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FINAL ENVIRONMENTAL ASSESSMENT

OF

REMEDIAL ACTION AT THE FALLS CITY

URANIUM MILL TAILINGS SITE

FALLS CITY, TEXAS

DECEMBER 1991

U.S. DEPARTMENT OF ENERGY

UMTRA PROJECT OFFICE

ALBUQUERQUE, NEW MEXICO

DISCLAIMER

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1.0 SUMMARY

1.1 PROJECT SUMMARY

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) (42 U.S.C. 4321 et seq.) authorized the U.S. Department of Energy (DOE) to perform remedial action at the Falls City tailings site (as well as at several other sites) to reduce the potential public health impacts from the residual radioactivity remaining at the site. The U.S. Environmental Protection Agency (EPA) promulgated standards (40 CFR 192) that contain measures to control the residual radioactive materials and other contaminated materials, and to protect the groundwater from further degradation. Remedial action at the Falls City site must be performed in accordance with these standards and with the concurrence of the U.S. Nuclear Regulatory Commission (NRC) and the state of Texas.

The Falls City tailings site is in Karnes County, Texas, approximately 46 miles southeast of San Antonio, Texas, and eight miles southwest of Falls City, Texas. The designated mill site consists of two parcels, including an office building, six tailings piles (piles 1, 2, 3, 4, 5, and 7), one tailings pond (pond 6), and associated waterborne and windblown contamination west, northwest of the intersection of Farm-to-Market Roads 1344 and 791. Parcel A consists of the building, five tailings piles (piles 1, 2, 4, 5, and 7), the tailings pond, and windblown contamination. It is fenced and is 473 acres. The sixth pile (pile 3) and adjacent windblown contamination are approximately one mile east of Parcel A, and north, northeast of this intersection, within a 120-acre area designated as Parcel B. Approximately 5,764,100 cubic yards (cy) of tailings and other contaminated materials are present at the site (Parcels A and B). The office building on the site will be demolished as part of the remedial action.

Areas adjacent to both parcels are still used for cattle grazing and dry land farming. The closest three occupied residences, as shown in Figure 3.26 of the environmental data and analysis report for remedial action (EADR) (DOE, 1991a), are about 1300 feet from piles 2 and 7 with a total of six occupants; the next closest residences are at least 3000 feet south and southeast of pile 4. Most potable water is supplied by a cooperative water supply company that draws water from the deep-lying (over 3000 feet deep) Carizzo Sandstone aquifer. Livestock is watered by a combination of water from the cooperative, surface water collection tanks, and wells in the Dilworth Sandstone and deeper aquifers.

Background (natural) groundwater within the Whitsett Formation aquifer system is highly variable with depth and location, as it occurs within the uranium ore body. This groundwater can be classified a "limited use" (Class III) groundwater based on high average concentrations of arsenic, cadmium, molybdenum, selenium, and uranium that render it untreatable by methods reasonably employed by public water systems in the region. The elevated concentrations of arsenic, cadmium, molybdenum, selenium, radium, and uranium represent widespread ambient contamination associated with naturally occurring oxidized ore deposits. The uppermost aquifer affected by the site (the Deweesville/Conquista and Dilworth aquifers) is not used for drinking water because of the poor quality and limited quantity of water.

The principal potential hazard associated with the tailings results from the production of radon gas, a radioactive decay product of the radium contained in the piles. Radon is an inert gas and can diffuse through the piles and be released into the atmosphere, where it and its radioactive decay products may be inhaled by humans. Exposure to radon that emanates from the piles and its decay products over a long period of time will increase the probability that health effects (i.e., cancers) may develop in persons living and working near the piles. Potential hazards may also be created by exposure to gamma radiation, the inhalation of airborne radioactive particulates, the ingestion of contaminated food produced in the areas around the tailings, and the ingestion of surface and groundwaters contaminated by the tailings. If the tailings are not properly stabilized, erosion or human removal of the contaminated materials could spread the contamination over a much wider area and increase the potential for public health hazards.

Seepage from the tailings piles and the tailings pond at this site has further impacted the naturally poor water quality in the shallow Deweesville/Conquista aquifer. Limited water quality impacts may occur in the underlying Dilworth aquifer. These localized areas of somewhat elevated uranium and associated constituent concentration levels are randomly distributed, difficult to distinguish absolutely from naturally occurring uranium mineralization, and may be related to some uranium exploration boreholes that have penetrated the Conquista Clay aquitard. Surface water quality impacts from runoff from the tailings area into Tordilla and Scared Dog Creeks are negligible.

The proposed remedial action for the Falls City tailings site is stabilization on site within Parcel A. Most of the tailings in piles 2 and 7 would be left in place; all of pile 1 would remain in place. The remainder of piles 2 and 7 and all of piles 3, 4, and 5, pond 6, and associated subsurface and windblown contamination would be placed within the area formed by piles 1, 2, and 7. The final embankment would be covered with a low-permeability radon barrier, erosion protection, and vegetative cover to ensure the long-term stability of the embankment, retard infiltration, and reduce seepage of tailings fluids to groundwater. All disturbed areas would be graded for positive drainage and reseeded.

Fine-grained borrow materials would be obtained from the proposed La Mesa borrow site adjacent to Parcel A. Sand and gravel erosion protection materials would be obtained from the Tordilla Hill borrow site southwest of the site. Rock erosion protection materials would be obtained from the existing Knippa quarry west of San Antonio, Texas.

Remedial action would include the incorporation of materials from an estimated seven remediated vicinity properties (VPs) associated with the Falls City tailings site; the contaminated materials from the seven VPs are presently stockpiled on Parcel A. The potential impacts of remedial action at the vicinity properties were previously assessed in a programmatic environmental report (DOE, 1985) and are not considered in this environmental assessment.

Selection of the no action alternative would not be consistent with the intent of Congress in the UMTRCA and would not result in compliance with the EPA standards. This alternative would result in the continued dispersion of the tailings by wind and water erosion and the possibility that livestock and wildlife could ingest contaminated vegetation. Seepage of tailings fluids to the shallow Deweesville/Conquista aquifer would continue indefinitely. Finally, continued erosion and possible use of the tailings could cause radiological contamination of other areas and could result in greater public health impacts than those calculated for this alternative.

Supplemental information providing further details on the conceptual remedial action design; groundwater hydrology; flora and fauna; radiation doses and health effects; and permits, licenses, and approvals can be found in the EADR (DOE, 1991a). Supplemental information on floodplains and wetlands can be found in Attachment 1 of this environmental assessment (EA).

1.2 IMPACT SUMMARY

The environmental impacts of the proposed action and the no action alternative are listed in Table 1.1. The cumulative impacts presented in this document are based on conservative impact assessment methods and are intended to represent a realistic upper limit on the severity of the potential impacts for stabilization on the site.

Table 1.1 Environmental impacts

Environmental component	Proposed action	No action
Excess cancer death risk during the action:		
to remedial action workers	0.014 excess cancer death risk during a 2-year period from radon decay products, gamma radiation, and airborne particulates.	N/A[a]
to general population	0.069 excess cancer death risk during a 2-year period from radon decay products and airborne particulates.	0.056 excess cancer death risk during a 2-year period from radon decay products and airborne particulates.
Excess cancer death risk after the action[b]	0.04 general population excess cancer death risk from radon decay products.	0.28 general population excess cancer death risk from radon decay products and airborne particulates.
Air quality (nonradiological, 24-hour maximum)	Secondary standard of 150 microg/m^3 for the maximum 24 hour TSP concentrations may be exceeded along the Tordilla Hill unpaved haul road (224 microg/m^3) during the two to three month haul period[d].	No change[c]
Mineral resources	The use of 182,670 cy of sand, gravel, and rock borrow materials would preclude their availability for other future uses; no commercially extractable mineral resources are found at the tailings site.	No change[c]
Soils[e]	The use of 847,360 cy of fine-grained soil borrow materials would preclude their availability for other future uses; a total of 749 acres of contaminated and borrow soils permanently lost.	No change[c]
Surface water	No impacts to surface water.	No change[c]
Groundwater	Groundwater immediately beneath the tailings site is contaminated. A gradual reduction in the seepage of tailings fluids to groundwater.	Continued contamination of the groundwater beneath the site.
Wildlife[f]	Loss of 765 acres of wildlife habitat and associated 44 hunter use days for upland game birds, cottontail rabbit, and white-tailed deer.	No change[c]

Table 1.1 Environmental impacts (Continued)

Environmental component	Proposed action	No action
Threatened and endangered (T&E) species	None.[h]	No change[c]
Vegetation	Loss of existing vegetation on 765 acres.	No change[c]
Land use	Disruption of existing uses adjacent to pile 3 and the haul route between pile 3 and the disposal site. After remedial action, 302 acres of previously disturbed and contaminated tailings pile and wind-blown areas would be available for productive use. The final restricted area would cover approximately 290 acres.	No change[c]
Noise	Elevated noise and general activity would not disrupt the residences 1300 feet from piles 2 and 7; maximum of 96 dBA on site, reducing to 55.8 dBA 0.2 mile away.[g]	No change[c]
Historical and cultural resources[i]	There are no known eligible archaeologic or historic sites in the area to be disturbed.	No change[c]
Population	Possible short term increases in local towns.	No change[c]
Employment	Remedial action would provide additional employment opportunities for local residents; average employment would be 38 workers; peak employment would be 60 workers.	No change[c]
Economic	Direct and indirect expenditures of $26,324,000 are anticipated to remain in Texas.	No change[c]
Transportation	Negligible short-term increases in traffic on FM-791 and FM-1344, US-181, and US-94.	No change[c]

Table 1.1 Environmental impacts (Concluded)

Environmental component	Proposed action	No action
Energy consumption	Irreversible use of 1,548,776 gallons of fuel and 110,232 kilowatt hours of electricity.	N/A[a]
Water consumption	Use of 2,100,000 gallons during remedial action for dust suppression, vehicle decontamination, and other miscellaneous uses on the site.	N/A[a]
Nonradiological accidents	4.8 injury accidents and 0.05 fatal accident on the site.	N/A[a]
Cost of remedial action[j]	$21,402,000.	N/A[a]

[a]Not applicable.

[b]Excess cancer death risk after remedial action was calculated for a constant population (see Section 4.2 and Table 4.2). Updated risk coefficients have been incorporated into this EA. The new risk coefficients were established such that "excess health effects" is defined as excess cancer death risk. This is true for radon daughter inhalation, radionuclide air particulate inhalation, and exposure to gamma radiation.

[c]No change from existing conditions; continued dispersion of tailings by wind, water, or unauthorized removal by humans.

[d]microg/m^3 - microgram per cubic meter; TSP - total suspended particulates.

[e]For impacts assessment purposes, all contaminated soils that are consolidated and stabilized within the disposal cell would be lost from future productive purposes.

[f]Hunter use days equal the number of hunters per acre times the number of acres of habitat that would be cleared times the number of days hunted per hunter.

[g]dBA - decibels on the A weighted scale.

[h]No impacts to state-listed T&E species. Consultation with the U.S. Fish and Wildlife Service pursuant to Section 7 of the Endangered Species Act indicated that there are no Federal listed species known to be present at or near the site.

[i]No cultural resource surveys have been done at the tailings or borrow sites, due to the highly disturbed nature of the area. Previously undisturbed areas will be surveyed prior to the start of remedial action.

[j]This cost does not include the remedial action for the estimated seven off-site vicinity properties or the costs associated with construction management, field supervision, engineering, or property acquisition.

2.0 REMEDIAL ACTION ALTERNATIVES

2.1 THE NEED FOR REMEDIAL ACTION

2.1.1 Background

In response to public 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 passed the UMTRCA (42 U.S.C. 4321 et seq.) which was enacted into law on November 8, 1978. In the UMTRCA, Congress acknowledged the potential health hazards associated with uranium mill tailings and identified 24 sites that were in need of remedial action. The Falls City, Texas, site is one of these sites.

Title I of the UMTRCA required the Secretary of Energy to designate sites to be cleaned up and authorized the DOE to enter into cooperative agreements with affected states or Indian tribes to clean up those inactive sites contaminated with uranium mill tailings. Title I also required the EPA to promulgate standards for these sites and defined the role of the NRC.

Effective March 23, 1987, the DOE and the state of Texas entered into a cooperative agreement under the UMTRCA. The cooperative agreement set forth the terms and conditions for remedial action efforts, including the DOE's development of a remedial action plan (in conjunction with the state of Texas), the DOE's preparation of an appropriate environmental document, real estate responsibilities, and other concerns.

The EPA published an environmental impact statement (EIS) (EPA, 1982) on the development and impacts of the standards and issued final standards (40 CFR 192) that became effective on March 7, 1983 (Table 2.1). In developing these standards, the EPA determined "that the primary objective for control of tailings should be isolation and stabilization to prevent their misuse by man and dispersal by natural forces" and that "a secondary objective should be to reduce the radon emissions from the piles." A third objective should be "the elimination of significant exposure to gamma radiation from tailings piles." These standards are to be met for up to 1000 years, to the extent reasonably achievable and, in any case, for at least 200 years.

On September 3, 1985, the U.S. Tenth Circuit Court of Appeals remanded the EPA groundwater standards contained in 40 CFR 192.02 (a)(2)-(3). The EPA issued proposed groundwater protection standards for comment on September 24, 1987. Under the UMTRCA, the DOE must comply with the proposed standards until final standards are promulgated. The design for the disposal of the Falls City residual radioactive materials and other contaminated materials

PART 192 - HEALTH AND ENVIRONMENTAL PROTECTION STANDARDS FOR URANIUM MILL TAILINGS

SUBPART A - Standards for the Control of Residual Radioactive Materials from Inactive Processing Sites

192.02 Standards

Control shall be designed to:

(a) Be effective for up to one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years, and,

(b) *Provide reasonable assurance that releases of radon-222 from residual radioactive* material to the atmosphere will not:

(1) Exceed an average release rate of 20 picocuries per square meter per second, or
(2) *Increase the annual average concentration of radon-222 in air at or above any* location outside the disposal site by more than one-half picocurie per liter.

SUBPART B - Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from *Inactive Uranium Processing Sites*

192.12 Standards

Remedial actions shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials from any designated processing site:

(a) The concentration of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than -

(1) 5 pCi/g, averaged over the first 15 cm of soil below the surface, and
(2) 15 pCi/g, averaged over 15 cm thick layers of soil more than 15 cm below the surface.

(b) In any occupied or habitable building -

(1) The objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL. In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL, and
(2) The level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour.

SUBPART C - Implementation (condensed)

192.20 Guidance for Implementation

Remedial action will be performed with the "concurrence of the Nuclear Regulatory Commission and the full participation of any state that pays part of the cost" and in consultation as appropriate with other government agencies and affected Indian tribes.

192.21 Criteria for Applying Supplemental Standards

The implementing agencies may apply standards in lieu of the standards of Subparts A or B if certain circumstances exist, as defined in 192.21.

192.22 Supplemental Standards

"Federal agencies implementing Subparts A and B may in lieu thereof proceed pursuant to this section with respect to generic or individual situations meeting the eligibility requirements of 192.21."

(a) ". . .the implementing agencies shall select and perform remedial actions that come as close to meeting the otherwise applicable standards as is reasonable under the circumstances."

(b) *". . .remedial actions shall, in addition to satisfying the standards of Subparts A and* B, reduce other residual radioactivity to levels that are as low as is reasonably achievable."

(c) "The implementing agencies may make general determinations concerning remedial actions under this Section that will apply to all locations with specified characteristics, or they may make a determination for a specific location. When remedial actions are proposed under this Section for a specific location, the Department of Energy shall inform any private owners and occupants of the affected location and solicit their comments. The Department of Energy shall provide any such comments to the other implementing agencies [and] shall also periodically inform the Environmental Protection Agency of both general and individual determinations under the provisions of this section."

Ref: Federal Register, Volume 48, No. 3, January 5, 1983, 40 CFR Part 192.

TABLE 2.1 EPA STANDARDS

has been formulated to achieve compliance with the requirements of the proposed standards. The proposed EPA groundwater protection standards are listed in Table 2.2.

2.1.2 The purpose of this document

This EA is prepared pursuant to the National Environmental Policy Act (NEPA), which requires Federal agencies to assess the impacts that their actions may have on the environment. This EA examines the short- and long-term effects of the DOE's proposed remedial action for the Falls City tailings site. The no action alternative is also examined.

The DOE will use the information and analyses presented here to determine whether the proposed action would have a significant impact on the environment. If the impacts are determined to be significant, an EIS will be prepared. If the impacts are not judged to be significant, the DOE will issue an official "Finding of No Significant Impact" and implement the proposed action. These procedures and documents are defined in regulations issued by the Council on Environmental Quality (CEQ) in 40 CFR, 1500 through 1508.

The proposed action also includes consolidation of the contaminated materials already removed from seven vicinity properties associated with the tailings site. These materials are presently stockpiled on the site. Vicinity properties are properties that are outside of the designated Falls City tailings site boundary and that were contaminated by tailings dispersed by water or wind erosion or by removal by humans. This contamination took place before the potential hazards of the tailings were known, and before laws and regulations restricting their disposal or use were in effect. The potential environmental impacts of remedial action at these properties were previously assessed in a programmatic environmental report (DOE, 1985) and, therefore, will not be addressed in this EA. The one exception to this is radiological impact; the radiological impacts for no action and for the proposed action at the vicinity properties are included in the EA analysis.

Additional and more detailed information is contained in the EADR (DOE, 1991a) supporting this document, and in the referenced supporting documentation.

2.1.3 The Falls City site

The Falls City tailings site is in Karnes County, Texas, approximately eight miles southwest of the town of Falls City (Figure 2.1). The site is approximately 46 miles southeast of San Antonio, Texas.

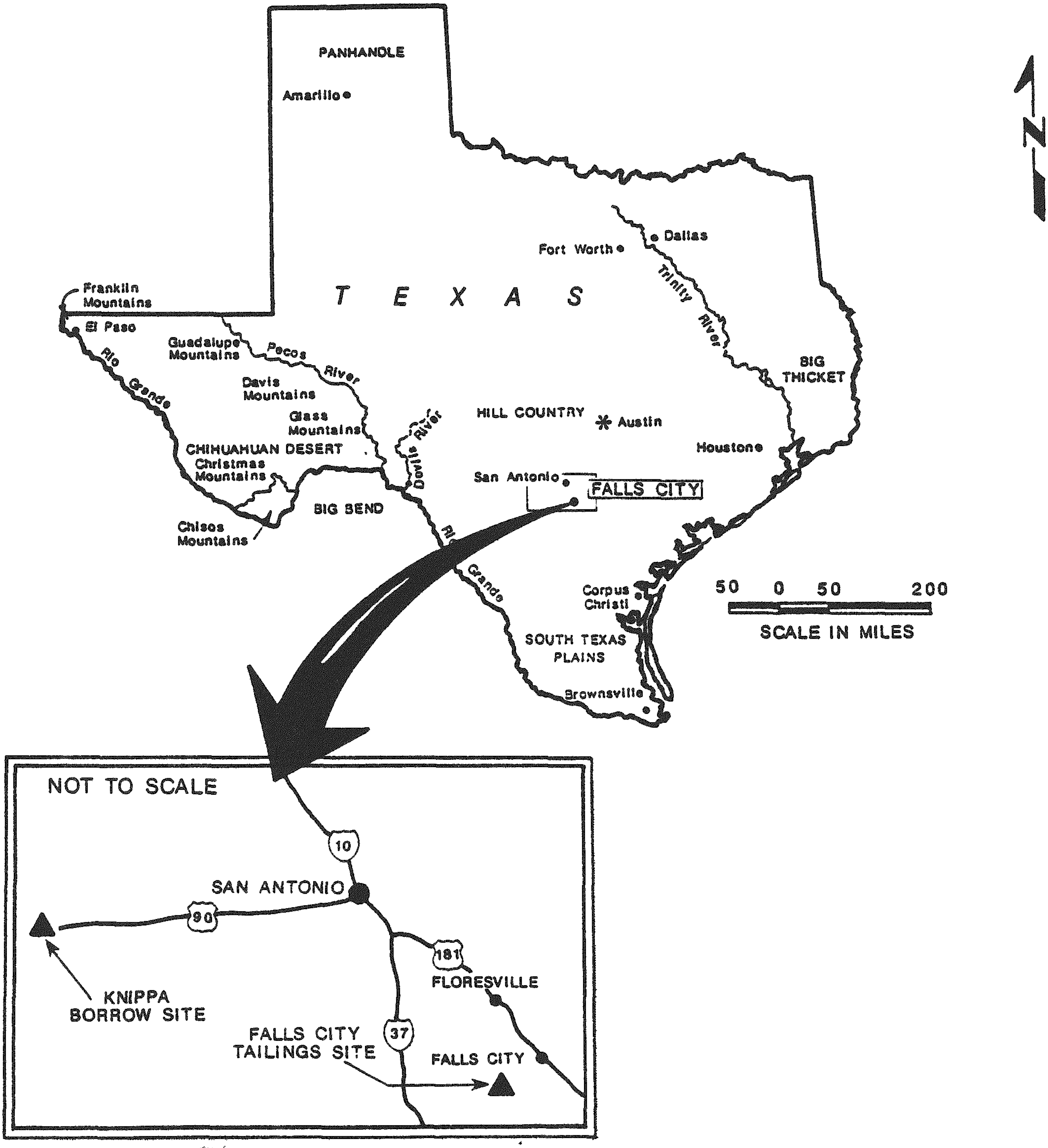


FIGURE 2.1
LOCATION OF THE FALLS CITY, TEXAS, SITES

Table 2.2 Proposed EPA groundwater protection standards

Hazardous constituent with proposed EPA MCLs	MCL (mg/l)[a]
Arsenic	0.05
Barium	1.00
Cadmium	0.01
Chromium	0.05
Lead	0.05
Mercury	0.002
Molybdenum	0.10
Nitrate	44
Selenium	0.01
Silver	0.05
Radium-226 and -228 (pCi/l)	5
Uranium-234 and -238 (pCi/l)	30
Gross alpha (pCi/l)	15
Benzene (Cyclohexatriene)	0.005
Carbon tetrachloride	0.005
p-Dichlorobenzene (Benzene, 1, 4 di-)	0.075
1-Dichloroethylene (Ethene, 1, 1 di-)	0.007
Endrin	0.0002
Ethylene dichloride	0.005
Lindane	0.004
Methoxychlor	0.100
Methylchloroform	0.200
Toxaphene	0.0055
2,4-D (Dichlorophenoxyacetic acid)	0.100
2,4,5-TP (Trichlorophenoxyprophoric acid)	0.010
Trichloroethylene	0.005
Vinyl chloride	0.002
Appendix I and Appendix IX inorganic hazardous constituents that must not exceed background water quality[b]	
Antimony and compounds	--
Aluminum phosphide	--
Beryllium and compounds	--
Carbon oxyfluoride	--
Copper	--
Cyanides (soluble salts and complexes)	--
Nickel and compounds	--
Strontium sulfide	--
Sulfide	--
Thallium and compounds	--
Tin	--
Vanadic acid, ammonium salt	--
Vanadium pentoxide	--
Zinc phosphide	--

[a]mg/l = milligrams per liter.
[b]See Appendix I, 40 CFR 192 (5/2/91 edition) and Appendix IX, 40 CFR 264 (7/1/90 edition) for organic hazardous constituents.

The tailings site consists of two parcels (Figure 2.2). Parcel A consists of the mill site, one remaining office building, five tailings piles (piles 1, 2, 4, 5, and 7), and one tailings pond (pond 6) west, northwest of the intersection of Farm-to-Market Roads 1344 and 791 (FM-1344 and FM-791). Parcel A is fenced and is 473 acres. A sixth tailings pile (pile 3) lies north, northeast of this intersection; this area is designated Parcel B. Parcel B is 120 acres. There is windblown contamination adjacent to both parcels, 298 acres at Parcel A and 80 acres at Parcel B. There are an estimated 5,764,100 cy of residual radioactive materials within both parcels (Table 2.3). The two parcels are approximately one mile apart (Figure 2.2).

Parcel A is situated on the divide between the watersheds of the San Antonio River (4.2 air miles to the northeast of the mill site area) and the Atascosa River (13.6 air miles to the southwest of the mill site area). The southern portion of Parcel A is within the Atascosa River watershed. The remainder of Parcel A and all of Parcel B are within the San Antonio watershed. Elevations of Parcel A range from 405 to 475 feet above mean sea level, while Parcel B is slightly lower in elevation and elevations range from 397 to 410 feet above mean sea level.

2.1.4 History of uranium operations

Susquehanna Western, Inc. (SWI) built and operated a uranium mill at the Falls City site from April 1961 until August 1973. The mill used a sulfuric acid leach/countercurrent decantation/solvent extraction process. Over 700 tons of U_3O_8 concentrate ("yellow cake") were sold to the Atomic Energy Commission while the mill was in operation.

Waste tailings and processing solutions from the SWI milling operation were impounded in seven separate ponds, four of which had been open pit mines excavated into the ore-bearing sandstone. The tailings ponds were 30 to 35 feet deep and unlined, except for the naturally clayey foundation soils and sediments.

In 1975, SWI sold the mill site and residual materials to Tepcore, Inc., who in turn sold the property to Solution Engineering, Inc. (SEI) and its partner Basic Resources, Inc. From late 1978 to early 1982, SEI conducted secondary solution mining of uranium from four of the piles. The operation included a system of shallow injection and recovery wells and an ion exchange bed to recover uranium and molybdenum from solution. The uranium leaching agent used was acid water from tailings pond 7. Residual process waters were pumped back to this pond (Bryson, 1987; FBDU, 1981). All ponds were evaporated except for pond 6, which is thought to be recharged by natural seepage. Small amounts of the original tailings surround the perimeter of pond 6 and may be present in the sediment.

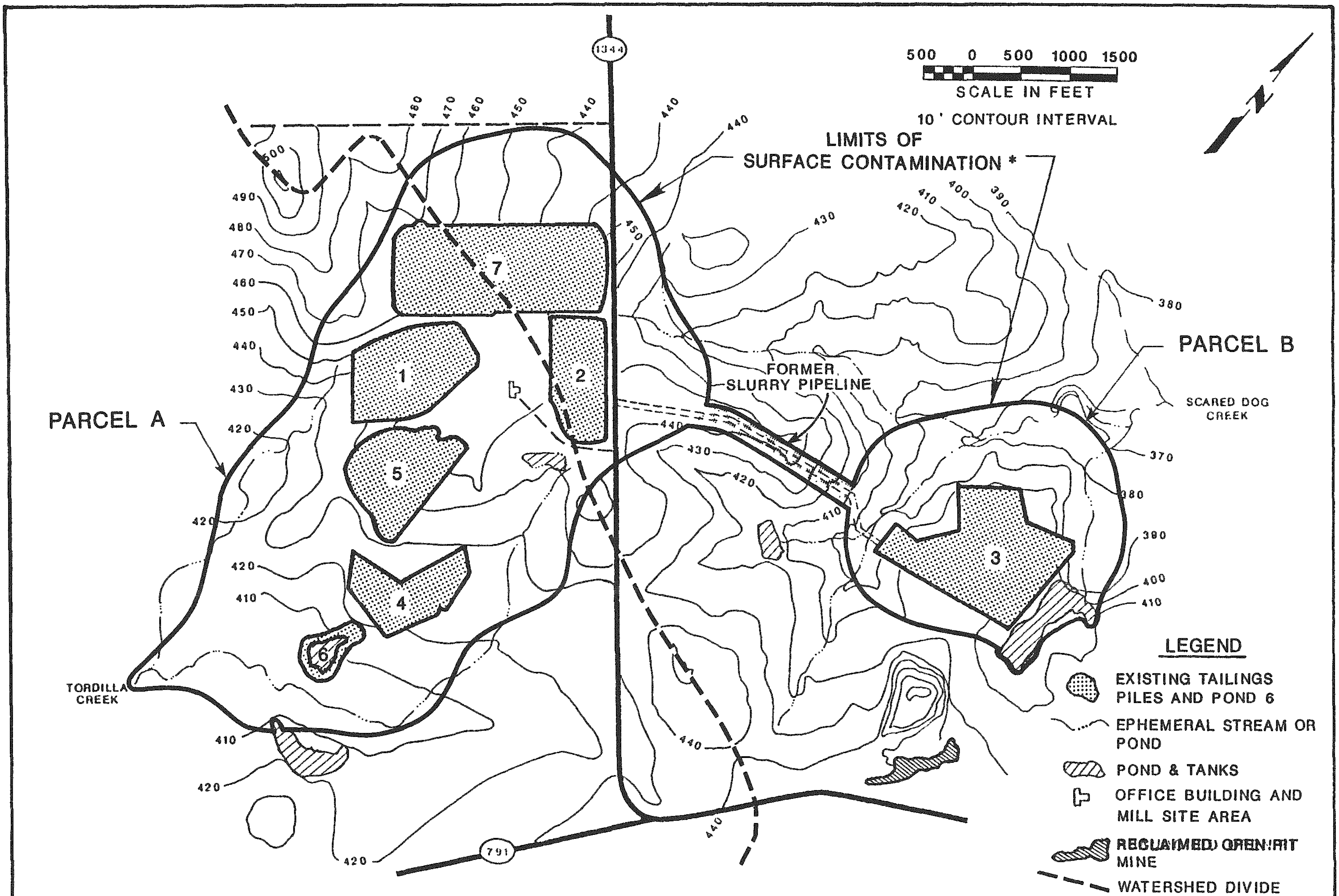


FIGURE 2.2
PRESENT CONDITIONS
FALLS CITY, TEXAS, SITE

Table 2.3 Contaminated areas, Falls City, Texas, site

Item	Volume (cy)	Average thickness (feet)	Area (acres)
Pile 1	550,400	14	24
Pile 2	300,000	7	26
Pile 3	736,900	13	39
Pile 4	418,900	18	13
Pile 5	695,700	18	21
Pond 6	94,300	7	8
Pile 7	2,100,000	28	46
Mill yard	119,200	2	37
Windblown Parcel A	552,400	1	298
Windblown Parcel B	195,900	1	80
Slurry pipeline	400	1	1
Totals	5,764,100		593

In 1982, the tailings piles were recontoured and covered with one to two feet of local clays. Revegetation with native grasses and shrubs was successful on piles 1, 2, 3, 4, and 5; pile 7 was covered with topsoil in 1986. All piles are nearly 100 percent vegetated. A number of shallow monitor wells, installed by SWI and SEI as conditions of their state operating permits, remain on the mill site property. Residual ponds of acidic process waters, which formerly covered portions of pile 7, were spray-evaporated by SEI.

2.2 THE PROPOSED ACTION--STABILIZATION ON SITE

The proposed action is to stabilize the contaminated materials on the Falls City site (Parcel A). The design for stabilization on site would comply with the EPA standards; the major design features are summarized below. More detailed design details are provided in Section 2.0, Conceptual Design, of the Falls City site EADR (DOE, 1991a), and in the "Final Remedial Action Plan and Site Conceptual Design for Stabilization of the Inactive Uranium Mill Tailings Site at Falls City, Texas" (DOE, 1991b).

2.2.1 Final conditions

All of pile 1 and most of piles 2 and 7 would be left in place to form the base of the proposed disposal cell (Figure 2.3). The materials (surface and subsurface) from the remainder of piles 2 and 7 and all of piles 3, 4, and 5, pond 6, and windblown contaminated areas would then be consolidated into the main embankment. The disposal cell would be roughly rectangular and would have a base of 2200 feet by 2600 feet and a maximum height of 48 feet above the surrounding terrain. The average height of the cell above the surrounding terrain grade would be approximately 20 feet. The disposal cell would have maximum sideslopes of 20 percent and a topslope of between one and two percent (Figure 2.4).

The tailings and contaminated materials would be covered with 24 inches of compacted earth (U.S. Soil Conservation Service soil classification "CH," a highly plastic clay to sandy clay) to inhibit radon emanation and water infiltration. The topslope of the cell would be covered with a six-inch-thick layer of gravel bedding material and a 30-inch-thick layer of fill, six-inch-thick layer of topsoil and vegetation. The sideslopes would be covered by a six-inch-thick layer of gravel bedding material, and would be topped by a 12-inch-thick layer of large rock for erosion protection. The final restricted site would cover 290 acres. Of this area, the disposal cell would cover 127 acres and a buffer area between the edge of the pile and perimeter of the restricted area would cover an additional 163 acres.

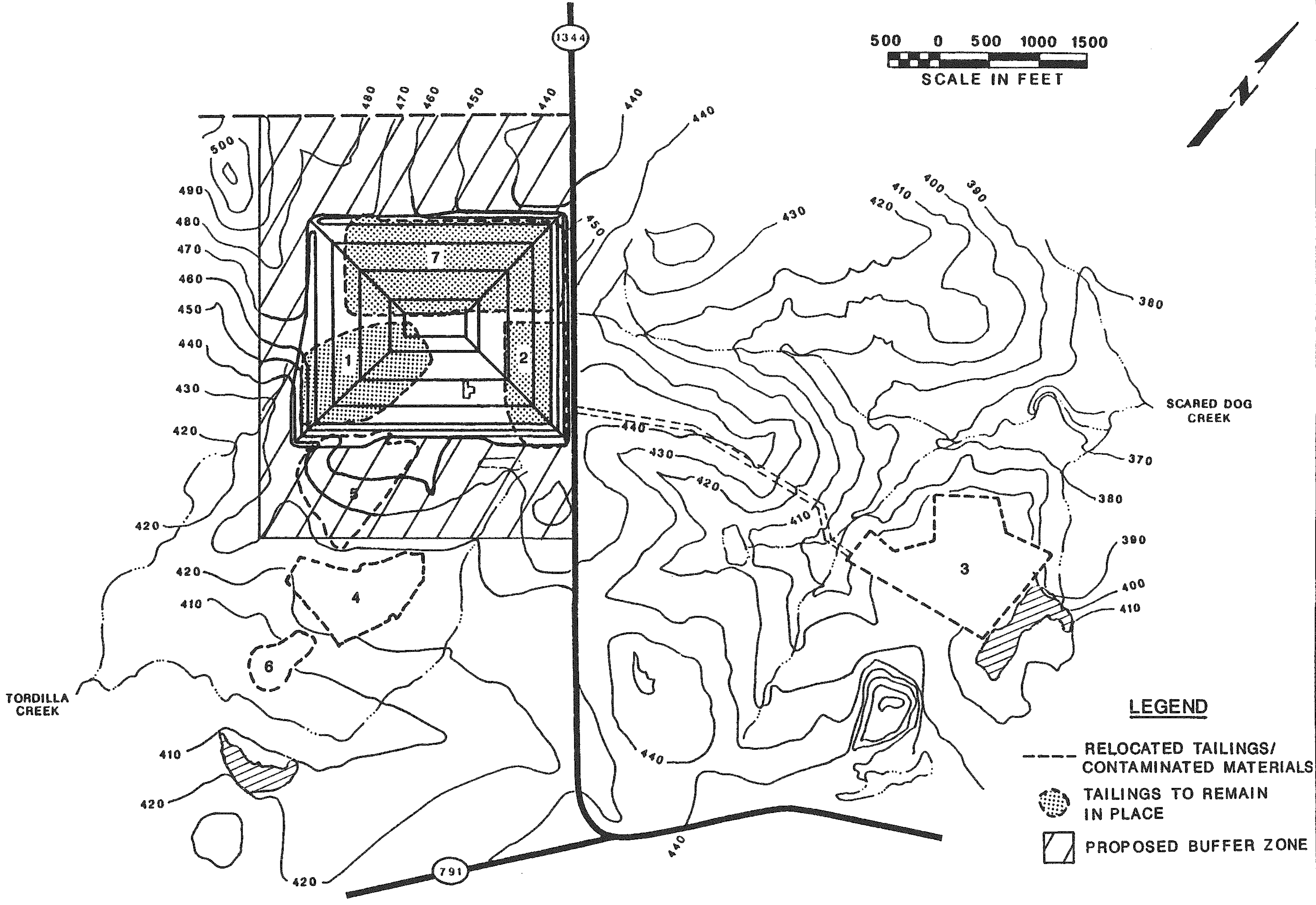


FIGURE 2.3
FINAL CONDITION
FALLS CITY, TEXAS, SITE

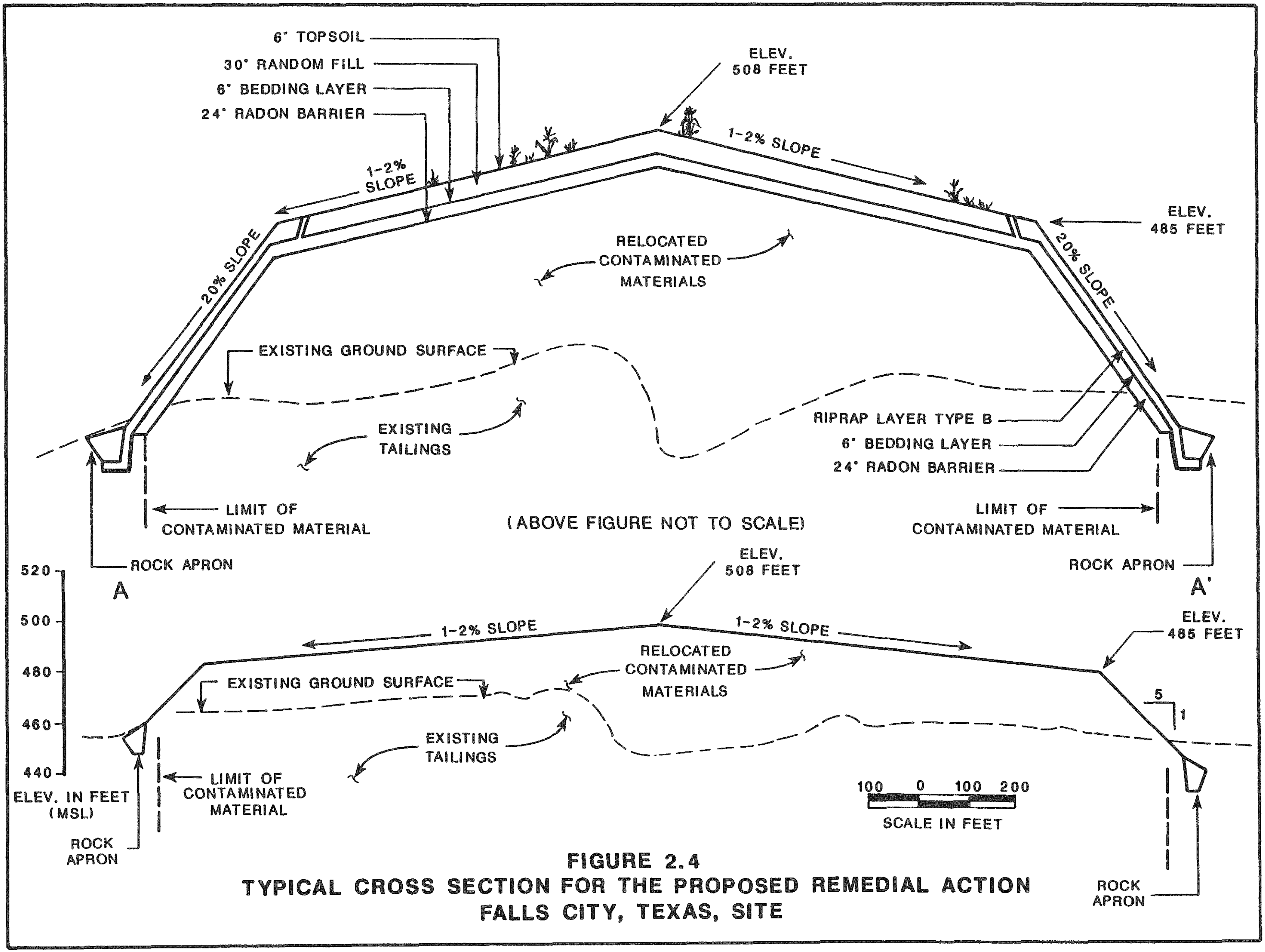


FIGURE 2.4
TYPICAL CROSS SECTION FOR THE PROPOSED REMEDIAL ACTION FALLS CITY, TEXAS, SITE

After remedial action, all disturbed areas, including the La Mesa borrow site, would be graded for positive drainage and reseeded. The Tordilla Hill and the Knippa borrow sites would not be reclaimed because they are existing rock quarries.

The proposed remedial action design presented in this EA is conceptual in nature and may change during the final design review process. However, the DOE anticipates that the actual final design will be similar to the conceptual design presented here, and that any changes in the final design will not alter the EA impacts analysis.

2.2.2 Major construction activities

The remedial action would be performed using conventional construction practices and techniques that would comply with all applicable Federal, state, and local regulations. The remedial action would also ensure the safe and environmentally sound stabilization of the tailings and other contaminated materials in accordance with the EPA standards.

The major construction activities would include site preparation, demolition of the existing structure on the site, construction of drainage control measures and wastewater treatment facilities, upgrading of the haul road between Parcels A and B, dewatering pond 6, relocation and consolidation of the tailings and windblown contaminated soils onto the main tailings embankment, excavation of borrow materials, placement of the radon barrier and cover materials onto the disposal cell, and restoration of disturbed areas (excluding the excavated pits and pond 6, Tordilla Hill and Knippa borrow sites).

2.2.3 Borrow sites

Construction of the stabilized disposal cell would require the use of borrow materials (earth, gravel, and rock). For the purposes of evaluating impacts and defining the conceptual design, specific borrow sites for radon barrier and erosion protection materials were identified; however, other borrow sites may be identified during the final design process and used for remedial action. The impacts identified for these borrow sites are conservative and represent a realistic upper limit on the severity of the impacts that may occur.

The proposed borrow sites are shown on Figure 2.5. The La Mesa borrow site is adjacent to piles 1, 4, 5, and 7 and would be the source of fine-grained earthen materials used for the radon barrier, topsoil fill layer, and site restoration. The Tordilla Hill borrow site is an existing rock quarry five road miles south of the mill site and would be the source of sand and gravel for

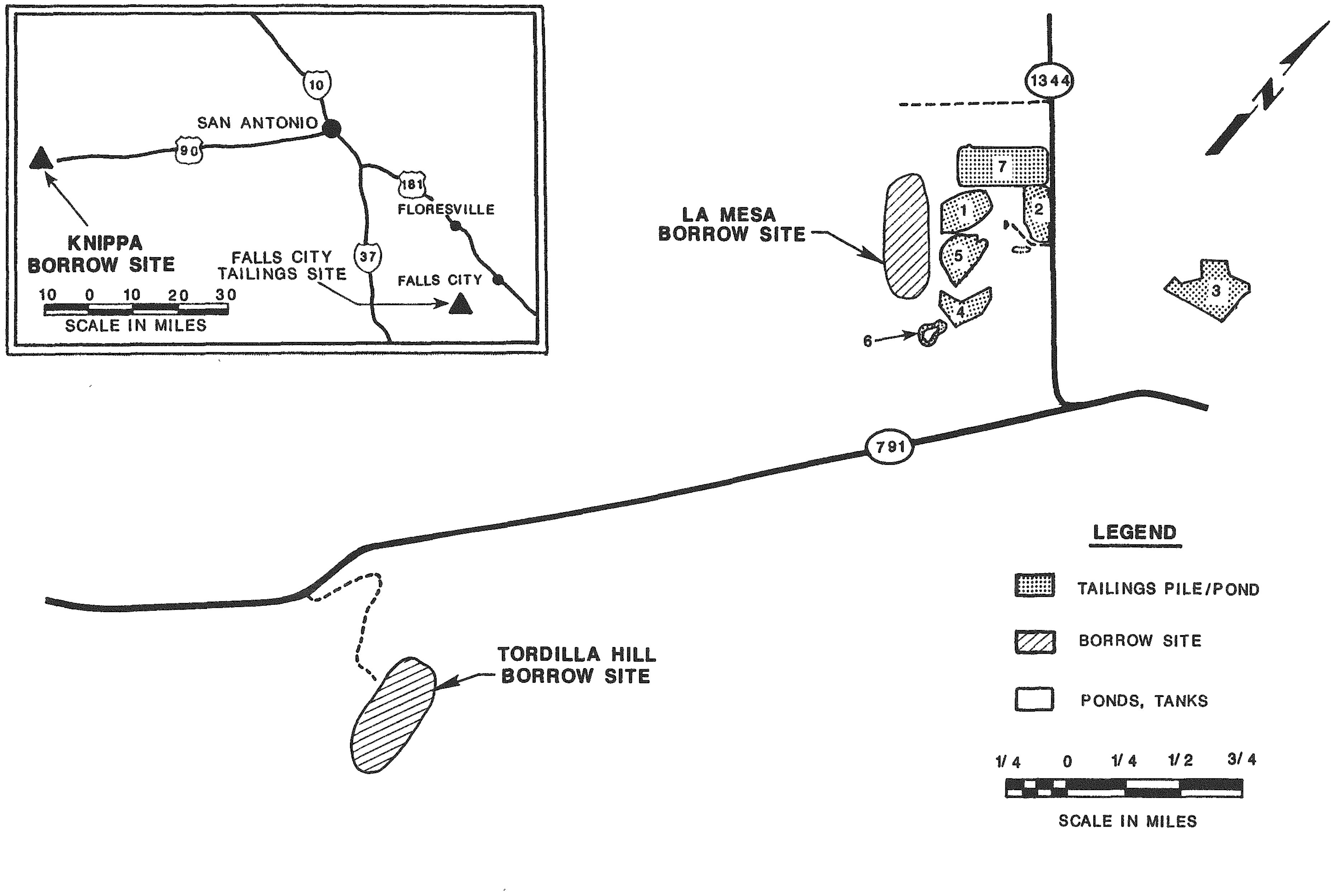


FIGURE 2.5
PROPOSED BORROW SITE LOCATIONS
FALLS CITY, TEXAS, SITE

erosion protection. The Knippa borrow site is an existing rock quarry 40 miles west of San Antonio, Texas, and would be the source of the rock.

Trucks would be used to transport borrow materials from the Tordilla Hill borrow site to Parcels A and B. At this time, no decision has been made regarding the mode of transportation of borrow materials from the Knippa borrow site west of San Antonio. Truck transport via existing U.S. Highways 94 and 181 (US-94 and US-181), or train transport from the existing borrow area through San Antonio and southward to Falls City using existing train transport systems combined with truck transport from Falls City to the disposal site, are alternatives currently under consideration. Both alternatives would require truck transport from Falls City to the tailings site using FM-791 and FM-1344.

2.3 OTHER ALTERNATIVES

2.3.1 No action

The no action alternative consists of taking no steps toward remedial action at the tailings site or at the areas of windblown contamination. The tailings piles and pond would remain in their present conditions and would continue to be subject to dispersion by wind and water erosion, use by livestock and wildlife, and possible unauthorized removal by humans. The selection of this alternative would not be consistent with the intent of Congress in the UMTRCA and would not result in compliance with the EPA standards.

2.3.2 Stabilization in place

Stabilization in place (SOP) was initially evaluated for the Falls City site. This alternative, although similar to stabilization on site (SOS), has several design differences. Piles 1, 2, and 7 would be left in place, as well as the subsurface materials from piles 4 and 5. The above-surface portions of piles 4 and 5, surface and subsurface contaminated materials from pile 3, and pond 6 would be excavated and incorporated into the area between piles 1, 2, and 7. All windblown materials would be consolidated in the area of piles 1, 2, and 7. The embankment would be covered with a radon barrier and erosion protection cover similar to that of the proposed action. The final restricted area would encompass 290 acres.

This design was subsequently dropped from further consideration because the SOS design (proposed action) provides better groundwater protection. The proposed remedial action design offers a greater reduction in both the surface area and the footprint of the disposal cell, as well as more excavation of subpile materials, which would reduce seepage and decrease groundwater contamination more than the SIP alternative.

2.3.3 Alternate disposal sites

In 1985, a preliminary analysis of possible alternate disposal sites identified three sites that had suitable characteristics. These sites (Grassy Bowl, Scared Dog, and Snake) were evaluated in the field (Figure 2.6). The Grassy Bowl site was selected as the best potential disposal site.

The environmental impacts of moving the tailings to the Grassy Bowl site are comparable to SOS, or higher, due to transportation-related impacts. This alternative does not provide sufficient environmental, economic, or groundwater protection benefits over the SOS alternatives to equal the increased costs and impacts associated with tailings transport. Therefore, this alternative was dropped from further consideration.

At the same time, a nearby former open-pit uranium mine (Conquista) was also considered as a possible disposal site (Figure 2.6). The Conquista facility today, however, is considered a Title II (active) facility by the NRC, and this alternative was subsequently dropped from further consideration. Licensing requirements (i.e., combining Title I and Title II materials) would have created complications that could have jeopardized the completion of the UMTRA Project.

2.3.4 Reprocessing the tailings

The Falls City tailings contain low levels of uranium. The feasibility of reprocessing the tailings for uranium was evaluated, and it was determined that the costs associated with the recovery of uranium would require a four or five times increase in uranium prices (based on 1981 uranium prices) for this effort to be feasible (FBDU, 1981).

In addition, reprocessing would not reduce the radium content of the tailings. Since radioactive decay of radium is the source of radon gas, the hazard from radon and radon decay products would not be reduced. Therefore, the reprocessed tailings would still require some form of remedial action to meet the EPA standards. Reprocessing was therefore eliminated from further consideration.

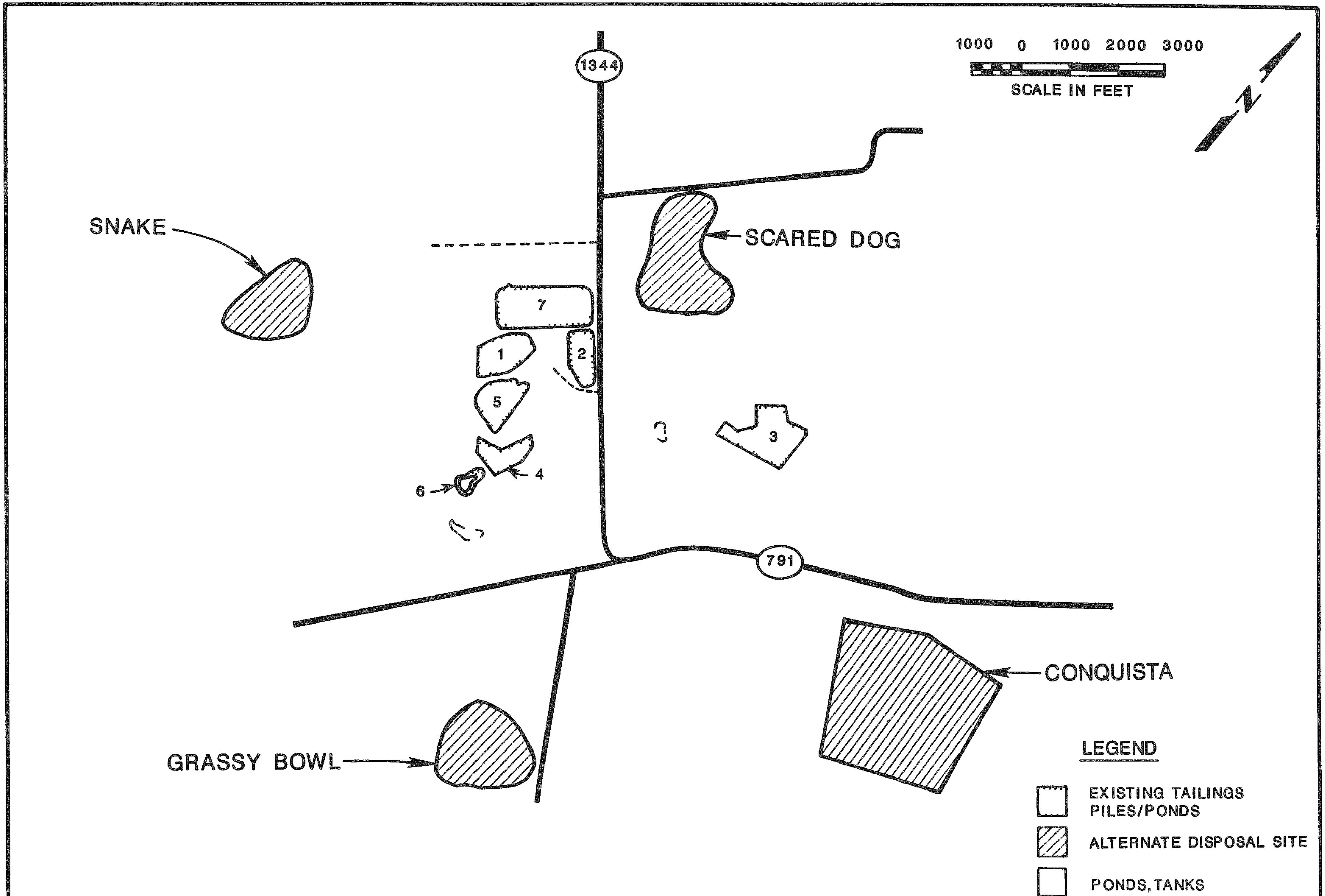


FIGURE 2.6
PREVIOUSLY CONSIDERED ALTERNATE DISPOSAL SITES
FALLS CITY, TEXAS, SITE

3.0 AFFECTED ENVIRONMENT

3.1 WEATHER AND AIR QUALITY

Local weather data for the Falls City site were obtained from a uranium operation 15 miles east of the site and from the San Antonio International Airport, which is over 50 air miles north of the site. The climate is considered subtropical, with mild temperatures and high humidity. The average annual maximum temperature is 79°F and the average annual minimum temperature is 58°F. Typical maximum summer temperatures are in the 90s and may exceed 100 degrees. The long-term (1951 through 1980) average maximum temperature for San Antonio was 77°F, while the minimum was 55°F (NOAA, 1986).

The average annual precipitation is 30.3 inches per year, but ranges from 25 to 38 inches per year. The greatest precipitation occurs in the late spring, summer, and early fall, while the least occurs in the winter.

High humidity is typical, and ranges from approximately 45 to 90 percent. The average noontime humidity for San Antonio during the period 1951 through 1980 ranged from 51 percent in July and August to 59 percent in January and May.

Wind flow data indicate that winds are predominantly from the southeast, north, or south, with northward flows predominating in the winter. Southeastward to southward flows predominate in the spring, summer, and fall (Chevron, n.d.).

The State of Texas air quality standards are the same as the Federal standards (Table 3.1). Annual standards are not to be exceeded at all, while Federal short-term standards are not to be exceeded more than once per year.

The nearest state air quality sampling station is in San Antonio, Texas. However, the air quality data obtained from San Antonio were judged to be not relevant to the Falls City site. Karnes County is considered an attainment area (pollutant concentrations below standards) by the Texas Air Control Board (Butts, 1986) for all priority pollutants (except ozone).

3.2 GEOLOGY

The Falls City site is near the northern margin of the West Gulf section of the Coastal Plain Physiographic Province (Figure 3.1) (Hunt, 1967). Regionally, floodplains flanked by several levels of fluvial terraces and cuestas are the prominent landforms.

Geologic structure in the region is dominated by the gently inclined (one to four degrees), gulfward-dipping, undeformed strata that compose the northern margin of the Gulf Geosyncline (Waters et al., 1955). The Eocene-age geologic strata that underlie and outcrop in the vicinity of

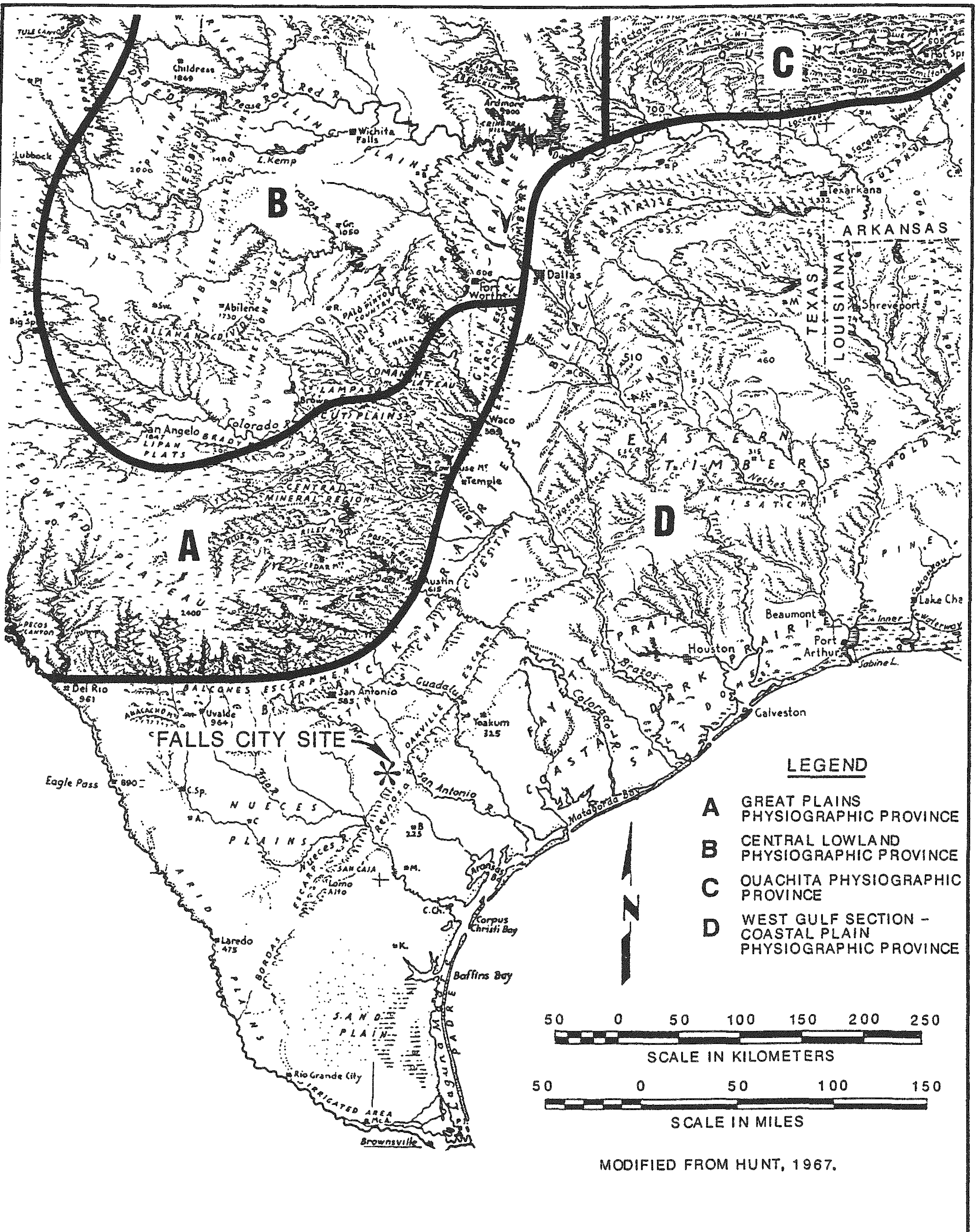


FIGURE 3.1
PHYSIOGRAPHIC SETTING OF THE FALLS CITY, TEXAS, SITE

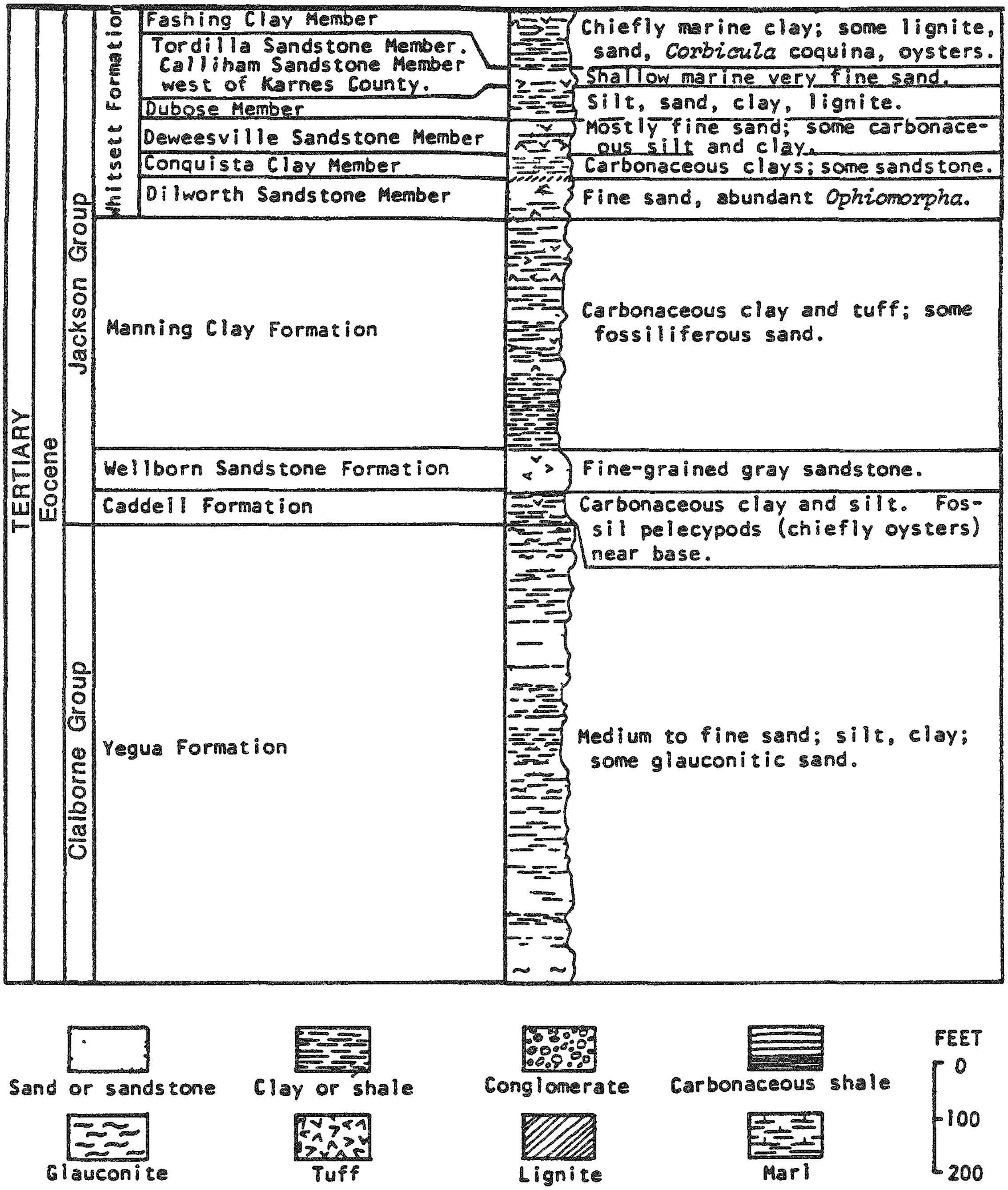
Table 3.1 Federal and State of Texas ambient air quality standards

Pollutant	Primary standard	Secondary standard
Sulfur dioxide		
24-hour maximum	365 microg/m^3	--
Annual arithmetic mean	80 microg/m^3	--
3-hour maximum	--	1300 microg/m^3
Particulates		
24-hour maximum	260 microg/m^3	150 microg/m^3
Annual geometric mean	75 microg/m^3	60 microg/m^3
Carbon monoxide		
8-hour maximum	10 milligrams/m^3	10 milligrams/m^3
1-hour maximum	40 milligrams/m^3	40 milligrams/m^3
Ozone		
1-hour average	235 microg/m^3	235 microg/m^3
Nitrogen dioxide		
Annual arithmetic mean	100 microg/m^3	100 microg/m^3
Lead		
Calendar quarterly arithmetic mean	1.5 microg/m^3	1.5 microg/m^3

the tailings piles and the borrow sites are composed of slightly lithified to poorly consolidated alternating mudstones, siltstones, and sandstones. In descending order, they include the Tordilla Hill Sandstone, Dubose Clay, Deweesville Sandstone, Conquista Clay, and Dilworth Sandstone Members of the Whitsett Formation of the Jackson Group, and the upper portion of the Manning Clay (Figure 3.2).

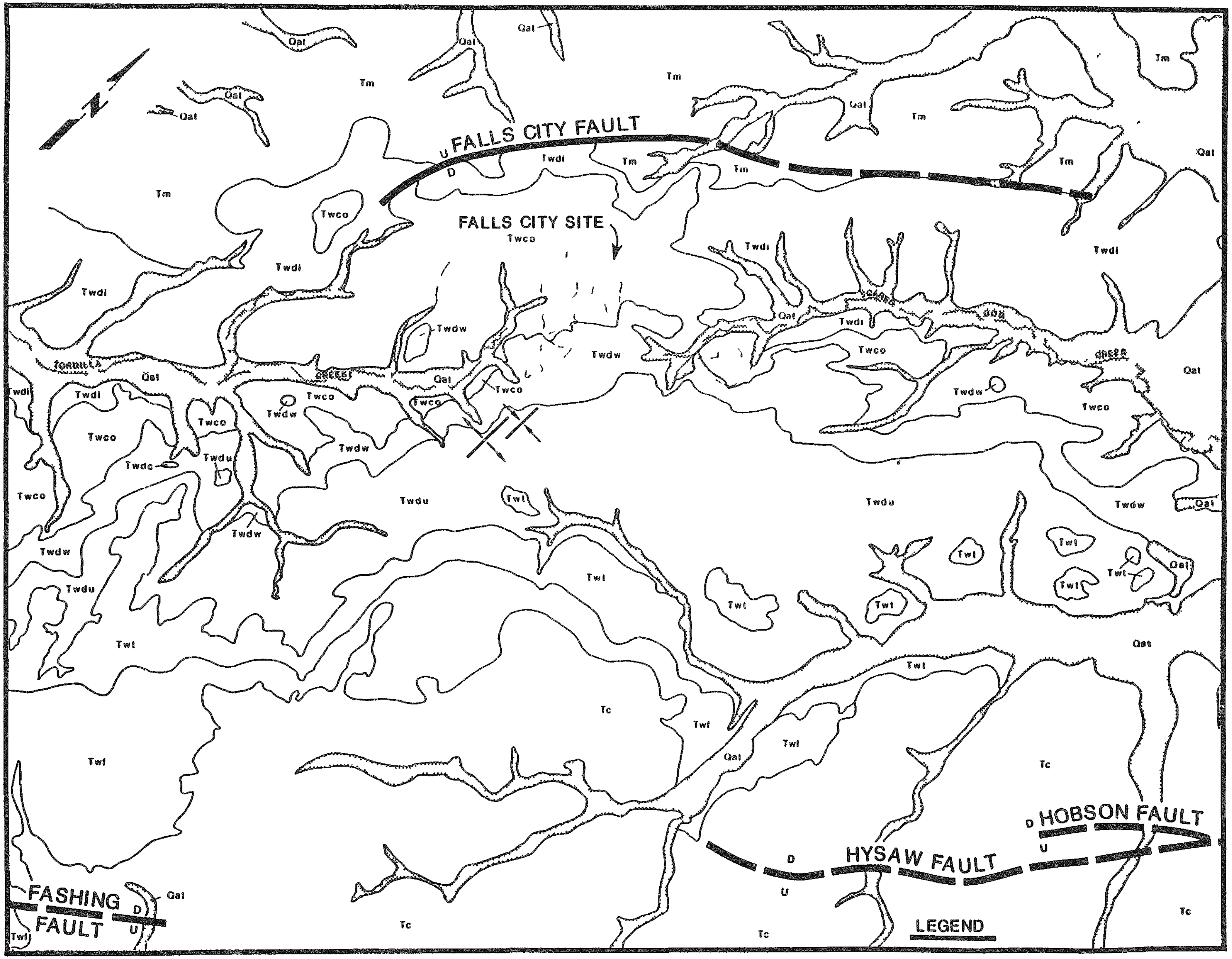
The site area is bounded one mile to the north by the northeastern-trending Falls City fault, and five miles to the south by the Fashing fault system. There is no evidence of faulting within the immediate boundary (TK&A, 1976; Eargle and Weeks, 1962) (see Figure 3.3).

Historically, the rate of seismic activity has been extremely low in the site region (Davis et al., 1985). No known or capable faults have been recognized. The only seismic activity (magnitude ≤ 3.9) occurred between 1974 and 1985 and was induced by oil and gas withdrawal in the fields eight miles away from the Falls City site.



MODIFIED FROM EARGLE et al., 1971.

FIGURE 3.2
GENERALIZED STRATIGRAPHIC SECTION
OF THE FALLS CITY, TEXAS, SITE



4000 0 4000 8000

SCALE IN FEET

MODIFIED FROM MOXHAM et al. (1958), BUNKER and MacKALLOR (1973), and DICKINSON (1976)b.

FIGURE 3.3
GEOLOGIC MAP OF THE FALLS CITY, TEXAS, SITE

Characteristic landforms in the site area are low, vegetated, rolling hills (Bunker and MacKallor, 1973). Potential geomorphic processes of concern include fluvial erosion and accelerated denudation of expansive soils. Major rivers in the area are four to five miles away from the site; smaller streams and drainages in the site area are ephemeral and do not support flow except during spring and fall storm periods. The rate of landform evolution associated with the lateral and headward erosion of these drainages is relatively slow due to the gently rolling topography, generally nonerosive soils, and the abundant, dense vegetation.

Neither a soils survey nor a general soils map have been published for Karnes County or the Falls City site area (Perkins, 1986). The loams, clayey loams, sandy loams, and clays occurring at the site range in thickness from five to 60 inches over parent materials. The very low to moderate permeability and moderate to high shrink-swell potential of these soils reflect their high montmorillonite clay content. The soil mantle at the tailings site was highly disturbed during the mining and milling processes. No farmlands considered to be prime or unique have been designated.

Mineral resources in the site area include uranium, hydrocarbons, lignite, clay, and building aggregates. Uranium occurs as shallow and oxidized, or deeper and unoxidized, deposits, chiefly in the Deweesville Sandstone Member of the Whitsett Formation of the Jackson Group (Eargle et al., 1975). Hydrocarbon deposits produce gas distillates and minor oil accumulations at depths of 5000 to 10,000 feet (Sams, 1974; Eargle, 1958). Minor oil accumulations are generally found throughout Karnes County. Uneconomic lignite deposits are also present beneath the site and regionally at great depths (Maxwell, 1962). Ceramic clay deposits occur in Karnes County, but none are presently mined. Building aggregate resources include locally occurring sand and gravel fluvial deposits, and well-indurated Tordilla Sandstone Member outcrops such as occur at the inactive Tordilla Hill borrow site. There are no known economic mineral deposits beneath the disposal site area. While uranium deposits are known to occur near the south corner of the cell, surface property owners own all mineral rights to a depth of 200 feet (TDOH, 1991). There is currently no mineral production occurring in the immediate site area. Oil and gas leases for 900 acres, including the mill site and proposed La Mesa borrow area, were obtained in 1990 by Leedes Exploration (TDOH, 1991). The Tordilla Hill borrow site and Knippa quarry are existing privately owned and operated quarries.

3.3 WATER

3.3.1 Surface water

This section provides a general description of the watersheds and surface water features that could impact the Falls City disposal site. A summary of water quality data in area ponds and Tordilla Creek is provided. A more detailed description of surface water conditions may be found in the Floodplains and Wetlands Assessment (Attachment 1).

Falls City tailings site

The Falls City site is on the divide between the Guadalupe River Basin to the north and the Nueces River Basin to the south. The river basin of the San Antonio River, a tributary of the Guadalupe River, borders the Falls City tailings site on the northeast; at its closest point, the San Antonio River is approximately 4.2 air miles from the mill site. The Atascosa River, an intermittent tributary of the Frio River, and ultimately the Nueces River, is approximately 13.6 air miles from the mill site at its closest point (USGS, 1983).

Runoff from the northern portions of pile 7 and pile 2 flows northward to the San Antonio River via an unnamed ephemeral stream. In addition, runoff from pile 3 flows into Scared Dog Creek, an intermittent stream that flows northeastward into the San Antonio River. Runoff from the south portions of pile 7 and pile 2 and all of piles 1, 4, 5, and pond 6 flows southwestward into Tordilla Creek, an intermittent stream, and ultimately into the Nueces River via Borrego Creek, the Atascosa River, and the Frio River.

Flood potential

A U.S. Geological Survey (USGS) gaging station on the San Antonio River is 0.9 mile upstream from the confluence of Scared Dog Creek near the bridge on FM-791. On September 29, 1946, a peak flow of 47,400 cfs and a water surface elevation of 320 feet above mean sea level (MSL) was recorded. The elevation of the proposed disposal site is approximately 450 feet above MSL and 2.5 miles away from the probable maximum flood (PMF) levels (USGS, 1983; NOAA, 1982).

A USGS gaging station on the Atascosa River is 1.1 miles southwest of the town of Whitsett and 10 miles south of the confluence of Borrego Creek. On September 23, 1967, a peak flow of 121,000 cfs and a water surface of 200 feet above MSL was recorded (USGS, 1983; NOAA, 1982). This is 250 feet below the elevation of the proposed disposal site; a PMF flood stage in the Atascosa River would not reach the disposal cell.

Borrow sites

The La Mesa borrow site is west of and adjacent to the mill site, and the Tordilla Hill borrow site is less than two air miles south of the mill site on Tordilla Hill in the Nueces River Basin. Runoff from both borrow sites would flow to the southwest into Tordilla Creek, and eventually into the Nueces River.

Surface water quality

Stock ponds are the only perennial surface water in the site vicinity, with storm water runoff creating periodic surface flows in the intermittent Tordilla Creek. Limited sampling data (two to three samples) indicate that surface water quality in Tordilla Creek flows and the stock ponds is in conformance with EPA drinking water standards, except for manganese and total dissolved solids (TDS). However, concentrations of manganese and TDS in surface water are below those concentrations found in background groundwater. Concentrations of TDS may be derived through evaporation. Tordilla Creek receives its baseflow from groundwater flow, which indicates surface water quality is presently not affected by the Falls City tailings site.

3.3.2 Groundwater

Groundwater conditions and groundwater quality impacts resulting from the processing and disposal of uranium at the Falls City site are summarized in this section. A more detailed discussion is provided in Section 3.0 of the EADR for the Falls City site (DOE, 1991a).

As part of the compliance with the proposed EPA groundwater protection standards for remedial actions at inactive uranium processing sites (40 CFR 192), the DOE has characterized the hydrogeology, water quality, and water resources at the Falls City site. Since the draft EA was released for review by the State of Texas and other cooperating agencies (DOE 1987), the DOE has conducted further hydrogeologic characterization of the site, based in part on extensive comments by the NRC and others. Some important changes to the understanding of the groundwater systems at the site have resulted. Major points are summarized below.

A low-yield aquifer system occurs within the upper 100 to 200 feet of Whitsett Formation sediments underlying the site. This formation contains alternating sequences of fine sands and sandstone, silty to clayey sands, sandy clays, and clays that crop out beneath the site and dip gently southeastward. Two low-yield aquifers have been identified within the Whitsett Formation aquifer system as the uppermost aquifer: the Deweesville/Conquista and Dilworth aquifers. They are underlain by the carbonaceous clays and lignite seams of the Manning Clay Formation, a 300-foot-thick aquitard. While there is no firm evidence of hydraulic connection between the two aquifers, both aquifers have been defined as the "uppermost aquifer" by the DOE due to the potential for interconnection related to the old exploration boreholes in the site area that cannot be absolutely disproved.

The more transmissive sands within the Whitsett Formation aquifer system (the Deweesville Sandstone Member and a fossiliferous sandstone bed within the Conquista Clay Member make up the Deweesville/Conquista aquifer and the Dilworth Sandstone Member in the Dilworth aquifer) show no apparent hydraulic connection during pumping tests. This hydraulic connection may be the result of downward leakage through clay interbeds, and vertical seepage along abandoned exploration boreholes in the vicinity of the mill site.

Saturated hydraulic conductivities of the most permeable beds of the Whitsett Formation aquifer system, as determined by pumping tests and single Packer pressure testing, range from approximately 0.5 to 1.2 feet per day (1.7×10^{-4} to 4.2×10^{-4} centimeters per second). The average linear groundwater velocity is 28 feet per year. The sandy members contain a high percent- age of silts and clays, and yield relatively small quantities (one to two gallons per minute) to pumped wells.

Because the tailings site is bisected by a local drainage divide, groundwater flow within the Whitsett Formation aquifer system is primarily northeastward and southwestward parallel to intermittent drainages. However, with increasing depth, groundwater becomes confined and flow becomes downdip (southeastward).

Because the tailings site overlies a feature that acts both as a topographic and shallow groundwater divide, there is no upgradient, uncontaminated body of groundwater that can be considered to be representative of background water quality for the Deweesville/Conquista aquifer. Background water quality was defined by selecting monitor wells that are crossgradient, downgradient, or sufficiently far from the site and, therefore, are not potentially affected by tailings seepage from the site. The selection of the background monitor wells also considered the effects of other uranium mines on water quality and the presence of uranium mineralization.

Background groundwater quality within the Whitsett Formation aquifer system is highly variable with depth and location. However, it can be classified as "limited use" groundwater based on high average cadmium, molybdenum, selenium, and uranium concentrations that render the water untreatable by methods reasonably employed by public water systems in the region. Elevated concentrations of arsenic, cadmium, molybdenum, radium, selenium, and uranium, as shown in Table 3.2, represent widespread ambient contamination associated with oxidized ore deposits and open pit mines in the vicinity of the site.

Hazardous constituents in groundwater were also identified that are likely to be derived from the residual radioactive materials at the tailings site (Table 3.3). Tailings fluids with low pH and high TDS exist within the interfingered sands and slimes of the tailings piles. These fluids are perched within the tailings and partially recharge the underlying Whitsett Formation aquifer system and have caused elevated concentrations of hazardous constituents in groundwater. These hazardous constituents within the tailings pore fluids at Falls City are mostly metal and metalloid elements associated with the uranium milling process. Some organic hazardous constituents were also detected in tailings pore fluids.

Concentrations of arsenic, cadmium, chromium, molybdenum, nitrate, selenium, uranium, and activities of net gross-alpha, radium-226 and -228 exceeded the MCLs established by the EPA in at

Table 3.2 Background groundwater quality summary, Falls City, Texas, site[a]

Aquifer zone and number of background wells	Deweesville/Conquista		Lower Conquista		Dilworth Sandstone		Manning Clay	
	8		1		6		3	
Constituent	Range of $\bar{X}$ (mg/l)	Average of $\bar{X}$ (mg/l)	Range of $\bar{X}$ (mg/l)[b]	Average of $\bar{X}$ (mg/l)	Range of $\bar{X}$ (mg/l)	Average of $\bar{X}$ (mg/l)	Range of $\bar{X}$ (mg/l)	Average of $\bar{X}$ (mg/l)
<u>Major ions</u>								
Calcium	485-1016	688	N/A	261	81-498	256	69-375	176
Chloride	360-2014	1138	177-850	337	49-861	542	195-1125	531
Iron	0.07-18.1	4.54	N/A	0.10	0.03-0.813	0.266	0.005-0.01	0.007
Magnesium	62-152	102	N/A	44.7	8.7-54.7	31.8	2.6-36.0	14.76
Manganese	0.12-6.81	2.53	N/A	1.53	0.008-3.23	0.711	0.205-0.253	0.371
pH	4.24-7.15	6.44	6.5-7.4	7.11	6.17-6.89	6.56	7.32-7.71	7.56
Potassium	57-105	78	N/A	57.3	19.5-44.0	32.9	27.9-45.6	37.6
Sodium	674-1040	815	N/A	679	100-551	381	341-584	473
Sulfate	562-2775	1710	45-466	366	197-1365	628	400-620	536
TDS	2539-6323	4505	1341-2819	2196	700-3635	2216	1280-2860	1933
<u>EPA MCLs inorganics</u>								
Arsenic	0.006-0.017	0.011	<0.01-0.01	0.006	0.005-0.365	0.071[c]	0.010-0.013	0.013
Barium	0.030-0.068	0.046	N/A	<0.1	0.03-0.055	0.049	0.035-0.06	0.053
Cadmium	0.005-0.022	0.011[c]	N/A	0.010	0.0005-0.003	0.001	0.002-0.005	0.003
Chromium	0.007-0.02	0.012	N/A	<0.01	0.004-0.013	0.009	0.005-0.006	0.005
Lead	0.015-0.027	0.022	N/A	0.02	0.005-0.012	0.007	0.005-0.085	0.032
Mercury	<0.0002	<0.0002	N/A	0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	0.01-0.798	0.172[c]	<0.01-0.12	0.063	0.013-0.089	0.052	0.018-0.093	0.062
Nitrate	0.5-22.3	6.46	N/A	8.2	0.5-7.3	2.77	1.22-19.2	7.65
Selenium	0.002-0.022	0.018[c]	<0.001-<0.005	0.003	0.003-0.012	0.010	0.003-0.007	0.006
Silver	0.005-0.013	0.009	N/A	<0.01	0.005-0.015	0.008	0.005-0.01	0.007
Ra-226 and -228 (pCi/l)	1.1-5.8	3.59	N/A	3.7	1.4-6.4	3.41	0.65-3.15	1.49
U-234 and -238 (mg/l)	0.01-0.112	0.058[c]	0.025-0.25	0.172[c]	0.018-2.46	0.438[c]	0.003-0.509	0.194[c]
Gross alpha[d] (pCi/l)	10-111	48	N/A	34	0-1192	211[c]	11-441	173
<u>Other Appendix IX constituents</u>								
Antimony	0.008-0.016	0.011	N/A	0.008	0.0015-0.008	0.004	0.004-0.005	0.0044
Beryllium	0.004-0.063	0.018	N/A	<0.01	0.004-0.007	0.0043	0.004-0.006	0.005
Cobalt	0.015-0.036	0.027	N/A	<0.05	0.02-0.04	0.028	0.02	0.027
Copper	0.016-0.030	0.023	N/A	<0.02	0.008-0.054	0.023	0.008-0.055	0.038
Cyanide	0.008-0.053	0.017	N/A	<0.01	0.005-0.013	0.009	0.005-0.01	0.008
Nickel	0.015-0.145	0.051	N/A	<0.01	0.02	0.023	<0.004	0.027
Sulfide	0.05-1.47	0.333	N/A	2.1	0.05	0.058	0.05-0.0925	0.358
Thallium	0.005-0.028	0.029	N/A	<0.01	0.028	0.029	0.005-0.028	0.038
Tin	0.010-0.190	0.067	N/A	<0.005	0.0025-0.011	0.008	0.004-0.029	0.014
Vanadium	0.033-0.111	0.081	N/A	0.03	0.018-0.17	0.067	0.08-0.105	0.068
Zinc	0.007-0.413	0.109	N/A	0.013	0.003-0.294	0.093	0.004-0.043	0.0192

[a]See EA Table 2.2 for EPA groundwater standards (MCLs) for UMTRA Project sites; see EADR Table 3.12 for background groundwater quality statistics for individual wells; see EADR Table 3.11 for completion information of background monitor wells.
[b]N/A = not analyzed.
[c]Mean values exceed MCLs.
[d]Gross alpha value includes uranium.

Table 3.3 Hazardous constituents summary, Falls City, Texas, site[a]

	Concentrations[b,c] Median	Mean	MCL[d]	or	Laboratory method detection limits
EPA inorganics with MCLs					
Arsenic	0.80	--	0.05		0.01
Barium	0.03	0.032	1.00		0.1
Cadmium	0.151	0.191	0.01		0.001
Chromium	0.04	--	0.05		0.01
Lead	N.D.[f]	--	0.05		0.01
Mercury	--	--	0.002		0.0002
Molybdenum	0.30	0.323	0.1		0.01
Nitrate (as N)	0.75	--	10		1.0
(as NO_3-)			44		
Selenium	0.06	--	0.01		0.005
Silver	N.D.	--	0.05		0.01
Radium-226/-228 (pCi/l)	252.0	153.3	5		1.0
Uranium-232/-238	5.34	3.89	0.044		0.003
Net Gross Alpha (pCi/l)	-1.19	--	15		1.0
EPA inorganics without MCLs[e]					
Antimony	N.D.	--	--		0.003
Beryllium	0.139	0.1228	--		0.005
Cobalt	0.60	0.66	--		0.05
Copper	0.08	--	--		0.02
Cyanide	0.02	--	--		0.01
Nickel	0.80	0.817	-		0.04
Sulfide	N.D.	--	--		0.1
Thallium	0.10	--	--		0.01
Tin	N.D.	--	--		0.005
Vanadium	1.00	1.29	--		0.01
Zinc	3.45	3.79	--		0.005

[a]Shows median/mean concentrations of tailings pore fluids compared to MCLs, or to laboratory method detection limits for constituents without MCLs.
[b]In mg/l, unless noted; pCi/l = picocuries per liter; observed concentrations in μg/l.
[c]Concentrations listed as median, mean, or both depending on statistical distribution.
[d]Maximum concentration limits; 40 CFR 192.02(2)(3)(iii).
[e]40 CFR 264, Appendix IX (7/1/90 edition) and 40 CFR 192, Appendix I (5/2/91 edition); constituents without MCLs.
[f]N.D. = not detected.

least one tailings pore water sample. Barium and mercury exceeded detectable concentrations in tailings pore water. Beryllium, cobalt, copper, cyanide, nickel, thallium, vanadium, and zinc are inorganic hazardous constituents without MCLs that were present in tailings pore fluids at detectable concentrations. No organic hazardous constituents with EPA MCLs were detected at levels above the MCL. However, concentrations of benzene 1,1,1-Trichlorethane were found to be detectable concentrations in one piezometer in the tailings. Bromoform, chloroform, dibromochloromethane, ethylbenzene, 2-Methylnaphthalene, naphthalene, toluene, and xylene are organic hazardous constituents without MCLs, but they were found to be present in tailings pore fluid at concentrations higher than the detectable concentration limits. Organic hazardous constituents were generally not detected in off-pile groundwater samples.

The extent of groundwater contamination from tailings seepage is difficult to define due to the high variability of background groundwater quality. However, high levels of molybdenum can be traced to the solution mining activity; the uranium levels have been contributed from the milling activities, and seem to be superimposed over the natural uranium mineralization in the area. The remaining hazardous constituents can be attributed to redistribution of natural mineralization. Generally, groundwater contamination from uranium processing is limited to the Deweesville/Conquista members of the Whitsett Formation.

Limited water quality impacts may occur in the underlying Dilworth aquifer. These localized areas of somewhat elevated uranium and associated constituent concentration levels are randomly distributed, difficult to distinguish absolutely from naturally occurring uranium mineralization, and may be related to some uranium exploration boreholes that have penetrated the Conquista aquitard. Although there is also some natural uranium mineralization in the Dilworth aquifer, reducing conditions in the overlying Conquista Clay member and in the Dilworth prevent contamination of the Dilworth aquifer.

Groundwater contamination in the Whitsett Formation aquifer system does not constitute a threat to human health or the environment. Because the groundwater is recognized as being of poor quality, there is little current use of the Dilworth and deeper aquifers for stock watering in the vicinity of the site. The Deweesville/Conquista aquifer is not being used for any purpose and has not been used in the past. There is also negligible projected future groundwater use of the Whitsett Formation aquifer system because deeper aquifers in the site vicinity supply good quality groundwater to area residents.

3.4 RADIATION

Existing radiation levels and concentrations of radioactive elements at the Falls City site, along with the naturally occurring levels and concentrations, are discussed below. A detailed discussion of radiation and health effects is presented in Section 5.0, Radiation, of the EADR (DOE, 1991a).

The radiation levels and concentrations of radioactive elements at and near the Falls City site, along with background values, are summarized in Table 3.4. The radiation levels and concentrations at the Falls City site are elevated above background values and above the EPA standards for surface radium-226 (Ra-226) concentrations due to the naturally elevated concentrations of radioactive elements in the native soils and the presence of tailings and other radioactive wastes from the milling operation. Some areas within the Falls City site were mined for uranium; however, the mining operation did not remove all of the uranium, with the result that soil enriched with uranium was left unexcavated in, under, and near the site. Tailings and other wastes (the residue from the uranium refining or milling operation) contain radioactive elements that were in the ore, with the exception of uranium, most of which was extracted.

Piles 3, 4, and 5 were open pit mines that were backfilled with tailings; therefore, the underlying material contains elevated levels of naturally occurring uranium. Piles 1 and 2 consist of tailings placed on grade (not in open pit mines); the underlying soil, however, contains elevated levels of naturally occurring uranium. The tailings forming pile 7 were placed on grade over soil with a normal concentration of radioactive elements. Pond 6 was an open pit mine that was allowed to pond. Approximately three hundred acres of land are contaminated by windblown tailings in Parcel A, and 80 acres are contaminated around pile 3 (Parcel B) to an average depth of one foot.

3.5 FLORA AND FAUNA

The existing flora and fauna at the Falls City site are summarized below; a more detailed account appears in Section 4.0 of the EADR (DOE, 1991a).

The Falls City site is within the Mesquite-Granjeno woods plant community on the South Texas Plains (McMahan et al., 1984). The South Texas Plains is a vegetational area encompassing approximately 20 million acres between San Antonio, the Gulf of Mexico, and the Rio Grande River. Suppression of fire during the last 100 years in this region has led to a reduction in grassland habitat and to an increase in dense brush habitat (Johnston, 1963).

Five plant community types were observed at and adjacent to the Falls City site, including grasslands, cleared pasture land, mesquite-shrubland, disturbed lands (rights-of-way, cleared strips of land, fence rows, and abandoned fields), and wetlands (TAC, 1990b; 1987). The first type is dominated by grasses, and occurs on and immediately adjacent to the piles. Plant species frequently observed on most of the piles were common sunflower and nettle. Giant pokeweed was common in some areas, especially on pile 5. Woody species were widely scattered; Roosevelt weed

Table 3.4 Radiation levels and contamination - Falls City, Texas, site

Description		Range[a]	Average	Source
Gamma exposure rate				
Background[b]		10.1-12.7 microR/hr	11.7 microR/hr	BFEC, 1986
Uranium-bearing soils		12.6-59 microR/hr	NA	BFEC, 1986
Mill yard		15-166 microR/hr	61 microR/hr	ORNL, 1980
Above tailings piles		9-500 microR/hr	NA	FBDU, 1981
		8-499 microR/hr	71 microR/hr	ORNL, 1980
Radon-222 in air				
Background concentration		0.41-0.94 pCi/l	0.6 pCi/l	BFEC, 1986
		0.9-1.9 pCi/l	1 pCi/l	FBDU, 1981
		0.4-1.8 pCi/l	0.8 pCi/l	TAC, 1990a
On-site (off-pile) concentration		0.7-2.4 pCi/l	1.6 pCi/l	BFEC, 1986
		0.4-4.0 pCi/l	1.4 pCi/l	TAC, 1990a
Flux above piles		3-78 pCi/m^2s	12 pCi/m^2s[c]	FBDU, 1981
Soil radioactivity				
Background[c]	Ra-226	1.5-3.7 pCi/g	2.4 pCi/g	BFEC, 1986
		0.54-1.4 pCi/g	0.93 pCi/g	ORNL, 1980
	Th-232	0.22-1.4 pCi/g	0.77 pCi/g	BFEC, 1986
		0.40-1.1 pCi/g	0.77 pCi/g	ORNL, 1980
	U-238	1.3-3.0 pCi/g	2 pCi/g	BFEC, 1986
		0.56-1.5 pCi/g	0.87 pCi/g	ORNL, 1980
Uranium-bearing soils	Ra-226	4.6-275.3 pCi/g	NA	BFEC, 1986
	Th-232	0.22-3.4 pCi/g	NA	BFEC, 1986
	U-238	3.3-26.4 pCi/g	NA	BFEC, 1986
On-site (off-pile)	Ra-226	1.4-56 pCi/g	8.6 pCi/g	ORNL, 1980
	Th-232	0.7-6.5 pCi/g	1.5 pCi/g	ORNL, 1980

Table 3.4 Radiation levels and contamination - Falls City, Texas, site (Concluded)

Description	Range	Average	Source
Average Ra-226 concentrations for tailings piles	89-343 pCi/g[d]	190 pCi/g[e]	f

[a]microR/hr = microroentgen per hour; pCi/l = picocuries per liter; pCi/m^2s = picocuries per square meter per second; pCi/g = picocuries per gram; NA = not available; Ra-226 = radium-226; Th-232 = thorium-232; U-238 = uranium-238.

[b]Non-uranium-bearing soils.

[c]This is not a weighted average and does not account for variations in pile areas.

[d]Range of individual pile average concentrations.

[e]This is a volume-weighted average.

[f]This value generated by the TAC using data from BFEC, 1986.

was the most common. Occasional mesquite, blackbrush, and live oak were observed. There were large areas devoid of vegetation on the tailings piles in 1986; by 1990, the piles were essentially 100 percent vegetated (TAC, 1990b; 1986).

The second plant community type is cleared pasture dominated by grass and herbs with scattered, large, live oak. This pasture occurs adjacent to pile 3.

The third plant community type is the mesquite-shrub woodlands. This type occurs around the tailings piles and at the proposed borrow sites. Mesquite is the principal tree species and the understory consists of various shrubs and a ground cover of grasses and herbs.

The fourth plant community type is dominated by plant species that re-invade mechanically disturbed sites and occurs along cleared strips of land called "senderos," and along fence rows. Plant species in these areas vary with the age of the disturbance; the species observed are similar to the species recorded in the mesquite woods.

The fifth plant community type consists of small wetland areas associated with small permanent ponds near the piles and an ephemeral pond on tailings pile 1. Wetland species such as black willow, sedges, spike rush, and cattail were noted in these areas.

Approximately 35 species of reptiles and amphibians were observed or are expected to occur within the tailings site area (TAC, 1990b; 1987; 1986; Werler, 1978; Tennant, 1984; DOE, 1983; Conant, 1975; Raun and Gehlbach, 1972). The 10 species observed during limited field surveys were the bullfrog and leopard frog in the wetland habitat and the ornate box turtle, three-toed box turtle, Texas spotted whiptail, racerunner lizard, common ratsnake, rough green snake, western ribbon snake, and western diamondback rattlesnake in the field and mesquite-shrub woodlands. Unconfirmed reports indicate that the Texas tortoise may occur within the tailings site area (see Threatened and endangered species, below).

A total of 77 bird species were observed during limited field surveys at the Falls City site (TAC, 1990b; 1987; 1986; DOE, 1983). The species recorded represent common nesting species and some migratory species. Additional migratory, wintering, and nesting species would be expected to occur in the area. The meadowlark was the most common nesting species observed in the grassland habitat, while common species noted in the mesquite-shrub habitat were the mockingbird, cardinal, bobwhite quail, Bewick's wren, and mourning dove. Herons such as the green-backed and little blue and waterfowl such as the blue-winged teal and black-billed whistling duck were observed in the wetland habitat. Game species observed include the bobwhite quail, wild turkey, and mourning dove. Birds of prey observed on the site include the red-tailed hawk, kestrel, northern harrier, and great horned owl.

A total of 27 species of mammals have been observed or may be expected to occur on the site (TAC, 1987; DOE, 1983; Davis, 1974). The cottontail rabbit was the most frequently observed species while white-tailed deer sign (tracks and droppings) were frequently observed. The coyote was the only large predator observed. The major mammalian game species observed on the site were the white-tailed deer and cottontail rabbit.

Threatened and endangered species

The U.S. Fish and Wildlife Service (FWS) did not identify any Federally listed threatened and endangered species as being present at the Falls City site during a consultation process, as stated in Attachment 2, Biological Documentation (Grahl, 1990; Perez, 1985). Information from the state of Texas indicates that 19 state-listed threatened and endangered species may occur or are confirmed to occur in the county in which the site is located (Karnes) or two nearby counties (Atascosa and Wilson) (Sullivan, 1990; Potter, 1985). However, extensive field surveys determined that none of the species occur on the site.

The ocelot was the one endangered mammal listed for these counties. An occasional ocelot may pass through or near the site; however, it would not be expected to reside in the area due to a lack of appropriate habitat (Twedt and Rappole, 1985; Tewes and Everett, 1982).

The Rio Grande siren is the only state-listed endangered amphibian that may occur near the site. This species was judged not to occur at the site due to the lack of observations in the three counties surrounding the site, and because the site is on the northernmost edge of the siren's range (Raun and Gehlbach, 1972). No state endangered fish and reptiles or threatened mammals are known to occur at the site. Four bird species on the state endangered list (bald eagle, whooping crane, interior least tern, and black-eyed vireo) migrate through the area and may occasionally stop over at or near the site, but do not nest at or near the site (Mabie, 1985; USFWS, 1985; 1984).

Seven threatened bird species (white-tailed hawk, zone-tailed hawk, arctic peregrine falcon, white-faced ibis, swallow-tailed kite, wood stork, and golden-cheeked warbler) may occur or have been confirmed near the site. These species do not nest near the Falls City site; however, they may occasionally be observed near the site during migration (TAC, 1990b; 1987; 1986; Hoffman, 1986; Armbruster, 1983; Millsap, 1981; Call, 1978; Pulich, 1976; Oberholser, 1974).

Five species of threatened reptiles have been reported from the three-county area surrounding the site. Three species of reptiles (Texas tortoise, Texas horned lizard, and Texas indigo snake) have the potential of occurring at or near the site based on their distribution and habitat requirements (Tennant, 1984; Rose and Judd, 1982; Raun and Gehlbach, 1972; Strecker and Johnson, 1935). However, intensive surveys for the Texas tortoise in May 1987 and June 1990 failed to result in the observation of this species or the horned lizard and indigo snake at or near the site (TAC, 1990b; 1987). The remaining two species of reptiles (reticulate collared lizard and timber rattlesnake), along with the sheep frog, were judged not to occur at the site due to the lack of appropriate habitat and/or lack of recent observations in the three-county area surrounding the site (Judd, 1985; Werler, 1978; Raun and Gehlbach, 1972; Montanucci, 1971).

3.6 LAND USE

Most of the land in Karnes County is under private ownership. Historically, land use in the area has consisted of dry land grain farming, with lesser amounts of swine production. In addition, cattle are raised and provide most of the agricultural cash receipts in Karnes County. Compared to farms in other areas of Texas and the United States, those in Karnes County would be considered small, averaging 300 acres in size. Although population density is low in the Falls City area, there are several residences on small farms within one mile of the disposal site. Karnes County does not have a land use plan or any land use restrictions applicable to the Falls City site.

More recently, the exploration and mining of uranium, oil, and gas have resulted in modified land use patterns in the Falls City area. In general, this area is comprised of small farms, densely wooded areas, and areas with uranium mill tailings or other mine spoils. The Falls City site was previously a part of a larger dairy farm. Cattle grazing is presently occurring within small portions of Parcels A and B.

All proposed borrow sites are on private property. The Tordilla Hill borrow site, which would be used for sand and gravel, and the Knippa borrow site, which would be used for rock, are existing quarry operations. The Tordilla Hill quarry, however, has been largely inactive since the mid-1980's. The proposed source for topsoil and fill, the La Mesa site, is adjacent to the western sides of piles 1, 4, and 5. This area is covered with dense mesquite and used for limited cattle grazing and by wildlife.

3.7 AMBIENT NOISE

The processing and borrow sites are in a rural area consisting predominantly of small farms. Noise studies have not been conducted at the sites; however, there are no sources for high noise levels in the immediate area. Considering the undeveloped nature of the land and low population density, the day-night sound levels (L_{dn}) in the area are probably in the 35- to 50-decibel range on the A-weighted sound measurement scale (dBA), which most closely approximates that of the human ear (NAS, 1977).

3.8 HISTORICAL AND CULTURAL RESOURCES

Historical resources

Settlers came to Karnes County relatively recently in comparison to the rest of the state. The major towns in the area date to the late 19th century, although the first Mexican land grant was awarded in the mid-18th century. The early county government was in Helena five miles northeast of Karnes City. Karnes County is known as the only county in Texas where the dominant immigrant nationality was Polish.

The Panna Maria Historic District is the only site in the county on the National Register of Historic Places (NRHP). This small community, less than 10 miles east of Falls City, consists mostly of 19th-century stone cottages similar to those of the builders' native Poland, and has the distinction of being the oldest Polish community in the country (MESA, 1982).

Cultural resources

Evidence of human activity indicates that the habitation of the area first took place 12,000 years ago, with the beginning of the Paleo-Indian Period. This period was succeeded by the Archaic Period 8000 years ago. The majority of cultural resources found in the region are from the Archaic Period. The Archaic Period was followed by the Neo-American, which began 1250 years ago and continued until the 1600s with the beginning of the Historic Period.

A cultural resources record search conducted by the Texas State Historic Preservation Officer (SHPO) found 10 prehistoric sites within a five-mile radius of the tailings site. These include one Paleo-Indian site, six lithic sites (including a Paleo-Indian quarry), and three lithic scatter sites (MESA, 1982).

No cultural resource surveys have been required at the tailings or at the Knippa and Tordilla Hill borrow sites, which are in very disturbed areas of agriculture, mining, milling, and prospecting. These locations are not expected to yield cultural resources. A cultural resource survey of the La Mesa borrow site has identified one prehistoric site that would require additional data collection to determine its eligibility for listing on the National Register of Historic Places (Ecker, 1991).

3.9 SOCIOECONOMIC CHARACTERISTICS

The main service center for the Falls City area is San Antonio, Texas (1980 population of 994,292), a one-hour drive to the northwest. Other nearby large cities include Beeville, 50 miles to the southeast (1988 estimated population of 6297), and Corpus Christi, 120 miles to the southeast of Falls City (1988 estimated population of 256,530) (West, 1990).

The population in Karnes County has generally continued to decrease since the 1980 census count of 23,316 residents (Pecotte, 1986). The most recent estimate of 12,621 residents was made in 1988 (West, 1990).

Although the area is characterized by very small towns, the population within a 48-mile radius of the site is estimated at 1.4 million persons. This is primarily a reflection of nearby San Antonio.

The 1988 population of Falls City was estimated at 563 residents, as compared to the 1980 recorded census count of 580 (West, 1990). Population change in the Falls City area is somewhat related to the availability of employment. Prior to the uranium mining in the 1960s and 1970s, many people left the area in search of better employment opportunities. When area uranium mills went into operation between 1962 and 1982, area employment (and population) tended to stabilize. When uranium milling activities ceased in the early 1980s, people again began to leave the area. Today it is felt that people are moving back to Falls City in appreciation of the values inherent to small town life and are commuting to jobs in other cities such as San Antonio (Thomas, 1986).

Historically, farming was a major part of the economy and employment in Karnes County. Today, however, farming must be supplemented by a second income. Mineral extraction was also a significant employment and economic base in Karnes County as well as adjacent areas. Since the decline of the uranium market in the early 1980s and the more recent drop in oil and gas exploration and drilling activities, employment in the mining industry has decreased.

Unemployment levels in Karnes County have changed from an annual average of four percent in 1980, to a peak of 9.6 percent in 1987, and dropped to 6.3 percent in 1989. Unemployment during the past decade in Karnes County, as well as overall throughout the state of Texas, peaked in 1987. It has since continued to decline (Butterfield, 1990; Dornwell, 1986).

Falls City has one school, which is a combination grade school and high school. Enrollment for 1990 is estimated at 300 students. The projected capacity is 400 students. Although small, the school district has received excellent academic ratings and, based on a testing program, was recently ranked fifth in the over 1100 school districts in Texas (Bronder, 1990; Thomas, 1986).

Medical care is not available in Falls City. Emergency treatment is provided at area hospitals and coordinated through the sheriff's department. Three hospitals are within an approximate 15-mile radius of Falls City. Both outpatient and emergency treatment are available at each hospital (Gottharzt, 1986; Lansord, 1986; Moczygemba, 1986). Medical care is also available in San Antonio.

Potable water in Falls City is supplied by a free-flowing artesian well in the Carrizo Sandstone aquifer at a depth of 3650 feet, well below the shallow aquifer contaminated by the Falls City tailings. City water is managed by the Falls City Water and Sewer Works. Average daily and peak uses in 1985 were approximately 100,900 gallons and 252,200 gallons, respectively. The projected capacity is 500,000 gallons per day (Gaddis, 1986). Few residents living outside of the city limits have their own wells. Most residents in the tailings site area are on the Three Oaks Water System. This is a cooperative membership water supply system that also pumps water from the Carrizo Sandstone aquifer (Pivonka, 1986). Average monthly use is five million gallons (Hosek, 1990).

Fire protection in Falls City is through a volunteer fire department in Falls City; there are approximately 12 volunteers. Karnes County has four cities that have volunteer fire departments (Dziuk, 1986).

3.10 TRANSPORTATION

San Antonio and Corpus Christi, Texas, are the major service centers for Falls City. United States Highway 181 (US-181) originates in San Antonio and passes through Falls City en route to the Corpus Christi area. Northwest of Falls City, US-181 is a four-lane, paved highway rated at level of service A; south of Falls City, it becomes two lanes and is also rated at level of service A (Mims, 1986). The level of service ratings refer to the amount of congestion occurring on the highway. Level of service A means that there is currently no congestion occurring. The 24-hour average daily traffic (ADT) count in 1989 was 4100 vehicles of all types counted at a highway point just north of Falls City, and 3900 vehicles of all types just south of Falls City (Muzny, 1990).

Texas FM-791 would be the primary access for workers from Falls City and other towns on US-181 to the Falls City site and for haulage trucks from the Tordilla Hill borrow site to the Falls City site. This two-lane, paved highway had an ADT count of 180 vehicles just southwest of the intersection of FM-1344 and FM-791 in 1989. Average daily traffic on FM-1344 just northwest of the intersection with FM-791 was 60 vehicles in 1989 (Muzny, 1990). Both FM-1344 and FM-791 are operating at level of service A (Mims, 1986).

Rock materials from the Knippa rock quarry in Uvalde County may be transported to US-90 west of San Antonio, Texas, to the disposal site. The ADT in 1989 on US-90 near the quarry was 5300 vehicles; the majority of the existing traffic is commercial truck traffic (Muzny, 1990).

The Southern Pacific railroad carries only freight between San Antonio, Texas, and Falls City, Texas. However, a Southern Pacific main line carries both passengers and freight west of San Antonio through Knippa, Texas. There are only freight stops in Knippa, Texas (Reaby, 1990).

4.0 ENVIRONMENTAL IMPACTS

4.1 INTRODUCTION AND THE NO ACTION ALTERNATIVE

The cumulative environmental impacts presented in this section are based on conservative assumptions and impact assessment procedures and thereby represent a realistic upper limit on the severity of the impacts that may occur. The actual impacts that would occur would likely be less severe than those identified here. All impact assessments are based upon the following assumptions: the remedial action would take approximately 36 months to complete, of which 24 months would involve excavation of contaminated material and placement of radon barrier materials; the construction schedule does not include a winter shutdown; the radon cover will be 24 inches thick; and the erosion barriers will vary from six inches thick (topslope) to 12 inches thick (sideslopes).

The borrow sites included in this EA were selected as the sources of the necessary borrow materials for the conceptual design and impacts analysis purposes. Preliminarily, the materials at these sites meet the UMTRA Project physical design criteria requirements. The borrow sites that will actually be used for the remedial action will be selected during the final design phase, and it is conceivable that other sites may be used. The impacts identified for the borrow sites included in this EA are conservative and represent a realistic upper limit on the severity of the impacts that may occur.

The no action alternative would not involve any remedial action and obviously would not affect most of the environmental resources described in Section 3.0, such as noise and historical and cultural resources. Dispersion of the tailings by wind and water erosion would continue to contaminate lands adjacent to the piles. Other environmental resources (e.g., air quality) would be affected only slightly by no action. Therefore, this section does not include detailed analyses of the impacts of no action on the resources that would remain unaffected. No action would, however, have impacts on public health and groundwater resources, and these impacts are discussed in detail in Sections 4.2 and 4.5.2, of the EA, and Section 3.0, Groundwater, and 5.0, Radiation, of the EADR (DOE, 1991a).

This alternative would result in the continued dispersion of the tailings by wind and water erosion and the possibility that livestock and wildlife could ingest contaminated vegetation. Seepage of tailings fluids to the shallow Deweesville/Conquista aquifer would continue indefinitely. Finally, selection of the no action alternative would not be consistent with the intent of Congress in the UMTRCA and would not result in compliance with the EPA standards. Continued erosion and possible use of the tailings could cause radiological contamination of other areas and could result in greater public health impacts than those calculated for this alternative.

4.2 RADIATION

The following sections discuss radiation exposure pathways and the excess health effects (i.e., excess cancer death risk) that would result during and after the remedial action to remedial action workers and to the general public. The procedures used to estimate excess cancer death risk are based on realistic but conservative assumptions. Section 5.0, Radiation, of the EADR (DOE, 1991a) contains detailed discussions of radiation exposure pathways and risk calculations.

4.2.1 Exposure pathways

There are five principal radiological pathways by which individuals could be exposed to radiological contaminants from the Falls City site. These are inhalation of radon and radon decay products; direct exposure to gamma radiation; inhalation and ingestion of airborne radioactive particulates; ingestion of contaminated foods produced in areas contaminated by tailings; and ingestion of groundwater and surface water contaminated with radioactive materials. For the calculation of excess cancer death risk, only those pathways that would result in the largest radiological doses to the general public were considered in detail. These are inhalation of radon and radon decay products; inhalation and ingestion of airborne particulates; and direct exposure to gamma radiation.

Radon is an inert gas (i.e., it does not react chemically with other elements) produced from the radioactive decay of Ra-226 in the U-238 decay series. As a gas, radon can diffuse through the tailings and into the atmosphere where it is transported by atmospheric winds over a large area. In the atmosphere, radon decays into its solid decay products, which attach to airborne dust particles and may be inhaled by humans. These dust particles, with the radon decay products attached, may adhere to the lining of the lungs and decay, releasing alpha radiation directly to the lungs.

Gamma radiation is also emitted by many members of the U-238 decay series. Gamma radiation behaves independently of atmospheric conditions and travels in a straight line until it contacts matter. Gamma radiation emitted from the tailings delivers an external exposure to the whole body. In general, gamma radiation levels emitted from tailings become negligible beyond approximately 0.3 mile from the perimeter of a tailings pile due to the interaction of the gamma rays with matter suspended in the air and with air molecules. At the Falls City site, gamma radiation exposure rates reach the average background rate within a shorter distance, about 0.1 mile from a tailings pile, due to interaction with the pile covers.

4.2.2 Health effects

Exposure to radiation may cause somatic health effects, which are manifested in the exposed individual (i.e., cancer) and genetic health effects, which are manifested in the descendents of the exposed individual. The genetic risk is approximately two-thirds of the somatic risk for gamma radiation. Measures taken to reduce the somatic health effects would also reduce the genetic effects. Therefore, the following discussion will address only somatic health effects.

Calculations of the excess cancer death risk in Section 5.0 of the EADR (DOE, 1991a) are based primarily on data and risk coefficients presented in the BEIR-IV (NAS, 1988) and BEIR-V (NAS, 1990) reports. As reported in BEIR-IV, a risk coefficient of 350×10^{-6} excess fatal lung cancer per person-WLM was used for exposure to radon decay products. The BEIR-V report was evaluated by the DOE (DOE, 1990) and a risk coefficient of 400×10^{-6} excess cancer death per person-rem was recommended for effective whole body exposure to gamma radiation and committed effective dose equivalent from inhalation or ingestion of radionuclide air particulates. As recommended by the DOE, this risk coefficient of 400×10^{-6} was used for gamma radiation and radionuclide air particulate exposure pathways.

<u>During remedial action</u>

Table 4.1 lists the estimated excess cancer death risk for the general population and remedial action workers that would occur during the 24-month remedial action period of tailings relocation and radon barrier placement.

During remedial action, increases in gamma exposure rates and airborne radioactive particulate concentrations would be larger than the increases in radon concentrations compared to levels prior to remedial action. These increased exposure rates would be due to disturbance of the tailings. However, dust control measures would be applied during remedial action to keep airborne radioactive particulate concentrations at a nonhazardous level.

The elevated gamma exposure rates during disturbance of the tailings would increase the risk to the remedial action workers. The risk to remedial action workers from inhalation of airborne radioactive particulates would be less than the risk from exposure to radon decay products. The risk from gamma radiation exposure to remedial workers is about 12 times the risk from decay products. This is due partly to conservative assumptions for gamma radiation used in the risk calculations. The risk assessment for gamma exposure is the upper limit of possible values for this exposure.

The excess cancer death risk to the general public during remedial action is principally dependent on the amount of tailings and contaminated materials to be disturbed and the number of people who live nearby. The proposed action would result temporarily in a slightly higher risk to the general population than the no action alternative. The estimated excess cancer death risk is very small in comparison to the natural incidence of cancer.

Table 4.1 Summary of excess cancer death risk for the general population and remedial action workers during the proposed 2-year remedial action, Falls City, Texas, site

Exposed group by remedial action alternative	Radon decay products exposure	Gamma exposure	Airborne particulates	Total
General population				
Proposed action	0.045	0.00	0.024	0.069
No action[a]	0.043	0.00	0.013	0.056
Remedial action workers				
Proposed action	0.001	0.012	0.0005	0.014
No action	0.0000	0.0000	0.0000	0.000

[a]Excess cancer death risk for the no action alternative, for a time period equivalent to the 24-month active tailings disturbance portion of the proposed 36-month remedial action period.

After remedial action

There would be no exposure to direct gamma radiation after remedial action because the use of an earthen cover over the tailings would reduce gamma radiation to approximately background levels. This cover would also ensure that, after remedial action, radon releases would be no greater than allowed by the EPA standard.

An estimated yearly excess cancer death risk of 0.004 from radon decay products would affect the general public after the proposed action. Since the tailings would remain within 50 miles of the city of San Antonio, the risk is higher than would be expected for an area with a rural population. There would be no excess risk from gamma radiation.

Table 4.2 lists the estimated total excess cancer deaths that would occur 10, 100, and 1000 years after the remedial action. These estimates reflect a stable population; the total excess cancer deaths would increase if the nearby population increased.

Table 4.2 Estimated total excess cancer deaths 10, 100, and 1000 years after the proposed remedial action and for no action, Falls City, Texas, site

	Number of years following the remedial action		
	10	100	1000
After the proposed action	0.04	0.4	4
No action	0.28	2.8	28

No action

Based on the MILDOS computer model, the no action alternative would result in a 0.028 annual excess cancer death risk to the general public (see Section 5.5.2, Radiation, of the EADR), which is seven times greater than the annual excess cancer death risk of 0.004 projected for the general population after completion of the proposed action. This risk is primarily due to inhalation of radon decay products and radionuclide air particulates. The estimated annual risk for the no action alternative does not consider the dispersion of the tailings by natural erosion or by people because there is no way to predict the level or rate of dispersion accurately. However, without remedial action, dispersion would occur over time, and the actual total risk might be greater than shown in Table 4.2.

4.3 AIR QUALITY

No deterioration of air quality is anticipated during any phase of the remedial action. The air-quality impacts of the proposed action were estimated by developing a detailed emissions inventory and modeling resultant air pollutant concentrations. The estimates of project-related emissions and air-quality impacts are conservative. In addition, it is expected that mitigation measures (e.g., spraying with water or dust suppressants) would reduce fugitive dust emissions by 50 percent at the tailings site and by 85 percent along the haul roads (CDH, 1981).

The emissions inventory includes estimated combustion emissions from construction equipment and fugitive dust emissions from wind erosion and the movement of tailings and borrow materials. Combustion emissions include hydrocarbons (HC), nitrogen oxides (NO_x), sulfur oxides (SO_x), carbon monoxide (CO), and particulates. The combustion and fugitive dust emissions for construction equipment and the movement of materials were calculated using air pollutant emission factors for construction equipment and associated operations (EPA, 1985; CDH, 1981). These emissions calculations were based on parameters such as fuel consumption, vehicle-miles traveled, vehicle speed, and the volumes of materials moved. Fugitive dust emissions from wind erosion were calculated using an adaptation of the universal soil loss equation, which includes components for soil erodibility, local climate, the size of the exposed area, and the vegetative cover (CDH, 1981).

Estimated total air pollutant emissions during the proposed action indicate that NO_x and CO would be the most abundant gaseous air pollutants (Table 4.3). However, the total combustion emissions would be relatively low compared to fugitive dust.

Ambient air pollution concentrations were estimated using the Industrial Source Complex Short Term (ISCST) dispersion model (EPA, 1986). Emissions of gaseous air pollutants would be much lower than fugitive TSP emissions, and the resulting concentrations of gaseous air pollutants would be well below the applicable air-quality standards.

Modeling for the proposed action was performed for the activities at the disposal site (including the La Mesa borrow site), pile 3, the Tordilla Hill borrow site, and for truck haulage along the 0.9 mile dirt road leading from the Tordilla Hill borrow site to FM-791. The maximum

Table 4.3 Estimated total air pollutant emissions during the proposed remedial action, Falls City, Texas, site

Source area for pollutants	Fugitive dust emissions (tons)	Combustion emissions (tons)				
		HC	NO_x	SO_x	CO	TSP
Disposal site[a]	334.26	5.55	81.97	6.65	18.26	5.08
Pile 3[b]	136.92	2.17	24.48	1.73	5.66	1.63
Tordilla Hill borrow site	27.71	0.77	10.82	1.30	2.53	1.04
Tordilla Hill haul road	152.45	--[c]	--[c]	--[c]	--[c]	--[c]
Totals	651.34	8.49	117.27	9.68	26.45	7.75

[a]Includes La Mesa Borrow site.
[b]Includes pile 3 haul road emissions.
[c]Not applicable.

24-hour TSP concentrations at the disposal site, pile 3, and the Tordilla Hill borrow site would not exceed the applicable primary (260 microg/m^3) or secondary (150 microg/m^3) EPA standards. The estimated maximum 24-hour TSP concentration along the Tordilla Hill unpaved haul road could exceed the secondary standard (224 microg/m^3); however, this analysis of air quality impacts was based on very conservative assumptions that tend to overpredict impacts and would occur only during the two to three month haul period.

4.4 GEOLOGY

Seismicity

The maximum acceleration estimated to occur at the site is 0.03 to 0.05 gravity (g). Based on previously published probabilistic analyses of seismic risk, a design acceleration value of 0.05 to 0.10 is recommended for the Falls City site (Algermissen et al., 1982; Coffman et al., 1982).

Mineral resources

Stabilization of the tailings on the site would not necessarily preclude future development of any mineral or oil and gas resources that may be discovered beneath or adjacent to the site. However, 42 U.S.C. 4321 *et seq*. requires that the mineral rights be transferred to the Federal government along with the disposal site. 42 U.S.C. 4321 *et seq*. 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 actions as the Commission deems necessary pursuant to a 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, oil, or gas resources from beneath the site would be governed by license conditions to prevent any disturbance of the disposal cell. If the costs of avoiding disturbance of the pile were too high, resource recovery would be precluded.

At the Falls City site, the DOE and the NRC are in agreement in deciding not to acquire the mineral and oil and gas rights beneath the final disposal area because the surface owner controls the uppermost 200 feet and the known oil and gas deposits are at great depth (at least 5000 feet deep). Development of these resources would not disturb the cell.

The proposed action would result in the consumption of borrow materials such as earth, sand, gravel, and rock. The consumption of these materials from the proposed sources (La Mesa, Tordilla Hill, and Knippa borrow sites) would constitute a permanent loss of these resources and could affect the future availability and cost of the rock from this resource area because sources of rock materials are limited in south Texas. However, the use of the Tordilla Hill and Knippa quarries for the sand, gravel, and rock materials would constitute a positive impact to the owners. The temporary activities at the borrow sites would not permanently preclude any potential mining or oil and gas activities.

The estimated in-place volumes of uncontaminated borrow materials that would be required for the proposed action are 447,460 cy of topsoil and clean fill; 399,900 cy of earthen materials for the radon barrier; 100,830 cy of sand for the bedding layer; 78,840 cy of gravel and rock for the erosion protection layer; and 3000 cy of gravel for upgrading the haul road between pile 3 and the disposal site.

Soils

Stabilization on site would result in the temporary disturbance and permanent loss of soils. These impacts would result from surface disturbances caused by the excavation of borrow materials, contaminated tailings, and contaminated windblown soils, and upgrading of the access road to pile 3.

The proposed action would result in the permanent loss of 749 acres of soil. This represents all of the contaminated areas (all piles, the pond, and the mill site area), totaling 214 acres; windblown contamination (378 acres); and the La Mesa borrow site (157 acres). The windblown contamination would be removed to depths between 1.25 to 1.50 feet. Soil lost from the previously developed Tordilla Hill and Knippa quarries has not been included in this estimate.

Restoration of all disturbed areas within Parcel A and Parcel B and outside of the final restricted area would consist of using La Mesa borrow materials to bring these areas to the surrounding grade, recontouring to promote drainage, and seeding with endemic plant species. The La Mesa borrow site would be graded for positive drainage and reseeded. The Tordilla Hill and Knippa quarry sites would not be restored because they are existing quarries. The details regarding revegetation will be formulated by the DOE and the Remedial Action Contractor in consultation with the state of Texas and local landowners.

4.5 WATER

4.5.1 Surface water

Surface water bodies will receive little or no impact from the remedial action. Neither Tordilla nor Scared Dog creeks will be disturbed. The stock pond adjacent to pile 3 will be breached and the water allowed to drain. Contaminated material on the pond bottom will be excavated and placed in the disposal cell. The pond will then be restored to its original condition. The intermittent pond close to pile 2, which is located within the final restricted site area, will be filled and contoured to match the surrounding terrain.

From data gathered at U.S. Geological Survey (USGS) gaging stations on the San Antonio and Atascosa Rivers, the Falls City site is above the Probable Maximum Flood (PMF) levels of both rivers, and the potential for floodwater reaching the disposal cell is negligible (USGS, 1983; NOAA, 1982). Additional information is presented in Attachment 1.

To prevent the potential erosion of the disposal cell, several erosion control features were incorporated into the remedial action design. Positive drainage around the cell would direct surface runoff away from the cell. The soil and vegetative cover on the topslopes, the rock erosion protection barrier on the sideslopes, and the perimeter rock aprons would be designed to withstand the erosive forces of severe rainfall events such as the Probable Maximum Precipitation (PMP). Rock aprons would also armor the cell from the possible migration of the gully north of FM-1344.

The only source of off-cell runoff that could impact the disposal cell is from a small, unnamed hill to the west of pile 7. The area southwest of the cell will be recontoured to convey the runoff resulting from a PMP event away from the tailings.

During the remedial action, consolidation of the tailings and contaminated materials would result in surface disturbance. Contaminated runoff from the disturbed areas could flow northeast into the San Antonio River or southwest into the Atascosa River. To prevent possible contamination of these rivers during stabilization, temporary drainage controls, such as a retention basin and wastewater treatment facilities, would be constructed.

4.5.2 Groundwater

Long-term groundwater quality impacts resulting from the proposed action and no action alternatives are summarized in this section. Calculations, procedures, and results are described in greater detail in Section 3.0, Hydrology, of the EADR (DOE, 1991a).

Consolidation of all the tailings into one disposal cell would reduce the surface area of the tailings from 177 to 127 acres. By reducing the surface area of the tailings and adding a low-hydraulic conductivity radon barrier, the amount of seepage would decrease. Total seepage from the stabilized embankment would be less than one gallon per minute (gpm), compared to 90 gpm for the surface area of the existing piles.

Subpart A of the proposed EPA groundwater protection standards (40 CFR 192) requires the establishment of concentration limits for identified hazardous constituents. These limits can be established as either background water quality concentration limits, the EPA's maximum concentration limits (MCLs), or alternate concentration limits (ACLs). Subpart C provides another mechanism for complying with the proposed groundwater protection standards: the application of supplemental standards. Supplemental standards can be invoked in circumstances of technical impracticability, Class III groundwater, or in instances where compliance with

Subpart A or B standards would create excessive environmental harm that outweighs any health benefits to be derived. In establishing a supplemental standard, the proposed remedial action must come as close to meeting the otherwise applicable standards as is reasonable under the circumstances. It must also be protective of human health and the environment if the Class III groundwater or technical impracticability criteria are the grounds for the supplemental standard.

To achieve compliance with the proposed EPA groundwater protection standards (40 CFR 192), the DOE proposes a supplemental standard for the Falls City site to ensure sufficient protection of human health and the environment. This supplemental standard would apply to groundwater in the uppermost aquifer, as defined in 40 CFR 192, because it meets the Class III groundwater definition. The supplemental standard will be narrative and will not include numerical concentration limits for the hazardous constituents identified in the Falls City tailings. A summary of the principal features of the water resources protection strategy for the Falls City site is summarized below. Additional information is provided in Section 3.0 of the Falls City EADR (DOE, 1991a).

The DOE has determined that groundwater in the uppermost aquifer at the Falls City disposal site meets the definition of Class III (limited use) because it meets the EPA's proposed supplemental standard criterion (40 CFR 192.11 (e)) of widespread ambient contamination that cannot be cleaned up using methods reasonably employed by public water systems. Therefore, the DOE is proposing to apply a supplemental standard for groundwater in the Deweesville/Conquista and Dilworth aquifers at the Falls City site.

Background (natural) groundwater quality varies by orders of magnitude in the Falls City site area since the aquifer contains a major uranium ore body that has undergone redistribution or uranium mineralization. The quality of the background groundwater from the Deweesville/Conquista and Dilworth aquifers that has not been affected by mining and milling activities at the designated site does not compare favorably with water typically used for public water supply systems in Texas. To make water from these aquifers potable would require multiple primary and secondary treatment technologies, which are not "cleanup methods reasonably employed by public water systems" typically used in Texas. These treatment technologies are also extremely costly. The removal of radionuclides would result in the production of huge quantities of radiologically contaminated and mixed sludges (wastes), which would present additional regional disposal complications. In addition, the extremely low transmissivity of the Deweesville/Conquista and Dilworth aquifers would make obtaining usable quantities of water for treatment purposes technically difficult and expensive.

In addition to the "reasonable treatment" criterion, potential beneficial uses of water were also considered. The water quality in the uppermost aquifer is widely accepted as being of poor quality and is not being used. The demonstration that remedial action satisfies the supplemental standard requires a determination of the potential for groundwater to affect human health and the environment. Potentially exposed populations and past, present, and future land and water use patterns were evaluated. Significant impacts to human health from consuming background groundwater in the Deweesville/Conquista and Dilworth aquifers were identified, including non-carcinogenic health effects and potential carcinogenic health effects associated with long-term consumption of groundwater with high arsenic, molybdenum, and uranium background concentrations. No health effects were identified for the consumption of produce irrigated with this groundwater.

The existing risk to humans associated with use of this groundwater is significant and there are no existing or foreseeable beneficial uses. The likelihood of consumption of groundwater from the Deweesville/Conquista aquifer is negligible because this groundwater has not been developed due to its history of poor quality, insufficient yields, and readily available alternate sources of good water. There is no past, present, or anticipated future beneficial use of the Deweesville/Conquista groundwater; only limited stock watering use of the Dilworth Sandstone and Manning Clay aquifers occurs. Therefore, remedial action would not affect any existing or potential beneficial use of groundwater in the Deweesville/Conquista aquifer, nor contribute to any risk to human health or the environment.

Therefore, the water contained in the uppermost aquifer meets the criterion of Class III groundwaters based on widespread ambient contamination in the Deweesville/Conquista and Dilworth aquifers (the uppermost aquifer); the aquifer is widely recognized as being of poor quality, it cannot be treated using reasonable methods, and it has limited beneficial uses.

For the narrative supplemental standard, concentration limits and points of compliance have not been specified. No groundwater monitoring at a point of compliance is proposed in the uppermost aquifer because background (natural) groundwater quality varies by several orders of magnitude; the uppermost aquifer is limited use; and proposing numerical concentration limits and monitoring groundwater quality at a point of compliance will not serve to protect human health and the environment further as there is no existing or potential beneficial use of the groundwater in the Deweesville/Conquista aquifer.

The narrative supplemental standard includes an applicability criterion, which is a demonstration that the remedial action design satisfies the supplemental standard and comes as close to meeting the otherwise applicable standards (MCLs or background) as is reasonable under the circumstances. The applicability criterion for the narrative supplemental standards is based on the classification of groundwater in the Deweesville/Conquista and Dilworth aquifers as "limited use," based on non-treatability by methods reasonably employed by area public water supply systems.

An engineering evaluation of the proposed remedial action design determined that the disposal cell would protect human health and the environment by incorporating natural and engineering design features that come as close to meeting the otherwise applicable standard as is reasonable under the circumstances (40 CFR 192.22(a)) by minimizing long-term seepage and transient drainage. The disposal cell cover would limit steady state vertical seepage (flux) through the tailings to 4×10^{-9} centimeters per second (cm/s) on the topslope and 2×10^{-8} cm/s on the sideslopes. This flux is lower than the drainage capacity of the Deweesville Sandstone and Conquista Clay Members, which would prevent tailings seepage from perching on the contact between the base of the tailings and the underlying Deweesville Sandstone and Conquista Clay Member. Because this flux is several orders of magnitude less than the natural recharge at the Falls City site, tailings seepage would also not create a condition of saturation in the Deweesville Sandstone and Conquista Clay Members at the contact with the tailings. The remedial action design also takes advantage of natural geochemical attenuation of hazardous constituents in natural materials beneath the disposal cell.

The need for and extent of groundwater cleanup at the Falls City site will be based on the extent of existing contamination and the potential for current or future beneficial use of the Deweesville Sandstone, Conquista Clay, and Dilworth Members. The DOE currently has studies underway to develop plans, guidance materials, and procedures for an aquifer restoration program. The decision on whether to perform groundwater cleanup will be part of this separate DOE program, and will include a separate NEPA process. By deferring cleanup of the groundwater at the Falls City site, the DOE has determined that there will be no risk to human health and the environment, since water quality in the uppermost aquifer is of poor quality and has no current or future beneficial use.

No action

If no action is taken to stabilize the tailings piles further, rates of seepage from the piles will remain constant. Current total seepage from all the tailings piles and the pond is calculated to be 90 gpm. Concentrations in the leachate would remain relatively stable for a substantial period of time, but would eventually decrease as soluble chemical species are leached from the piles.

Tailings seepage would continue to influence groundwater quality in the Deweesville/Conquista aquifer. The geochemically reducing conditions in the Dilworth aquifer (see Section 3.3.4, Geochemical Characterization, in the EADR) prohibits the migration of contaminants from the overlying Deweesville/Conquista aquifer to the Dilworth aquifer, or any underlying units.

The aquifer is presently unused due to its poor natural quality. Effectively, the aquifer quality would continue to deteriorate; however, the deteriorating water quality would still have no effect on human health because the water would remain unused.

4.6 FLORA AND FAUNA

Terrestrial ecosystems would be impacted directly and indirectly by remedial actions. Direct impacts would result from excavation of contaminated soils, disposal of tailings, construction and upgrading of the haul road to pile 3, and borrow activities. Indirect impacts would include increased fugitive dust emissions, elevated noise levels, and human activities at and adjacent to the direct impact area. Direct impacts can either be short- or long-term, while indirect impacts would be for the duration of remedial action.

Remedial action at the Falls City site would result in clearing the vegetation and removing much of the topsoil on 765 acres of land and would impact five plant community types (Table 4.4). The mesquite-shrub habitat is the largest type to be cleared (330 acres) and represents the most biologically productive and diverse habitat to be impacted. The majority of this habitat is found at the La Mesa borrow site and in the areas of windblown contamination surrounding piles 1, 2, 3, 4, 5, and 7. Grass-dominated areas, which cover 216 acres within the tailings pile areas and mill yard, would also be cleared. The loss of this area would have the least impact on wildlife due to the early successional nature of the habitat.

Remedial action would eliminate a total of approximately 765 acres of game-species habitat. All 765 acres are white-tailed deer habitat, while 481 and 436 acres are upland game-bird and cottontail rabbit habitat, respectively. Game and nongame species would be eliminated from these cleared areas. Based on data from the state of Texas, the estimated total loss in hunter-use days would be 44 per year (TPWD, 1990; Boydston and Reagan, 1989; Gore and Reagan, 1989; and Wilson, 1986).

The duration of these direct impacts due to clearing land would depend on the level of reclamation efforts. If reseeding with grass were successful on the cleared areas, wildlife associated with the grassland habitat type would be expected to return. The loss of mesquite-shrubland habitat along with its associated wildlife would be a relatively long-term loss (a period of years).

Prior to the initiation of surface disturbance, the plan for restoration of excavated areas would be determined by the Remedial Action Contractor and the DOE in consultation with the appropriate regulatory agency, land owners, or other authority. In general, this plan would

Table 4.4 Estimated acres of plant community types affected by the proposed remedial action, Falls City, Texas, site

Area	Plant community type (in acres)						
	Grass dominated[a]	Grass dominated (pasture-hay)	Mesquite-shrublands	Grass/young mesquite (senderos, fence rows, abandoned fields)	Wetlands	Open water	Total
Piles 1, 2, 4, 5, 7[b]	177	38	132	125	1		473
Pile 3[c]	39	24	25	26	1	4	119
La Mesa borrow site	--	--	157	--	--	--	157
Tordilla Hill borrow site	--	--	15	--	--	--	15
Haul road	--	--	1	--	--	--	2
Total	216	62	330	151	2	4	765
Percentage	28%	8%	43%	20%	>1%	1%	100%

[a]Includes areas at and adjacent to the tailings piles.
[b]Includes tailings piles, mill yard, and windblown contaminated areas.
[c]Includes tailings piles and windblown contaminated areas.

involve backfilling, recontouring, and revegetating. Impacts would be mitigated by scheduling the restoration as soon as possible after completion of surface-disturbing activities.

Remedial action activities would not impact Federal- or state-listed threatened and endangered species. The U.S. Fish and Wildlife Service indicated that no Federally-listed species occur at or near the site (Attachment 2, Biological Documentation), while the state identified 19 species that could potentially occur at the site. It was determined that three species of reptile (the Texas tortoise, the Texas horned lizard, and the Texas indigo snake) have the potential for occurring at the site. However, evidenced by the lack of sightings during the biological surveys, remedial action would have minimal impact to these species.

The impacts of dust, noise, and human activity on all flora and fauna represent short-term impacts (for the life of the project or less). These impacts would be lessened since many of the construction activities would occur in already-disturbed areas; activities such as clearing windblown contamination would occur in selected areas for relatively short periods, and the surrounding mesquite-shrub habitat would reduce the distance these disturbances penetrate into undisturbed areas.

4.7 LAND USE

The final restricted site containing the stabilized tailings and a buffer area would encompass 290 acres within Parcel A. It would be under the direct control of the Federal government and would be permanently restricted from any public access and development. Consequently, any use of these 290 acres would be permanently precluded. The final restricted site area would be fenced.

Upon completion of remedial actions, all of Parcel B (120 acres) and 183 acres of Parcel A would be released for other uses.

Use of the haul road to pile 3 would unavoidably disrupt adjacent grazing use; at this time, the haul road is an unfenced primitive dirt road that cattle cross while grazing. This road would be used for an estimated 6.5 months to move tailings and windblown contamination from Parcel B to the disposal site area. Once remedial action is completed, the haul road would likely be left in place.

The proposed action would also result in the disturbance of approximately 172 acres at the La Mesa (157 acres) and Tordilla Hill (15 acres) borrow sites. Use of the La Mesa borrow site would preclude short-term grazing and seasonal hunting uses presently occurring at this site. Once remedial action was completed, the La Mesa borrow site would be regraded to approximate existing contours and to provide good drainage. The disturbed areas would be seeded. The Tordilla Hill and Knippa borrow sites would not be reclaimed because they are existing quarries.

4.8 NOISE

A noise prediction model (Kessler et al., 1978) was used to estimate maximum A-weighted noise level in decibels (dBA) emitted from the processing/disposal site and borrow sites and along the transportation routes during the remedial action.

Processing site

The maximum level of noise generated during the remedial action at the processing site and La Mesa borrow site, 96 dBA, would occur during the last phase of construction when the cover is being emplaced. At the nearest residence (about 1300 feet to 0.5 mile away), maximum outdoor noise levels would be reduced to 55.8 dBA. At this distance, noise from the construction activity would not be significant.

Tordilla Hill borrow site

At the Tordilla Hill borrow site, construction noise of 90 dBA would be generated only during month 26 when the material for the radon barrier is excavated. The nearest residence to this borrow area is about one mile away. At this distance, the construction noise would be reduced to 40 dBA and would be indistinguishable from ambient noise.

Knippa Quarry

The Knippa quarry is an operating commercial gravel pit; therefore, noise impacts at this site were not evaluated.

Transportation routes

For the proposed remedial action, traffic due to haul trips would increase along the transportation routes to be used during remedial action. One haul truck can be expected to produce outdoor noise levels of 85 and 79 dBA at distances of 50 and 100 feet, respectively, from the source (Kessler et al., 1978). Indoors, the noise would be reduced to 70 and 64 dBA at these distances.

4.9 HISTORICAL AND CULTURAL RESOURCES

No historical or archaeological resource surveys have been conducted at the tailings or Knippa and Tordilla Hill borrow sites. The tailings site and nearby areas have been extensively disturbed due to agricultural activities, open pit mining, and prospecting. The Tordilla Hill and Knippa borrow sites are existing quarry locations. For these reasons, it is unlikely that historical or archaeological sites would be impacted by the remedial action. A Class III cultural resource survey has been conducted in the relatively undisturbed La Mesa borrow area. One prehistoric site requiring additional data has been identified (Ecker, 1991).

If the site cannot be avoided, or if resources eligible for inclusion on the National Register for Historic Places are identified, and if the DOE determines that they would be impacted by the remedial action, a data recovery plan would be developed and implemented by the Texas State Historic Preservation Officer and DOE to mitigate any impacts.

4.10 SOCIOECONOMICS

Impacts on population and employment in the Falls City area were assessed by evaluating the average and peak labor force requirements for the remedial action and the existing availability of unemployed workers with suitable job skills.

The remedial action is estimated to require an average of 38 workers of all kinds but primarily heavy equipment operators (average need for 19) since the majority of the remedial action would be completed using scrapers, bulldozers, graders, and front-end loaders. A peak work force of 60 workers would be needed for the first three months; equipment operators (approximately 20) and general laborers and mechanics (approximately 19) would be in the greatest demand.

Because of the high area unemployment in the mining and construction sectors and the proximity to San Antonio, it is estimated that the majority of the work force would be available locally, or from towns within a commuting distance. Population increases related to the remedial action are expected to be negligible.

Assuming that workers would likely reside in nearby towns and San Antonio, indirect employment would not occur because spending would be so widely dispersed.

Since workers could reside in any of three counties, changes in unemployment levels cannot be evaluated other than that the remedial action would have a positive temporary effect on existing unemployment levels.

The estimated cost of the proposed action is $21,402,000. This figure includes costs associated with the labor, purchases, or rentals of all equipment, materials, and supplies, as well as miscellaneous expenditures and subcontracts, including profit. This figure does not include construction management. It was assumed that the materials, equipment, and supplies would be available within the greater Falls City-San Antonio area. It is anticipated that the work force would come from or reside in area communities. Wages and salaries are estimated at $4,258,000; materials at $1,928,000; equipment at $4,284,000; supplies at $4,488,000; and miscellaneous costs at $6,444,000.

In addition to direct local expenditures, revenue would be generated indirectly from money recirculating throughout the economy. Research on the indirect impacts of similar construction projects on rural areas in the western United States suggests the use of an indirect income multiplier of 1.23 (Mountain West Research, Inc., 1979) to determine the monies generated from the respending of project-related dollars. Indirect revenues are estimated to be $4,922,000.

4.11 TRANSPORTATION

The proposed action would require minimal use of public highways; however, all road segments in the site area are currently underused and could easily sustain increased use levels. The majority of the remedial action would take place on Parcel A and would require use of scrapers or other heavy equipment on the site. Contaminated materials (tailings and windblown) from Parcel B would be carried by trucks along a 0.8-mile graveled haul road and would cross FM-1344 to reach the disposal site. Borrow materials from the La Mesa borrow site adjacent to the disposal site area would also be moved by scrapers.

Transport of borrow materials from the Tordilla Hill borrow site would require use of 3.3 miles of FM-791 and 0.7 mile of FM-1344, and about one mile of unpaved dirt road to access the borrow site. Trucks would be used to transport borrow materials from the Tordilla Hill borrow site to the disposal site area for upgrading the access road to pile 3 in Parcel B during the first three months. An estimated 10 trips per day would occur. Bedding materials from the Tordilla Hill borrow site would be obtained over a two-month period of time during the last year of remedial action. An estimated 26 trips per day would be related to this activity. This additional use of FM-791 and FM-1344 would not impact existing uses or level of service on these roads.

At this time, no decision has been made on the transportation mode from the Knippa quarry west of San Antonio. If truck transportation is selected, an estimated 200 trips per day over a two-month period would be required to transport the rock materials to the disposal site. Users of US-90 or US-181 would remain unaffected by this increase in traffic (four to five percent increase). However, this use level is almost double the existing use on FM-791 and FM-1344. Area residents, however, experienced higher use levels when uranium milling activities were in operation.

If rail transportation is selected for transporting the borrow materials from the Knippa quarry, the rock will be loaded directly into railroad cars at the quarry and the cars will be transferred southward at San Antonio (Reaby, 1990). Trucks would be used to transfer the materials from the railroad station in Falls City to the disposal site. This would result in the same level of increased use on FM-791 and FM-1344 as if an all-truck transportation option were used.

Workers would use US-181, FM-791, and FM-1344 to commute to work. An average of 38 workers, and peak of 60 workers, would commute from area towns and would have a minimal impact on current uses of these highways.

4.12 ENERGY AND WATER CONSUMPTION

The proposed remedial action would require consumption of fuel and electricity to operate the construction equipment and for on-site operations such as field offices. In addition, water would be needed for activities such as dust control and for washing equipment. The sources of the water would be determined by the Remedial Action Contractor and the water would be obtained according to all applicable state, Federal, and local laws and regulations. Little or no water should be necessary for compaction of tailings and other materials due to the high in situ moisture content and high plasticity of the materials used in the final embankments. Possible sources of construction water are the surface water in nearby ponds, the San Antonio River, and groundwater drawn from new or existing wells in the site area.

Total estimated fuel, electricity, and water consumption for the proposed action are 1,548,776 gallons, 110,232 kilowatt-hours, and 2.1 million gallons, respectively. The fuel required for the proposed action would be trucked from a commercial source to the tailings sites and would probably be stored on the site in tanks. Electricity would be provided by generators at the work sites or by nearby power lines.

4.13 ACCIDENTS NOT INVOLVING RADIATION

The proposed remedial action would involve the extensive use of heavy construction equipment (e.g., bulldozers, scrapers, front-end loaders) and truck trips, as tailings, other contaminated materials, and borrow materials are transported between the various sites. Remedial action workers would also be commuting between their homes and the work sites. Accidents associated with the operation of construction equipment and materials handling activities could occur during the remedial action. These hazards would be similar to those encountered in any large earthmoving project such as surface mining or heavy construction. Based on 1981 accident data for the mining and construction industries, approximately 0.0422 injury accident and 0.00045 fatal accident would occur per worker-year of labor (DOC, 1983).

Since the majority of all work will be done on Parcel A and only limited use of trucks would occur there, no public highway accidents were calculated. The small average commuting work force of 38 to 60 would create a negligible increase in area traffic. Limited use of trucks would occur to transport borrow materials from the Tordilla Hill borrow site to the disposal site area; highway miles associated with this activity were estimated at 50,000 miles, which are negligible in accident calculations.

A total of 113.3 worker-years are projected for the proposed action. Using the on-site construction accident rates, it is projected that remedial action could lead to 4.8 injury accidents and 0.05 fatal accident.

4.14 MITIGATIVE MEASURES

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

- Monitor wells in the tailings piles would be abandoned (grouted or removed) to prevent direct seepage of tailings fluids into the Deweesville/Conquista and Dilworth aquifers.

- Where possible, the DOE will properly abandon uranium exploration boreholes in the site vicinity to prevent direct seepage of contaminated groundwater to the Dilworth aquifer.

- Water or chemical dust suppressants would be applied to disturbed areas and all haul roads would be graveled to inhibit dust emissions.

- Any off-site spills of contaminated materials would be cleaned up immediately in compliance with applicable regulations.

- Areas disturbed during the remedial action would be backfilled, graded, and revegetated. Prior to the initiation of surface disturbance, the plan for restoration of excavated areas would be determined by the Remedial Action Contractor and the DOE in consultation with the appropriate regulatory agency, land owners, or other authority.

- Tailgates and covers would be firmly secured when the contaminated materials are being moved.

- Any equipment used would be cleaned up before release to prevent the spread of contaminated materials.

- Local labor would be used whenever possible to reduce the sociological impacts to the local communities and to provide economic benefits.

- Operations would be conducted only during normal work hours to minimize noise disturbance to local residents.

- Drainage controls and a wastewater retention pond(s) would be constructed at the site to prevent contaminated wastewater and surface runoff from leaving the site during remedial action. Contaminated water will be disposed of through evaporation. Any water remaining at the end of construction will be treated, using a mobile treatment plant, and released. Contaminated soils and residues on the bottom of the pond(s) will be excavated and placed in the disposal cell.

- Cultural resource surveys will be performed on all previously unsurveyed portions of the selected borrow areas before surface disturbing activities are initiated. If the one site identified at the proposed La Mesa borrow area cannot be avoided, or if eligible cultural resources are identified, and cannot be avoided, a data recovery program would be designed and implemented in consultation with the Texas SHPO.

Mitigative measures necessary to ensure the protection of remedial action workers and the long-term stability of the tailings are described in the <u>UMTRA Project Environmental, Health, and Safety Plan</u> (DOE, 1989), the Final Remedial Action Plan (DOE, 1991b), and the <u>Guidance for UMTRA Project Surveillance and Maintenance</u> (DOE, 1986a).

REFERENCES

Algermissen et al. (S. T. Algermissen, D. M. Perkins, P. C. Thenhaus, S. L. Hanson, and B. L. Bender), 1982. Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States, U.S. Geological Survey, Open-File Report 82-1022.

Armbruster, J. S., 1983. "Impacts of Coal Surface Mining on 25 Migratory Bird Species of High Federal Interest," U.S. Fish and Wildlife Service, FWS/OBS-83/35, Fort Collins, Colorado.

BFEC (Bendix Field Engineering Corporation), 1986. Radiological Characterization of the Falls City, Texas, Uranium Mill Tailings Remedial Action Site, GJ-47, prepared by BFEC, Grand Junction, Colorado, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Baker, V. R., 1977. Stream-Channel Response to Floods with Examples from Central Texas, Geological Survey of America Bulletin, Vol. 88, pp. 1057-1071.

Barnes, V. E., 1976. "Geologic Atlas of Texas, Crystal City--Eagle Pass Sheet," University of Texas at Austin, Bureau of Economic Geology.

Boydston, G., and M. Reagan, 1989. "Performance Report, Texas Big Game Investigations, Job No. 4: Big Game Harvest Regulations (White-Tailed Deer Harvest Surveys)," Federal Aid Project No. W-109-R-9, Texas Parks and Wildlife Department, Austin, Texas.

Bronder, Louise, 1990. Clerk at Falls City High School, Falls City, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated July 12, 1990.

Bryson, Hal, 1987. "Groundwater Contamination at the Falls City, Texas Uranium Tailings Site," unpublished thesis, University of Virginia, Charlottesville, Virginia, May 1987.

Bunker, C. M., and J. A. MacKallor, 1973. "Geology of the Oxidized Uranium Ore Deposits of the Tordilla Hill-Deweesville Area, Karnes County, Texas, a Study of a District Before Mining," U.S. Geological Survey, Professional Paper 765.

Butterfield, Suzanne, 1990. Texas Employment Commission, Austin, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated July 11, 1990.

Butts, Larry, 1986. Texas Air Control Board, Austin, Texas, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated July 3, 1986.

CDH (Colorado Department of Health), 1981. Fugitive Dust Emissions, Air Pollution Control Division, Denver, Colorado.

Call, M. W., 1978. "Nesting Habitats and Surveying Techniques for Common Western Raptors," U.S. Bureau of Land Management, Denver Service Center, Denver, Colorado.

Cannon, Clem, 1986. Karnes County Auditor, Karnes City, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated October 2, 1986.

Chevron, n.d. "Meteorological Monitoring Assessment Report for the Years 1979 through 1985," Chevron Resources Panna Maria Uranium Operations, Panna Maria, Texas.

Coffman et al. (J. L. Coffman, C. A. Von Hake, and C. W. Stover), 1982. Earthquake History of the United States, Publication 41-1, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Washington, D.C.

Conant, R., 1975. A Field Guide to Reptiles and Amphibians of Eastern and Central North America, Houghton Mifflin Co., Boston, Massachusetts.

DOC (U.S. Department of Commerce), 1983. Statistical Abstracts of the United States, 1981 to 1982, Bureau of the Census, Washington, D.C.

DOE (U.S. Department of Energy), 1991a. Environmental Analysis and Data Report for the Falls City Uranium Mill Tailings Remedial Action, Falls City, Texas, UMTRA-DOE/EA-150320.EADR, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 1991b. Final Remedial Action Plan for Stabilization of the Inactive Uranium Mill Tailings Site at Falls City, Texas, UMTRA-DOE/AL-050520.0000, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 1990. "Final Report to the Secretary of Energy - Implications of the BEIR-V report to the Department of Energy," DOE/EH-0158T, DOE Assistant Secretary for Environment, Safety, and Health, Office of Health, Washington D.C.

DOE (U.S. Department of Energy), 1989. UMTRA Project Environmental, Health, and Safety Plan, UMTRA-DOE/AL-150224.0006, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 1987. "Environmental Assessment of Remedial Action at the Falls City Uranium Mill Tailings Site, Falls City, Texas," unpublished draft, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 1986a. Guidance for UMTRA Project Surveillance and Maintenance, UMTRA-DOE/AL-350124.0000, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 1986b. Alternate Site Selection Process for UMTRA Project Sites, UMTRA-DOE/AL-200129.0007R-2, prepared by the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 1985. Programmatic Environmental Report for Remedial Action at UMTRA Project Vicinity Properties, UMTRA-DOE/AL-150327.0000, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 1984. Plan for Implementing EPA Standards for UMTRA Sites, UMTRA-DOE/AL-163, prepared by the DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

DOE (U.S. Department of Energy), 1983. "Environmental Assessment of Remedial Actions on the Uranium Mill Tailings at the Falls City Site, Falls City, Texas," DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Davis et al. (S. D. Davis, W. D. Pennington, and S. M. Carlson), 1985. "Historical Seismicity of the State of Texas--A Summary," in Gulf Coast Association of Geological Societies Transactions, Vol. 35, pp. 39-44.

Davis, W. B., 1974. "The Mammals of Texas," Texas Parks and Wildlife Department, Bulletin 41, Austin, Texas.

Dickinson, K. A., 1976. "Stratigraphy and Depositional Environments of Uranium Host Rocks in Western Karnes County, Texas," U.S. Geological Survey, Miscellaneous Field Studies Map, No. MF-1029, Scale 1:24,000.

Dornwell, Richard, 1986. Labor Market Analyst, San Antonio Regional Office of the Texas Employment Commission, San Antonio, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated October 2, 1986.

Dziuk, Rudy, 1986. Fire Chief, Falls City Fire Department, Falls City, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated September 29, 1986.

EPA (U.S. Environmental Protection Agency), 1987. "EPA Proposed Standards for Remedial Action at Inactive Uranium Processing Sites with Groundwater Contamination," 52 FR 36000; September 1987.

EPA (U.S. Environmental Protection Agency), 1986. "Industrial Source Complex (ISC) Dispersion Model User's Guide," Second Edition, Research Triangle Park, North Carolina.

EPA (U.S. Environmental Protection Agency), 1985. Compilation of Air Pollutant Emission Factors, AP-42, Fourth Edition, Research Triangle Park, North Carolina.

EPA (U.S. Environmental Protection Agency), 1982. Final Environmental Impact Statement for Remedial Action Standards of Inactive Uranium Processing Sites (40 CFR Part 192), EPA 520/4-82-013-1, Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1974. Information on Levels of Environmental Noise Requirements to Protect the Public Health and Welfare with an Adequate Margin of Safety, EPA-550/9-74-004, Washington, D.C.

Eargle, D. H., 1958. "Regional Structure and Lithology in Relation to Uranium Deposits, Karnes County Area, Texas," in Economic Geology, Vol. 53, No. 7, p. 919.

Eargle, D. H., and A. D. Weeks, 1962. "Geologic Setting and Origin of the Uranium Deposits of the Karnes Area, Southeast Texas," in Economic Geology, Vol. 57, No. 6, p. 1010.

Eargle et al. (D. H. Eargle, K. A. Dickinson, and B. O. Davis), 1975. South Texas Uranium Deposits, American Association of Petroleum Geologists Bulletin, Vol. 59, No. 5, pp. 766-779.

Eargle et al. (D. H. Eargle, G. W. Hinds, and A. M. Weeks), 1971. "Uranium Geology and Mines," in South Texas Guidebook No. 12, University of Texas, Bureau of Economic Geology, Austin, Texas.

Ecker, Herb, 1991. Staff archaeologist, Center for Archaeological Research, University of Texas at San Antonio, San Antonio, Texas, personal communication with M. B. Leaf, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated July 26, 1991.

FBDU (Ford, Bacon & Davis, Utah Inc.), 1981. Engineering Assessment of Inactive Uranium Mill Tailings, Falls City Site, Falls City, Texas, DOE/UMT-011, FBDU 360-16, UC 70, prepared by FBDU, Salt Lake City, Utah, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Gaddis, Howard, 1986. City Engineer, San Antonio, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated October 2, 1986.

Gibson, Lay James, and William V. Stephenson, 1983. "Evaluating the Impacts of New Industry," in Industrial Development, September-October 1983.

Gore, H. G., and J. M. Reagan, 1989. "Job Performance Report, Federal Aid in Wildlife Restoration Act Texas, Job No. 1: White-Tailed Deer Population Trends," Texas Parks and Wildlife Federal Aid Project No. W-109-R-9, Austin, Texas.

Gottharzt, Margaret, 1986. Medical Records Department, Otto Kaiser Memorial Hospital, on U.S. Highway 181 between Kenedy and Karnes City, Karnes County, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated October 1, 1986.

Grahl, T., 1990. Acting Field Supervisor, U.S. Fish and Wildlife Service, Ecological Services, Corpus Christi, Texas, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated June 27, 1990.

Hoffman, S., 1986. U.S. Fish and Wildlife Service, Albuquerque, New Mexico, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated August 15, 1986.

Hosek, Ken, 1990. Water Operator, Three Oaks Water Supply Corporation, Falls City, Texas, personal communication with M. B. Leaf, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated September 9, 1990.

Hunt, C. B., 1967. Physiography of the United States, W. H. Freeman and Company, San Francisco, California, 526 pp.

Johnston, M. C., 1963. "Past and Present Grasslands of Southern Texas and Northeastern Mexico," in Ecology, Volume 44, Number 3, pp. 456-466.

Judd, F. W., 1985. "Status of *Siren intermedia texana*, *Notophthalmus meridionalis*, and *Crotaphytus reticulatus*," prepared for the U.S. Fish and Wildlife Service, Office of Endangered Species, Corpus Christi, Texas.

Kessler et al. (F. M. Kessler, P. D. Schomar, P. C. Shanaud, and E. Rosendahl), 1978. Construction Site Noise Control-Benefit Estimation Technical Background, U.S. Army Corps of Engineers, Construction Engineering Research Laboratory Technical Report N-37, Champaign, Illinois.

Lansord, Janie, 1986. Accounting Department, Wilson Memorial Hospital, Floresville, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated October 1, 1986.

MESA (Minority Enterprise Service Associates), 1982. Cultural Resources Backup to Falls City UMTRAP report, prepared for Ford, Bacon & Davis Utah Inc., Salt Lake City, Utah.

Mabie, D. W., 1985. "Performance Report Nongame Wildlife Investigations: Bald Eagle Survey," Job No. 30, Federal Aid Project No. W-103-R-15, Texas Parks and Wildlife Department, Austin, Texas.

Manka, Mike, 1986. Chevron Resources Panna Maria Uranium Operations, Panna Maria, Texas, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated July 9, 1986.

Maxwell, R. A., 1962. "Mineral Resources of South Texas--Region Served Through the Port of Corpus Christi," University of Texas, Austin, Texas, Bureau of Economic Geology, Report of Investigations, No. 43.

McMahan et al. (C. A. McMahan, R. G. Frye, and K. L. Brown), 1984. "The Vegetation Types of Texas Including Cropland," Texas Parks and Wildlife Department, Austin, Texas.

Millsap, B. A., 1981. "Distribution Status of Falconiformes in West Central Arizona . . . with Notes on Ecology, Reproductive Success, and Management," U.S. Bureau of Land Management, Technical Note 355, Phoenix, Arizona.

Mims, Ray, 1986. Planning Engineer, District Office, State Department of Highways and Public Transportation, San Antonio, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated September 23, 1986.

Moczygemba, Jane, 1986. Karnes City Hospital, Inc., Karnes City, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated October 1, 1986.

Montanucci, R. R., 1971. "Ecological and Distributional Data on Crotaphytus reticulatus (Sauria:Iguanidae)," in Herpetologica, Volume 27, pp. 183-197.

Mountain West Research, Inc., 1979. A Guide to Methods for Impact Assessment of Western Coal/Energy Development, Billings, Montana.

Moxham et al. (R. M. Moxham, D. H. Eargle, and J. A. MacKallor), 1958. "Texas Coastal Plain Geophysical and Geologic Studies," in Geologic Investigations of Radioactive Deposits, U.S. Department of Interior Progress Report TEI-740, U.S. Geological Survey, Washington, D.C.

Muzny, Rosemary, 1990. Transportation Planning Division, State Department of Highways and Public Transportation, Austin, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated July 12, 1990.

NAS (National Academy of Sciences), 1990. Health Effects of Exposure to Low Levels of Ionizing Radiation: BEIR-V, Committee on the Biological Effects of Ionizing Radiations, National Academy Press, Washington D.C.

NAS (National Academy of Sciences), 1988. Health Risks of Radon and Other Internally Deposited Alpha Emittors: BEIR-IV, Committee on the Biological Effects of Ionizing Radiations, National Academy Press, Washington, D.C.

NAS (National Academy of Sciences), 1977. Guidelines for Preparing Environmental Impact Statements on Noise, Committee on Hearing Bioacoustics and Biomechanics, Working Group Number 69, Washington, D.C.

NOAA (National Oceanic and Atmospheric Administration), 1986. "Local Climatological Data Annual Summary with Comparative Data, San Antonio, Texas," National Climatic Data Center, Ashville, North Carolina.

NOAA (National Oceanic and Atmospheric Administration), 1982. Hydrometeorological Report No. 52, Application of Probable Maximum Precipitation Estimates - United States East of the 105th Meridian, U.S. Government Printing Office, Washington, D.C.

NRC (U.S. Nuclear Regulatory Commission), 1981a. MILDOS, A Computer Program for Calculating Environmental Radiation Doses from Uranium Recovery Opera- tions, NUREG/CR-2011, PNL-3767, Washington, D.C.

NRC (U.S. Nuclear Regulatory Commission), 1981b. Data Base for Radioactive Waste Management Impacts Analyses Methodology Report, NUREG/CR-1759, Volume 3, Washington, D.C.

NRC (U.S. Nuclear Regulatory Commission), 1980. Final Generic Environmental Impact Statement on Uranium Milling, NUREG-0706, Office of Nuclear Material Safety and Safeguards, Washington, D.C.

ORNL (Oak Ridge National Laboratory), 1980. "Radiological Survey of the Inactive Uranium Mill Tailings at Falls City, Texas," ORNL-5462, Oak Ridge, Tennessee.

Oberholser, H. C., 1974. The Bird Life of Texas, Volumes One and Two, University of Texas Press, Austin, Texas.

Pecotte, B., 1986. Texas State Data Center, Hargill, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated July 31, 1986.

Perez, R., 1985. U.S. Fish and Wildlife Service, Corpus Christi, Texas, personal communication with David Lechel, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated December 2, 1985.

Perkins, F., 1986. District Conservationist, Kenedy (Karnes County, Texas) Office of the Soil Conservation Service, personal communication with Bryan Hobbs, Jacobs Engineering Group Inc., Albuquerque, New Mexico, February 1986.

Peterson, R. T., 1980. A Field Guide to the Birds East of the Rockies, Houghton Mifflin Company, Boston.

Pierce, Ken, 1986. Karnes County Commissioner, Karnes City, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated October 2, 1986.

Pivonka, Louella, 1986. Falls City Clerk, Falls City, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated September 30, 1986.

Potter, F. E., 1985. Texas Parks and Wildlife Department, Austin, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated April 25, 1985.

Pulich, W. M., 1976. The Golden-Cheeked Warbler, Texas Parks and Wildlife Department, Austin, Texas.

Raun, G. G., and F. R. Gehlbach, 1972. "Amphibians and Reptiles in Texas, Taxonomic Synopsis, Bibliography, County Distribution Maps," Dallas Museum of National History, Bulletin 2, Dallas, Texas.

Reaby, John, 1990. Trainmasters Office, Southern Pacific Railroad, San Antonio, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated August 3, 1990.

Rose, F. L., and F. W. Judd, 1982. "Biology and Status of Berlandier's Tortoise (Gopherus berlandieri)," in North American Tortoises: Conservation and Ecology, U.S. Fish and Wildlife Service, Research Report 12, Washington, D.C.

Ruyz, Ida, 1986. Karnes County Sheriff's Department, Karnes City, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated September 29, 1986.

Sams, R. H., 1974. "Atkinson Field: Good Example of Subtle Stratigraphic Trap," in Oil and Gas Journal, August, 1974, pp. 156-157.

Strecker, J. K., and J. E. Johnson, 1935. "Notes on the Herpetology of Wilson County, Texas," in Baylor University Bulletin, Volume 38, Number 3, pp. 17-23.

Sullivan, D., 1990. Texas National Heritage Program, Texas Parks and Wildlife Department, Austin, Texas, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated June 18, 1990.

TAC (Technical Assistance Contractor; Jacobs-Weston Team), 1990a. Falls City Radon Monitoring: Pre-Remedial Action Summary, prepared by the TAC, Albuquerque, New Mexico, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

TAC (Technical Assistance Contractor; Jacobs-Weston Team), 1990b. "Unpublished Field Notes, Falls City, Texas, Uranium Mill Tailings Site," prepared by the TAC, Albuquerque, New Mexico, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

TAC (Technical Assistance Contractor; Jacobs-Weston Team), 1987. "Unpublished Field Notes, Falls City, Texas, Uranium Mill Tailings Site," prepared by the TAC, Albuquerque, New Mexico, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

TAC (Technical Assistance Contractor; Jacobs-Weston Team), 1986. "Unpublished Field Notes, Falls City, Texas, Uranium Mill Tailings Site," prepared by the TAC, Albuquerque, New Mexico, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

TDOH (Texas Department of Health) 1991. Written review comment to DOE for FCT Site Environmental Assessment, dated July 1, 1991. Regarding oil and gas leases and mineral rights for Falls City Site.

TK&A (Turk, Kehle, & Associates), 1976. Reconnaissance Hydrogeology of Uranium Mill Tailings, Falls City, Texas, report prepared for Ford, Bacon and Davis Utah Inc., Salt Lake City, Utah.

TPWD (Texas Parks and Wildlife Department), 1990. "Small Game Harvest Survey Results 1981-82 through 1989-90," TPWD, Austin, Texas.

Tennant, A., 1984. The Snakes of Texas, Texas Monthly Press, Austin, Texas.

Tewes, M. E., and D. D. Everett, 1982. "Study of the Endangered Ocelot Occurring in Texas, Year-End Report, 19 August 1981-18 August 1982," Caesar Kleberg Wildlife Research Institute, Texas A and I University, Kingsville, Texas.

Thomas, Luther, 1986. Superintendent, Falls City School, Falls City, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, September 19, 1986.

Twedt, D. J., and J. H. Rappole, 1985. "Distribution, Abundance, and Habitat Preferences of the Ocelot and Jaguarundi in South Texas, Year-End Report, 1 October 1984-30 September 1985," Caesar Kleberg Wildlife Research Institute, Texas A and I University, Kingsville, Texas.

USFWS (U.S. Fish and Wildlife Service), 1985. "Endangered and Threatened Wildlife and Plants; Interior Population of the Least Tern Determined to be Endangered," Federal Register, Volume 50, Number 102, pp. 21784-21792.

USFWS (U.S. Fish and Wildlife Service), 1984. "Endangered Species of Texas and Oklahoma," prepared by the USFWS, Albuquerque, New Mexico.

USGS (U.S. Geological Survey), 1983. Water Resources Data, Texas, Water Year 1982, U.S. Geological Survey Water-Data Report TX-82-3, National Technical Information Service, Springfield, Virginia.

Waters et al. (J. A. Waters, P. W. McFarland, and J. W. Lea), 1955. Geologic Framework of Gulf Coastal Plain of Texas, American Association of Petroleum Geologists Bulletin, Vol. 39, No. 9, pp. 1821-1850.

Werler, J. E., 1978. "Poisonous Snakes of Texas," Bulletin No. 31, Texas Parks and Wildlife Department, Austin, Texas.

West, Michael, 1990. Texas Department of Commerce, Research and Planning Division, Austin, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated July 11, 1990.

Wiggins, Gary, 1986. Auditor, Falls City, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated October 2, 1986.

Willard, John, 1986. Chief of Occupational Health Programs, Texas Department of Health, Austin, Texas, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated October 2, 1986.

Wilson, D. E., 1986. Texas Parks and Wildlife Department, Austin, Texas, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated August 26, 1986.

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Chevron Panna Maria, Texas	Mike Manka	air quality data
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City Hall Falls City, Texas	Lovella Pivonka	Local water and area use information
Conoco (Conquista Project) Falls City, Texas	Wayne Tieman	Groundwater monitoring data
Falls City Auditor Falls City, Texas	Gary Wiggins	Socioeconomics
Falls City Fire Department Falls City, Texas	Rudy Dziuk	Socioeconomics
Karnes City Hospital Karnes City, Texas	Jane Mouzygamba	Socioeconomics
Karnes County Auditor Karnes City, Texas	Clem Cannon	Socioeconomics
Karnes County Commissioner Karnes City, Texas	Ken Pierce	Socioeconomics
Karnes County Sheriff's Department Karnes City, Texas	Ida Ruyz	Socioeconomics
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Pan American University Edinburg, Texas	Frank Judd	Texas tortoise
San Antonio Regional Office of the Texas Employment Commission San Antonio, Texas	Richard Dornwell	Socioeconomics
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Texas A & I University Kingsville, Texas	Mark Kopeny	White-tailed hawk
Texas Air Control Board Austin, Texas	Larry Butts	Air quality information
Texas Historical Commission Austin, Texas	LaVerne Herrington Dan Prikryl	Historic and Cultural Resources
Texas Parks and Wildlife Department Austin, Texas	Don Wilson Floyd Potter Ron George Mike Reagan Bruce Thompson	Upland game T&E species mourning dove white-tailed deer T&E species
Texas Water Commission (TWC) Austin, Texas	Charles Greene	TWC files on Falls City site groundwater
Texas Water Commission (TWC) San Antonio, Texas	Liska Mercer	TWC files on Falls City site groundwater
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U.S. Fish and Wildlife Service Denver Wildlife Research Center Albuquerque Field Station Albuquerque, New Mexico	Norm Scott Tom Fritts	T&E reptiles Texas tortoise
U.S. Fish and Wildlife Service Denver Wildlife Research Center Fort Collins, Colorado	Bruce Bury	Texas tortoise
U.S. Fish and Wildlife Service Ecological Services Corpus Cristi, Texas	Ken Collins Rogelio Perez Pedro Ramirez Jr.	Wildlife

AGENCIES, ORGANIZATIONS, AND PERSONS CONSULTED (Concluded)

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Phillip Zelle	Jacobs-Weston	Radiation

ATTACHMENT 1

FLOODPLAINS AND WETLANDS ASSESSMENT

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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. These regulations are designed to be coordinated with the environmental review requirements of the National Environmental Policy Act. This attachment provides an assessment of impacts on the floodplains and wetlands associated with the Falls City, Texas, uranium mill tailings remedial action project pursuant to 10 CFR 1022. A floodplains and wetlands involvement notification of remedial action at the Falls City site appeared in the Federal Register on February 19, 1988 (FR 5033).

The proposed action is to stabilize the uranium mill tailings and associated contaminated materials on the site. A total of two acres of wetlands occurs on one of the tailings piles, at two stock ponds, and along an ephemeral stream. These areas would be cleaned up during remedial action and the wetlands replaced during site restoration. More detailed information describing the proposed remedial action appears in Section 2.0 of the Falls City EA and Section 2.0 of the Falls City EADR (DOE, 1991).

2.0 PROJECT DESCRIPTION

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) (42 U.S.C. 4321 et seq.) authorizes the DOE to perform remedial action at the Falls City tailings site near Falls City, Texas as well as other sites, to reduce the potential public health impacts from the residual radioactivity at the site. The remedial actions at inactive uranium mill sites are performed by the Uranium Mill Tailings Remedial Action (UMTRA) Project. The U.S. Environmental Protection Agency (EPA) promulgated standards (40 CFR 192) in March 1983 for remedial actions.

The Falls City site is eight miles southwest of Falls City, Texas, in Karnes County (Figure 2.1). The site area is characterized by flat-lying to rolling wooded areas and farmlands. The elevation of the site is approximately 450 feet above mean sea level. Land uses in the surrounding area include dry land farming, beef and dairy cattle production, swine production, and some economic mineral development.

Parcel A of the site covers 473 acres and contains the mill site, five tailings piles, windblown and waterborne contaminated materials, and one pond; Parcel B covers 120 acres and consists of one tailings pile and the adjacent contaminated material. Approximately 5,764,100 cubic yards of tailings and other contaminated materials are present at the Falls City site.

The proposed remedial action for the Falls City site is consolidation of all of the tailings and contaminated materials into one embankment on Parcel A, leaving pile 1 and the majority of piles 2 and 7 in place. The stabilized pile would be roughly rectangular and would have a base of 2200 feet by 2600 feet and a maximum height of 48 feet above grade. The average height of the cell would be 20 feet. The disposal cell would have maximum sideslopes of 20 percent and a topslope of one to two percent. The pile would be covered with a layer of compacted soil to inhibit radon emanation. The topslope would be covered by fill and topsoil to develop a vegetated cover; the sideslopes would be covered with gravel and rock. These layers would protect the cell against erosion, penetration by animals, and inadvertent human intrusion. The final restricted site would cover 290 acres. Of this total, the disposal cell would cover 127 acres, and the buffer area would cover 163 acres. All contaminated areas would be cleaned up, resulting in a total of 593 acres affected by remedial action. Areas disturbed during remedial action would be restored in accordance with applicable permits, licenses, and approvals and released for appropriate uses.

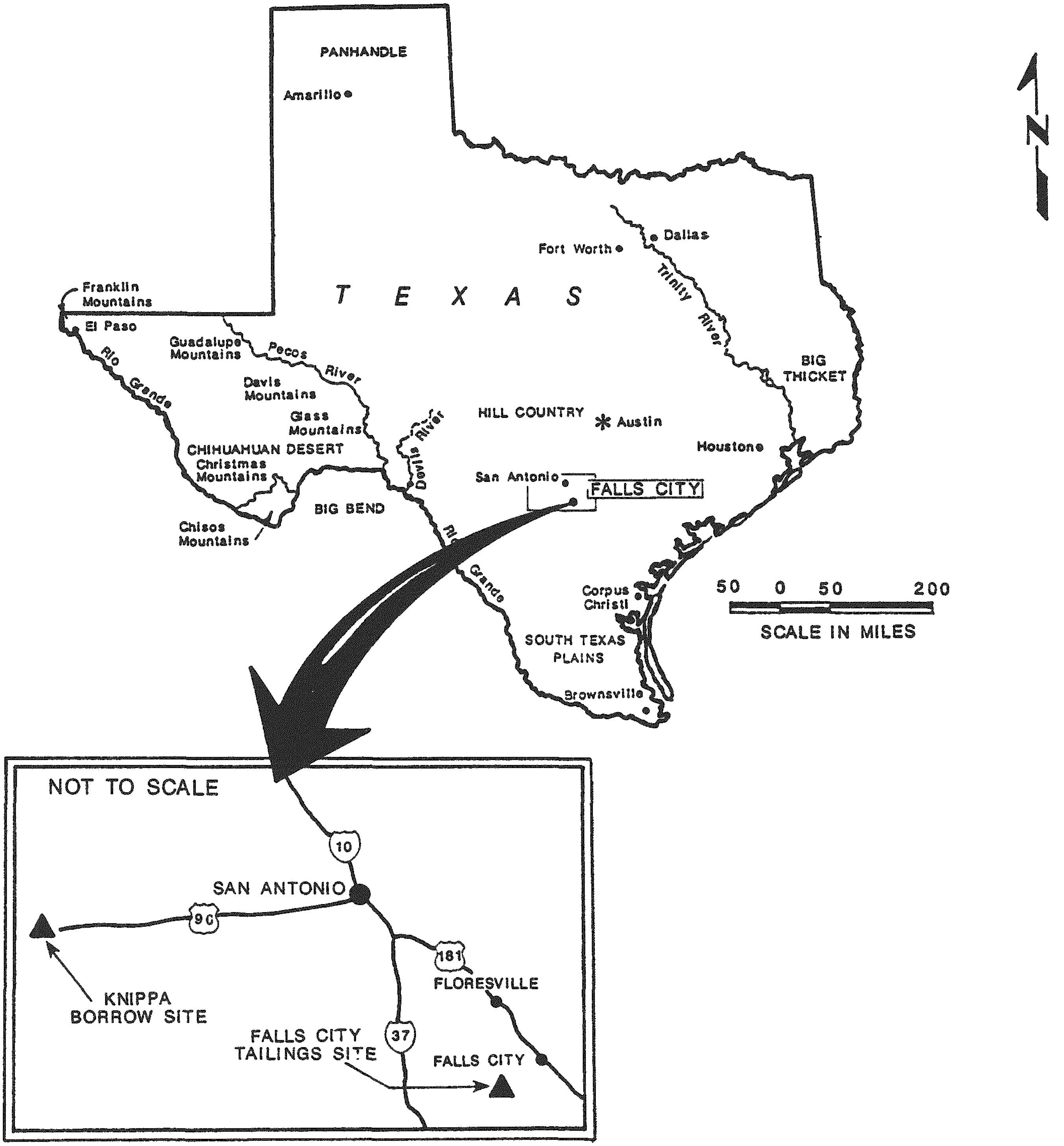

FIGURE 2.1
LOCATION OF THE FALLS CITY TAILINGS SITE NEAR FALLS CITY, TEXAS

3.0 FLOODPLAIN EFFECTS

3.1 AFFECTED ENVIRONMENT

There are two river basins in the region of the Falls City tailings site (Figure 3.1). The Nueces River Basin is south of the site and encompasses 16,600 square miles, while the Guadalupe River Basin is north of the site and encompasses roughly 10,100 square miles.

Several intermittent streams are located in the immediate vicinity of the tailings site (Figure 3.2). Scared Dog Creek is northeast of the designated site and drains toward the San Antonio River. Tordilla Creek is south of the site and drains towards the southwest. An unnamed creek immediately north of the site boundary drains to the north and eventually into the San Antonio River.

3.2 FLOOD CONDITIONS

A flood analysis was performed to determine whether remedial action activities would impact the floodplains of the San Antonio River, the only perennial river in the vicinity of the designated site. A flood analysis of the Atascosa River was also performed.

Because it was concluded that the probable maximum flood (PMF) floodplains of the San Antonio and Atascosa Rivers would not be impacted by remedial action at the Falls City site, 100-year flood analyses of either river were not performed.

Estimates for the PMF of the San Antonio River and Atascosa River were determined using the U.S. Army Corps of Engineers' (COE) HEC-1 hypothetical storm over a subbasin (COE, 1981). The PMF floodplain of the San Antonio River does not extend any closer than 2.5 miles from the designated site, while the PMF floodplain of the Atascosa River is over 12 miles from the site.

The 100-year floodplains of the intermittent streams in the immediate vicinity of the Falls City site were not determined. These streams drain away from the designated site and, based on historical performance, are not expected to migrate toward areas affected by the proposed remedial action.

3.3 IMPACTS

Because of the site's distance from the nearest streams of concern, and in addition to the elevation difference, it was determined that the construction of the disposal cell at the Falls City site would have no impact on the floodplain of the San Antonio River, the perennial stream nearest the site. Also, remedial action would not affect any of the intermittent streams in the vicinity of the designated site.

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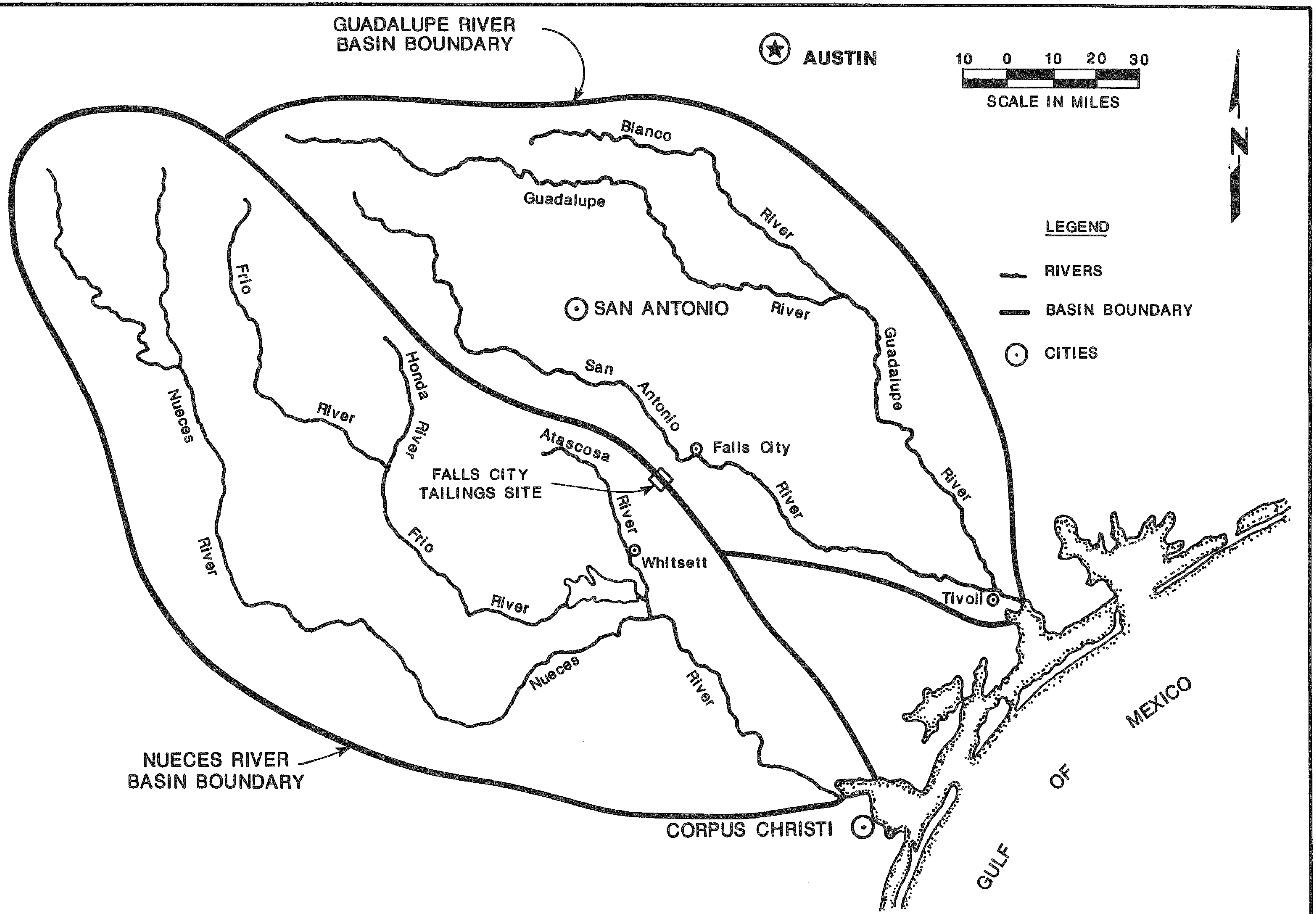

FIGURE 3.1
REGIONAL DRAINAGE CHARACTERISTICS NEAR FALLS CITY, TEXAS

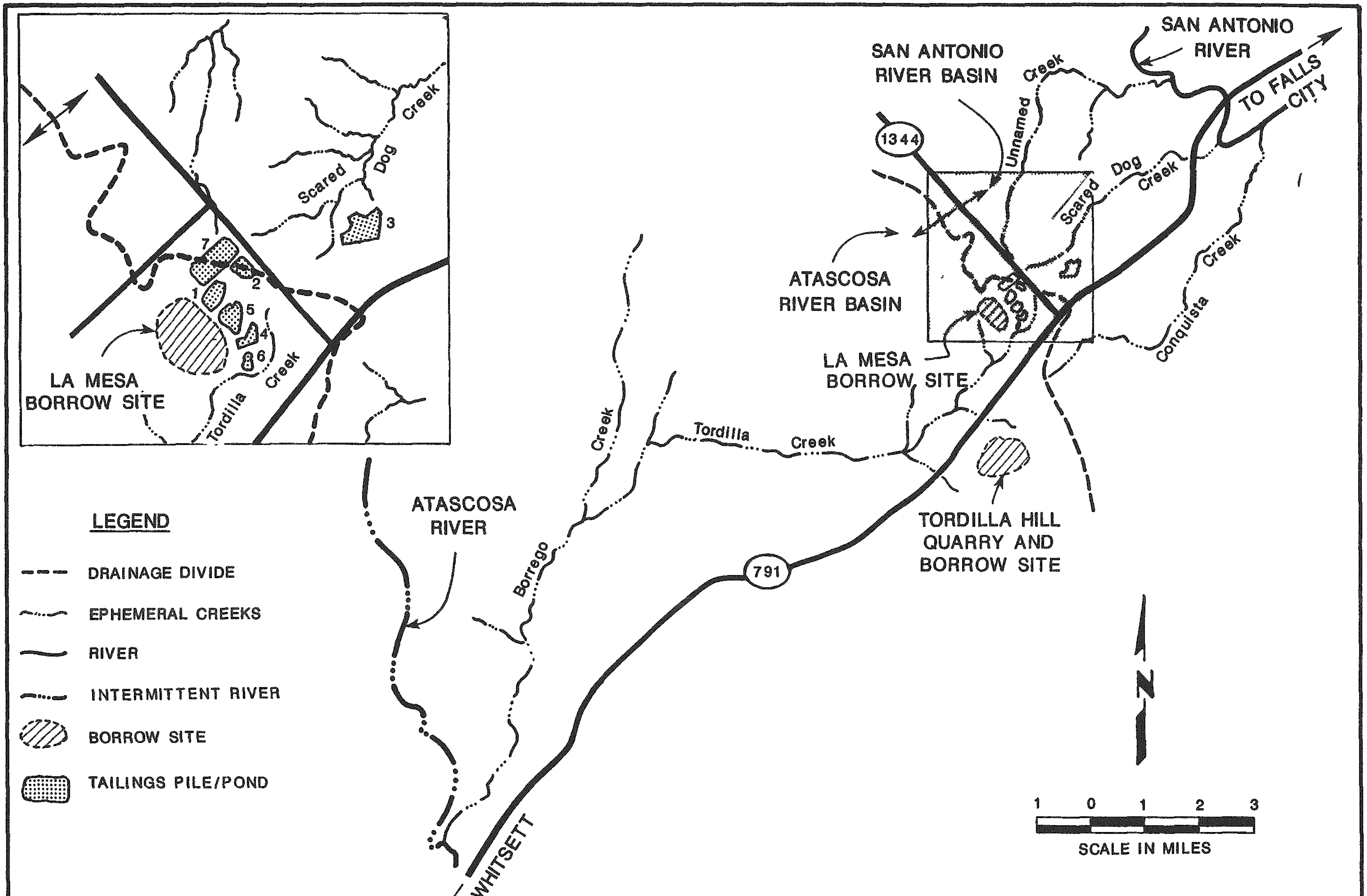

FIGURE 3.2
SURFACE WATER FEATURES
AT THE FALLS CITY, TEXAS, SITE

4.0 WETLANDS EFFECTS

4.1 DESCRIPTION OF WETLANDS

A small wetland occurs at the western edge of the stock pond south of pile 3 (Figure 4.1). This area has been heavily grazed and the vegetation is trampled and cropped short. Species of *Juncus* and *Carex* occur in this area. The pond associated with this wetlands was approximately fifty percent grown over with water primrose (*Ludwigia peploides*) (TAC, 1990). Another small amount of wetlands grew at the western edge of the pond south of the mill site (Figure 4.1). Cattail (*Typhal sp.*) grew in scattered clumps along with *Juncas* and *Carex*. A small segment of wetlands occurs on pile 1. Cattail formed a fairly dense growth in this wetland in 1986 (TAC, 1986); it was much more scattered in 1990 (TAC, 1990). *Juncus* and *Carex* were also common in this area. The final segment of wetlands occurs at the south end of the site along an ephemeral drainage (Figure 4.1). Cattail, *Juncus* sp., *Carex* sp., chufa (*Cyperus escalantes*), *Scripus* sp., and reed canary grass (*Phalaris arundinacea*) were observed growing in small clumps along this drainage.

The wetlands at the Falls City site provide marginal wildlife habitat principally because of their small size. The western ribbon snake (*Thamnophis proximus*), yellow-bellied water snake (*Natrix Crythrogastor flavigaster*), bullfrog (*Rana* cates beiana), and leopard frog (*Rana pipieus*) were observed at or near the wetlands.

A total of 26 species of birds were observed at the wetlands and associated ponds. Migrant species include the greater yellow-legs (*Tringa melanoleuca*), dowitcher (*Limnodromus sp*.), and pectoral sandpiper (*Calidris melanotos*). Water birds that may nest in the region include green-backed (*Butorides striatus*), little blue (*Egretta caerula*), and great blue (*Ardea herodias*) herons, and blue-winged teal (*Anas discors*), and fluvous whistling (*Dendrocygna bicolor*), and black-bellied whistling (*Dendrocygna autumnalis*) ducks. It is unlikely that colonial nesting herons nest at or near the site since no heronries were reported in the three-county area around the site (Texas Colonial Waterbird Society, 1982) and none were observed during site visits. Ducks probably nest within the three-county area, but the habitat around the ponds is not appropriate for waterfowl nesting due to the lack of brood cover.

No mammal species strictly indicative of wetlands were observed near the wetlands and ponds areas at the Falls City site.

4.2 IMPACTS ON WETLANDS

Remedial action would involve cleaning up two acres of wetlands; one acre at the pond south of pile 3 and approximately one-third acre at the other three sites. This would have a positive impact because these wetlands are contaminated with uranium mill tailings which potentially pose a threat to wildlife using these areas.

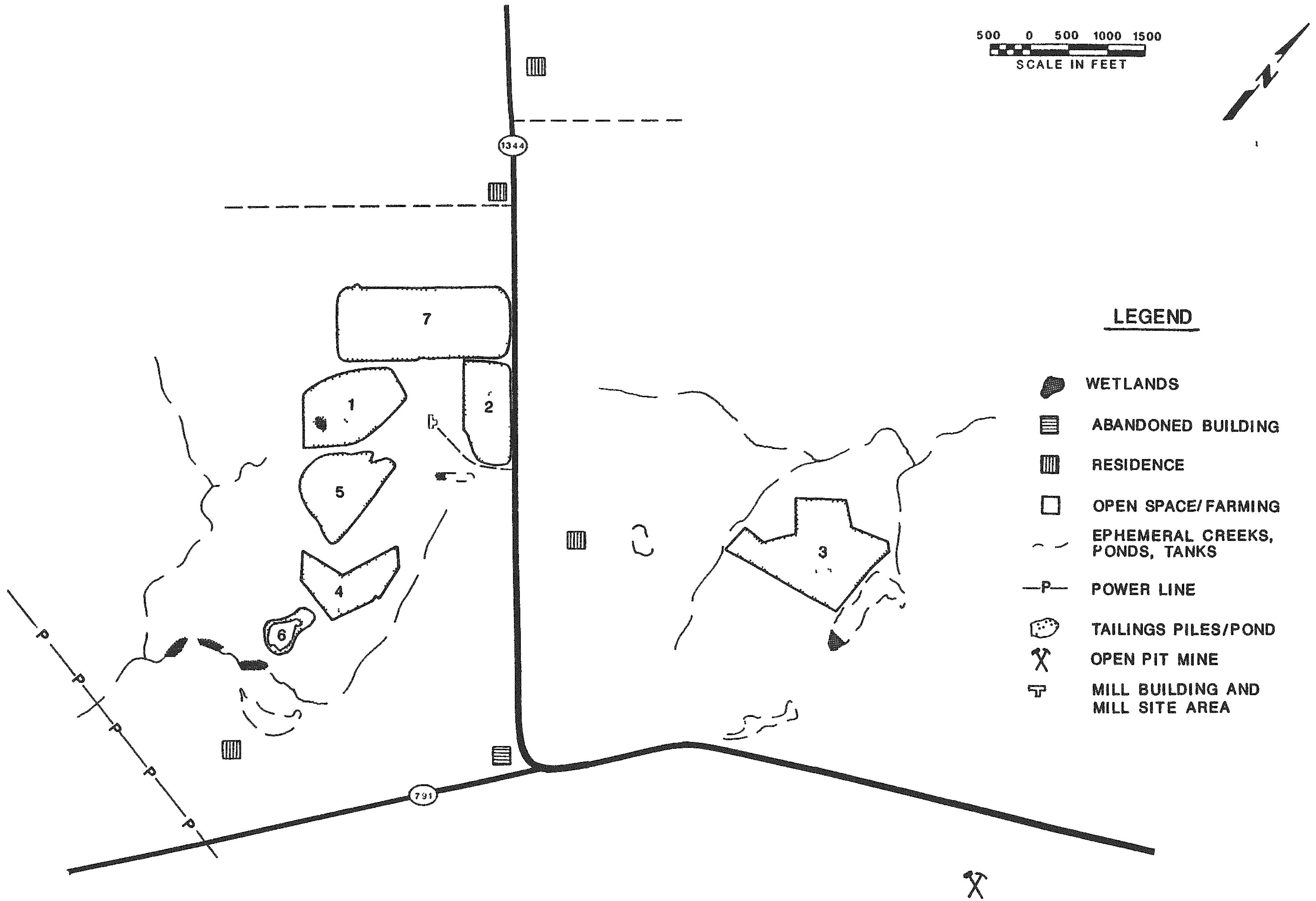

FIGURE 4.1
WETLANDS
AT THE FALLS CITY, TEXAS, SITE

4.3 MITIGATION OF IMPACTS ON WETLANDS

Revegetation represents the major mitigation measure that would be applied to the impacted wetland habitat at the Falls City site. There is no alternative to clearing the wetlands because the land is contaminated above EPA standards. Species such as cattail, Juncus sp., and Carex sp. can be re-established. Work in the revegetation of riparian habitats with woody species has also proven successful (Swenson and Mullins, 1985; York, 1985). Willow and other woody plant species have been successfully established from pole plantings.

Prior to the initiation of surface disturbance, the plan for restoration of excavated areas and recreation of wetlands would be determined by the Remedial Action Contractor and the DOE in consultation with the appropriate regulatory agency, land owners, or other authority.

5.0 ALTERNATIVES

The only alternative to the proposed action considered was the no action alternative. This alternative consists of taking no steps toward remedial action at the Falls City site. The radioactive 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 (42 U.S.C. 4321 et seq.) and would not result in compliance with the U.S. Environ- mental Protection Agency (EPA) standards (40 CFR 192). There is no alternative to clearing 2.0 acres of wetlands at the Falls City site because the wetlands occur in areas contaminated above the EPA standards. Therefore, by law, these areas must be remediated.

REFERENCES

COE (U.S. Army Corps of Engineers), 1981. HEC-1 Flood Hydrograph Package, User's Manual, Computer Program 723-X6-L2010, Water Resources, Support Center, The Hydrologic Engineering Center, Davis, California.

DOE (U.S. Department of Energy), 1991. Environmental Analysis and Data Report for the Falls City Uranium Mill Tailings Remedial Action, Falls City, Texas, UMTRA-DOE/EA-150320.EADR, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Swenson, E. A., and C. L. Mullins, 1985. "Revegetating Riparian Trees in Southwestern Floodplains," in Riparian Ecosystems and Their Management: Reconciling Conflicting Use, U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-120, Fort Collins, Colorado.

TAC (Technical Assistance Contractor; Jacobs-Weston Team), 1990. "Unpublished Field Notes, Falls City, Texas, Tailings Site," unpublished report prepared by the TAC, Albuquerque, New Mexico, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

TAC (Technical Assistance Contractor; Jacobs-Weston Team), 1986. "Unpublished Field Notes, Falls City, Texas, Tailings Site," unpublished report prepared by the TAC, Albuquerque, New Mexico, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Texas Colonial Waterbird Society, 1982. "An Atlas and Census of Texas Waterbird Colonies 1973-1980," Caesar Kleberg Wildlife Research Institute, Texas A and I University, Kingsville, Texas.

York, J. C., 1985. "Dormant Stub Planting Techniques," in Riparian Ecosystems and Their Management: Reconciling Conflicting Uses, U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-120, Fort Collins, Colorado.

ATTACHMENT 2

BIOLOGICAL DOCUMENTATION

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services
c/o CCSU, Campus Box 338
6300 Ocean Drive
Corpus Christi, Texas 78412

SE/ES

December 2, 1985

Consultation No. 2-11-86-I-13

Mr. David Lechel
Manager, Environmental Services
Jacobs Engineering Group Inc.
5301 Central Avenue N.E., Suite 1700
Albuquerque, New Mexico 87108

Dear Mr. Lechel:

This responds to your letter dated October 21, 1985 regarding the effects of the clean-up and disposal of uranium mill tailings at an inactive uranium processing site near Falls City, Texas on species Federally listed or proposed for listing as threatened or endangered.

Our data indicate no listed species would be affected by the proposed action.

If we can be of further assistance, please call our office at 512-888-3346 or FTS 734-3346.

Sincerely yours,

ROGELIO PEREZ
Field Supervisor

cc:
Director, U.S. Fish & Wildlife Service, Washington, D.C. (SE)
Regional Director, U.S. Fish & Wildlife Service, Albuquerque, NM (AHR)
Regional Director, U.S. Fish & Wildlife Service, Albuquerque, NM (SE)

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
c/o CCSU, Campus Box 338
6300 Ocean Drive
Corpus Christi, Texas 78412

June 27, 1990

Consultation No. 2-11-86-I-13a

Charles J. Burt
Jacobs Engineering Group Inc.
5301 Central Avenue N.E., Suite 1700
Albuquerque, NM 87108

Dear Mr. Burt:

This responds to your letter dated May 30, 1990 requesting information on species Federally listed or proposed for listing as threatened or endangered which may occur near Falls City, Karnes County, Texas. In addition, your project was evaluated with respect to the occurrence of wetlands or other important fish and wildlife habitat in the area. This consultation is an update of consultation no. 2-11-86-I-13 dated December 2, 1985.

The project involves the clean up of uranium mill tailings, and is part of the Uranium Mill Tailings Remedial Action Project administered by the U. S. Department of Energy. Two proposed borrow sites have been identified: La Mesa and Tordilla Hill. It is our understanding that an environmental assessment will be prepared for this project.

Our data indicate that Federally listed species are unlikely to be present in the action area. With respect to wetlands and other important fish and wildlife habitat, it appears that the proposed borrow sites are near Tordilla Creek. Be advised that among its many mandates concerning the protection of natural resources, the U.S. Fish and Wildlife Service is required to comply with Executive Order 11988, regarding the National Policy on Floodplain Management, which requires that each Federal agency "avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative."

Floodplains and the riparian vegetation and wetlands they support act as natural buffers to floods and aid in water quality maintenance and groundwater recharge. These benefits can be lost through the clearing of vegetation, filling and excavation activities associated with development. In addition to providing valuable foraging and nesting habitat to fish and wildlife, floodplains represent a high cultural resource to the general public. Therefore, the Service cannot support projects involving any type of Federal assistance that may adversely impact or reduce the 100-year floodplain.

We recommend that any potential for leaching of uranium, heavy metals, trace elements or any radioactive material into the creek, nearby ponds or underground water table be examined and eliminated as part of the Remedial Action Project. We also wish to express a concern about the ponds in the action area that are, or may be, contaminated. Waterfowl and other wildlife that use the ponds will be susceptible to this contamination if the situation is not remedied. We would appreciate the opportunity to see a copy of the Environmental Assessment when prepared.

If we can be of further assistance, please contact Arthur Coykendall of our office at (512) 888-3346 or FTS 529-3346.

Sincerely,

Thos E Grahl

THOMAS E. GRAHL
Acting Field Supervisor

cc:
Regional Director, U.S. Fish & Wildlife Service, Albuquerque, NM (FWE/SE)