contaminated with low levels of radioactive and other hazardous constituents. The volume of contaminated materials is 620,000 cubic yards (yd^3) [470,000 cubic meters (m^3)], covering 55 acres (ac) [22 hectares (ha)] at the UC site and 12 ac (4.9 ha) at the NC site. The contaminated materials would be covered with a combination of earth, gravel, and rock materials to inhibit radon emanation from the contaminated materials and water infiltration through the pile and to prevent erosion of the disposal cell. Section 2.0 of this EA provides additional information on the proposed action.

The amount of land disturbed during remedial action would be 262 ac (105 ha): 67 ac (27 ha) at the tailings site areas; 40 ac (16 ha) of additional windblown contamination; 65 ac (26 ha) at the proposed disposal site; 65 ac (26 ha) at the Disappointment Valley borrow site; and 25 ac (10 ha) at the Dolores River borrow site. Remedial action would take place over a 19-month period that includes one 5-month winter shutdown.

2.2 STUDY AREA

The UC, NC, Burro Canyon, and borrow sites are in Great Basin sagebrush habitat within the Colorado Plateau (Kuchler, 1975). The UC and NC tailings sites and the Dolores River borrow site are in the Dolores River valley, which is surrounded by sandstone cliffs and steep juniper-covered hillsides. Flat land is confined to the riparian zone along the river. The Burro Canyon disposal site and Disappointment Valley borrow site are in upland areas dominated by desert shrubs.

The ecological characteristics at the Slick Rock sites were determined during field surveys (TAC, 1991, 1990, 1986, 1985; DOE, 1983), consultations with natural resource personnel from state and Federal agencies, and review of the pertinent literature. The flora and fauna observed or expected to occur at the sites plus scientific names of most species referred to in the text appear in Tables 2.1 through 2.5. The plant species list (Table 2.1) was derived from site-specific surveys and includes the more common species in the area of the sites (TAC, 1986; DOE, 1983). Surveys of fisheries were not conducted as part of this study; fish species that occur in the Dolores River were determined from other studies as referenced in Table 2.2. Surveys specifically for amphibians, reptiles, and mammals were not conducted at the sites. The occurrence of species within these groups was recorded during surveys for other purposes (Tables 2.3 and 2.5). Nesting birds along the Dolores River were identified during June 1990 and June 1991 surveys for the southwestern willow

Table 2.1 Plant species observed in the area of the UC and NC UMTRA sites

Species		Habitat	
Scientific name	Common name	Riparian	Upland
	TREES AND SHRUBS		
Acer negundo	box elder	X	
Artemisia arbuscula	black sagebrush		X
Artemisia tridentata	big sagebrush	X	X
Atriplex canescens	fourwing saltbush	X	X
Atriplex sp.	saltbush	X	X
Brickellia scabra	brickellia	X	
Cercocarpus montanus	mountain mahogany		X
Chrysothamnus nauseosus	golden rabbitbrush	X	X
Chrysothamnus viscidiflorus	rabbitbrush	X	
Elaeagnus angustifolia	Russian olive	X	
Ephedra sp.	mormon tea		X
Forestera neomexicana	wild privet	X	
Gutierrezia sarothrae	broom snakeweed		X
Haplopappus scopurlorum	goldenweed	X	
Juniperus sp.	juniper	X	
Opuntia polyacantha	plains prickly pear		X
Pinus edulis	pinon pine		X
Populus angustifolia	narrowleaf cottonwood	X	
Populus fremontii	Fremont cottonwood	X	
Rhus trilobata	squawbush	X	
Rosa fendleri	fendler rose	X	X
Salix sp.	willow	X	
Sarcobatus vermiculatus	greasewood	X	
Tamarix pentandra	saltcedar	X	
Yucca baccata	banana yucca		X
Yucca sp.	yucca		X
	FORBS AND HERBS		
Amaranthus sp.	pigweed	X	
Ambrosia confertifolia	slimleaf bursage		X
Arctium minus	burdock	X	
Astragalus amphioxys	milkvetch	X	X
Astragalus sp.	milkvetch	X	X
Centaurea repens	Russian knapweed	X	X
Chenopodium watsoni	Watson goose foot	X	
Chrysopsis hispida	gold aster	X	X
Clematis liqusticifolia	virgin's bower	X	
Cleome lutea	yellow bee plant	X	
Cleome serrulata	Rocky Mountain bee plant	X	
Descurainia obtusa	tansy mustard	X	

Table 2.1 Plant species observed in the area of the UC and NC UMTRA sites (Concluded)

Species		Habitat	
Scientific name	Common name	Riparian	Upland
	FORBS AND HERBS (Concluded)		
Eriogonum wrightii	Wright buckwheat		X
Glycyrrhiza lepidota	licorice	X	
Grindelia squarrosa	curlycup gumweed	X	
Halogeton glomeratus	halogeton	X	
Helianthus annuus	common sunflower	X	X
Hymenopappus pauciflora	white ragweed	X	
Ipomoea sp.	morning glory	X	
Ipomopsis aggregata	desert trumpet	X	
Lesquerella rectipes	bladder pod	X	
Leucelene ericoides	babywhite aster		X
Melilotus officinalis	yellow sweet clover	X	
Mirabilis multiflora	Colorado four o'clock	X	
Salsola iberica	Russian thistle		X
Senecio multicapitatus	groundsel	X	X
Sphaeralcea coccinea	scarlet globe mallow	X	X
Stanleya pinnata	prince's plume	X	X
	GRASSES		
Agropyron desertorum	crested wheatgrass		X
Andropogon gerardii	big bluestem	X	
Bouteloua gracilis	blue grama		X
Bouteloua sp.	grama sp.		X
Bromus rubens	red brome	X	X
Bromus tectorum	cheatgrass	X	X
Cynodon dactylon	Bermuda grass	X	
Hilaria jamesii	galleta		X
Oryzopsis hymenoides	Indian ricegrass		X
Phragmites communis	reed	X	
Sitanion hystrix	squirrel tail	X	X
Sporobolus cryptandrus	sand dropseed		X
Stipa comata	needle and thread	X	X

Ref. TAC, 1986; DOE, 1983.

Table 2.2 Fish species recorded in the Dolores River near Slick Rock, Colorado

Scientific name	Common name	Status
Catostomus discobolus	bluehead sucker	Native
Catostomus latipinnis	flannelmouth sucker	Native
Lepomis cyanellus	green sunfish	Nonnative
Cottus bairdi	mottled sculpin	Native
Cyprinus carpio	common carp	Nonnative
Gila robusta	roundtail chub	Native
Cyprinella lutrensis	red shiner	Nonnative
Notropis stramineus	sand shiner	Nonnative
Pimephales promelas	fathead minnow	Nonnative
Rhinichthys osculus	speckled dace	Native
Ictalurus punctatus	channel catfish	Nonnative
Ameiurus melas	black bullhead	Nonnative

Ref. Kehmeier, 1986; Valdez *et al.*, 1992, 1982; Holden and Stalnaker, 1975.

Table 2.3 Amphibians and reptiles observed or expected to occur in the area of the UC and NC UMTRA sites

Species		Habitat	
Scientific name	Common name	Riparian	Upland
Ambystoma tigrinum	tiger salamander	X	X
Scaphiopus intermontanus	great basin spadefoot	X	X
Bufo punctatus[a,b]	red-spotted toad	X	
Bufo woodhousii[a,b]	Woodhouse's toad	X	
Hyla arenicolor[a,b]	common tree frog	X	
Rana pipiens	leopard frog	X	
Crotaphytus collaris[a]	collared lizard		X
Gambelia wislizenii	leopard lizard		X
Phrynosoma douglassii	short-horned lizard		X
Sceloporus undulatus[a]	eastern fence lizard	X	X
Sceloporus occidentialis[a]	western fence lizard	X	
Sceloporus graciosus[a]	sagebrush lizard		X
Uta stansburiana[a]	side-blotched lizard		X
Urosaurus ornatus	tree lizard	X	X
Eumeces multivirgatus	many-lined skink	X	X
Chemidophorus tigris[a]	northern whiptail		X
Chemidophorus velox[a]	plateau whiptail		X
Coluber constrictor	racer	X	X
Pituophis melanoleucus[a]	gopher snake	X	X
Lampropeltis triangulum	milk snake	X	X
Thamnophis elegans	western terrestrial garter snake	X	
Crotalus viridis	western rattlesnake	X	X

[a]Species observed on the site.
[b]Observed by Beck (1993) in canyons feeding into the Dolores River

Ref. Beck, 1993; Hammerson, 1986; TAC, 1991, 1990, 1986, 1985; DOE, 1983; Pioneer, 1979; Bernard and Brown, 1978.

Table 2.4 Bird species observed at or near the UC and NC UMTRA sites

Species		Nesting habitat	
Scientific name	Common name	Riparian	Upland
Ardea herodias	great blue heron	X	
Anas platyrhynchos	mallard	X	
Charadrius vociferus	killdeer	X	X
Actitis macularia	spotted sandpiper	X	
Cathartes aura	turkey vulture	X	X
Circus cyaneus[a]	northern harrier	X	
Buteo jamaicensis	red-tailed hawk	X	X
Falco sparverius	American kestrel	X	X
Columba fasciata	band-tailed pigeon	X	X
Columba livia[b]	rock dove	X	X
Zenaida macroura	mourning dove	X	
Chordeiles minor	common nighthawk	X	X
Aeronautes saxatalis	white-throated swift	X	X
Archilochus alexandri	black-chinned hummingbird	X	X
Selasphorus platycercus	broad-tailed hummingbird	X	
Ceryle alcyon	belted kingfisher	X	
Colaptes auratus	northern flicker	X	
Picoides villosus	hairy woodpecker	X	
Melanerpes lewis	Lewis' woodpecker	X	X
Tyrannus verticalis	western kingbird	X	X
Myiarchus cinerascens	ash-throated flycatcher	X	X
Contopus sordidulus	western wood pewee	X	
Sayornis saya	Say's phoebe	X	
Empidonax wrightii	gray flycatcher	X	X
Eremophila alpestris	horned lark		X
Tachycineta thalassina	violet-green swallow	X	
Stelgidopteryx serripennis	northern rough-winged swallow	X	
Hirundo pyrrhonota	cliff swallow	X	
Hirundo rustica	barn swallow	X	
Aphelocoma coerulescens	scrub jay		X
Gymnorhinus cyanocephalus	pinyon jay	X	X
Pica pica	black-billed magpie	X	
Corvus brachyrhynchos	American crow	X	
Corvus corax[b]	raven		X
Sitta pygmaea	pygmy nuthatch		X
Troglodytes aedon	house wren	X	
Catherpes mexicanus	canyon wren		X
Salpinctes obsoletus	rock wren		X
Polioptila caerulea	blue-gray gnatcatcher	X	X
Sialia currucoides	mountain bluebird		X

Table 2.4 Bird species observed at or near the UC and NC UMTRA sites (Concluded)

Species		Nesting habitat	
Scientific name	Common name	Riparian	Upland
Turdus migratorius	American robin	X	
Lanius ludovicianus	loggerhead snake	X	X
Mimus polyglottos	northern mockingbird	X	X
Toxostoma bendirei	Bendire's thrasher		X
Bombaycilla cedrorum	cedar waxwing	X	
Vireo gilvus	warbling vireo	X	
Vireo solitarius	solitary vireo	X	
Vireo vicinior	gray vireo		X
Dendroica petechia	yellow warbler	X	
Icteria virens	yellow-breasted chat	X	
Pheucticus melanocephalus	black-headed grosbeak	X	X
Guiraca caerulea	blue grosbeak	X	
Passerina amoena	lazuli bunting	X	
Pipilo erythrophthalmus	rufous-sided towhee	X	
Pooecetes gramineus	vesper sparrow	X	X
Passerculus sandwichensis	savannah sparrow	X	X
Chondestes grammacus	lark sparrow	X	X
Spizella passerina	chipping sparrow	X	X
Amphispiza bilineata	black-throated sparrow		X
Sturnella neglecta	western meadowlark	X	X
Euphagus cyanocephalus	brewer's blackbird	X	
Molothrus ater	brown-headed cowbird	X	X
Icterus galbula	northern oriole	X	
Carduelis psaltria	lesser goldfinch	X	
Carduelis tristis	American goldfinch	X	
Carpodacus mexicanus	house finch	X	X

[a]Species observed only in Disappointment Valley borrow site area.
[b]Species which nest on cliffs.

Ref. TAC, 1991, 1990, 1986, 1985; DOE, 1983; Pioneer, 1979.

Table 2.5 Mammals observed or expected to occur in the area of the UC and NC UMTRA sites

Species		Habitat	
Scientific name	Common name	Riparian	Upland
Sylvilagus nuttallii	mountain cottontail	X	
Sylvilagus audubonii [a]	desert cottontail		X
Lepus californicus	black-tailed jackrabbit		X
Eutamias minimus[a]	least chipmunk		X
Ammospermophilus leucurus[a]	white-tailed antelope ground squirrel		X
Spermophilus richardsonii [a]	Richardson's ground squirrel	X	X
Spermophilus variegatus	rock squirrel		X
Thomomys talpoides	northern pocket gopher	X	X
Perognathus flavus	silky pocket mouse		X
Dipodomys ordii [a]	Ord's kangaroo rat	X	X
Castor canadensis[a]	beaver	X	
Peromyscus crinitus	canyon mouse		X
Peromyscus maniculatus[a]	deer mouse	X	X
Peromyscus truei [a]	pinon mouse		X
Onychomys leucogaster [a]	northern grasshopper mouse		X
Neotoma lepida[a]	desert woodrat		X
Ondatra zibethicus[a]	muskrat	X	
Zapus princeps	western jumping mouse	X	
Erethizon dorsatum[a]	porcupine	X	X
Canis latrans[a]	coyote	X	X
Urocyon cinereoargenteus	gray fox	X	X
Procyon lotor [a]	raccoon	X	X
Mustela frenata	long-tailed weasel	X	X
Mustela vison	mink	X	
Taxidea taxus	badger	X	X
Spilogale gracilis	western spotted skunk	X	X
Mephitis mephitis[a]	striped skunk	X	X
Lutra canadensis[a]	river otter	X	
Felis rufus[a]	bobcat	X	X
Odocoileus hemionus[a]	mule deer	X	X
Antilocapra americana[a,b]	pronghorn antelope		X
Ovis conadesis mexicana	desert bighorn sheep	X	X

[a]Species observed at or near the sites.
[b]Species observed only in Disappointment Valley borrow site area.

Ref. TAC, 1986; DOE, 1983; Pioneer, 1979; Bernard and Brown, 1978.

flycatcher, and this listing is considered fairly complete. Other bird species would be expected at the sites during the winter or as migrants.

Union Carbide and North Continent sites

Six plant community types were observed: disturbed grassland, desert shrub, and four riparian plant communities. The grass/herb type occurs on the tailings piles and other nearby disturbed areas. The UC tailings pile was planted with crested wheatgrass; Indian ricegrass and red brome are other grass species that occur sporadically. Widely scattered shrubs, including fourwing saltbush and rabbitbrush, also occur on this pile. Vegetative growth on the pile was sparse, and there is much bare ground. The NC tailings pile has a more developed plant cover than the UC pile. Commonly observed grass species include cheatgrass, red brome, and Indian ricegrass. Major shrub species observed include saltbush, rabbitbrush, and broom snakeweed. Herbs such as licorice, desert trumpet, scarlet globemallow, and prince's plume were also observed on the NC pile (DOE, 1983).

Within the desert shrub type, widely scattered shrubs (sagebrush, rabbitbrush, and broom snakeweed) were the dominant species in these areas. Ground cover was sparse and various grass and herb species were observed.

The four riparian vegetation plant communities consist of the dense riparian shrub type closest to the river, the upper riparian shrub and grassland types at a somewhat higher elevation above the river, and cottonwood stands. A more detailed description of the riparian plant communities is provided in Attachment 2 of this EA.

The Dolores River in the area of the Slick Rock sites traverses narrow canyons and consists of riffles, pools, and slow runs. Flow rates in the Dolores River in the area of the Slick Rock sites are dominated by releases from McPhee Dam. During the drought years of 1988 through 1991, low flows of 20 to 50 cubic feet per second (ft^3/s) [0.57 to 1.42 cubic meters per second (m^3/s)] were common (Valdez *et al.*, 1992). A recent 2-year study of the fisheries of the Dolores River resulted in the identification of 12 species from the river in the area of the sites; five of these were native and seven were nonnative species (Table 2.2) (Valdez *et al.*, 1992). Native species were predominant, with the flannelmouth sucker and the roundtail chub being the most common species. Over a 10-year period from 1981 to 1991, a decrease in the roundtail chub and an increase in the flannelmouth sucker were noted (Valdez *et al.*, 1982, 1992).

Detailed studies of terrestrial wildlife at the tailings sites were not conducted. Reconnaissance surveys at and near the sites (TAC, 1991, 1990, 1986, 1985), studies by Beck (1993), and surveys in nearby Disappointment Valley (Pioneer, 1979) resulted in the observation of 11 species of reptiles and amphibians. An additional 11 species may occur at or near the sites.

A total of 66 species of birds were observed at or near the UC and NC sites (Table 2.4) (TAC, 1991, 1990, 1986, 1985). These observations resulted in a fairly complete list of nesting species, along with a few species that are migrants or nest some distance from the sites. The yellow-breasted chat, blue grosbeak, and yellow warbler were commonly observed in the dense brushy riparian habitat along the river. The western wood pewee, mourning dove, and robin were frequently observed in the cottonwood stands and nearby open shrub riparian habitat.

Very few waterbird species (*i.e.,* waterfowl, wading birds, shore-birds) were observed near the Dolores River. The river does not provide nesting waterfowl habitat because there is a lack of brood-rearing habitat, especially with the summer drawdown of the river, although one mallard brood was observed along the river in 1990 (TAC, 1990). Waterfowl winter along the river in very small numbers (BLM, 1980). The other water bird species recorded were the great blue heron and the spotted sandpiper.

Two species of raptors observed near the tailings sites were the red-tailed hawk and the kestrel. These species probably nest in the cottonwood stands along the river or on cliffs adjacent to the river. An aerial (helicopter) survey for nesting raptors was conducted by the FWS along the river; no nesting raptors were located during this survey (FWS, 1987a).

A total of 32 species of mammals have been observed or may occur at the UC and NC sites (Table 2.5). Nineteen of these species were observed on the sites or in nearby Disappointment Valley (Beck, 1993; TAC, 1991, 1990, 1986, 1985; Pioneer, 1979). Fresh beaver signs (cuttings) were commonly observed along the river and within the dense riparian shrub habitat. The only large ungulate species observed near the UC and NC sites was the mule deer. The UC and NC sites are summer range for this species and its droppings were common in the Dolores River floodplain. Other species recorded from tracks along the river were the raccoon, skunk, river otter (discussed in detail below), bear, muskrat, and bobcat. The desert bighorn sheep was released by the Colorado Division of Wildlife (CDOW) along the Dolores River starting in 1986. The population is doing well and regularly occurs in the Slick Rock area.

Burro Canyon site

The Burro Canyon disposal site area is in an upland area above the Dolores River Valley. The site itself is grass-dominated, with widely scattered herbs such as scarlet globe mallow also observed. Widely scattered shrubs occur in the area, with fourwing saltbush being the most common species observed. Prickly pear is also fairly common. The disposal site area is surrounded by low ridges covered with pinon pine/juniper woods. Big sagebrush, black sagebrush, and broom snakeweed are common shrubs. Species of cactus observed in these woods are claret cup, Simpson bell cactus, and Whipple's claw cactus (TAC, 1990).

Borrow sites

The Dolores River borrow site is located on a terrace above the Dolores River. Part of the area is cleared pasture with a vegetative cover dominated by grass and herbs. The remainder of the borrow site is desert-shrub habitat similar to that described above for the UC and NC tailings sites. Wildlife that would occur at this borrow site are similar to those described for the tailings sites, except that open-ground nesting birds such as the meadowlark and horned lark should be more common.

The Disappointment Valley borrow site is located on relatively flat terrain about 4.5 miles (mi) [7.2 kilometers (km)] east of the tailings sites. This site is located in desert-shrub habitat where relatively low-growing black greasewood [1 to 3 feet (ft) high] [0.3 to 0.9 meters (m) high] was the dominant shrub species observed. Widely scattered fourwing saltbush, rabbitbrush, and big sagebrush were also noted. Grass was the dominant ground cover (mostly blue grama) along with scattered herbs. Wildlife indicative of upland shrub habitat occurs at this borrow site. The horned lark, western meadowlark, vesper sparrow, and black-throated sparrow were the most common nesting bird species in the grassland and shrub habitats near the site (Pioneer, 1979).

3.0 THREATENED AND ENDANGERED SPECIES

The listing of T&E species and other species of concern that may occur in the area of the UC and NC sites was obtained through consultation with the FWS (see Appendix A for FWS letters). This process identified 11 species that may occur at the site (Table 3.1). Of this total, seven are Federally listed species and four are Federal candidate species.

Table 3.1 Threatened or endangered species and other species of concern that may occur at the UC and NC UMTRA sites near Slick Rock, Colorado

Species		Federal	Federal	State
Scientific name	Common name	listed	candidate	species
Gila elegans	bonytail chub	X		X
Gila cypha	humpback chub	X		X
Ptychocheilus lucius	Colorado squawfish	X		X
Xyrauchen texanus	razorback sucker	X		
Haliaeetus leucocephalus	bald eagle	X		X
Falco peregrinus	peregrine falcon	X		X
Mustela nigripes	black-footed ferret	X		X
Chlidonias niger	black tern		X	
Empidomax trailii extimus	southwestern willow flycatcher		X	
Plegadis chihi	white-faced ibis		X	
Lutra canadensis sonorae	southwestern otter		X	X

Of the 11 species listed, 4 are fish species. Fish sampling in 1971 and more recently in 1981 failed to result in the capture of bonytail chub, humpback chub, Colorado squawfish, or razorback sucker in the Dolores River. Valdez *et al.* (1982) not only failed to capture any bonytail chub, humpback chub, or razorback sucker, they also found no records of these species being observed or captured in the Dolores River. The Colorado squawfish occurred historically in the Dolores River but was probably absent from the river by 1960 (Sigler *et al.*, 1966). Valdez *et al.* (1982) indicated that Dolores River flow reductions due to irrigation, dominance of nonnative fish species, and point-source pollution are the principal factors that have resulted in the elimination of T&E species from the Dolores River. However, the Colorado squawfish may be coming back to the Dolores River. Four squawfish were captured in the lower 1.2 mi (2 km) of the river in 1991, which is about 120 miles (192 km) downriver from the Slick Rock sites. An analysis of the Dolores River

indicated that it may be suitable for all life stages of the Colorado squawfish. The principal factors that may limit the river's ability to support the squawfish are low flows in the summer and potentially lethal levels of copper and iron that are released into the river during summer floods caused by intense rain storms (Valdez *et al.*, 1992). Valdez *et al.* (1992) recommended that experimental stocking of the Dolores River with Colorado squawfish and razorback sucker be considered. The purpose of this would be to conduct various studies on these endangered species. However, the potential for these fish being introduced to the Dolores River within the next few years is low because an augmentation plan for these species has not been finalized and other rivers have a higher priority for being stocked with these species (Rose, 1993).

The four endangered fish species do not occur anywhere near the Slick Rock sites; therefore, remedial action activities would not have a direct impact on them. However, the proposed remedial action may have an indirect impact on these endangered fish. The FWS has determined that the continued existence of the Colorado squawfish, bonytail chub, humpback chub, and razorback sucker in the Upper Colorado River Basin (which includes the Dolores River) is in jeopardy due to depletion of water within the basin (FWS, 1987b). Water required for remedial action would result in a net depletion of water within the basin, which may have a negative impact on these species and would result in a "may affect" determination by the FWS. This determination requires the initiation of a formal consultation with the FWS under the Endangered Species Act. According to the "Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin" (FWS, 1987b), water depletion subject to a "may affect" determination would require a one-time contribution to the FWS of $11.98 per acre-foot of water used based on the average annual project depletion. Water for remedial action would be obtained from the Dolores River or from aquifers hydraulically connected to the river. This water use would be subject to the one-time contribution to the FWS. Approximately 93 acre-feet of water would be required during the 19-month remedial action period. The annual water use would be approximately 59 acre-feet and would be subject to the $11.98 per acre-foot contribution.

The bald eagle is not known to nest along the Dolores River but does occur along the river during the winter. Winter use is very dispersed (BLM, 1980) and consists principally of diurnal feeding activities (Button, 1986). There are no known nocturnal roost sites along the river. The nearest nocturnal roost to the Slick Rock sites is 7 miles (11 km) to the southeast along Disappointment Creek in Disappointment Valley. The roost site is in a stand of large, old cottonwoods. The number of bald eagles that roost at this site is directly proportional to the severity of the winter (Button, 1986). The closest roost site to the Disappointment Valley borrow site is 1.5 mi (2.4 km) to the south-southeast; 10 bald eagles were counted at this site in 1991 and 1992 (Clark, 1993). Remedial action activities would not have a direct impact on wintering bald eagles, since the Project would either be shut down during the bald eagle wintering period or only limited activity such as building demolition would take place. In addition, bald eagle use of the nocturnal roost site in Disappointment Valley would not be affected due to the same shutdown. Winter bald eagle use of the Dolores River may be indirectly affected by the cleanup of the contaminated riparian zone, which could mean clearing all the large cottonwoods. These trees provide potential diurnal roost sites for eagles hunting in the area. The one contaminated area with large cottonwoods is across the river from the UC site; this area

would not be disturbed because supplemental standards would be applied to this area. Therefore, remedial action activities are not expected to affect wintering bald eagles along the Dolores River or in Disappointment Valley.

Historically, the peregrine falcon nested in at least 27 locations in Colorado. By 1972, there were eight known nesting locations, none of which produced any young. This drastic reduction was due to the widespread use of dichlorodiphenyltrichloroethane (DDT) (Scott, 1985). The peregrine falcon recovery program began in 1975; as of 1987, the total number of breeding pairs had increased to 23, with 22 pairs successfully fledgling young (CDOW, 1988).

One of the state's successful peregrine falcon breeding territories is 8 air miles (12 km) from the UC and NC sites. In 1984, an adult male and immature female engaged in nesting behavior but did not lay eggs. Young were successfully fledged at this site every year since 1985 (Craig, 1993). Peregrine falcons have also been observed engaged in nesting behavior at another site, which is also 8 air miles (13 km) from the UC and NC sites. A pair occupied a territory in 1984 and produced infertile eggs. Nesting behavior was not observed in 1985 and 1986, although adult birds were in the area both years (Button, 1986; Craig, 1986). This pair successfully produced young in 1987 and has done so every subsequent year (Craig, 1993). Remedial action activities would not have a direct impact on nesting peregrines; however, peregrine falcons may travel long distances from the aerie to secure food. The UC and NC sites are within the feeding range of nesting peregrine falcons, which has been estimated to be up to 10 mi (16 km) (CDOW, 1978). In addition, preferred feeding areas are riparian habitat such as occur along the Dolores River at the Slick Rock sites (FWS, 1984). Remedial action activities would probably preclude use of the Dolores River riparian zone in the area of the tailings piles by peregrine falcons. These activities would take place for two nesting seasons and would constitute a short-term limited impact. Following remedial action, peregrine falcon use of the riparian zone near the piles would be reduced since there would be a reduced prey base as a result of clearing the vegetation. This impact would be relatively long-term; its duration would depend on the time taken for riparian habitat recovery. However, remedial action would take place on the periphery of the hunting territory; numerous feeding areas for the nesting peregrine falcons are located elsewhere within the range of the aerie. Therefore, remedial action is expected to have no effect on the peregrine falcon's nesting along the Dolores River (Craig, 1993).

The UC and NC sites are within the historic range of the black-footed ferret (CDOW, 1978). The most recent wild population of ferrets occurred in Wyoming (Clark *et al.*, 1984). However, there are now no known ferret populations in the wild; the only known population is in captivity near Laramie, Wyoming (Leachman, 1987). This species is closely associated with prairie dogs in that the prairie dog is the ferret's main food source, and it uses prairie dog burrows for shelter and to raise its young (Hillman and Clark, 1980). For this reason, all prairie dog colonies are considered potential black-footed ferret habitat.

Prairie dog colonies do not occur at the tailings piles, the windblown and waterborne contaminated areas, the Burro Canyon disposal site, or the Dolores River borrow site. No prairie dog colonies were observed during a brief survey in the area of the Disappointment Valley borrow site. However, surveys near the proposed site indicate that the Gunnison

prairie dog (*Cynomys gunnisoni*) is a common inhabitant of the grassland areas in Disappointment Valley (Pioneer, 1979). More detailed surveys for the prairie dog will be conducted in Disappointment Valley once the exact location of the borrow site is known. Remedial action activities at the UC or NC, Burro Canyon disposal, or Dolores River borrow sites would not affect the black-footed ferret.

The remaining four species in Table 3.1 are Federal candidate species. The white-faced ibis breeds in colonies in freshwater marshes from eastern Oregon sporadically across to North Dakota and south into parts of Kansas and Colorado. It winters in the southwestern United States and Mexico. The ibis feeds in areas with extensive marshes or at ponds, and is known to fly long distances from its nest or roost site to feed in marshes and pools, along rivers and streams, and in irrigated fields. The marshes are typically dominated by tule (*Scirpus* sp.), cattail (*Typha* sp.), and reed (*Phragmites* sp.) (Armbruster, 1983). In western Colorado, the white-faced ibis occurs as an uncommon to common migrant in aquatic and agricultural habitats (Kingery and Graul, 1978). This species was not observed along the Dolores River at or near the Slick Rock sites, including an 8-mile (13-km) stretch of the river that was surveyed during the nesting season in 1990 and 1991 (TAC, 1991, 1990, 1986, 1985); however, if it did occur near the Slick Rock sites, the area along the Dolores River would be used only for feeding because there is no suitable nesting habitat. Therefore, remedial action activities would not affect this species.

The black tern is a likely breeding species in southwestern Colorado (Kingery and Graul, 1978). This species nests in marshes that are typically dominated by cattail and build their nests over water (Bergman *et al.*, 1970; Davis and Ackerman, 1985; Dunn, 1979). The black tern has never been observed at the Slick Rock sites during wildlife surveys; these surveys included nesting bird surveys along an 8-mile (13-km) stretch of the Dolores River in 1990 and 1991 (TAC, 1991, 1990, 1988, 1985). Further, suitable nesting habitat for this species does not occur along the river at or near the sites. Therefore, nesting black terns do not occur at or near the sites, and remedial action will not affect this species.

Based on trapping records, it is known that the river otter occurred in the lower Colorado River Basin, which includes the Dolores River, in the 18th and 19th centuries. A combination of overtrapping and, later, mining eliminated the river otter from the Dolores River, probably by the early 1900s (Beck, 1987). The CDOW began planning a river otter reintroduction program in 1972. The Dolores River was chosen as a release site because the lower 180 mi (290 km) historically held this species and the present-day conditions along the river appear to provide good otter habitat.

From 1988 through 1991, 27 otters were released into the river; of these, 8 have died and 2 have moved to other river systems (Beck, 1992). Otter use of the river has concentrated in a 45-mi (72-km) stretch that begins about 45 mi (72 km) upriver from the UC or NC sites, although they do not inhabit the river in the Slick Rock area (Beck, 1990, 1993). The habitat along the river provides cover (riparian vegetation and beaver dens) and food [principally crayfish (*Orconectes virilis*)] for the otter in the tailings site area (Beck, 1990).

Remedial action activities are not expected to have a negative impact on the river otter because no activities would take place in the river (Beck, 1993). There is a slight possibility that an otter could be struck by a haul truck due to their habit of occasionally leaving the river and running down roads (Beck, 1993). The elimination of radioactive materials from the floodplain may be a positive measure in that a potential source of contamination of the otters' habitat would be removed. The revegetation of riparian areas that may be cleared should take place rapidly to prevent saltcedar from revegetating the area (Beck, 1990). Willow, wild privet, sedges, and grasses should be planted. Revegetation of the wetland riparian zone along the river is discussed in Attachment 2 of the EA.

The southwestern willow flycatcher is a subspecies of the widely distributed willow flycatcher. The northern boundary of the range of E.t. *extimus* has not been determined, although it is believed to be in the area of the New Mexico-Colorado state line. E.t. *extimus* intergrades with the northern subspecies, E.t. *adostas*. E.t. *extimus* populations have declined precipitously, and the destruction of riparian habitat is the principal cause of this decline; 500 to 1000 pairs probably exist in the wild (Unitt, 1987). The southwestern willow flycatcher generally nests in willows; in recent years it has begun to nest in saltcedar (Unitt, 1987). The preferred habitat in the southwest is riparian habitat along bodies of water, such as occurs along the Dolores River. Wildlife surveys along the river in the area of the tailings sites did not result in the observation of this species (TAC, 1986, 1985). Surveys specifically for this species were conducted during June 1990 and June 1991 along an 8-mi (13-km) stretch of the river, and the southwestern willow flycatcher was neither heard nor observed (TAC, 1991, 1990). An additional survey for this species will take place in June 1993.

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APPENDIX A

SECTION 7

CONSULTATION LETTERS FROM THE FISH AND WILDLIFE SERVICE

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE ENHANCEMENT
Western Colorado Sub-Office
529 25½ Road, Suite B-113
Grand Junction, CO 81505-6199
PHONE: (303) 243-2778 FAX: (303) 245-6933

IN REPLY REFER TO:
FWE/CO:DOE-UMTRA
MS 65412 GJ

December 14, 1992

Linda Ulland, Manager
Environmental Services
Jacobs Engineering Group
5301 Central Ave N.E., Suite 1700
Albuquerque, NM 87108

Dear Ms. Ulland:

This is in response to your request for an updated list of threatened and endangered species to be addressed in the biological assessment you are preparing for the Uranium Mill Tailings Remedial Action (UMTRA) Project near Slick Rock, San Miguel County, Colorado.

The following threatened or endangered species may occur in the project area or be impacted by the project:

Black-footed ferret — Mustela nigripes

If there are prairie dogs in the project area, surveys for the black-footed ferret may be required.

Bald eagle — Haliaeetus leucocephalus

Our previous letters indicated that bald eagles may visit the area.

Peregrine falcon — Falco peregrinus

There are two Peregrine falcon eyries within 10 miles of the project area.

If there is any change in water quality or a depletion of water from the Colorado River or its tributaries as a result of the project, there may be an effect on the endangered Colorado River fishes:

Bonytail chub	Gila elegans
Colorado squawfish	Ptychocheilus lucius
Humpback chub	Gila cypha
Razorback sucker	Xyrauchen texanus

The following species are candidates for official listing as threatened or endangered species. These species are associated with riparian and wetland habitats in western Colorado. If the project is expected to impact riparian

habitats, the effects on these candidate species should be addressed in the biological assessment.

Black tern	Childonias niger
Southwestern willow flycatcher	Empidomax trailii extimus
White-faced ibis	Plegadis chihi
Southwest otter	Lutra canadensis sonorae

Previous surveys for the UMTRA project indicated that there are no federally listed or candidate plant species in the project area.

If the Service can be of further assistance, please contact Lucy Jordan at the letterhead address or (303) 243-2778.

Sincerely,

Keith L. Rose
Assistant Colorado State Supervisor

cc: FWS/FWE, Golden
FWS/FWE, Salt Lake City
CDOW, Montrose

LJordan:slikrock.let:120492

DOI/SEC/0490-0002 11.15.1.4

United States Department of the Interior

FISH AND WILDLIFE SERVICE
COLORADO FIELD OFFICE
730 SIMMS STREET
ROOM 292
GOLDEN, COLORADO 80401

IN REPLY REFER TO:

FWE/CO:DOE:UMTRA
Mail Stop 65412 Grand Junction APR 06 1990

Mr. Charles J. Burt
Environmental Specialist
Jacobs Engineering Group, Inc.
5301 Central Avenue N.E. Suite 1700
Albuquerque, New Mexico 87108

Dear Mr. Burt:

This responds to your February 26, 1990, letter requesting an update of federally listed species that may be associated with the proposed Uranium Mill Tailings Remedial Action Projects at Slick Rock and Maybell, Colorado.

We have reviewed the lists provided to Jacobs Engineering, Inc. in 1986 and 1988. The following changes should be made:

1) Slick Rock site

ADD: Southwestern otter (Lutra canadensis sonorae) as a Candidate 2 species

DELETE: Long-billed curlew (Numenius americanus)
Swainson's hawk (Buteo swainsoni)
White-faced ibis (Plegadis chihi)
Spotted bat (Euderma maculatum)

2) Maybell site

ADD: Columbian sharptailed grouse (Tympanuchus phasianellus columbianus) and the
Western snowy plover (Charadrius alexandrinus nivosus)

DELETE: Long-billed curlew (Numenius americanus)
Swainson's hawk (Buteo swainsoni)
White-faced ibis (Plegadis chihi)
Spotted bat (Euderma maculatum)

We appreciate the opportunity to update the species lists for these actions. Please contact John Anderson in our Grand Junction office at (303) 243-2778 if there are any questions.

Sincerely,

Nancy I. Chu
Acting Colorado State Supervisor

cc: FWS/FWE, Grand Junction
FWS/FWE, Salt Lake City
CDOW, Grand Junction

United States Department of the Interior

FISH AND WILDLIFE SERVICE
COLORADO FIELD OFFICE
730 SIMMS STREET
ROOM 292
GOLDEN, COLORADO 80401

IN REPLY REFER TO:

(FWE)

December 28, 1988

Charles J. Burt
Environmental Specialist
Jacobs Engineering Group, Inc.
5301 Central Avenue N.E. Suite 1700
Alburquerque, New Mexico 87108

Dear Mr. Burt:

This responds to your November 21, 1988, letter requesting an update of Federally listed species that may be associated with the proposed Uranium Mill-tailings Remedial Action Projects at Slickrock, Naturita, Gunnison and Maybell, Colorado.

We have reviewed the lists provided to Jacobs Engineering, Inc. in 1986 and 1988. The following changes should be made:

1) Naturita site - Delete the Grand Junction milkvetch.

2) Maybell site - Delete the White River penstemon. Add the bonytail chub.

3) Gunnison site - Add the Colorado squawfish, humpback chub, and bonytail chub.

The list for the Slickrock site needs no changes.

We appreciate the opportunity to update the species lists for these actions. Please contact Bob Leachman of our Grand Junction office at (303) 243-2773 if there are any questions.

Sincerely,

Richard P. Krueger

Acting for LeRoy W. Carlson
Acting State Supervisor

cc: FWS/FWE, Salt Lake City
Official File
Reading File

United States Department of the Interior
FISH AND WILDLIFE SERVICE
ENDANGERED SPECIES OFFICE
[illegible] 25½ ROAD
INDEPENDENCE PLAZA
SUITE B-113
GRAND JUNCTION, COLORADO 81505
TELEPHONE: 303-241-0563

IN REPLY REFER TO:

February 27, 1986

Mr. Dave Lechel
Manager, Environmental Services
Jacobs Engineering Group, Inc.
5301 Central Avenue N.W., Suite 1700
Albuquerque, N.M. 87108

Dear Mr. Lechel:

We have received your letter of January 22, 1986, regarding Uranium Mill Tailings Remedial Action (UMTRA) Project plans of Department of Energy for clean-up of uranium tailing sites near Naturita, Montrose County, Colorado, and near Slickrock, San Miguel County, Colorado.

We are furnishing you with the following list of rare species which may be present within the area of influence of your project. The lists pertain to both sites with the exception noted below:

Federally Listed Species

E Bald eagle	Haliaeetus leucocephalus
E Black-footed ferret	Mustela nigripes
E Bonytail chub	Gila elegans
E Colorado squawfish	Ptychocheilus lucius
E Humpback chub	Gila cypha
E Peregrine falcon	Falco peregrinus (Slickrock site only)

Historically, the endangered black-footed ferret (Mustela nigripes) may have occurred in portions of southwestern Colorado. Although unconfirmed sightings of this mammal have occurred in northwestern Colorado, the only known population is in Meeteetse, Wyoming. Literature documents a close association between prairie dogs and black-footed ferrets. The standard that is used for determining possible project effects to black-footed ferrets is the disturbance of currently occupied prairie dog habitat. Should any of the activities that are part of the above-referenced project result in an impact to prairie dogs, black-footed ferret surveys may be necessary.

If water quality in the Colorado River will be affected by project activities, or if remedial action of any kind results in the consumptive use of water from the upper Colorado River basin, then resulting impacts to the Colorado squawfish (Ptychocheilus lucius), humpback chub (Gila cypha), and bonytail chub (Gila elegans) must be addressed in your assessment of impacts.

The lead Federal agency for Endangered Species Act (ESA) Section 7 consultation should review their proposed Federal action and determine if the action would affect any listed species. If the determination is "may affect" for listed species, the Federal agency must request in writing formal consultation from the Field Supervisor, U.S. Fish and Wildlife Service, Endangered Species Office, 2078 Administration Building, 1745 West 1700 South, Salt Lake City, Utah 84104. At this time, this agency should provide this office a biological assessment and/or any other relevant information was used in making the impact determinations.

We would like to bring to your attention species which are candidates for official listing as threatened or endangered species (Federal Register, Vol. 47, No. 251, December 30, 1982, and Vol. 50, No. 188, September 27, 1985). While these species have no legal protection at present under the Endangered Species Act, they are quite rare and restricted. We believe that it is within the spirit of the ESA to consider project impacts to candidate species at this time. Additionally, we wish to make you aware of the presence of Federal candidates should any be proposed or listed prior to the time that all Federal actions related to the project are complete.

Federal Candidate Species

Ferruginous hawk	Buteo reglais
Grand Junction milkvetch	Astragalus linifolius
Long billed curlew	Numenius americanus
Paradox lupine	Lupinus paradox
Razorback sucker	Xyrauchen texanus
Swainson's hawk	Buteo swainsoni
White-faced ibis	Plegadis chihi

The Paradox lupine is known to occur at one of the Naturita sites. Our staff botanist has recently visited the site and confirmed the presence of this rare plant.

We appreciate your interest in conserving endangered species. If you require further information on listed species, please contact John Anderson of our Grand Junction, Colorado office, telephone 303-241-0563.

Sincerely,

Robert P. Smith

Robert P. Smith
Project Leader

ATTACHMENT 2

FLOODPLAIN/WETLANDS

ASSESSMENT

2 of 2

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ac	acre
cm	centimeter
DOE	U.S. Department of Energy
EA	environmental assessment
ft	feet
ft^3/s	cubic feet per second
ha	hectare
km	kilometer
m	meter
m^3/s	cubic meters per second
mi	mile
MSL	mean sea level
NC	North Continent
UC	Union Carbide
UMTRA	Uranium Mill Tailings Remedial Action

1.0 INTRODUCTION

In 1979, the U.S. Department of Energy (DOE) established regulations (10 CFR 1022) to comply with floodplain/wetlands environmental review requirements. These regulations provide for compliance with Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands. The regulations are designed to be coordinated with the environmental review requirements of the National Environmental Policy Act. This attachment assesses impacts on the floodplains and wetlands associated with the Slick Rock Uranium Mill Tailings Remedial Action (UMTRA) Project pursuant to 10 CFR 1022.

The two Slick Rock tailings piles plus windblown and waterborne tailings have contaminated lands within the floodplain of the Dolores River near the Union Carbide (UC) and North Continent (NC) tailings sites. The proposed action for the UC and NC sites is to move the two tailings piles and other contaminated materials to the Burro Canyon disposal site, which is an upland area 5.7 road miles (mi) [9.2 kilometers (km)] north of the NC site. The net result of remedial action would be to move all contaminated materials out of the Dolores River floodplain. More details regarding the proposed action are in Section 3.0 of the environmental assessment (EA).

2.0 FLOODPLAIN EFFECTS

A flood analysis was performed to determine the impacts of remedial action in the 100-year floodplain. The estimated 100-year flood was determined using cloud-burst rainfall distributions (USACE, 1986) and 6-hour 100-year precipitation values (Miller *et al.*, 1973). This information was used in the HEC-1 computer program (USACE, 1981) to determine the peak discharges for the 100-year flood event. The HEC-2 computer model (USACE, 1982) was used to determine the boundary of the 100-year floodplain.

2.1 EXISTING FLOODPLAIN CONDITIONS

The boundaries of the 100-year floodplain of the Dolores River at the UC and NC sites are shown in Figures 2.1 and 2.2, respectively. A 100-year flow of 84,200 cubic feet per second (ft^3/s) [2380 cubic meters per second (m^3/s)] could occur in the Dolores River near the UC and NC tailings sites. The bases of both tailings piles are within the 100-year floodplain. The maximum water level during the 100-year flood event would be 5446 feet (ft) [1660 meters (m)] above mean sea level (MSL) at the UC pile and 5465 ft (1666 m) above MSL at the NC site.

Borrow activities at the Dolores River borrow site would likely occur within the 100-year floodplain of the Dolores River. Analyses of the washes near the Disappointment Valley borrow site indicated that construction activities would not occur within the 100-year floodplain (Pioneer, 1979).

2.2 FLOODPLAIN DISTURBANCE DURING REMEDIAL ACTION

During remedial action, an estimated 28 acres (ac) [11 hectares (ha)] of land would be cleaned up in the floodplain of the Dolores River at the UC site; an estimated 13 ac (5 ha) would be cleaned up in the floodplain at the NC site. This cleanup would result in the excavation of up to 1 ft (0.3 m) of soil at these sites except at the tailings piles, where the excavation would be deeper. The net effect would be the clearing of all the vegetation and a slight deepening of the existing river channel.

2.3 POST-REMEDIAL ACTION ACTIVITIES

After remedial action has been completed, the original contours of the Dolores River 100-year floodplain would be reestablished by applying clean fill material and grading to the preremedial action elevations. However, the UC pile, which is currently 50 ft (15 m) above the existing floodplain, would not be replaced with a pile of equivalent size. Following remedial action, the boundary of the 100-year floodplain in the former UC pile area would be at approximately premilling elevations, which would result in a widening of the floodplain by 6.6 ac (2.7 ha). Remedial action at the NC site would not increase the size of the

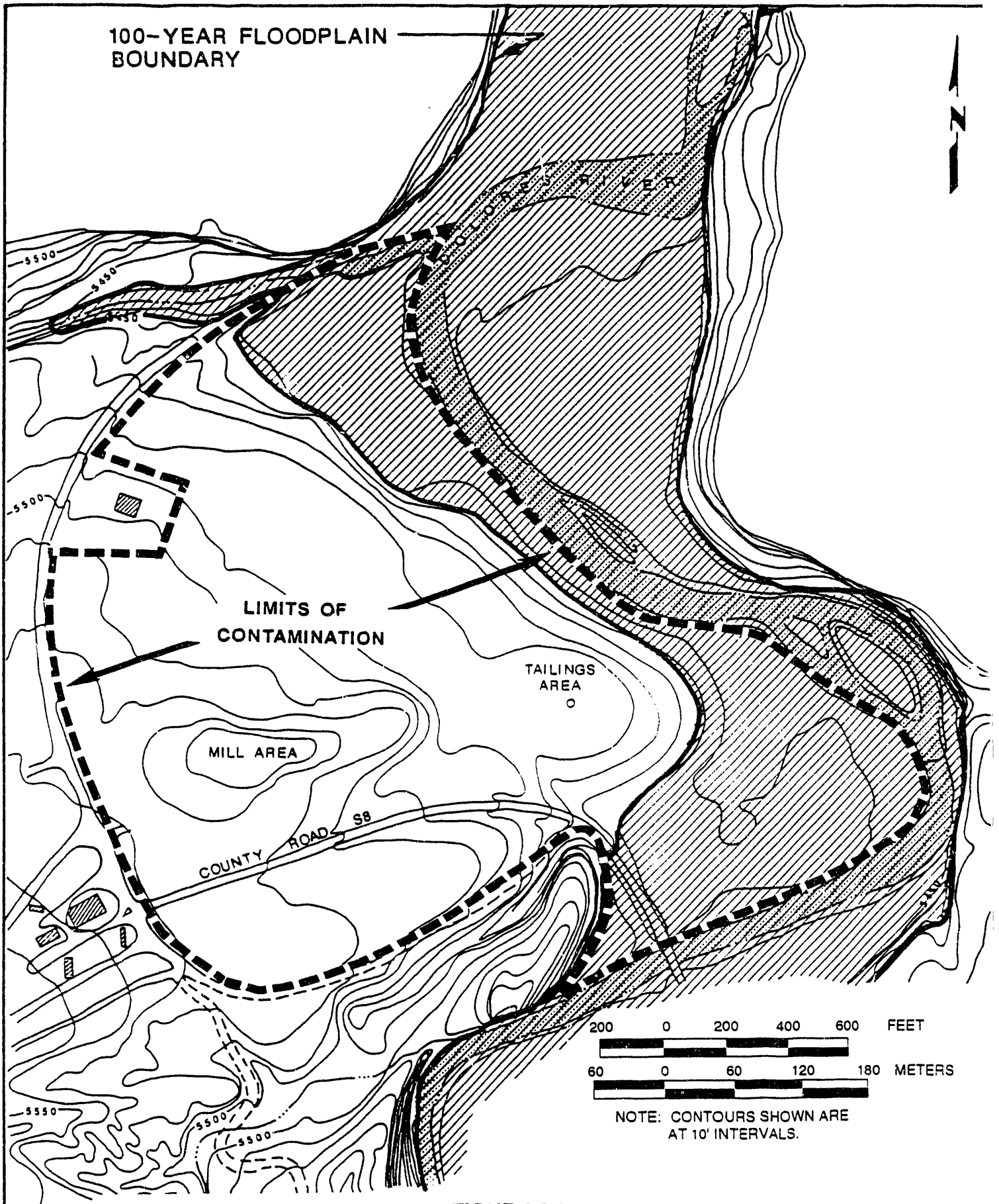

FIGURE 2.1
100-YEAR FLOODPLAIN BOUNDARY AT THE UC SITE
SLICK ROCK, COLORADO

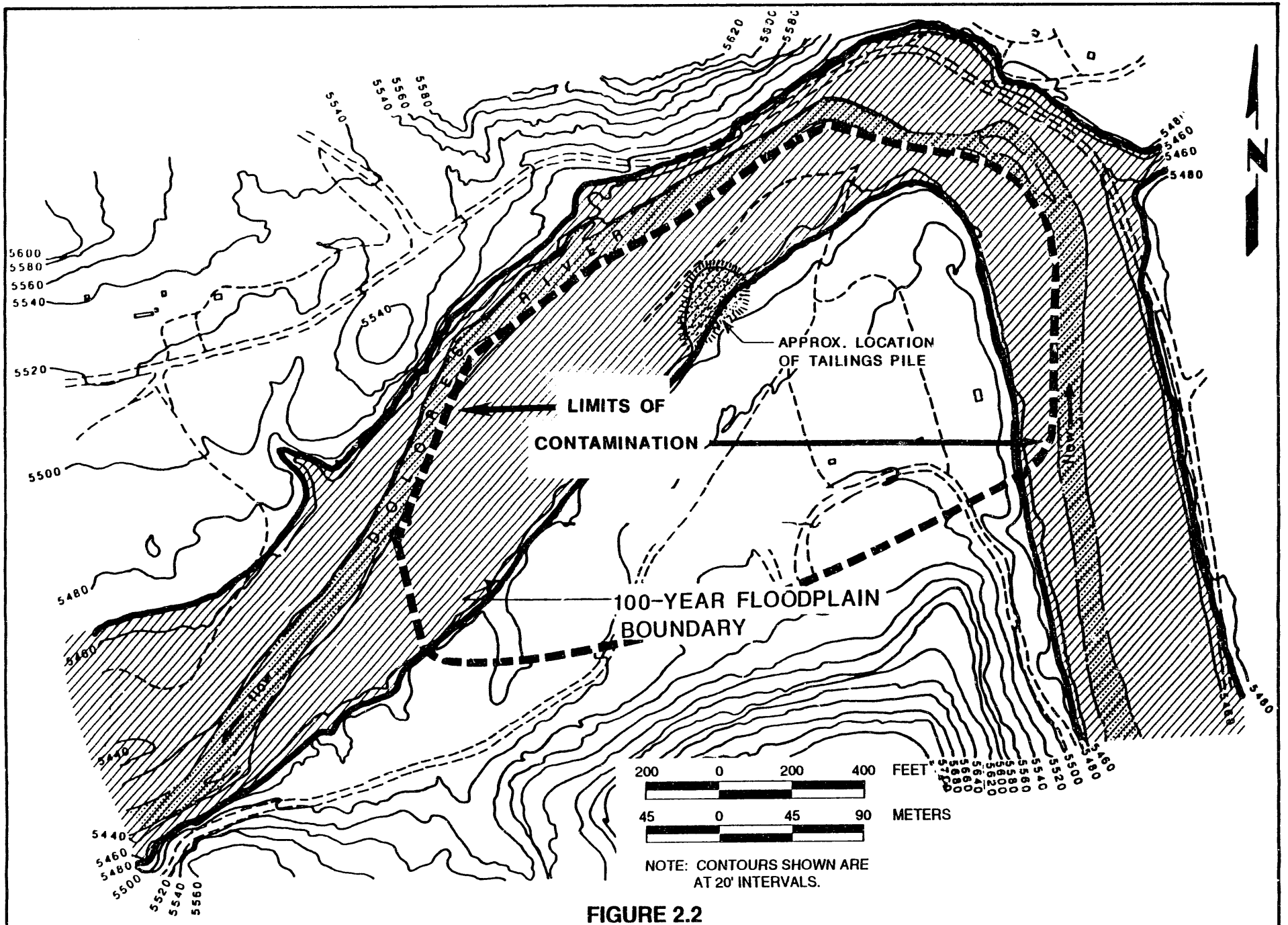

FIGURE 2.2
100-YEAR FLOODPLAIN BOUNDARY AT THE NC SITE
SLICK ROCK, COLORADO

100-year floodplain because this pile is not above the existing topography; all excavated areas would be restored to preremedial action elevations.

2.4 MITIGATIVE MEASURES

Potential impacts during remedial action within the floodplain of the Dolores River would be mitigated by use of the following measures:

- Contaminated materials in the floodplain would be excavated during periods of low flow in the river.
- Riparian vegetation along the river not subject to excavation would be left undisturbed as much as possible to reduce river velocities and associated erosion during flood events.
- Revegetation would begin as soon as practical after removal of contaminated materials.
- Berms, riprap, or other erosion controls would be used as necessary to minimize erosion.
- The excavated floodplain would be restored to preexisting conditions except for the UC pile.

3.0 WETLANDS ASSESSMENT

3.1 WETLANDS DESCRIPTION

An estimated 26 ac (11 ha) of riparian plant communities are within the contaminated area next to the UC tailings pile, while 17 ac (7 ha) of riparian plant communities occur near the NC tailings site (Figures 3.1 and 3.2). A third area of riparian plant communities contaminated with tailings is across the river from the UC site (Figure 3.1). This area covers 17 ac (7 ha) and would likely be excluded from remedial action because supplemental standards would be applied (MK Corporation, 1993). The area would be eligible for supplemental standards for the following reasons:

- The average radium-226 (Ra-226) levels are only slightly above the cleanup standard.
- Seventeen acres of scarce riparian habitat occur in this area.
- There is no vehicular or foot access to this area; there are no residences within 0.25 mi (0.40 km) of this site, and only 10 people live within 10 mi (16 km) of the site.
- Remedial action would be very costly because it would be necessary to construct a bridge across the river to access the site.
- There is a low probability of health risks anticipated from radon emission, particulate inhalation, or ingestion of contaminated materials due to the Ra-226 concentration and remoteness of the area.

Four plant community types were observed in these three areas. The dense riparian shrub community grows in thin bands along the riverbank or on islands. Shrubs such as willow and saltcedar form a very dense growth in this habitat. Other shrubs observed included wild privet, fourwing saltbush, squawbush, Fendler rose, and big sagebrush. Small narrowleaf cottonwood and Russian olive were occasionally observed. There was little ground cover in the dense growth of willow and saltcedar; more open areas had a dense growth of grass and herbaceous species (*e.g.*, yellow sweet clover and milkvetch).

The remaining riparian plant communities are at a somewhat higher elevation above the river. The upper riparian grass type had a dense ground cover of grass and herbs with widely scattered shrubs, including big sagebrush, wild privet, greasewood, saltbush, squawbush, Fendler rose, saltcedar, and Russian olive. The upper riparian shrub subtype was similar except that shrubs were much more common; sagebrush and greasewood were most abundant. This type also had a dense ground cover of grass and herbs.

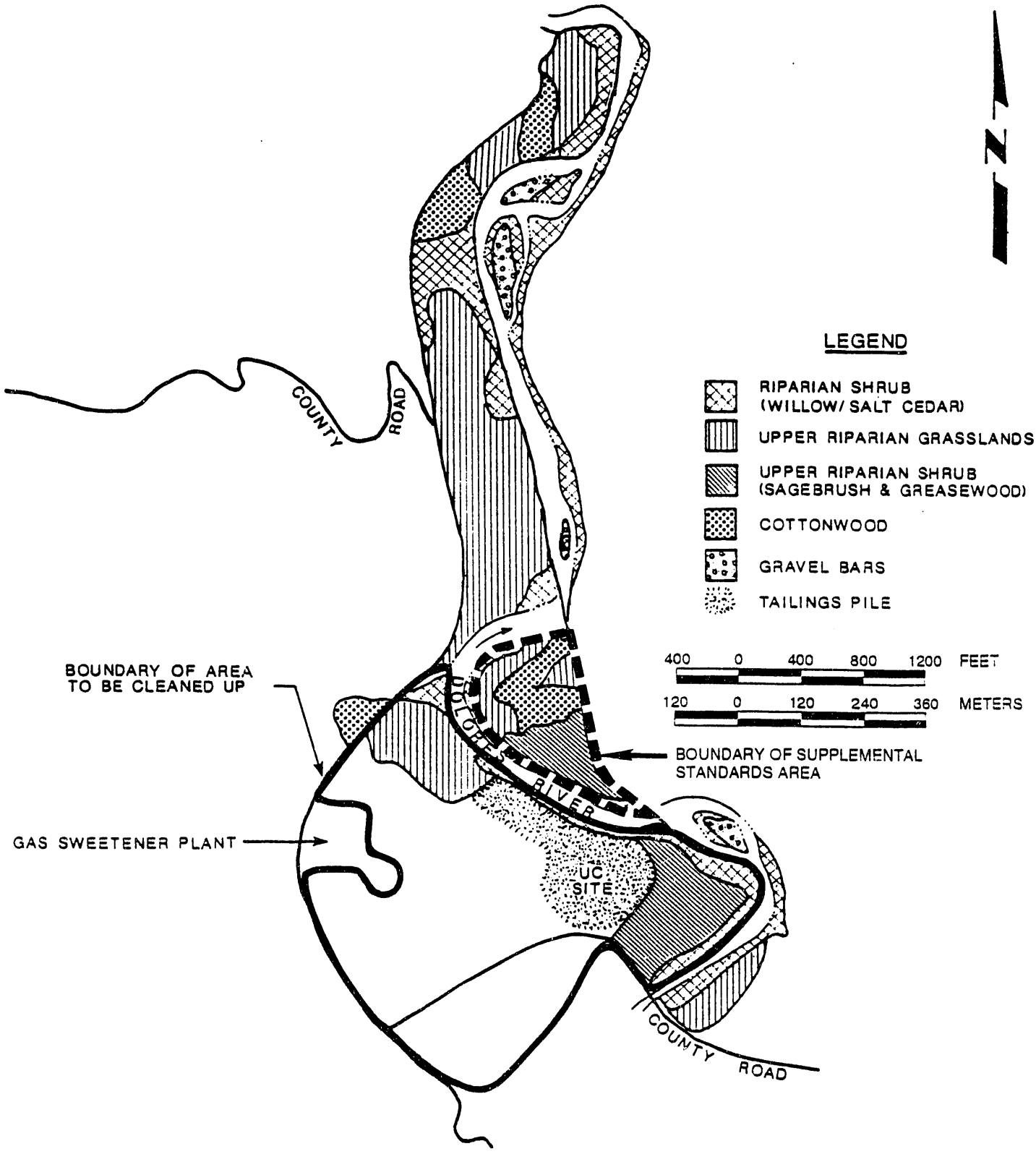

FIGURE 3.1
PLANT COMMUNITY TYPES IN THE RIPARIAN ZONE ALONG THE DOLORES RIVER AT THE UC SITE SLICK ROCK, COLORADO

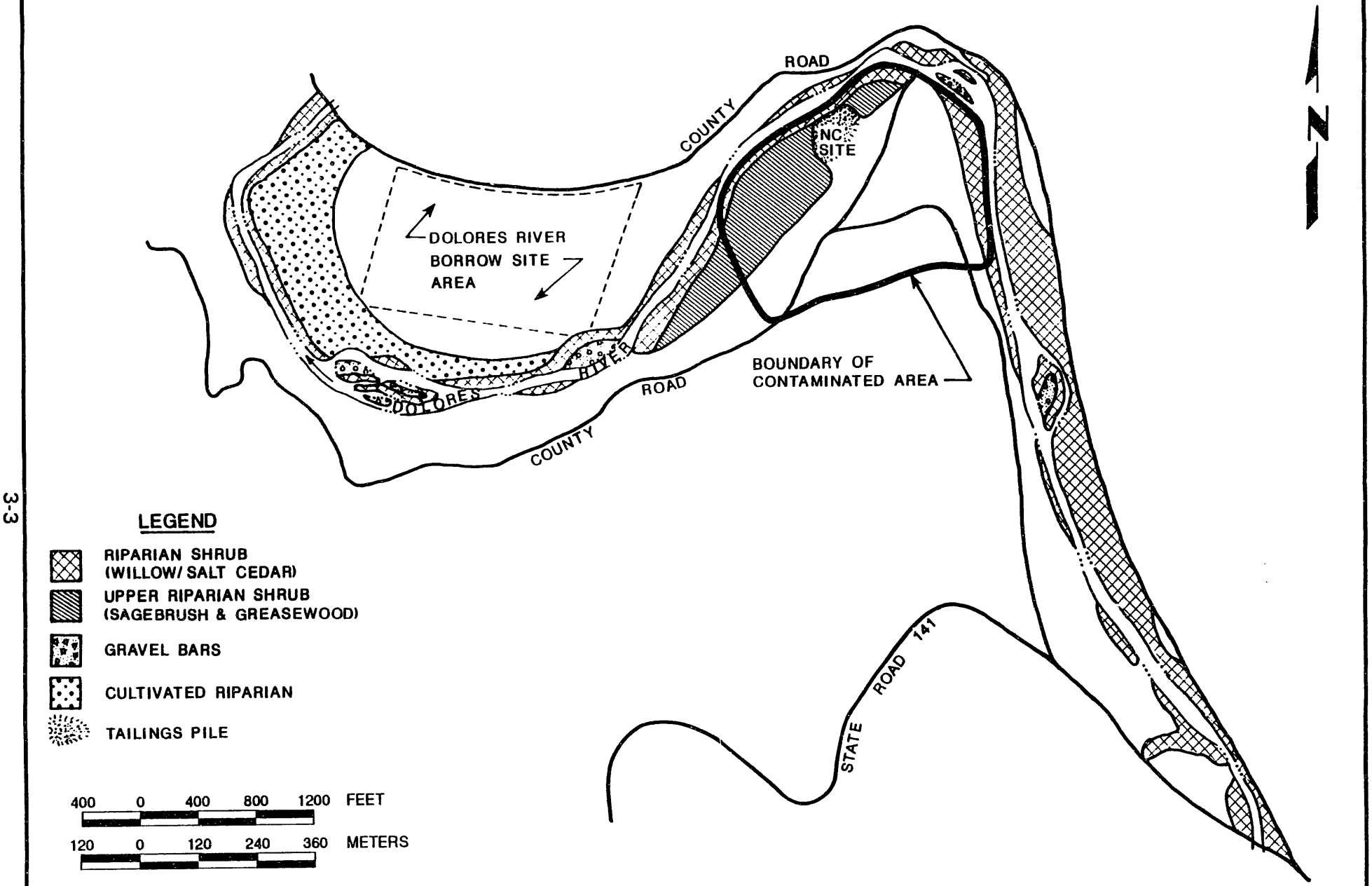

FIGURE 3.2
PLANT COMMUNITY TYPES IN THE RIPARIAN ZONE ALONG THE DOLORES RIVER AT THE NC SITE, SLICK ROCK, COLORADO

ATTACHMENT 2

The final riparian plant community was dominated by cottonwood. Fremont cottonwood was the dominant species; some narrowleaf cottonwood was also observed. The cottonwood stands were open and most of the cottonwoods were fairly large. The average height of 14 trees in the riparian zone across the river from the UC site was 45 ft (14 m) [ranging from 35 to 60 ft (11 to 18 m)], while the average diameter at breast height was about 20 inches (in) [51 centimeters (cm)] [ranging from 10 to 32 in (25 to 81 cm)]. No cottonwood reproduction was observed, and an estimated 34 percent of the trees were either dead or dying. The lack of reproduction could be the result of grazing or the lowered water table due to irrigation withdrawals upriver of the UC and NC sites. There was a dense grass ground cover in these stands, and scattered shrubs, including squawbush, wild privet, sagebrush, greasewood, rabbitbrush, and box elder, were observed.

The riparian habitat is more diverse and productive in terms of wildlife use than the surrounding upland habitats. For example, quantitative studies of breeding birds indicate that densities are 3 to 10 times higher in the riparian zone than in the desert-shrub habitat (Szaro and Jakle, 1985; Johnson and Carothers, 1982). Warren and Schwalbe (1985) determined that lizard density was highest in the riparian zone along the Colorado River and lowest in the desert-shrub habitat. Observations along the Dolores River confirmed this; of the 66 species of birds observed at the sites, 56 were from the riparian zone and 34 were observed in the upland area (refer Table 2.4 in Attachment 1, Biological Assessment). Surveys for the southwestern willow flycatcher took place along an 8-mile stretch of the Dolores River in 1990 and 1991, and all nesting birds were recorded (Table 3.1). The cliff swallow is the most common species recorded; this colonial species was concentrated in two areas and was infrequently observed elsewhere along the river. The yellow-breasted chat was the most common noncolonial nesting species and was very common in the dense growth of willow, wild privet, and other shrubs that grow along the river. Other common species in this habitat were the mourning dove, yellow warbler, and spotted sandpiper. Species such as the great-blue heron, turkey vulture, red-tailed hawk, and American kestrel are recorded but were not known to nest along the segment of river surveyed.

Observations at the Slick Rock sites also indicate that mule deer use of the riparian zone was higher than of the surrounding upland habitat (DOE, 1983). Beaver are very common along the river and provide den sites for the state-endangered river otter, which has recently been reintroduced into the river. Refer to Attachment 1 for more details on the river otter use of the Dolores River.

3.2 WETLANDS IMPACTS

A total of 60 ac (24 ha) of riparian plant communities are contaminated at or near the UC and NC sites. Supplemental standards would be applied to a 17-ac

Table 3.1 Nesting birds observed in 1990 and 1991 in the riparian zone along an 8-mile stretch of the Dolores River in the area of the Slick Rock, Colorado, UMTRA Project sites

Species	1990	1991
Cliff swallow	52	100
Yellow-breasted chat	31	52
Mourning dove	26	24
Violet green swallow	23	0
Yellow warbler	18	19
Spotted sandpiper	10	16
Scrub jay	9	1
Western wood pewee	8	2
Blue grosbeak	7	3
Brown-headed cowbird	6	5
Northern oriole	6	9
Western kingbird	5	2
Cedar waxwing	5	0
Black-headed grosbeak	5	5
Killdeer	5	4
Black-billed magpie	4	6
House wren	4	1
Great-blue heron	3	5
Black-chinned hummingbird	3	1
Lark sparrow	3	5
Turkey vulture	2	3
Red-tailed hawk	2	0
Common nighthawk	2	0
Common crow	2	0
Raven	2	0
Solitary vireo	2	1
Warbling vireo	2	2
Northern mockingbird	2	0
Rufous-sided towhee	2	4
Say's phoebe	2	1

Table 3.1 Nesting birds observed in 1990 and 1991 in the riparian zone along an 8-mile stretch of the Dolores River in the area of the Slick Rock, Colorado, UMTRA Project sites (Concluded)

Species	1990	1991
Mallard	1	0
Band-tailed pigeon	1	0
Belted kingfisher	1	0
White-throated swift	1	21
Lewis woodpecker	1	0
Ash-throated flycatcher	1	1
Gray flycatcher	1	0
Horned lark	1	0
Barn swallow	1	11
Northern rough-winged swallow	1	0
Blue-gray gnatcatcher	1	0
American robin	1	2
American goldfinch	1	4
Northern flicker	0	2
House finch	0	10
Lesser goldfinch	0	1
Kestrel	0	3
Total	266	326

Ref. TAC 1990, 1991.

(7-ha) area across from the UC site, resulting in 43 ac (17 ha) of riparian plant communities being impacted (see Figures 3.1 and 3.2).

The riparian vegetation along the Dolores River is a mosaic of habitat types that differ from each other primarily due to different species and/or vertical configuration of the vegetation. At present, the major factors affecting the pattern of this mosaic appear to be elevation (relative to the Dolores River) and grazing. The upper riparian shrub type is the most abundant habitat within the contaminated area [19 ac (8 ha)], followed by the riparian shrub [16 ac (6 ha)], and the upper riparian grassland [8 ac (3 ha)]. Cottonwood-dominated areas would not be impacted because supplemental standards would be applied.

The clearing of 43 ac (17 ha) of riparian wetland vegetation would constitute an unavoidable impact on vegetation and wildlife. The clearing of vegetation from the riparian zone would reduce wildlife use to essentially zero. The duration of this impact would depend on the level of restoration efforts undertaken. Remedial action would remove not only the vegetation but also some of the topsoil. This topsoil cannot be stockpiled because it is contaminated and must be incorporated into the disposal cell.

3.3 MITIGATION OF IMPACTS ON WETLANDS

Revegetation represents the major mitigation measure to be applied to the wetlands at the UC and NC sites. The revegetation plan of U.S. Army Corps of Engineers-regulated wetlands [16 ac (6.5 ha) of riparian shrub] will be provided in the DOE's 404 permit application. The revegetation of the remaining riparian plant communities may be included in the 404 permit issued by the Corps of Engineers. Work in the revegetation of riparian habitats with pole plantings has proven successful (Swenson and Mullins, 1985; York, 1985). Cottonwood and willow, which are the two major species growing in the shrub-dominated wetlands along the Dolores River, have been successfully established from pole plantings. If possible, cuttings from vegetation growing near the disturbed land should be obtained. Revegetation of these areas should also include planting wild privet and ground cover of sedges and grass.

4.0 ALTERNATIVES TO THE PROPOSED ACTION

The no action alternative consists of taking no steps toward remedial action at the UC and NC sites. The tailings and other contaminated materials would remain in their present condition and would continue to be subject to dispersal by wind and water erosion and unauthorized removal by humans. The selection of this alternative would not be consistent with the intent of Congress in the Uranium Mill Tailings Radiation Control Act (UMTRCA) (PL 95-604) and would not result in compliance with the U.S. Environmental Protection Agency (EPA) standards (40 CFR Part 192).

The feasibility of applying supplemental standards was assessed and, as indicated in Section 3.1, supplemental standards would be applied to a 17-ac (7-ha) segment of riparian vegetation across the Dolores River from the UC site. The application of supplemental standards to the remaining riparian zone would not be feasible due to relatively high levels of contamination.

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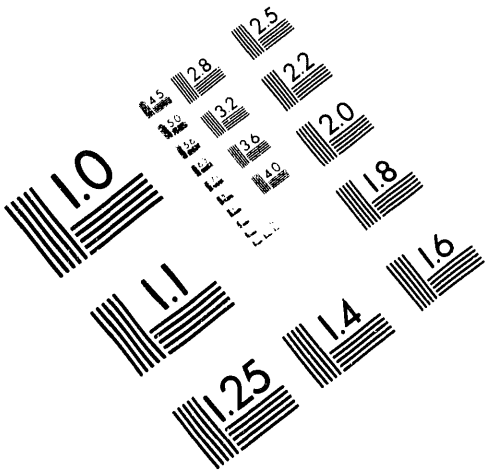

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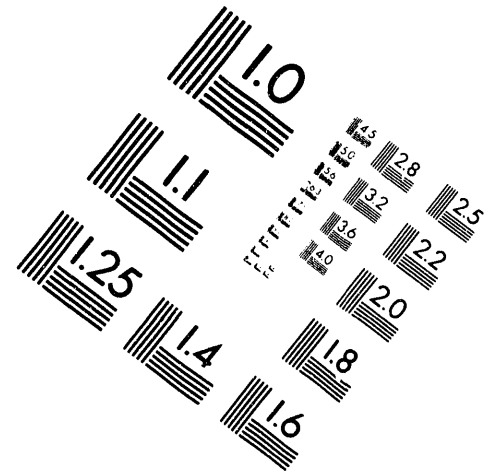

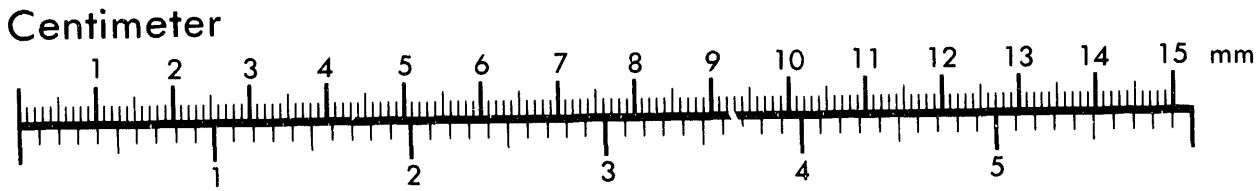

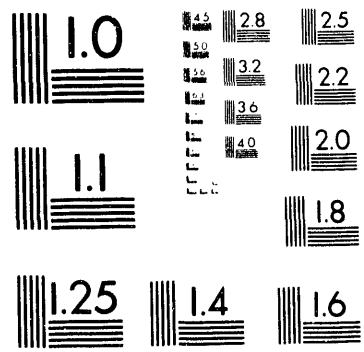

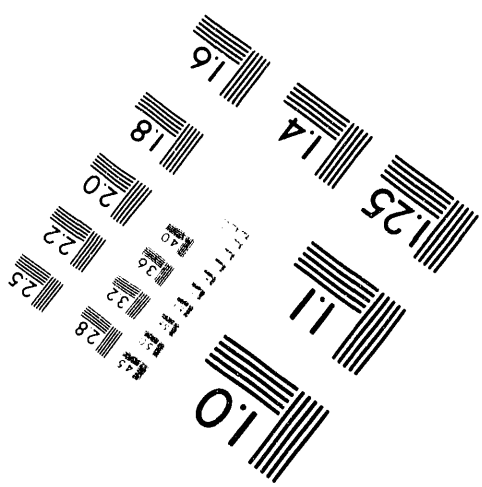

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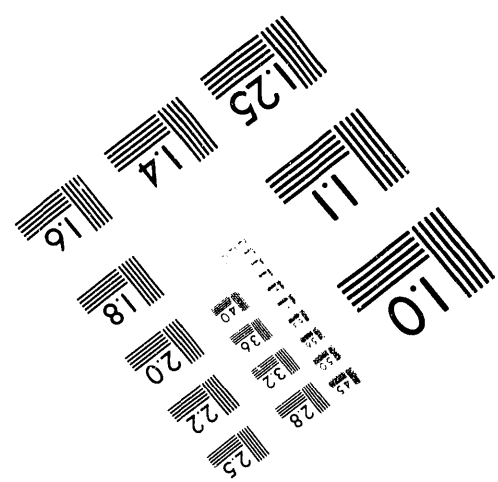

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