U.S. Department of Energy
Grand Junction Office
2597 B¾ Road
Grand Junction, CO 81503

OCT 3 1 2001

John J. Melvyn Leach, Chief
Uranium Recovery and Low-Level Waste Branch
Division of Waste Management
U.S. Nuclear Regulatory Commission
Mail Stop T7J9
Washington, D.C. 20555

Dear Mr. Leach:

Enclosed is the Management Action Process (MAP) document for the UMTRA Ground Water (UGW) Project. The objective of the MAP is to update the project status and communicate progress and issues with our federal, state, Native American, and local participants by providing a single document that is updated annually.

In 1996, the UGW Project was transitioned to the U.S. Department of Energy–Grand Junction Office. Since that transition, the project has moved forward by closing out 10 sites and implementing compliance strategies on all high-priority sites. The project has continued to meet milestones and operate in a cost-effective manner. Milestones are identified and tracked by Project Performance Measures. These measures and milestones are shown in Tables 5-1 and 5-2. The total estimated cost (life cycle) of the project has decreased dramatically from earlier projections, with a projected cost of less than $200 million today (see Table 5.3).

If you have questions on any aspect of the information presented in this document, or if you have suggestions on improvements, please call me at 970/248-7612. I hope you find the MAP useful and informative.

Sincerely,

Donald R. Metzler
Technical/Project Manager

Enclosure

cc w/o enclosure:
S. Marutzky, MACTEC-ERS
Project File GWADM1.1 (P. Taylor)

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GJO–2001–216–TAR
MAC–GWADM 1.1
Revision 3

UMTRA
Ground Water Project

UMTRA Ground Water Project Management Action Process (MAP) Document

September 2001

Prepared by the
U.S. Department of Energy
Grand Junction Office

Work Performed Under DOE Contract No. DE–AC13–96GJ87335 for the U.S. Department of Energy

GJO–2001–216–TAR
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UMTRA Ground Water Project

Management Action Process (MAP) Document

September 2001

Prepared by
U.S. Department of Energy
Grand Junction Office
Grand Junction, Colorado

Project Number UGW–511–0001–05–001
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Work Performed Under DOE Contract Number DE–AC13–96GJ87335

UMTRA Ground Water Project
Management Action Process (MAP) Document

Approved by:

9/21/2001

Ray Plieness
DOE–GJO Deputy Manager

Date

Sept 19, 2001

Donald Metzler
DOE–GJO Program Manager/Projects Team Leader

Date

18 Sept. 01

Sam Marutzky
MACTEC–ERS Project Manager

Date

18 Sept. 01

John Elmer
MACTEC–ERS Engineering Manager

Date

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Acronyms

ACLs	alternate concentration limits
ACWP	actual cost of work performed
AEC	U.S. Atomic Energy Commission
AL	Albuquerque
BCWP	budgeted cost of work performed
BCWS	budgeted cost of work scheduled
BLRA	Baseline Risk Assessment
CAM	cost account manager
CFR	U.S. Code of Federal Regulations
DOE	U.S. Department of Energy
EA	Environmental Assessment
EM–40	Office of Environmental Restoration
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FOS	Facility Operations and Support
FY	fiscal year
GCAP	Ground water Compliance Action Plan
GJO	Grand Junction Office
HQ	Headquarters
IAEA	International Atomic Energy Agency
ITR	Independent technical review
MAP	management action process
MCLs	maximum concentration limits
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PEIS	Programmatic Environmental Impact Statement
RAP	Remedial Action Plan
ROD	Record of Decision
RRM	residual radioactive material
SIP	stabilized in place
SOS	stabilized on site
SOWP	Site Observational Work Plan
TAR	Technical Assistance and Remediation
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act
U.S.C.	United States Code
WBS	work breakdown structure

1.0 Introduction

One of the missions of the U.S. Department of Energy (DOE) is to plan, implement, and complete DOE Environmental Restoration (ER) Programs at facilities that were operated by or in support of the former U.S. Atomic Energy Commission (AEC). These facilities include the 24 inactive processing sites identified as Title I sites in the Uranium Mill Tailings Radiation Control Act (UMTRCA) (42 United States Code [U.S.C.] Section 7901 et seq.). These Title I sites operated from the late 1940s through the 1970s. In UMTRCA, Congress acknowledged the potentially harmful health effects associated with uranium mill tailings and directed DOE to stabilize, dispose of, and control the tailings in a safe and environmentally sound manner. The Uranium Mill Tailings Remedial Action (UMTRA) Surface Project involved cleanup of buildings, tailings, and contaminated soils at the processing sites and any associated vicinity properties. Surface remediation at the processing sites concluded in 1998 with the completion of the Naturita and Maybell, Colorado, sites.

The UMTRA Ground Water Project (project) was authorized in an amendment to UMTRCA (42 U.S.C. Section 7922[a]) when Congress directed DOE to perform ground water remediation at the designated processing sites without a time limitation. Congress also directed DOE to comply with U.S. Environmental Protection Agency (EPA) standards (Title 40 *Code of Federal Regulations* [CFR] Part 192). The final EPA ground water standards pertinent to the project were published on January 11, 1995, (60 Federal Register 2854). The project addresses any contamination derived from a milling operation that is present at levels above EPA standards. The project is funded by the DOE ER Program and is managed by the DOE Grand Junction Office (GJO).

The mission of the project is to implement compliance strategies that will ensure protection of human health and the environment from ground water contaminated by past operations at these 24 sites (Figure 1–1). These sites are located in 10 States and on 4 Native American-owned lands. At many of these former millsites, contaminated ground water is migrating beyond the boundaries of the sites. DOE has controls in place at some of these sites to minimize any potential effects to human health and the environment that could result from this off-site ground water contamination. Results of baseline risk assessments indicate that no one is being adversely affected by use of the contaminated ground water at this time. The U.S. Nuclear Regulatory Commission (NRC), the regulatory agency for the UMTRA Ground Water Project, will ensure DOE compliance with EPA standards. NRC is also authorized to license or to certify the cleanup and closure of the UMTRA Project sites. DOE works in partnership with NRC and the project stakeholders, including States, Native American tribes/nations, local communities, and land owners to complete the project in a timely and cost-effective manner consistent with ER Program priorities.

1.1 Purpose of Management Action Process

The project management action process (MAP) fosters common ground and consensus-building among Federal, State, Native American, and local participants by providing a single, updated document that presents

- The status of the project, including accomplishments and progress completed on tasks.
- A strategy for successful completion of the project.

- The requirements summary, with schedules and costs of both completed and uncompleted activities.
- The identification of project improvement and optimization opportunities.
- A tool for setting priorities for and the sequence for performing work activities.
- A forum for identifying and resolving technical, administrative, or regulatory issues that could impede or enhance the effective on-schedule performance of compliance strategy implementation.
- A vehicle for evaluating alternative compliance strategies and summarizing project and site-specific decisions.

1.2 Organization of the MAP Document

This MAP document is organized into the following sections:

- **Section 1.0** provides a summary of the current status of the project and defines the mission, objectives, and major milestones of the project. This section presents the purpose of this MAP document, organization of the document, and the strategies for implementation of the MAP. This section also identifies key participants and relationships between the UMTRA Ground Water Project and the related but separate Long-Term Surveillance and Maintenance Project, as well as among DOE, NRC, and stakeholders.
- **Section 2.0** provides a summary of each sites characteristics, including local and regional land use setting, and social, economic, cultural, and ecological factors influencing that site. Site-specific information on surface remedial action and ground water contamination is also provided. This section includes a table of environmental conditions at the sites, site maps showing extent of contamination in ground water, and a table that lists the principal constituents of concern at each site.
- **Section 3.0** provides a summary of the current status of each site's ER progress and accomplishments, regulatory compliance, and waste management and material disposition activities. This section presents the status of the public involvement process and the management efforts related to integration of the project tasks in Section 1.0, Introduction.
- **Section 4.0** presents qualitative relative risks for each site that were determined using a revised ranking methodology developed in 1996.
- **Section 5.0** presents the proposed action specified in the Programmatic Environmental Impact Statement (PEIS) and critical performance criteria for measuring the success of the project in implementing the selected strategy. The project is evaluating this approach in response to the recent ITR recommendations addressed in Section 7.0, Issues To Be Resolved.
- **Section 6.0** includes the project master schedule, which is based on the April 19, 2001 Passback update.

- **Section 7.0** identifies the specific technical and administrative issues related to the project.
- **Appendix A** presents a summary of past cost, projected budget information for restoration and compliance actions, and funding requirements by compliance strategy based on the ten year plan budget.
- **Appendix B** lists major ER documents relevant to the project.
- **Appendix C** describes approved and/or pending decision documents.
- **Appendix D** presents site summaries for each of the sites.
- **Appendix E** presents a summary of project controls.

Figures follow the text in each section, as needed.

1.3 Environmental Restoration Objectives

The mission of the project is to eliminate or reduce, to acceptable levels, the potential health and environmental consequences of milling activities by meeting EPA ground water standards set forth in 40 CFR 192, Subpart B. This action is required, in concert with the UMTRA Surface Project cleanup work that is now completed, to allow final NRC concurrence that each processing site is fully compliant with all environmental regulations and protective of human health and the environment.

The prime objectives of the project are to select and implement ground water compliance strategies at each site (including appropriate interim actions) to protect human health and the environment and to fully comply with the EPA ground water cleanup standards in a cost-effective and timely manner. These primary project objectives will be accomplished when NRC concurs with DOE ground water compliance activities at each site.

Primary project objectives include

- Obtain NRC concurrence that compliance with ground water standards has been achieved, according to the requirements of Title 40 CFR Part 192, at processing sites where tailings have been relocated to an off-site disposal cell.
- Complete Title 40 CFR Part 192 ground water compliance activities at processing sites where surface contamination has been stabilized in place or on the site to facilitate the two-step NRC licensing of the site according to the requirements of Title 10 CFR Subsection 40.27.

Secondary project objectives include

- Health and safety objectives

- Conduct project activities in a safe and environmentally sound manner in accordance with the Occupational Safety and Health Administration (OSHA) requirements, EPA standards, and applicable Federal, Native American tribe/nation, and State laws.

- Implement compliance strategies, including any interim actions or institutional controls required in the near term, to ensure that exposure to contaminated ground water is below acceptable limits.

- Regulatory objectives

  - Satisfy National Environmental Policy Act (NEPA) provisions (42 U.S.C. Section 4321 et seq.), as implemented by the Council on Environmental Quality regulations (Title 40 CFR Parts 1500-1508) and DOE guidelines.

  - DOE Order 5400.1

- Public involvement process objectives

  - Conduct a public participation program to encourage stakeholder awareness, understanding, participation, input, and support of the project decision-making process.

  - Maintain a proactive public affairs and community relations program that includes accurate and timely information.

  - Foster cooperation between DOE and affected stakeholders to accomplish the project mission successfully and in a mutually satisfactory manner.

  - Establish required project cooperative agreements with States and Native American tribes/nations.

- Project management objectives

  - Complete the project under budget. The April 2001 DOE–GJO life cycle baseline budget is $171 million.

  - Complete the project in FY 2011. This accelerated schedule is contingent upon obtaining required funding, consensus building with stakeholders, and resolution of technical and programmatic issues. At this time all sites will be transferred to Long-Term Surveillance and Maintenance (LTSM) Program as necessary.

  - Work with NRC and stakeholders to achieve compliance in a cost-effective and expeditious manner.

1.4 Accomplishments

Activities that have been accomplished in prior years and activities that are planned for FY 2001 are described in the following sections.

1.4.1 Activities Accomplished

- **Baseline risk assessments**—Site-specific baseline risk assessments (BLRA), quantifying human and environmental exposures to the site contaminants of concern, have been performed at 20 sites. BLRAs for Slick Rock and Rifle, Colorado, are for two sites each (Appendix B).

- **Site Observational Work Plans**—Final Site Observational Work Plans (SOWPs) have been prepared for 12 sites: Ambrosia Lake and Shiprock New Mexico; Falls City, Texas; Grand Junction, Gunnison, New and Old Rifle, Colorado; Mexican Hat, Utah; Riverton and Spook, Wyoming; and Monument Valley and Tuba City, Arizona. Final SOWP equivalents have been prepared for 4 sites: Maybell, Colorado, Lakeview, Oregon; Canonsburg, Pennsylvania; and Salt Lake City, Utah.

- **Programmatic Environmental Impact Statement**—The PEIS was approved in January 1997 and the Record of Decision was published in April 1997.

- **Decision documents**—The final UMTRA Surface Project Remedial Action Plans (RAP) for Lowman, Idaho, and Mexican Hat, Utah, declared that no ground water contamination resulted from the past activities at the site and that no further UMTRA Ground Water Project action was required for NRC to complete licensing requirements. Ground Water Compliance Action Plans have been approved by the NRC for Ambrosia Lake, New Mexico; Falls City, Texas; Lowman, Idaho; Maybell, Colorado; Salt Lake City, Utah; and Riverton and Spook, Wyoming. Other compliance action plans are in progress.

- **Cooperative agreements**—Cooperative agreements are in place with the states of Colorado and Utah, and the Navajo Nation and Hopi Tribe. A Cooperative Agreement is being negotiated with the state of Oregon.

- **NEPA**—Final NEPA documents have been prepared for Grand Junction, Gunnison, Maybell, New Rifle, and Old Rifle, Colorado; Falls City, Texas; Spook and Riverton, Wyoming; Canonsburg, Pennsylvania; Ambrosia Lake, New Mexico; Salt Lake City, Utah; Tuba City, Arizona; and Lakeview, Oregon.

1.4.2 Scheduled for Completion in FY 2001

Project Management

Tasks identified under the Project Management Subtask provide general management support to all site activities. Categories of tasks include management, public involvement, International Atomic Energy Agency (IAEA) Support, database management, quality assurance, environmental compliance, records, and health and safety.

Management
This task includes task order planning, status reporting, task and resource management, fiscal year and life cycle scheduling and budgeting, and customer interaction. Project Task Orders will be prepared and modifications will be submitted as necessary. Project technical and fiscal performance will be reported weekly and monthly. Long-range plans including the Management Action Process document will be updated as necessary. The Life-Cycle Baseline will be updated

annually. Reports will be prepared tracking total project funding and costs. Frequent meetings will be held with the customer and site leads to discuss project/task status, issues, and upcoming plans. Cooperative agreements will be maintained including payment of invoices and tracking of costs against commitments.

Database Management

The SEE.UMTRA database will be maintained and updated with new data as the data becomes available. The database will be updated to Access 2000 and future program updates will be performed as necessary, such as additional reports, new graphical interfaces, and statistical capabilities. Reports will be produced for incorporation into the data validation packages and data files will be made available to the stakeholders either on diskettes or on the Internet. Site maps will be maintained in GIS and revised with current land survey data and results from new field investigations.

Records

Project records will be identified, bar-coded and filed according to the Project File Index. Updates to the index will be prepared and distributed. The UMTRA Ground Water Library will be maintained. Project records from the UMTRA office in Albuquerque have been added as received. Records will be audited twice a year for completeness and quality.

Public Affairs

Public participation will be encouraged by conducting multiple meetings with key stakeholders and the public. In addition, project documents will be made available to the public as requested. Site-specific public affairs activities will be budgeted within each site.

IAEA Support

MACTEC–ERS is assisting in investigating the "Holistic Approach to Remediating Uranium Mill Tailings and Contaminated Ground Water." A report will be developed which will be the first of three annual reports. The scope of the report will include issues related to remediating uranium mill tailings and contaminated ground water, the relevant elements of the holistic approach; background information, case histories, and a compilation of records related to this topic; synopses of interviews with environmental managers who have successfully completed remedial actions at uranium mill tailing sites; and GJO's plans and approach for performing further research and development of the holistic approach.

Environmental Compliance

Project environmental compliance and reporting activities will be performed in accordance with DOE Order 5400.1. These include negotiating and maintaining access agreements, data reporting requirements, waste management, and interfacing with regulatory agencies.

Quality Assurance

The Quality Assurance Program Plan (QAPP) (DOE 1998) defines the QA requirements and implementing documents for the UMTRA Ground Water Project. The QAPP is based on the GJO QA Program as defined in the GJO *Quality Assurance Standards* manual. The GJO QA Program was developed in response to DOE Order 5700.6C and 10 CFR 830.120. It also incorporates ANSI/ASQC E4-1994, *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs.* The GJO QA requirements have been graded to meet the needs of the project by this QAPP.

The QAPP has been prepared to provide assurance by MACTEC–ERS that the work performed under the Ground Water Project will be of the quality required to satisfy program objectives. The QAPP controls all work performed by MACTEC–ERS under the Ground Water Project. QA requirements will be applied to subcontractors through procurement documents as applicable.

The QAPP will be updated as required to meet the needs of the project. Audits of the Ground Water Project or elements of the project will be performed by QA personnel as necessary to evaluate implementation of and compliance with the requirements of the QA program.

In addition to the QAPP, project work plans will contain data quality objectives for data collection and validation.

Health and Safety

All project activities will comply with applicable health and safety requirements as described in the site-specific work plans. Site-specific surveillance will be performed to ensure compliance with the work plans. Site-specific project safety plans are listed in Table B–1, Appendix B.

Environmental Sciences Laboratory Support

The Environmental Sciences Laboratory (ESL) was established to support site-managed projects with research personnel and laboratory services. Project managers collaborate with ESL personnel to determine solutions to contaminant and long-term stewardship problems.

ESL personnel operate several field test facilities and a mobile laboratory to conduct expedited site characterization that emphasizes an observational approach, and to perform prototype tests for remediation designs. Because many of the projects investigate uranium contamination, the ESL maintains several instruments capable of measuring uranium concentrations at parts-per-billion levels.

Procedures and procedure manuals used by ESL personnel will be updated as needed by the projects. Compliance documents such as protocols, procedures, and the Chemical Hygiene Plan will be updated as needed.

Ground Water Code Revision

A ground-water modeling program using the GANDT computer code, developed by Sandia National Laboratories for the Department of Energy, has been used at two sites while a commercially available program is currently being used at three sites. There are advantages to using both codes; however, the Project would benefit by combining these advantages into one program. Therefore, the GANDT code will be revised to incorporate MODFLOW and MT3DMS as the flow and transport codes, respectively. A subcontract has been established to revise the GANDT code as required.

The new program will provide industry-accepted code for flow and transport, as well as provide source-term simulations and uncertainty analysis of the current GANDT code. The new code will be distributed under the name GANDT 2.0 and will be available on the UMTRA Ground Water Project web site.

The new code shall retain current GANDT features as follows:

- Conditioning of hydraulic conductivity, hydraulic head, and solute transport data to model simulations;
- Uncertainty analysis using Latin Hypercube Sampling (LHS) and Monte Carlo techniques; and
- Source-term simulation through the unsaturated zone into the underlying aquifer using the MULTIMED code.

Important new features of GANDT 2.0 shall include the following:

- A user-friendly interface based on a Windows environment (98, 2000, NT),
- Flow modeling incorporating the USGS MODFLOW code, and
- Transport modeling incorporating the MT3DMS code.

A graphical user interface (GUI) will be incorporated into GANDT 2.0. The GUI shall allow the user to export report ready figures and tables.

GANDT 2.0 also shall incorporate the following diagnostic features:

1. Automated check for validity of numerical formats during data input;
2. If rum-time errors occur during program execution, the run-time error messages shall be displayed on the screen;
3. All standard ASCII outputs from MODFLOW and MT3DMS shall be written as a part of program execution.

Gunnison

Institutional Controls
Support will be provided to DOE to secure a viable and enforceable institutional control as part of the compliance strategy for the natural flushing alternative.

SOWP
The Site Observational Work Plan (SOWP) will be finalized after receiving state of Colorado and NRC comments.

EA/FONSI
An Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) will be finalized after receiving public comment.

GCAP
The draft Ground Water Compliance Action plan (GCAP) will be completed after receiving NRC and State comments. A geochemical source evaluation, decommissioning of wells, and a pilot study work plan will be performed.

LTMP
After NRC concurrence on the GCAP, the Long Term Surveillance Management Plan (LTMP) will be prepared for review and approval.

Grand Junction

Institutional Controls
An audit to verify the viability of the institutional control will be performed.

Lakeview

LTMP
After NRC concurrence on the GCAP, an LTMP will be prepared for review and approval.

Institutional Controls
Support will be provided to DOE for establishment of institutional controls and provision of an alternate water supply.

Monument Valley

Alternate Water Supply
A level of effort oversight support is being provided to assist the Navajo Nation in the design and construction of an alternate water supply to provide drinking water for the Cane Valley community. DOE is providing funding for a new well in the De Chelly aquifer and construction of the main 8-inch line from the well to the former millsite.

Power Line
A level of effort oversight support will be provided to assist the Navajo Nation in the design and construction of an electrical power line to provide service to support the remedial action.

Phase I Subpile Soil Remediation
Ammonium depletion, plant productivity, and nitrate uptake will continue to be monitored in *Atriplex* planted in the contaminated subpile soils area.

Shiprock

SOWP
The draft final SOWP Rev. 2 is being revised based on stakeholder reviews and the final SOWP will be completed. Formal responses to comments will be prepared and incorporated into the GCAP.

EA
An Environmental Assessment (EA) will be completed that documents the environmental impacts associated with the proposed compliance strategy(ies). The draft EA will be revised based on comments received and the final EA will be approved by DOE.

FONSI
Preparation of the Finding of No Significant Impact (FONSI) will be finalized in FY 2001 after the EA is approved. The FONSI will be reviewed by DOE and the stakeholders, then revised and approved by DOE before being published in the Federal Register.

GCAP
Preparation of the draft Ground Water Compliance Action Plan (GCAP) will be completed. This document will contain the necessary elements for the NRC and Navajo Nation to concur on the selection of the proposed compliance strategies.

NABIR Support
The NABIR program will be supported as needed.

Interim Actions
Interim actions will be maintained in Bob Lee Wash, Many Devils Wash, and flood plain seeps.

Rifle

Remedial Actions
The ZVI prototype testing will be completed, the test data will be evaluated and a final design will be selected. The full-scale vanadium pilot study will continue for 6 months with a follow-up second phase planned using lixiviant. Data from samples and field observations will be analyzed and the flow and transport model will be updated. The extraction will be optimized to reduce the maximum vanadium concentration in the "hot spot" to a level that will eventually be below the ACL after 100 years of natural flushing.

Wetland Monitoring
On-going monitoring at the New Rifle mitigation wetland will continue under this task. Activities to demonstrate compliance with the COE 404 permit will be performed. An annual monitoring report will be completed and submitted to the DOE for Army Corps of Engineer concurrence.

Institutional Controls
Support will be provided to DOE to secure a viable and enforceable institutional control as part of the compliance strategy for the natural flushing alternative

Tuba City

Remedial Action
The Phase I remediation system will be operated and maintained. The system includes the extraction and reinjection well fields and French drain, treatment system, evaporation pond, and infrastructure. A lessons-learned document will be prepared resulting from problems related to start up of the treatment system. As-built drawings will be prepared of the Phase I system.

Additional injection wells will be installed and a telemetry system for the monitoring wells will be designed and installed to automate data collection. Well locations for Phase II will be optimized.

Construction
A shop building will be constructed to house equipment, tools, and supplies. Modifications will be made on the control building and the area surrounding the treatment compound will be landscaped.

Durango

Field Investigations
Field investigations will be completed and the data evaluated. A flow and transport model will be developed using the new version of GANDT (GANDT 2.0). Verification sampling will be conducted.

SOWP
A draft Site Observational Work Plan (SOWP) will be prepared for DOE review.

PeRT Wall
Permeable reactive barriers at the Bodo Canyon Disposal site will continue to be monitored to determine their effectiveness in treating contaminated water coming from the tailings. Monthly inspections and quarterly sampling will continue on Cell E. Material in Cell D will be changed out to allow evaluation of a different reactive material. Tests on liquids capable of rejuvenating ZVI materials will be evaluated and tested on Cell E. An annual report and a publication will be prepared.

Slick Rock

Field Investigations
Field investigations will be completed and the data evaluated. A flow and transport model will be developed using GANDT 2.0.

SOWP
A draft Site Observational Work Plan (SOWP) will be prepared for DOE review.

Green River

Field Investigations
A work plan describing the site conditions, targeted compliance strategies, data gaps, and data quality objectives will be prepared to conduct field investigations.

Naturita

SOWP
Support will be provided to USGS to complete data analysis and flow and transport modeling. A draft SOWP will be prepared based on previous investigations conducted by USGS.

Annual Ground Water Monitoring

A sampling and analysis plan work order (SAPWK) will be developed as required by the TAR Contractor prior to initiating field sampling. The schedule will be based on sampling frequency identified below and presented in *UMTRA Ground Water Project, FY 2001 Sampling Frequencies and Analysis*. Access to monitor wells will be verified prior to initiating field activities. MACTEC–ERS will verify and validate inorganic and radiochemical water quality data that are acquired in the field or received from the FOS laboratory. An annual review and update as necessary of water sampling and analysis plans for each site shall be completed.

The deliverable products will include the following:

- Sampling and analysis plan work order
- Monitor well access status summary
- Sample collection with chain of custody
- Completion of a validated data package four (4) weeks or less after receipt in the database of the data analysis from the FOS Contractor

1.5 Project Team

The project is managed by the Grand Junction Office of DOE, reporting to the UMTRA Project Office in Albuquerque. Table 1–1 lists project team members and key participants.

1.6 Organizational Interfaces

Table 1–2 shows the roles and responsibilities of each organization. Table 1–3 presents DOE and contractor responsibilities for the programmatic and technical tasks. Many tasks are shared by both organizations to facilitate efficient implementation. Figure 1–2 presents DOE organizational interfaces for the UMTRA Ground Water Project. Figure 1–3 presents the contractor organization chart.

1.7 Status of Management Action Process

The MAP establishes an efficient and comprehensive means for DOE to provide direction at this formative stage, and throughout the remainder of the project life cycle, to ensure successful attainment of the project objectives. The MAP document will be updated annually.

1.8 Strategy for Management Action Process

The project team will meet regularly to review the projects progression through the MAP and to address individual issues as well as the overall strategy. As directed in the MAP guidance document, the project has completed step one, "The Development of the Straw Document," and step two, "The Identification of The Project Team" (DOE 1996a).

Step three, "Project Review," is largely centered on the recent ITR recommendations. The responses to this teams report have been developed as part of the MAP and, when coupled with the ITR report, will serve as the basis for the project review.

Step four, "Compile and Adopt Recommendations," has been documented in the response to the ITR report as incorporated into the MAP document.

Step five, "Assemble and Write Your MAP Document," has proceeded to the preparation of this MAP document, which proposes approaches for resolving issues.

Step six, "Execution of Process and Maintenance of the MAP Document," is an ongoing process and will be performed by the project team who will review and summarize the status of the project to ensure key issues are resolved in a timely manner. This group will identify those issues and propose solutions for annual MAP document updates.

Table 1–1. Project Team

Organization	Name	Role/Responsibility	Telephone
DOE–ID	**TDB**		
DOE–GJO	Donna Bergman-Tabbert Ray Plieness	Grand Junction Office, Manager Grand Junction Office, Deputy Manager	(970) 248-6001 (970) 248-6091
Project Team			
DOE–HQ	Paul Beam	HQ Program Manager	(301) 903-8133
DOE–GJO	Donald Metzler	Program Manager	(970) 248-7612
Contractor	John Elmer Sam Marutzky	Manager Engineering/Geosciences Project Manager	(970) 248-6356 (970) 248-6059
Matrix Support			
DOE–GJO	Audrey Berry Vernon Cromwell Gail Majors Chris Pennal Tracy Plessinger	Public Affairs Health and Safety Budget Analyst Program Analyst Environmental Compliance Manager	(970) 248-7727 (970) 248-7735 (970) 248-6010 (970) 248-6011 (970) 248-6197
Stakeholder Representatives			
Colorado	Jeff Deckler Wendy Naugle	Colorado Department of Public Health and Environment	(303) 692-3387 (303) 692-3394
New Mexico	Marcy Leavitt Scott McKitrick	New Mexico Ground Water Protection & Remediation Bureau Ground Water Section	(505) 827-0219 (505) 827-2895
Oregon	David Stewart-Smith	Oregon State Dept. of Energy	(503) 378-6469
Pennsylvania	James G. Yusko	Dept. of Environmental Protection	(412) 442-4000
Texas	Gary Smith Bruce Calder	Texas Department of Health - Bureau of Radiation Control	(512) 834-6688 (512) 834-6688
Utah	Rob Herbert	Utah Dept. of Environmental Quality, Div. Radiation Control	(801) 536-0046
Wyoming	John Erickson Roberta Hoy	Wyoming Dept. Of Environmental Quality	(307) 332-3047 (307) 777-5922
Hopi Tribe	Norman Honie Dorcie Ahownewa	Office of Mining & Mineral Resources Office of Mining & Mineral Resources	(520) 734-2441 (520) 734-7140
Navajo Nation	Madeline Roanhorse Raymond Russell	Director, Navajo UMTRA Program Asst. Dir., Navajo UMTRA Program	(520) 871-6982 (520) 871-6982
Arapaho-Shoshone Tribes	Don Aragon	Northern Arapaho-Shoshone Tribes	(307) 332-3164
Nuclear Regulatory Commission	Mike Layton William Von Till	Nuclear Materials Safety & Safeguards Nuclear Materials Safety & Safeguards	(301) 415-6676 (301) 415-6251

Table 1–2. Organization Functions

Organization	Role/Responsibility
DOE–HQ	Provides funding and overall project guidance.
DOE–ID	Provides GJO funding, support, and direction to implement project guidance.
DOE–GJO core team	Provides project management and implementation, develops and implements compliance strategies and project scope, oversees contracts, establishes milestones and stakeholder agreements, and provides interface with the public.
GJO TAR and FOS contractors	Provide technical and management staff to perform project activities, as tasked.
NRC	Provides project regulatory oversight.
EPA	Establishes compliance and remediation standards.
Native American tribes/nations and States	Participate in project activities, review and comment on documents, implement institutional controls, provide stakeholder consideration, and perform other responsibilities as will be outlined in model cooperative agreement that is under development.

Table 1–3. Responsibilities Matrix

Activity	2000	2002
Programmatic Tasks		
Define scope, budget, schedules, resources	D,C	D,C
Maintain PBS	C	C
Procure funding	D	D
Monitor performance	D,C	D,C
Coordinate activities with stakeholders	D,C	D,C
Negotiate cooperative agreements	D	D
Manage NEPA process	D,C	D,C
Acquire permits/access agreements	C	C
Technical Tasks		
Develop SOWPs	C	C
Conduct field investigations	C	C
Evaluate data	C	C
Prepare work plans	C	C
Prepare NEPA documentation	C	C
Prepare GCAPs	C	C
Construct remedial systems	C	C
Perform monitoring	C	C
Maintain database	C	C
Procure subcontracts	C	D,C

D = DOE; C= contractor

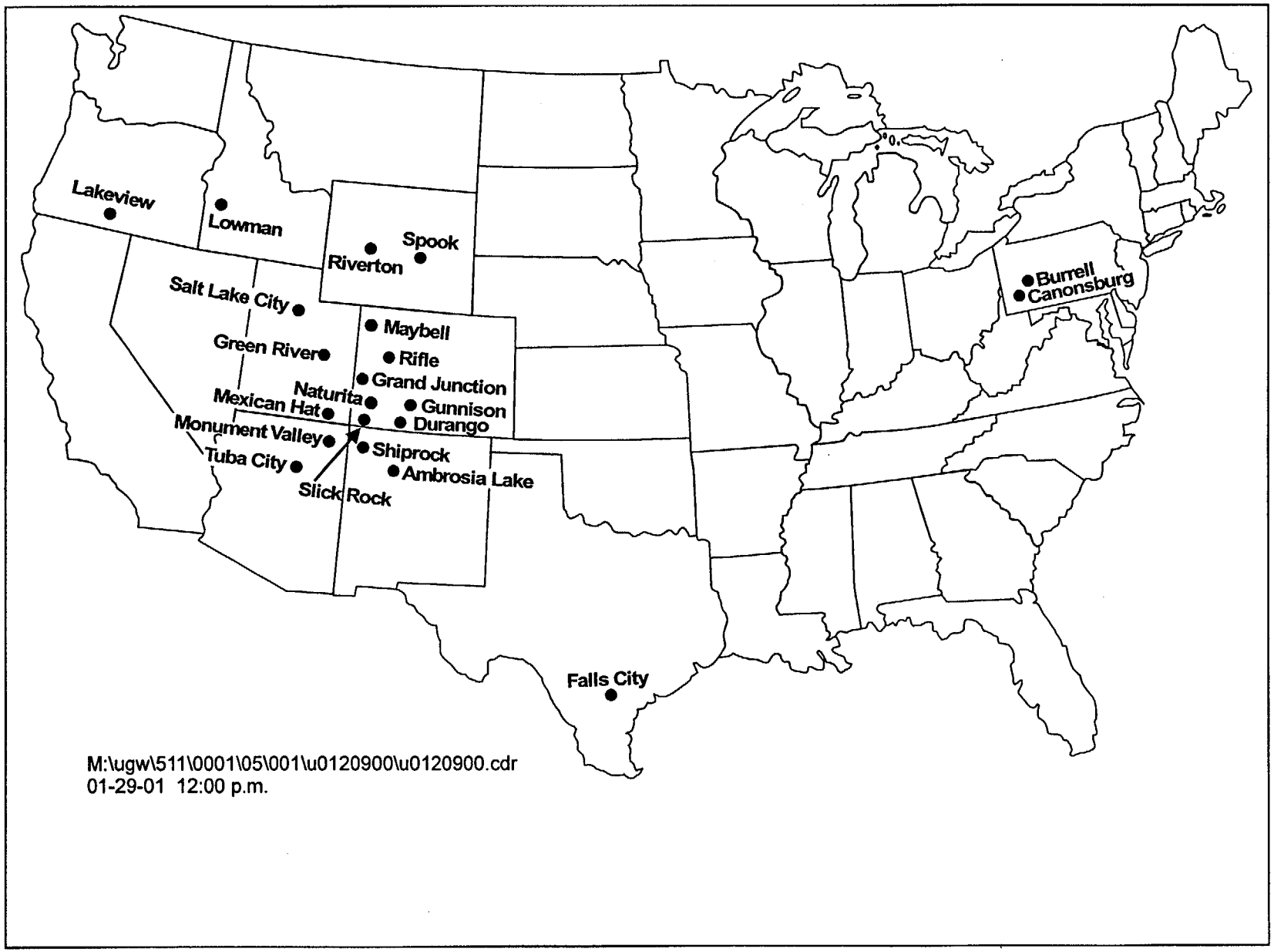

Figure 1–1. Locations of Title 1 Sites

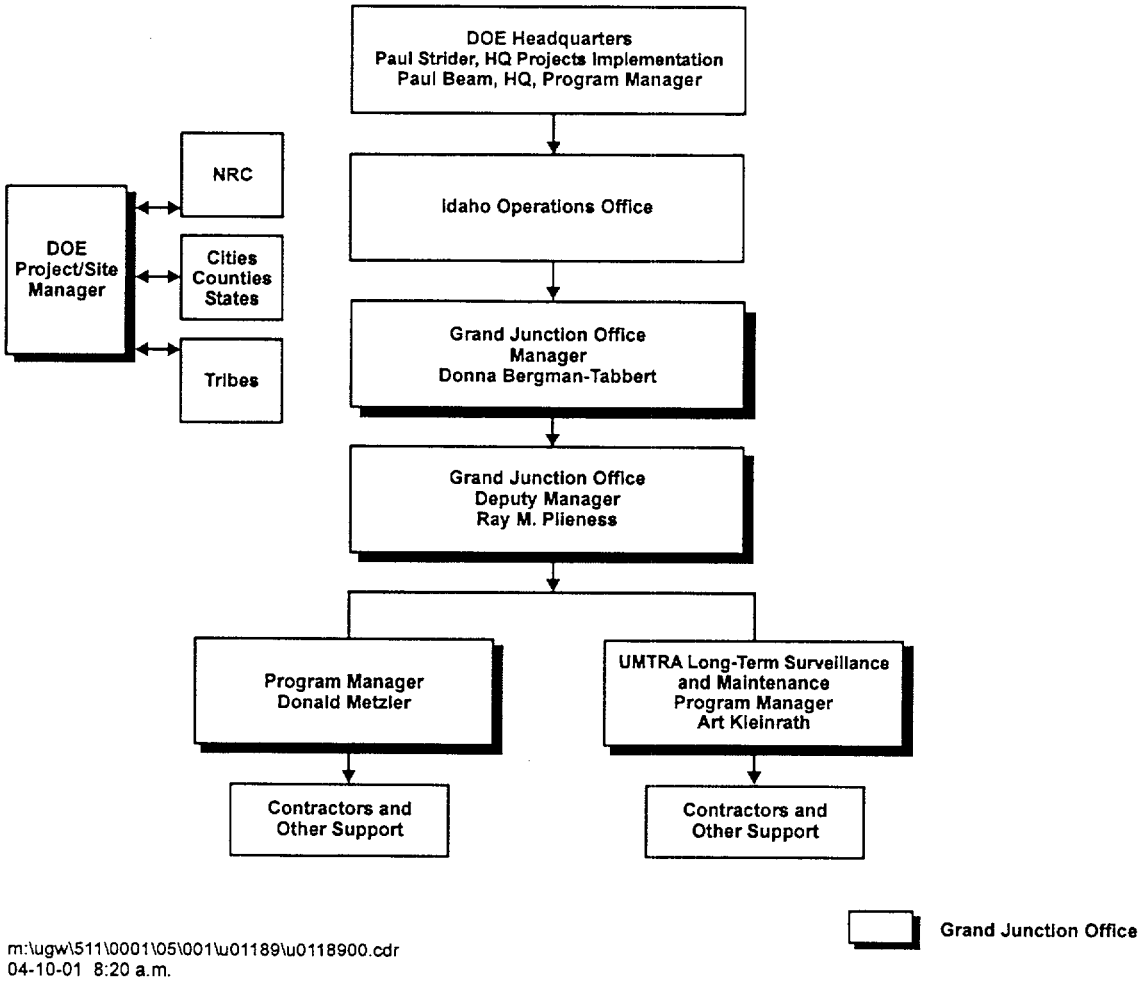

Figure 1–2. DOE Organizational Interfaces for UMTRA Ground Water Project

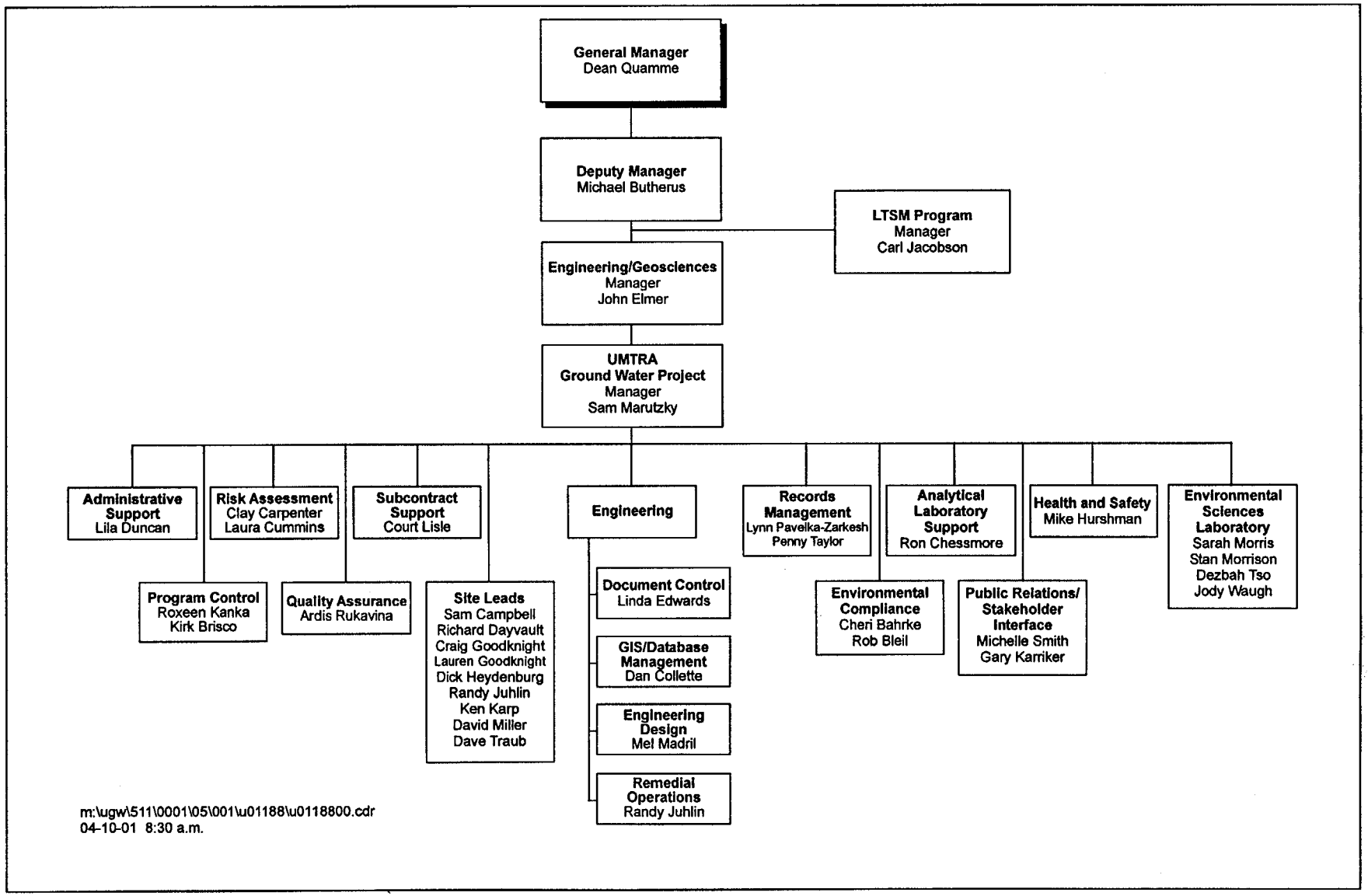

Figure 1–3. Contractor Organization Chart

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2.0 Site Descriptions and Comprehensive Planning

2.1 Operational History

The 24 sites designated under Title I of UMTRCA were active in the production of uranium for use by the AEC from the 1940s through the 1970s. The sites received ore from a variety of sources and provided various concentrates of uranium to the AEC. DOE started the cleanup of surface contamination at the UMTRA sites beginning with Canonsburg, Pennsylvania, in 1983 and concluded site surface cleanup activities with the Naturita, Colorado, site in 1998.

DOE intends to complete implementation of all required compliance strategies at the UMTRA sites, addressing any human health and environmental risks associated with the cumulative estimated 10 billion gallons (gal) (3.8 billion liters [L]) of contaminated ground water, no later than FY 2011 to facilitate subsequent NRC licensing of the sites.

The UMTRA Surface Project removed or encapsulated the bulk of the source term contributing to ground water contamination at the processing sites. The tailings and other residual radioactive materials (RRM) were disposed of in one of three methods, on the basis of site-specific considerations. The following summaries present the relationship between the UMTRA Surface Project disposal methods and the NRC licensing procedures, which together define the requirements of the follow-on UMTRA Ground Water Project at the processing sites.

One-Step Licensing by the NRC—Relocated sites are processing sites from which tailings and RRM are removed to an off-site disposal cell. Off-site disposal cells (not the processing sites) are licensed by NRC soon after closure. However, compliance with EPA ground water standards at the processing sites requires NRC concurrence.

Two-Step Licensing by the NRC—Stabilized-in-place (SIP) sites are processing sites at which tailings and RRM were left in place, contoured, and covered; stabilized-on-site (SOS) sites are processing sites at which tailings and RRM were moved to another location within the original site boundary. Licensing at these sites involves initial NRC acceptance of the long-term care program for the surface remedial action at these processing sites, with subsequent DOE verification, and NRC concurrence that ground water compliance has been met.

Table 2–1 lists surface remedial action data (dates of completion, disposal options, acreages, and volumes of contaminated materials) and the amount of existing contaminated ground water at the 24 UMTRA Project sites.

2.2 Environmental Setting

The 24 Title I sites are located in 10 States (Figure 1–1) and on 4 Native American tribe/nation lands. Table 2–2 lists the key features of the environmental setting of each processing site.

Table 2–1. History of Project Operation

UMTRA Project Site	UMTRA Surface Project Data					Estimated Amount of Contaminated Ground Water (millions of gallons)
	Processing Site Remedial Action Completion Date	On-Site Disposal (SIP/SOS)	Off-Site Disposal (relocated)	Cubic Yards of Contaminated Material (thousands)	Contaminated Land (acres)	
Ambrosia Lake, NM	6-95	√		5,162	612	320
Belfield, ND[a]	N/A			58	31	4.7
Bowman, ND[a]	N/A			100	71	58
Canonsburg, Pa[b]	12-85	√		265	79	5.3
Durango, CO	5-91		√	2,533	127	100
Falls City, TX	7-94	√		6,019	593	1,200
Grand Junction, CO	8-94		√	4,425	114	330
Green River, UT	12-89	√		382	48	180
Gunnison, CO	12-95		√	796	68	1,100
Lakeview, OR	10-89		√	944	116	1,200
Lowman, ID	6-92	√		126	30	0
Maybell, CO	12-96	√		4,100	214	230
Mexican Hat, UT	2-95	√		2,558	250	110
Monument Valley, AZ	3-94		√	925	83	1,200
Naturita, CO	10-98		√	399	247	100
New Rifle, CO	7-96		√	3,096	238	600
Old Rifle, CO	7-96		√	661	88	70
Riverton, WY	9-90		√	1,793	140	500
Salt Lake City, UT	6-89		√	2,710	128	350
Shiprock, NM	9-86	√		2,800	130	190
Slick Rock, CO (UC)	12-96		√	547	92	26
Slick Rock, CO (NC)	12-96		√	85	47	12
Spook, WY	9-89	√		315	21	1,000
Tuba City, AZ	5-90	√		1,631	327	1,700
Total		10	12	42,430	3,894	10,586

Table 2-2. Environmental Setting and Current Land Use

UMTRA Project Site	Current Land Use				Site Characteristics				
	Tribe/Nation	Urban	Suburban	Rural	Annual Precipitation (inches)	Wetlands	Surface Water	Cultural Resources	Threatened and Endangered Species
Ambrosia Lake, NM				√	9			√	
Belfield, ND			√		16	√	√	√	
Bowman, ND				√	16	√	√	√	√
Canonsburg, PA		√			37		√	√	
Durango, Co			√		19		√		√
Falls City, TX				√	30	√	√		√
Grand Junction, CO		√			8	√	√		√
Green River, UT				√	6		√	√	
Gunnison, CO			√		11	√	√		√
Lakeview, OR			√		17	√	√		
Lowman, ID				√	27	√	√		
Maybell, CO				√	13	√	√	√	√
Mexican Hat, UT	√			√	6	√	√		
Monument Valley, AZ	√			√	6	√	√	√	
Naturita, CO				√	9	√	√	√	√
New Rifle, CO			√		11	√	√		√
Old Rifle, CO			√		11	√	√		√
Riverton, WY	√			√	8	√	√	√	
Salt Lake City, UT		√			15	√	√		
Shiprock, NM	√		√		6	√	√		√
Slick Rock, CO (Union Carbide)				√	7	√	√	√	√
Slick Rock, CO (North Continent)				√	7	√	√	√	√
Spook, WY				√	11		√		√
Tuba City, AZ	√			√	6				
Total	5	3	7	14		18	22	11	13

Past processing site operations have resulted in ground water contamination. EPA has established maximum concentration limits (MCLs) for certain hazardous constituents in ground water contaminated by uranium processing. Table 2–3 lists the constituents that have exceeded MCLs in ground water at each site. Figures 2–1 through 2–17 present the extent of contaminant migration at processing sites as shown by the concentrations of indicator constituents in ground water. Site-specific UMTRA Surface Project RAPs and UMTRA Ground Water Project BLRAs and SOWPs contain more information about the environmental setting for each site.

2.3 Current Site and Adjacent Land Uses

Portions of the SIP and SOS sites are restricted for current and future use because of the siting of the disposal cells used in the cleanup of the surface. Access to these sites is restricted. At relocated sites, the goal is to release the former processing sites for unrestricted use. One site (Grand Junction, Colorado) has been returned to the local community for the development of a park. The other sites will be returned to Native Americans, private property holders, or States. Currently, private properties adjacent to the site under which the contaminated ground water plumes have migrated have no institutional or engineering controls in place to ensure that inappropriate ground water use does not occur. Table 2–2 lists the current land uses at these sites and their surrounding areas.

2.4 Facilities, Infrastructure, and Equipment

The project does not possess any facilities, infrastructure, or equipment as envisioned in the guidance document. Minimal equipment in the form of automatic data processing equipment (personal computers) has been purchased by the project as well as water sampling equipment, vehicles, and supplies.

2.5 Influencing Factors

A number of factors may potentially influence the planning and implementation of the project:

- **Economic Factors**—The UMTRA Ground Water Project will provide less benefit to local economies than the UMTRA Surface Project. By removing a local nuisance and potential health hazard (the tailings sites) and creating numerous construction jobs, the UMTRA Surface Project served as an economic stimulus to many of the affected communities. Community support based on economic stimulus is not likely to be as strong for the Ground Water Project.

  Funding for the UMTRA Ground Water Project is an element of the annual DOE ER budget request to Congress. Under UMTRCA, States are required to provide cost-sharing funds for remedial actions at the sites. Therefore, the continued progress of the project is subject to appropriations from separate government agencies. Contingency plans may be advisable to address potential funding shortfalls to ensure the project progress is not jeopardized.

Table 2–3. Environmental Condition of Ground Water

UMTRA Project Site	Off-Site Migration	Constituents Exceeding Maximum Concentration Limits[a]											
		Arsenic	Cadmium	Chromium	Lead	Mercury	Molyb-denum	Net Gross Alpha	Nitrate	Radium-226/228	Selenium	Silver	Uranium
Ambrosia Lake, NM	√						√	√	√		√		√
Belfield, ND[b]	N/A												
Bowman, ND[b]	N/A												
Canonsburg, PA								√					√
Durango, CO			√		√		√	√			√		√
Falls City, TX	√	√	√			√	√	√	√	√	√		√
Grand Junction, CO	√						√	√			√		√
Green River, UT	√						√	√	√	√	√		√
Gunnison, CO	√	√						√					√
Lakeview, OR	√	√					√	√					
Lowman, ID[b]	N/A												
Maybell, CO		√	√				√	√	√	√			√
Mexican Hat, UT[d]	√	√		√			√	√					
Monument Valley, AZ	√							√	√		√		√
Naturita, CO	√						√	√					√
New Rifle, CO	√	√	√				√	√	√		√		√
Old Rifle, CO	√						√	√		√	√		√
Riverton, WY	√				√		√	√					√
Salt Lake City, UT	√	√					√	√			√		√
Shiprock, NM	√		√				√	√	√	√	√		√
Slick Rock, CO (Union Carbide)	√						√	√	√		√		√
Slick Rock, CO (North Continent)	√							√					√
Spook, WY[c]	√		√	√			√	√	√	√	√	√	√
Tuba City, AZ	√						√	√	√	√	√		√
Total	18	7	6	2	3	1	17	21	10	7	13	1	19

[a] Constituents with exceedances of Title 40 CFR Part 192 maximum concentration limits during at least two sampling rounds in ground water samples from wells on or downgradient of UMTRA Project processing sites, 1990 to 2000. Some of the constituents that exceed the maximum concentration limits may reflect naturally occurring conditions unrelated to uranium milling activities.
[b] The designated uranium millsites at Belfield and Bowman, North Dakota, will not be remediated by DOE because the State of North Dakota has declined to provide the statutorily required cost-share funds to remediate the sites. The Lowman, Idaho, site has no ground water contamination.
[c] Data from 1987-1988 sampling rounds.
[d] Perched water above uppermost aquifer.
N/A - not applicable.

Social Factors—At many of the processing sites where the visible surface remedial action has been completed, the surrounding communities are anxious to start developing the sites and adjacent properties. However, if the underlying ground water is not acceptable for unrestricted use, the desire of the communities may be counter to the DOE requirement to ensure protection of human health and the environment. Development considerations will become an increasing consideration in the compliance-strategy implementation and priority-setting aspects of the project.

Cultural Factors—The majority of the sites are located in arid environments with ground water resources relatively undeveloped and/or of critical cultural importance for continuation of traditional land uses in the West. Contaminated ground water has migrated beneath and beyond the boundaries of off-site properties at most of the sites, including Native American tribe/nation lands at five sites. Cultural factors may become an increasing consideration in the compliance-strategy implementation and priority-setting aspects of the project.

Environmental Factors—A critical consideration is the environmental impacts associated with the continued off-site migration of contaminants, which increases the size of the contaminant plume.

Regulatory Factors—The successful progress and completion of the project requires that DOE gain NRC and stakeholder approval of the PEIS, site-specific Environmental Assessment (EA), and selected compliance strategies. It is appropriate that (1) cooperative agreements be negotiated and approved in a timely fashion; (2) that the primacy of guiding regulations (Federal, State, and local) be consistently assessed should alternate concentration limits (ACLs) or supplemental standards (according to Title 40 CFR Part 192, Subpart B) be considered at some sites; and (3) that there is assurance that any compliance strategy which includes institutional controls be capable of implementation by the cognizant State, Native American tribe/nation, or local governing agency for the period of time required.

Technical Factors—Restoration of ground water to cleanup standards may not be practical with current technologies.

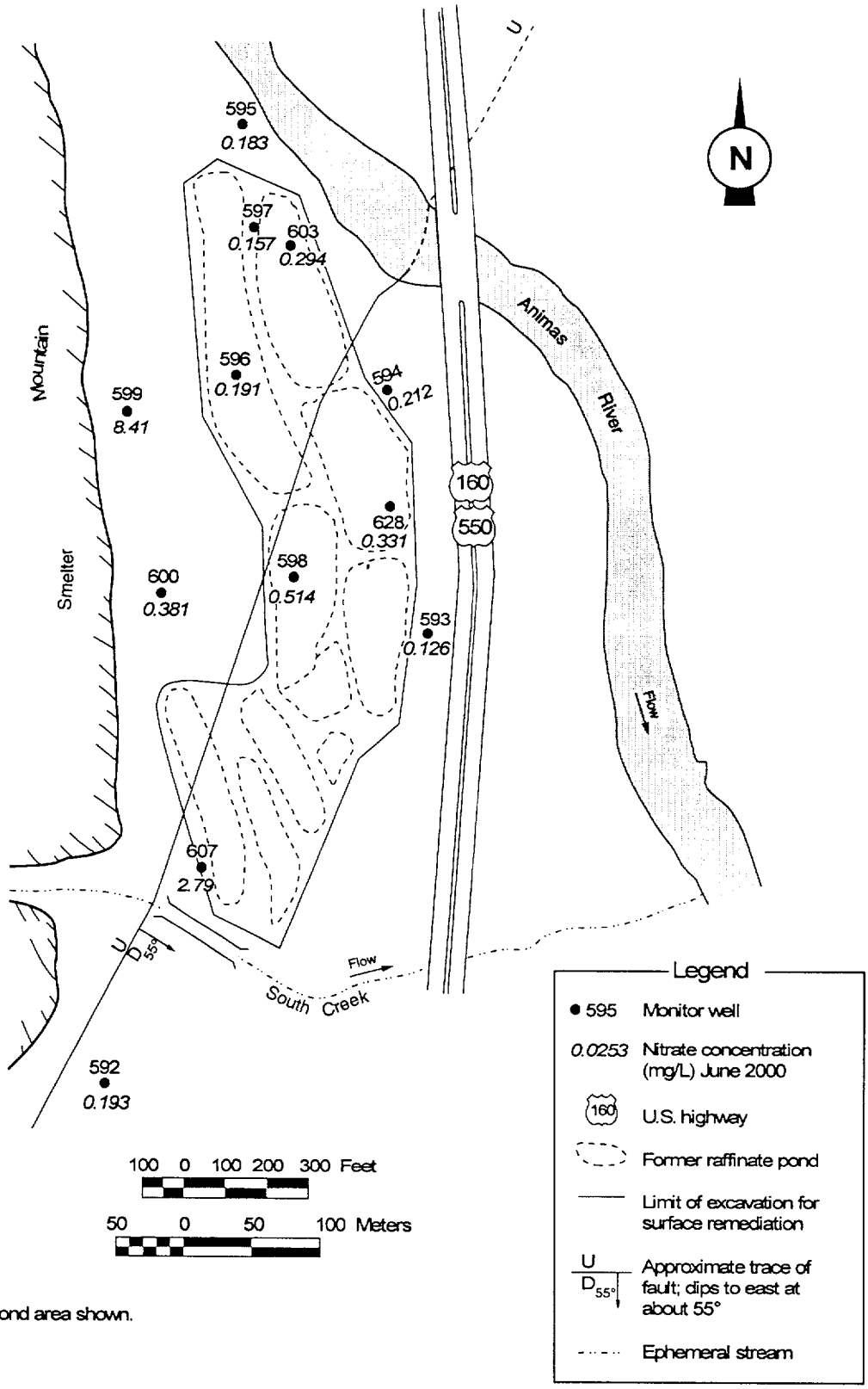
Other Factors—Institutional controls, such as deed restrictions to control, limit, or prohibit use of contaminated ground water, may be an important component of the final compliance strategy at several of the sites. Implementation and enforcement of institutional controls and statutory or codified restrictions on private land and resource uses may be difficult to obtain. The States, Native American tribes/nations, and/or local governments would be important players in implementing and enforcing this potential compliance strategy at the sites. However, the practicality and enforceability of institutional controls may have to be determined on a case-by-case basis.

2.6 Future Uses of Land, Facilities, and Equipment

The use of surrounding lands is also a concern from the perspective that plumes at most sites have already migrated off site. The impact to the project of having contamination affecting private property or Native American lands is far greater than having the plumes migrate onto publicly held lands. The project cleanup criteria are prescriptive and are largely independent of land use. The current and potential future uses of the land will have to be evaluated when assessing the prioritization of the site activities as well as the implementation of institutional

controls. At sites where the surface disposal cell is on the site (SIP or SOS sites), future land use will be limited by the presence of the disposal cell. Sites where the tailings and other RRM were removed may be returned to States, Native American tribes/nations, or private landowners. In some cases, this transfer of ownership was completed before ground water activities at the site were concluded. Sites located on Native American lands will remain the property of the tribes/nations.

The project does not anticipate leaving any substantial quantity of equipment or facilities that are government owned or operated in place at the end of the project. Alternative water-supply systems or other facilities would be left in place, but ownership is expected to be transferred from DOE to another entity before the project is completed.



Note: Raffinate pond area shown.

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Figure 2–1. Nitrate Concentrations in Ground Water at Raffinate Pond Area at Durango, Colorado, Site (Datum: June 2000)

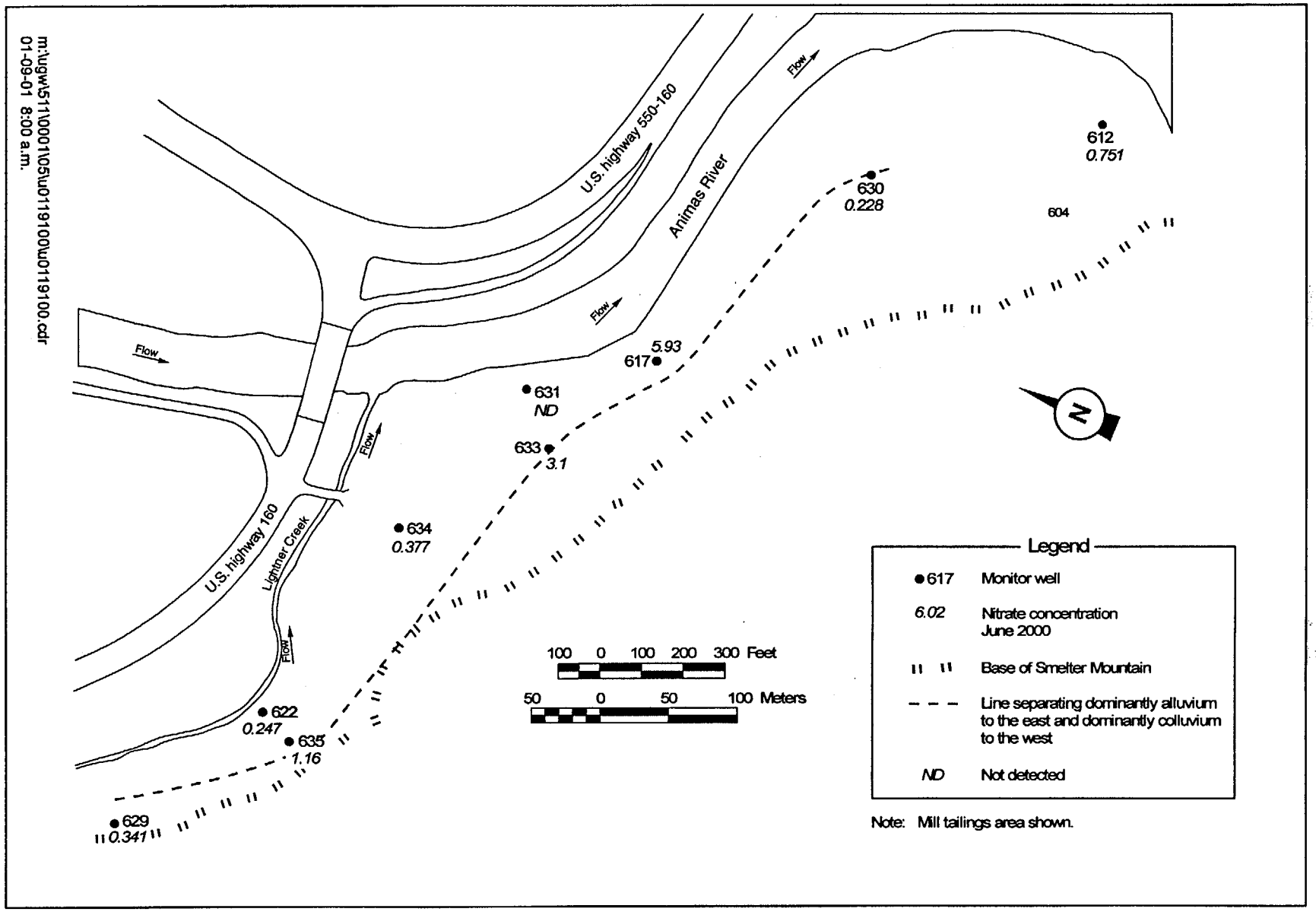

Figure 2–2. Nitrate Concentrations in Millsite Ground Water at Durango, Colorado, Site (Datum: June 2000)

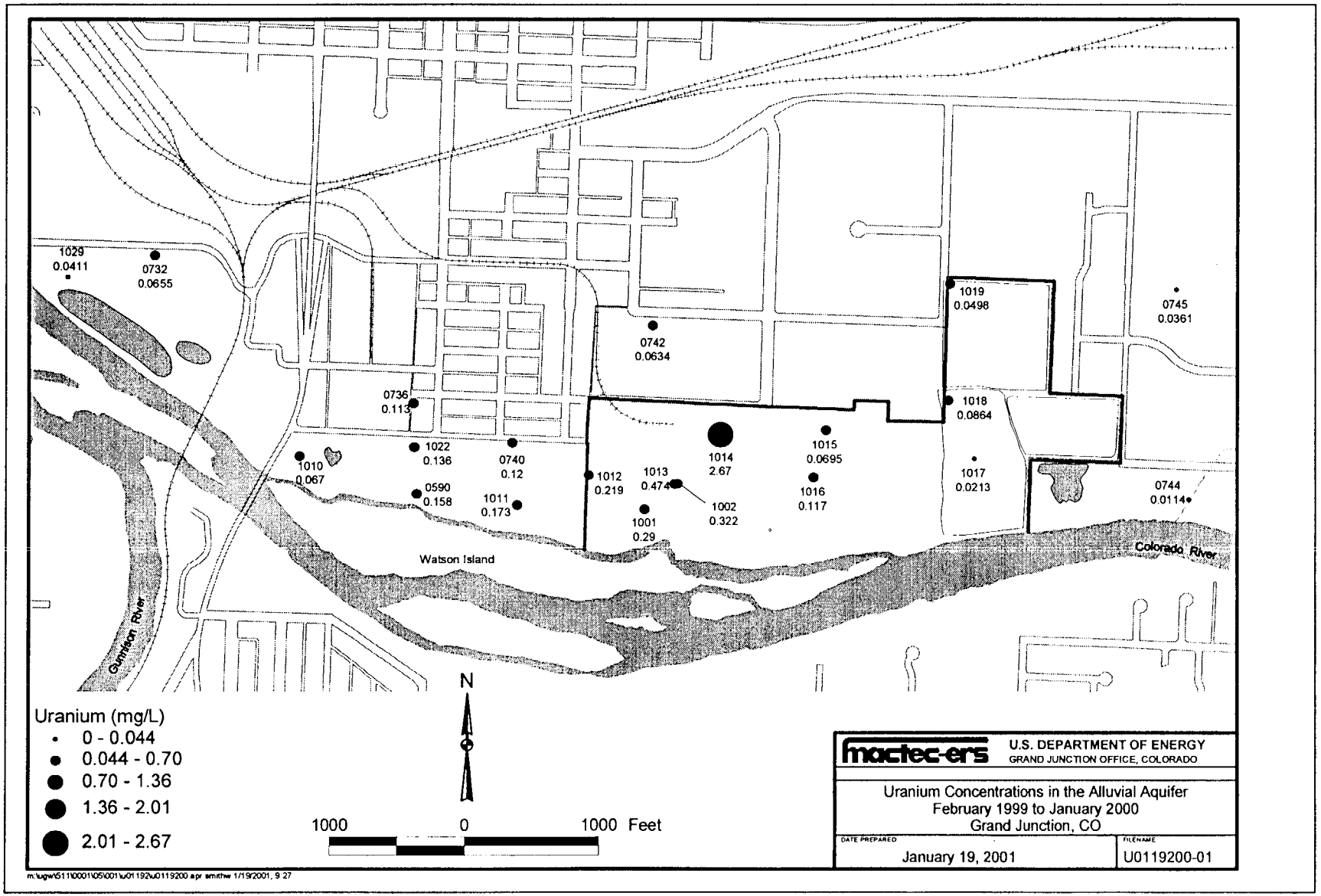

Figure 2–3. Uranium Concentrations in the Alluvial Aquifer Ground Water at Grand Junction, Colorado, Site (Datum: February 1999 to January 2000)

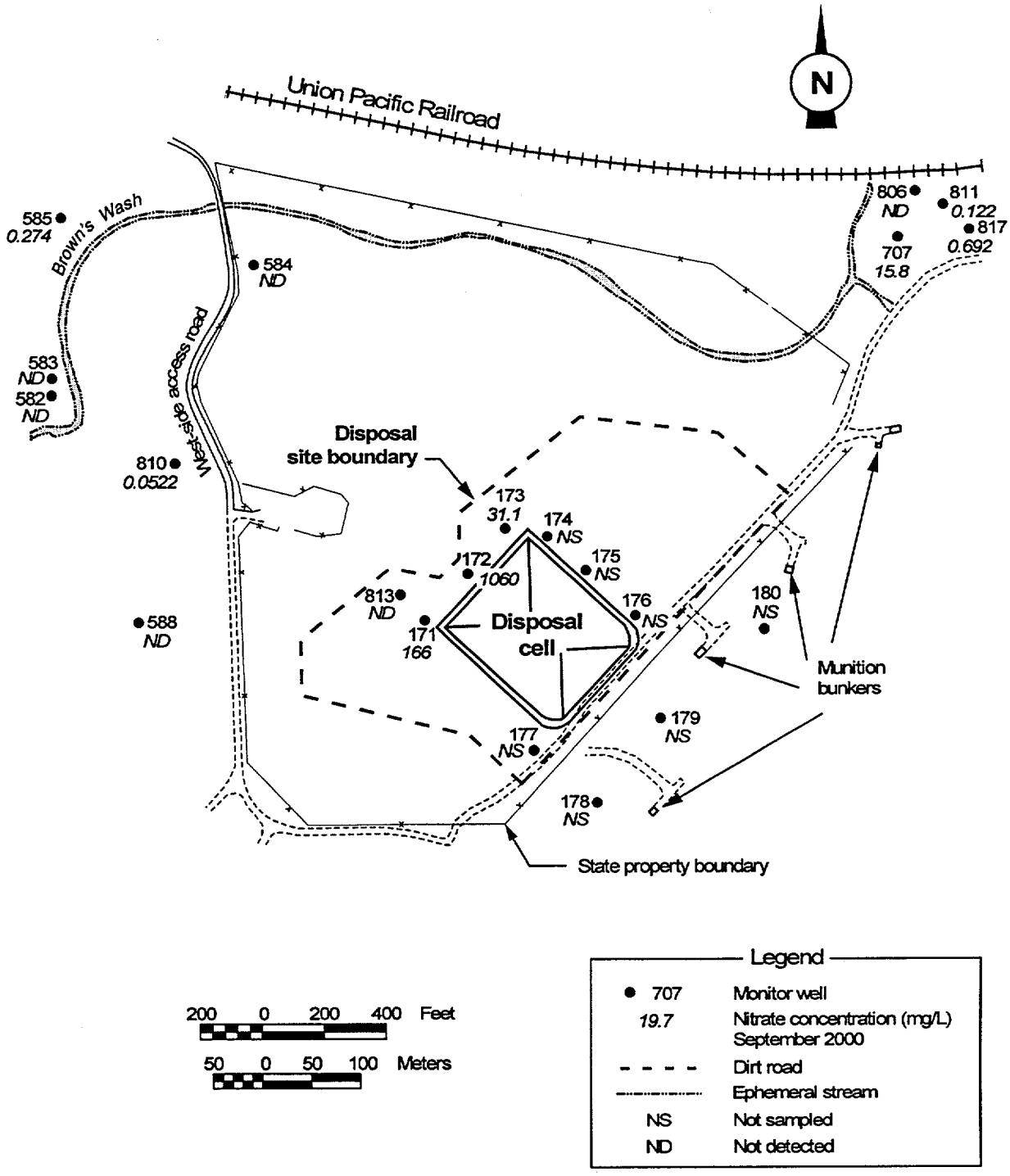

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Figure 2–4. Nitrate Concentrations in Ground Water at Green River, Utah, Site (Datum: September 2000)

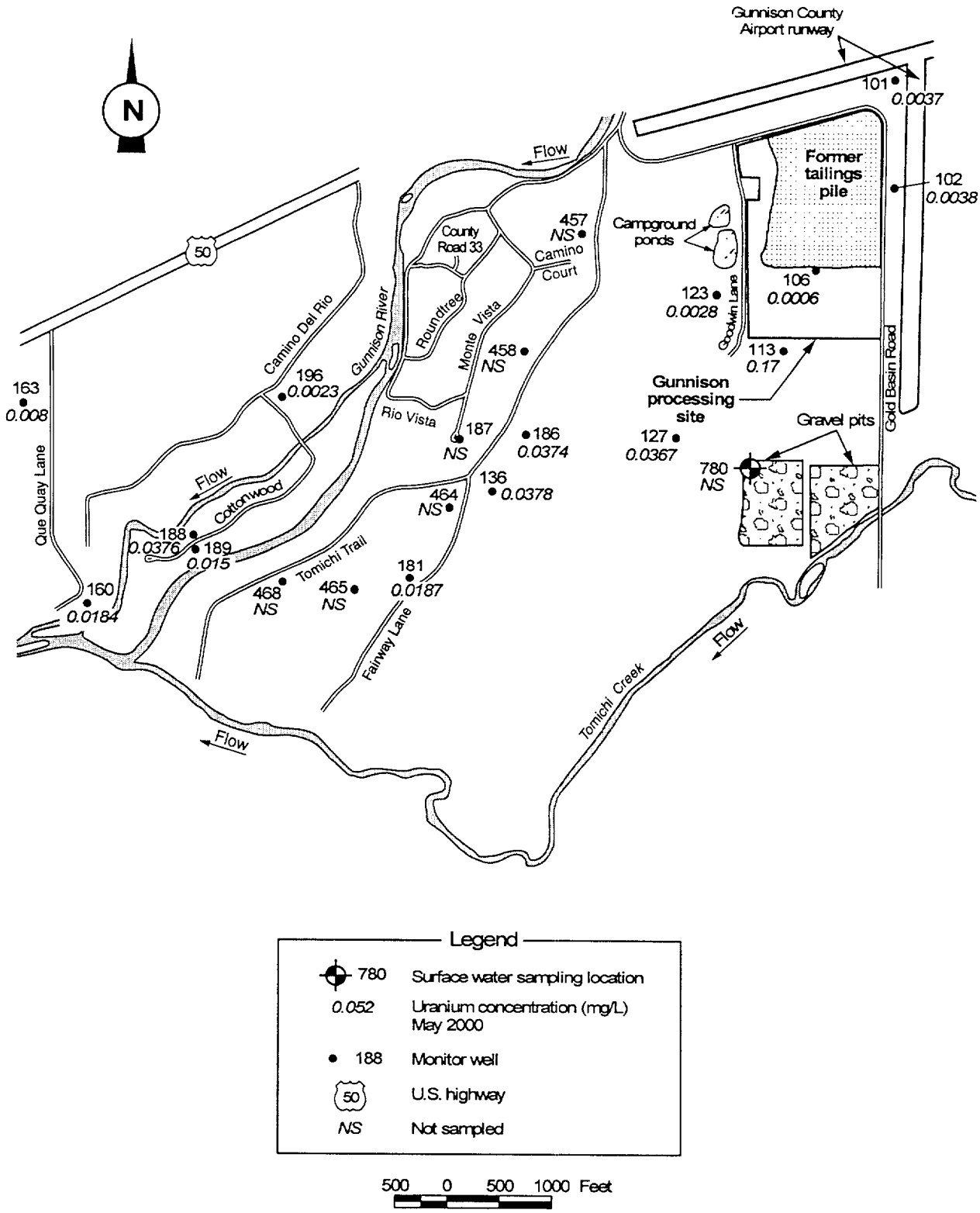

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Figure 2–5. Uranium Concentrations in Ground Water at Gunnison, Colorado, Site (Datum: May 2000)

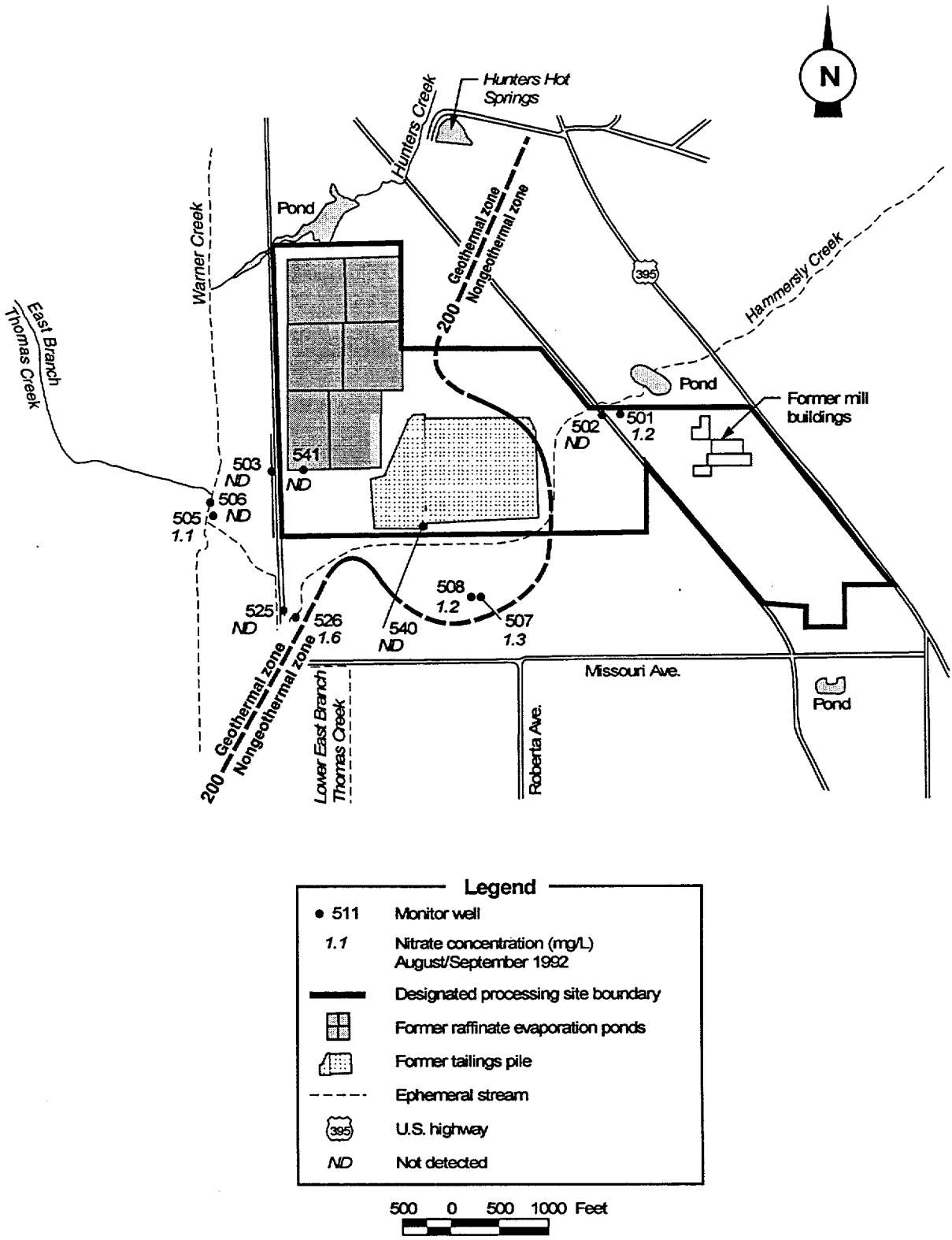

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Figure 2–6. Nitrate Concentrations in Ground Water at Lakeview, Oregon, Site (Datum: August/September 2000)

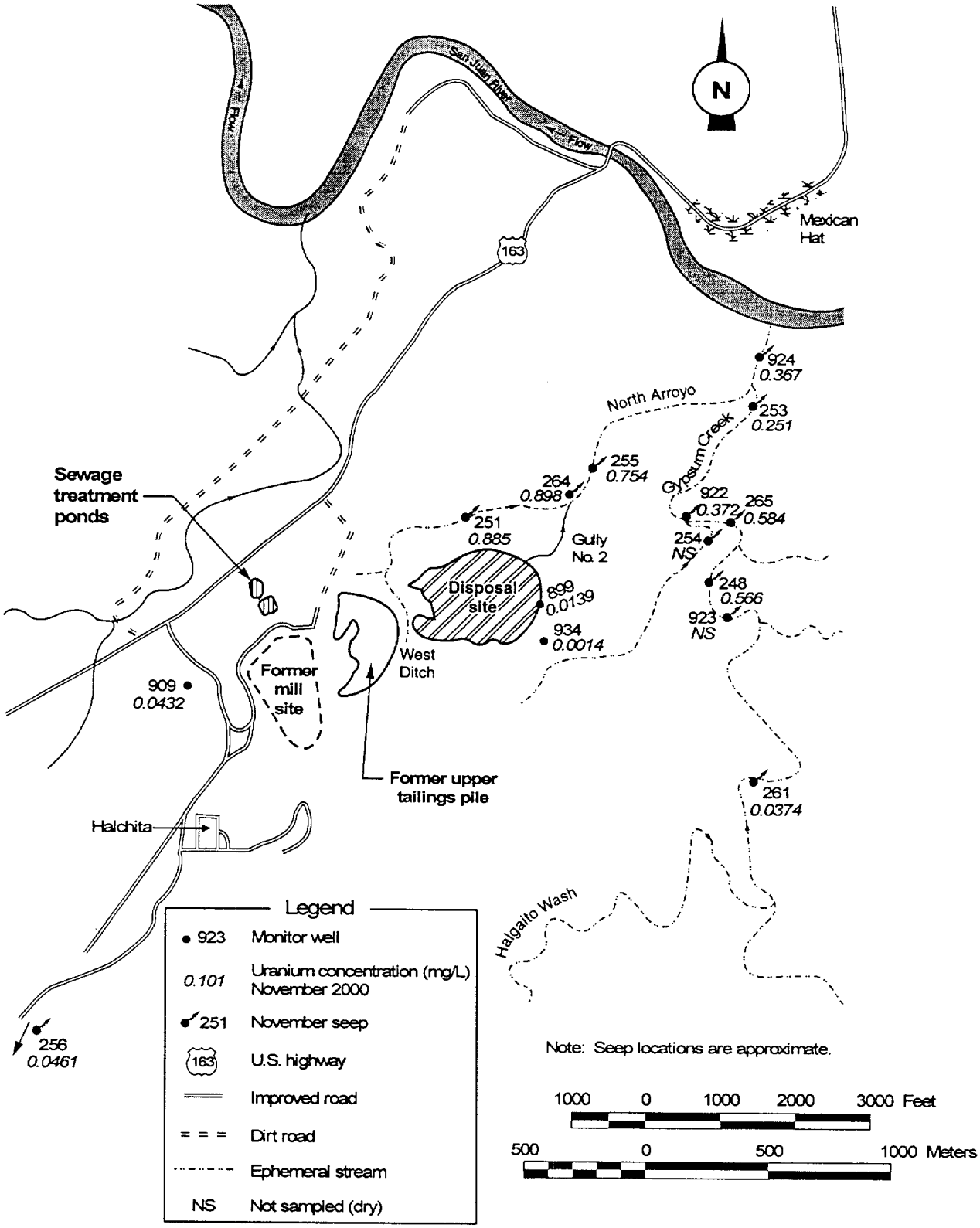

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Figure 2–7. Uranium Concentrations in Ground Water at Mexican Hat, Utah, Site (Datum: November 2000)

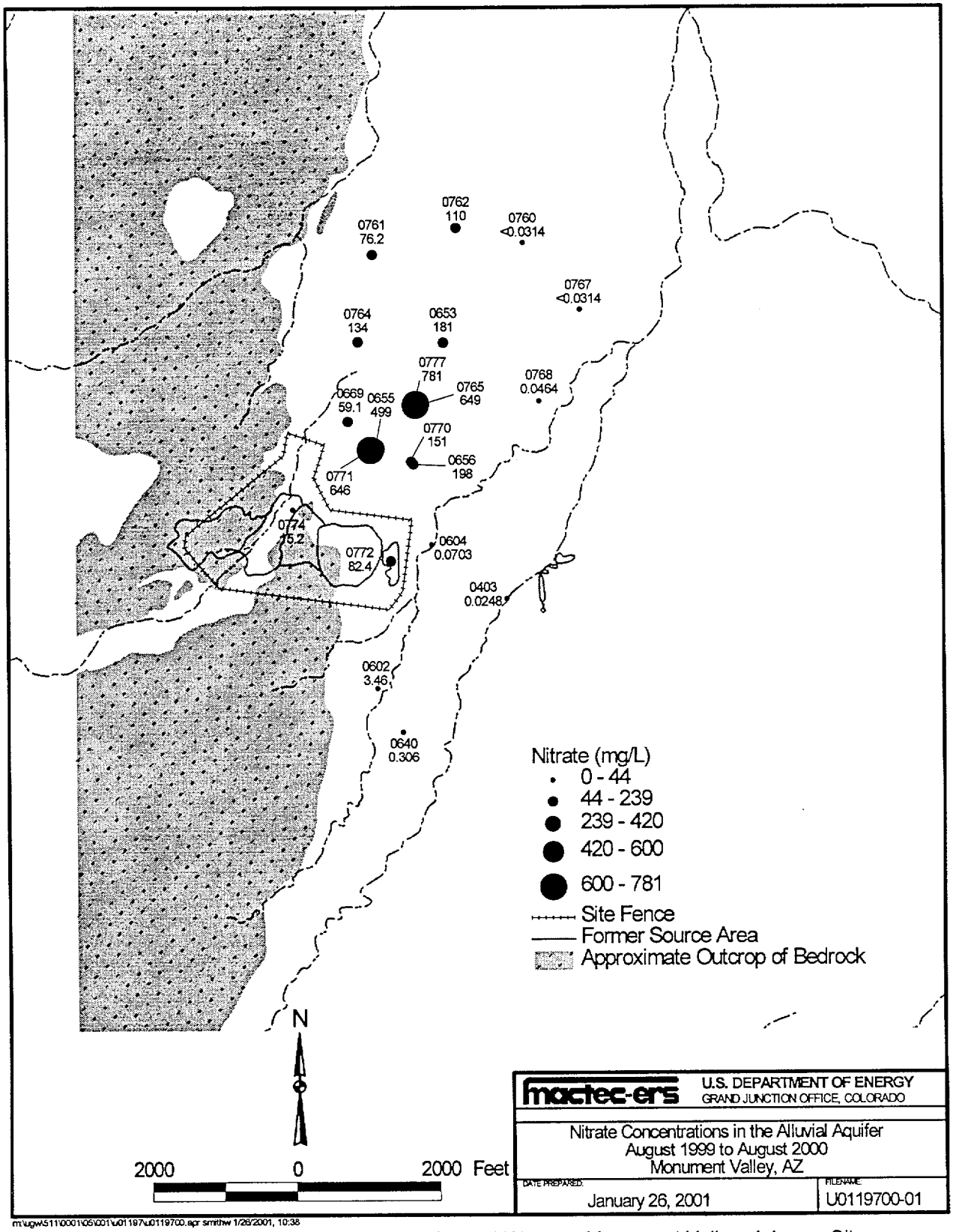

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Figure 2–8. Nitrate Concentrations in Ground Water at Monument Valley, Arizona, Site (Datum: August 1999 to August 2000)

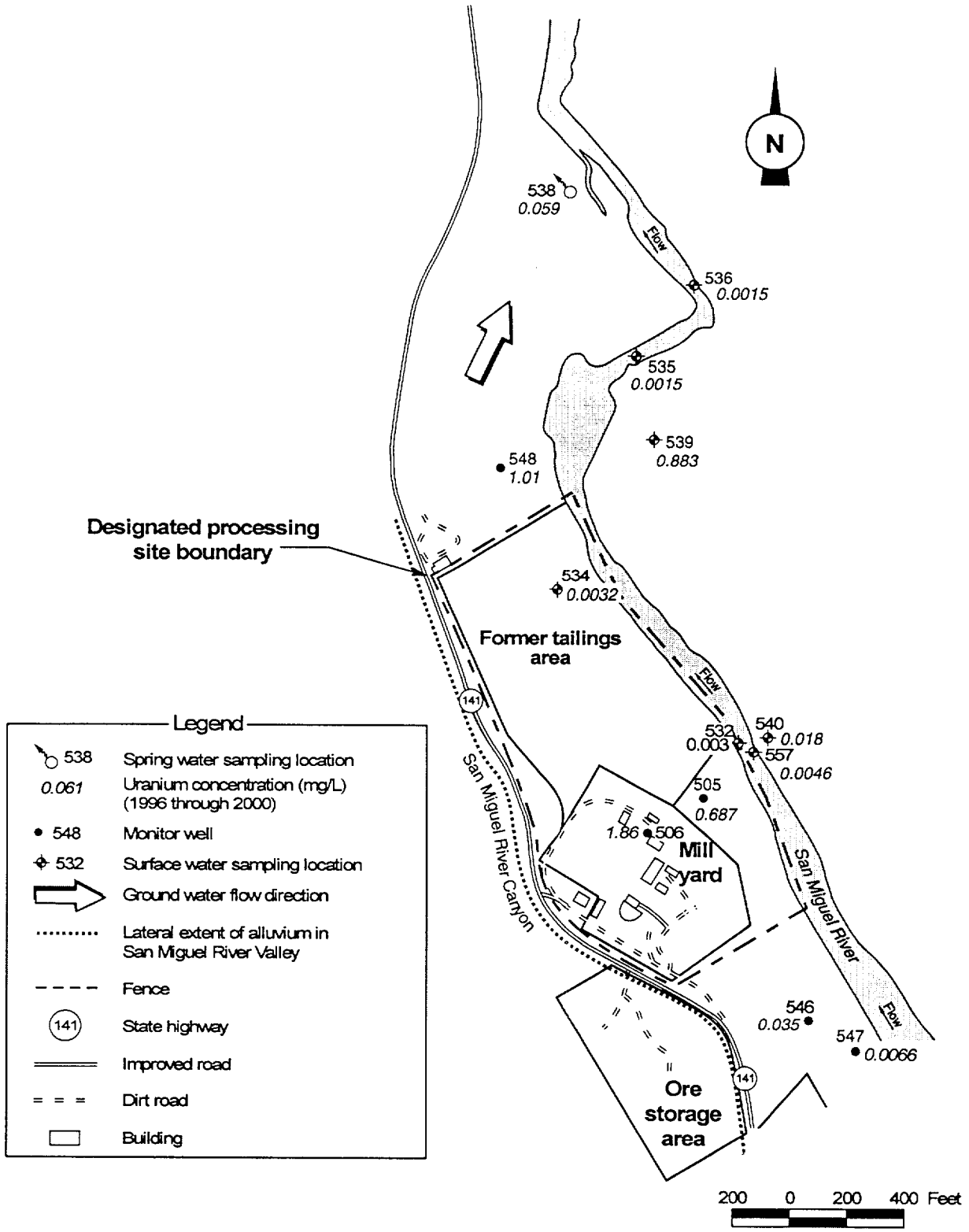

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Figure 2–9. Uranium Concentrations in Ground Water at Naturita, Colorado, Site (Datum: 1996 through 2000)

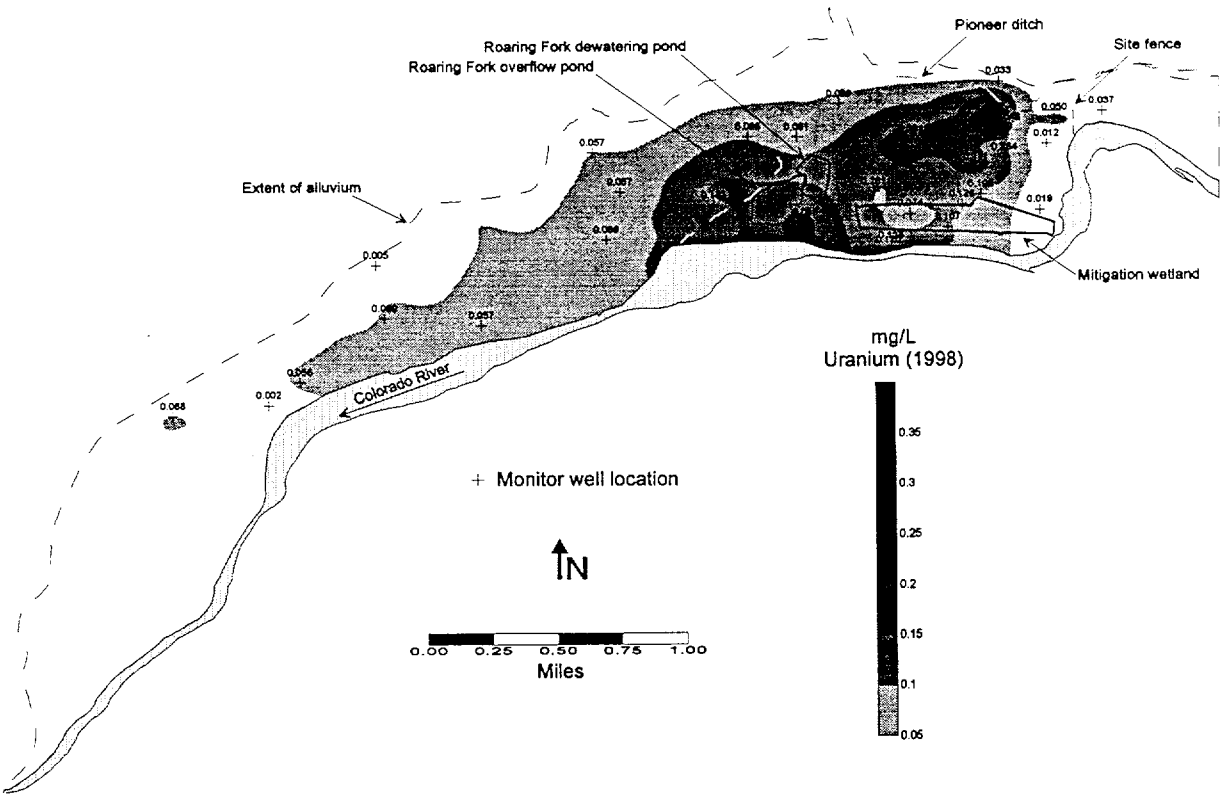

Figure 2–10. Uranium Concentrations in Ground Water at New Rifle, Colorado, Site (Datum: 1998)

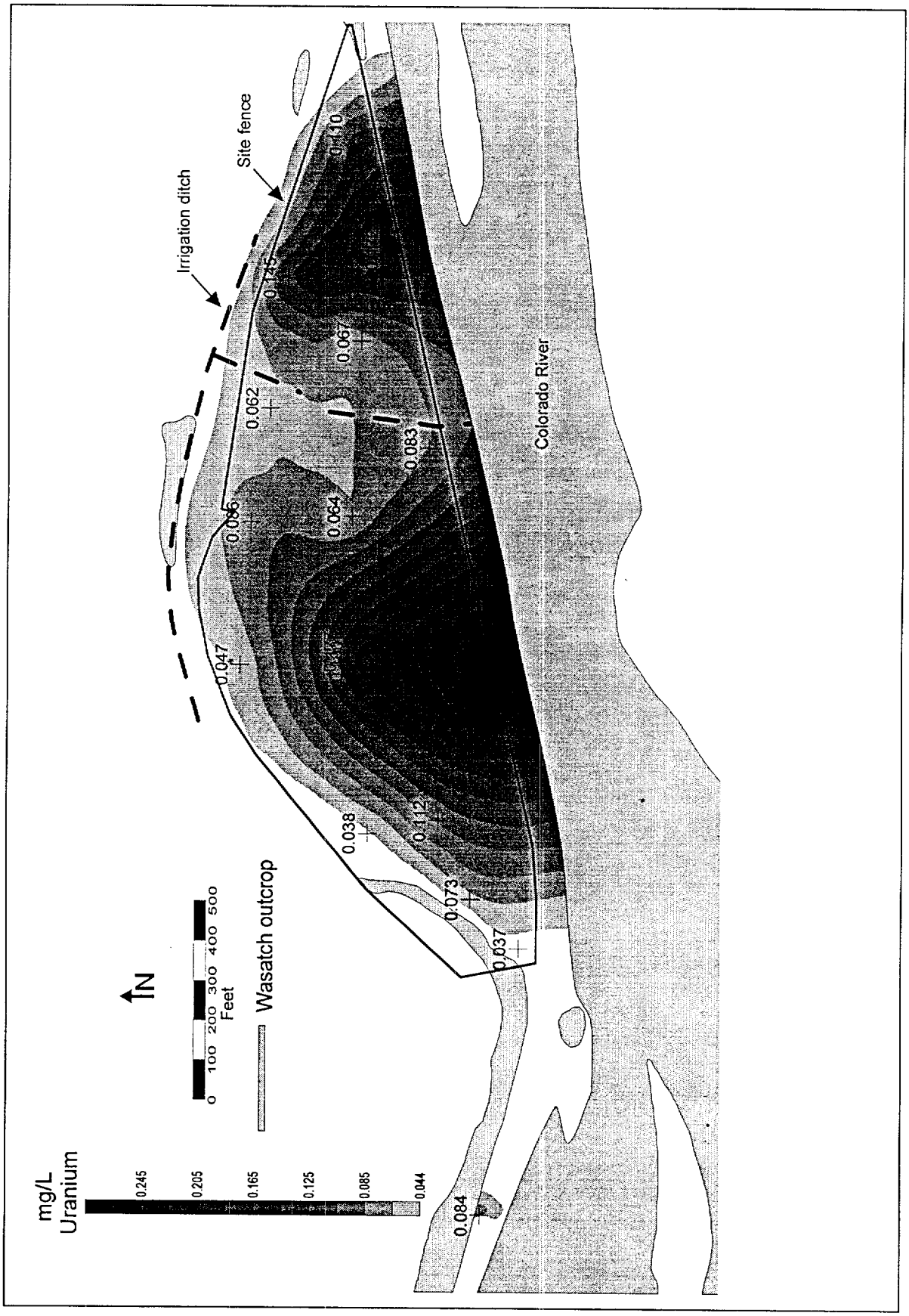

Figure 2–11. Uranium Concentrations in Ground Water at Old Rifle, Colorado, Site (Datum: 1998)

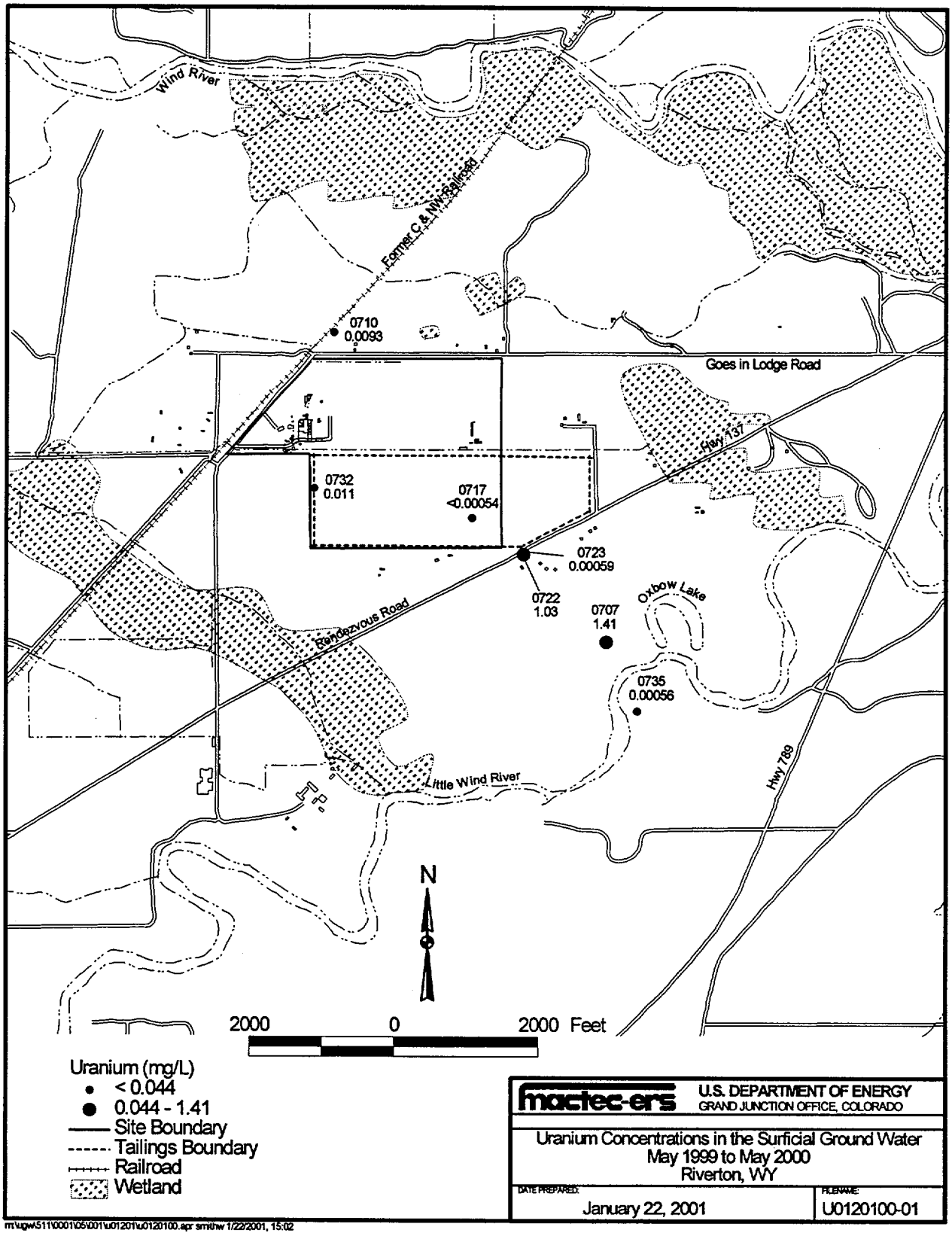

Figure 2–12. Uranium Concentrations in Ground Water at Riverton, Wyoming, Site (Datum: May 1999 to May 2000)

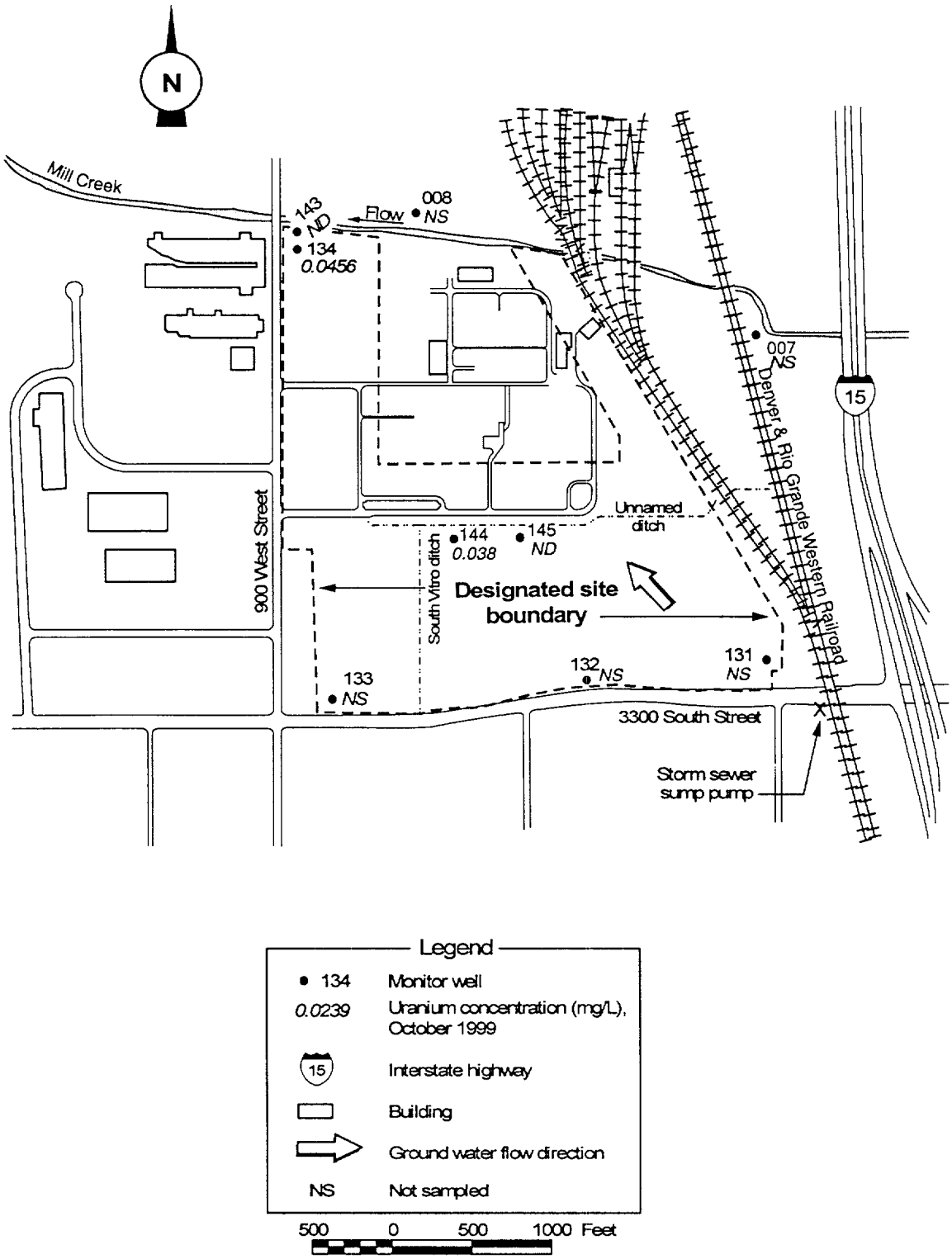

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Figure 2–13. Uranium Concentrations in Ground Water at Salt Lake City, Utah, Site (Datum: October 1999)

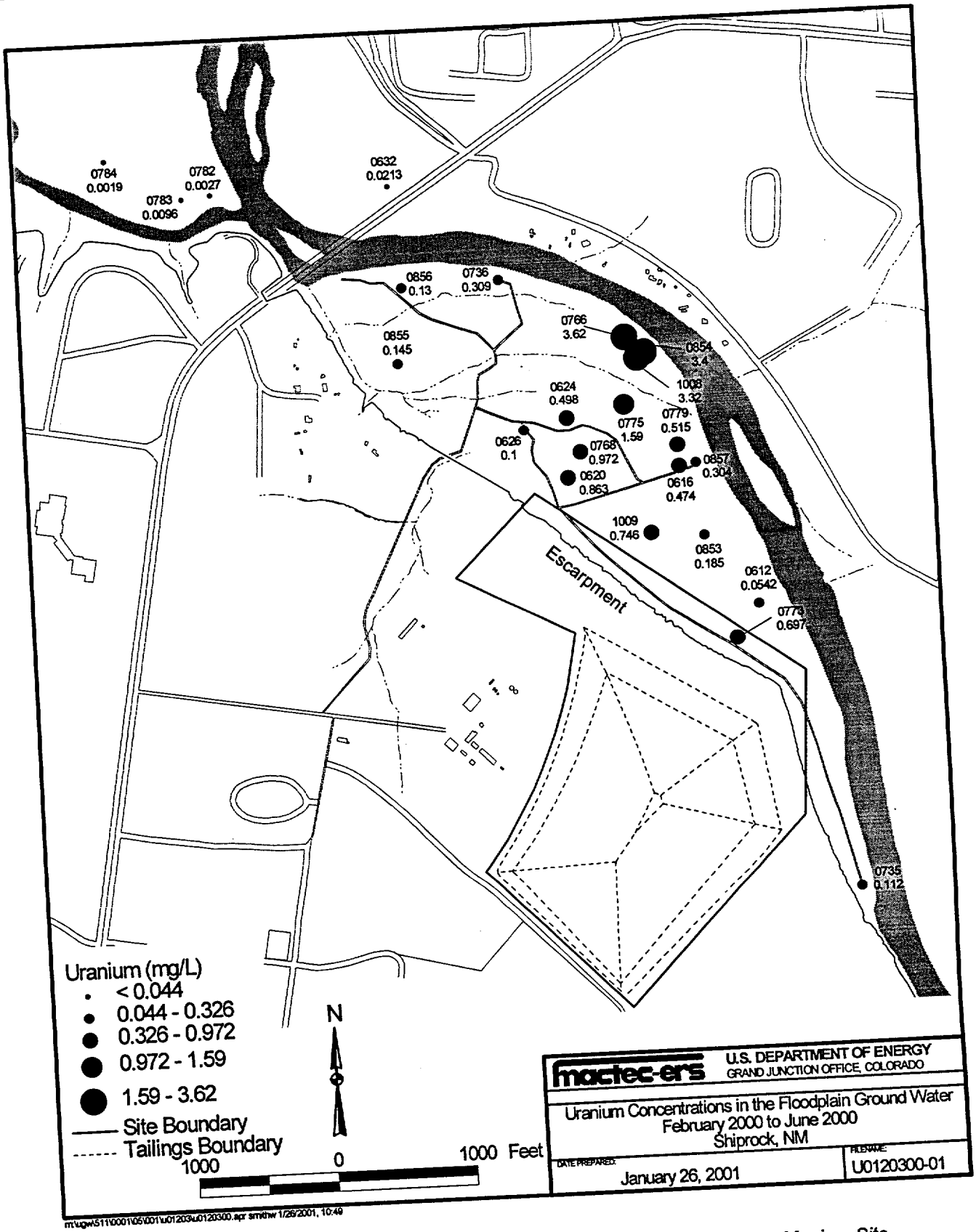

Figure 2–14. Uranium Concentrations in Ground Water at Shiprock, New Mexico, Site (Datum: February to June 2000)

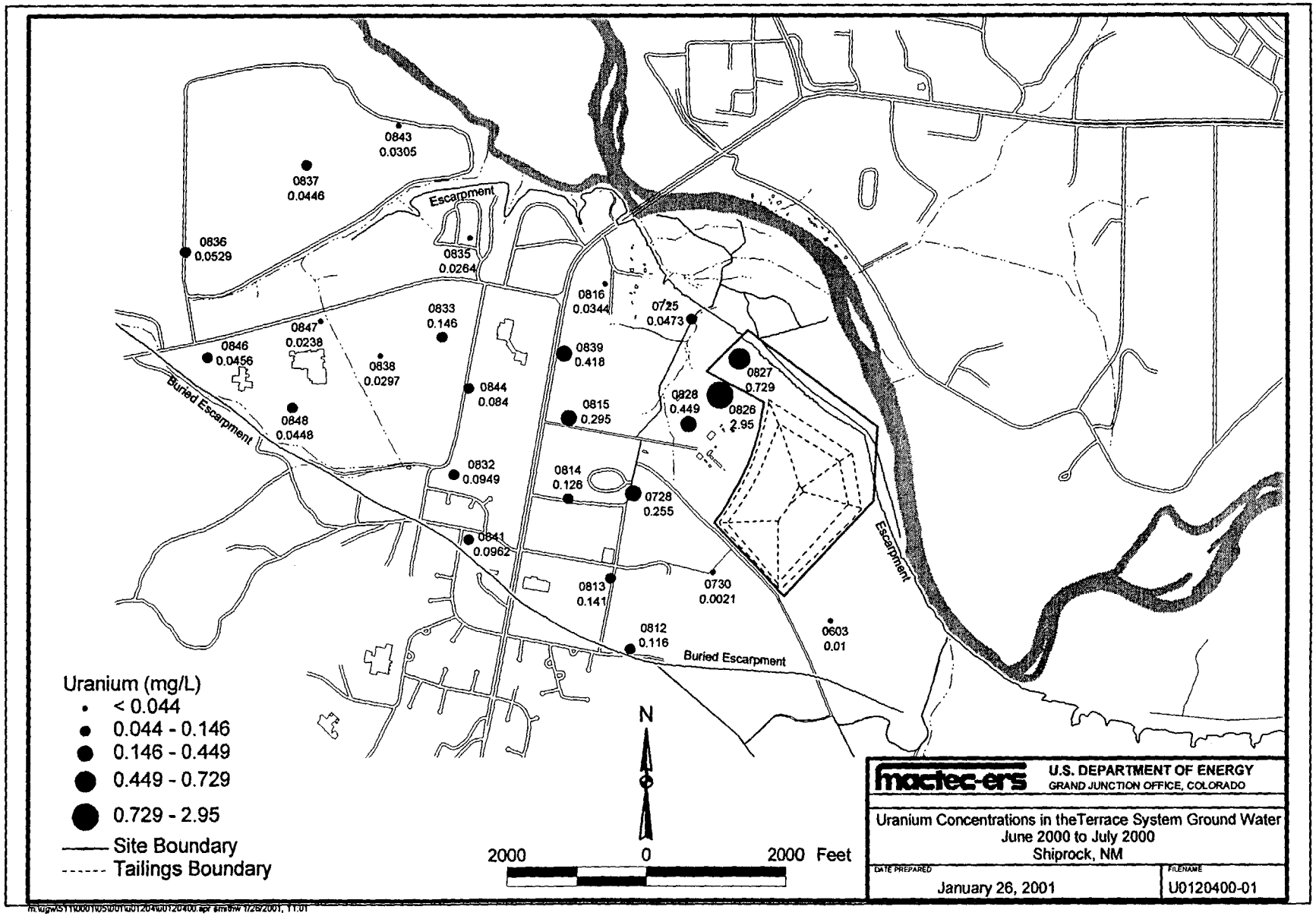

Figure 2–15. Uranium Concentrations in Ground Water at Shiprock, New Mexico, Site (Datum: June/July 2000)

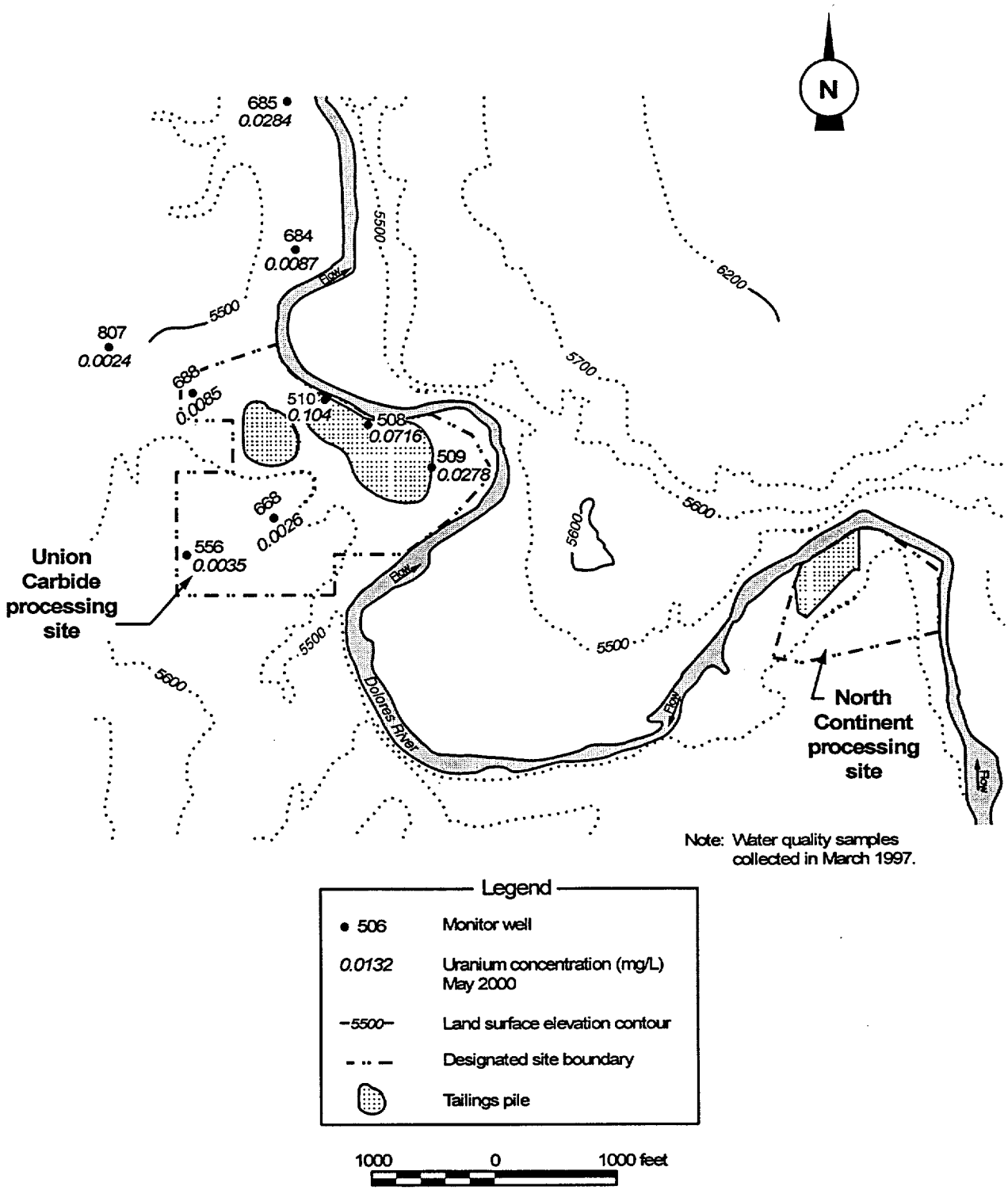

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Figure 2–16. Uranium Concentrations in Ground Water at North Continent and Union Carbide Sites, Slick Rock, Colorado (Datum: May 2000)

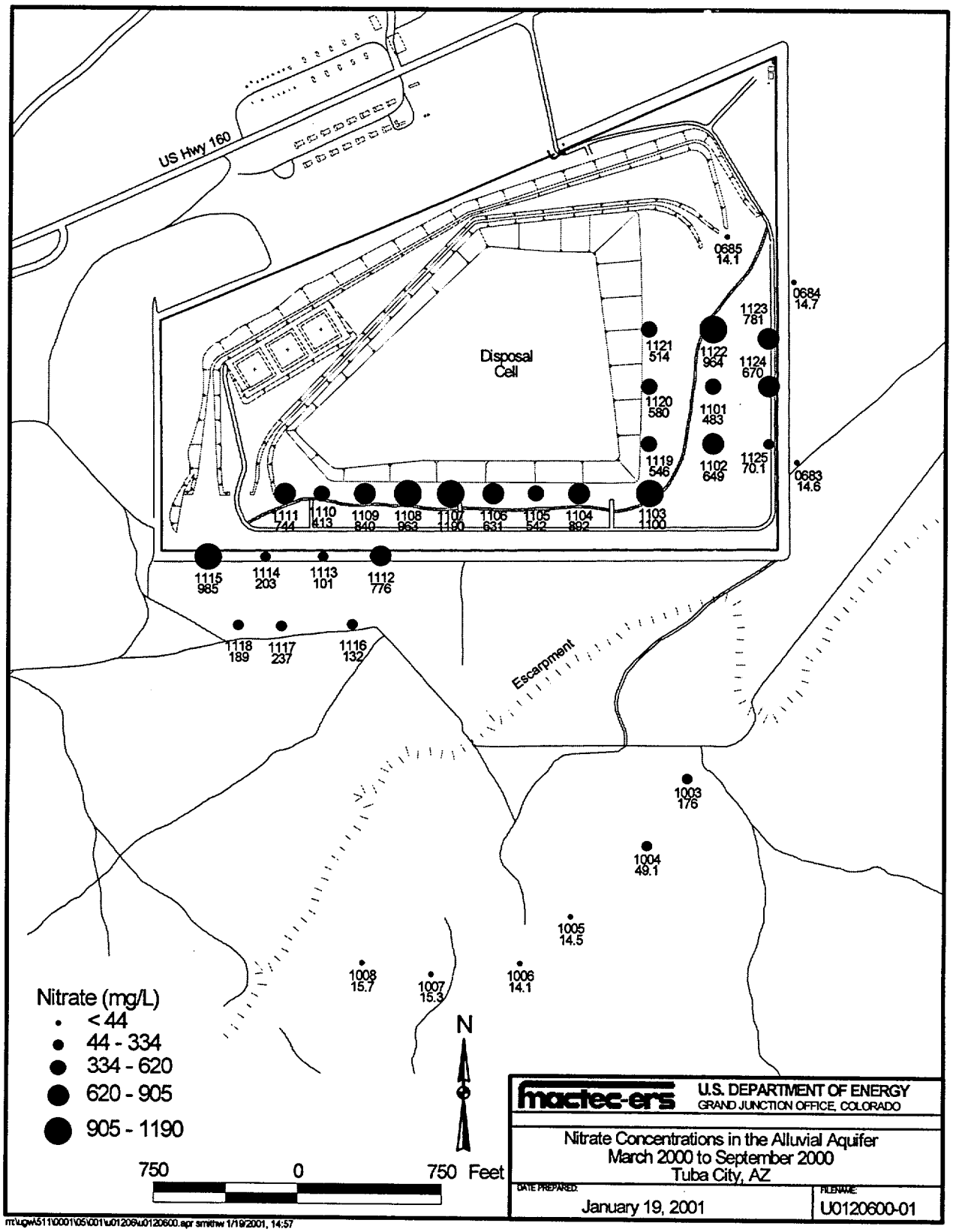

Figure 2–17. Nitrate Concentrations in Ground Water at Tuba City, Arizona, Site (Datum: March to September 2000)

3.0 Status of Environmental Restoration Activities

This section presents a summary of the programmatic status of the project. The major programmatic activities for FY 2001 are to:

- continue active remediation activities at two sites (Tuba City and Monument Valley),
- prepare draft GCAP and NEPA documentation for Shiprock,
- complete NEPA documentation at the Gunnison site,
- complete field investigations at four sites (Durango, Slick Rock (2), Naturita),
- initiate field investigations at Green River, Utah,
- obtain NRC concurrence for compliance action at four sites (Old Rifle, Lakeview, Grand Junction, and Gunnison), and
- transfer three sites to LTSM (Grand Junction, Lakeview, and Salt Lake City)

Table 3–1 presents the site status for UMTRA Ground Water sites. Figure 3–1 presents a flowchart of major activities and documentation for each of the compliance strategies. Project documentation is similar for each compliance strategy.

Baseline Risk Assessment – used to determine if the ground water at a site poses an immediate risk to human health and the environment.

Site Observational Work Plan – characterizes the site ground-water conditions and documents how DOE will demonstrate compliance with EPA ground water standards.

Ground Water Compliance Action Plan (GCAP) – presents descriptions of the compliance strategy to be implemented for a site. For the no-remediation alternative, the GCAP may be a modified section of the Surface Remedial Action Plan. For sites where active and/or passive remediation will be implemented, the GCAP Plan will be a separate plan that includes the verification monitoring to be performed.

National Environmental Policy Act (NEPA) decision documents

- **Environmental Assessment** – identifies the proposed site-specific ground-water compliance strategy and alternatives, analyzes effects, and specifies any measures necessary to reduce adverse impacts.
    - Finding of No Significant Impact – issued if an Environmental Assessment shows the proposed strategy would not significantly affect the environment
    - Site-Specific Environmental Impact Statement – prepared if the Environmental Assessment shows adverse effects would be significant.
- **Categorical Exclusion** – intended for actions that will clearly have no significant adverse affects on the environment. Categorical Exclusions exempt the actions from further environmental evaluation under NEPA. Categorical Exclusions are currently planned to be prepared for the site characterization (i.e., Site Observational Work Plan) activities. In some cases, DOE may determine that certain actions are adequately addressed in existing NEPA documentation.

Remedial action – implemented for active remediation sites and involves stabilizing, controlling, or cleaning up contaminants at a site.

Verification monitoring – implemented for passive remediation sties to confirm that the passive remediation strategy is working.

Ground-Water Certification Report – prepared for active and passive remediation sties to document that actions required in the Ground-Water Compliance Action Plan were successfully completed and that the site meets EPA standards.

Long-Term Surveillance Plan – Plan describing the long-term surveillance and maintenance program for a licensed site.

Long-Term Monitoring Plan – Plan describing the long-term monitoring to be performed at a non-licensed site.

3.1 Current Environmental Restoration Activities

Site-specific compliance strategies have been determined for each site. In some cases these strategies are only targets for cost estimates for budget development purposes (Table 3–2). The Belfield and Bowman sites are not presently scheduled for further project activities because the State of North Dakota has declined participation in the UMTRCA-mandated cost sharing of funding for these sites. The Lowman site is not scheduled for further project activities because NRC concurred with the Surface Project RAP, which recommends no further ground water action because of the lack of ground water contamination. The compliance strategy approaches are

- **No Further Remediation**—No remediation could be used under two circumstances: (1) at sites that do not have ground water contamination above MCLs and/or background levels; and (2) at sites that have ground water contamination above MCLs and/or background levels but qualify for supplemental standards or ACLs. Use of this strategy could involve a demonstration of compliance and, in some cases, additional site characterization.

- **Natural Flushing**—Natural flushing is passive ground water remediation because it does not involve manipulation of ground water flow, quantity, or quality. Natural flushing could be the selected remedy at sites where (1) compliance with the ground water standards would occur within a period of 100 years or less; (2) where adequate monitoring and institutional controls could be established and maintained throughout the flushing period; (3) where institutional controls could result in conditions that were protective of human health and the environment; and (4) where the ground water was neither a current nor a projected drinking water source.

- **Active Remediation**—Active ground water remediation would be used at sites where methods such as gradient manipulation, ground water extraction, and in situ ground water treatment were required to meet ground water standards.

Table 3-1. UMTRA Ground Water Site Status as of April 9, 2001

Site	SOWP	GCAP	NEPA	NRC Concurrence	Transferred to LTSM Program	Alternate Water Supply	Status
Ambrosia Lake	Yes	Yes	Yes	Yes	8/28/00	No	
Canonsburg	Yes	Yes	Yes	Yes	2/22/00	No	
Durango	No	No	No	No	No	No	Site assessment ongoing
Falls City	Yes	Yes	Yes	Yes	8/28/00	No	
Grand Junction	Yes	Yes	Yes	No	No	No	Awaiting NRC concurrence on GCAP
Green River	No	No	No	No	No	No	Initiating site assessment
Gunnison	Rev. 1 in DOE/state review	Draft	Draft EA	No	No	Yes (1994)	Draft SOWP in state review; Draft EA/GCAP in DOE review
Lakeview	Yes	Yes	Yes	No	No	In progress	Awaiting NRC concurrence on GCAP
Lowman	NA	NA	NA	NA	10/30/94	No	
Maybell	Yes	Yes	Yes	Yes	8/28/00	No	
Mexican Hat	Yes	Yes	Yes	Yes	8/28/00	No	
Monument Valley	Yes	Draft	Draft	No	No	In progress	Land farming pilot study on hold
Naturita	No	No	No	No	No	No	Initiating site assessment
Riverton	Yes	Yes	Yes	Yes	No	Yes (1996)	Fourth year of verification monitoring
New Rifle	Yes	Draft	Draft EA	No	No	Yes (1997); extension in progress	Addressing NRC comments on GCAP; initiated pilot test for vanadium removal
Old Rifle	Yes	Draft	Yes	No	No	No	Awaiting NRC concurrence on GCAP
Shiprock	Rev. 2 in DOE review	No	Draft EA	No	No	No	Draft EA in public review
Salt Lake City	Yes	Yes	Yes	Yes	8/28/00	No	
Slick Rock (2)	No	No	No	No	No	No	Site assessment ongoing
Spook	Yes	Yes	Yes	Yes	8/28/00	No	
Tuba City	Yes	Yes	Yes	Yes	No	No	Performance testing pump-and-treat system

Table 3–2. Targeted Site Compliance Strategies

Site	Proposed Strategy	Applicable Standard[a]
Ambrosia Lake, NM	No remediation	SS
Belfield, ND[b]	Not applicable	Not applicable
Bowman, ND[b]	Not applicable	Not applicable
Canonsburg, PA	No remediation	ACL
Durango, CO	Passive remediation with natural flushing	MCL/BG/ACL
Falls City, TX	No remediation	SS
Grand Junction, CO	No remediation	SS
Green River, UT	No remediation	SS
Gunnison, CO	Passive remediation with natural flushing	MCL/BG/ACL
Lakeview, OR	No remediation	SS
Lowman, ID	No remediation	N/A
Maybell, CO	No remediation	SS
Mexican Hat, UT	No remediation	N/A
Monument Valley, AZ	Active remediation/Passive remediation with natural flushing	MCL/BG/ACL
Naturita, CO	Passive remediation with natural flushing	MCL/BG/ACL
New Rifle, CO	Passive remediation with natural flushing	MCL/BG/ACL
Old Rifle, CO	Passive remediation with natural flushing	MCL/BG/ACL
Riverton, WY	Passive remediation with natural flushing	MCL/BG/ACL
Salt Lake City, UT	No remediation	SS
Shiprock, NM	Active remediation/Passive remediation with natural flushing/No remediation	MCL/BG/ACL/SS
Slick Rock (NC)[c], CO	Passive remediation with natural flushing	MCL/BG/ACL
Slick Rock (UC)[c], CO	Passive remediation with natural flushing	MCL/BG/ACL
Spook, WY	No remediation	SS
Tuba City, AZ	Active remediation	MCL/BG/ACL

[a]SS = supplemental standards; MCL = maximum concentration limits; BG = background levels; N/A = not applicable, and ACL = alternate concentration limits.
[b]The designated uranium millsites at Belfield and Bowman, North Dakota, will not be remediated by DOE because the State of North Dakota has declined to provide the statutorily required cost-sharing funds to remediate these sites.
[c]NC = North Continent; UC = Union Carbide.

3.2 Regulatory Agreements, Consent Decrees, Compliance, and Other Legal Drivers

UMTRCA is the legal driver for the project. Under the terms of UMTRCA, EPA has established the ground water protection standards in Title 40 CFR Part 192. NRC is responsible for evaluating and certifying the projects compliance with EPA standards. All necessary Cooperative Agreements are in place with the affected States and Native American tribes/nations. Table 3–2 presents the status of cooperative agreements.

3.3 Current Waste Management and Material Disposition Activities

The project is currently producing treatment sludge and investigation derived waste at Tuba City and New Rifle. The investigation-derived wastes (drill cuttings and purge waters) are being

disposed on site on the basis of field screening (DOE 1997a, 1999). If purge water is unacceptable for on-site disposal, the wastes generated would be disposed of as RRM at a permitted and licensed facility. The treatment sludge at the Tuba City site is being disposed of in a lined evaporation pond on site. The sludge eventually will be disposed of at the Cheney Disposal facility. The vanadium sludge at the New Rifle site is being disposed of at the Cheney Disposal facility.

Table 3–3. Status of UMTRA Ground Water Cooperative Agreements

Partner	Implementation Date	Agreement Number
State of Colorado	8/25/98	GJ79476
State of Texas	N/A	N/A
Navajo Nation	2/24/99	GJ79477
State of Wyoming	N/A	N/A
Northern Arapaho and Shoshone Tribes	N/A	N/A
Hopi Tribe	1/27/99	GJ79478
State of Utah	10/29/99	GJ79483
State of New Mexico	N/A	N/A
State of Oregon	anticipated 6/01	
State of Pennsylvania	N/A	N/A
N/A = Not applicable		

3.4 Public Involvement Process

DOE encourages public participation, as directed by the Secretary of Energy (DOE 1994). The UMTRA Ground Water Public Participation Plan (DOE 1997b) describes activities which provide public involvement in the project. This plan is updated annually. A toll-free number has been established to answer questions about the project. The number is 1-800-399-5618. Also, a website has been established at WWW.DOEGJPO.COM.

The goals of the public participation program are to promote public awareness, understanding, and support of the project and to maintain a proactive public affairs and community relations program that accurately identifies public/media concerns. The community relations program also establishes public involvement and information activities to promote two-way communication between DOE–GJO and the public (stakeholder involvement).

Specific Public Involvement Plans (PIPs) are created for each ground water site. This document is not a technical document and is much smaller than the original plan. The site-specific PIP provides information on what kind of public participation has taken place at that site and forecasts additional public involvement goals.

Frequent verbal and written communication will be prepared and distributed to project stakeholders. Communication will be the key element in building stakeholder consensus for the compliance approaches followed by the project.

3.5 Program Management

The DOE–GJO Manager is authorized to manage and execute project functions. The Manager is supported by the UMTRA Ground Water Project Manager and other members of the project team. GJO manages the project and its contractors in accordance with overall project policy and DOE–HQ guidance. GJO is responsible for the following activities:

- Preparing task orders that the TAR and FOS contractors will manage and control to ensure performance-based support of DOE responsibilities in a cost-effective manner.
- Coordinating activities with Native American tribes/nations, State and local governments, and the public.
- Negotiating cooperative agreements.
- Developing ground water compliance strategies.
- Operating the Project Control System.
- Managing the NEPA process.
- Managing the selection and implementation of compliance strategies.
- Initiating procurement for and management of project contractors.
- Acquiring necessary licenses and permits.
- Complying with the ground water standards as the second phase of licensing the SIP and SOS sites.
- Complying with applicable Federal, Native American tribe/nation, State, and local laws and regulations and DOE orders.

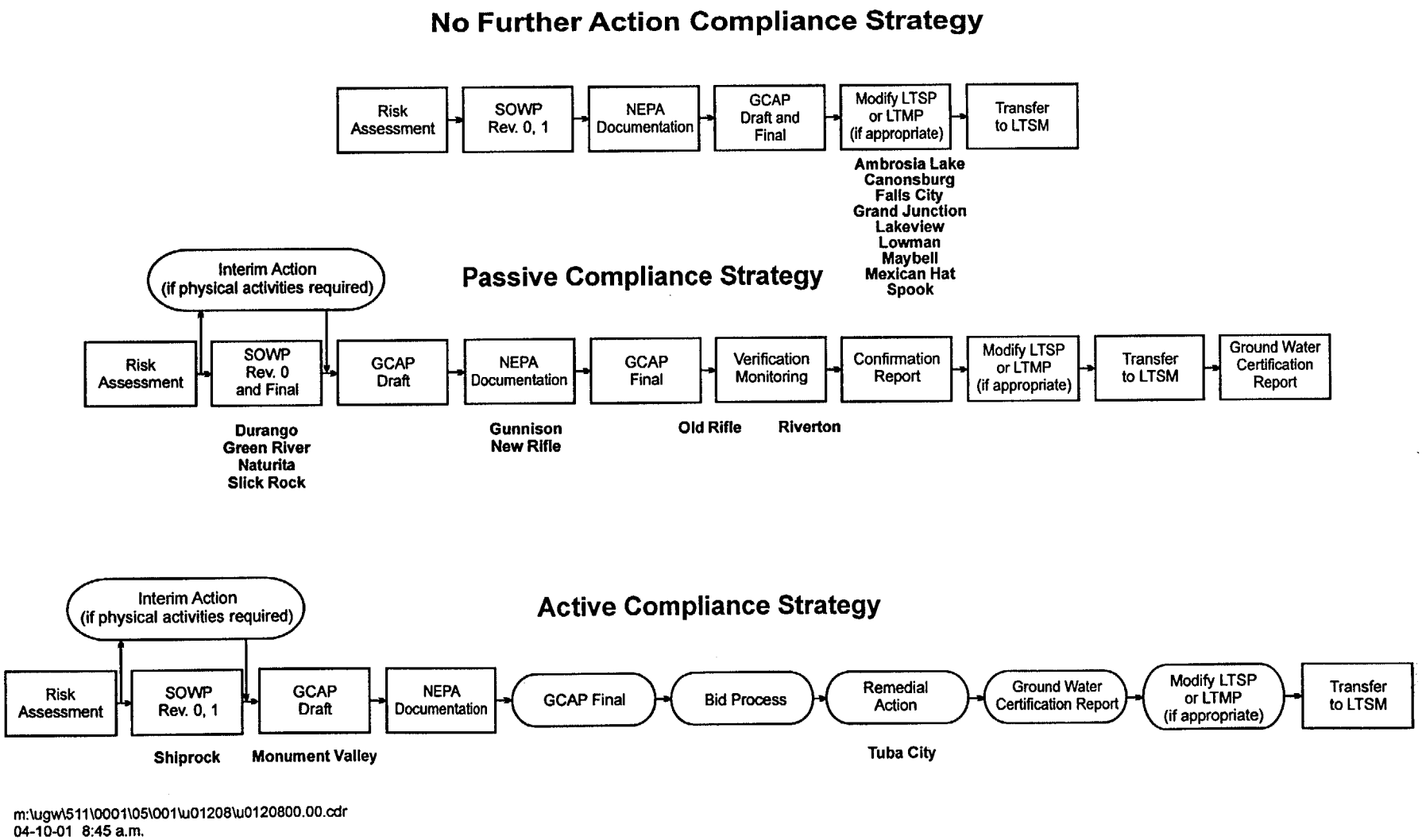

Figure 3–1. Ground Water Compliance Strategies Flowchart

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4.0 Site Relative Ranking

In 1992, the U.S. Department of Energy (DOE) prioritized the Uranium Mill Tailings Remedial Action (UMTRA) Ground Water sites. The 1992 prioritization scoring was modeled after an objective risk-based ranking system used by DOE in 1991 to rank environmental restoration problems for budget purposes. This cost-benefit system estimates the relative value of performing environmental restoration using criteria such as human health risks, environmental impacts, socio-economic impacts, and regulatory requirements. From these individual categories, a composite score for each site was determined, with the highest composite scores receiving the top priority. Details on the 1992 prioritization approach are presented in *Proposed Approach to Remedial Action Prioritization/Categorization for the Uranium Mill Tailings Remedial Action Project* (memorandum from Mark L. Matthews, Uranium Mill Tailings Remedial Action Project Office, August 8, 1991).

In 1995, the Independent Technical Review (ITR) of the UMTRA Ground Water Remediation Project developed site-specific liability rankings. The ITR report suggested new criteria to be used in prioritizing the UMTRA Ground Water sites. Based on this input, DOE revised the prioritization scoring for UMTRA Ground Water sites in 1997. Stakeholders requested that the following issues be incorporated into a revised prioritization approach.

- Risk of Failure for Institutional Controls
- Liability Reduction
- Sole Source Aquifers
- Offsite Plumes
- New Baseline Risk Assessment (BLRA) Information
- Contamination on Tribal Lands
- Reduce Final Categories From Five to Three

Table 4–1 presents the new site rankings based on these revisions.

Table 4-1. Revised Prioritization Scoring for UMTRA Ground Water Sites

Site	Population Risk (10%)	Individual Health Risk (25%)	Sole Source Water Resource (5%)	Risk Timing (10%)	Failure Institutional Controls (10%)	Environ-mental Risk (15%)	Socio-Economic Impact (10%)	Regu-latory Impact (15%)	Composite Score*
Category I									
Gunnison	5	5	3	7	7	4.5	4.9	7	55.2†
Rifle (2)	5	6	5	7	4.7	4.5	3.2	7	54.7
Tuba City	3	5	7	7	2.8	2.6	6.1	6	50.8
Riverton	5	5	3	7	4.7	3.3	3	6	50.7**
Monument Valley	3	5	5	6	2.8	3	5.7	6	49.0**
Category II									
Naturita	3	6	3	5	5.6	4.4	3	5	47.2
Shiprock	5	5	1	3	5.6	3.5	4.4	5	46.8**
Slick Rock(2)	3	6	3	3	5.6	4.6	2.4	5	44.9
Lakeview	4	5	3	7	0.7	3.3	2.6	6	42.3
Durango	5	5	3	5	0	3.3	3.7	5	40.2
Grand Junction	4	4	3	3	3.7	4.5	3.4	5	39.9
Green River	3	5	3	5	0.7	3.2	2.4	5	37.4
Salt Lake City	5	4	3	4	0.7	1.5	3.2	5	34.2
Falls City	3	5	3	4	0.5	3.4	1.4	3	32.5
Bowman	2	4	5	4	0.7	3.5	1.4	4	31.9
Category III									
Belfield	3	4	3	4	0.7	2.5	1.4	4	30.4
Ambrosia Lake	2	4	5	4	0.7	3.1	1	3	29.4
Maybell	2	4	7	2	0	2.4	1.4	4	28.5
Canonsburg	2	4	1	3	0	3.3	1.4	4	27.9
Mexican Hat	2	2	3	2	0.5	3.3	2.6	4	27.6**
Lowman	2	2	5	2	0	2.2	1	2	18.8
Spook	2	2	3	2	0.7	2.3	1	1	17.2

* Based on the 1992 Prioritization Scoring with input from Stakeholders and consideration of ITR report recommendations.

** Three points were added to the composite score for these sites because contamination occurs on tribal land. This approach was suggested by stakeholders at the May 22-23, 1997 meetings.

† The Gunnison site was ranked using the existing baseline risk assessment. Since the risk assessment was prepared, alternative water has been supplied by DOE, which has greatly reduced the potential risks.

5.0 Environmental Restoration Strategy

The ER strategy recommended in the PEIS is to use a consistent, objective, risk-based, and compliance-driven approach to conduct the project. The preferred alternative would use active, passive, and/or no remediation ground water compliance strategies to meet EPA ground water standards at the 24 project sites. The observational method is being used to streamline assessment and evaluation of site remediation requirements.

5.1 Key Assumptions

Key assumptions for this project are divided into the following categories: institutional, regulatory compliance, project management, human resources, and site specific.

- **Institutional**
  - DOE, Native American tribes/nations, States, the public, NRC, EPA, and Congress all influence project policy and conduct as project stakeholders.
  - As project stakeholders, communities near the UMTRA sites expect timely compliance with UMTRA standards and equitable treatment.
  - DOE will negotiate to obtain access to adjacent private properties underlain by ground water contamination plumes.
  - The public will participate in the development of compliance strategy alternatives for the project before options are selected for each site. All affected States and Native American tribes/nations, except Idaho and North Dakota, will participate in completing the cooperative agreements.
  - As with the UMTRA Surface Project, Native American tribes/nations and State agencies will continue to take an active role in ensuring site compliance. The procedure for obtaining MCLs, ACLs, and supplemental standards will be agreed upon by the Native American tribes/nations, States, DOE, and NRC before the Ground Water Compliance Action Plan for a site is prepared, if applicable.
- **Regulatory Compliance**
  - UMTRCA will continue to be the regulatory driver.
  - The project will comply with applicable Federal, Native American tribe/nation, State, local laws and regulations, and DOE orders according to the considerations identified in the PEIS.
  - No UMTRA Title I sites will appear on the National Priority List or State Superfund lists.

- **Project Management**

  - Conceptual recommendations presented by the ITR team will be acceptable to DOE and efforts to create changes to meet the intent of these recommendations will be acceptable to all levels of DOE.

  - Waste disposal capacity will be available when needed.

  - The ground water cooperative agreements will be in place in time for scheduled ground water compliance activities.

  - Federal and State funding will be available in a timely manner and at a required level. Contingency plans will be developed to accommodate required actions, when necessary.

  - The project will follow the compliance-strategy selection framework identified in the PEIS.

- **Human Resources**

  - GJO will maintain sufficient staff to manage the project and the work of the contractors.

  - GJO will obtain assistance from other government agencies such as the Bureau of Reclamation, as needed.

- **Site Specific**

  - The site-specific compliance strategies identified in budget documents are for budget purposes only. They are not intended to preempt the public involvement process or preclude stakeholder input to the final selection of a compliance strategy.

5.2 Strategy for Remedy Selection

The PEIS was prepared (1) to provide the framework for determining the appropriate ground water compliance strategy at each project processing site; (2) to assess the potential programmatic impacts of the project; and (3) to provide a tiering document for the site-specific NEPA documents.

The PEIS recommended action for the project is to develop compliance strategies for each site that will meet the requirements of Title 40 CFR Part 192. These strategies were documented in the programmatic ROD. Compliance strategies include no ground water remediation, natural flushing, active remediation, and a combination of passive and active remediation. Using the observational approach, each site will be characterized to the extent necessary to determine which strategy will be most effective. Using existing site data, a conceptual model of site conditions will be developed and a "most-probable" ground water strategy will be selected to guide additional data needs. In the case of active remediation, "most-probable" remediation

alternatives will also be identified. Results of the characterization will be documented in site-specific SOWPs.

Upon completion of the characterization phase, EAs will be prepared that tier off the PEIS. The EAs will present the preferred compliance strategy and remedial alternative for review by the stakeholders. Upon approval of the EAs, a Findings of No Significant Impact report will be completed and a draft GCAP prepared for stakeholder review prior to finalization.

The PEIS identifies the process for selecting the remedial action for the project. The approach is to select strategies that ensure protection of human health and the environment by achieving compliance with EPA ground water standards at the 21 remaining sites (excluding Lowman, Idaho, and Belfield and Bowman, North Dakota) while maximizing cost-effectiveness. The proposed action provides a framework to ensure that the final strategy is protective of human health and the environment. DOE–GJO also is committed to ensuring protection of human health and the environment from contaminated ground water before final strategy selection.

Figure 5–1 shows the process (logic framework). The framework is a risk-based decision-making process; each step considers protection of the public health and the environment in determining the appropriate strategy to meet ground water protection standards.

The first step in the decision-making process is to characterize the site (Box 1) and to determine if the uranium processing activities at a specific site have resulted in ground water contamination that exceeds background levels or MCLs (Box 2).

If ground water contamination from uranium processing activities does not exceed background levels or MCLs, no remedial action would be necessary (Box 3). If ground water contamination from uranium processing activities exceeds background levels or MCLs, the next step would be to determine if compliance with EPA ground water standards could be achieved by applying supplemental standards based on the existence of limited-use ground water (Box 4).

If limited-use ground water were shown to exist and if supplemental standards were protective of human health and the environment (Box 5), no site-specific remediation would be required (Box 7). If limited-use supplemental standards were not protective, the next step would be to determine if ACLs would apply (Box 6). If ACLs were protective of human health and the environment, ACLs would be applied (Box 7). If not, it would be necessary to determine if the contaminated ground water plume would qualify for supplemental standards based on the criterion that remediation would cause more environmental harm than benefit (Box 8).

At some sites where supplemental standards or ACLs may be applied, ground water monitoring and institutional controls may be required to ensure continued protection of human health and the environment (Box 9). In addition, when limited-use ground water applies, supplemental standards shall ensure that the current and reasonably projected uses of the affected ground water are preserved. If so, supplemental standards would be applied and no remediation would be necessary (Box 7). If supplemental standards would not be protective, the next step would be to determine if natural flushing would bring the contaminated ground water within MCLs, background levels, or ACLs within 100 years (Box 10). Natural flushing is a ground water remediation strategy by which natural ground water processes result in compliance with the EPA ground water standards. If it were determined that institutional controls could be maintained

during the natural flushing period (Box 11) and that this strategy were protective of human health and the environment, natural flushing would be used (Box 12).

If natural flushing would not be protective, it would be necessary to determine if natural flushing in combination with active remediation methods would meet the EPA ground water standards and would be protective of human health and the environment (Boxes 13 and 14). If so, natural flushing in combination with active remediation methods would be implemented (Box 12). Combined with natural flushing, active remediation methods could be used for a short time to remove the most contaminated ground water from a restricted area. Another option is to use low-operation and low-maintenance active remediation methods such as gradient manipulation or geochemical barriers, in conjunction with natural flushing.

A risk assessment and a SOWP may show that natural flushing combined with active remediation would not result in ground water quality that is protective of human health and the environment. If that were the case, the next step in the framework would be to determine if active ground water remediation techniques would meet EPA ground water standards (Box 15), and if so, to implement those techniques (Box 16). Several methods of active ground water remediation could be used, including gradient manipulation, ground water extraction, and in situ ground water treatment. The active remediation methods could be used individually or in combination with other cleanup methods. If active remediation resulted in compliance with the EPA standards, remedial action would be complete. If these methods did not result in compliance, supplemental standards based on technical impracticability of remediation would be applied, along with institutional controls where necessary (Box 17).

Interim actions will be implemented to protect human health and the environment while a final compliance strategy is being evaluated. Interim actions will be implemented when a reasonable likelihood exists that inappropriate use of the water is likely to occur during the evaluation phase.

5.3 Regulatory Activity Strategy

NRC is the regulatory agency responsible for ensuring that project activities comply with EPA standards as established in UMTRCA. Individual Native American tribes/nations and States also have authority over various aspects of project activities. GJO will work closely with the NRC, Native American tribes/nations, and States to ensure that project activities comply with applicable regulations.

5.4 Nonregulatory Activity Strategy

This project actively involves the public, seeking their input and keeping them informed at all times. This public involvement process has been followed throughout the PEIS process, and DOE–GJO will continue to make concerted efforts to improve communication with stakeholders. Section 3.4, "Public Involvement Process," presents a discussion of the activities associated with this effort.

5.5 Performance Measures

Project performance measures have been developed as shown in Table 5–1. Project milestones are presented in Table 5–2.

Table 5–1. Project Performance Measures

Release Site Description	Planned Assessment Date	Actual Assessment Date	Planned Completion Date	Actual Completion Date
Ambrosia Lake, New Mexico	1998	6/98	1998	6/98
Canonsburg, Pennsylvania	1998	9/98	1998	9/98
Durango, Colorado	2002		2002	
Falls City, Texas	1997	5/97	1998	4/98
Grand Junction, Colorado	1999	2/99	1999	4/99
Green River, Utah	2003		2004	
Gunnison, Colorado	2000	9/00	2000	9/00
Lakeview, Oregon	2004	9/99	2005	9/99
Lowman, Idaho	1996	12/95	1996	12/95
Maybell, Colorado	1995	9/95	1997	10/96
Mexican Hat, Utah	1998	8/98	1999	9/99
Monument Valley, Arizona	1998	6/98	2011	
Naturita, Colorado	2002		2003	
Rifle (New), Colorado	1999	9/99	1999	9/99
Rifle (Old), Colorado	1999	3/99	1999	7/99
Riverton, Wyoming	1998	2/98	1998	2/98
Salt Lake City, Utah	1998	9/98	1998	9/98
Shiprock, New Mexico	1999	9/99	2011	
Slick Rock - (North Continent)	2002		2002	
Slick Rock, Colorado - (Union Carbide)	2002		2002	
Spook, Wyoming	1997	5/97	1997	5/97
Tuba City, Arizona	1998	4/98	2011	

Table 5–2. Project Milestones

Milestone	Planned/Actual Date
UGW - Transfer Spook, WY to LTSM Program	Oct 1997/Sep 1998
UGW - Transfer Maybell, CO to LTSM Program	Sep 1997/ Sep 1998
UGW - Transfer Mexican Hat, UT to LTSM Program	Nov 1999/Aug 2000
UGW - Transfer Falls City, TX to LTSM Program	May 1999/Mar 2000
UGW - Transfer Riverton, WY to LTSM Program	Aug 2004/
UGW - Transfer Ambrosia Lake, NM to LTSM Program	Dec 2000/Mar 2000
UGW - Transfer Shiprock, NM to LTSM Program	Aug 2011/
UGW - Transfer Canonsburg, PA to LTSM Program	Oct 2000/Feb 2000
UGW - Transfer New Rifle, CO to LTSM Program	Apr 2007/
UGW - Transfer Old Rifle, CO to LTSM Program	Apr 2007/
UGW - Transfer Lakeview, OR to LTSM Program	May 2000/
UGW - Transfer Gunnison, CO to LTSM Program	May 2007/
UGW - Transfer Durango, CO to LTSM Program	Jan 2010/
UGW - Transfer Grand Junction, CO to LTSM Program	Mar 2000/
UGW - Transfer Slick Rock, CO to LTSM Program	Apr 2009/
UGW - Transfer Naturita, CO to LTSM Program	Sep 2008/
UGW - Transfer Salt Lake City, UT to LTSM Program	May 2000/Mar 2000
UGW - Transfer Green River, UT to LTSM Program	Aug 2008/
UGW - Transfer Tuba City, AZ to LTSM Program	Oct 2011/
UGW - Transfer Monument Valley, AZ to LTSM Program	Oct 2011/

Current performance measures are

- **Relative risk reduction**—Currently, five sites are planned for alternate water supplies to reduce the risk for potential exposure. The Gunnison and Rifle, Colorado, and Riverton, Wyoming, sites alternate water supplies are completed. A partial alternate water supply for the New Rifle site was completed in 1997; an extension of this water supply is planned for FY 2002. An alternate water supply at the Monument Valley, Arizona, site is scheduled for completion in FY 2002. The alternate water supply at Lakeview, Oregon, is in progress.

- **Relative risk funding trend**—Table 5–3 presents budget baseline costs by year.

Table 5–3. Budget Baseline (based on April 2001 Life Cycle Baseline)
(in $k)

	Pre-1999	1999	2000	2001	2002	2003	2004
Baseline	$38,720	$8,969	$12,348	$10,924	$14,349	$15,057	$10,673
Cumulative	$38,720	$47,689	$60,037	$70,961	$85,310	$100,367	$111,040
	2005	2006	2007	2008	2009	2010	2011
Baseline	$22,059	$9,768	$8,061	$8,088	$8,132	$8,262	$7,481
Cumulative	$133,099	$142,867	$150,928	$159,016	$167,148	$175,410	$182,891

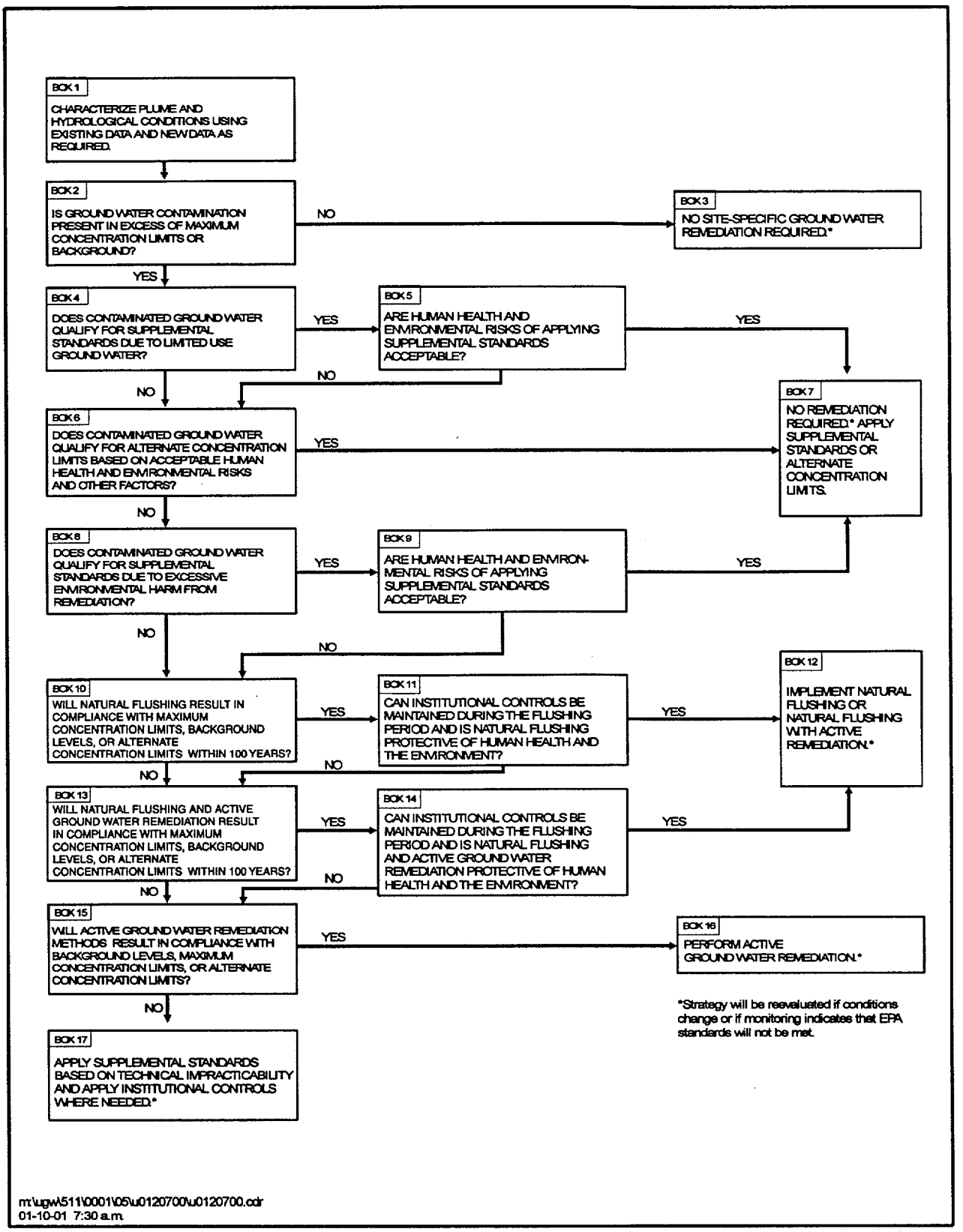
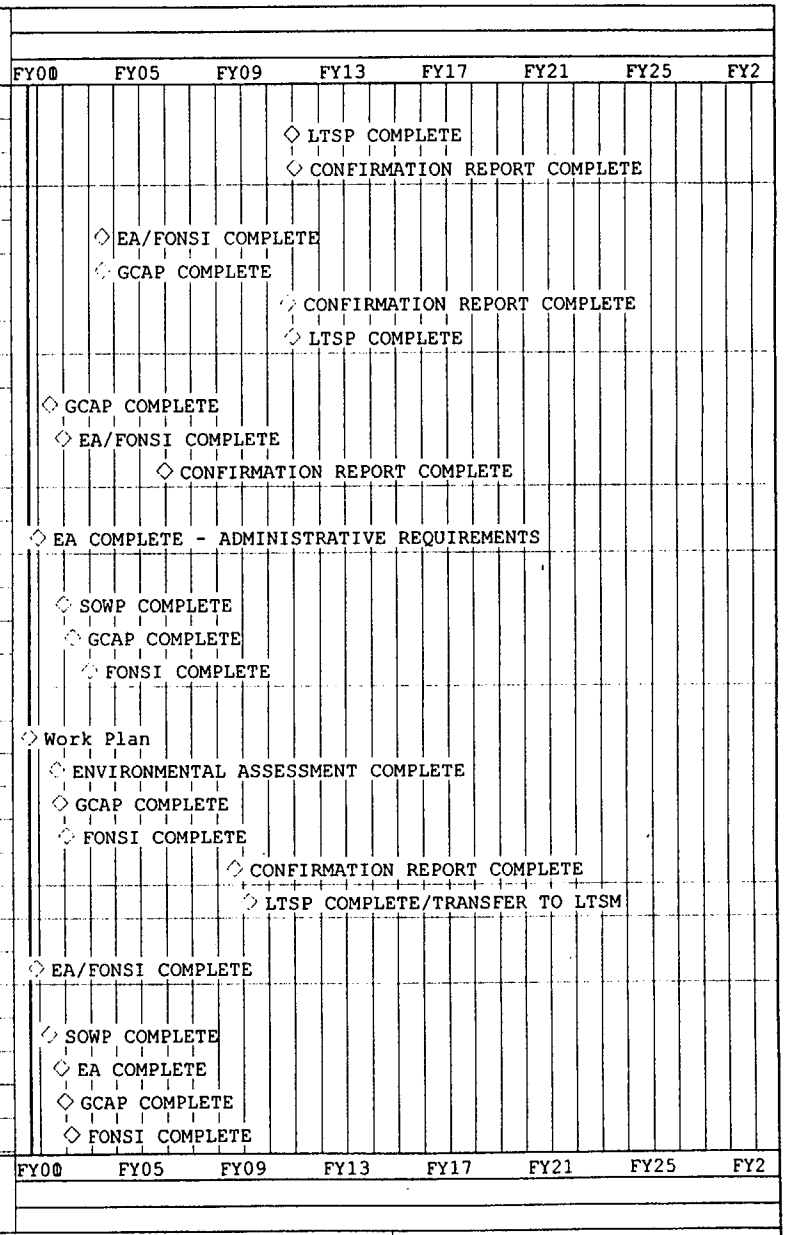


Figure 5–1. Logic Framework

6.0 Environmental Restoration Program Master Schedule

Figure 6–1 lists the major activities for each site from FY 2000 through FY 2024, as scheduled in the April 2001 life-cycle baseline budget.

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
TUBA CITY - WBS:51101			
VV9060	LTSP COMPLETE		29SEP11
VV9050	CONFIRMATION REPORT COMPLETE		31OCT11
MONUMENT VALLEY - WBS:51102			
NN9030	EA/FONSI COMPLETE		15APR04
NN9020	GCAP COMPLETE		21APR04
NN9050	CONFIRMATION REPORT COMPLETE		29JUL11
NN9060	LTSP COMPLETE		30SEP11
RIFLE - WBS:51104			
PP9030	GCAP COMPLETE		25MAR02
PP9010	EA/FONSI COMPLETE		27SEP02
PP9040	CONFIRMATION REPORT COMPLETE		18SEP06
SHIPROCK - WBS:51105			
SS9010	EA COMPLETE - ADMINISTRATIVE R		28SEP01
GREEN RIVER - WBS:51114			
HH9040	SOWP COMPLETE		25SEP02
HH9070	GCAP COMPLETE		31JAN03
HH9060	FONSI COMPLETE		29SEP03
DURANGO - WBS:51115			
EE9000	Work Plan		18MAY01
EE9015	ENVIRONMENTAL ASSESSMENT COMPL		17JUN02
EE9025	GCAP COMPLETE		1AUG02
EE9020	FONSI COMPLETE		31OCT02
EE9035	CONFIRMATION REPORT COMPLETE		5JUN09
EE9050	LTSP COMPLETE/TRANSFER TO LTSM		22DEC09
GUNNISON - WBS:51118			
II9010	EA/FONSI COMPLETE		14AUG01
SLICK ROCK - WBS:51120			
TT9000	SOWP COMPLETE		12FEB02
TT9010	EA COMPLETE		1AUG02
TT9030	GCAP COMPLETE		17SEP02
TT9020	FONSI COMPLETE		16DEC02



Plot Date 11JUN01
Data Date 20MAY01
Project Start 1JAN94
Project Finish 12SEP30

(c) Primavera Systems, Inc.

Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

UGM1

Sheet 1 of 2

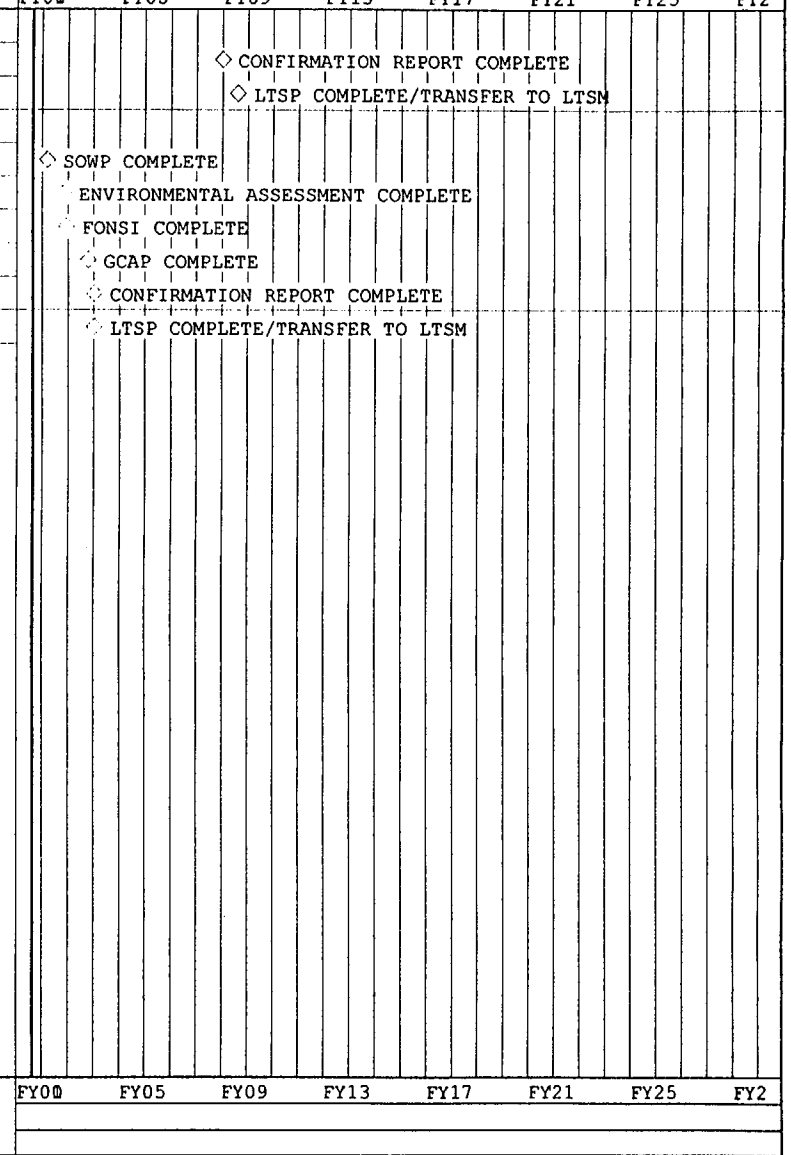
UNITED STATES DEPARTMENT OF ENERGY
UMTRA GROUND WATER PROJECT
Milestone Schedule

Mactec-ERS

Date	Revision	Checked	Approved
6/11/01		DKS	

Figure 6–1. UMTRA Ground Water Project Summary Schedule

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
SLICK ROCK - WBS:51120			
TT9040	CONFIRMATION REPORT COMPLETE		29SEP08
TT9050	LTSP COMPLETE/TRANSFER TO LTSM		6MAY09
NATURITA - WBS:51122			
OO9000	SOWP COMPLETE		12DEC01
OO9010	ENVIRONMENTAL ASSESSMENT COMPL		30JUL02
OO9020	FONSI COMPLETE		6SEP02
OO9030	GCAP COMPLETE		15JUL03
OO9040	CONFIRMATION REPORT COMPLETE		8OCT03
OO9050	LTSP COMPLETE/TRANSFER TO LTSM		8OCT03



Plot Date 11JUN01
Data Date 20MAY01
Project Start 1JAN94
Project Finish 12SEP30

(c) Primavera Systems, Inc.

Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

UGW1

Sheet 2 of 2

UNITED STATES DEPARTMENT OF ENERGY
UMTRA GROUND WATER PROJECT
Milestone Schedule

Mactec-ERS

Date	Revision	Checked	Approved

Figure 6–1 (continued). UMTRA Ground Water Project Summary Schedule

End of current text

7.0 Issues To Be Resolved

Project tasks include resolving specific technical and administrative issues.

- Viability of budgeted compliance approaches for individual sites. The current budget lists targeted compliance strategies for the sites on the basis of available information. The site-specific acceptability and viability of these targeted strategies has yet to be determined for sites still in the assessment phase.

- Monument Valley Land Farm – The land farm pilot study is on hold pending approval from the Navajo Nation. Local grazing permit holders have objected to the pilot study. Discussions are ongoing to resolve issues; however, the study is currently 1 year behind schedule.

- Shiprock Remedial Action – The Shiprock site has a very complex conceptual model due to hydrogeologic factors. The compliance strategy is equally complex including no further action, natural flushing, and active remediation.

- Slick Rock Organic Plume – An organic plume at the Slick Rock Union Carbide site appears to be the remnant of an old gasoline spill. The plume does not leave the site.

- Tuba City Treatment System – The treatment system at the Tuba City site continues to foul with solids build up. Numerous pilot tests have been performed to determine the cause(s). It is anticipated that a final solution will be determined in FY 2001 with implementation in FY 2002.

- Vanadium Contamination – Vanadium contamination at the New Rifle and Naturita sites likely will not naturally flush to risk-based levels in 100 years. An active treatment system is being piloted at the New Rifle site to determine its viability.

- Institutional Controls at New Rifle – Institutional controls will be required at the New Rifle site during the period of natural flushing. A cooperative agreement is being developed with the City of Rifle, County of Garfield, and State of Colorado to provide a potable water supply to residents within the footprint of the plume. The institutional controls will include zoning restrictions that insure ground water is not used.

- Riverton Public Relations – The Arapaho-Shoshone tribe is soliciting a contractor to evaluate the natural flushing compliance strategy to determine its viability. The tribes believe DOE has withheld information that does not support the natural flushing strategy.

End of current text

8.0 References

DOE (U.S. Department of Energy), 1993. *Technical Approach to Groundwater Restoration,* U.S. Department of Energy, UMTRA Project Office, Albuquerque, New Mexico, November.

_____, 1994. *Guidance for Implementation of the Department's Public Participation Policy*, memorandum from the Secretary of Energy, U.S. Department of Energy, Washington, DC.

_____, 1995a. *Guidance Document for Preparing Water Sampling and Analysis Plans for UMTRA Project Sites,* U.S. Department of Energy, Environmental Restoration Division, UMTRA Project Team, Albuquerque, New Mexico, September.

_____, 1995b. *Uranium Mill Tailings Cleanup, Continuous But Future Costs Are Uncertain*, GAO/RCEO–96–37, December.

_____ , 1996a. *Final Management Action Process (MAP) Resource Guide*, prepared for the U.S. Department of Energy, Office of Environmental Restoration (EM–40).

_____, 1996b. *Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project, Volumes I and II*, U.S. Department of Energy, Grand Junction Projects Office, Grand Junction, Colorado, October.

_____, 1997a. *Management Plan for Field-Generated Investigation Derived Waste,* U.S. Department of Energy, Grand Junction, Colorado.

_____, 1997b. *Public Participation Plan*, GJO–97–26–TAR, P–GJO–2351, Revision 1, Prepared by the U.S. Department of Energy, Grand Junction Projects Office, Grand Junction, Colorado, October.

_____, 1998. *Quality Assurance Program Plan*, MAC–2014, Prepared by the U.S. Department of Energy, Grand Junction Projects Office, Grand Junction, Colorado, February.

_____1999. *Emergency Spill and Accident Response Plan for the Transportation of Residual Radioactive Materials,* U.S. Department of Energy, Grand Junction, Colorado.

Jacobs Engineering Group, Inc., 1995. *Contaminated Ground Water, Volume Calculation (Output)*, UPDCC File Location No. 0.16.1, Albuquerque, New Mexico.

Matthews, Mark L., 1991. Memorandum dated August 8, 1991.

Code of Federal Regulations

10 CFR 40, *Domestic Licensing of Source Material*, U.S. Nuclear Regulatory Commission.

40 CFR 192, *Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings*, U.S. Environmental Protection Agency.

40 CFR 1500, *Purpose, Policy, and Mandate*, Council on Environmental Quality.

40 CFR 1501, *NEPA and Agency Planning*, Council on Environmental Quality.

40 CFR 1502, *Environmental Impact Statement*, Council on Environmental Quality.

40 CFR 1503, *Commenting*, Council on Environmental Quality.

40 CFR 1504, *Predecision Referrals to the Council of Proposed Federal Actions Determined To Be Environmentally Unsatisfactory*, Council on Environmental Quality.

40 CFR 1505, *NEPA and Agency Decision Making*, Council on Environmental Quality.

40 CFR 1506, *Other Requirements of NEPA*, Council on Environmental Quality.

40 CFR 1507, *Agency Compliance*, Council on Environmental Quality.

40 CFR 1508, *Terminology and Index*, Council on Environmental Quality.

Federal Register

60 FR 2854, *Groundwater Standards for Remedial Actions at Inactive Uranium Processing Sites*, final rule, U.S. Environmental Protection Agency, January 11, 1995.

60 FR 22913, *Record of Decision*, U.S. Department of Energy, April 28, 1997.

United States Code

42 USC Section 4321 et seq., *National Environmental Policy Act*, January 1, 1970.

42 USC Section 7901 et seq., *Uranium Mill Tailings Radiation Control Act*, November 8, 1978.

42 USC Section 7922 et seq., *Uranium Mill Tailings Remedial Action Amendments Act*, November 5, 1988.

Appendix A

Fiscal-Year Funding Requirements

Table A-1. FY 1997-FY2001 Budget Estimates

SITE	FY 1997		FY 1998		FY 1999		FY 2000		FY 2001
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned
Ambrosia Lake	$ 373,281	$ 171,747	$ 321,472	$ 31,086	$	$	$	$	
Canonsburg	8,436	3,137	266,784	69,013	5,770	8,525	25,256	14,934	
Durango	65,010	55,573	255,914	95,173	110,266	105,526	448,263	247,505	775,555
Falls City	278,721	184,337	303,321	95,212	43,267	43,038	77,784		
Grand Junction	378,197	293,184	1,183,648	597,543	404,867	346,192	76,184	30,516	30,519
Green River	123,970	79,611	79,309	67,368	15,013	14,240	30,258	16,339	121,909
Gunnison	355,417	229,222	753,538	129,197	203,043	156,263	503,871	420,728	178,476
Lakeview					71,093	61,491	108,227	18,521	81,562
Lowman									
Maybell	72,046	38,412	87,936	818					
Mexican Hat	32,456	34,029	54,278	69,249	125,344	119,345	133,685	4,855	49,528
Monument Valley	976,568	1,161,725	927,755	1,224,348	1,502,920	1,453,439	2,184,186	1,047,544	1,467,135
Naturita	107,776	80,475	157,015	67,531	16,486	17,333	76,613	32,972	576,580
Riverton	1,076,044	891,627	578,335	368,804	64,665	37,000	33,259	2,186	
Rifle	383,453	421,585	777,388	827,340	1,165,671	1,085,295	700,829	504,938	543,428
Shiprock	231,734	484,556	848,167	433,589	1,007,338	1,042,731	883,091	1,240,170	693,991
Salt Lake City	103,769	71,665	136,232	31,992	124,443	124,443	61,562	20,634	
Slick Rock	101,513	53,141	75,462	30,007	12,990	12,990	181,006	294,282	336,212
Spook	2,800	7,394		63,924					
Tuba City	1,061,127	1,241,575	986,023	1,045,008	5,056,306	4,960,798	6,085,585	6,108,312	3,534,177
Nonsite	2,009,808	1,561,048	1,598,049	2,669,651	835,977	845,976	1,390,341	2,343,854	2,534,685
Total	$ 7,742,126	$ 7,064,043	$ 9,390,626	$ 7,916,853	$10,765,459	$10,434,625	$13,000,000	12,348,290	10,923,757

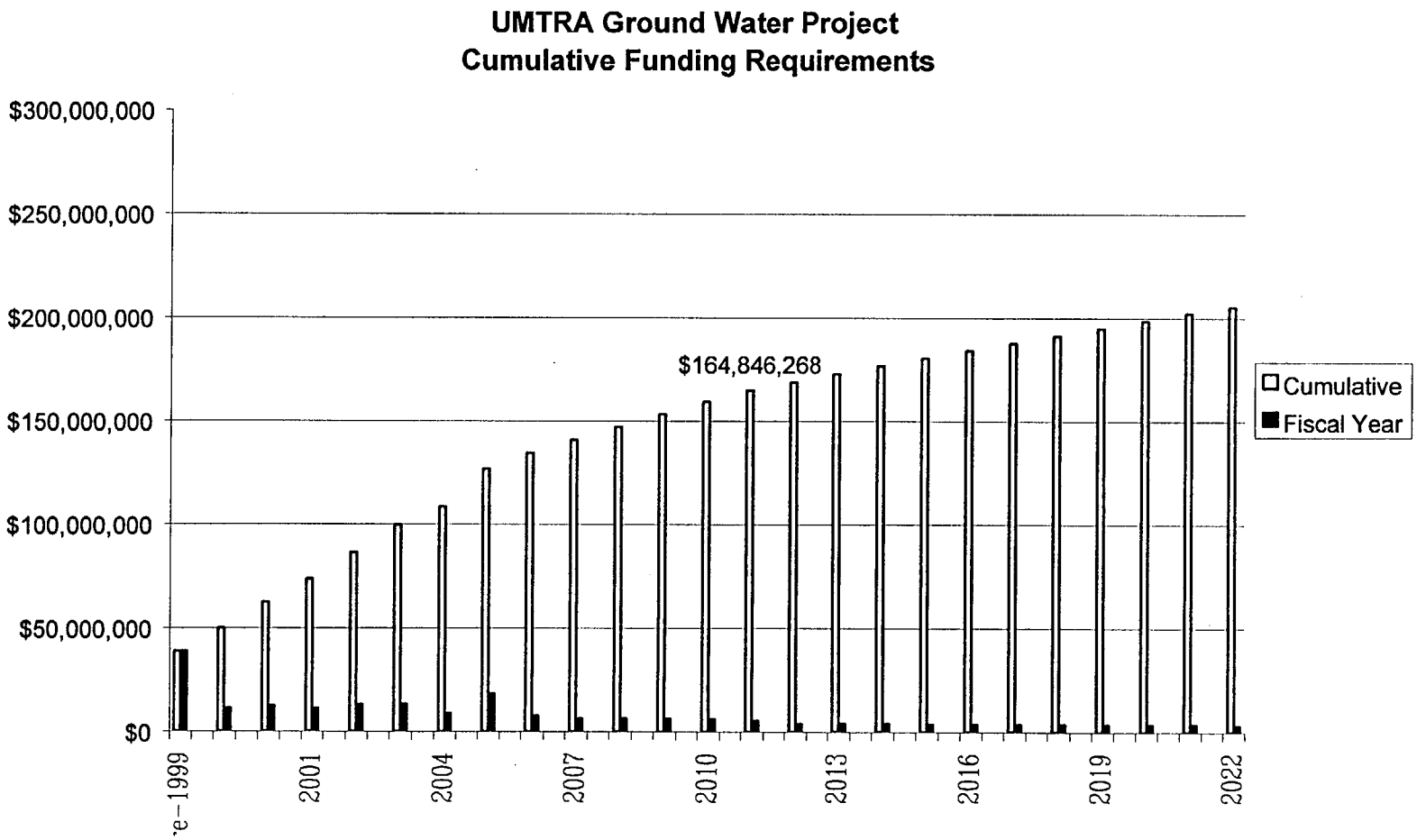


Figure A–1. UMTRA Ground Water Project Cumulative Funding Requirements

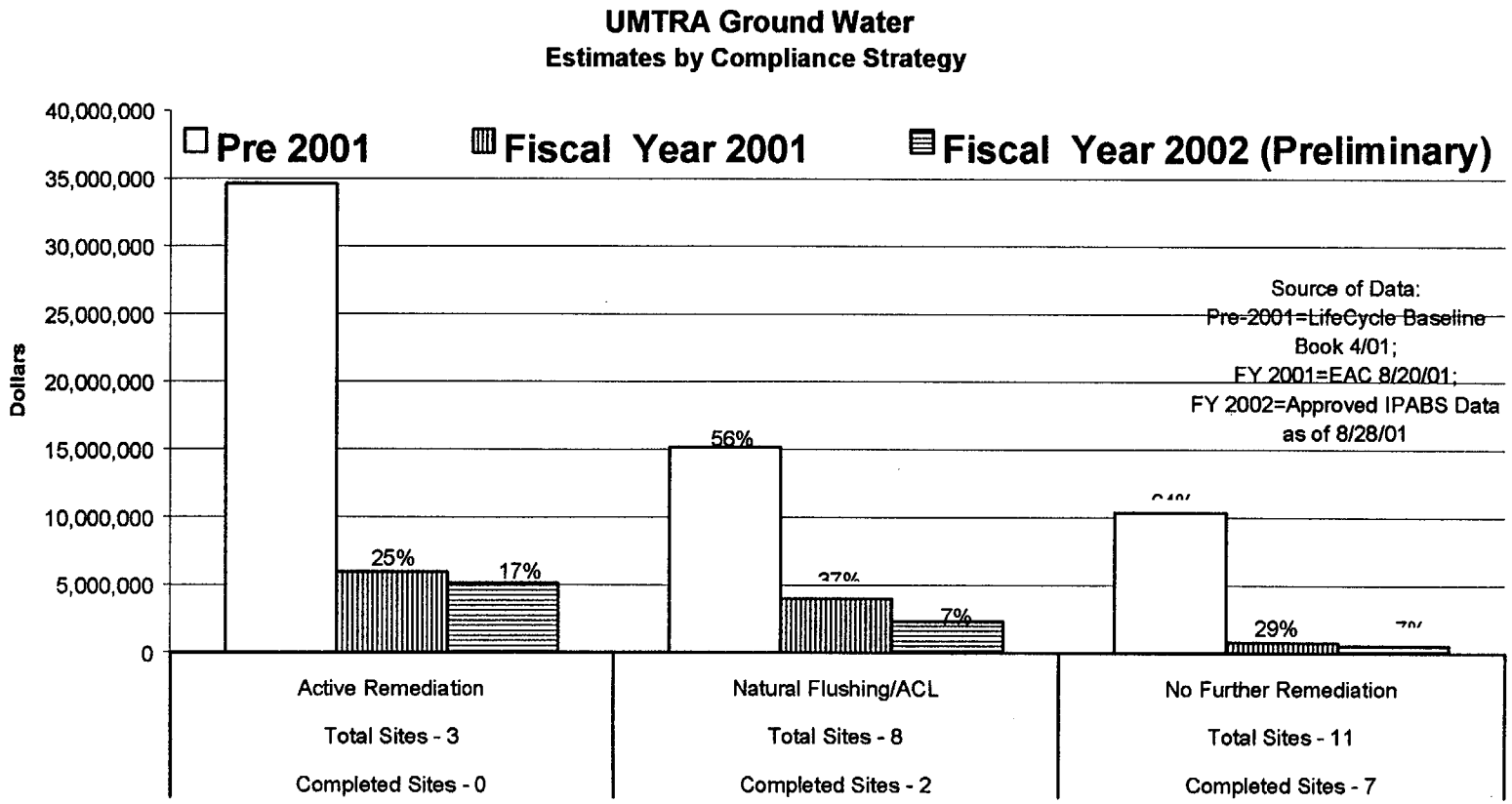


Figure A–2. Funding Requirements by Compliance Strategy

Appendix B

Major Environmental Restoration Documents

Table B–1. Major Programmatic Documents

Title	Date	Phase	Applicable Site
Ground Water Monitoring Program Plan	May 1992	Planning	All sites
Environmental Monitoring Plan	December 1992	Planning	All sites
Guidance Document for Preparing Water Sampling and Analysis Plans	August 1993	Planning	All sites
Public Information Plan	September 1993	Planning	All sites
Technical Approach to Ground Water Restoration	November 1993	Planning	All sites
Ground Water Protection Management Program Plan	February 1994	Planning	All sites
Technical Approach for the Management of UMTRA Ground Water Investigation-Derived Wastes	February 1994	Planning	All sites
Waste Minimization and Pollution Prevention Awareness Program Plan	July 1994	Planning	All sites
UMTRA Water Sampling Handbook	August 1994	Monitoring	All sites
Ground Water Project Plan	September 1994	Planning	All sites
Quality Assurance Implementation Plan	September 1994	Planning	All sites
Environmental Protection Implementation Plan	October 1994	Planning	All sites
FY 1993 Annual Environmental Report	October 1994	Monitoring	All sites
Human Health Risk Assessment Methodology	November 1994	Assessment	All sites
Environment, Safety, and Health Plan	March 1995	Planning	All sites
Planning Guide for Site Observational Work Plans	July 1995	Planning	All sites
FY 1994 Annual Environmental Report	August 1995	Monitoring	All sites
Public Participation Plan	October 1996	Planning	All sites
Programmatic Environmental Impact Statement	January 1997	Planning	All sites
Monument Valley Project Safety Plan	February 1997	Assessment	MON
Record of Decision	April 1997	Planning	All sites
Project Safety Plan for Grand Junction	October 1997	Assessment	GRJ
Project Safety Plan for New and Old Rifle Project Sites	October 1997	Assessment	RFL
Quality Assurance Program Plan	February 1998	Planning	All sites
Sampling Health & Safety Plan	June 1998	Monitoring	All sites
Project Safety Plan for Installation and Sampling of Monitoring Wells on the Naturita UMTRA Site	October 1998	Assessment	NAT
Independent Baseline Review	April 1999	Planning	All sites
Project Safety Plan—Installation of New Monitoring Wells and Abandonment of Old Wells a the Salt Lake City Vitro Processing Site	July 1999	Assessment	SLC
Project Safety Plan—Installation and Abandonment of Monitor Wells at the Gunnison Processing Site	September 1999	Assessment	GUN
Project Safety Plan—Installation of Monitor Wells at the Shiprock, New Mexico Site	January 2000	Assessment	SHP
UGW Life-Cycle Baseline	March 2000	Planning	All sites
Sampling Frequencies and Analyses	November 2000	Monitoring	All sites
Project Safety Plan for the Remedial Action Construction of the UMTRA Ground Water Project, Tuba City, Arizona	January 2001	Assessment	TUB
Sampling and Analysis Plan	June 2001	Monitoring	All sites
Management Action Process Document	June 2001	Planning	All sites
Environmental Procedures Catalogue	Continuously updated	Monitoring	All sites

Table B-2. Major Site-Specific Documents[a]

Site	WSAP	BLRA	SOWP	NEPA	GCAP
Ambrosia Lake	January 1994	NA	February 1995 Rev. 0	March 1998	July 1998 **NRC Concurrence July 1998**
Belfield	September 1994	September 1994, F, Rev. 1	NA	NA	NA
Bowman	September 1994	November 1994, F, Rev. 0	NA	NA	NA
Canonsburg	September 1995	November 1995, F, Rev. 1	(SOWP equivalent-ACL application) September 1998	March 1999	March 1999 **NRC Concurrence January 2000**
Durango	September 1995	September 1995, F, Rev. 1			
Falls City	September 1995	September 1995, F, Rev. 1	May 1997 Rev. 1	March 1998	September 1998 **NRC Concurrence September 1998**
Grand Junction	August 1995	September 1995, F, Rev. 2	May 1999 Rev. 1	May 1999	April 1999 **State Concurrence November 1999**
Green River	August 1995	September 1995, F, Rev. 1			
Gunnison	September 1995	April 1994, F, Rev. 1	October 2000 Rev. 1		
Lakeview	September 1995	March 1996, F, Rev. 1	SOWP equivalent-August 1999	In progress	August 1999
Lowman	NA	NA	NA	January 1991	(RAP)-April 1991 **NRC Concurrence April 1997**
Maybell	June 1994	March 1996, F, Rev. 1	NA	April 1997	(RAP)May 1997 **NRC Concurrence April 1997**
Mexican Hat	September 1995	(Eco Risk)-March 1994	September 1995 Rev. 0 July 1998 Rev. 1	NA	**NRC Concurrence February 1996**
Monument Valley	September 1995	March 1996, F, Rev. 1	September 1995 Rev. 0 March 1996 Rev. 0 February 1998 Rev. 1 June 1998, Rev. 1 April 1999 F **NRC acceptance January 2000**	In progress	August 1999 draft
Naturita	September 1995	November 1995, F, Rev. 1			
New Rifle	September 1995	August 1995, F, Rev. 1	Sept. 1999 Rev. 1	In progress	September 1999
Old Rifle	September 1995	August 1995, F, Rev. 1	April 1999 Rev. 1 August 1999 F	May 1999	Revised November 2000 NRC Review in Progress
Riverton	April 1994	September 1995, F, Rev. 1	February 1998 Rev. 1	January 1998	February 1998 September 1998 **NRC Concurrence May 1999**

Table B-2 (continued). Major Site-Specific Documents[a]

Site	WSAP	BLRA	SOWP	NEPA	GCAP
Salt Lake City	September 1995	September 1995, F, Rev. 1	NA	September 1998	September 1998 Awaiting NRC review
Shiprock	September 1995	April 1994, F, Rev. 1	September 1999 Rev. 1 October 2000 Rev. 1	In Progress	
Slick Rock - NC	September 1994	September 1995, F, Rev. 1			
Slick Rock - UC	September 1994	September 1995, F, Rev. 1			
Spook	March 1994		April 1995 Rev. 0	April 1997	May 1997 **NRC Concurrence October 1997**
Tuba City	February 1996	June 1994, F, Rev. 0	July 1995 Rev. 0 February 1998 Rev. 1 September 1998 F	December 1998	**NRC Concurrence March 2000**

[a]WSAP = Water Sampling and Analysis Plan; BLRA = Baseline Risk Assessment; SOWP = Site Observational Work Plan; F = final; NEPA = National Environmental Policy Act; GCAP = Ground water Compliance Action Plan

End of current text

Appendix C

Decision Document
Record of Decision Summaries

Decision Document
Record of Decision Summaries

At this stage in the Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project, few final decision documents have been completed because the cleanup strategies for most site activities are still in the planning or characterization phases.

The final Surface Project Remedial Action Plan for the Lowman, Idaho, site declared that ground water contamination did not result from uranium processing activities. The U.S. Nuclear Regulatory Commission (NRC) concurred that no further action was required under the UMTRA Ground Water Project to complete the licensing requirements for the site (see Exhibit A). The NRC concurred in April 1997 on the Maybell, Colorado, Remedial Action Plan and Remedial Action Implementation Plan (see Exhibit B), and, in October 1997, on the Spook, Wyoming, Ground water Compliance Action Plan (see Exhibit C).

The Record of Decision for the Programmatic Environmental Impact Statement was published in the *Federal Register* on April 28, 1997. This decision will result in the selection of the remedial alternative on a site-specific basis for the UMTRA Ground Water Project.

End of current text

Exhibit A

NRC Letter for Lowman, Idaho

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 21,1997

Mark L. Matthews, Project Manager
Uranium Mill Tailings Remedial Action Project Office
U.S. Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, NM 87115

Dear Mr. Matthews:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of the final Remedial Action Plan and Site Design (RAP) and all associated documentation pertinent to the proposed remedial action for the uranium mill tailings site at Lowman, Idaho. Our review is documented in the Final Technical Evaluation Report (TER) (see Enclosure 1), which discusses the NRC staff's evaluation of the remedial action for compliance with the EPA standards.

In the groundwater area, the Lowman site is unique in that it does not have the outstanding open issue of postponed groundwater cleanup as a result of DOE's ability to demonstrate a lack of groundwater contamination at the site. Therefore, based on our review, the NRC can give full concurrence in the final Lowman Remedial Action Plan and Site Design. As a result, I have signed the original signature pages transmitted to the NRC for signature with Revision 3 to the RAP. The completed signature pages for the RAP are included as Enclosure 2.

DOE submitted RAP Modification (RAP MOD) No. 1 as Revision 2 to the RAP on April 22, 1991, for NRC staff review and concurrence. The RAP MOD requested the use of supplemental standards to prevent excessive environmental harm from the removal of residual radioactive material in the proposed remedial action for Lowman. The NRC staff reviewed and concurred in this RAP MOD on June 18, 1991. Our review of this RAP MOD has also been documented in the final TER and the signature pages for the RAP MOD are provided in Enclosure 3.

As you are aware, DOE also recently submitted to the NRC Revision B to the Remedial Action Inspection Plan (RAIP) (June 24, 1991) for review and concurrence; and two Project Interface Documents Nos. 12-S-04 and 12-S-05 (June 11, 1991) for review. As a result of our review of these documents, the NRC staff concurs in the RAIP and is in agreement with the classification of the PID No. 12-S-04. The staff, however, does not agree with the Category II classification of PID No. 12-S-05 and will provide a complete discussion of our evaluation under separate cover at a later date.

If you have any questions regarding the information in the enclosed final TER, please contact me at FTS 492-3439 or the NRC Project Manager, S. L. Wastler, at FTS 492-0582.

Sincerely,

Original signed by

John J. Surmeier, Chief
Uranium Recovery Branch
Division of Low-level Waste Management
and Decommissioning

Enclosures: As stated

cc: P. Mann, DOE/AL
M. Abrams, DOE/AL
R. Donovan, Idaho
C. Cody, Idaho
K. Feldman, EPA

Exhibit B

NRC Letter for Maybell, Colorado

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 21,1997

Mr. George Rael, Acting Director
Environmental Restoration Division
Uranium Mill Tailings Remedial Action Project
Albuquerque Operations Office
U.S. Department of Energy
P.O. Box 5400
Albuquerque, NM 87185-5400

UMAY000031

SUBJECT: FINAL TECHNICAL EVALUATION REPORT FOR THE MAYBELL, COLORADO, URANIUM MILL TAILINGS SITE

Dear Mr. Rael:

The U.S. Nuclear Regulatory Commission staff has completed its review of the final Remedial Action Plan and Site Design (RAP) and the Remedial Action Inspection Plan (RAIP), Revision O, for the inactive uranium mill tailings sites at Maybell, Colorado. The staff's review is documented in the enclosed final Technical Evaluation Report (TER).

Based on this review, the NRC staff concurs in the Maybell RAP and RAIP. The Department of Energy (DOE) has proposed no groundwater cleanup at the Maybell site. This proposal is based on the following: DOE's characterization of the uppermost aquifer as "limited use," containing wide-spread ambient contamination not related to uranium milling activities; no current or projected future water use of the aquifer within a 4.8 km (3 mile) radius of the site; no apparent discharge of tailings contaminated groundwater to surface-water bodies or deeper aquifers in the vicinity; and continued groundwater monitoring of the existing contamination to assure conditions remain unchanged. Based on its review of DOE's proposal, the NRC staff agrees with DOE's findings and concludes that DOE has demonstrated compliance with all groundwater protection provisions of 40 CFR 192, Subparts A through C. As a result of the staff's concurrence, NRC is prepared to sign the signature pages for the Maybell RAP, following their submittal by DOE.

If you have any questions concerning this subject, please contact the NRC Project Manager, Robert Carlson, at (301) 415-8165.

Sincerely,

Original signed by D.M. Gillen for

Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards

Enclosure: As stated
cc: W. Woodworth, DOE Alb
S. Hamp, DOE Alb
E. Artiglia, TAC Alb

End of current text

Exhibit C

NRC Letter for Spook, Wyoming

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 9,1997

Mr. Ray Plieness, Project Manager
U.S. Department of Energy
Grand Junction Office
2597 B ¾ Road
Grand Junction, CO 81503

SUBJECT: ACCEPTANCE OF THE FINAL GROUND WATER COMPLIANCE ACTION PLAN FOR THE INACTIVE URANIUM MILL TAILINGS SITE AT SPOOK, WYOMING

Dear Mr. Plieness:

The U.S. Nuclear Regulatory Commission staff hereby concurs with the U.S. Department of Energy's (DOE's) Ground Water Compliance Action Plan (GCAP), dated March 18, 1997 for the Spook Uranium Mill Tailings Remedial Action Project site at Spook, Wyoming. This action completes the remedial action for the Spook site under the Uranium Mill Tailings Radiation Control Act of 1978, as amended (UMTRCA).

DOE submitted a final Remedial Action Plan and Site Conceptual Design for Stabilization of the Inactive Uranium Mill Tailings at Spook, Wyoming, dated July, 1989. The staff reviewed and conditionally concurred with the proposal in December, 1989. The conditional concurrence was based on DOE's deferring compliance with the groundwater cleanup provisions of Title 40 Code of Federal Regulations Part 192 (40 CFR 192), Subparts B and C. DOE's final Completion Report dated October, 1991 was reviewed by NRC staff and accepted by letter dated March 4, 1992. NRC staff accepted DOE's Long Term Surveillance Plan for the site by letter dated September 21, 1993 and the site was transferred to long-term care under the general license provisions of 10 CFR 40.27.

As discussed in the enclosed Technical Evaluation Review (TER), NRC staff has determined that the GCAP and modification of the Spook Remedial Action Plan satisfies the requirements set forth in the UMTRCA, and the regulations in 40 CFR 192, Subparts B and C for the cleanup of groundwater contamination resulting from the processing of ores for the extraction of uranium. No modifications to the Long-Term Surveillance Plan are required.

If you have any questions concerning this subject please contact the NRC Project Manager, Janet Lambert, at (301) 415-6710.

Sincerely,

Original signed by

Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards

Enclosure: As stated

cc: D. Metzler, DOE GJO
F. Bosiljevac, DOE Alb
J. Virgona, DOE GJO
R. Edge, DOE GJO

End of current text

Exhibit D

NRC Letter for Ambrosia Lake, New Mexico

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 17, 1998

Mr. Donald R. Metzler, Project Manager
U.S. Department of Energy
Grand Junction Office
2597 B3/4 Road
Grand Junction, CO 81503

SUBJECT: REVIEW OF AMBROSIA LAKE GROUND WATER COMPLIANCE ACTION PLAN

Dear Mr. Metzler:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of the Ambrosia Lake, New Mexico, Ground Water Compliance Action Plan (GCAP), dated April 1998, which was submitted by a U.S. Department of Energy (DOE) letter dated June 1, 1998. The GCAP reiterates DOE's strategy of "No-Ground-Water-Remediation," based on the ground water in the uppermost aquifer being classified as limited use and, thus, no program to monitor ground water is required.

As discussed in the enclosed Supplemental Technical Evaluation Report (STER), the NRC staff has reviewed the GCAP, and agrees with DOE that the uppermost aquifer does not represent a ground-water resource, because of the limited extent of saturation in the aquifer and its inability to sustain a yield of 150 gallons (570 liters) per day to wells. The uppermost aquifer is expected to return to its premilling and mining condition of little-to-no saturation, further eliminating the unit as a potential future ground-water resource. Ground water does not discharge to the land surface, and the nearest surface water is located approximately 1.5 miles (2.4 kilometers) southwest of the site. No current exposure pathways due to ground-water contamination exist, nor are any foreseen.

Based on the above, the NRC staff concurs with the GCAP. If you have any questions concerning this letter or the enclosed STER, please contact the NRC Project Manager, Ken Hooks, at (301) 415-7777.

Sincerely,

Original signed by

Joseph Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards

Docket No. WM-67
Enclosure: As stated

cc: W. Woodworth, DOE Alb
F. Bosiljevac, DOE Alb
E. Artiglia, TAC Alb
M. Leavitt, NMED Santa Fe, NM

End of current text

Exhibit E

NRC Letter for Falls City, Texas

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 18, 1998

Mr. Ray Plieness
U.S. Department of Energy
Grand Junction Office
2597 B 3/4 Road
Grand Junction, CO 81503

SUBJECT: ACCEPTANCE OF THE FINAL GROUND WATER COMPLIANCE ACTION PLAN FOR THE INACTIVE URANIUM MILL TAILINGS SITE AT FALLS CITY, TEXAS

Dear Mr. Plieness:

The U.S. Nuclear Regulatory Commission (NRC) staff hereby concurs with the U.S. Department of Energy's (DOE's) Ground Water Compliance Action Plan (GCAP), dated April 8, 1998, for the Uranium Mill Tailings Remedial Action Project site at Falls City, Texas. This action completes the remedial action for the Falls City site under the Uranium Mill Tailings Radiation Control Act of 1978, as amended (UMTRCA).

DOE submitted a final Remedial Action Plan and Site Conceptual Design for Stabilization of the Inactive Uranium Mill Tailings at Falls City, Texas, dated November 1991. The staff reviewed and conditionally concurred with the proposal in August 1992. The conditional concurrence was based on DOE's deferring compliance with the ground-water cleanup provisions of Title 40 Code of Federal Regulations Part 192 (40 CFR 192), Subparts B and C. DOE's final Completion Report dated August 1996, was reviewed by NRC staff and accepted by letter dated April 16, 1997. NRC staff accepted DOE's Long Term Surveillance Plan for the site by letter dated July 8, 1997, and the site was transferred to long-term care under the general license provisions of 10 CFR 40.27.

As discussed in the enclosed Supplemental Techncial Evaluation Review (TER), NRC staff has determined that the GCAP and modification of the Falls City Remedial Action Plan satisfies the requirements set forth in the UMTRCA, and the regulations in 40 CFR 192, Subparts B and C for the cleanup of ground-water contamination resulting from the processing of ores for the extraction of uranium.

DOE must modify the LTSP to include monitoring of the existing plume for five years (until 2003) in wells 862, 886, 891, 924, and 963 for the protection of beneficial water use. This action completes the remedial action for this site under UMTRCA.

R. Plieness -2-

If you have any questions concerning this letter, please contact the NRC Project Manager, Elaine Brummett, at (301) 415-6606.

Sincerely,

Original signed by

Joseph Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards

Enclosure: As stated

cc: D. Metzler, DOE GJPO

Exhibit F

NRC Letter for Riverton, Wyoming

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 03, 1999

Mr. Ray Plieness
U.S. Department of Energy
Grand Junction Office
2597 B 3/4 Road
Grand Junction, CO 81503

SUBJECT: ACCEPTANCE OF THE FINAL GROUNDWATER COMPLIANCE ACTION PLAN FOR THE RIVERTON, WYOMING, TITLE I UMTRA SITE

Dear Mr. Plieness:

The U.S. Nuclear Regulatory Commission (NRC) staff hereby concurs with the U.S. Department of Energy's (DOE's) Groundwater Compliance Action Plan (GCAP), dated September 5, 1998, for the Uranium Mill Tailings Action Project Site at Riverton, Wyoming. This action completes the remedial action for the Riverton site under the Uranium Mill Tailings Radiation Control Act of 1978, as amended (UMTRCA).

The DOE Groundwater Project has completed an Environmental Assessment (EA) of groundwater compliance activities at the Uranium Mill Tailings Site, Riverton, Wyoming. DOE has also submitted a Final Site Observational Work Plan (SOWP), dated February 25, 1998, to NRC. In September 1998, NRC staff reviewed the SOWP, which included the Draft GCAP. The review focused on the proposed groundwater remediation strategy for compliance with 40 CFR Part 192, and the technical information presented in support of this strategy. NRC staff had no technical objection to DOE's SOWP or Draft GCAP.

As discussed in the enclosed Technical Evaluation Report (TER), NRC staff has determined that the Final GCAP for the Riverton site satisfies the requirements set forth in the UMTRCA, and the regulations in 40 CFR 192, Subparts B and C for the cleanup of groundwater contamination resulting from the processing of ores of the extraction of uranium. Therefore, NRC concurs on the Final GCAP.

The NRC staff concurs with the GCAP for the Riverton site. If you have any questions concerning this letter, please contact Mr. Michael Layton, of my staff, at (301) 415-6676.

Sincerely,

Original signed by

N. King Stablein, Acting Chief
Uranium Recovery and Low-Level Waste Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards

Enclosure: As stated
cc: D. Metzler

End of current text

Exhibit G

NRC Letter for Canonsburg, Pennsylvania

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 24, 2000

Mr. Donald R. Metzler
U.S. Department of Energy
Grand Junction Office
2597 B 3/4 Road
Grand Junction, CO 81503

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION CONCURRENCE OF THE GROUND WATER COMPLIANCE ACTION PLAN AND APPLICATION FOR ALTERNATE CONCENTRATION LIMITS FOR THE CANONSBURG, PENNSYLVANIA, UMTRA SITE

Dear Mr. Metzler:

The U.S. Department of Energy (DOE) submitted a Groundwater Compliance Action Plan (GCAP) and Application for Alternate Concentration Limits (ACL) for the Canonsburg, Pennsylvania, UMTRA site in letters dated September 9, 1998, April 8, 1999, and September 27, 1999. A request for additional information was made from this office, and DOE satisfied our concerns in a submittal dated December 17, 1999. Our staff has reviewed this information and concurs with the Groundwater Compliance Action Plan and approves the application for alternate concentration levels.

The staff has determined that the GCAP for the Canonsburg, Pennsylvania site satisfies the requirements set forth in the Uranium Mill Tailings Radiation Control Act of 1978, as amended and the standards in 40 CFR 192, Subpart B for the cleanup of groundwater contamination resulting from the processing of ores for the extraction of uranium. The compliance strategy proposed in the GCAP will achieve compliance with Subpart B of 40 CFR 192.12 through no remediation in conjunction with the application of an ACL, including groundwater monitoring and institutional controls to ensure that the ACL will continue to be protective of human health and the environment.

The staff's Technical Evaluation Report has been enclosed for your information. DOE should revise the Long-Term Surveillance Plan to be consistent with the Groundwater Compliance Action Plan.

D. Metzler 2

Please feel free to contact the NRC Project Manager, Jill Caverly, at (301) 415-6699 should you have any questions regarding this matter.

Sincerely,

Original signed by

Thomas H. Essig, Chief
Uranium Recovery and
Low-Level Waste Branch
Division of Waste Management
Office of Nuclear Material Safety and
Safeguards

Enclosure: Technical Evaluation Report

cc: James G. Yusko, Pennsylvania
Department of Environmental
Protection

Exhibit H

NRC Letter for Tuba City, Arizona

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 10, 2000

Mr. Donald R. Metzler
U.S. Department of Energy
Grand Junction Office
2597 B 3/4 Road
Grand Junction, CO 81503

SUBJECT: ACCEPTANCE OF THE FINAL PHASE I GROUND-WATER COMPLIANCE ACTION PLAN FOR THE URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT SITE AT TUBA CITY, ARIZONA

Dear Mr. Metzler:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of the U.S. Department of Energy's (DOE's) Final Phase I Ground-water Compliance Action Plan (GCAP), submitted by cover letter dated August 18, 1999, for the Uranium Mill Tailings Remedial Action (UMTRA) Project site at Tuba City, Arizona.

DOE plans to remediate the site in two phases. Phase I will include installation of extraction wells, injection wells, and an infiltration trench, extraction of ground water from the most contaminated areas of the plume and containment of the down-gradient movement of the plume. Phase II will include the expansion of remediation capacity and monitoring to ensure that aquifer restoration standards are met.

The NRC staff's review focused on the proposed ground-water remediation strategy for compliance with 40 CFR Part 192 and the technical information presented in support of this strategy. DOE has proposed a combination of active remediation strategies to remediate ground-water quality at the Tuba City site. The proposed strategy combines the pumping alternative that uses extraction and injection wells and an infiltration trench with distillation. Aquifer restoration standards (required by 40 CFR 192) have been established for nitrate, molybdenum, selenium, and uranium and aquifer restoration goals (not required by 40 CFR Part 192, but requested by the Navajo Nation) have been established for sulfate, total dissolved solids (TDS), chloride, sodium, pH and corrosivity.

Based on its review, the NRC staff has determined that the final Phase I GCAP satisfies the requirement set forth in the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978, and the regulations in 40 CFR 192 for the cleanup of ground-water contamination resulting from the processing of ores for the extraction of uranium. Therefore, NRC staff concurs with the final Phase I GCAP.

D. Metzler -2- March 10, 2000

If you have any questions concerning this subject, please feel free to contact the NRC Project Manager, Melanie Wong, at (301) 415-6262 or e-mail at mcw@nrc.gov.

Sincerely,

Original signed by

Thomas H. Essig, Chief
Uranium Recovery and
Low-Level Waste Branch
Division of Waste Management
Office of Nuclear Material Safety and
Safeguards

Enclosure: Technical Evaluation Report

cc: R. Plieness, DOE - GRJ
M. Roanhorse, Navajo Nation
S. Marutzky, MACTEC- ERS

Exhibit I

NRC Letter for Mexican Hat, Utah

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 14, 2000

Mr. Donald R. Metzler
U.S. Department of Energy
Grand Junction Office
2597 B 3/4 Road
Grand Junction, CO 81503

SUBJECT: RESPONSE TO NAVAJO NATION'S CONCERNS REGARDING GROUND-WATER COMPLIANCE STRATEGY FOR THE URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT SITE AT MEXICAN HAT, UTAH

Dear Mr. Metzler:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its re-examination of the U.S. Department of Energy's (DOE's) ground-water compliance strategy for the Uranium Mill Tailings Remedial Action (UMTRA) Project site at Mexican Hat, Utah, as requested by letter dated May 4, 1999. Your letter stated that the Navajo Nation submitted a letter to the DOE, dated April 6, 1999, which outlined concerns regarding the conceptual site model and the level of characterization that DOE performed at the Mexican Hat Project site. Your May 4, 1999, letter contained, as enclosures, a copy of the Navajo Nation's April 6, 1999, letter and DOE's May 4, 1999, response to that letter.

Many of the concerns expressed by the Navajo Nation in the April 6, 1999, letter appear to center around a Site Observational Work Plan (SOWP) for a ground-water cleanup program that DOE developed for the Navajo Nation. The April 6, 1999, letter identified two main concerns regarding the site characterization information in the SOWP: the geologic isolation of the "first water-bearing zone" and the contamination in that geologic horizon. A description of the technical basis for these concerns was not provided. Furthermore, the letter also questioned the construction quality of down-gradient wells.

The NRC has not reviewed or commented on the Mexican Hat SOWP, because staff reviewed and concurred in the compliance of ground-water cleanup provisions of 40 CFR 192, Subpart B for the former Mexican Hat processing site during the Remedial Action Plan and Site Design phase of the surface tailings remediation. NRC's review findings and concurrence are documented in the February 27, 1996, "Final Technical Evaluation Report for the Monument Valley and Mexican Hat Uranium Mill Tailings Sites."

Based on DOE's request, NRC staff performed a cursory re-examination of the ground-water compliance technical evaluation, which supported our concurrence at the Mexican Hat site. The re-examination did not produce any insight that would result in NRC reconsidering the concurrence at the Mexican Hat site. We are unable to further evaluate the Navajo Nation's concerns at the Mexican Hat site, without specific technical information on those concerns.

D. Metzler 2

We are always open to examining newly developed data or analyses at Mexican Hat, or any other UMTRA site. However, due to limited programmatic resources, we respectfully ask that any future requests to reexamine existing information or evaluate new information focus on potential adverse impacts to human health and the environment or continued compliance with the requirements of 40 CFR 192, Subparts A through C.

If you have any questions concerning this subject, please feel free to contact the NRC Project Manager, Melanie Wong, at (301) 415-6262 or e-mail at mcw@nrc.gov.

Sincerely,

Original signed by

Thomas H. Essig, Chief
Uranium Recovery and
Low-Level Waste Branch
Division of Waste Management
Office of Nuclear Material Safety and
Safeguards

cc: R. Plieness, DOE - GRJ
M. Roanhorse, Navajo Nation

Exhibit J

NRC Letter for Salt Lake City, Utah

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 15, 2000

Mr. Donald R. Metzler
U.S. Department of Energy
Grand Junction Office
2597 B 3/4 Road
Grand Junction, CO 81503

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION CONCURRENCE OF THE GROUNDWATER COMPLIANCE ACTION PLAN FOR THE SALT LAKE CITY, UTAH, UMTRA SITE

Dear Mr. Metzler:

The U.S. Department of Energy (DOE) submitted a Groundwater Compliance Action Plan (GCAP) for the Salt Lake City, Utah, Uranium Mill Tailings Remedial Action (UMTRA) Project Site by cover letter dated September 25, 1998. DOE submitted replacement pages to the September 25, 1998, report in a letter dated February 5, 1999. U.S. Nuclear Regulatory Commission (NRC) staff reviewed the GCAP and sent a Request for Additional Information (RAI) by letter dated October 14, 1999. DOE submitted a Revised GCAP by letter dated May 31, 2000, which addressed NRC's concerns. NRC staff has reviewed the above information and concurs with the GCAP. The compliance strategy proposed in the GCAP will achieve compliance with Subpart B of 40 CFR 192.21 (g) through the application of Supplemental Standards based on ***limited use groundwater.***

The staff has determined that the GCAP for the Salt Lake City site satisfies the requirements set forth in the Uranium Mill Tailings Control Act of 1978, as amended (UMTRCA), and the standards in 40 CFR 192, for the cleanup of groundwater contamination resulting from the processing of ores for the extraction of uranium.

The staff's Technical Evaluation Report has been enclosed for your information. DOE should revise the Long-Term Surveillance Plan to be consistent with the GCAP.

If you have any questions concerning this subject, please contact the NRC Project Manager, Mr. Harold Lefevre, at (301) 415-6678, or by e-mail at hel@nrc.gov.

Sincerely,

Original signed by

Philip Ting, Chief
Fuel Cycle Licensing Branch
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety and Safeguards

Enclosure: Technical Evaluation Report

cc: W. Sinclair, Utah Division of Radiation Control

End of current text

Appendix D

Site Summaries

Durango, Colorado

The Durango UMTRA Project site is in La Plata County, Colorado, just southwest of the city of Durango. Surface water bodies include the Animas River and Lightner Creek, both of which border the site. Milling operations were on the west side of the Animas River, extending from the floodplain to the base of Smelter Mountain. The site consisted of two areas: the tailings piles in the milling area and the raffinate pond about 0.5 mile (0.8 kilometer) to the south. About 2.5 million cubic yards (1.9 million cubic meters) of contaminated material was removed from the 127-acre (51-hectare) site and vicinity properties. The contaminated material was transported to the Bodo Canyon disposal cell, about 1.5 miles (2.4 kilometers) from the processing site. Surface remedial action was completed in May 1991.

Background ground water quality is poor due to elevated iron and manganese concentrations and moderately high salinity. Ground water in the uppermost aquifer beneath the processing site has been affected by the past uranium-ore processing. The principal contaminants in ground water are arsenic, cadmium, chloride, lead, manganese, molybdenum, selenium, sodium, sulfate, and uranium. Contamination appears to be confined within the area bordered by Lightner Creek and the Animas River. If any contaminated ground water discharges into the Animas River, contaminant concentrations are quickly diluted to near background levels.

The former processing site area is underlain by approximately 1,760 feet (520 meters) of Mancos Shale bedrock, which is truncated along the Smelter Mountain fault at the south end of the terrace supporting the site. Along the base of Smelter Mountain the Mancos Shale is directly overlain by a layer of colluvium up to 25 feet (9 meters) thick. Closer to Lightner Creek and the Animas River, deposits of river-lain sand and gravel up to 15 feet (5 meters) thick occur over the shale bedrock and under the colluvium.

Ground water in the colluvium near the base of Smelter Mountain is recharged primarily by runoff from the mountain and by infiltrating precipitation. The sand and gravel deposits receive recharge from Lightner Creek and the Animas River. During spring runoff when the river stage is high, water flows into the aquifer. When the river stage is lower, ground water flows from the aquifer into the Animas River. Ground water beneath the area of the former raffinate pond is recharged by infiltration of precipitation and by ground water moving through the bedrock from the west.

The site was revegetated after the completion of remedial action and contains a healthy stand of vegetation. Surface water and sediment samples from the Animas River and Lightner Creek indicate that contaminated ground water from the site has not contaminated these water bodies or their sediments. Riparian vegetation along the Animas River consists of cottonwoods and box elders. Threatened or endangered species known to exist at or near the site include the bald eagle, which winters along the river, and the peregrine falcon, which nests about 1mile (1.6 kilometers) from the site.

The Durango area has a semiarid climate; the average annual precipitation is 19 inches (48 centimeters). The city of Durango has a 2000 population of about 14,000; an additional 44,000 live in the surrounding La Plata County. The nearest year-round resident is immediately west of the site. The processing site contains no known cultural resources.

Because no one is currently using the water for domestic purposes or for irrigation, no human health risks are currently associated with contaminated ground water. This favorable risk situation will continue if land and water use on and near the site does not change.

Grand Junction, Colorado

The Grand Junction UMTRA Project site is at an elevation of about 4, 600 feet (1,400 meters) in the broad, arid Grand Valley in west central Colorado. The millsite is located on city-owned land along the north side of the Colorado River in Mesa County. The facility was constructed on the floodplain of the Colorado River in an area that now is within the city limits and contains light industry and private dwellings. The mill operated from 1950 to 1970 in a 144-acre (46-hectare) area and processed 2.3 million tons of ore for uranium and vanadium. From the late 1980s to early 1990s the site served as an interim repository for mill tailings excavated from local properties, known as vicinity properties. From 1991 to 1994, about 4.6 million cubic yards (3.6 million cubic meters) of tailings and other contaminated material were removed to the Cheney repository located 18 miles (29 kilometers) southeast of Grand Junction.

The 2000 census indicates the city of Grand Junction population is about 42,000, the population of Mesa County is 116,255. The climate is arid; the area receives about 8 inches (20 cm) of precipitation annually. No cultural or historic resources are present at the site. Threatened or endangered species identified near the site include the bald eagle, which winters along the river, and the Colorado squawfish, which may inhabit side channels of the river near the site.

The uppermost aquifer at the Grand Junction site is within the Colorado River alluvium, which underlies the site and ranges in saturated thickness from less than 10 feet (3 meters) to more than 20 feet (6 meters). Alluvial ground water levels beneath the site vary from 2 to 5 feet (1 to 2 meters) annually; the lowest levels occur in fall and winter. Ground water flows from east to west-southwest in the alluvial aquifer, depending on the stage of the river, and discharges into the Colorado River. Ground water velocity is variable because of old river channel deposits beneath the site, but averages about 700 feet (214 meters) per year. Impermeable shales of the Dakota Sandstone Formation underlie the alluvial aquifer and function as an aquitard preventing downward movement of contaminated fluids.

Millsite-related fluids contributed ammonia, manganese, molybdenum, uranium, and vanadium to the alluvial aquifer under the site. Several of these contaminants are present in ground water up to 2,500 feet (760 meters) west of the site, but concentrations are decreasing over time. Human health and ecological risks were evaluated on and off the site and found to be acceptable.

The alluvial aquifer in the Grand Junction area has naturally occurring concentrations of uranium and selenium that exceed UMTRA Project maximum concentration limits. The high levels of uranium and selenium are derived from ground water leaching the Mancos Shale that underlies most of the valley. The compliance strategy proposed in the Environmental Assessment is supplemental standards based on widespread ambient contamination not caused by milling operations. A Finding of No Significant Impact was issued in October 1999. As a best management practice, ammonia, molybdenum, and uranium will be monitored for the next 20 years to verify continued attenuation. Institutional controls prevent use of ground water beneath and downgradient of the site as a source of drinking water. A city park will eventually occupy the old millsite.

Green River, Utah

The Green River UMTRA Project site is in Grand County, Utah, 1 mile (1.6 kilometers) southeast of the city of Green River. The site is partially in the floodplain of Brown's Wash, an intermittent tributary of the Green River. The tailings pile covered 8 acres (3 hectares); an additional 40 acres (16 hectares) were contaminated with tailings. An estimated 382,000 cubic yards (292,000 cubic meters) of contaminated material was placed in a 6-acre (2-hectare) disposal cell on the site. Surface remediation was completed in October 1989.

The Green River disposal cell is on a terrace above Brown's Wash. This wash is approximately 800 feet (240 meters) north of the cell. The original tailings pile was in the floodplain of Brown's Wash, along the southern border of the wash. The wash flows only during periods of heavy precipitation and is dry for most of the year. However, pools of water that may be created by the discharge of contaminated ground water into Brown's Wash are often present downstream of the site. Sampling over the years has shown that these pools contain elevated concentrations of nitrate, selenium, uranium, and other constituents that have the potential to be harmful to aquatic and terrestrial organisms. The Green River is about 2,000 feet (610 meters) west of the site and surface water samples from the river indicate that site-related contaminated ground water is not adversely affecting water quality of the river.

The site is in a sparsely populated area. The 2000 population of the city of Green River was 973. Two cultural resource sites near the processing site are eligible for inclusion on the National Register of Historic Places. The Green River site is arid; the average annual precipitation is 6 inches (15 centimeters), and average annual snowfall is 10 inches (25 centimeters). No threatened or endangered species occur at or near the site.

Ground water beneath the Green River site is present in three hydrostratigraphic units: the Brown's Wash alluvium, the unnamed upper member of the Cedar Mountain Formation, and the underlying Buckhorn Member of the Cedar Mountain Formation. The Brown's Wash alluvial aquifer is limited to 300 to 400 feet (90 to 120 meters) on each side of the wash and is up to 35 feet (11 meters) thick. Ground water ranges in depth from 9 to 17 feet (3 to 5 meters) below ground surface and flows west toward the Green River at a velocity ranging from 0.6 to 2 feet (0.2 to 0.7 meter) per day. The unnamed upper member of the Cedar Mountain Formation consists of a coarser-grained sandstone/siltstone/conglomerate facies and a finer-grained limestone/claystone/shale facies ranging in thickness from 130 to 160 feet (40 to 50 meters). Ground water occurs under confined and semiconfined conditions primarily in the coarser-grained unit at depths ranging from 3 to 75 feet (1 to 23 meters). Ground water in the coarser-grained unit flows generally west toward the Green River and has a strong upward hydraulic gradient. The underlying Buckhorn Member consists primarily of sandstone with minor interbeds of mudstone and shale at depths ranging from 124 to 160 feet (38 to 50 meters) Ground water in this unit occurs under confined conditions and has a strong upward hydraulic gradient.

Background ground water quality in the alluvial aquifer has not been determined. As a result of past milling operations, concentrations of cadmium, chromium, molybdenum, nitrate, selenium, and uranium in the alluvial aquifer beneath the site exceed UMTRA Project maximum concentration limits. Background concentrations of cadmium, chromium, and selenium in the unnamed member of the Cedar Mountain Formation exceed the maximum concentration limits. Ground water in the upper part of this unit beneath the Green River site has been contaminated by past uranium-ore processing; maximum concentrations of arsenic, cadmium, chromium, lead,

molybdenum, nitrate, selenium, and uranium exceed maximum concentration limits. The strong upward hydraulic gradient in the lower part of the unnamed member and the Buckhorn Member has prevented contaminants from infiltrating into ground water in those units.

There are no known uses of the ground water at or near the Green River processing site. The city of Green River uses water from the Green River, upriver of the tailings site, for its water supply.

Gunnison, Colorado

The Gunnison UMTRA Project site is on state-owned land and is adjacent to the city of Gunnison in Gunnison County, Colorado. The 2000 population of Gunnison was 5,409. The site is on a drainage divide between the Gunnison River and Tomichi Creek in the Gunnison River valley. Approximately 719,000 cubic yards (550,000 cubic meters) of contaminated material were on 68 acres (28 hectares). The contaminated material was moved to the Gunnison disposal site approximately 6 miles (10 kilometers) from the processing site. Surface remedial action began in May 1992 and was completed in December 1995.

The processing site was located on floodplain alluvium between the Gunnison River and Tomichi Creek. The site is about 0.4 mile (0.6 kilometer) east of the Gunnison River and 0.4 mile (0.6 kilometer) west of Tomichi Creek. It is bounded on the west by small storm drainage ditches and on the south and west by irrigation ditches. Surface water and sediment samples have been collected from the Gunnison River and Tomichi Creek upstream and downstream from the processing site and from shallow ponds near the site. No site-related contaminants have adversely affected surface water and sediments near the site.

No threatened or endangered fish species have been identified in the Gunnison River. Endangered species near the site are the whooping crane, which stops and feeds in the floodplain of Tomichi Creek during migration, and the bald eagle, which occurs along the Gunnison River during the winter. There are no known cultural resources at the site. The site is semiarid; the average annual precipitation is 11 inches (28 centimeters), and an average annual snowfall is 58 inches (147 centimeters).

The uppermost aquifer at the site is in the floodplain alluvium of the Gunnison River and Tomichi Creek. These alluvial deposits extend to at least 110 feet (34 meters) beneath the processing site. The aquifer is recharged from rain, snowmelt, the Gunnison River, Tomichi Creek, and seasonal irrigation ditches around the site. Ground water discharges into the Gunnison River and Tomichi Creek. The average depth to ground water beneath the site is 5 feet (2 meters) below ground surface. The ground water flows southwest at an average velocity of 500 feet (150 meters) per year.

Concentrations of all constituents in background alluvial ground water are below UMTRA Project maximum concentration limits. Tailings seepage has contaminated the alluvial ground water beneath the processing site; concentrations of net gross alpha, radium-226 and -228, and uranium have exceeded the maximum concentration limits at least twice since 1990. The uranium plume extends approximately 7,000 feet (2,000 meters) southwest from the site to the Gunnison River.

Downgradient of the site, 311 private wells are completed in the alluvial aquifer. Twenty-two of these private wells are known to have contained elevated levels of uranium from the processing

site plume. In 1994 a permanent alternate water supply system was constructed for the residents who have wells in and adjacent to the contaminant plume. The municipal water supply for the city of Gunnison is unaffected by the contamination because it comes from wells in the alluvial aquifer upgradient of the processing site.

Lakeview, Oregon

The Lakeview UMTRA Project site is in Lake County, Oregon, about 1 mile (1.6 kilometers) north of the city of Lakeview. About 926,000 cubic yards (708,000 cubic meters) of contaminated material on 116 acres (47 hectares) at the Lakeview processing site were stabilized off the site at the Collins Ranch disposal cell, 7 miles (11 kilometers) northwest of Lakeview. Surface remedial action was completed in October 1989. Land at and around the former processing site is now entirely in private ownership.

The Lakeview site is nearly surrounded by ranch lands. Two lumber mills, one to the southeast and one to the east, and a perlite facility to the east constitute most of the industrial facilities in the immediate area. The 2000 population was about 7,400 in Lake County and 2,500 in the city of Lakeview. No historic or prehistoric sites were reported in the vicinity of the site.

Surface water bodies at the site include Hunters Creek and associated wetlands along the northern boundary of the site, Warner Creek just west of the site, the East Branch of Thomas Creek along the east and south boundaries, Hammersley Creek on the east side, and a pond near the site of the former mill buildings. Surface water and sediment samples from these water bodies indicate that site-related contaminated ground water has not adversely affected the water or sediment quality. The Lakeview site is in a semiarid, high desert climate, with cool temperatures and an average annual precipitation of about 17 inches (43 centimeters). No threatened or endangered species are known to exist at or near the site; however, migrant species may find suitable habitat near the site.

Ground water beneath the site occurs in an alluvial/lacustrine aquifer. Depth to the water table beneath the site varies from 5 to 15 feet (1.5 to 4.6 meters). Ground water moves south and southwest at about 50 to 160 feet (15 to 49 meters) per year. Recharge to the alluvial/lacustrine aquifer is from precipitation and from surface water infiltration from nearby cold water and geothermal water streams. Ground water is withdrawn from agricultural, industrial, municipal, and domestic wells in the site vicinity and discharges into surface water channels that drain into Goose Lake, about 8 miles (13 kilometers) south of the site.

The milling process contributed arsenic, chloride, manganese, and sulfate to ground water beneath the site. A ground water sulfate plume has migrated off the site up to 2,300 feet (719 meters) to the southwest. Sampling in 1999 indicates a sulfate concentration of about 1,200 mg/L and elevated concentrations of manganese and chloride. No ground water is being used from the area of the former tailings pile and evaporation pond where contaminants are most concentrated; other ground water in the area is used for domestic, livestock, and industrial purposes. Human health and ecological risk assessments indicate no unacceptable risks associated with the site contamination. The contaminated water is not used as a source of drinking water.

Background ground water consists of low-temperature water from surface infiltration and hot water from geothermal sources. Geothermal water from Hunters Hot Springs immediately north

and upgradient of the former millsite flows onto the site. Arsenic, radium, molybdenum, and silica are concentrated in the geothermal waters. Arsenic concentrations average 0.09 mg/L, which exceeds the UMTRA Project standard of 0.05 mg/L. DOE has proposed a compliance strategy of supplemental standards based on limited use ground water. The proposed action is based on naturally occurring high concentrations of arsenic from the geothermal source. As a best management practice, monitoring for arsenic, chloride, manganese, and sulfate will continue in the area. DOE will provide an upgrade to a domestic water line that will run along the downgradient side of the former millsite to allow anyone in this corridor access to city water. Lake County will require residents to hook up to this water supply instead of drilling wells for domestic use.

Mexican Hat, Utah

The former Mexican Hat processing site is within the Navajo Reservation in San Juan County, Utah. The village of Halchita is about 0.5 mile (0.8 kilometer) from the site; the 2000 population was about 88. The village of Mexican Hat, Utah, is 2 miles (3.2 kilometers) from the site, and the 1990 estimated population was 259. The site consisted of two tailings piles totaling 69 acres (28 hectares). An estimated 2.8 million cubic yards (2.2 million cubic meters) of contaminated material was contained in these two tailings piles and on an additional 250 acres (101 hectares) of adjacent land. The contaminated material at this site and contaminated material from the Monument Valley, Arizona, processing site are stabilized in a 68-acre (27-hectare) disposal cell at the Mexican Hat site. Surface remediation was completed in 1995.

The climate is arid; average annual precipitation is 6 inches (15 centimeters). The Mexican Hat site is in a rural setting surrounded by desert shrub habitat. The site is adjacent to an intermittent arroyo (called the North Arroyo) that is a tributary to Gypsum Creek, a larger ephemeral arroyo that, when flowing, empties into the San Juan River. The site is about 1 mile (1.6 kilometers) from the San Juan River. There are no known threatened or endangered species or historic resources at or near the processing site.

During construction of the Mexican Hat disposal cell, seeps were discovered in the North Arroyo. In Gypsum Creek northeast of the site, naturally occurring seeps are present. The North Arroyo and Gypsum Creek seeps discharge site-related contaminated ground water with concentrations of nitrate, selenium, uranium, and gross alpha that have exceeded EPA maximum concentration limits at various times in the past. Surface water samples from the San Juan River indicate that if site-related contaminated ground water is discharging into the river, it is not adversely affecting water quality.

The tailings site is on top of the Halgaito Formation outcrop. Ground water beneath the site occurs in the upper and lower units of the Halgaito. Perched water in the upper unit is present only as a result of past milling operations and is only in a localized area of saturation beneath the site at depths ranging from 35 to 60 feet (11 to 18 meters). The perched water in the upper unit generally flows northeast and is controlled by the structural dip and fractures in the formation. The water discharges with very low flow rates (less than 1gallon [4 liters] per minute) into isolated seeps in the North Arroyo and Gypsum Creek.

The lower unit of the Halgaito Formation occurs at a depth of 180 to 200 feet (55 to 61 meters) beneath the site and is considered the uppermost aquifer at the site. Ground water in this formation flows generally northeast at an average velocity of 4 feet (1 meter) per year. Recharge

to the unit is limited and may occur as rainfall in areas to the west where the unit is closer to or exposed at ground surface. The discharge area for ground water in the lower unit is the San Juan River. The presence of a thick, low-permeability unit and an upward hydraulic gradient has prevented contaminated water in the upper unit from entering the lower unit of the Halgaito Formation.

Because the ground water in the upper unit of the Halgaito Formation occurs as a result of milling operations, background ground water quality could only be defined from seeps isolated from site-related contamination. Background ground water in the lower unit shows maximum observed concentrations of gross alpha, radium-226 and -228, selenium, and uranium that have exceeded UMTRA Project maximum concentration limits. Ground water in the upper unit of the Halgaito has concentrations of arsenic and chromium that have exceeded UMTRA Project maximum concentration limits at least twice since 1990.

There are no records of past or current users of the ground water from the upper and lower units of the Halgaito Formation in the Mexican Hat site area. Domestic water for Halchita is supplied by a treatment facility that obtains water from the San Juan River. The Mexican Hat water supply is from a converted oil exploration well and the San Juan River.

Monument Valley, Arizona

The Monument Valley UMTRA Project site is on the Navajo Reservation in northeastern Arizona, about 15 miles (24 kilometers) south of Mexican Hat, Utah, and about 13 miles (21 kilometers) east of the scenic Monument Valley tribal park. Comb Ridge, the most prominent topographic feature, is east of the site. The Monument Valley site is in a sparsely populated area. The nearest town is Dennehotso, about 5 miles (8 kilometers) south and has a population of 734. The climate is arid; average annual precipitation is 6.4 inches (16 centimeters), and an average annual snowfall is 3.3 inches (8.4 centimeters). The region is characterized by a desert shrub habitat with scattered junipers growing on higher terrain and rocky areas. There are no known threatened or endangered species at or near the site.

The tailings site consisted of two tailings piles, windblown-contaminated soil, and piles of debris. The total volume of contaminated material at the site was 942,000 cubic yards (720,000 cubic meters) on 83 acres (34 hectares). All the contaminated material has been moved to the Mexican Hat, Utah, disposal cell 17 road miles (27 kilometers) to the north, and surface remedial action was completed in May 1994.

The three main aquifers at the site are, in descending order, the surficial, Shinarump, and De Chelly aquifers. Depth to ground water in the surficial aquifer ranges from a few feet in Cane Valley Wash to slightly more than 60 feet (18 meters) downgradient from the site. This ground water is recharged by occasional infiltration from precipitation and upward leakage from the semiconfined Shinarump. Depth to ground water in the Shinarump ranges from 7 to 50 feet (2 to 15 meters) below ground surface. The De Chelly aquifer consists of fine-grained sandstone that is approximately 500 feet (150 meters) thick in the site area. Ground water in the De Chelly is present under artesian conditions in three wells south and east of the site and may be unconfined in areas west of the site, where the maximum measured depth to ground water is 165 feet (50 meters).

Nitrate and uranium are the only site-related contaminants that exceed UMTRA Project maximum concentration limits in the surficial aquifer. A nitrate plume with concentrations ranging from 44 to 1,030 mg/L extends approximately 4,500 feet (1,370 meters) north of the site. Uranium concentrations exceed the UMTRA standard of 0.044 mg/L at only one location, where 1997 data indicated a concentration of 0.069 mg/L. A similar uranium concentration is present in a well completed in the De Chelly at this location. No other constituents have been detected at concentrations above the maximum concentration limits in the De Chelly. The Shinarump aquifer has not been significantly affected by site-related contaminants. All constituents are below maximum concentration limits, although concentrations of ammonium, calcium, sulfate, and radium-226 exceed the upper limits of natural background.

Naturita, Colorado

The Naturita UMTRA Project site is in Montrose County, Colorado, approximately 2 miles (3 kilometers) northwest of the town of Naturita along the San Miguel River. Much of the site is in the floodplain of the river. Between 1977 and 1979, the tailings were moved to a facility 3 miles (5 kilometers) south of the processing site for reprocessing. About 547,000 cubic yards (418,000 cubic meters) of contaminated material were on 247 acres (100 hectares) at the site. This total includes 194 acres (79 hectares) that were contaminated with windblown and waterborne tailings. The contaminated material was relocated to the Umetco disposal cell near the former townsite of Uravan, about 15 miles (24 kilometers) northwest of Naturita. Surface remedial action was completed in October 1998.

The Naturita processing site is in a sparsely populated area on the south side of the San Miguel River. The 2000 population of the town of Naturita was 635. The San Miguel River is the only surface water body in the site area. Surface water samples have shown that site-related contaminated ground water is not adversely affecting the water in the river. Cottonwoods and willows dominate a riparian wetland zone along the river. Junipers and piñon pines dominate the surrounding hillsides. The San Miguel River contains no endangered fish species. The endangered southwestern willow flycatcher may occur at the site. Wintering bald eagles also occur along the river in the processing site area.

The site is on private land. The nearest residence is approximately 2,000 feet (600 meters) north-northwest of the site. The Naturita site is arid; estimated average annual precipitation is 9 inches (23 centimeters), and the average annual snowfall is approximately 30 inches (80 centimeters). Three prehistoric sites near the site are eligible for inclusion on the National Register of Historic Places.

Ground water beneath the Naturita site occurs in the alluvial deposits of the San Miguel River floodplain. This aquifer is recharged by the river southeast of the site and discharges into the river northwest of the site. The alluvial aquifer flows approximately parallel to the river at an estimated linear velocity of 22 feet (7 meters) per year. Background ground water quality in the alluvium near the processing site did not exceed the UMTRA Project maximum concentration limits. Elevated concentrations of uranium in the alluvial ground water extend approximately 1,500 feet (460 meters) downgradient from the processing site. Other site-related contaminants that have exceeded maximum concentration limits in this aquifer at least twice since 1990 are arsenic, molybdenum, selenium, radium-226 and -228, and net gross alpha.

Contaminated ground water in the alluvial aquifer has not affected water quality in the underlying Salt Wash aquifer. There are no known uses of the contaminated alluvial ground water beneath or downgradient of the processing site.

Rifle, Colorado (Old and New)

The Old and New Rifle UMTRA Project sites are near the city of Rifle, Colorado, in Garfield County. The Old Rifle site is 0.3 mile (0.5 kilometer) southeast of the city of Rifle. The New Rifle site is 2 miles (3 kilometers) southwest of Rifle. The 2000 population of the city of Rifle is about 6,784. The region is semiarid, with an annual average precipitation of 11 inches (28 centimeters) and an average annual snowfall of 41 inches (104 centimeters). Threatened or endangered species in the site area include the razorback sucker in the Colorado River and the bald eagle. No cultural resources were identified at or near the Old and New Rifle sites.

Approximately 661,000 cubic yards (505,000 cubic meters) of contaminated material was on 88 acres (36 hectares) at the Old Rifle site, and approximately 3.5 million cubic yards (2.7 million cubic meters) of contaminated material was on 238 acres (96 hectares) at the New Rifle site. The contaminated material from both sites was transported to the Estes Gulch disposal cell, about 6 miles (10 kilometers) north of the Rifle sites. Remedial action was completed in July 1996.

The Old and New Rifle sites are in the floodplain of the Colorado River. The base of the Old Rifle site is slightly above the Colorado River during average flow and is separated from the river by railroad tracks. The Colorado River flows 1,000 feet (300 meters) east and 600 feet (180 meters) south of the former location of the New Rifle tailings pile. The mill and ore storage areas were located between the tailings pile and the river to the east.

Before surface remedial action, the Old Rifle site contained a small wetland (0.7 acre [0.3 hectare]). About 20 acres (8 hectares) of wetlands were at the New Rifle site, including wetlands in the southeast portion of the site and in the contaminated area west of the site. These wetlands were destroyed during surface remediation, and a 34-acre (14-hectare) wetland was constructed near the former location of a tailings pile at the New Rifle site.

Both Rifle sites are underlain by Colorado River alluvium. Unconfined ground water is present at the base of the alluvium and in the weathered upper few feet of the underlying Wasatch Formation. Semiconfined and confined ground water occurs in interlayered sandstone, siltstone, and claystone beds deeper in the Wasatch. In general, ground water in the alluvium and in the Wasatch Formation flows southwest. The alluvium at the Old Rifle site is approximately 20 feet (6 meters) thick, and depth to ground water ranges from 5 to 15 feet (2 to 5 meters). Alluvium at the New Rifle site is 20 to 30 feet (6 to 9 meters) thick, and depth to ground water ranges from 5 to 10 feet (2 to 3 meters).

Historical milling operations have resulted in contaminants infiltrating into alluvial ground water at both sites. The presence of confining layers and upward hydraulic gradients in the Wasatch Formation has prevented significant downward migration of contaminants into the bedrock aquifers. Any site-related contaminants discharging into the Colorado River at both sites are quickly diluted to background concentrations. An open irrigation ditch is the only other surface water present at the Old Rifle site. Water samples collected from the ditch indicated that all constituents are within the range of natural background. At the New Rifle site, the only

permanent surface water features besides the Colorado River are the constructed wetland and a gravel pond. All constituents in water samples collected from the east end of the wetland were within the range of natural background. Concentrations of most constituents in samples collected from the gravel pond in 1998 exceeded the upper limits of natural background. Concentrations of uranium, molybdenum, and nitrate in pond samples exceeded the UMTRA Project maximum concentration limits, suggesting that discharge from contaminated alluvial ground water is affecting water quality in the pond. However, concentrations of these constituents, which have been measured historically since 1991, appear to be decreasing with time. This observed decrease indicates that the alluvial aquifer is naturally flushing and will eventually reduce concentrations of site-related contaminants to background levels.

Based on 1998 sampling data and updates to the human health and ecological risk assessments, contaminants of potential concern at the Old Rifle site are arsenic, selenium, uranium, and vanadium. An evaluation of present-day conditions at the site indicates that all exposure pathways are incomplete at this time; the only potential risks associated with site ground water are associated with future changes in ground water use or changes in site vegetation.

Results of 1998 sampling data and updates to the human health and ecological risk assessments at the New Rifle site indicate that the contaminants of concern are ammonia, arsenic, cadmium, fluoride, manganese, molybdenum, nitrate, selenium, sulfate, uranium, and vanadium. An evaluation of present-day risks at the site indicates that no risks currently exist for human health. No pathways are present at this time for use of untreated site-related ground water. Although domestic wells have been installed into the alluvial aquifer, the wells are required to have treatment systems to ensure that ground water is safe for drinking. Ecological risks reported for the New Rifle wetland and the gravel pond represent a combination of possible present risks and potential future risks. Present risks include those where pathways and receptors currently exist, such as ingestion of water from the pond by mule deer and muskrats. Future risks are those that could be present if and when the New Rifle wetland and gravel pond develop into more viable habitats (e.g., after aquatic plants become established in the pond and reconstructed wetland and are available as a food source for likely receptors).

The proposed strategy to achieve compliance with EPA ground water standards at the Old Rifle site is natural flushing, alternate concentration limits for selenium and vanadium, and institutional controls in the form of a deed restriction. The proposed compliance strategy at the New Rifle site is natural flushing; alternate concentration limits for ammonium, selenium, and vanadium; and institutional controls consisting of zone district changes and deed restrictions. Depending on the results of a pilot study, the strategy for vanadium may require some form active remediation at the New Rifle site.

Salt Lake City, Utah

The Salt Lake City UMTRA Project site is in Salt Lake County, Utah, 4 miles (6 kilometers) south-southwest of the center of Salt Lake City. A total of 2.7 million cubic yards (2.1 million cubic meters) of tailings was removed from 128 acres (52 hectares) on this site and transported to the South Clive disposal site, 85 miles (136 kilometers) west of Salt Lake City. Surface remedial action was completed in June 1989.

The Salt Lake City site is in an urban area and is bounded by a sewage treatment plant on the north, a railroad on the east, and city streets on the south and west. The 2000 population of Salt

Lake City was 181,743. The Jordan River flows 1,500 feet (460 meters) west of the site, and Mill Creek, a perennial stream, flows along the site's northern boundary. South Vitro Ditch traverses the site, and a small wetland is just east of the site. Surface water samples indicate that the site-related contaminated ground water has not adversely affected surface water quality. Limited sediment sampling indicates that sediments in the South Vitro Ditch may have high levels of molybdenum.

The climate at the site is semiarid; average annual precipitation is 15 inches (38 centimeters), and the average annual snowfall is 59 inches (150 centimeters). There are no threatened or endangered species or cultural resources at or near the processing site.

An unconfined aquifer approximately 45 feet (14 meters) thick and composed of sand, silt, and clay is the uppermost aquifer beneath the site. The major sources of recharge for this aquifer are infiltration of precipitation and upward leakage from a lower confined aquifer. The upward hydraulic gradient in the lower confined aquifer appears to have prevented contaminants from migrating downward into the lower aquifer. Water levels of the unconfined aquifer beneath the site range from 5 to 15 feet (1.5 to 5 meters) below ground surface. This aquifer flows primarily toward the northwest and discharges into surface water bodies such as Mill Creek and the Jordan River. The estimated ground water velocity is 170 feet (50 meters) per year.

Background ground water has a total dissolved solids content ranging from 300 to 550 milligrams per liter and sulfate levels ranging from 2 to 6 milligrams per liter. Arsenic concentrations have exceeded the maximum concentration limit in most background ground water samples. A contaminant plume exists beneath the site, and molybdenum, net gross alpha, and uranium concentrations in the plume have exceeded the maximum concentration limits in some on-site and downgradient monitor wells at least twice since 1990. The estimated volume of contaminated ground water at the Salt Lake City site is 350 million gallons (1.3 million cubic meters).

Because of its poor quality and minimal yield the uppermost aquifer has very limited potential for domestic or agricultural use. Residents of Salt Lake City obtain water from a municipal supply system upgradient of the former processing site.

Shiprock, New Mexico

The Shiprock UMTRA Project site is within the Navajo Reservation in San Juan County in northeast New Mexico. The site is south of the San Juan River near the southeast edge of the town of Shiprock, the largest town in the Navajo Nation. The population of Shiprock, based on the 2000 census, is about 8,156, predominantly Native American. Residents of Shiprock use the public water system, which is supplied mainly from the Farmington, New Mexico, water system.

Approximately 1.6 million cubic yards (1.2 million cubic meters) of contaminated materials on 130 acres (53 hectares) were stabilized in a 72-acre (29-hectare) disposal cell on the lower part of a terrace in the same location as the former tailings piles on the millsite. Remedial action was completed in September 1986. The site is arid, averaging 7 inches (17 centimeters) of precipitation and 4.1 inches (10.4 centimeters) of snowfall annually. Threatened and endangered species occur near the site, including wintering bald eagles and southwest willow flycatchers

along the San Juan River and the Mesa Verde cactus in the upland desert/shrub plant community. No historic resources are present at or near the site.

The site is along the south side of the San Juan River on an elevated terrace about 50 feet (21 meters) above the river. Bob Lee Wash traverses the west side of the site and flows into the floodplain of the San Juan River. This wash is ephemeral, except for the lower 600 feet (200 meters) that receives a constant discharge of about 60 gallons (200 liters) per minute of nonpotable water from an artesian well west of the wash. This water has created a wetland within Bob Lee Wash and a 3-acre (1.2-hectare) wetland at the mouth of the wash where it discharges into the floodplain of the river. In addition, two seeps flow from the base of the escarpment below the disposal cell into the floodplain of the river. These seeps flow at an estimated rate of 0.3 to 1 gallon (1 to 4 liters) per minute. Other surface water on the floodplain consists of small areas near the wetland and short sections of several ditches.

Surface water and sediment samples from the San Juan River downgradient of the site and from Bob Lee Wash indicate site-related contaminants have not affected these waters. Water quality data from the two seeps show elevated concentrations of nitrate, selenium, sulfate, and uranium.

The Shiprock disposal cell is on unconsolidated alluvial terrace deposits underlain by Mancos Shale bedrock. Ground water occurs in the lower part of the terrace deposits and in the upper, weathered portion of the Mancos Shale. Terrace ground water has moved south and west from the disposal cell to a sump area in an ancestral channel of the San Juan River. From this sump area, ground water has moved northwest toward the irrigated area around the Shiprock High School and eastward to Many Devils Wash area. Some ground water appears at the surface in upper Bob Lee Wash and in Many Devils Wash. Interim actions are planned to fence and cover the exposed contaminated ground water. The ground water layer in the alluvium above the bedrock is thin, generally less than 3 feet (1 meter), and the rate of recharge to the monitor wells is slow. Ground water also moves along fractures and horizontal bedding layers and appears as seeps along the escarpment.

Background ground water quality has not been defined for the terrace alluvium and upper Mancos Shale because all monitor wells installed have either intercepted contaminated ground water or were dry in outlying terrace areas. Background ground water quality in the floodplain alluvium was defined by monitor wells installed in the floodplain about 1 mile (0.6 kilometer) upstream from the site. Uranium-ore milling and processing have resulted in ground water contamination in the alluvium and upper Mancos Shale on the terrace and in the floodplain alluvium. The contaminated ground water in the terrace alluvium and upper Mancos Shale beneath the site and in the floodplain alluvium along the river contains high concentration of ammonium, manganese, nitrate, selenium, sulfate, and uranium. The volume of contaminated ground water is estimated to be 300 million gallons (1.2 million cubic meters).

Slick Rock, Colorado (two sites)

The Slick Rock UMTRA Project sites are near Slick Rock, Colorado, along the Dolores River in San Miguel County. The population of San Miguel County, from the 2000 census, is 6,594. The Union Carbide processing site is approximately 1 mile (1.6 kilometers) down river from the North Continent processing site. Both sites are partially in the floodplain of the Dolores River in a sparsely populated area.

The volume of contaminated material consisted of about 488,000 cubic yards (373,000 cubic meters) on 92 acres (37 hectares) at the Union Carbide site and 85,000 cubic yards (65,000 cubic meters) on 47 acres (19 hectares) at the North Continent site. All contaminated material was removed and placed in the Burro Canyon disposal cell 2 miles (3 kilometers) north of the sites. Surface remedial action was completed at the two sites in December 1996.

The Union Carbide and North Continent sites are in a steep canyon of the Dolores River, in the floodplain of the river. The Dolores River is the only permanent water body in the area of the sites, although there are dry washes. Surface water and sediment samples indicate contaminated ground water at the site has not adversely affected the water or sediment quality of the river. Willows and other shrubs dominate the riparian wetland zone along the river. The riparian zone supports many productive plant communities, which in turn support diverse wildlife. The surrounding canyon contains steep cliff faces or steep slopes dominated by desert shrubs. No endangered fish species are in the river in the area of the sites; threatened and endangered species in the area are the bald eagle, southwest willow flycatcher, Mexican spotted owl, and the Uncompahgre fritillary butterfly.

Both processing sites are on private land. The major land use in the area is grazing. A gas sweetener plant is adjacent to the Union Carbide site.

The Slick Rock site area is arid; mean annual precipitation is 7 inches (18 centimeters), and the average annual snowfall is about 30 inches (76 centimeters).

Ground water beneath the Slick Rock sites occurs in the alluvial aquifer of the Dolores River and in the underlying Entrada Sandstone and Navajo Sandstone Formations. Ground water in the alluvium generally flows northwest, parallel to the flow of the river. Depth to alluvial ground water ranges from 10 to 20 feet (3 to 6 meters) beneath the sites. The average linear ground water velocity in the alluvium ranges from 100 feet (30 meters) per year at the North Continent site to 150 feet (50 meters) per year at the Union Carbide site. The alluvial aquifer is recharged by seepage from the Dolores River upstream and by precipitation. Ground water discharges from the alluvium into the Dolores River downgradient.

Ground water quality in the alluvium beneath the Union Carbide site has been affected by past uranium milling operations. Contaminant plume migration has been limited to within or slightly downgradient of this site. Concentrations of molybdenum, nitrate, selenium, uranium, net gross alpha, and radium-226 and –228 have exceeded ground water standards for the UMTRA Project at least twice since 1990.

The former uranium milling operations has also affected alluvial ground water beneath the North Continent site. Hazardous constituents that have exceeded maximum concentration limits at least twice since 1990 are net gross alpha, radium-226 and –228, and uranium.

As of 2000, work is in progress to address ground water contamination at the Slick Rock sites. DOE will conduct a field investigation to collect additional data to support the proposed remediation strategy of natural flushing. The field investigation will focus on the alluvial aquifer, which contains most of the contaminated ground water. The investigation will also evaluate effects to the Entrada Sandstone Formation and interaction between the alluvial and bedrock aquifers. Previous investigations have indicated that the former milling operations at either site has not affected the Navajo Sandstone.

Water use in the Slick Rock area is limited. One domestic well, completed in the Navajo Sandstone, is known to be currently in use in the area; water quality in this well is similar to background water quality. There are no known human uses of contaminated alluvial ground water at either the Union Carbide or the North Continent site.

Tuba City, Arizona

The Tuba City UMTRA Project site is in Coconino County, Arizona, approximately 6 miles (10 kilometers) east of Tuba City on U.S. Highway 160. The site is located within the Navajo Reservation. The 2000 census shows that Tuba City has a population of 8,225, predominantly Native American. The Tuba City area is on the Kaibito Plateau in the desert shrub vegetation zone. The surrounding terrain is dominated by dissected sandstone formations, mesas, and alluvial terraces. The area is arid; annual precipitation averages 6 inches (15 centimeters). Most of the precipitation occurs as rainfall; snowfall averages 4 inches (10 centimeters) per year. Surveys conducted at the site have not identified any cultural resources or threatened or endangered species.

Moenkopi Wash is the primary surface water source in the area. It lies south to southeast of the site and is about 5,000 feet (1,500 meters) southeast of the site at its closest location. Moenkopi Wash is an intermittent stream that joins the Little Colorado River southwest of the Tuba City area. Although the wash is intermittent, flood flows have been as high as 14,500 cubic feet per second (410,000 liters per second). No other streams exist near the site. A natural spring and several seeps occur along the base of the cliff adjacent to Moenkopi Wash, about 6,000 feet (1,830 meters) east-southeast for the site. The spring is used to water livestock, but the seeps have very little flow and are evident by riparian plant species and damp areas along the cliff face.

Past uranium milling operations at the Tuba City site contaminated the surface with mill tailings that were placed in piles, windblown tailings, waterborne tailings, demolished mill buildings, and other contaminated material that was spread over 327 acres (132 hectares). In May 1990, DOE completed remediation of the surface contamination. Remediation consolidated the contaminated materials into a 50-acre (20-hectare) engineered disposal cell that is designed to last between 200 and 1,000 years.

In addition to surface contamination, past milling operations also contaminated the ground water in the uppermost aquifer at the site. The aquifer, known as the N-aquifer, is in the Navajo Sandstone and Kayenta Sandstone Formations. DOE has begun remediation by installing a series of wells to pump the contaminated ground water to the surface, a treatment system to remove the contaminants, and a series of wells and a trench to put the treated ground water back into the aquifer. Depth to the water table at the site varies from 20 to 150 feet (6 to 50 meters) below ground surface. Ground water flows southeast toward Moenkopi Wash at rates varying from 2 to 100 feet (0.6 to 30 meters) per year. The ground water is primarily contaminated with elevated levels of molybdenum, nitrate, selenium, sulfate, and uranium. The contaminant plume extends approximately 2,000 feet (610 meters) downgradient of the site. The estimated volume of contaminated ground water is about 1.7 billion gallons (6.4 million cubic meters). Ground water within the contaminant plume is not used for domestic or agricultural purposes. Analyses of water and sediment samples from Moenkopi Wash and from the seeps near Moenkopi Wash show that these surface features have not been affected by contamination from the site.

Appendix E

Project Controls

E1.0 Project Controls

The Project Control System for the U.S. Department of Energy Grand Junction Office (DOE–GJO) assigned projects is based on the application of DOE Order 413.3, *Program and Project Management for the Acquisition of Capital Assets*. A graded approach for the use of these documents is applied to each project based on the relative risk and complexity of the project. The Project Control System is made up of the basic components of schedule control, cost control, performance measurement, and change control.

E1.1 Schedule Control

Schedule control is maintained through the development of a baselined life-cycle schedule for any given project. The baseline schedule depicts all major activities and milestones associated with a project, and this schedule is formally agreed to by the cognizant GJO project manager and the operating contractor. A project's progress is measured against the approved baselined schedule.

The schedule is developed on an electronic network processor using critical path methodologies that allow for a detailed analysis of a project's progress, that provide early warning of possible problem areas, and that also provide *what-if* capabilities for problem mitigation. The schedule, shown in either a logic network or a Gantt chart format, graphically depicts the integrated relationships of the project activities. The schedule also ties directly to other project documents such as the work breakdown structure (WBS), statement of work, and the fiscal year budgets. No changes can be made to the baselined schedule without formal documentation and approval by DOE through a Task Order Modification.

E1.2 Cost Control

Cost control is maintained through the use of a DOE-validated Project Control System and the "earned value" concept of performance measurement. The project budget is also formally agreed to by the cognizant GJO project manager and the operating contractor.

Baselined fiscal-year and life-cycle budgets are developed using the baselined schedule as the guideline for planning task expenditures and are directly integrated with the schedule, the WBS, and the statement of work. Actual costs incurred are compared to performance on a monthly basis and the resulting variances are analyzed by the project manager and the project management team to determine what corrective actions, if necessary, are required. No changes can be made to the baselined budget without formal documentation and approval by DOE through a Task Order Modification.

E1.3 Performance Measurement

Performance measurement, as stated previously, is based on the concept of earned value as it relates to schedule and cost. Each subtask manager, on a monthly basis, determines progress against the baselined schedule and assigns a performance value to that progress. This value is normally expressed as a percentage of work accomplished against the plan and may range from 0 percent (no progress) to 100 percent or higher. This performance is represented as the budgeted cost of the work performed (BCWP) and is compared against the budgeted cost of the work scheduled (BCWS) and the actual cost of the work performed (ACWP). The resulting schedule

variances (BCWP – BCWS) and cost variances (BCWP – ACWP) are analyzed by the project manager and project management team to determine the overall status of the project. The project status information is summarized and formally reported to DOE–GJO on a monthly basis.

E1.4 Change Control

A task order modification methodology has been established to provide for modifications to a task order/project caused by changes in requirements, design development, or desired improvements. The primary objectives of this modification process are to incorporate

- Baseline changes in a manner that maintains traceability from the original approved baseline.
- Only those changes that are authorized.
- Changes in a timely manner.

Meeting these objectives ensures that the baseline against which cost and schedule performance is being measured for currently authorized work.

The DOE Change Control Board is responsible for reviewing all task order modifications and for preparing Baseline Change Proposals for project changes that exceed a DOE change control threshold.