GJO–99–111–TAR
MAC–GWRFL 1.9–1

UMTRA
Ground Water Project

Draft Ground Water Compliance Action Plan for the New Rifle, Colorado, UMTRA Project Site

April 2003

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

Work Performed Under DOE Contract No. DE–AC13–02GJ79491 for the U.S. Department of Energy
Approved for public release; distribution is unlimited.

GJO-2002-364-TAC
GJO–GWRFL–1.9

Draft Ground Water Compliance Action Plan for the New Rifle, Colorado, UMTRA Project Site

April 2003

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

Work Performed under DOE Contract No. DE–AC13–02GJ79491

Contents

Figures

Tables

Appendices

1.0 Introduction

This Ground Water Compliance Action Plan (GCAP) will serve as a stand-alone modification to Section E.3.6 of the *Final Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Sites at Rifle, Colorado* (DOE 1992) and is the concurrence document for compliance with Subpart B of Title 40 *Code of Federal Regulations* Part 192 (40 CFR 192) for the New Rifle site.

The proposed compliance strategy for the New Rifle site is based on the compliance strategy selection framework described in Section 2.1 of the *Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project* (PEIS) (DOE 1996b) (Figure 1). The proposed action is based on information presented in the *Final Site Observational Work Plan for the UMTRA Project New Rifle Site* (SOWP) (DOE 1999) and further studies conducted on vanadium.

2.0 Ground Water Compliance

The U.S. Department of Energy (DOE) is required by the PEIS to follow the ground water compliance strategy selection framework summarized in Figure 1 in selecting the appropriate compliance strategy to clean up ground water in the uppermost aquifer affected by former processing activities at the Uranium Mill Tailings Remedial Action (UMTRA) Project New Rifle site. The uppermost aquifer is the alluvial aquifer at New Rifle. The compliance strategy focuses on contaminants of concern (COCs) retained after completion of the updated human health and ecological risk assessment screening processes (DOE 1999).

The proposed compliance strategy for the New Rifle site is passive remediation of the alluvial aquifer in the form of natural flushing to U.S. Environmental Protection Agency (EPA) maximum concentration limits (MCLs) established in 40 CFR 192 or to an alternate concentration limit (ACL) with institutional controls and monitoring. Because vanadium geochemistry is different from that of the other COCs, additional studies were conducted on vanadium before it was included in the proposed compliance strategy. An explanation of the targeted strategy process is summarized in Table 1. Appendix C discusses the alternate concentration limits for ammonia, selenium, and vanadium.

2.1 Assessment of Environmental Data

The first step in the decision process was an assessment of both historical and new environmental data collected to characterize hydrogeological conditions and the extent of ground water contamination related to uranium-ore processing at the site.

The New Rifle site is located along a broad section of Colorado River floodplain alluvium consisting of a complex interfingering of fine- and coarse-grained materials, which contain sand, silt, gravel, and cobbles. The thickness of the alluvial deposits at the New Rifle site ranges from 20 to 30 feet (ft) over most of the site. Up to 100 ft of alluvium is present downgradient from the site where it fills local valleys. Depths to ground water range from approximately 5 to 10 ft at the site. The greatest depth to water is 90 ft approximately 1½ miles downgradient from the site. Saturated thicknesses generally range from 10 to 20 ft in the vicinity of the site.

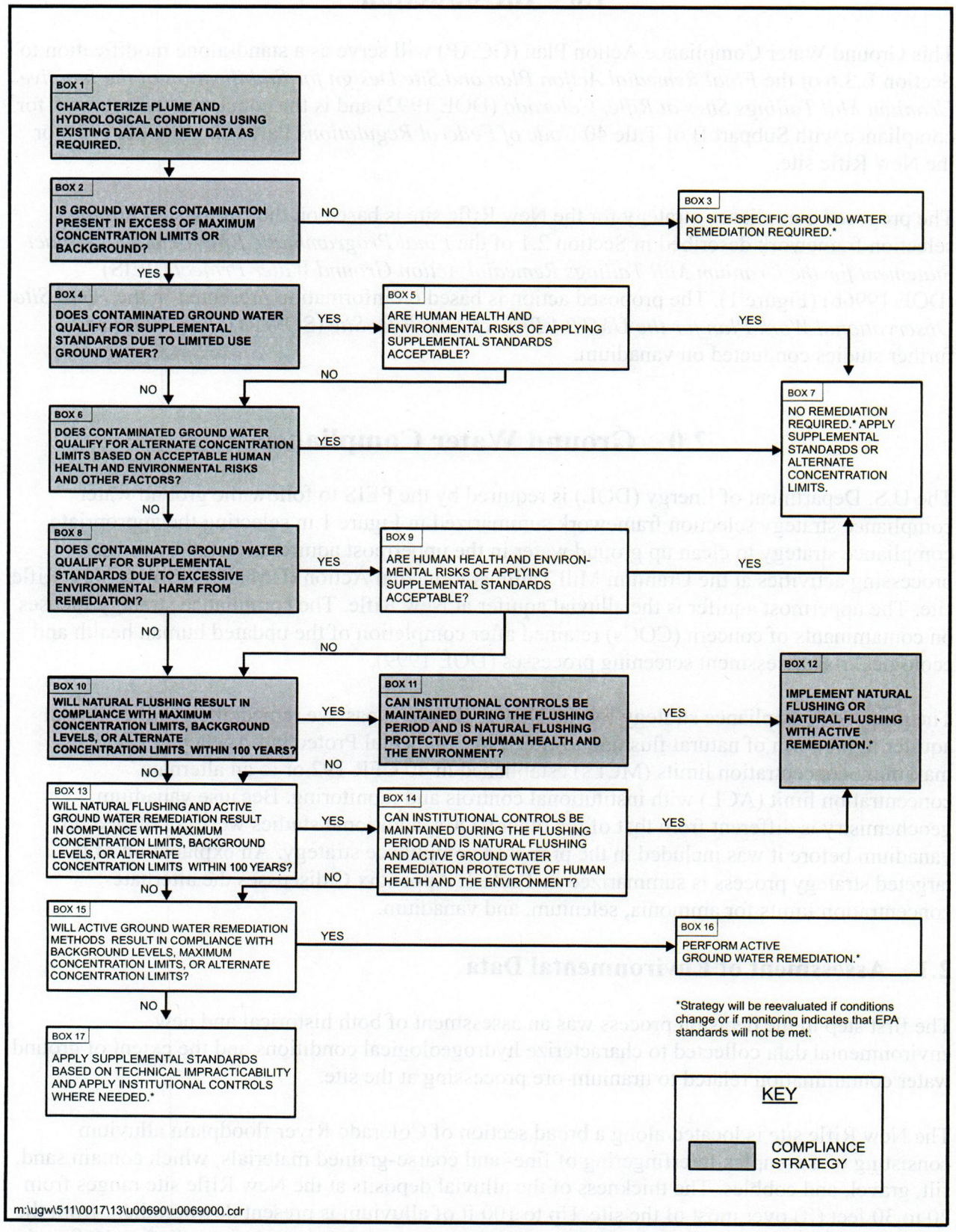


Figure 1. Compliance Strategy Selection Framework for the New Rifle Site

C01

Recharge to the alluvial aquifer occurs mostly as infiltration of precipitation, leakage from the unnamed intermittent tributaries and Pioneer Ditch located north of U.S. Highway 6, and by the Colorado River, especially along the north-south reach of the river east of the site, (Figure 2) which appears to be a ground water recharge source throughout the year. Discharge from the alluvial aquifer is to the mitigation wetland, to the Roaring Fork gravel pits, and to the Colorado River. Plant evapotranspiration in areas of shallow ground water is the only other process by which ground water may be discharged from the alluvial aquifer. Ground water beneath the site generally flows in a west-southwest direction with a hydraulic gradient ranging from 0.0019 to 0.0040 ft/ft. The conceptual site model is presented in Section 5.0 of the SOWP (DOE 1999).

Table 1. Explanation of Compliance Strategy Selection Process

Box (Figure 1)	Action or Question	Result or Decision
1	Characterize plume and hydrological conditions.	See conceptual site model presented in Section 5.0 and contaminant screening presented in Section 6.0 of the New Rifle SOWP. Move to Box 2.
2	Is ground water contamination present in excess of UMTRA MCLs or background?	Selenium, arsenic, molybdenum, nitrate, and uranium exceed the UMTRA MCLs at one or more monitoring points. Ammonium, fluoride, manganese, and vanadium are elevated compared to background and exceed RBCs. Move to Box 4.
4	Does contaminated ground water qualify for supplemental standards due to limited use ground water?	Alluvial ground water is a potential source of drinking water and therefore is not classified as limited use. Move to Box 6.
6	Does contaminated ground water qualify for ACLs based on acceptable human health and environmental risk and other factors?	Ground water does not currently qualify for ACLs on the basis of acceptable human health and environmental risk. Move to Box 8.
8	Does contaminated ground water qualify for supplemental standards due to excessive environmental harm from remediation?	Although the applicability has not been formally assessed, it is unlikely that remedial action would cause excessive harm to the environment. Move to Box 10.
10	Will natural flushing result in compliance with UMTRA MCLs, background, or ACLs within 100 years?	Ground water modeling shows that natural flushing will reduce these constituents to concentrations allowing unrestricted access within the 100-year time frame. Move to Box 11.
11	Can institutional controls be maintained during the flushing period and is natural flushing protective of human health and the environment?	The final compliance strategy is protective of human health and the environment. A zone overlay and city resolution will prevent use of water for the 100-year natural flushing period. Ground water can be used without restriction after 100 years and will be protective of human health and the environment at that time. Move to Box 12.
12		Implement natural flushing or natural flushing with active remediation. Natural flushing is selected.

2.2 Ground Water Contaminants

The second step of the compliance strategy selection process compares the COCs in ground water with MCLs in 40 CFR 192, other existing water standards, or background levels. Ground water beneath the New Rifle site was contaminated by former vanadium and uranium ore-processing operations that were ongoing from 1958 through 1972, from lignite ash processing from 1964 to 1967, and from vanadium processing (which did not produce tailings but may have produced milling solutions) from 1973 to 1984. Site-specific field investigations have shown that the alluvial ground water is the only aquifer affected by the former milling operations.

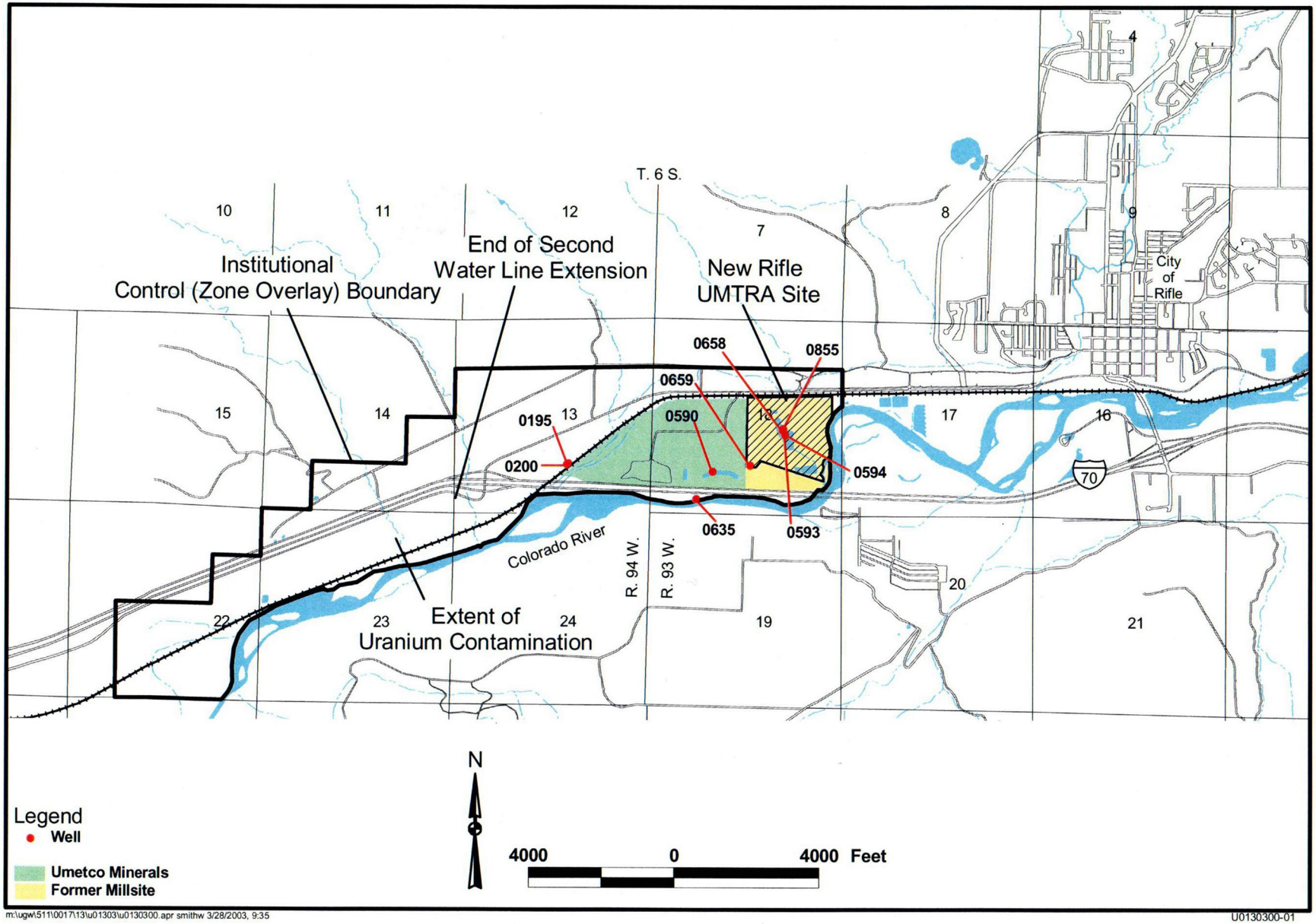


Figure 2. Extent of Contamination at the New Rifle Site

C02

COCs in the alluvial aquifer are identified as ammonia, arsenic, fluoride, manganese, molybdenum, nitrate, selenium, uranium, and vanadium. The following discussion of these COCs pertains to data collected during 2000–2001. Table 2 shows concentrations of these COCs before surface remedial action, just after remedial action and during preparation of the SOWP, and current 2002 data. Wells 0215, 0216, 0218, 0657, 0658, 0659, and 0590 are used as baseline wells, because they have long-term data. Substitute wells located closest to these wells were used for fluoride and selenium during the 1987 to 1994 range because analyses were not available for these constituents at baseline wells. Table 2 shows that, except for selenium and vanadium, COC concentrations have decreased since surface remedial action. These COC concentrations are explained in this section.

Table 2. New Rifle Chemistry Trends

COC	Historical Range Aug. 1987–Aug. 1994	Mean	SOWP Range (1998–1999)	Mean	Current Range (2002)	Mean	Difference of Means, Historical to Current	Difference of Means, SOWP to Current
As	0.97–1.3	1.1	0.0001–0.304	0.0391	0.0009–.058	0.018	–1.08	–0.02
NH_4	506–1745	1,030	0.004–475	146	12–409	139	–891	–7
F	0.06–9.0	4.7	0.477–5.5	2.5	0.343–3.49	1.82	–2.88	–0.68
Mn	9–13	9.9	0.34–4.55	2.1	0.647–7.59	2.98	–6.92	+0.88
Mo	2.3–3.7	2.9	0.010–6.84	2.2	0.018–5.87	1.56	–1.34	–0.64
NO_3	552–1110	784	0.11–324	35	0.02–191	78.1	–706	+43.1
Se	0.005–0.2	0.06	0.001–0.782	0.09	0.0001–0.255	0.079	+0.03	–0.011
U	0.24–0.37	0.29	0.010–0.395	0.11	0.17–0.310	0.093	–0.20	–0.02
V	0.59–2.8	1.3	0.001–25.3	3.17	0.0003–8.09	1.85	+0.55	–1.32

Wells used for this table are 0215, 0216, 0218, 0657, 0658, 0659, and 0590
Historical wells used for F are 0584 (for 0659), 0587 (for 0659), 0590, 0594 (for 0658), and 0625 (for 0216)
Historical wells used for Se are 0584 (for 0659), 0587 (for 0659), 0590, 0594 (for 0658), and 0625 (for 0216)

Original plume maps developed for the New Rifle SOWP in 1998–1999 are shown in Attachment B of Appendix B, *Ground Water Monitoring Plan for the New Rifle Site, Colorado* Also in Attachment B are 2002 COC spot plots for all of the wells currently being sampled.

The highest ammonia concentrations (reported as ammonium) appear to have originated near the center of the former gypsum-vanadium evaporation ponds, and migrated in a southwesterly direction through the western portion of the mitigation wetland. The highest ammonia concentration of 409 milligrams per liter (mg/L) is in off-site monitor well 0590, which is centered near the west end of the mitigation wetland, approximately 2,100 ft downgradient from the probable source area. Elevated concentrations extend west of the mitigation wetland boundary to the Roaring Fork gravel operation. Like the nitrate plume, most of the ammonia plume appears to have migrated downgradient as natural flushing progressed. Table 2 shows that ammonia concentrations have decreased more than 80 percent in the former millsite area since remediation.

Arsenic concentrations at most wells are below the detection limit of 0.001 mg/L and exceed the EPA ground water standard of 0.05 mg/L at only two locations—0658 and 0855—along the eastern edge and at the southwest corner of the former tailings pile footprint. The highest concentration of 0.223 mg/L was detected in a sample from recently installed well 0855 (not shown in Table 2) during the June 2002 sampling round. Mean arsenic concentrations have decreased by about two orders of magnitude in the millsite area during the past 15 years.

Fluoride concentrations in the plume currently exceed the Safe Drinking Water Act (SDWA) level of 4 mg/L at two sampling points. The maximum concentration is 5.9 mg/L at well 0635 (not in Table 2), although background concentrations have historically exceeded the standard as well. Current mean fluoride concentrations on the millsite are generally about half their original 1987 to 1994 values.

Manganese concentrations exceed the maximum historical background concentration of approximately 4 mg/L two sampling locations; background concentrations exceed the Colorado secondary drinking water standard of 0.05 mg/L and the agricultural standard of 0.2 mg/L. Manganese concentrations are currently about one-third of their historical values (Table 2).

The highest current levels of molybdenum are 2.9 and 5.5 mg/L and are located beneath the former tailings area (well 0659) and the former gypsum-vanadium evaporation ponds (well 0658). These values exceed the EPA ground water standard of 0.1 mg/L. The plume extends off site in a southwest-west direction as far downgradient as the Roaring Fork gravel operation. The most downgradient extent of the molybdenum plume is at monitor well 0195, located just west of the Roaring Fork holding pond, where concentrations are about 0.25 mg/L. Table 2 shows that mean molybdenum concentrations for the former millsite area are about half what they were before remedial action.

Nitrate contamination has migrated almost completely off-site in a southwest-west direction. The highest nitrate concentration detected on site in the most recent sampling round was at well 0658, which measured 194 mg/L as NO_3. In contrast, the highest off-site concentration was 273 mg/L at well 0201. This contaminant distribution indicates that the nitrate plume is moving through the alluvial aquifer as flushing progresses. Nitrate in the former millsite area decreased more than an order of magnitude from pre-remediation to post-remediation time and has risen slightly during the past 4 years (Table 2). This may be due to continuing oxidation of ammonia in this area.

The distribution of selenium contamination exceeding the 0.05 mg/L SDWA standard, which is the proposed cleanup level for New Rifle, is generally confined to the site. This final cleanup level is proposed because natural background concentrations exceed the EPA standard of 0.01 mg/L. The highest selenium concentration of 0.95 mg/L was detected at well 0855 in June 2002, but was 0.40 mg/L at well 0855 in December 2002. Well 0855 was installed in April 2000 and is located near well 0658. Well 0658, which has a longer monitoring history, had 0.20 mg/L of selenium in June 2002, but was down to 0.07mg/L in December 2002. Table 2 shows the general trend in selenium across the millsite. Concentration increased slightly during the remedial action period from previous concentrations, and is now continuing to fall. This might be expected for a multivalent species that can be mobilized from sorbed locations in the substrate during periods of disturbance. Vanadium displays similar trends.

Uranium contamination extends over the greatest area in the alluvial ground water. Figure 2 shows the extent of contamination. Uranium has migrated a significant distance off site, and the Roaring Fork gravel ponds separate two distinct plumes (see Appendix B, Attachment B). The highest uranium concentration of 0.31 mg/L, which is more than nine times the EPA standard of 0.044 mg/L, was at well 0658 during June 2002, in the east plume near the center of the former gypsum-vanadium evaporation ponds. The highest current concentration in the west plume is 0.15 mg/L at monitor well 0195. Table 2 shows the overall decreasing trend for uranium during the past 15 years in the millsite area. Concentrations are down about 70 percent.

No ground water standards have been established for vanadium. A human health risk-based concentration for drinking water in a residential setting is 0.33 mg/L and is used in this report as a conservative cleanup level.

After the initial characterization work for the SOWP, additional detailed characterization of vanadium distributions in soil and ground water at the New Rifle site was conducted. The vanadium pilot study (DOE 2000) showed that elevated vanadium concentrations in ground water are generally confined to the site, with a "hot spot" just downgradient and adjacent to the former vanadium-gypsum ponds, although an area in the mitigation wetland south of the site also contained relatively high concentrations. The highest vanadium concentration of 32 mg/L was detected in a sample from a temporary borehole collected during a May 2000 sampling event in support of the vanadium pilot study. The borehole was located just downgradient of historical on-site wells 0593 and 0594, which were removed during surface remediation. The historical wells showed a continuous decrease in vanadium concentrations, from 20 mg/L in 1985 to 0.73 mg/L in 1992, when the wells were removed during surface remediation. Location 0658 is a stainless steel well point, only 5.5 ft deep, in the same general vicinity and was installed using a backhoe. The vanadium concentration at this location was 44 mg/L in November 1996, just after surface remedial action, then declined steadily to 6.9 mg/L in December 2000. During the pilot study, the concentration at this location increased to 15.4 mg/L, but has since dropped to 5.4 mg/L in December 2002. A new monitor well, 0855, was installed using a rotosonic rig to a depth of 11 ft in 2000 immediately upgradient from well 0658 to corroborate vanadium behavior in that area. Concentrations of vanadium in samples from this well have remained much more constant than at well point location 0658, ranging from a low of 16.4 mg/L in June 2002 to a high of 22.2 mg/L in December 2002. Well 0855 will continue to be sampled during regular monitoring in conjunction with well 0658. It is likely that vanadium solubility increases when the subsurface has been disturbed, as with the installation of a monitoring well, and then decreases rather quickly as the system returns to equilibrium. If this is true, the concentrations of vanadium in well 0855 should begin to decrease to levels close to those in well 0658.

DOE conducted a pilot study for the removal of vanadium from ground water between November 2001 and April 2002 (DOE 2002). Nearly 3,000,000 gallons of contaminated water were treated using zero-valent iron. The process was about 95 percent efficient in removing vanadium from the water and approximately 99 kilograms of vanadium were removed from the plume. Little if any decreases in vanadium were observed at a nearby monitoring well and it was concluded that most vanadium was sorbed to alluvial aquifer sediments and was being released into the ground water as new water flowed past the sediments.

Table 2 shows the general trend for vanadium over the former millsite area and also shows the increase in ground water concentrations during surface remedial action disturbance and the relatively sharp decrease in concentrations after cessation of surface activities. As shown for well 0855, other intrusive activities, such as drilling into the center of the vanadium plume, can also disturb the geochemistry of the ground water system in the immediate area of the disturbance and cause a temporary increase in dissolved vanadium concentrations. (This is also thought to be true for other multivalent species such as arsenic and selenium.) Time-concentration plots of vanadium since 1996, when the surface remediation was completed, show consistent decreases in dissolved vanadium concentrations in the former millsite area. Plates 1A and 1B in Appendix D show vanadium plume maps for 1998 and 2002, respectively, and indicate a substantial decrease in dissolved vanadium levels at the New Rifle site.

2.3 Need for Remediation

In the next step of the evaluation process, the need for remediation is assessed. Ground water quality and yield are compared to limited use criteria in 40 CFR 192, and human health and environmental risks are evaluated. The ground water in the vicinity of the New Rifle site does not qualify for limited use, but currently ground water does not pose any unacceptable risks to human health and the environment. Controls are in place to prevent improper use of ground water, and ground water discharging to the Colorado River is greatly diluted so that contaminants pose no risk to humans and ecological receptors. Therefore, current contaminant concentrations in ground water are protective of human health and the environment, and the application of passive remediation and natural flushing is justified. Natural flushing will reduce concentrations of all site constituents to MCLs or risk-based levels and allow unrestricted use within 100 years.

2.4 Evaluation of Natural Flushing

An evaluation was completed to determine whether natural flushing alone would successfully remediate the alluvial aquifer within the permitted 100-year period. Results of ground water contaminant transport modeling using the USGS MODFLOW software package (McDonald and Harbaugh 1988) and the MT3D transport code (Zheng 1990) are presented in Section 5.0 and Appendix D of the SOWP (DOE 1999). These codes are fully described in the references cited and have been verified, benchmarked, and approved for use by most government and regulatory agencies. Predicted concentrations for arsenic, molybdenum, nitrate, selenium, and uranium after 100 years of natural flushing are summarized here. The modeling did not include the influence of the Roaring Fork gravel ponds, however, the operation ceased production in 2002. Modeling was performed using data through January 1999. Additional modeling was completed using Groundwater Analysis and Network Design Tool (GANDT), which predicted all COCs would flush within 100 years (Metzler, Marutzky, and Knowlton 1998).

2.4.1 Ground Water Modeling Predictions

Ground water modeling using G.W. Vistas was performed in 1999 for arsenic, molybdenum, nitrate, selenium, uranium, and vanadium. Vanadium was remodeled in 2002 using an analytical solution.

Molybdenum is predicted to decrease to levels below the MCL of 0.1 mg/L after a period of about 25 years. Attachment A in Appendix B shows predicted molybdenum concentration versus time in wells 0590 and 0670. The background concentration used for the modeling was 0.019 mg/L, and none of the background wells had sample concentrations that exceeded the MCL.

Uranium is predicted to decrease to levels below the MCL after a period of about 40 years. Attachment A in Appendix B shows predicted uranium concentration versus time in wells 0195, 0210, 0590, and 0670. The average calculated background concentration of 0.038 mg/L was used for ground water modeling. Levels of uranium in excess of 0.06 mg/L have been detected in some background monitor wells. Therefore, the compliance standard for uranium in site ground water may be either background or the MCL of 0.044 mg/L. The monitoring strategy is designed to account for variations in background uranium that may exceed the MCL.

Based on modeling results, maximum selenium concentrations are predicted to decrease to 0.05 mg/L, the SDWA standard and proposed ACL, in about 100 years or less, as shown in Attachment A in Appendix B for wells 0598 and 0670. Background wells have concentrations of selenium that were approximately twice the MCL of 0.01 mg/L, based on results from the last several rounds of sampling.

Modeling results for arsenic, suggest that natural flushing may reduce arsenic concentrations to the MCL 0.05 mg/L in as early as 20 years, as shown in Attachment A in Appendix B for wells 0590 and 0670. These modeling results are consistent with decreases in arsenic concentrations observed to date.

Nitrate (as NO_3) is predicted to decrease to levels below the MCL of 44 mg/L after 10 years of natural flushing, as shown in Attachment A of Appendix B for wells 0195, 0590, and 0670. Modeling did not take into account geochemical and biological reactions that could affect nitrate behavior. However, a conservative modeling approach was used, and it is anticipated that nitrate will be below the MCL well within the 100-year natural flushing period.

Initial vanadium modeling predictions indicated that it would take about 300 years for vanadium to flush to levels allowing unrestricted use of ground water. However, observed decreases in vanadium over the past 4 years in the vanadium plume area are not consistent with model predictions and suggest that decreases in dissolved vanadium may be more rapid than the model predicts. Late in 2002, additional evaluation of vanadium data was performed to understand why vanadium concentrations were dropping faster than modeling had predicted (Appendix D). Twelve wells in the vanadium plume area—0590, 0216, 0217, 0218, 0219, 0657, 0658, 0659, 0664, 0669, 0670, and 0855—having the longest regular sampling history in the former millsite area were selected, and time versus concentration graphs were generated.

These graphs were extrapolated with a regression curve generated with an analytical solution referred to as 3DADE (Leij and Bradford 1994). This method accounts for an initial concentration, advective and dispersive transport, and the effects of vanadium partitioning between solid and dissolved phases. This analysis suggested that dissolved vanadium at most locations will be below the risk-based screening level of 0.33 mg/L within 50 years and will be below this level at all locations within 100 years. Appendix D, Figures 3, 4, 5, and 6, provides more detailed description of this method.

The apparent reason for the discrepancy between the earlier model and observed vanadium concentrations stems from the behavior of vanadium in this ground water setting. Vanadium sorbs to subsurface materials to a greater degree than most ground water contaminants. The subsurface materials that act as sorbents include iron and manganese hydroxides, clays, and organic materials; all are commonly found in alluvial sediments at the New Rifle site. Therefore, vanadium tends to be easily sorbed but slowly released from these locations into the ground water. Changes in ground water chemistry, such as the addition or loss of oxygen or change in pH, may accelerate the vanadium uptake to or release from various sorbants in the alluvial material. Evidence strongly suggests that disturbing the subsurface down into the water table tends to release vanadium from sorbed sites and increase concentrations in the ground water; Consequently, future disturbance should be minimized. Institutional controls that prevent disturbance of the ground water system should prevent desorption of vanadium and allow it to decrease to the risk-based concentration. The resulting sorption and desorption processes are controlling the natural flushing of vanadium observed today. Field data show that, although

vanadium may still be sorbed to substrate matrices, the amount of dissolved vanadium is decreasing at a rate that will allow it to be naturally flushed within 100 years if the ground water system is not disturbed.

Modeling was not performed for ammonia, fluoride, and manganese, as no MCL exist for these contaminants. However, based on historical trends (see Table 2) and geochemical similarity to other constituents, it is likely that these constituents will reach background levels or other applicable standards within the 100-year natural flushing time frame. Monitoring will be conducted for these constituents to ensure that concentration trends are consistent with this assumption and that acceptable levels can be reached. The SDWA standard of 4.0 mg/L will be met for fluoride; manganese will be reduced to background concentrations of 4 mg/L. Ammonia does not have an MCL, so an ACL of approximately 200 mg/L (total reported as ammonium) is proposed. This is a risk-based concentration for unrestricted use. This value is an approximation because ammonia toxicity varies with temperature and pH. However, based on historical results and trends, ammonia concentrations should be below this value within the 100-year flushing time frame. Institutional controls will be maintained during the flushing period to prevent improper use of contaminated ground water.

2.5 Human Health and Environmental Risks

2.5.1 Summary of Site Risks

An evaluation of present-day conditions associated with the area of ground water contamination Standard 4b at the New Rifle site indicates that no risks currently exist for humans, because no complete exposure pathways are present at this time for use of untreated site-related ground water. Domestic wells have been installed in the alluvial aquifer; however, the wells are required to have treatment systems to ensure that the ground water is safe for drinking. Potential future risks are based on current levels of contamination. These risks will decline through time as contaminant concentrations decrease.

Ecological risks reported for the New Rifle wetland and the Roaring Fork pond represent a combination of possible present risks and potential future risks. Present ecological risks include those where receptors and complete exposure pathways currently exist (e.g., ingestion of surface water from the Roaring Fork pond by mule deer and muskrats). Future risks are those that could be present when the New Rifle wetland and Roaring Fork pond develop into more viable habitats.

Ecological risks discussed here and in the SOWP (DOE 1999) represent no significant threats to existing healthy populations. No evidence has been observed to date that indicates site-related contamination has resulted in environmental degradation. In the case of the Roaring Fork pond, the risk is associated with the gravel mining operation and current reclamation efforts. The disturbed conditions created by the operation are likely to prevent any near-term development of the Roaring Fork pond into an important habitat for wildlife and are likely to discourage its use as a significant food or water source for ecological receptors.

A large portion of the New Rifle wetland has been reconstructed over the last several years. Although construction is complete, site-related contamination may limit the types of vegetation that can initially thrive in that location. Undoubtedly the same limitations will affect aquatic organisms as well. However, as contamination decreases through time, the New Rifle wetland

can be expected to support a greater variety of plant and animal species. Thus, site-related contamination more probably represents a short-term hindrance to wetland species diversification than a threat to existing viable populations. Risks associated with the New Rifle wetland are generally low, especially in terms of probable population effects. Development of a compliance strategy for the site must account for current risks and for potential risks that could exist for up to 100 years in the future. Table 3 summarizes the contaminants that could not be eliminated through application of human health or ecological screening criteria during the risk assessment updates described in the SOWP (DOE 1999). However, hypothetical risks through use of ground water for drinking or agricultural purposes are mitigated through the institutional controls established for the site for the duration of the natural flushing period.

Additional information on potential risk to human health and the environment is provided in Section 3.0.

Table 3. Summary of Current and Potential Future Risks

Contaminant	Potential Future Human Health Risks		Current/Future Ecological Risks	
	On Site	Off Site	NRW	RFP
Ammonia	Y	Y*	ND	Y
Arsenic	Y	N	N	N
Cadmium	N	N	Y	Y
Fluoride	Y	Y*	Y	N
Manganese	Y	Y	N	N
Molybdenum	Y	Y	ND	ND
Nitrate	Y	Y	ND	Y
Selenium	Y	Y*	N	N
Sulfate	N	N	N	Y
Uranium	Y	Y	Y	Y
Vanadium	Y	Y*	N	N

Y = contaminant is a COC
N = constituent is not a COC
* = contaminant extends only immediately downgradient of site
ND = not sufficient data to evaluate
NRW = New Rifle wetland
RFP = Roaring Fork pond

2.5.2 Institutional Controls

ICs are restrictions that effectively protect public health and the environment by limiting access to a contaminated medium; at the New Rifle site, the medium is alluvial ground water. If natural flushing is to be protective of human health and the environment, institutional controls must be maintained during the flushing process to prevent improper use of the ground water.

A comprehensive ICs program is being implemented to prevent future use of contaminated ground water associated with the New Rifle site (Appendix A and A2). Regulators require ICs for the constituents that will flush to acceptable levels during the 100-year natural flushing period and for vanadium, which will require restrictions for an extended control period. The ICs program will consist of a combination of legal administrative actions, including a deed restriction covering the former millsite property, and City of Rifle and Garfield County ordinances enacting zone overlays covering the extent of the contamination plume. Where these restrictions are required, DOE must ensure that the beneficial uses that the ground water could have satisfied are

provided for. DOE funded two water line extensions to the current municipal system to ensure the availability of potable water to properties affected by site-related contamination. Because the second water line extension will not cover the full extent of the contaminated ground water plume, DOE has provided reverse osmosis systems for users within the ICs boundary but beyond the reach of the water line. DOE will continue to provide reverse osmosis systems on an as-needed basis to users within this affected area who do not have access to the municipal supply.

2.5.2.1 Deed Restriction

The State of Colorado and DOE anticipated the need for ICs at the millsite at completion of surface remediation when the property was slated for transfer to the City of Rifle. In 1996, DOE funded an extension of the city water line to the border of the millsite property, so a drinking water source would be available if needed. Deed restrictions have been proposed to the property title that prohibit use of contaminated ground water and prohibit excavation of contaminated soil that may cause surface expression of the ground water. The deed restriction contains the following language:

> "Grantee [City of Rifle] covenants...(ii) not to use ground water from the site for any purpose, and not to construct wells or any means of exposing ground water to the surface unless prior written approval for such use is given by the Grantor [Colorado Department of Public Health and Environment] and the U.S. Department of Energy."

This language will be effective upon transfer of the site from the State to the City of Rifle and will ensure that any future landowner is subject to the same restrictions. Upon title transfer, the deed restriction fulfills the requirement for permanence and enforceability by government entities and serves as a perpetual institutional control. A copy of the deed restriction is included in Appendix A.

2.5.2.2 Zone Overlay

Ground water modeling showed that COCs in the ground water from former milling activities would flush to acceptable levels in the 100-year time frame allowed by regulations for a natural flushing compliance strategy. DOE asked the local governmental agencies to apply a zone overlay with ground water restrictions to the affected area for a period not to exceed 100 years. DOE defined the ICs boundary for a zone overlay on the basis of an evaluation of the extent of uranium contamination, the most widespread contaminant associated with the site. To ensure that the area is protective of human health, a small buffer zone was included. The zone overlay boundary follows quarter-quarter section lines and natural features such as the Colorado River for easy delineation. The zone overlay boundary, defined as the Institutional Control Boundary, is shown in Figure 3. To ensure the beneficial use that the ground water would have provided during the period controls are needed, DOE entered into a cooperative agreement with the City of Rifle, the County of Garfield, and the State of Colorado to fund a water line extension within the ICs boundary.

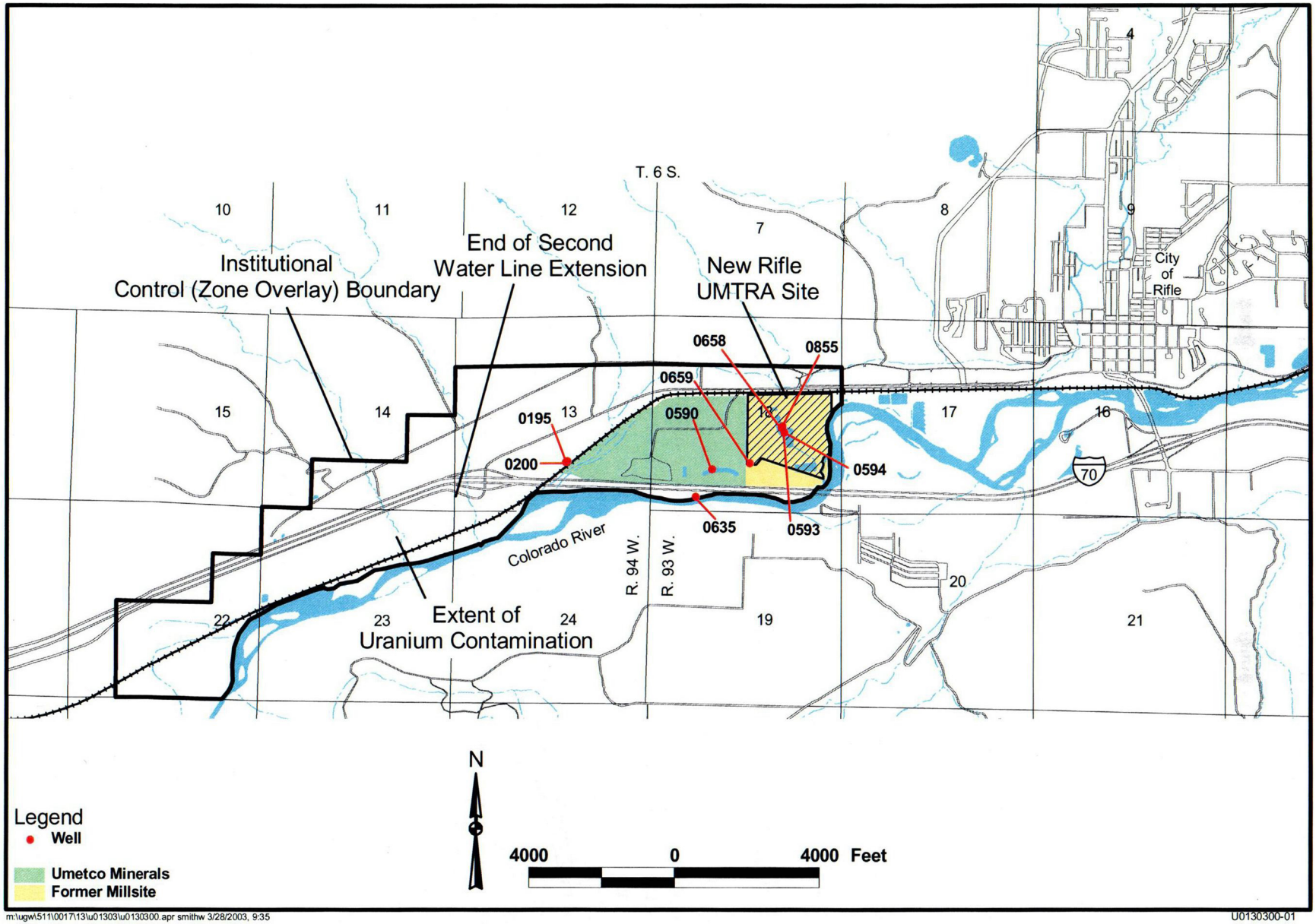


Figure 3. Institutional Control Boundary for the New Rifle Site

C03

The zone overlay (IC) boundary encompasses property currently under jurisdiction of Garfield County. Garfield County passed a resolution to require residents to prove a potable source of water in order to develop property within the defined area. The resolution does not require connection to the city water system but does establish a drinking water constraint zone in which any source of water intended for human consumption must meet applicable standards.

Most of the land within the IC boundary has been identified as a growth corridor for the City of Rifle and will likely be annexed the city when controls are needed. To ensure a safe source of domestic water, the City of Rifle passed an ordinance to require any resident within the IC boundary to tap into the city's municipal water system when annexation occurs. Copies of the city and county ordinances are included in Appendix A.

2.6 Compliance Strategy Selection

The final step in the framework is the selection of an appropriate compliance strategy to meet EPA ground water standards in 40 CFR 192. DOE has determined that natural flushing combined with institutional controls and continued monitoring is the appropriate compliance strategy for remediation of all contaminants at the New Rifle site. This approach will be protective of human health and the environment.

2.7 Ground Water and Surface Water Monitoring

Appendix B discusses the monitoring plan for New Rifle. The monitoring strategy for the alluvial aquifer is designed to track the progress of the natural flushing process in meeting compliance standards for site COCs. The progress will be tracked by comparing the actual concentrations against the model predictions and associated uncertainties and by applying a statistical test for trend. Standards for selenium, vanadium, and ammonia are their proposed ACLs of 0.05 mg/L, 0.33 mg/L, and 200 mg/L (as NH_4), respectively. For uranium, the cleanup goal is the EPA standard of 0.044 mg/L or background, whichever is higher. For arsenic, the cleanup goal is the EPA standard of 0.05 mg/L; for molybdenum the cleanup goal is the EPA standard of 0.1 mg/L; and for nitrate the cleanup goal is the EPA standard of 44 mg/L as NO_3. The goal for fluoride is the SDWA maximum contaminant level of 4 mg/L. The cleanup goal for manganese is approximately background, which has historically been as high as 4 mg/L. Monitoring will focus on these contaminants.

Wells 0217, 0218, 0219, 0657, 0658, 0659, 0664, 0669, 0670, 0855, and 0864 have been established as appropriate for monitoring the areas with highest concentrations of arsenic, selenium, and vanadium as well as elevated concentrations of most other constituents. In addition to the wells listed above, wells 0169, 0170, 0172, 0173, 0195, 0201, 0210, 0215, 0216, 0590, and 0635 have been established as appropriate for monitoring the progress of natural flushing in the alluvial aquifer. The perimeter of the plume is approximately defined by well 0172 to the southwest, wells 0170 and 0173 along the northern boundary, well 0169 to the northeast, and wells 0215 and 0216 to the southeast. In no case is the concentration of any COC at any of these perimeter wells more than twice the standard, whereas concentrations in some of the other wells exceed standards by a factor of five or higher for many COCs. Background wells 0169 and 0173 will be used to monitor background concentrations of uranium to assist in establishing the appropriate cleanup standard (EPA or background, whichever is higher). All wells in the network are considered to be point-of-compliance wells.

The other wells in the monitoring program are included to monitor the progress of flushing in key points within the boundaries of the plume. Well 0210, in which only uranium levels exceed the EPA standard (but are within the range of background), is along the railroad tracks near the Colorado River south of Interstate 70. Wells 0195 and 0201, in which levels of ammonia (well 0201 only), nitrate, molybdenum, and uranium exceed the cleanup goals, are located to the west and east, respectively, of the Roaring Fork gravel pit, approximately on the north-south centerline of the current plume. Well 0590 is immediately south of the borrow pit pond, and concentrations of molybdenum, nitrate, selenium, and uranium exceed EPA standards, and concentrations of ammonia, manganese, and vanadium exceed cleanup goals. Well 0635 is south of the borrow pit pond, south of Interstate 70 along the Colorado River, concentrations of molybdenum and uranium exceed EPA standards, and ammonia and fluoride levels exceed cleanup goals. Private wells 0442 and 0617 were sampled after installation of the reverse osmosis units to ensure continued satisfactory performance of those units. The proposed monitoring locations are shown on Figure 4.

Surface water locations to be monitored include locations 0320, 0322, 0452, 0453, and 0575. These are considered to be point of exposure locations. Water quality will be monitored in the Colorado River, the mitigation wetland, and the Roaring Fork holding pond on the downgradient and adjacent UMETCO property where a gravel mining operation currently exists. Results of the wetland samples will be used to help evaluate the progress of wetland reestablishment. All COCs are being analyzed at all surface locations.

Section 2.4.1 presents results of ground water modeling for arsenic, molybdenum, selenium, uranium, and nitrate. This modeling predicts that concentrations of all COCs will decrease and that their contaminant plumes will not spread beyond their current boundaries. The purpose of the monitoring plan is to confirm that natural flushing is progressing approximately in conformance with the predictions of the model and that concentrations of constituents that were not modeled are decreasing as well.

Sampling of the wells in the hot spot areas for vanadium will be twice per year for 5 years following concurrence of this GCAP by the U.S. Nuclear Regulatory Commission. After that time, monitoring of wells in this area will be reevaluated to see if frequencies can be coordinated with other sampling.

Otherwise, sampling of each well or surface location will take place annually for 10 years. If concentrations of a COC sampled in a well are below its standard for 3 consecutive years, cleanup will be considered complete at that location, and monitoring will be discontinued for that COC. After the first 10 years of monitoring, the monitoring frequency will be reduced to once every 5 years until the year 2030, assuming COCs continue to show a decline through the first 10-year period. At that time the monitoring strategy will be reevaluated and adjusted as appropriate based on previous results. It is anticipated that further monitoring will take place at a frequency of no less than once every 10 years. Analysis of any COC that is below its standard will continue for 3 consecutive years to eliminate it from further analysis. If the monitoring of wells at the perimeter of the contaminant plumes shows that contaminants have begun to spread beyond the current plume boundaries, or if some other changes in contaminant trends are noted, the sampling plan may also be reevaluated and adjusted at that time. If monitoring indicates that all contaminants in some areas have decreased below cleanup goals, institutional controls can be lifted in those areas. As part of the monitoring program, DOE will also evaluate the effectiveness of the institutional controls on a regular basis (e.g., yearly surveys of changes in water use in the area). Monitoring requirements are summarized in Table 4.

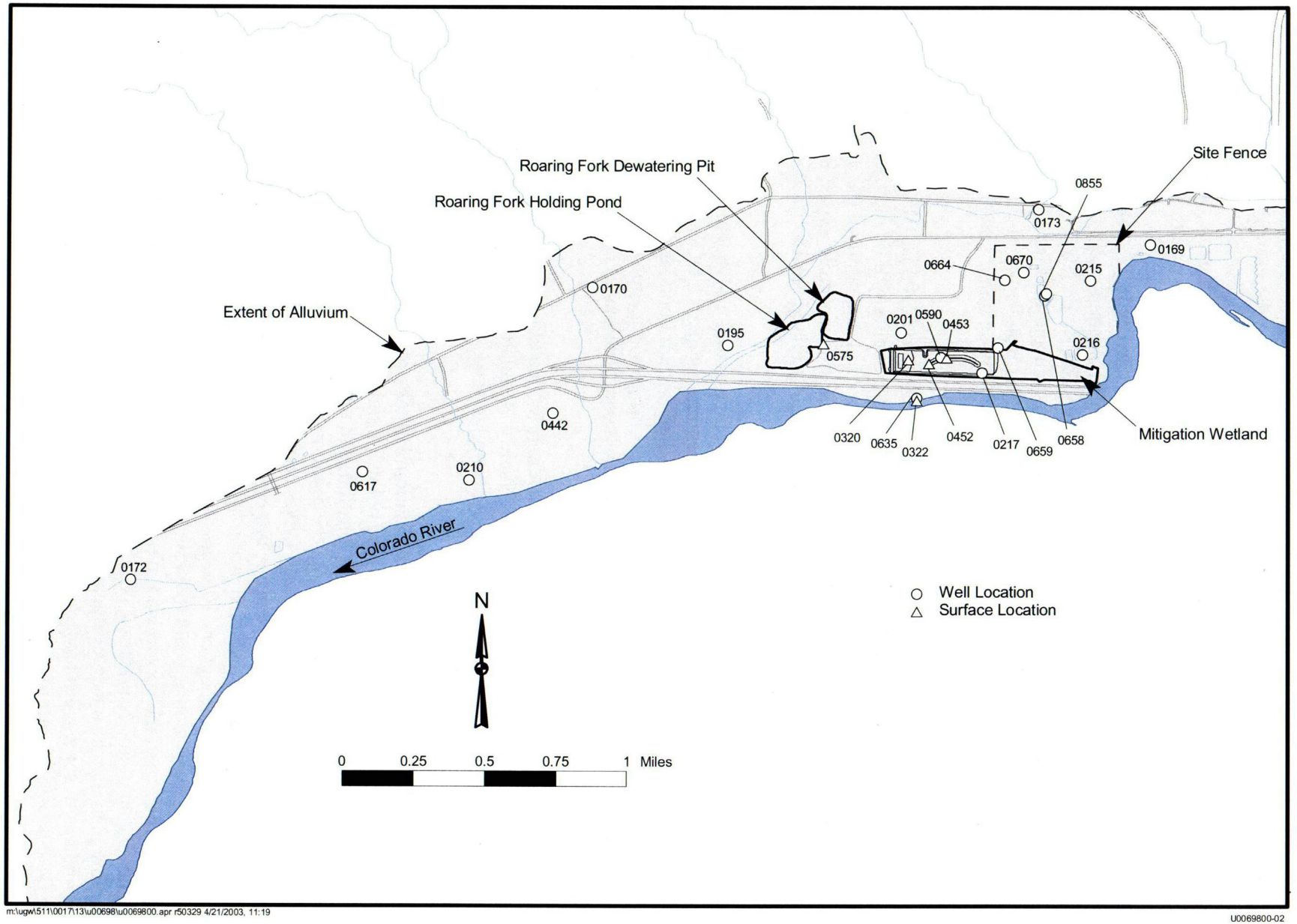


Figure 4. Proposed Monitoring Locations for the New Rifle Site

C04

Table 4. Summary of Monitoring Requirements

Location	Monitoring Purpose	Analytes	Frequency[a]
0215, 0216, 0217, 0590, 0658, 0659, 0664, 0669, 0670, 0855	Additional monitoring of vanadium plume area.	V, TDS	Semiannually for 5 years for wells monitoring vanadium plume. Results reevaluated at that time. Probably, monitoring will be at same frequency as other wells after that time.
0215, 0216, 0217, 0590, 0658, 0659, 0664, 0669, 0670, 0855	Monitor vanadium plume area	As, V, Se, Mo, U, NH^4, NO^3, Mn, F, TDS	All other wells and locations, annually for 10 years and every 5 years thereafter until 2030. Monitoring requirements will be reevaluated at that time, but are anticipated to take place at a frequency of no less than once every 10 years.
0170, 0172, 0210	Monitor middle and leading edge of Mo, U, and NO_3 plumes.	Mo, U, NO_3, TDS	
0169, 0173	Monitor background to establish appropriate standard for uranium; ensure no upgradient spread of plumes.	As, V, Se, Mo, U, NH_4, NO_3, Mn, F, TDS	
0195, 0201, 0635	Monitor flushing in main body of plumes; point of compliance wells for ACLs.	As, V, Se, Mo, U, NH_4, NO_3, Mn, F, TDS	
0320, 0322, 0452, 0453, 0575	Monitor surface water to determine impact of ground water discharge to surface water; 0322 is point of exposure location.	As, V, Se, Mo, U, NH_4, NO_3, Mn, F, TDS	
0442/0446, 0617/0685	Private wells before and after reverse osmosis treatment; 0442 & 0617 are pre-treatment, 0446 & 0685 are post-treatment.	As, V, Se, Mo, U, NH_4, NO_3, Mn, F, TDS	

[a]Monitoring for a COC will be discontinued if concentrations are below standards for 3 consecutive years.
TDS = total dissolved solids

Monitor wells not required as part of the monitoring network will be decommissioned according to applicable State of Colorado regulations and UMTRA Project procedures. Decommissioning will be accomplished in the near future under the Long-Term Surveillance and Maintenance Program.

3.0 Environmental Considerations

To comply with National Environmental Policy Act (NEPA) requirements, DOE prepared the PEIS, which was issued in October 1996 (DOE 1996b). The PEIS assesses the potential programmatic effects of conducting the UMTRA Ground Water Project, provides a method for determining site-specific ground water compliance strategies, and provides data and information that can be used to prepare site-specific environmental impact analyses more efficiently. In the proposed action (preferred alternative), ground water compliance strategies are tailored to each site to achieve conditions that are protective of human health and the environment. The selection framework for determining an appropriate compliance strategy at each site is presented in Section 2.1 of the PEIS and is discussed in Section 2.0 of this GCAP. Relevant areas of environmental concern are discussed below.

Environmental issues and resources potentially affected by the proposed action include the following:

- Risk to human health and the environment.
- Ground water use.
- Surface water use.
- Land use.
- Exposure to contaminated ground water.
- Environmental site restoration.

Environmental impacts from the proposed action on these issues and resources have been assessed in several referenced documents (DOE 1990, 1992, 1996a, 1996b, and 1999). Results of this assessment are summarized in the following sections for the most likely remediation scenario. Section 3.1 discusses the environmental issues, and Section 3.2 covers environmental impacts associated with the assumption that natural flushing will be adequate to reduce concentrations of all COCs to their respective remediation levels within the statutory time limit of 100 years.

3.1 Common Environmental Issues

On the basis of data in the SOWP, nine constituents present in the alluvial aquifer—ammonia, arsenic, fluoride, manganese, molybdenum, nitrate, selenium, uranium, and vanadium—pose a potential risk to human health or exceed established standards. The data also indicated that contamination was restricted to the surficial aquifer; the deeper Wasatch Formation has not been contaminated as a result of residual radioactive materials. Therefore, the risk assessment in the final SOWP (Section 6.0) focuses on the surficial aquifer.

The SOWP determined that ingestion of untreated alluvial ground water as a regular source of drinking water would result in the only unacceptable risk to human health. Currently, this exposure pathway is incomplete; hence, no actual human health risk exists. Under the proposed action, an institutional control over the plume area would prohibit ground water use for drinking water for 100 years. Because of the institutional control restriction, no human health risks will exist for the duration of this control. Concentrations of all COCs are anticipated to decrease to levels allowing unrestricted use within 100 years of natural flushing. It is anticipated that unrestricted use of site ground water after the termination of institutional control will pose no unacceptable human health risk.

As described in Section 2.5, site ground water currently presents few ecological risks, and those few risks that do exist tend to limit the diversity of species that can thrive in the area, rather than present risk to existing healthy populations. If ground water from on site wells or wells on the UMETCO property were used for irrigation, the water could be harmful to terrestrial plants because of current concentrations of arsenic and vanadium. Also, ammonia levels would be expected to limit the types of species that can thrive in the New Rifle wetland during the near term.

Existing documents, including the SOWP (DOE 1999) and the PEIS (DOE 1996b), describe the human health and ecological risks associated with implementing the proposed compliance strategy. Implementation of institutional controls will be protective of human health and the environment. Both the SOWP and the Environmental Impact Statement for surface remediation (DOE 1990) identify background ground water quality as generally poor and not projected for use as a public water supply.

To accommodate the NEPA obligation to make relevant environmental information available to public officials and citizens before decisions are made and before actions are implemented, DOE will distribute relevant environmental documents, such as this one, and the Environmental Assessment to the stakeholders and conduct a public meeting.

3.2 Environmental Issues Associated with Natural Flushing

Natural flushing will not involve any surface-disturbing activities. The only field activities required following implementation of the GCAP will be continued monitoring of the wells shown in Figure 4, along with limited well-decommissioning activities. Therefore, potential adverse effects typically associated with surface-disturbing activities will not occur.

Natural flushing will produce no adverse effects to air quality, surface water quality, cultural resources, sensitive plant or wildlife species (including threatened or endangered species), or designated or sensitive natural resource areas (e.g., wetlands, wilderness, parks, and scenic rivers). Although contaminants will flush to the Colorado River, ground water quality results presented in the SOWP indicate that the dilution factor of the Colorado River is so great (a factor of approximately 30,000) that the COCs are essentially undetectable. General comments received in the PEIS suggest that the public may consider monitoring wells a scenic impact. The majority of the wells at the New Rifle site are hidden by distance and visual barriers, but any potential impacts could be resolved with flush mounts of the well at the surface.

3.3 Environmental Issues Associated with Institutional Controls

Application of ICs will not involve any surface-disturbing activities. The only field activities required following implementation of the GCAP will be continued monitoring of the wells shown in Figure 4, along with limited well-decommissioning activities. Therefore, potential adverse effects typically associated with surface-disturbing activities will not occur.

Application of ICs will produce no adverse effects to air quality, surface water quality, cultural resources, sensitive plant or wildlife species (including threatened or endangered species), or designated or sensitive natural resource areas (e.g., wetlands, wilderness, parks, and scenic rivers). Although contaminants will flush to the Colorado River, ground water quality results presented in the SOWP indicate that the dilution factor of the Colorado River is so great that the COCs are essentially undetectable. General comments received in the PEIS suggest that the public may consider monitoring wells a scenic impact. The majority of the wells at the New Rifle site are hidden by distance and visual barriers, but any potential impacts could be resolved with flush mounts of the well at the surface.

Placing an institutional control on properties affected by contamination will restrict some uses of the land. However, DOE has provided funding to extend the municipal water supply to areas affected by ground water contamination. Existing domestic wells in the contaminated alluvial

aquifer have been equipped with reverse osmosis units. The institutional control placed on affected land ensures that any property owners will have potable water for future land development.

4.0 References

McDonald, M.G., and A.W. Harbaugh, 1988. *Techniques of Water-Resources Investigations of the United States Geological Survey,* Chapter A1: A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model, Book 6, Modeling Techniques, U.S. Geological Survey Open-File Report.

Metzler, D., S. Marutzky, and R. Knowlton, 1998. "Implementing the Natural Flushing Strategy: A Case History," from *Uranium Mining and Hydrogeology II,* Proceedings of the International Conference and Workshop, Freiberg, Germany, published by GeoCongress, Freiberg Technische Universität, September.

U.S. Department of Energy, 1990. *Final Environmental Impact Statement for Remedial Actions at the Former Union Carbide Corporation Uranium Mill Sites, Rifle, Garfield County, Colorado,* DOE/EIS–0132–F, prepared by the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico, March.

———, 1992. *Final Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Rifle, Colorado*, prepared by the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico, February.

———, 1996a. *Baseline Risk Assessment of Ground Water Contamination at the Uranium Mill Tailings Sites Near Rifle, Colorado,* DOE/AL/62350–179, Rev. 2, February.

———, 1996b. *Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project,* DOE/EIS–0198, prepared by the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico, October.

———, 1999. *Final Site Observational Work Plan for the UMTRA Project New Rifle Site,* GJO-99-88-TAR, Rev. 1, prepared by the U.S. Department of Energy, UMTRA Project Office, Grand Junction Office, Grand Junction, Colorado, April.

———, 2000. *Draft Work Plan for Vanadium Pilot Study New Rifle UMTRA Site, Rifle, Colorado*, GWRFL10.6.4, U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, July.

———, 2002. *Performance Report on the Operations of the Pilot Plant for the Treatment of Vanadium in Ground Water, New Rifle UMTRA Site, Rifle, Colorado,* GJO-2001-278-TAR, MAC-GWRFL-10.6.5-1, prepared by the U.S. Department of Energy, UMTRA Project Office, Grand Junction Office, Grand Junction, Colorado, December.

Zheng, C., 1990. *MT3D, A Modular Three-Dimensional Transport Model*, Documentation and User's Guide, First Edition, S.S. Papadopulos and Associates, Inc., Bethesda, Maryland.

Appendix A

Institutional Controls for the New Rifle Site

A1—Deed Restriction for Millsite Property

Recorded at _____ o'clock _____M., _____
Reception No. _____ _____ Recorder

QUIT CLAIM DEED

The Colorado Department of Public Health and the Environment ("Grantor"), whose address is 4300 Cherry Creek Drive South, Denver, Colorado, 80222-1530, City and County of Denver, State of Colorado, pursuant to 42 U.S.C.§ 7914 (e) (1) (B) and C.R.S. § 25-11-303, hereby donates and quit claim(s) to the City of Rifle ("Grantee"), whose address is 202 Railroad Avenue, Rifle, Colorado, 81650, City of Rifle, County of Garfield, State of Colorado, the following real property in the County of Garfield, State of Colorado, to wit: A parcel of land containing One hundred forty two (142) acres, more or less, described as follows:

That portion of land located in the S1/2 of the S1/2 of the NE1/4 of Section 18, Township 6 South, Range 93 West, of the 6th P.M., lying adjacent to and south of the South right-of-way line of the D&RG Railroad, except the east 297 feet, also Lot 5, Section 18, Township 6 South, Range 93 West, Lot 6, Section 18, Township 6 South, Range 93 West, except the east 297 feet of said Lot 6, also Lots 7 & 8 in Section 18, Township 6 South, Range 93 West, lying adjacent to and north of the Interstate 70 right-of-way line. Also two tracts of meander land situated in the S1/2 of Section 18, Township 6 South, Range 93 West, 6th P.M. described as follows:

Meander Land Tract 1

Beginning at the Southeast corner of Lot 6, and the East line of said Section 18; thence North 86 degrees 45 minutes West 594 feet; thence South 76 degrees 45 minutes West 660 feet; thence South 58 degrees 00 minutes West 1188 feet; thence South 75 degrees 00 minutes West 330 feet; thence South 250 feet; thence Southeasterly to the Westermost point of Lot 8 described above; thence North 49 degrees 13 minutes East 330 feet; thence North 79 degrees 45 minutes East 594 feet; thence North 45 degrees 30 minutes East 844.8 feet; thence South 69 degrees 00 minutes East 990 feet to the East line of said Section 18; thence North to the POINT OF BEGINNING.

Meander Land Tract 2

Beginning at the Southeast corner of Lot 7 and the East line of said Section 18; thence South 336.6 feet; thence South 75 degrees 55 minutes West 55.44 feet; thence South 61 degrees 00 minutes West 152.91 feet; thence South 61 degrees 00 minutes West, more or less, to the North right-of-way line of U.S. Interstate 70; thence West 810 feet to the South line of said Lot 7; thence North 62 degrees 15 minutes East 660 feet; thence North 75 degrees 30 minutes East 554.4 feet to the POINT OF BEGINNING.

Subject to: (i) any coal, oil, gas, or other mineral rights in any person; (ii) existing rights-of-way for roads, railroads, telephone lines, transmission lines, utilities, ditches, conduits, or pipelines on, over, or across said lands; (iii) court liens, judgments, or financial encumbrances such as deeds of trust for which a formal consent or order has been obtained from a court for the lien holder; (iv) other rights, interests, reservation or exceptions of record; and the following terms, conditions, rights, reservations and covenants:

Grantor reserves to (i) itself, the U. S. Department of Energy, their employees, agents and contractors the right of access to the property as may be necessary to complete activities under the Uranium Mill Tailings Radiation Control Act of 1978, 42 U.S.C. § 7901 et seq. ("UMTRCA") and for other lawful purposes, until such time as Grantor and the U.S. Department of Energy determine that all remedial activities are complete; and (ii) to itself any non-tributary groundwater underlying this parcel, the right to develop tributary groundwater, and the right to surface access for groundwater development.

Grantee covenants to hold harmless the Grantor and the Department of Energy for any liability associated with disruption of any public purpose ventures on the property conveyed by this deed, the disruption of any improvement on said property made by the Grantee, its successors and assigns, and any temporary or permanent limitations to the use of the property, should the Grantor and the Department of Energy be required to perform additional surface remedial activities on the property conveyed by this deed.

Grantee covenants (i) to comply with the applicable provisions of UMTRCA, 42 U.S.C. #7901 et. seq., as amended; (ii) not to use ground water from the site for any purpose, and not to construct wells or any means of exposing ground water to the surface unless prior written approval for such use is given by the Grantor and the U.S. Department of Energy; (iii) not to sell or transfer the land to anyone other than a governmental entity within the state; (iv) that any sale or transfer of the property described in this deed shall have prior written approval from the Grantor and the U.S. Department of Energy; and that any deed or other document created for such sale or transfer and any subsequent sale or transfer will include information stating that the property was once used as a uranium milling site and all other information regarding the extent of residual radioactive materials removed from the property as required by Section 104(d) of the Uranium Mill Tailings, 42 U.S.C. sec. 7014(d), and as set forth in the Annotation attached hereto; (v) not to perform construction and/or excavation or soil removal of any kind on the property without permission from the Grantor and the U.S. Department of Energy unless prior written approval of construction plans (e.g., facilities type and location), is given by the Grantor and the U.S. Department of Energy; (vi) that any habitable structures constructed on the property shall employ a radon ventilation system or other radon mitigation measures; and (vii) that its use of the property shall not

adversely impact groundwater quality, nor interfere in any way, with groundwater remediation under UMTRCA activities; and (viii) to use the property and any profits or benefits derived therefrom only for public purposes as required by UMTRCA sec. 104(e)(1)(C), 42 U.S.C. 7914 (e)(1)(C).

These covenants are made in favor and to the benefit of Grantor, shall run with the land and be binding upon Grantee and its successors and assigns, and shall be enforceable by Grantor;

Grantee acknowledges that the property was once used as a uranium milling site, and that the Grantor makes no representations or warranties that the property is suitable for Grantee's purposes;

IN WITNESS WHEREOF:

APPROVED AS TO FORM:

David Kreutzer - Assistant Attorney General

GRANTOR:

STATE OF COLORADO
Bill Owens, Governor
Acting by and through
The Department of Public Health and Environment

By:_____
Executive Director

By:_____
Program Approval

ACCEPTANCE OF DEED
AND COVENANTS

GRANTEE:

_____
(Full Legal Name of Agency)

By:_____
Name

Title:_____

Signed this day of , 19

STATE OF COLORADO, } ss.
County of

The foregoing instrument was acknowledged before me this

day of , 19 , by

My commission expires

Witness my hand and official seal

_____
Notary Public.

ATTACHMENT A

LAND ANNOTATION

NEW RIFLE; COLORADO PROCESSING SITE

The Uranium Mill Tailings Radiation Control Act (Public Law 95-604), Section 104, requires that the State notify any person who acquires a designated processing site of the nature and extent of residual radioactive materials removed from the site, including notice of the date when such action took place, and the condition of the site after such action. The following information is provided to fulfill this requirement.

The New Rifle, Colorado processing site consists of one land parcel which contained a large tailings pile, the mill building, and associated structures. Approximately 3,232,000 cubic yards of contaminated materials which included 1) tailings; 2) subpile soils; 3) surficial materials in the mill yard; 4) windblown materials; and 5) mill demolition debris were removed from the mill site from 1988-1996. The remediation was conducted in accordance with regulations promulgated by the U.S. Environmental Protection Agency, in 40 CFR 192. These regulations require that the concentration of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than: 5 pCi/g (picocuries per gram), averaged over the first 15 cm (centimeters) of soil below the surface, and 15 pCi/g averaged over 15 cm thick layers of soil more than 15 cm below the surface. Verification measurements were conducted at the site by dividing the site into approximately 30-foot by 30-foot grids. A soil sample was collected and analyzed for contaminants from each grid to verify that the standards had been met.

After remediation was complete the site was backfilled with clean fill material, graded for drainage and revegetated. Backfill materials were routinely analyzed for radium-226 and were determined to have concentrations near background (1.5 pCi/g). To replace old wetland areas on the site, new wetlands were constructed in accordance with Army Corp of Engineer (COE) requirements. These wetland areas should not be disturbed without COE approval.

Excavation of residual radioactive material was also conducted for thorium-230 beneath the tailings pile in the subpile soils. For thorium-230, the cleanup standard was determined as a projected 1,000 year radium-226 concentration based on the eventual decay of the thorium to radium. The average thorium in-growth at depth was calculated to be 3.8 pCi/g.

All verification grids on the site met the EPA standards for radium and thorium, except grids M-08-07 and M-08-10. These areas are shown on the attached map. Additional information regarding the depth to the remaining deposits is available upon request from Colorado Department of Public Health and Environment and has been provided to Garfield County. When excavating in these areas, worker protection should be assured, and the material should be replaced at depth in the excavation. The EPA standards also allow for contamination to be left in place where removal would present a risk of injury to workers, would result in environmental harm, or where the cost of removal clearly outweighs the benefit in terms of risk reduction. At the New Rifle site, these areas where contamination was left (called "supplemental standards")

are the following. The supplemental standards areas are shown on the attached map.

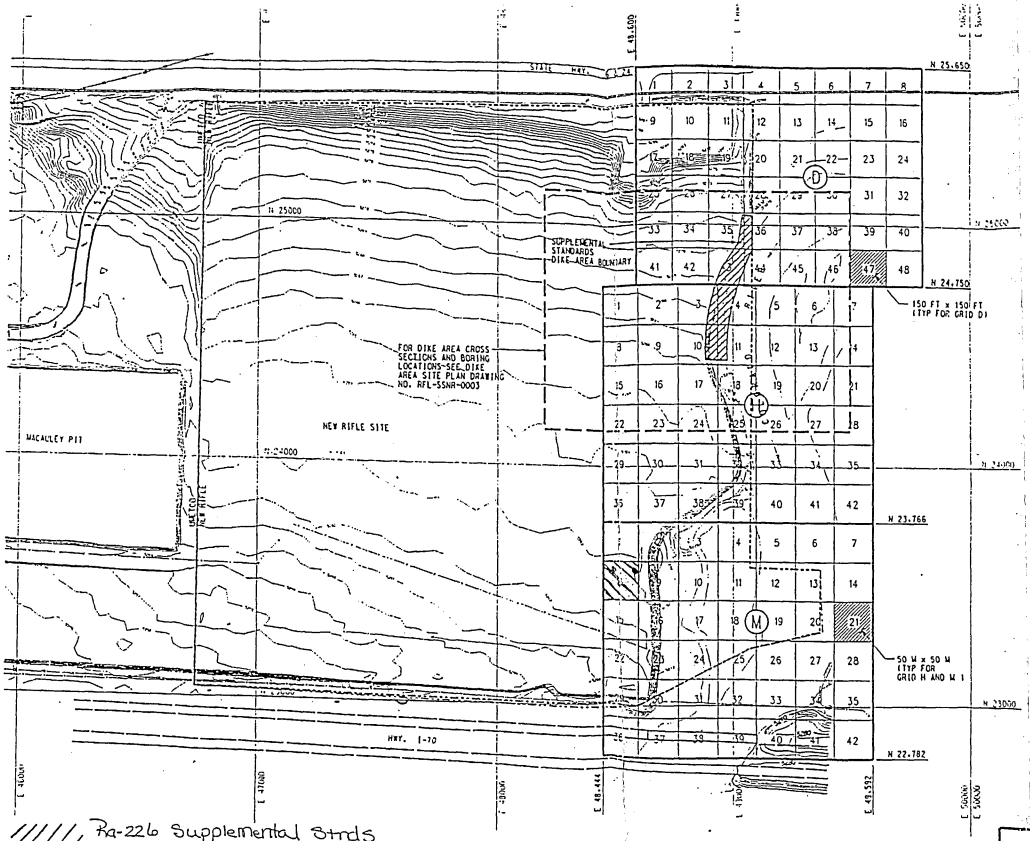
1) Approximately 400 cubic yards of tailings were left under the Corps of Engineers dike east of the site. The deposit is covered with clean fill and poses no risk.

2) Deposits remain north of the site along U.S. Highway 6 and 24, and the Union Pacific right-of-way. These deposits extend approximately 1/4 mile east and west of the site boundary.

The groundwater beneath the New Rifle mill site remains contaminated and will be addressed during Phase II of the uranium mill tailings remedial action project. Several groundwater monitor wells are present on and downgradient of the site and will remain in place until the U.S. Department of Energy determines that they can be removed.

Any person who acquires a designated processing site shall apply for any permits, including U.S. Army Corps of Engineers Section 404 permits regarding construction in or near wetlands, as required by law.

Additional information concerning the remedial action, and groundwater conditions is available from the Colorado Department of Public Health and Environment, Hazardous Materials and Waste Management Division.



Ra-226 Supplemental Stnds

Th-230 Supplemental Stnds

REFERENCE DRAWINGS

RFL-SSNR-0003 — DIKE AREA PLAN AND BOREHOLE LOCATIONS

LEGEND

- RAILROAD TRACKS
- FENCE
- NEW RIFLE SITE BOUNDARY

	30FT	30FT	30FT	30FT	30FT
30FT	1	2	3	4	5
30FT	6	7	8	9	10
30FT	11	12	13	14	15
30FT	16	17	18	19	20
30FT	21	22	23	24	25

150FT x 150FT GRID

SAMPLE GRID NO.

A-37-19

A = SHEET NO. (SEE KEY MAP ABOVE)

37 = 150FT x 150FT GRID

19 = 30FT x 30FT SUBGRID

	10M	10M	10M	10M	10M
10M	1	2	3	4	5
10M	6	7	8	9	10
10M	11	12	(42)	14	15
10M	16	17	18	19	20
10M	21	22	23	24	25

50M x 50M GRID

SAMPLE GRID NO.

E-42-19

E = SHEET NO. (SEE KEY MAP ABOVE)

42 = 50M x 50M GRID

19 = 10M x 10M SUBGRID

0 50 100 150 200 SCALE METERS

OFF 100 200 400 600 800FT SCALE FEET

NO.	DATE	REVISION	BY	CH	ENG MGR	PROJ MGR	DOE APP
4	6/25/87	REISSUED FINAL - ADDED DIKE AREA BOUNDARY					
3	12/4/86	ISSUED FINAL					
2	11/5/86	PRELIMINARY FOR REVIEW					
1							

U.S. DEPARTMENT OF ENERGY
ALBUQUERQUE, NEW MEXICO

DESIGNED | DRAWN | CHECKED | INSPECTED | RECOMMENDED | APPROVED | DATE | DOE PROJECT ENGINEER | DATE

NEW RIFLE PROCESSING SITE
RIFLE, COLORADO
SUPPLEMENTAL STANDARDS FOR RIVER DIKE

DIKE AREA SITE PLAN

MORRISON KNUDSEN CORPORATION
ENGINEERS & CONSTRUCTORS
UMTRA PROJECT
P.O. MARKET STREET TOWER, SUITE 1000, SAN FRANCISCO, CA 94105

PROJECT NO. DE-AC04-83AL18796

DRAWING NO. RFL-SSNR-0002 REV. 2

A2—Garfield County Institutional Controls for Property Within the Institutional Control Boundary

589784 10/09/2001 01:19P B1292 P941 M ALSDORF
1 of 4 R 0.00 D 0.00 GARFIELD COUNTY CO

STATE OF COLORADO)
)ss
County of Garfield)

941

At a regular meeting of the Board of County Commissioners for Garfield County, Colorado, held in the Commissioners' Meeting Room, Garfield County Courthouse, in Glenwood Springs on Monday, the 8th of October, 2001, there were present:

John Martin, Commissioner Chairman
Larry McCown, Commissioner
Walt Stowe, Commissioner
Don DeFord, County Attorney
Mildred Alsdorf, Clerk of the Board
Ed Green, County Manager

when the following proceedings, among others were had and done, to-wit:

RESOLUTION NO. 2001-73

A RESOLUTION CONCERNED WITH AMENDING THE GARFIELD COUNTY ZONING RESOLUTION OF 1978 BY THE ADDITION OF SECTION 3.14, DRINKING WATER CONSTRAINT (DWC) ZONE DISTRICT.

WHEREAS, on the 2nd day of January, 1979, the Board of County Commissioners of Garfield County, Colorado, adopted Resolution No. 79-1 concerning a Zoning Resolution for the County of Garfield, State of Colorado; and

WHEREAS, the Board is authorized by the provisions of Sections 30-28-109 through 30-28-116, C.R.S. 1973, as amended, to provide for the approval of amendments to such Zoning Resolution, and the Board has so amended the said Resolution; and

WHEREAS, on December 16, 1991, the Board adopted a codified version of the Garfield County Zoning Resolution of 1978 and all subsequent amendments; and

WHEREAS, on September 14, 2001, the Garfield County Planning Commission recommended approval of the proposed text amendment;

WHEREAS, a public hearing was held on the 17th day of September 2001 and continued to the 24th day of September, 2001, before the Board of County Commissioners of Garfield County, Colorado, at the Commissioners meeting room, Suite 301, Garfield County Courthouse, 109 8th Street, Glenwood Springs, Colorado, as to which hearing, public notice was given in accordance with requirements of Section 10 of the Garfield County Zoning Resolution;

WHEREAS, the Board on the basis of evidence produced at the aforementioned hearing has made the following determination of fact:

1. That an application for a zone district text amendment was made consistent with the

requirements of Section 10.00 of the Garfield County Zoning Resolution of 1978, as amended;

2. That the Board of County Commissioners is authorized by the provisions of Section 30-28-116, C.R.S. 1973, as amended, to provide for the approval of amendments to the Garfield County Zoning Resolution;

3. That the public hearing before the Board of County Commissioners was extensive and complete, that all pertinent facts, matters and issues were submitted and that all interested parties were heard at the hearing;

4. That the Garfield County Planning Commission has reviewed the proposed zone district text amendment and made a recommendation as required by Section 10.04 of the Garfield County Zoning Resolution of 1978, as amended;

5. That the proposed text amendment are in the best interest of the health, safety, morals, convenience, order, prosperity and welfare of the citizens of Garfield County.

NOW, THEREFORE, BE IT RESOLVED by the Board of County Commissioners of Garfield County, Colorado, that the Garfield County Zoning Resolution, adopted on the 2nd day of January, 1979, and identified as its Resolution No. 79-1, as subsequently amended by this Board, shall be and hereby is amended and said language will be incorporated into the codified Garfield County Zoning Resolution adopted by the Board on December 16, 1991 as follows:

3.14 Drinking Water Constraint Zone (DWC)

3.14.01 Uses, by right: :

Agricultural, including farm, garden, greenhouse, nursery, orchard, ranch, small animal farm for production of poultry, fish, fur-bearing and other small animals, and customary accessory uses including buildings for shelter and enclosure of persons, animals or property employed in any of the above uses; retail establishment for sale of goods processed from raw materials produced on the lot;

Buildings for shelter and enclosure of persons employed in any of the uses by right, kennel, riding stable and veterinary clinic, guiding and outfitting;

Manufactured home as the principal use of the lot meeting standards contained in Section 5.03.01(2);

Single-family dwelling; customary accessory uses only where it is accessory to the uses listed above.

3.14.02 Uses, conditional:

Aircraft landing strip, airport-utility, salvage yard, sanitary landfill and storage, Home occupation

3.14.03 Uses, special:

Pumping facilitics, electrical distribution ,water impoundments, access routes, utility lines, pipelines;

Camper park, agriculture-related business, resort, airport - air carrier, plant for fabrication of goods from processed natural resources; material handling, warehouse facilities/staging areas, fabrication areas, storage areas, extraction, processing; public gatherings; commercial park; recreational support facilities; guest houses.

3.14.04 Minimum Lot Area: Two (2) acres.

3.14.05 Maximum Residential Lot Coverage: fifteen percent (15%).

3.14.06 Minimum Setback: (Unless otherwise permitted by special use permit.)

(1) Front yard: (a) arterial streets: seventy-five (75) feet from centerline or fifty (50) feet from lot line, whichever is greater; (b) local streets: fifty (50) feet from street centerline or twenty-five (25) feet from front lot line, whichever is greater;
(2) Rear yard: twenty-five (25) feet from rear lot line;
(3) Side yard: ten (10) feet from side lot line, or one-half (1/2) the building height, whichever is greater.

3.14.07 Maximum Height of Buildings: Forty (40) feet. (Unless otherwise permitted by special use permit.)

3.14.08 Additional Requirements: All uses shall be subject to the provisions of Section 5 (Supplementary Regulations).
All of the uses listed a use by right, conditional use or special use, will be allowed provided any use that includes the human consumption of ground water, shall have an approved domestic water supply. An approved domestic water supply shall be either an approved community water system as defined by the Colorado Department of Health and Environment, Drinking Water Standards or from a ground water source on the property that is treated by a reverse osmosis water treatment system that meets the water quality standards promulgated under the criteria cited in CRS § 25-8-204 (1) & (2).

Dated this 8th day of October, 2001.

ATTEST:

GARFIELD COUNTY BOARD OF COMMISSIONERS, GARFIELD COUNTY, COLORADO

GARFIELD COUNTY SEAL COLORADO

Clerk of the Board

Chairman

589784 10/09/2001 01:19P B1292 P944 M ALSDORF
4 of 4 R 0.00 D 0.00 GARFIELD COUNTY CO

Upon motion duly made and seconded the foregoing Resolution was adopted by the following vote:

COMMISSIONER CHAIRMAN JOHN F. MARTIN, Aye
COMMISSIONER WALTER A. STOWE, Aye
COMMISSIONER LARRY L. MCCOWN, Aye

STATE OF COLORADO)
)ss
County of Garfield)

I, _____, County Clerk and ex-officio Clerk of the Board of County Commissioners, in and for the County and State aforesaid, do hereby certify that the annexed and foregoing Resolution is truly copied from the Records of the Proceeding of the Board of County Commissioners for said Garfield County, now in my office.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of said County, at Glenwood Springs, this _____ day of _____, A.D. 2001.

County Clerk and ex-officio Clerk of the Board of County Commissioners

_____.

038

STATE OF COLORADO)
)ss
County of Garfield)

At a meeting of the Board of County Commissioners for Garfield County, Colorado, held in the Commissioners' Meeting Room, Garfield County Courthouse, in Glenwood Springs on Monday, the 8th day of October,2001, there were present:

John Martin, Commissioner Chairman
Larry McCown, Commissioner
Walt Stowe, Commissioner
Don DeFord, County Attorney
Mildred Alsdorf, Clerk of the Board
Ed Green, County Manager

when the following proceedings, among others were had and done, to-wit:

RESOLUTION NO. 2001-72

A RESOLUTION CONCERNED WITH THE APPROVAL OF A ZONE DISTRICT AMENDMENT FOR AN AREA WEST OF RIFLE TO DRINKING WATER CONSTRAINT (DWC).

WHEREAS, the Board of County Commissioners of Garfield County proposed to rezone the herein described property in Garfield County to Drinking Water Constraint (DWC).

WHEREAS, the Board of County Commissioners of Garfield County have heretofore adopted and enacted a Zoning Resolution for Garfield County, Colorado, including as a part thereof, certain zoning maps regulating permitted uses upon the lands within Garfield County, Colorado; and

WHEREAS, sections 30-28-109 through 30-28-116 C.R.S.. as amended, provide for the approval of all zoning plans and the adoption and amendment of regulations and resolutions to implement such zoning plans by the Board of County Commissioners of a given county; and

WHEREAS, the County has given notice of public hearing upon such application by publication in a newspaper of general circulation in Garfield County and provided notice of said hearing to all property owners adjacent to said property subject to the zone district amendment, and such hearing having been held on September 17, 2001, which was continued to September 24, 2001 and this Board having given full consideration to the evidence; and

447
0
31

589783 10/09/2001 01:16P B1292 P939 M ALSDORF
2 of 3 R 0.00 D 0.00 GARFIELD COUNTY CO

WHEREAS, based upon the evidence, testimony, exhibits, review of the Comprehensive Plan for the unincorporated area of the County, recommendation from the Garfield County Planning Commission, comments of the Garfield County Planning Department, comments of public officials and agencies and comments from all interested parties in connection with said application, this Board makes the following findings in respect thereto, to-wit:

1. That all applicable regulations regarding a Zone District Amendment have been complied with including, but not limited to, Section 10.00 of the Garfield County Zoning Resolution of 1978, as amended.

2. That proper publication and public notice was provided as required by law for the hearing before the Board of County Commissioners.

3. That the public hearing before the Board of County Commissioners was extensive and complete, that all pertinent facts, matters and issues were submitted and that all interested parties were heard at the meeting.

NOW, THEREFORE, BE IT RESOLVED by the Board of County Commissioners of Garfield County, Colorado, that the following described area and the property included therein, be rezoned Drinking Water Constraint (DWC).

LEGAL DESCRIPTION

All of that property located north of the northern bank of the Colorado River located in the S1/2 of Section 18, T. 6 S., R. 93 W.; and the S1/2 of Section 13; the E1/2 SE1/4; SW1/4 SE1/4, SE1/4SW1/4 of Section 14; the SE1/4NE1/4, SE1/4, E1/2 SW1/4 of Section 22; N1/2 of Section 23 and the NW1/4 of Section 24, T. 6 S., R. 94 W. of the 6th P. M..

Dated this 8th day of October, A.D. 2001.

ATTEST:

GARFIELD COUNTY BOARD OF COMMISSIONERS, GARFIELD COUNTY, COLORADO

GARFIELD COUNTY COLORADO

Clerk of the Board

Chairman

589783 10/09/2001 01:16P B1292 P940 M ALSDORF
of 3 R 0.00 D 0.00 GARFIELD COUNTY CO

Upon motion duly made and seconded the foregoing Resolution was adopted by the following vote:

COMMISSIONER CHAIRMAN JOHN F. MARTIN, Aye
COMMISSIONER WALTER A. STOWE, Aye
COMMISSIONER LARRY L. MCCOWN, Aye

STATE OF COLORADO)
)ss
County of Garfield)

I, _____, County Clerk and ex-officio Clerk of the Board of County Commissioners, in and for the County and State aforesaid, do hereby certify that the annexed and foregoing Resolution is truly copied from the Records of the Proceeding of the Board of County Commissioners for said Garfield County, now in my office.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of said County, at Glenwood Springs, this ____ day of _____, A.D. 2001.

County Clerk and ex-officio Clerk of the Board of County Commissioners

_____

A3—City of Rifle Institutional Controls for Property Within the Institutional Control Boundary

Note: Currently all property within the IC boundary falls under the jurisdiction of Garfield County. However, this IC has been developed in the anticipation that at least some of the property within the IC boundary will be annexed into the City of Rifle during the period of time the ICs apply.

CITY OF RIFLE, COLORADO
ORDINANCE NO. 24
SERIES OF 2001

AN ORDINANCE OF THE CITY OF RIFLE, COLORADO, AMENDING TITLES 10, 16 AND 17 OF THE RIFLE MUNICIPAL CODE PROHIBITING THE USE OF GROUNDWATER FOR POTABLE PURPOSES WITHIN THE URANIUM MILL TAILINGS REMEDIATION PROJECT RIFLE INSTITUTIONAL CONTROL BOUNDARY.

WHEREAS, past uranium mining activities in the vicinity of the City of Rifle resulted in a plume of contaminated groundwater, which plume is shown on the Rifle Institutional Control Boundary Map; and

WHEREAS, to ensure that contaminated groundwater is not consumed for potable purposes, it is necessary for the public health to prohibit such use; and

WHEREAS, the Rifle City Council finds and determines that amending the Rifle Municipal Code to require owners of property within the Rifle Institutional Control Boundary to connect to the City's potable water supply is in the best interest of the citizens of Rifle.

NOW, THEREFORE, THE COUNCIL OF THE CITY OF RIFLE, COLORADO, ORDAINS THAT:

1. The City Council incorporates the foregoing recitals as findings by the City Council.

2. Amendment. Title 10 of the Rifle Municipal Code is hereby amended as follows:

10.04.010 Definitions

[in the correct alphabetical order]

*. "DOE" means the United States Department of Energy.

*. "Rifle Institutional Control Boundary" means the boundary of a geographic area in and adjacent to the City of Rifle that has been identified and mapped by the United States Department of Energy within which lands are subject to non-potable polluted groundwater

*. "Rifle Institutional Control Boundary Map" means a map recorded with the Garfield County Clerk and Recorder as Reception No. _____ that depicts the Rifle Institutional Control Boundary and subject lands.

10.04.050 Service Outside City--Policy

It is the policy of the City to decline to extend water service to property lying outside the corporate limits of the City, except for areas located within the Rifle Institutional Control Boundary, unless (a) the lack of municipal water creates a real hardship upon the owner of the property, (b) the property is capable of being annexed to the City within a reasonable time, as determined by the City Council, and (c) the owners, for themselves, their successors and assigns, sign a binding agreement to annex the property to the City at such time as it becomes eligible for annexation. The City expressly reserves the right, as may be limited by state or federal law, to impose such conditions as it may see fit relative to the furnishing of such service and to refuse such service in its discretion.

All provisions of this chapter apply to those areas outside the corporate limits of the City, except those areas covered by a contract which expressly establishes other rules for the area served under the contract.

All of the provisions of this chapter also apply to those areas which were located within the boundaries of the Rifle Village South Metropolitan District on June 1, 1988, except as expressly modified by an agreement between the City and the District incorporated into Ordinance No. 1, Series of 1988 and areas which are located within the Rifle Institutional Control Boundary.

10.04.080 Connection Required

The owner of any house or other building occupied for business or residence purposes, situated within the City and abutting any street, alley or right-of-way in which there is now located or may in the future be located a water distribution main of the City, is required at such owner's expense to connect such building by means of a service line directly with the distribution main in accordance with the provisions of this chapter. Further, any such owner located within the Rifle Institutional Control Boundary is prohibited from accessing groundwater for potable purposes or from connecting groundwater in any way to the municipal water system. The point or points at which connection is made to the distribution main shall be determined by the City Manager.

10.04.090 Connection Requirement - Exception

Except for property located within the Rifle Institutional Control Boundary, connection to the water supply system of the City shall not be required for any property which is served by an existing well or other water supply system, which system is approved by the Garfield County Health Department and which system serves said property in substantially the same manner as it would be served by the water supply system of the City.

This section shall apply solely to property located outside of the Rifle Institutional Control Boundary served by an existing well or other water supply system prior to connection to the water supply system of the City, and shall not be construed to permit any person already connected to the water supply system of the City, whose property may subsequently be served by a well or other water supply system, to disconnect from the water supply system of the City.

10.04.230 Disconnection

For the purposes of this section, "customer" shall mean the person designated on City records as the person responsible for payment of charges incurred for the use at his premises of the water supply system of the City.

Except for property located within the Rifle Institutional Control Boundary, tThe City shall disconnect the service line of any premises at the curb stop, upon request of the customer.

***

10.04.530 Unlawful Acts

***

It shall be unlawful for any person to connect a surface or groundwater source or otherwise create a water connection or cross connection to the municipal water system.

It shall be unlawful for any person located within the area identified as the Rifle Institutional Control Boundary to access groundwater for potable purposes or in any way connect a groundwater source to the municipal water system.

3. Amendment. Title 16 of the Rifle Municipal Code is hereby amended as follows:

16.06.020 Amendments

***

(2) Section 106.4.1 entitled "Issuance" is amended to include the following paragraphs:

A building permit will not be issued in the City of Rifle jurisdiction until all construction drawings, applications, and permit fees are

submitted and approved, including those for plumbing, and mechanical portions of the project. Additionally, a building permit will not be issued in the City of Rifle jurisdiction within the Rifle Institutional Control Boundary unless the plans indicate a connection to the Rifle municipal water system with no access to groundwater for potable purposes. Notwithstanding the foregoing, a footing and foundation permit may be issued prior to reception of other permit information if adequate structural and site plan information is provided.

16.20.060 Prohibitions

***

F. No person shall occupy any new building, factory-built housing unit, manufactured home or mobile home until sewage disposal facilities, meeting the minimum standards of the Colorado Department of Health and the ordinances of the City have been installed and have been approved. No person shall occupy any building, factory-built housing unit, manufactured home or mobile home unless potable domestic water facilities have been installed and have been approved, in writing, by the City.

G. No person within the Rifle Institutional Control Boundary and within the Rifle municipal limits shall construct or occupy any structure, building, factory built housing unit, manufactured home or mobile home that requires or utilizes a water source without first connecting to the City of Rifle potable municipal water system.

16.22.020 Waiver of Permit Requirements

Except for property within the Rifle Institutional Control Boundary, the Building Official may waive any permit requirements contained within this title or the codes adopted by reference thereunder only after a determination is made that the effect of such a waiver is minor and will not affect the health, safety and welfare of the citizens of the City.

16.22.060 Permits–General Conditions

***

D. All structures within the Rifle Institutional Control Boundary that require potable water service shall be connected to the City of Rifle potable municipal water system.

16.22.100 Issuance of Certificate of Occupancy

In addition to the requirements for the issuance of a certificate of occupancy contained in the codes adopted by reference in this title, no certificate of occupancy shall be issued until the following improvements have been installed in the development where the building or structure is located and have been approved by the Public Works Director or his/her designee:

***

I. For property within the Rifle Institutional Control Boundary, a connection is made to the Rifle potable municipal water system and no access is made to groundwater sources for potable purposes.

4. Amendment. Title 17 of the Rifle Municipal Code is hereby amended as follows:

17.01.200 Definitions

[in the correct alphabetical order]

*. "DOE" means the United States Department of Energy.

*. "Rifle Institutional Control Boundary" means the boundary of a geographic area in and adjacent to the City of Rifle that has been identified and mapped by the United States Department of Energy within which lands are subject to non-potable polluted groundwater

*. "Rifle Institutional Control Boundary Map" means a map recorded with the Garfield County Clerk and Recorder as Reception No. _____ that depicts the Rifle Institutional Control Boundary and subject lands.

17.02.140 Pre-annexation Agreements for Property within the Rifle Institutional Control Boundary

Any owner of property that requests municipal services within the Rifle Institutional Control Boundary, as shown on the Rifle Institutional Control Boundary Map, and outside the Rifle municipal limits, shall enter into a pre-annexation agreement with the City, which agreement shall prohibit the property from utilizing groundwater for potable purposes and require connection to the municipal water supply. Any owner of property within the Rifle Institutional Control Boundary that enters into a pre-annexation agreement will be eligible to receive water service from the City when available.

INTRODUCED on September 5, 2001, read by title, passed on first reading, and ordered published as required by the Charter.

INTRODUCED a second time at a regular meeting of the Council of the City of Rifle, Colorado, held on September 19, 2001, passed without amendment, approved, and ordered published in full as required by the Charter.

Dated this _____ day of _____, 2001.

CITY OF RIFLE, COLORADO

By _____
Mayor

ATTEST:

_____
City Clerk

Appendix B

Ground Water Monitoring Plan for the New Rifle Site, Colorado

Ground Water Monitoring Plan

New Rifle Site, Colorado

April 2003

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

Work Performed under DOE Contract No. DE–AC13–02GJ79491

Contents

Figures

Tables

Attachments

1.0 Introduction

No remediation with application of alternate concentration limits (ACLs) for vanadium and natural flushing for all other constituents in conjunction with institutional controls and the application of ACLs, and monitoring were selected as the compliance strategies for the New Rifle Uranium Mill Tailings Remedial Action (UMTRA) ground water site near Rifle, Colorado. Ground water modeling and historical monitoring has indicated that levels of eight of the nine contaminants of concern (COCs)—ammonia, arsenic, fluoride, manganese, molybdenum, nitrate, selenium, and uranium—will be reduced to their target remediation levels by natural flushing in a timeframe of 100 years or less. Monitoring of the ground water quality is necessary to determine if contaminant levels are changing as predicted and ensure that the flushing process is working satisfactorily. This plan describes the monitoring and sampling approach.

2.0 Purpose and Scope

This plan first provides a very brief site background. More detailed descriptions of the site can be found in numerous documents including the *Final Site Observational Work Plan for the UMTRA Project New Rifle Site* (SOWP; DOE 1999). The monitoring plan is then described and includes a discussion of the monitoring network, analytes, sampling methods and procedures, and quality assurance/quality control (QA/QC) measures. A discussion is provided regarding data interpretation and evaluation of the progress of natural flushing. Lastly, environmental compliance issues are addressed.

3.0 Site Background

The New Rifle UMTRA Project site is a former ore-processing facility located approximately 2.3 miles west of the city of Rifle in Garfield County, Colorado.

The New Rifle site is located near the northeastern edge of the Colorado Plateau Physiographic Province on the Colorado River. The alluvial floodplain consists of a complex interfingering of fine and coarse-grain materials, which contain sand, silt, gravel, and cobbles, with a thickness of approximately 20 to 30 feet. Depth to ground water ranges from 5 to 10 feet below land surface. The alluvium directly overlies an 8- to 13-foot section of weathered Wasatch Formation claystone that appears to be hydraulically connected to, and of similar hydraulic characteristics as the unconsolidated sediments of the alluvium.

Surface water features at and near the New Rifle site include the Colorado River, the Roaring Fork gravel ponds, the mitigation wetland, the Pioneer irrigation ditch, intermittent tributary streams, and the City of Rifle wastewater treatment ponds. Some of these features are shown on Figure 1. The Colorado River forms the southern boundary of the New Rifle site and is the dominant surface-water feature, ultimately receiving most of the surface drainage from the New Rifle site. Precipitation falling on the site drains south directly into the river and into the mitigation wetland ponds south of the site. The river also receives ground water discharge from the alluvial aquifer along the southern portion of the site.

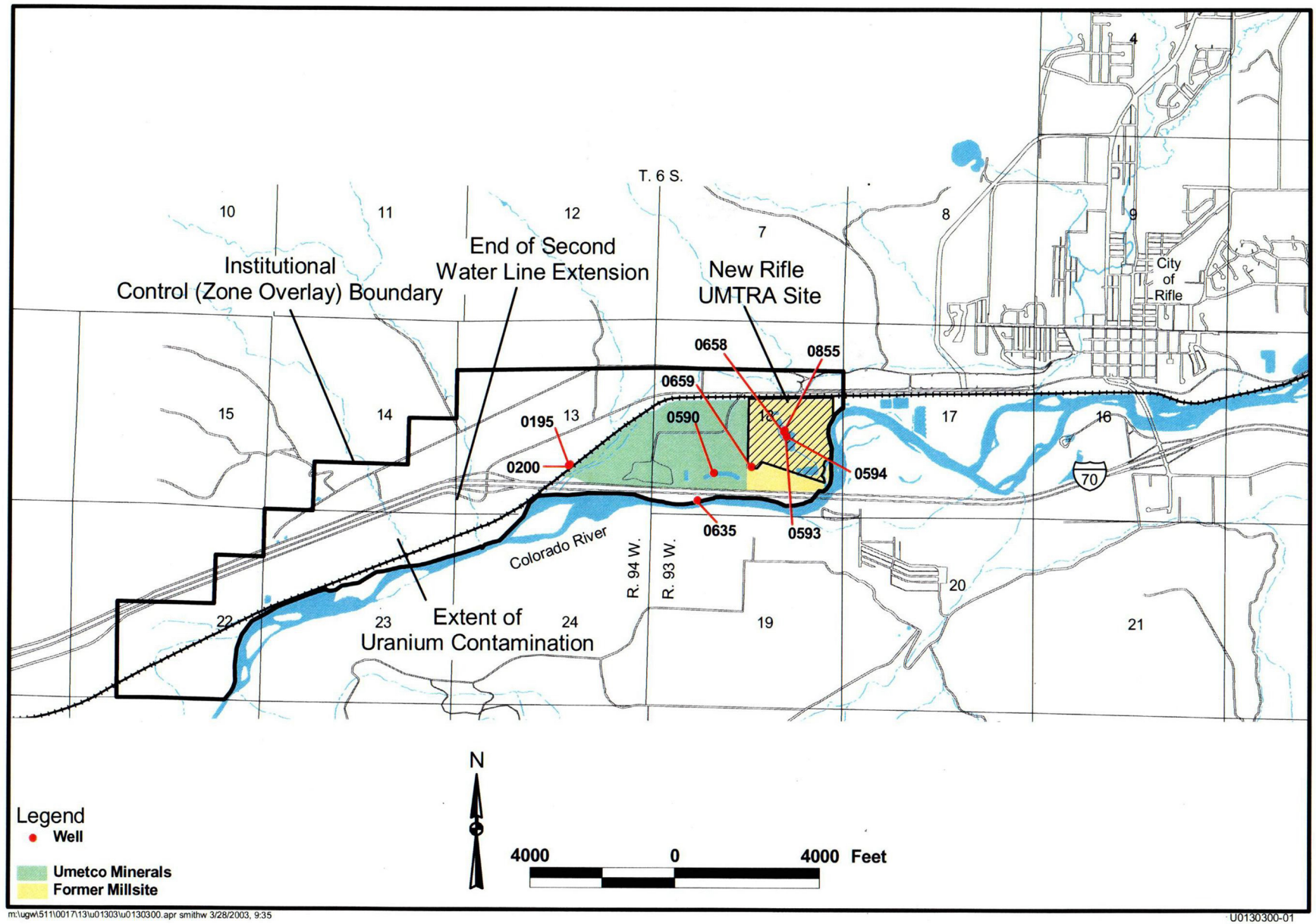


Figure 1. Site Location for New Rifle Showing Ownership and Proposed Institutional Control Boundary

C05

The goals of the wetland mitigation are to replace or restore total acreage, type, and function of wetland areas affected by surface remediation and related activities. The mitigation wetland is being monitored to assess trends in cover and density of wetland vegetation as required by the Section 404 permit issued by the U.S. Army Corps of Engineers (Permit No. 190110228). Monitoring of the wetland will continue for at least the next 2 years or until reclamation goals are met. Monitoring requirements for the permit consist mainly of vegetation surveys. Results of this monitoring are presented in annual reports pursuant to Special Condition No. 2 of the Section 404 Permit (DOE 2001). Monitoring requirements for the Section 404 are not included in this document. However, while not specifically required by the permit, surface water sampling of the wetland is also taking place to evaluate progress of wetland reclamation. That monitoring is included in this document.

Wetland vegetation coverage increased significantly for the wet meadow during FY 2001. When the areas of tamarisk and pond are added to the wetland vegetation subtotal, there were 20.9 acres of wetland habitat for FY 2001, compared to 17.6 acres in FY 2000. Ammonia levels in and near the wetland area are decreasing, as indicated by ground and surface water sampling results at the site. Because of the increased wetland acres and decreased ammonia levels, measures called for in the Wetland Management Plan to mitigate high ammonia levels are not seen as necessary at this time.

The vegetation areas in the east half of the wetland appear to be well established and stable when the below normal precipitation averages are taken into account. Wetland plants are gradually encroaching into the weed areas, and ongoing weed control measures will be implemented to enable this trend to continue. The west half of the wetland is starting to establish, and should continue to improve as long as ammonia levels keep dropping and the wetland plants continue to multiply.

Ground water beneath the site generally flows in a west to southwestern direction with a hydraulic gradient ranging from 0.0019 to 0.004 ft/ft. Recharge to the alluvial aquifer occurs mostly as infiltration of precipitation, leakage from the unnamed intermittent tributaries and Pioneer ditch north of U.S. Highway 6, and by the Colorado River, especially along the north-south reach of the river east of the site which appears to be a ground water recharge source throughout most of the year. During periods of spring runoff between May and June the Colorado River also temporarily recharges the alluvial aquifer along the southwestern portion of the site when high river flows start to exceed ground water elevations in the alluvial aquifer.

Several surface features at the New Rifle site interact with alluvial ground water, which influence the contaminant migration from the site. Primary features of concern include the Colorado River, the Roaring Fork gravel operations, and the mitigation wetland located south of the former mill site. Understanding the interactions between these surface features provides a more complete conceptual model of the hydrologic dynamics. The conceptual site model is presented in Section 5.0 of the SOWP (DOE 1999). Table 1 shows the onsite concentrations of COCs and prescribed concentrations after natural flushing period.

Plume maps developed for the SOWP using 1998–1999 data and spot plots for 2002 data are shown in Attachment B. These figures generally show decreases in contaminants except for elevated values of nitrate downgradient as the system flushes. Spot plots also show elevated values for arsenic, selenium, and vanadium in the newly installed well 0855. These concentrations are expected to decrease in this well as the system approaches equilibrium.

Molybdenum is predicted to decrease to levels below the UMTRA standard of 0.1 milligrams per liter (mg/L) after a period of about 25 years. The background concentration used for the modeling was 0.019 mg/L, and none of the background wells exceeded the maximum concentration limits (MCLs).

Table 1. Onsite Concentrations of COCs

Contaminant of Concern	Current Maximum (mg/L)	Current Site Mean (mg/L)	Future Target (mg/L)
Arsenic	0.058	0.018	0.05[a]
Ammonia	409	139	200[c]
Fluoride	3.49	1.82	4.0[b]
Manganese	7.59	2.98	4.0[d]
Molybdenum	5.87	1.56	0.05[a]
Nitrate	191	78.1	44[a]
Selenium	0.255	0.08	0.05[b]
Uranium	0.310	0.093	0.044[a]
Vanadium	8.09	1.85	0.33[c]

[a]EPA (UMTRA) Maximum Concentration Limit
[b]EPA Safe Drinking Water Limit
[c]Risk-based Value
[d]Background Concentration

Uranium is predicted to decrease to levels below the UMTRA standard after a period of about 40 years. A background concentration of 0.038 mg/L uranium, the average calculated background uranium concentration, was used for purposes of ground water modeling. Levels of uranium in excess of 0.06 mg/L have been observed in some background monitor wells. Therefore, the compliance standard for uranium in site ground water may be either background or the UMTRA standard of 0.044 mg/L. The monitoring strategy is designed to account for variations in background uranium that may exceed the UMTRA standard.

Based on modeling results, maximum selenium concentrations are predicted to decrease to 0.05 mg/L, approximately the Safe Drinking Water Act (SDWA) standard and proposed site ACL, in about 100 years or less. Background wells had concentrations of selenium that were twice the UMTRA standard of 0.01 mg/L, based on results from the last few rounds of sampling.

Modeling results for arsenic suggest that decreasing arsenic concentrations to the UMTRA standard of 0.05 mg/L by natural flushing can occur as early as 20 years. These modeling results are consistent with decreases in arsenic concentrations observed to date.

Nitrate is predicted to decrease to levels below the UMTRA standard of 44 mg/L after 10 years of natural flushing. Modeling did not take into account geochemical and biological reactions that could affect nitrate behavior or oxidation of ammonium to nitrate. However, a conservative modeling approach was used and it is anticipated that nitrate will be below the UMTRA standard easily within the 100-year natural flushing period.

Vanadium does not lend itself to standard transport modeling techniques because of its unusual geochemical characteristics. Vanadium sorbs tightly to various substrate; therefore, an analytical solution, 3DADE (Leij and Bradford 1994) was used as a predictive tool for vanadium concentration. According to this method, dissolved vanadium will decrease to levels below 0.33 mg/L within 100 years across the site. Appendix D provides a more detailed description of this methodology.

Modeling was not performed for ammonia, fluoride, and manganese, as no UMTRA standards exist for these contaminants. However, based on historical trends and geochemical similarity to other constituents, it is likely that these constituents will reach background levels or other applicable standards within the 100-year natural flushing time frame. Monitoring will be conducted for these constituents to ensure that contaminant trends are consistent with this assumption and that acceptable levels can be reached.

4.0 Ground Water and Surface Water Sampling and Analysis

4.1 Monitoring Strategy

The monitoring strategy for the alluvial aquifer is designed to determine the progress of the natural flushing process in meeting compliance standards for site COCs. The progress will be tracked by comparing the actual concentrations against the model predictions and associated uncertainties and by applying a statistical test for trend. Standards for selenium, vanadium, and ammonia are their proposed ACLs of 0.05 mg/L, 0.33 mg/L, and 200 mg/L (as NH_4), respectively. For uranium, the cleanup goal is the UMTRA standard of 0.044 mg/L or background, whichever is higher. For arsenic, the cleanup goal is the UMTRA standard of 0.05 mg/L, for molybdenum the cleanup goal is the UMTRA standard of 0.1 mg/L, and for nitrate the cleanup goal is the UMTRA standard of 44 mg/L. The goal for fluoride is the SDWA MCL of 4 mg/L. The cleanup goal for manganese is approximately background, which has historically been as high as 4 mg/L. Monitoring will focus on these contaminants.

Wells 0218, 0657, 0658, 0659, 0855, and 0864 were established as appropriate for monitoring the "hot spots" with highest concentrations of vanadium, arsenic, and selenium, as well as elevated concentrations of most other constituents (Figure 2, Table 2). In addition, wells 0217,0219, 0659, 0664, 0670, and 0856 were added to track flushing in the main vanadium plume area. These wells will be sampled semi-annually for the next 5 years and re-evaluated at that time. Wells 0169, 0170, 0172, 0173, 0195, 0201, 0210, 0215, 0216, 0590, and 0635 have been established as appropriate for monitoring progress of the natural flushing in the alluvial aquifer. The perimeter of the plume is approximately defined by well 0172 to the southwest; well 0170 and 0173 along the northern boundary; well 0169 to the northeast; and wells 0215 and 0216 to the southeast. In no case is the concentration of any COC at any of these perimeter wells more than twice the standard, whereas some of the other wells exceed treatment standards by a factor of five or higher for many COCs. Background wells 0169 and 0173 do not show millsite contamination and will be used to monitor background concentrations of uranium to assist in establishing the appropriate cleanup standard (UMTRA standard or background, whichever is higher). All wells in the network are considered to be points of compliance (POC).

The other wells in the natural flushing monitoring program are intended to monitor the progress of the flushing in key points within the boundaries of the plume. Well 0210, which exceeds the UMTRA standard for uranium only (but is within the range of background), is along the railroad tracks near the Colorado River south of Interstate 70. Wells 0195 and 0201, which exceed the cleanup goals for ammonia (0201 only), nitrate, molybdenum and uranium, are located to the west and east, respectively, of the Roaring Fork gravel pit, approximately on the north-south centerline of the current plume. Well 0590 is immediately south of the borrow pit pond and

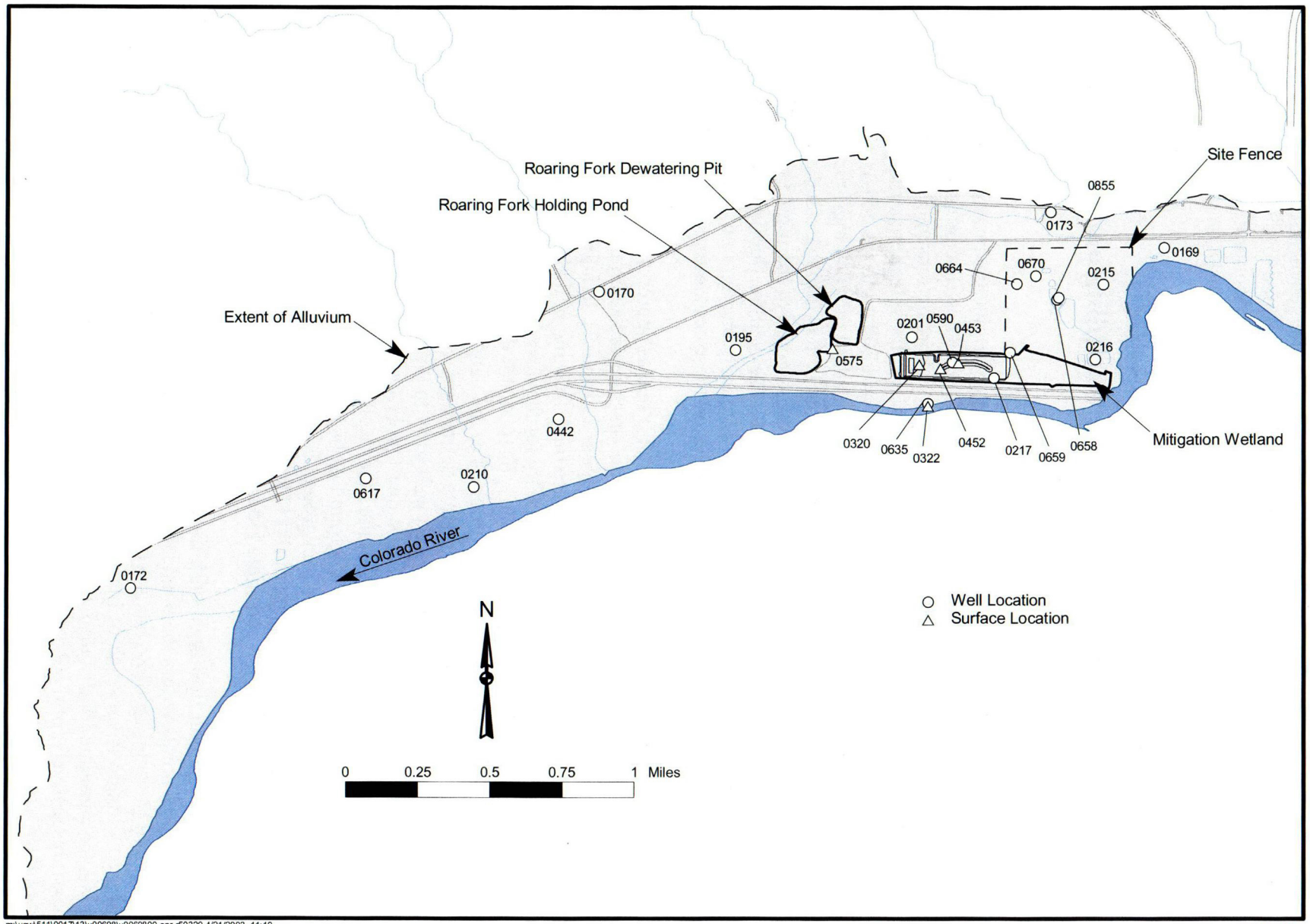


Figure 2. Proposed Monitoring Locations for the New Rifle Site

C06

Table 2. Summary of Monitoring Requirements

Location	Monitoring Purpose	Analytes	Frequency[a]
0215, 0216, 0217, 0590, 0658, 0659, 0664, 0669, 0670, 0855	Additional monitoring of vanadium plume area.	V, TDS	Semiannually for 5 years for wells monitoring vanadium plume. Results reevaluated at that time. Probably, monitoring will be at same frequency as other wells after that time.
0215, 0216, 0217, 0590, 0658, 0659, 0664, 0669, 0670, 0855	Monitor main plume area	As, V, Se, Mo, U, NH^4, NO^3, Mn, F, TDS	All other wells and locations, annually for 10 years and every 5 years thereafter until 2030. Monitoring requirements will be reevaluated at that time, but are anticipated to take place at a frequency of no less than once every 10 years.
0170, 0172, 0210	Monitor middle and leading edge of Mo, U, and NO_3 plumes.	Mo, U, NO_3, TDS	
0169, 0173	Monitor background to establish appropriate standard for uranium; ensure no upgradient spread of plumes.	As, V, Se, Mo, U, NH_4, NO_3, Mn, F, TDS	
0195, 0201, 0635	Monitor flushing in main body of plumes; point of compliance wells for ACLs.	As, V, Se, Mo, U, NH_4, NO_3, Mn, F, TDS	
0320, 0322, 0452, 0453, 0575	Monitor surface water to determine impact of ground water discharge to surface water; 0322 is point of exposure location.	As, V, Se, Mo, U, NH_4, NO_3, Mn, F, TDS	
0442/0446, 0617/0685	Private wells before and after reverse osmosis treatment; 0442 & 0617 are pre-treatment, 0446 & 0685 are post-treatment.	As, V, Se, Mo, U, NH_4, NO_3, Mn, F, TDS	

[a]Monitoring for a COC will be discontinued if concentrations are below standards for 3 consecutive years.
TDS = total dissolved solids

exceeds UMTRA standards for molybdenum, nitrate, selenium, and uranium, and cleanup goals for ammonia, manganese, and vanadium. Well 0635 is located to the south of the borrow pit pond, south of Interstate 70 along the Colorado River; it exceeds UMTRA standards for molybdenum and uranium and cleanup goals for ammonia and fluoride. Private wells 0442 and 0617 will be sampled before and after the reverse osmosis units to ensure continued satisfactory performance of those units. The proposed monitoring locations are shown on Figure 2.

Surface water locations to be monitored include 0320, 0322, 0452, 0453, and 0575. These locations are considered to be potential points of exposure (POE). Water quality will be monitored in the Colorado River, the mitigation wetland, and the Roaring Fork holding pond on the downgradient and adjacent UMETCO property where a gravel mining operation currently exists. Results of the wetland samples will be used to help evaluation the progress of wetland reestablishment. All COCs are being analyzed at all surface locations.

Results of ground water modeling for six of the COCs at the New Rifle site (arsenic, molybdenum, selenium, uranium, nitrate, and vanadium) indicate that concentrations of all of these COCs are expected to decrease to acceptable levels within 100 years and that the contaminant plumes for all these COCs are not expected to spread beyond their current

boundaries. The monitoring plan is intended to confirm that the natural flushing is progressing approximately in conformance with the predictions of the model and that constituents that were not modeled decrease as well. Predicted time-concentration plots for selected wells and current COC postings are presented in Attachment A. Plume maps and spot plots for all COCs are shown in Attachment B. Time concentration plots for selected wells are shown in Attachment C.

Unless otherwise indicated, sampling of each well or surface location will take place annually for 10 years. Wells located in the vanadium plume area will be monitored for vanadium semi-annually for 5 years and results re-evaluated at that time. If a COC sampled in a well is below standards for a consecutive 3-year period, cleanup will be considered complete at that location and monitoring will be discontinued for that COC. After the first 10 years of monitoring have been completed, monitoring will be reduced to every 5 years until the year 2030, assuming COCs continue to show a decline through the first 10-year period. At that time the monitoring strategy will be reevaluated and adjusted as appropriate based on previous results. It is anticipated that further monitoring will take place at a frequency of no less than every 10 years. Any COC that is below standards will be analyzed for 3 consecutive years to eliminate it from further analysis. If the monitoring of wells at the perimeter of the contaminant plumes shows that contaminants have begun to spread beyond the current plume boundaries, or if some other changes in contaminant trends are noted, the sampling plan may also be reevaluated and adjusted at that time. If monitoring indicates that all contaminants in some areas have decreased below cleanup goals, institutional controls can be lifted in those areas. As part of the monitoring program, DOE will also evaluate the effectiveness of the institutional controls on a regular basis (e.g., yearly surveys of changes in water use in the area). Monitoring requirements are summarized in Table 2.

Monitor wells not required as part of the monitor network will be abandoned according to applicable State of Colorado regulations and UMTRA project procedures. Abandonment will be accomplished in the future under the LTSM program after concurrence of NRC and the State with this GCAP.

4.2 Ground Water and Surface Water Sampling

Ground water and surface water sampling will be performed in accordance with the *Addendum to the Sampling and Analysis Plan for the UMTRA Ground Water Project* (DOE 1996) and the *Environmental Procedures Catalog* (DOE 2002). Ground water samples will be collected from each of the wells and the surface water location specified in Table 2 and submitted to the Grand Junction Office (GJO) Analytical Laboratory for analysis. Samples will be collected annually for the first 10 years of monitoring.

The following procedures from the *Environmental Procedures Catalog* (DOE 2002) will be used for ground water sampling:

- GN-8(P), "Standard Practice for Sample Labeling."
- GN-9(P), "Standard Practice for Chain-of-Sample-Custody and Physical Security of Samples."
- GN-13(JP), "Standard Practice for Equipment Decontamination."
- LQ-2(T), "Standard Test Method for the Measurement of Water Levels in Ground Water Monitor Wells."
- LQ-3(P), "Standard Practice for Purging Monitor Wells."
- LQ-4(T), "Standard Test Method for the Field Measurement of pH."

- LQ-5(T), "Standard Test Method for the Field Measurement of Specific Conductance."
- LQ-6(T), "Standard Test Method for the Field Measurement of the Oxidation-Reduction Potential (Eh)."
- LQ-7(T), "Standard Test Method for the Field Measurement of Alkalinity."
- LQ-8(T), "Standard Test Method for the Field Measurement of Temperature."
- LQ-9(T), "Standard Test Method for the Field Measurement of Dissolved Oxygen."
- LQ-10(T), "Standard Test Method for Turbidity in Water."
- LQ-11(P), "Standard Practice for Sampling Liquids."
- LQ-12(P), "Standard Practice for the Collection, Filtration, and Preservation of Liquid Samples."

4.3 GJO Laboratory Analysis

Ground water and surface water samples will be submitted to the GJO Analytical Laboratory. All procedures will be checked for accuracy through internal laboratory QC checks (e.g., analysis of blind duplicates, splits, and known standards). Sample preservation will consist of storing the samples in an ice chest with Blue Ice (or equivalent) to cool samples during field sampling, packaging, and shipping. Ground water samples will be analyzed for total dissolved solids (TDS) and the nine COCs—ammonia, arsenic, fluoride, manganese, molybdenum, nitrate, selenium, uranium, and vanadium.

4.4 Quality Assurance and Quality Control

The objective of QA and QC measures is to provide systematic control of all tasks so as to maximize accuracy, precision, comparability, and completeness. Basic sampling procedures are presented in the *Environmental Procedures Catalog* (DOE 2002). Deviations from these procedures will be noted in a Field Variance Log with an explanation and a description of its possible effect on data quality.

4.4.1 Sample Control

To maintain evidence of authenticity, the samples collected must be properly identified and easily distinguished from other samples. Samples collected at the New Rifle site will be identified by a label attached to the sample container specifying the sample identification number, location, date collected, time collected, and the sampler's name or initials.

Ground water and surface water samples for laboratory analysis will be kept under custody from the time of collection to the time of analysis. Chain-of-custody forms will be used to list all sample transfers to show that the sample was in constant custody between collection and analysis.

While the samples are in shipment to the GJO Analytical Laboratory, custody seals will be placed over the cooler opening to ensure that the integrity of the samples has not been compromised. The receiving laboratory must examine the seals on arrival and document that the seals are intact. Upon opening the container, the receiving laboratory will note the condition of the sample containers (e.g., broken or leaking bottles).

4.4.2 Laboratory Quality Control

Laboratory QC will follow the specifications in relevant EPA (SW–846) or the *Handbook of Analytical and Sample-Preparation Procedures,* Volumes I, II, III, and IV. Quality control will include analysis of blanks, duplicates, spikes, and check samples.

5.0 Data Evaluation and Interpretation

5.1 Preliminary Monitoring Results

The amount of analytical data available varies by location. Regular monitoring of most wells in the monitoring network was initiated in 1998. For some locations, earlier sample data are available. Time-concentration plots for upgradient, on-site, and downgradient monitoring wells are shown in Attachment C for selected COCs.

Considerable scatter exists in many of the plots, particularly when concentrations reach low levels and seasonal fluctuations could exert a greater influence than natural flushing. However, most of the wells that have had the highest historical contaminant concentrations do tend to display decreasing trends. However, the limited timeframe over which monitoring has occurred to date make any conclusions tentative at best.

One method of trend analysis that may be applicable to the New Rifle data is the nonparametric Mann-Kendall test for trend. A discussion of this test methodology is provided in Attachment D. The test does not require any particular data distribution and will accommodate missing values and data reported as less than the detection limit. Essentially it analyzes a series of data by subtracting the values of earlier collected data from later collected data. The number of resulting positive values are summed and resulting negative values are summed. The difference of these sums is determined by subtracting the number of negative values from the number of positive values. The result is the S statistic. This is compared to a probability table (also in Attachment D) to determine the probability that the series of values does not represent an increasing or decreasing trend. Therefore, the smaller the probability, the greater the confidence that a real trend exists.

The Mann-Kendall statistic was calculated using molybdenum and uranium for selected wells for the New Rifle site. Data used are from August 1998 through November 2000. Results are presented in Table 3. Well locations represent background (0169 and 0173), and the plume immediately downgradient of the site (0218, 0590, 0635, 0659). Based on the results, there are strong indications that molybdenum has been decreasing in the wells downgradient of the site. Uranium results are less conclusive.

Use of the Mann-Kendall statistic does not assist in comparing predicted versus observed contaminant concentrations, but it does give a measure of how much significance should be attached to otherwise qualitative conclusions. If wells in critical locations at the site (e.g., plume centers) began to exhibit data that showed no clear trends, and if concentrations at those wells were unacceptably high, this could be an indication that natural flushing is not working and that the compliance strategy should be reassessed. If, on the other hand, data from critical wells continued to display decreasing trends, it could mean that natural flushing should continue to operate. While not providing a clear "go—no-go" answer, results from application of the

Table 3. Mann Kendall Trend Statistic—Ground Water at New Rifle Site

Well 0169-Molybdenum

Time	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of –
Concentration	0.0067	0.0235	0.0067	0.0065	0.0076	0.006		
		0.0168	0	-0.0002	0.0009	-0.0007	3	2
			-0.0168	-0.017	-0.0159	-0.0175	0	4
				-0.0002	0.0009	-0.0007	1	2
					0.0011	-0.0005	1	1
						-0.0016	0	1
							5	10

S= -5
probability = .235 of no trend (approx. 78% probability that a decreasing trend exists)

Well 0173-Molybdenum

Time								
Concentration	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of –
	0.0206	0.0281	0.019	0.0215	0.0198	0.0232		
		0.0075	-0.0016	0.0009	-0.0008	0.0026	2	3
			-0.0091	-0.0066	-0.0083	-0.0049	0	4
				0.0025	0.0008	0.0042	3	0
					-0.0017	0.0017	1	1
						0.0034	1	0
							7	8

S= -1
probability = .5 of no trend (chance of a trend is as likely as no trend)

Well 0218-Molybdenum

Time								
Concentration	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of –
	3.46	2.63	2.26	2.17	1.86	1.95		
		-0.83	-1.2	-1.29	-1.6	-1.51	0	5
			-0.37	-0.46	-0.77	-0.31	0	4
				-0.09	-0.4	-0.22	0	3
					-0.31	-0.22	0	2
						0.09	1	0
							1	14

S= -13
probability = .0083 of no trend (99.2 % chance that a decreasing trend exists)

Well 0590-Molybdenum

Time								
Concentration	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of --
	2.46	2.45	2.19	1.78	1.52	1.51		
		-0.01	-0.27	-0.68	-0.94	-0.95	0	5
			-0.26	-0.67	-0.93	-0.68	0	4
				-0.41	-0.67	-0.27	0	3
					-0.26	-0.27	0	2
						-0.01	0	1
							0	15

S= -15
probability = .0014 of no trend (99.9 % probability that a decreasing trend exists)

Well 0635-Molybdenum

Time								
Concentration	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of --
	0.891	0.765	0.661	0.79	0.78	0.993		
		-0.126	-0.23	-0.101	-0.111	0.102	1	4
			-0.104	0.025	0.015	0.228	3	1
				0.129	0.119	0.332	3	0
					-0.01	0.203	1	1
						0.213	1	0
							9	6

S= 3
probability = .36 of no trend (64% chance of an increasing trend)

Well 0659-Molybdenum

Time								
Concentration	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of --
	6.41	5.43	5.26	5.14	4.16	3.99		
		-0.98	-1.15	-1.27	-2.25	-2.42	0	5
			-0.17	-0.29	-1.27	-1.44	0	4
				-0.12	-1.1	-1.27	0	3
					-0.98	-1.15	0	2
						-0.17	0	1
							0	15

S= 15
probability = .0014 of no trend (99.9 % probability that a decreasing trend exists)

Well 0169-Uranium

Time	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of --
Concentration	0.0419	0.0366	0.0346	0.0346	0.0323	0.0343		
		-0.0053	-0.0073	-0.0073	-0.0096	-0.0076	0	5
			-0.002	-0.002	-0.0043	-0.0023	0	4
				0	-0.0023	-0.0003	1	2
					-0.0023	-0.0003	1	1
						0.002	1	0
							3	12

S= -9
probability = .068 of no trend (approx. 97 probability that a *decreasing trend* exists)

Well 0173-Uranium

Time								
Concentration	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of --
	0.0289	0.0331	0.0308	0.0299	0.0267	0.0289		
		0.0042	0.0019	0.001	-0.0022	0	4	1
			-0.0023	-0.0032	-0.0064	-0.0042	0	4
				-0.0009	-0.0041	-0.0019	0	3
					-0.0032	-0.001	0	2
						0.0022	1	0
							5	10

S= -5
probability = .235 of no trend (approx. 76% chance of a decreasing trend)

Well 0218-Uranium

Time								
Concentration	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of --
	0.0991	0.106	0.108	0.114	0.0973	0.0842		
		0.0069	0.0089	0.0149	-0.0018	-0.0149	3	2
			0.002	0.008	-0.0087	-0.0238	2	2
				0.006	-0.0107	-0.0298	1	2
					-0.0167	-0.0298	0	2
						-0.0131	0	1
							6	9

S= -3
probability = .36 of no trend (64 % chance that a decreasing trend exists

Well 0590-Uranium

Time								
Concentration	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of -
	0.0843	0.0739	0.0841	0.0765	0.0832	0.0783		
		-0.0104	-0.0002	-0.0078	-0.0011	-0.006	0	5
			0.0102	0.0026	0.0093	-0.0058	3	1
				-0.0076	-0.0009	0.0018	1	2
					0.0067	0.0018	2	0
						-0.0049	0	1
							6	9

S= -3

probability = .36 of no trend (64 % chance that a decreasing trend exists

Well 0635-Uranium

Time								
Concentration	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of -
	0.114	0.12	0.1	0.101	0.0656	0.0643		
		0.006	-0.014	-0.013	-0.0484	-0.0497	1	4
			-0.02	-0.019	-0.0544	-0.0557	0	4
				0.001	-0.0344	-0.0357	1	2
					-0.0354	-0.0367	0	2
						-0.0013	0	1
							2	13

S= 3

probability = .0082 of no trend (99.1% chance of a decreasing trend)

Well 0659-Uranium

Time								
Concentration	Aug-98	Jan-99	Jun-99	Dec-99	Jun-00	Nov-00	No. of +	No. of -
	0.0955	0.126	0.0854	0.139	0.0831	0.142		
		0.0305	-0.0101	0.0435	-0.0124	0.0465	3	2
			-0.0406	0.013	-0.0429	0.016	2	2
				0.0536	-0.0023	0.0566	2	1
					-0.0559	0.003	1	1
						0.0589	1	0
							9	6

S= 3

probability = .36 of no trend (64% probability that an increasing trend exists)

Mann-Kendall test may help in the decision-making process. As each round of sampling data become available, the statistical calculations can be updated and results reported.

6.0 Environmental Compliance and Waste Management

6.1 Compliance Requirements

National Environmental Policy Act (NEPA): The entire area has had surveys and investigations completed. No additional cultural resources or threatened and endangered (T&E) surveys are required. DOE has categorically excluded the activities in this monitoring plan from further NEPA review.

Transportation Requirements: Transportation of hazardous materials and regulated waste will be performed in compliance with the regulatory requirements of the U.S. Department of Transportation at 49 CFR Parts 106–180 and applicable local and state transportation requirements.

6.2 Waste Management

Investigation Derived Waste (IDW): Although few regulatory requirements exist that are directly applicable to field-generated IDW management, DOE remains committed to managing IDW in a manner that is protective of human health and the environment through the use of best management practices.

All *liquid IDW,* consisting of well purge water, will be dispersed on the ground at the well from which the water was extracted.

Solid IDW includes disposable sampling equipment, personal protective equipment (PPE), used field test kits, and trash. All solid IDW must be containerized in plastic bags and managed as solid waste at a permitted, licensed, or registered solid or industrial waste disposal or treatment facility. A radiological field evaluation is not required because the sampling is not being conducted in a supplemental standards area and because solid IDW that has come in incidental contact with contaminated ground water is not considered residual radioactive material (RRM).

7.0 References

Efroymson, R.A., M.E. Will, G.W. Suter II, A.C. Wooten, 1997. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision,* ES/ER/TM–85/R3, prepared for the U.S. Department of Energy, East Tennessee Technology Park, Tennessee, November.

U.S. Department of Energy, 1996. *Addendum to the Sampling and Analysis Plans for the UMTRA Ground Water Project,* P–GJPO–2353, prepared for the U.S. Department of Energy, Grand Junction Projects Office, Grand Junction, Colorado, October.

U.S. Department of Energy, 1999. *Final Site Observational Work Plan for the UMTRA Project Old Rifle Site,* GJO–99–88–TAR, Rev. 1, prepared by the U.S. Department of Energy, UMTRA Project Office, Grand Junction Office, Grand Junction, Colorado, April.

———, 2001. *404 Monitoring Report for the New Rifle, Colorado, UMTRA Project Site,* GJO–2001–259–TAR, prepared by the U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, September.

———2002. *GJO Environmental Procedures Catalog,* GJO 6, continuously updated, prepared by the U.S. Department of Energy Grand Junction Office, December.

U.S. Environmental Protection Agency, 1996. *ECO Update, Ecotox Thresholds,* Intermittent Bulletin Volume 3, Number 2, Publication 9345.0–12FSI, EPA 540/F–95/038, January.

———, 2000. "Updated Risk-Based Concentration Table," from R.L. Smith, available on the EPA Region III Internet Website at http://www.epa.gov/reg3hwmd/risk/rbc971.htm.