Mr. Myron Fliegel
Nuclear Regulatory Commission
Two White Flint
11545 Rockville Pike #2
Mail Stop: T8F42
Rockville, MD 20852-2738

July 25, 2007

Dear Mr. Fliegel:

Per request from Jalena Maestas, enclosed please find a copy of the draft *Ground Water Compliance Action Plan for the Lakeview, Oregon, Processing Site*, dated September, 2006.

Best regards,

Richard Dayvault
Stoller Site Lead

cc: J. Maestas

DRAFT

DOE–LM/1323–2006

Office of Legacy Management

Ground Water Compliance Action Plan for the Lakeview, Oregon, Processing Site

September 2006

U.S. Department of Energy

Office of Legacy Management

Work Performed Under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management.
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DOE–LM/1323-2006

Ground Water Compliance Action Plan for the Lakeview, Oregon, Processing Site

September 2006

Work Performed by S.M. Stoller Corporation under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado

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Acronyms and Abbreviations

BLRA	baseline risk assessment
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
GCAP	Ground Water Compliance Action Plan
IC	institutional control(s)
MCLs	maximum concentration limits
mg/L	milligrams per liter
mi	mile(s)
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
PEIS	Programmatic Environmental Impact Statement
RAP	Remedial Action Plan
ROD	Record of Decision
Surface EA	surface environmental assessment
UMTRA	Uranium Mill Tailings Remedial Action

End of current text

1.0 Introduction

This Ground Water Compliance Action Plan (GCAP) presents the proposed compliance strategy for ground water cleanup at the Lakeview, Oregon, uranium processing site. It is based on U.S. Department of Energy (DOE) evaluation of information included in the engineering assessment for the site (DOE 1981), the surface environmental assessment (Surface EA) (DOE 1985), the *Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Lakeview, Oregon* (RAP) (DOE 1992), the baseline risk assessment (BLRA) (DOE 1996b), and information gathered from 1999 to 2005. This GCAP will serve as a stand-alone modification to the RAP (DOE 1992), to address ground water restoration and compliance with the U.S. Environmental Protection Agency (EPA) ground water protection standards for the Uranium Mill Tailings Remedial Action (UMTRA) Project Title I sites. Responses to *Request for Information – Ground Water Compliance Action Plan for the Lakeview, Oregon, UMTRA Project Site* received from the Nuclear Regulatory Commission (NRC) on February 4, 2004, are included in the text of this document. The GCAP will be the NRC concurrence document for compliance with Subpart B of 40 CFR 192 for the Lakeview processing site.

The proposed compliance strategy for the Lakeview site is based on the compliance strategy selection framework following the steps presented in the *Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project* (PEIS) (DOE 1996a). National Environmental Policy Act (NEPA) issues and environmental concerns are addressed in the Environmental Checklist for the site and are discussed in Section 5.0 of this document. The public has been actively involved in the decision-making process as discussed in Section 4.0 of this document.

To achieve compliance with Subpart B of 40 CFR 192 at the former Lakeview processing site, DOE proposes no remediation based on limited use ground water and application of supplemental standards. The criterion of 40 CFR 192.11(e)(2) "Widespread, ambient contamination not due to activities involving residual radioactive materials from a designated processing site exists that cannot be cleaned up using treatment methods reasonably employed in public water systems..." is cited. As a best management practice, institutional controls (IC) and monitoring will also be implemented to ensure the effectiveness of this compliance strategy. Justification for the compliance strategy is provided in the discussion of site information in Section 2.0. Details of the compliance strategy are discussed in Section 3.0.

End of current text

2.0 Site Information

2.1 Location

The Lakeview site is approximately 1.5 mile (mi) north-northwest of the town of Lakeview in Lake County, Oregon (Figure 2–1). The former millsite is located on private land east of County Road 2–18 and north of Missouri Avenue in Sections 3, 4, 9, and 10, Township 39S, Range 20E, Washington Meridian at 42 degrees 12 minutes 43 seconds north latitude and 120 degrees 22 minutes 09 seconds west longitude (Plate 1). The Lakeview site sits at the base of the Warner Mountains to the east, and is located within one of several fault-block basins in south-central Oregon, which are characterized by the presence of closed-basin lakes (Phillips and Van Denburgh 1971).

2.2 Remedial Action History and Current Land Status

The 258-acre site includes areas formerly occupied by seven raffinate or evaporation ponds and a tailings pile and mill buildings. From 1986 to 1988, 736,000 tons (943,630 cubic yards) of uranium mill tailings and other process-related solid waste were removed from the Lakeview, Oregon, processing site and moved to a disposal cell located on the Collins Ranch about 7 miles northwest of Lakeview. In some areas of the former raffinate or evaporation ponds, contaminated materials were removed from depths of more than 50 feet (ft) below ground surface (David Steward-Smith 2002 personal communication). The cost of the project was $24,571,000 (DOE 1999).

Pacific Pine Products, a lumber company, now uses the former mill buildings. Other small businesses have constructed buildings in the immediate area of the former mill buildings. Barbwire fences enclose the former evaporation pond and tailings pile areas in open fields. The entire site is zoned for commercial–light industrial use. The southern portion of the area is part of Lake County's urban growth boundary where commercial businesses are being developed. Other areas in and near the site are also being developed for commercial businesses.

2.3 Site Characteristics

2.3.1 Climate

The Lakeview area is characterized by low humidity, frequent sunny days, and moderate seasonal temperature ranges. The average annual temperature is 46 degrees Fahrenheit (°F) and ranges from an average temperature of 27 °F in January to 67 °F in July (DOE 1996b). The average annual precipitation is 14 inches (DOE 1996a). The area can be generally described as a semi-desert.

2.3.2 Geologic Setting and Hydrogeology

The regional geology is dominated by fault block structures, as evidenced by the normal fault along the west side of the Warner Mountains and the Goose Lake graben. Tertiary volcanic rocks occur in the upthrown fault blocks east and north of Lakeview, nearest the former millsite. Alluvial and lacustrine sediments within the graben may reach thicknesses of 2,000 ft in the Lakeview area (DOE 1992).

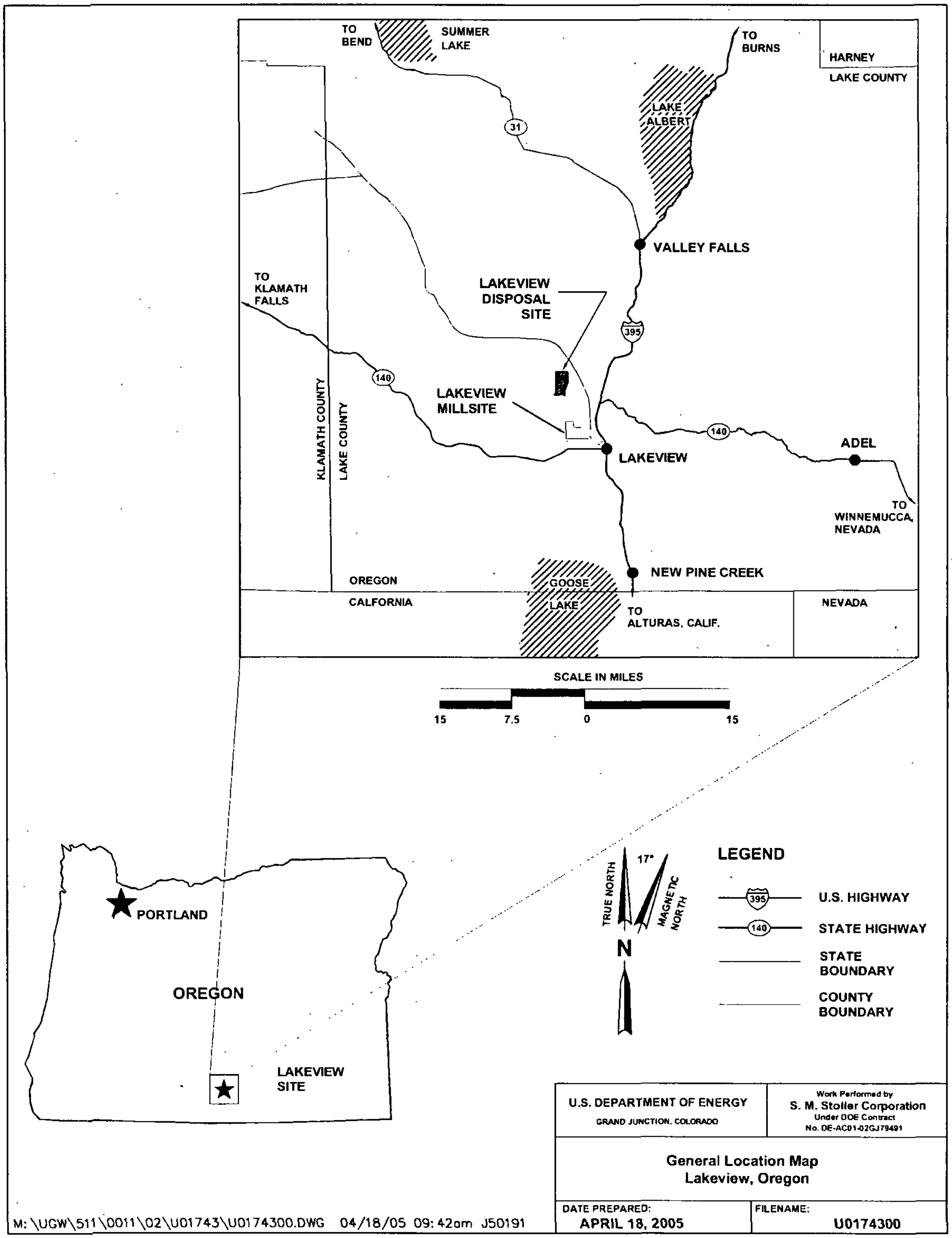

Figure 2–1. General Location Map Lakeview, Oregon

Generally, individual pulses of sediment are coarser near the boundaries of the basin and become finer grained toward the center. The relative rate of basin subsidence and long term climatic variations control the rates and types of deposition in various parts of the basin. Differential subsidence in grabens as large as the Goose Lake basin is common, which can also contribute to contemporaneous deposition of coarser and finer sediments in various areas. Wetter climatic periods creating long-lived lakes can produce finer-grained and more laterally continuous deposits. This combination of tectonics and climatic factors produce the heterogeneous unconsolidated sediment pile in the basin consisting of discontinuous clays, sands, and gravels. This is demonstrated in cross sections, Figure 2–2 and Figure 2–3, based on lithologic logs from boreholes.

The BLRA identified two main water-bearing zones in the uppermost aquifer. According to this document, the aquifer consists of a shallow water-bearing zone (30 ft deep or less) and a deeper zone (60 to 75 ft deep) that are partially separated by interfingering layers of clayey sediments. Aquifer testing has demonstrated that the two zones are hydraulically connected, though this connection is restricted (DOE 1991). Further study of lithologic logs from wells installed by DOE during the surface program suggests that the proposed upper and lower intervals may be laterally continuous over limited areas, but generally lack widespread lateral continuity. In the predominantly east-west cross section A – A' shown on Plate 1 (Figure 2–2), sands and gravels are separated intermittently by clays and silts. Upper and lower zones may be distinguishable in several well pairs, but the zones are indistinguishable in other areas. Similarly, the predominantly north-south cross section B – B' (Figure 2–3), located farther out in the basin, does not consistently demonstrate separation of zones. However, the continued interfingering of finer-and coarser-grained sedimentary units with depth can act as an effective hydrologic barrier.

Mr. Loren Lucore of Lucore Drilling Company, who has drilled shallow water wells in the Lakeview area for 30 years, was interviewed in 2002 about the locations of water bearing zones and the general water quality in these zones. Mr. Lucore states that generally, fine sand and clay make up the uppermost 30 feet of the sediments, which can yield water of poor quality. An unctuous blue clay is present from about 30 feet to 45 feet in many but not all locations; and a black sand to gravel extends from 45 to 60 feet that usually yields sufficient water for well production. Below 60 feet are various sands, gravels, and clays. Water quality is generally better at this depth, though is poor enough in many locations that private well users install some type of treatment units before water can be consumed. Deep wells, several hundred feet deep, have much better quality water. This interpretation of water occurrence generally agrees with lithologic logs.

In the area of the former millsite and in areas south of the site, the ground water in both the upper and lower zones moves from northeast to southwest at rates ranging from 50 to 160 ft per year (DOE 1996b). Figure 2–4 shows the recent potentiometric surface after 3 additional wells were installed to obtain water levels in the area south of the former millsite. It also shows a general west to southwest flow direction for the shallow ground water, away from the nearby Warner Mountains.

Ground water from a geothermal artesian source northeast of the site flows southwest through the subsurface beneath the western side of the site and feeds springs that surface north of the site at Hunters Hot Springs. Water from the hot springs feed Hunters Creek, which flows to the southwest and enters into Warner Creek, located west of the site. Ground water quality at the Lakeview site is influenced by the geothermal waters, as discussed in Section 2.3.3. However, the influence of the geothermal waters on the site's ground water appears more important near the northern and western portions and becomes less important along the eastern and southern portions of the site.

2.3.3 Ground Water and Surface Water Quality

Water quality in the vicinity of the Lakeview site is quite variable. This is probably the result of numerous influences, which may include milling processes at the Lakeview site. The BLRA compared ground water beneath the site with ground water assumed to be background, and determined that ground water beneath the Lakeview site was contaminated by former uranium-ore processing operations (DOE 1996b). Based on comparison with background water, COPCs in the alluvial aquifer were determined to be arsenic, boron, iron, manganese, molybdenum, nickel, sodium, chloride, sulfate, uranium, and polonium-210 (DOE 1996b). A problem with this previous evaluation is that only a single well or well pair was used to represent nongeothermal background; this well pair was located near the base of the mountains along Hammersley Creek. Because this area essentially receives recharge directly from the mountains, the water quality may not be indicative of background water quality in the main portion of the valley.

Historical knowledge of the Lakeview site throws some doubt on the site as the major source of ground water contamination in the area. The site was operational for a very short period of time (less than 3 years) over 40 years ago. Contaminants were removed 18 years ago. Monitoring at the site has occurred for approximately the last 20 years. At other UMTRA sites with similar contaminants as those at Lakeview, decreasing contaminant concentrations have generally been observed over such a time frame when those contaminants are milling related. At Lakeview, on the other hand, concentrations of most constituents have remained relatively constant. No decreasing trends have been observed. Uranium, the constituent that was the target of the milling operation, is virtually absent in the ground water. It is possible that uranium and other mill-related constituents have been flushed from the site and replaced by ambient ground water.

Data collected during preparation of the environmental assessment (DOE 1985) and the surface remedial action plan (DOE 1992) for the former millsite both indicate that the major source of ground water contamination was likely to be the raffinate ponds as opposed to the tailings pile. Tailings were relatively dry (though did contain some slimes), while the raffinate ponds were used as storage areas for liquids after ore processing activities ceased but before surface cleanup commenced. Therefore, the ponds could have served as an ongoing source of contamination. However, concentrations of fluids collected from the raffinate ponds (Table B.3.1, DOE 1992) indicate concentrations of sulfate and manganese were actually relatively low in the ponds compared with recent concentrations of these constituents detected in ground water. Recent concentrations of manganese in wells 0503 and 0505 are higher than concentrations reported for the 20 historical raffinate pond analyses. These concentrations could be derived from the higher concentrations observed in the tailings pile, but would require a due west ground water flow direction. However, high levels of manganese are also observed due south of the former tailings pile location. If derived from migration of tailings contamination, this would require a due south ground water flow gradient. Because concentrations are not consistent with concentrations observed in the raffinate ponds or with flow gradients observed at the site, some other source of contamination or a more complex release mechanism must be at play. Geochemical profiles completed through the pile were evaluated in the EA for the site (DOE 1985, Appendix D) and

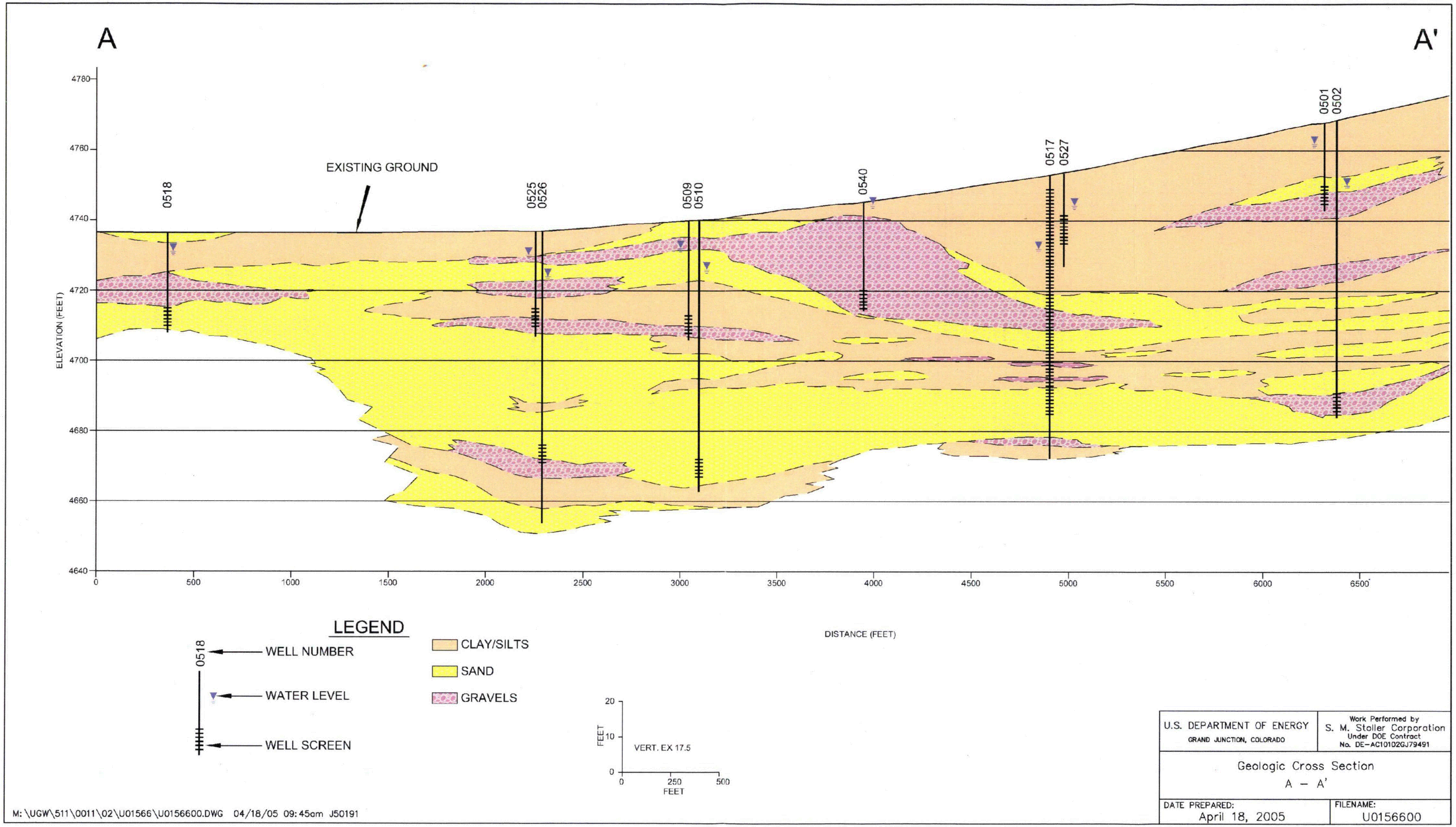

Figure 2–2. Geologic Cross Section A – A'

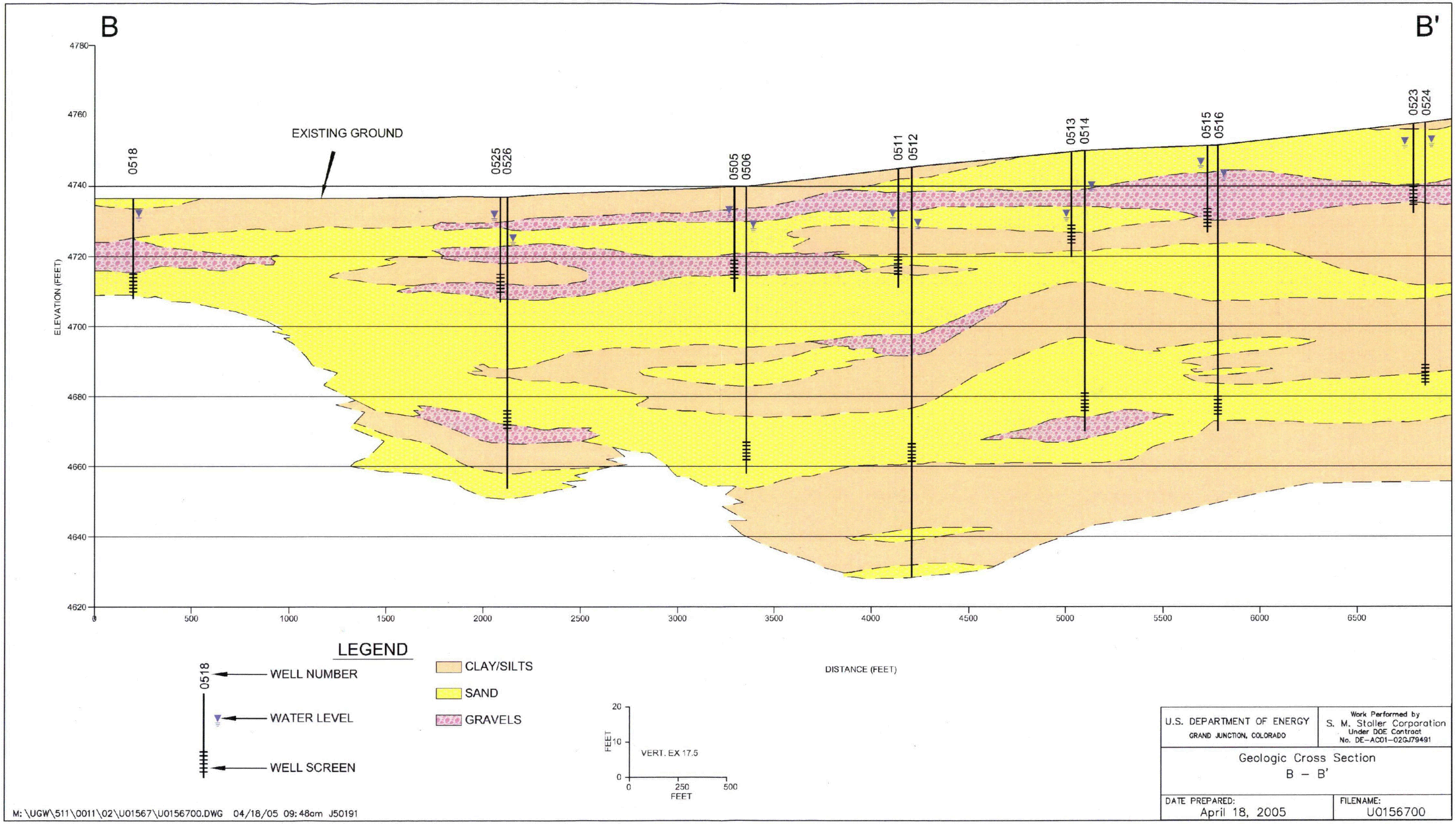

Figure 2–3. Geologic Cross Section B – B'

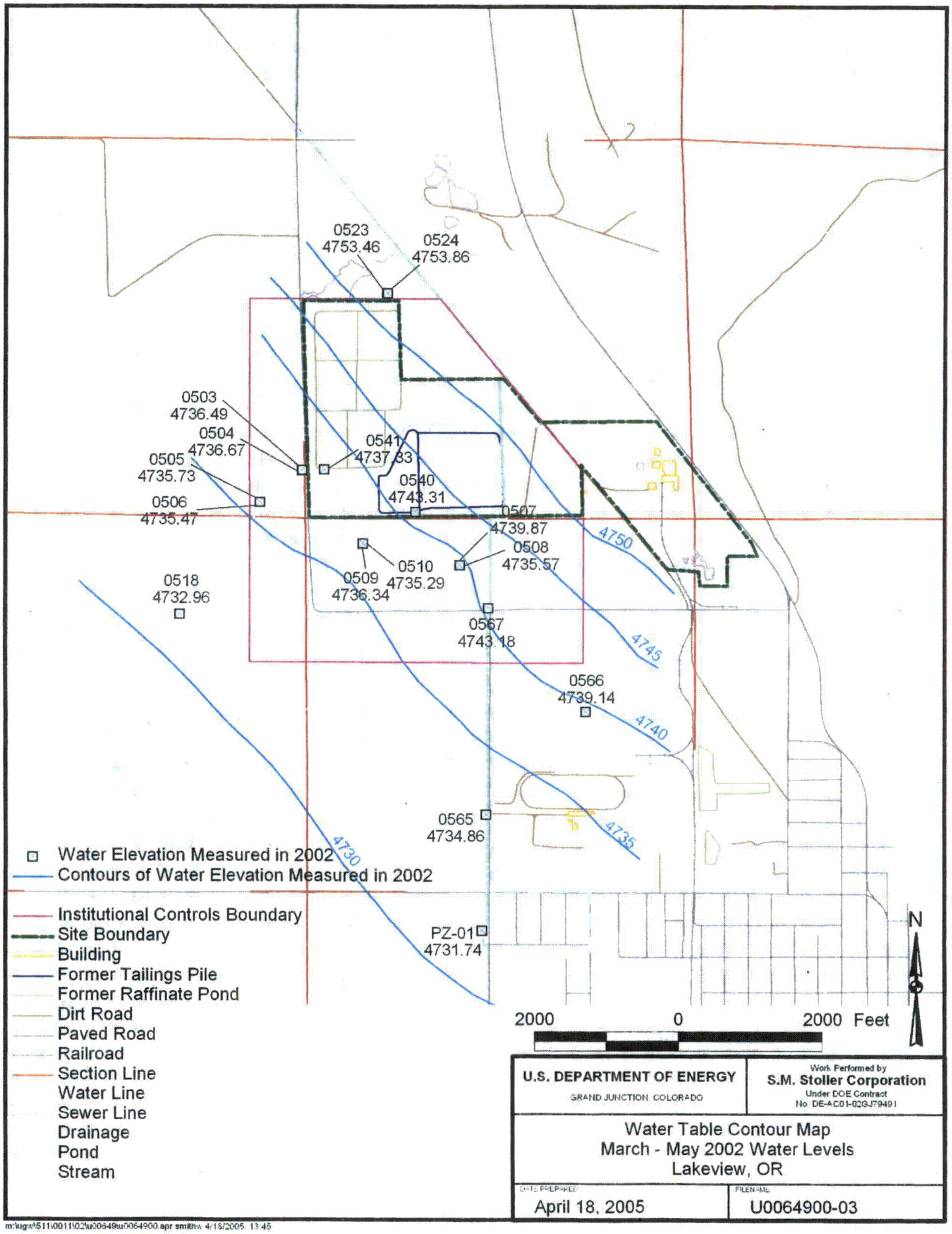

Figure 2–4. Water Table Contour Map March–May 2002 Water Levels, Lakeview, Oregon

indicate that some constituents may be preferentially immobilized or mobilized with vertical migration from the pile. The same may also be true with the raffinate ponds, though no vertical profiling was conducted there. Concentrations of both sodium and chloride in the ground water exceed historic concentrations in tailings and pond fluids and suggest dissolution of naturally occurring salts in lake sediments. Other potential influences on ground water quality are discussed below.

Sediments comprising the alluvial aquifer were deposited in a closed lake setting and contain considerable natural salt content. The soluble salts can only be removed by overflow into another basin, by incorporation into the lake bottom as interstitial brines, or by wind transport of desiccated evaporite minerals (Phillips and Van Denburgh 1971). A highly saline lake (Goose Lake) once covered the entire area and undoubtedly served as a source of ground water. Only the remnants of this larger lake currently exist today as the smaller Goose Lake, Summer Lake, and Lake Abert (Langbein 1962). Goose Lake has dried up several times in recent history and undoubtedly has contributed large amounts of salts into the sediments. The current water quality of Goose Lake is poor and is not of drinking quality. Other graben-controlled lakes in this semi-arid area contain high salt contents (Phillips and Van Denburgh 1971). The USGS has described graben-controlled lacustine depositional environments in their *Ground Water Atlas of the United States* (HA730-H). This report notes that these "...unconsolidated-aquifer deposits generally yield freshwater but locally yield saltwater, especially in south-central Oregon and coastal areas." This supports the existence of naturally saline water in the Lakeview area.

As noted in the BLRA (DOE 1996b), soils in the vicinity of the site are described by the U.S. Department of Agriculture Soil Conservation Service as "sodic and saline" and unfit for lawns, topsoil, and embankments, due to excess salt. Water quality is generally better to the east of the site where it is closer to the source of fresh surface-water recharge in the mountains. Farther west, where water has been in more prolonged contact with the salty lake sediments, water quality is generally poorer. It is possible that over time, as ground water flows through and reacts with the salty lake deposits, some dissolution of the salt occurs and salt-related contaminants become elevated. This is illustrated in Figure 2–5 from EPA's Groundwater Protection Strategy (EPA 1988), which depicts a geologic and hydrologic setting much like that at Lakeview. The discontinuous nature of the sediments in the Lakeview area may also result in local stagnation of ground water, which would further promote reaction of the ground water with the sediments.
A study of closed desert basins by Duffy and Al-Hassan (1988) indicates that solute gradients naturally exist in such ground water systems, both laterally and vertically. Generally, salinities increase with distance from the ground water recharge zones (i.e., adjacent to the mountains) and are highest in basin centers. They further indicate that salinities appear to decrease with depth at locations toward the basin centers. This is consistent with observations made at the Lakeview site, though the situation at Lakeview is further complicated by the presence of the geothermal area as well as site-related influences.

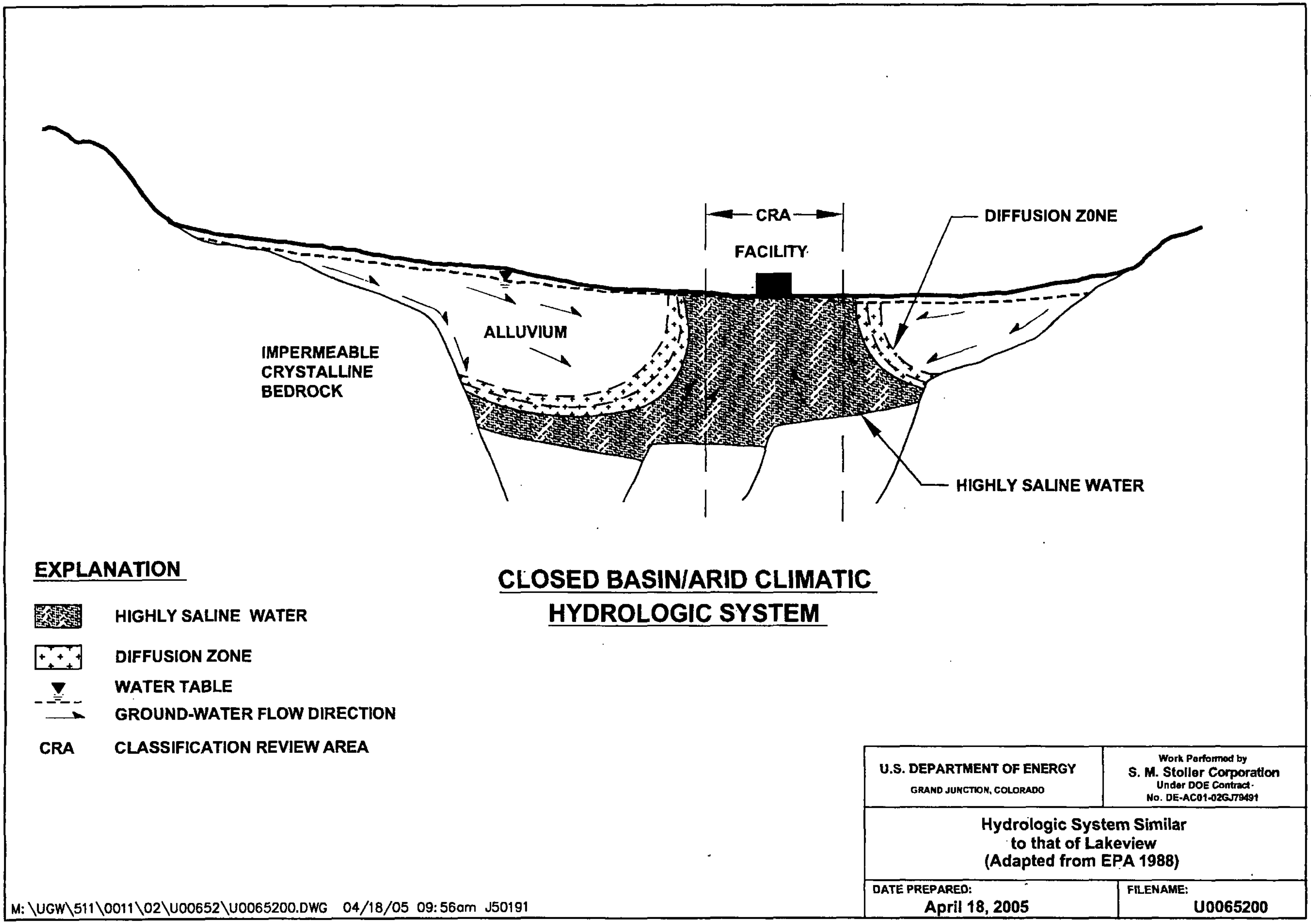

Figure 2–5. Hydrologic System Similar to that of Lakeview

Other activities can release salts from the lacustrine sediments. A large portion of the Goose Lake valley floor receives irrigation water. According to the BLRA, surface water from Thomas and Warner Creeks is diverted to a system of unlined irrigation ditches that serve the area west, southwest, and south of the site (DOE 1996b). Studies in other irrigated areas in the arid to semiarid west have shown irrigation can lead to dissolution of salts in saline subsurface materials; subsequent discharge of salty ground water to rivers in the area can have a significant deleterious effect on surface water quality (DOI 1999).

As noted in Section 2.3.2, a geothermal area is present to the northeast of the Lakeview millsite. Arsenic and boron concentrations are elevated in the geothermal area and are most likely a product of that geothermal activity. Arsenic is known to be associated with geothermal systems in the western United States. Boron may also be present in subsurface geothermal fluids or it may be a result of the dissolution of subsurface salts by those fluids. It is known that boron is a significant trace component in the subsurface salts in the Lakeview area (Phillips and Van Denburgh 1971). Likewise, chloride, sodium, and sulfate are significant components of those salts and could result from geothermal activity as well.

An isolated area of high sulfate concentrations in ground water is located south of the site along Roberta Avenue, about 2,500 ft past the maximum extent and east of the sulfate plume (Figure 2–10). This area also has elevated concentrations of chloride, sodium, calcium, manganese, and iron (Figure 2–7 through Figure 2–9). The BLRA indicates that these constituents may or may not be related to uranium milling activities and suggests additional investigations could be conducted to better answer this question. The BLRA further suggests that the high levels of these constituents may be related to the presence of former logging ponds upgradient from those wells. This condition could be produced by the of leaching of lake sediments produced from slightly acidic water derived from the wood chips and other organic materials produced during sawmill operations. Anecdotal evidence from residents downgradient of the logging facility suggests that operations at the facility adversely affected water quality in some private wells. The logging operation also used the former raffinate ponds on the Lakeview site for similar purposes as the offsite ponds and may have affected ground water quality in the vicinity of the former millsite as well, further complicating interpretation of ground water quality.

To address this issue, three shallow wells were drilled in May 2002, to help determine the piezometric surface in the area south of the site. Figure 2–4 shows the piezometric surface contoured in this area using these new data. It shows the water table sloping off to the west, away from the Warner Mountains. According to this figure, ground water would not flow from the millsite to the south; therefore, contamination along Roberta Avenue could not be derived from the former millsite.

Figure 2–6 through Figure 2–11 are spot plots that were generated for the 2002 GCAP report showing chemical concentrations in ground water. Since that time, the number of wells to be sampled was decreased to five to reflect a representative ground water sample of the former millsite area. Therefore, the spot plots were not updated; however, Table 2–1 and text revisions in this section discuss the most recent ground water sampling results conducted in May 2006. Circles on the above referenced figures indicate results of the comprehensive (one time) March 2002 sample round; squares on the above referenced figures indicate where samples were collected in 1999 but were not able to be collected in 2002.

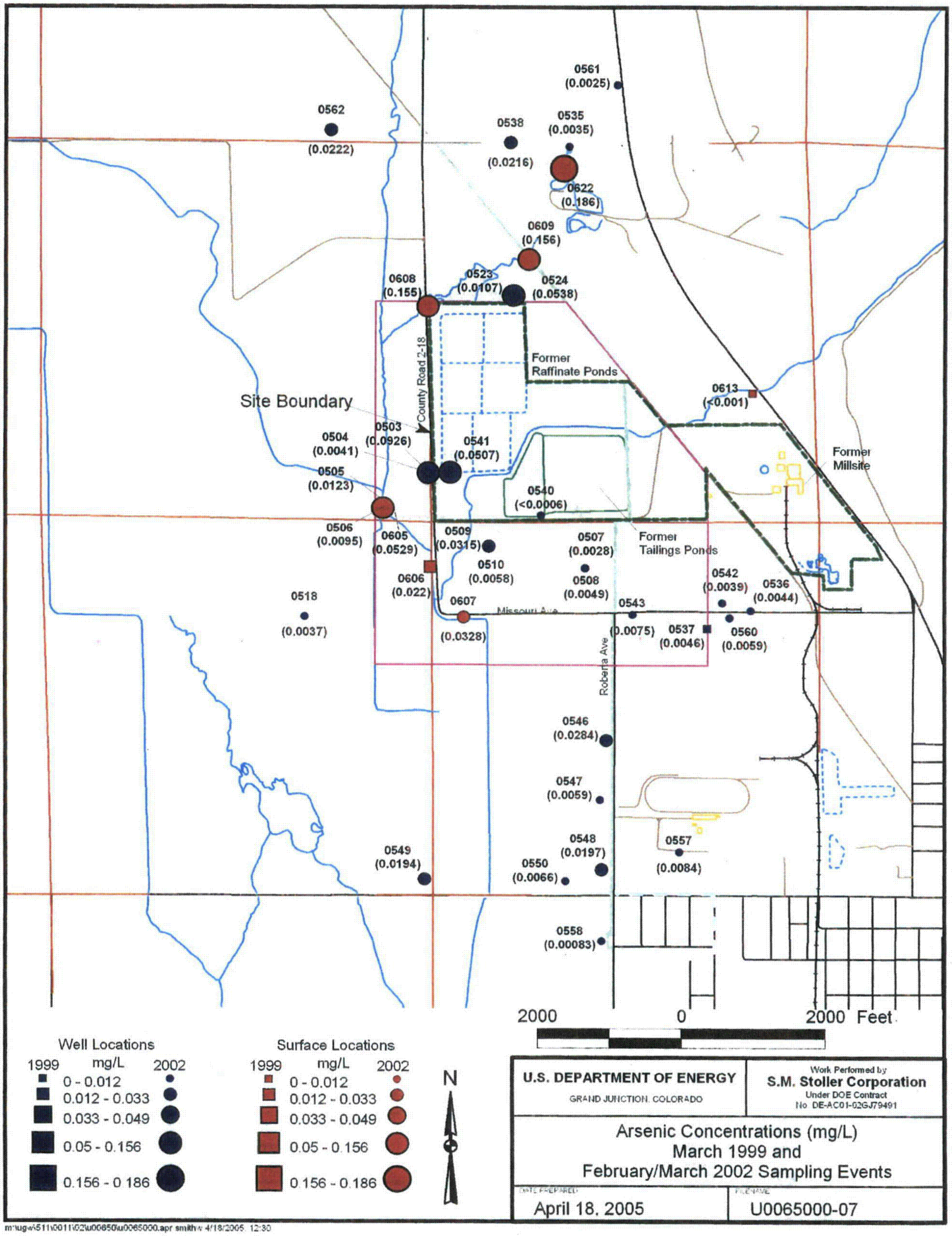

Figure 2–6. Arsenic Concentrations (mg/L) March 1999 and February/March 2002 Sampling Event

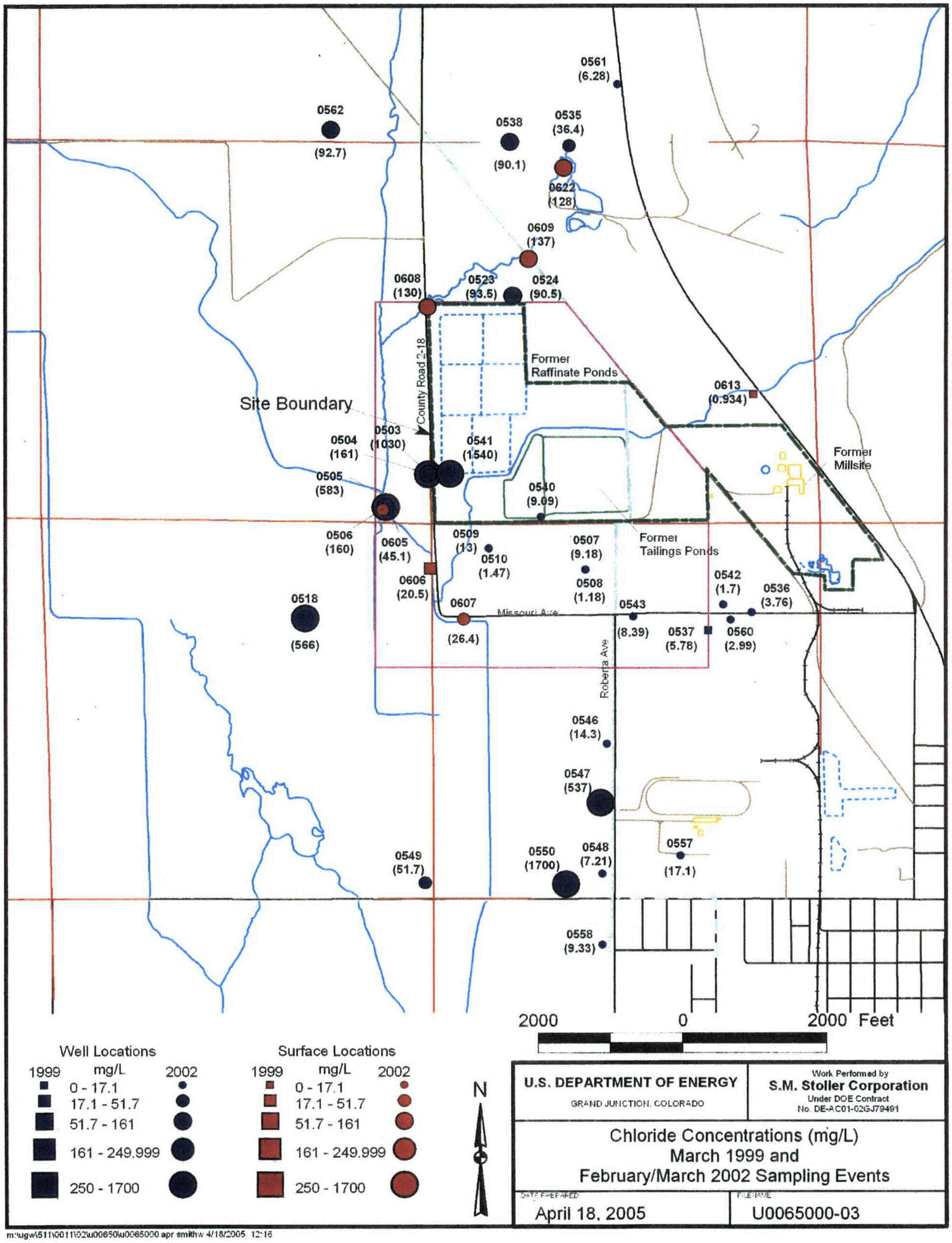

Figure 2–7. Chloride Concentrations (mg/L) March 1999 and February/March 2002 Sampling Events

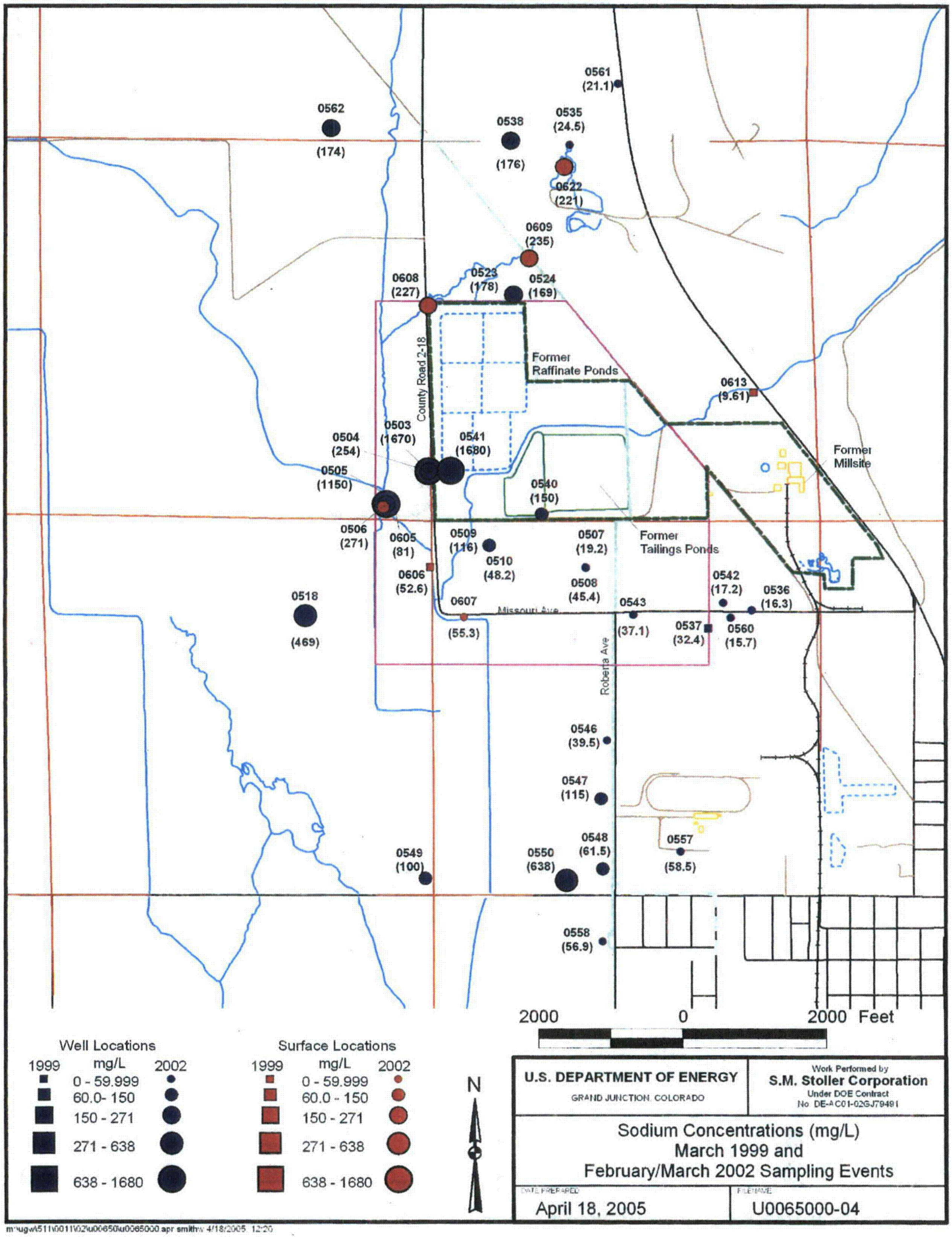

Figure 2–8. Sodium Concentrations (mg/L) March 1999 and February/March 2002 Sampling Events

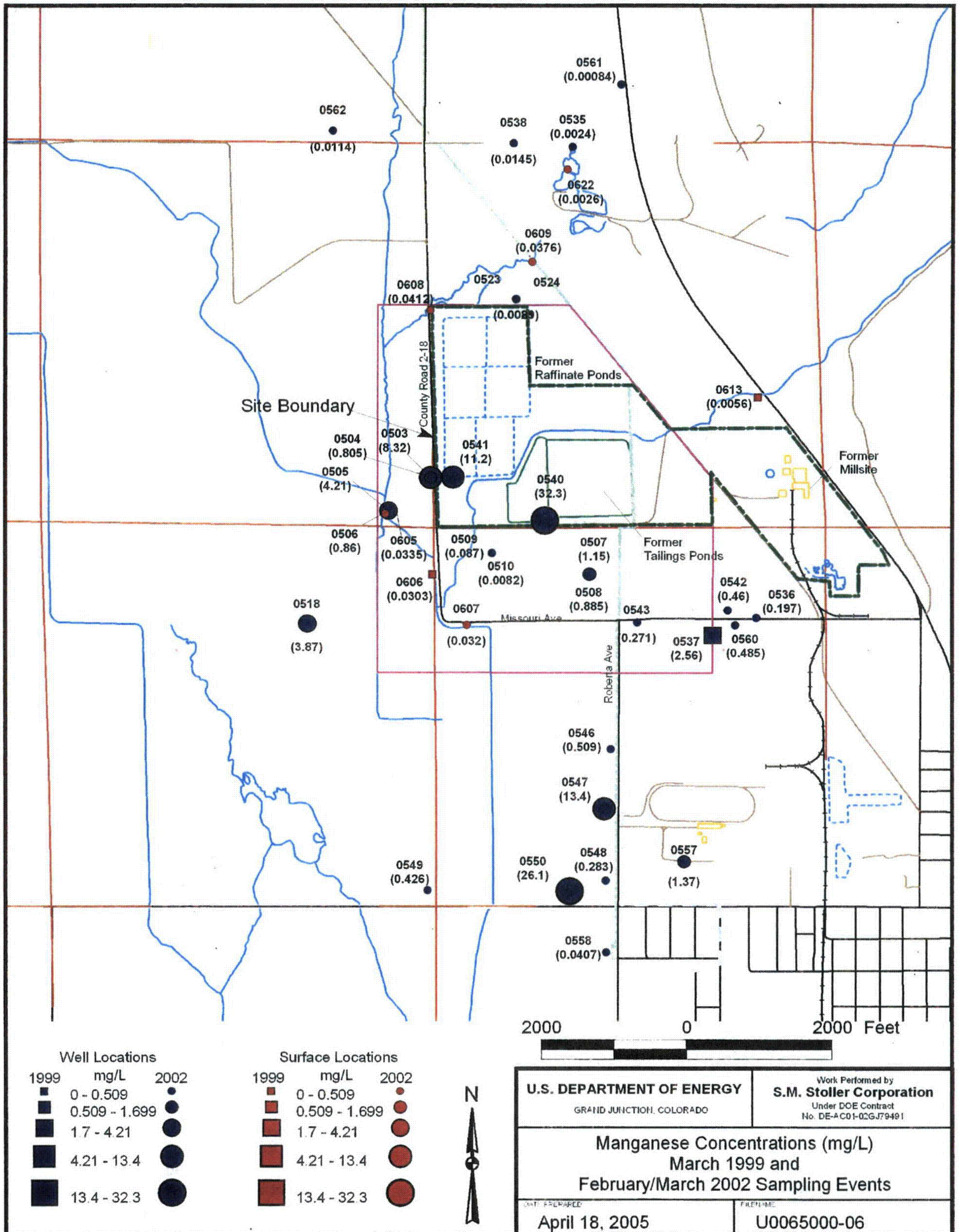

Figure 2–9. Manganese Concentrations (mg/L) March 1999 and February/March 2002 Sampling Events

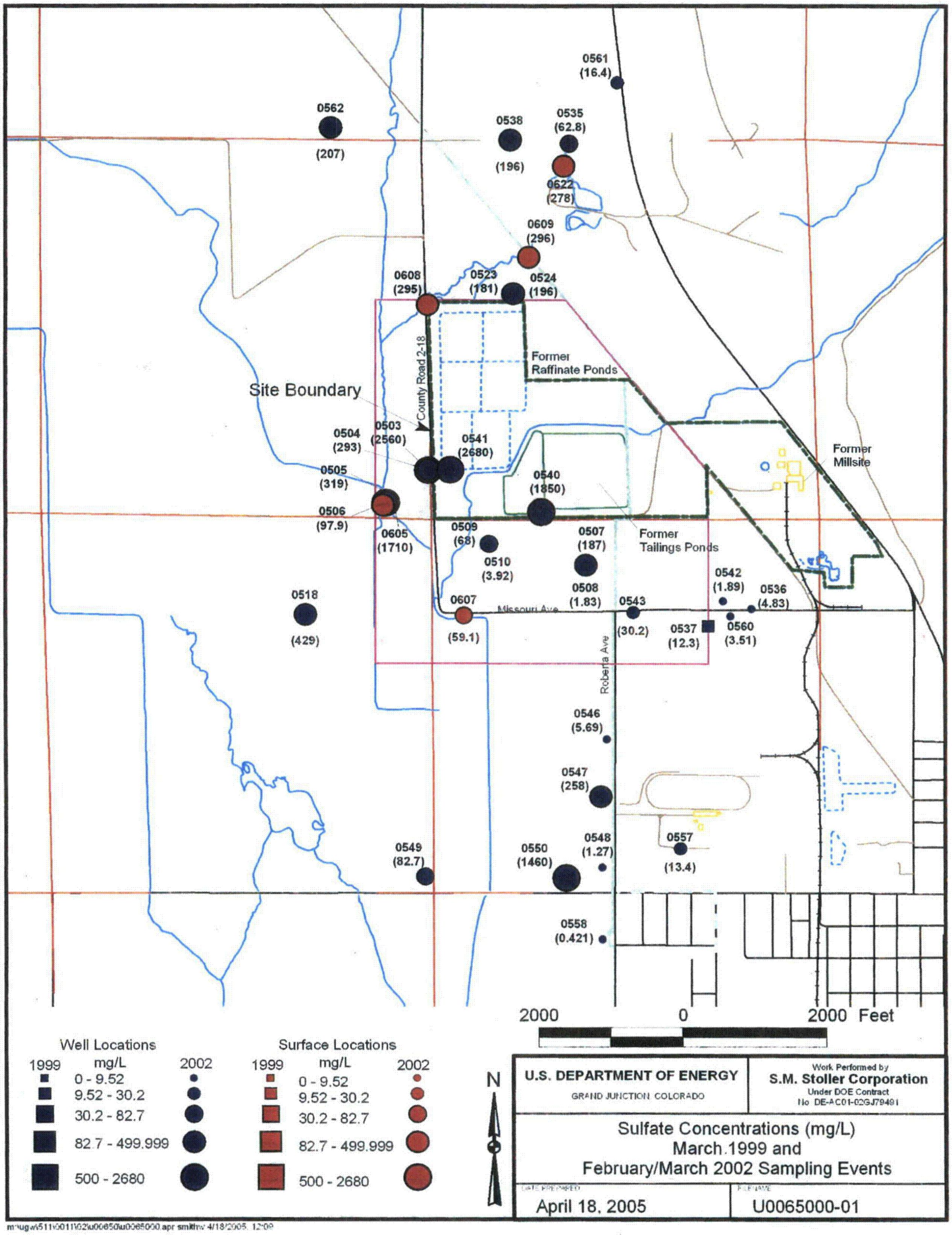

Figure 2–10. Sulfate Concentrations (mg/L) March 1999 and February/March 2002 Sampling Events

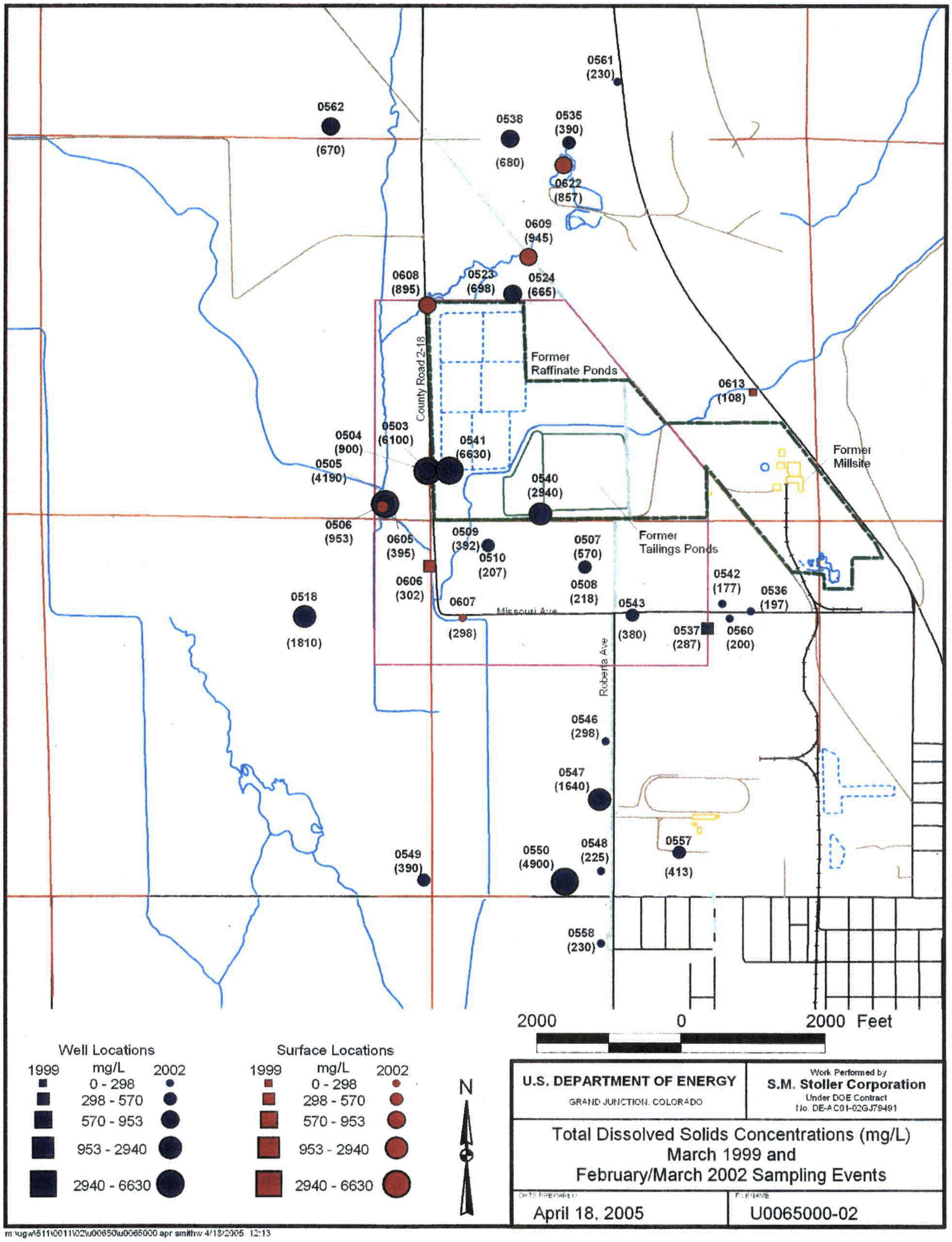

Figure 2–11. Total Dissolved Solids Concentrations (mg/L) March 1999 and February/March 2002 Sampling Events

Evaluation of recent ground water analyses indicates that currently only one well contains constituents that exceed maximum concentration limits (MCLs) established for the UMTRA project in 40 CFR 192. Well 0503 contains 0.097 mg/L arsenic for the May 2006 sampling, nearly twice the 0.05 mg/L MCL. Most of the elevated arsenic concentrations (MCL) from historical sampling can be attributed to the occurrence of geothermal water. Water collected at location 0622, in the Hunters Hot Spring pond, where geothermal water surfaces as a geyser, contained up to 0.186 mg/L arsenic. Sampling in the pond was discontinued after 2002.

In the past, concentrations of molybdenum slightly exceeded the MCL at two locations. However, molybdenum has also been identified as a common trace constituent in surface water contained in Goose Lake (Phillips and Van Denburgh 1971). It is below the risk-based concentration at all locations and below detection at most locations. Therefore, analyses for molybdenum have been discontinued.

Uranium was slowly increasing in well 0540 from 1990 to 1999, and reached 0.057 mg/L in March 2002, exceeding the UMTRA standard of 0.044 mg/L. In May 2004, the concentration dropped back below the standard to 0.011 mg/L and in May 2006, the concentration was 0.010 mg/L. The well is located downgradient of the former tailings pile and uranium in the ground water was probably leached from the tailings. This is the only well that has ever exceeded the 0.044 mg/L standard and it is located within the site boundary and the institutional control boundary (see Section 3.2.1). Therefore, no one will access the shallow ground water for drinking purposes. The nearest downgradient well from 0540 in well 0509 and shows decreasing concentrations of uranium since monitoring began in 1985. Well 0509 contained 0.00003 mg/L of uranium in May 2004 and 0.00004 mg/L in May 2006. Well 0540 will be sampled to monitor any increases or decreased in uranium and well 0509 will be sampled for two more sample rounds (years 2008 and 2010) to ensure that uranium is not migrating downgradient from well 0540.

The remaining constituents analyzed—boron, chloride, iron, manganese, sodium, sulfate, and TDS—are elevated when compared to available water quality standards or other benchmarks. Federal secondary drinking water standards are exceeded for chloride, iron, manganese, sulfate, and TDS. These values are not enforceable and are based on considerations such as taste and smell. Compared to health-based benchmarks (e.g., health advisories, risk- based concentrations), only boron, manganese, sodium, and sulfate are a concern (see Section 2.5). No toxicity data exist for chloride.

Samples were collected in 2004 and 2006 for a limited subset (5 locations) of the 2002 wells and analyzed for a limited set of analytes as recommended in the previous version of this document. Results are shown in Table 2-1.

Table 2–1. Results of 2004/2006 Sampling and Analyses

Well No.	Manganese	Sulfate	Uranium	TDS
0503	7.8/7.7	2,500/2,500	0.0002/0.0002	6,000/6,000
0505	3.2/2.7	1,600/1,600	0.0004/0.0004	4,100/4,200
0509	0.098/0.11	30/31	0.0003/0.0004	345/350
0540	24/26	1,400/1,400	0.011/0.010	2,150/2,200
0543	1.25/1.10	10/8.1	0.0007/0.0005	245/211

These results indicate little difference in concentrations for most wells and for most analytes. Time-concentration graphs (Figure 3–3 and Figure 3–4) show little change for sulfate and manganese. As mentioned, an exception is the decrease in the concentration of uranium for well 0540 to 0.011 and 0.010 mg/L from a previous high of 0.057 mg/L in 2002. The recent concentrations are similar to concentrations from historical sampling events.

2.4 Applicability of Supplemental Standards

Based on the discussion on ground water quality above, there is good reason to believe that contamination of ground water exists that is not mill-related. While no single source of contamination seems to account for all of the contaminants and their distribution, multiple processes at work result in an overall degradation of the aquifer. Ground water in the Lakeview area should qualify for supplemental standards based on widespread ambient contamination not related to the milling process. The UMTRA ground water regulations (40 CFR Part 192) note that the use of supplemental standards for limited use ground water applies the ground water classification system in EPA's Groundwater Protection Strategy (EPA 1988). Based on this strategy, limited use ground water would be considered to be Class III for most of the affected area.

Ground water in the unconfined surface aquifer is of limited use because of widespread, elevated concentrations of naturally occurring chloride, manganese, sodium, and sulfate that have probably been leached from salts in the closed-basin lacustrine deposits making up the shallow aquifer system. Arsenic is also more locally elevated due to the presence of a geothermal area north of the site. The influence of this geothermal area on water chemistry decreases to the south and west of the site. Levels of contaminants present in the alluvial aquifer cannot be treated to acceptable levels by methods reasonably employed in public water systems.

Domestic and monitoring wells that are completed in the uppermost aquifer near the east side of the former processing site tap generally high quality water coming off the upthrown mountain block to the east. Wells located farther west access ground water that that has been in contact with lake sediments for longer periods of time. EPA's Groundwater Protection Strategy (EPA 1988) notes that an entire aquifer need not meet the Class III criteria in order to qualify for that designation; if a substantial portion meets the criteria the Class III designation can be justified. Figure 2–5 demonstrates a possible scenario for the general geochemical setting at the Lakeview site.

2.4.1 Reasonableness of Ground Water Treatment

For supplemental standards to apply, it must be demonstrated that ground water cannot be reasonably treated for municipal use. If the high salt and geothermal ground water were treated, high concentrations of arsenic, chloride, silica, sodium, sulfate, and TDS would need to be removed. No rigorous feasibility study was performed on Lakeview area water. Chloride, sodium, sulfate, and TDS concentrations in alluvial ground water were elevated at another UMTRA Project site in Grand Junction, Colorado, where a detailed study was conducted (DOE 1999b). Data from the study were used as an analogue. In the Grand Junction study, arsenic was not among the primary constituents, but selenium and uranium were. For the Grand Junction site, treatment methods for removal of arsenic are similar to those for uranium. The average annual cost to treat the water for a household was estimated to be $400 in 1999. Water for Lakeview residents is produced from rain collectors located in mountains east of the town and, when necessary, from deep wells located near the base of the mountains and close to town. By comparison, the annual cost per household for domestic water in Lakeview in 1999 was $150 (personal communication, city utility director in 1999); thus, the cost to treat the shallow water was considered unreasonable.

For the Grand Junction site, average ground water quality for the seven background locations was unsuitable for drinking water, though individual wells on any given sampling occasion can have water of drinkable quality. NRC concurred with the ground water compliance strategy of no remediation based on application of supplemental standards on January 3, 2002.

2.5 Human Health and Environmental Risks

Assessment of site conditions indicates that supplemental standards would be protective of human health under current conditions. Future risks to human health would be unacceptable if the high salt or geothermal water were used as a primary source of drinking water. This use is not expected because other sources of drinking water are available and ICs would be in place to prohibit access to contaminated ground water.

A limited ecological evaluation was performed for this site in the BLRA. That evaluation concluded that there is a low potential to threaten the food chain (through bioaccumulation and biomagnification) of terrestrial and aquatic wildlife. However, the BLRA identified two potential areas of concern: (1) phytotoxicity of plants that have roots in direct contact with the aquifer and (2) use of ground water as a long-term source of drinking water for livestock. Visual reconnaissance of the former millsite for the past six years indicates that no phytotoxicity is occurring as a result of ground water constituents. Therefore, this does not appear to be a significant issue.

Potential effects on livestock have been studied at other DOE uranium mill tailings sites. Lampham and others (1989) and Henningsen (1997) evaluated this issue at two millsites by comparing contaminants of potential concern (COPC) concentrations in ground water to tissue concentrations in affected livestock. The 1989 study, conducted near the Ambrosia Lake site in New Mexico, concluded that some concentrations of radionuclides were elevated in livestock, but not to the levels predicted from bioaccumulation models. Radionuclides are not an issue at the Lakeview site.

Henningsen conducted the 1997 study downgradient of the former millsite at Monticello, Utah. That study is more relevant to the Lakeview situation because it included the evaluation of arsenic and manganese. The concentrations of arsenic and manganese in ground water from Monticello were lower than those at Lakeview; however, for the study, contributions from soil, sediment, and vegetation resulted in an analogous contaminant loading. The study concluded that the edible portions of livestock were not affected by site contamination. The only effect observed was in bone tissue, which accumulated contaminants with chemical properties similar to those of calcium. One shortcoming of comparing this study to Lakeview is that sulfate was not a COPC at Monticello. Sulfate concentrations in ground water at the Lakeview site may cause diarrhea in livestock, but long-term negative effects are not likely.

These studies and the qualitative screening evaluation done for the Lakeview BLRA indicate that ground water contaminants are unlikely to significantly affect livestock exposed to the ground water at or downgradient of the site. Overall, the application of supplemental standards would be protective of human health and the environment.

3.0 Ground Water Compliance

3.1 Compliance Strategy Framework

The framework defined in the PEIS (DOE 1996a) governs selection of the strategy to achieve compliance with EPA ground water standards. Stakeholder review of the final PEIS is documented and supported by the Record of Decision (Federal Register [FR] v. 62, No. 81, 1997). Figure 3–1 and Table 3–1 present summaries of the framework used to determine the appropriate ground water compliance strategies for the Lakeview site. The framework considers human health and environmental risk, stakeholder input, and cost. A step-by-step approach in the PEIS results in the selection of one of three general compliance strategies:

- ***No remediation***—Compliance with the EPA ground water protection standards would be met without altering the ground water or cleaning it up in any way. This strategy could be applied for those constituents at or below maximum concentration limits (MCLs) or background levels or for those constituents above MCLs or background levels that qualify for supplemental standards or ACLs.
- ***Natural flushing***—This strategy would allow natural ground water movement and geochemical processes to decrease contaminant concentrations to regulatory limits. The natural flushing strategy can be applied where ground water compliance could be achieved within 100 years, where effective monitoring and IC can be maintained, and where the ground water is not currently and is not projected to be a source for a public water system.
- ***Active ground water remediation***—This strategy would require engineered ground water remediation methods such as gradient manipulation, ground water extraction and treatment, land application, phytoremediation, and in situ ground water treatment to achieve compliance with EPA standards.

3.2 Implementation

The UMTRA Project regulations provide for several ways to comply with the ground water protection standards for Subpart B of 40 CFR 192.12(c). These include meeting the provisions of 40 CFR 192.02(c)(3) or a supplemental standard established under 40 CFR 192.22. The provisions of 40 CFR 192.02(c)(3) include: (1) the background level of the constituent in ground water; (2) the MCL for any constituents listed in Table 1 to Subpart A; or (3) an ACL established pursuant to paragraph (c)(3)(ii) of that section.

The compliance strategy proposed for the Lakeview site is no remediation with the application of supplemental standards based on widespread ambient contamination that is not milling related. Institutional controls and monitoring will continue as a best management practice. These components of the compliance strategy are described separately.

3.2.1 Institutional Controls

Because of the heterogeneous nature of the subsurface and the various contaminant sources, ambient contamination is not uniformly distributed throughout the surficial aquifer. There are some pockets of relatively good quality water, particularly close to the mountains, or intermittent streams draining the mountains, from which aquifer recharge is obtained. Private wells are located in the area; some tap into water suitable for drinking without treatment while other homeowners equip their in-house spigots with some type of treatment unit. This is especially true of homeowners located along Roberta Avenue south of the millsite. The only possible harm of using water potentially contaminated by milling processes is direct ingestion by humans. The IC limits access to contaminated ground water for humans by providing city water to the area potentially impacted by milling contamination.

The implementation of ICs was accomplished in a two-part effort. An IC boundary was established around the western part of the former millsite that included land containing and extending beyond probable millsite contamination based on sulfate (Plate 1). DOE negotiated with the town of Lakeview and Lake County officials to increase the diameter of a domestic water line (in the IC area) that was being constructed from the town of Lakeview to a new state prison located north of town. This construction was completed in the spring through fall of 2002. The corridor for the water line to the prison intersects the southern and eastern sides of the IC area and provides municipal water to residents inside the zone. DOE paid $200K to fund this difference in cost for the waterline. In exchange, Lake County and the town of Lakeview both passed ordinances requiring future land users inside an IC area to obtain hookups from the new domestic water line or be required to drill a well to a depth that will guarantee no potential millsite contamination is encountered.

The second part of this IC was the establishment of a minimum depth to which a well must be drilled before water is used for drinking purposes. DOE reviewed well pair chemistry that suggested that no site-related contamination is present at depths greater than 100 ft. This depth is comparable to anecdotal information from an experienced well driller, indicating that good water throughout the area is usually found at depths greater than 60 ft. To investigate this question further, DOE sampled and analyzed water from several municipal or multi-use domestic wells in the millsite area during the 2002 sampling event. Wells 0557, 0558, and 0562 are 300 to 400 ft deep and all produce large volumes of potable water. Results showed good quality water with relatively low total dissolved solids. Therefore, DOE proposed to the Oregon Water Resources Commission that domestic wells in the IC area can be safely drilled and screened to depths exceeding 250 ft. This is considered to be a conservative or maximum depth estimate, but the State of Oregon endorsed this depth. Exclusion of the upper 250 ft for domestic ground water use within the IC boundary was codified by the Oregon Water Resources Commission, a body within the Oregon Water Resources Department, in Salem, Oregon on March 12, 2004. This is the state agency responsible for ensuring that domestic well applications are reviewed and approved before drilling permits are issued. The content of the ruling titled *Special Area Well Construction Standards – Lakeview, Oregon*, OAR Chapter 690, Division 200, is provided in Appendix A.

No one is drinking contaminated water from private domestic wells inside the IC boundary. One resident within the IC boundary does have a private drinking water well that is less than 250 ft in depth. This well (0543) produces high quality water at 155 ft and is considered to be grandfathered under the current compliance strategy. DOE has monitored the well for six years and will continue to monitor this well to ensure adequate water quality is maintained. If water quality deteriorates to unacceptable values, DOE will provide a new well and screen it below the 250-foot level, or hook up the owner to municipal water. DOE visited the owners in 2005 in an attempt to provide the owners with a hookup to municipal water or to drill a deeper well. The residents currently have clean, cold, good tasting drinking water and were not interested in any action that might alter this situation.

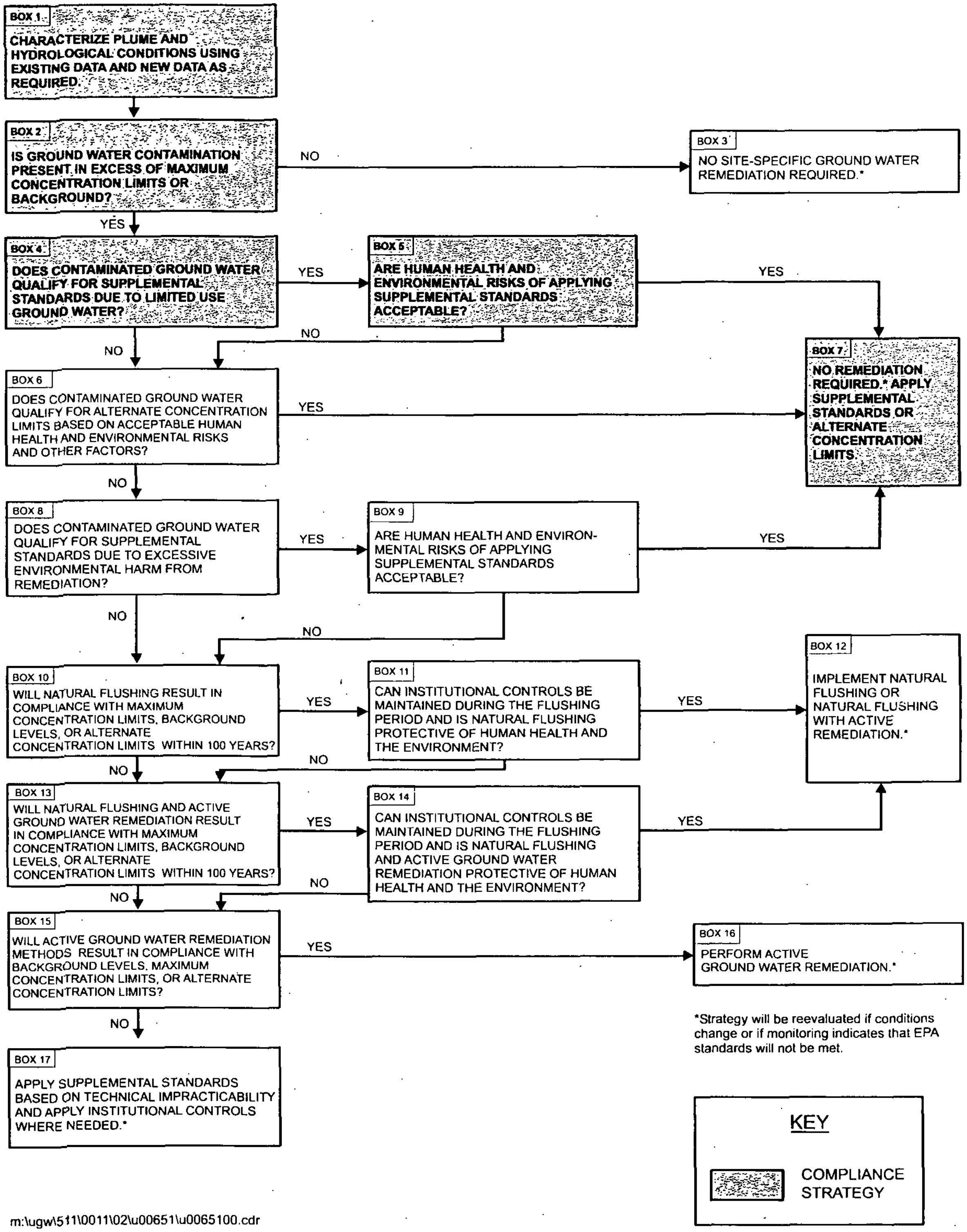

Figure 3–1. Ground Water Compliance Strategy

Table 3–1. Explanation of Compliance Strategy Selection Process

Box (Figure 3–1)	Action or Question	Result or Decision
1	Characterize plume and hydrologic conditions.	Use of the Surface EA, RAP, BLRA, and March 1999 through March 2002 sample analyses. Go to Box 2.
2	Is ground water contamination present in excess of UMTRA MCLs or background?	Arsenic concentrations exceed the UMTRA MCL. Sulfate, manganese, chloride, and TDS exceed secondary standards established in the Safe Drinking Water Act. Sodium and boron are elevated above some health advisory levels. Go to Box 4.
4	Does contaminated ground water qualify for supplemental standards due to limited use ground water?	Ground water qualifies for limited use based on widespread ambient contamination from mobilization of sulfate, manganese, chloride, sodium and TDS from naturally occurring salts contained in lake sediments. A more localized area is also affected by elevated arsenic and boron from a geothermal area. Go to Box 5.
5	Are human health and environmental risks of applying supplemental standards acceptable?	No one is currently drinking water contaminated from uranium milling activities. IC will prevent any future use of water from the former millsite. The environment is not being adversely affected by contaminated water. Go to Box 7.
7	No remediation required. Apply supplemental standards or alternate concentration limits.	Supplemental standards based on widespread contamination that is not milling related are applied. As a best management practice, institutional controls will be adopted and limited monitoring will continue.

MCL = UMTRA Project maximum concentration Limit in 40 CFR 192

3.2.2 Ground Water Monitoring Plan

As a best management practice, a limited ground water monitoring program will continue at the former Lakeview millsite. The monitoring network is shown in Figure 3–2. Samples will be collected from monitoring locations at a frequency of every other year for 10 years after this GCAP is accepted and will be analyzed for sulfate and manganese. The private domestic well located within the IC boundary along Missouri Avenue (well 0543) will be monitored to ensure it will continue to provide high quality drinking water.

Wells 0503, 0505, and 0540 are near the leading edge of the historically listed sulfate and manganese plumes. Though these constituents are believed to have sources other than site-related causes, (as evidenced by similar elevated concentrations in wells along Roberta Avenue) elevated concentrations in the vicinity of the Lakeview site may be at least partially attributable to milling operations. Concentrations of sulfate and manganese in these wells have remained relatively constant over the 22-year monitoring period (Figure 3–3 and Figure 3–4); continued monitoring will simply ensure that any unexpected changes can be detected. Monitoring will be reevaluated 10 years after acceptance of this GCAP by NRC.

Uranium increased in well 0540 to slightly above the UMTRA standard in 2002. Concentrations of uranium in this well dropped to previous levels during the 2004 and 2006 sampling events. Monitoring for uranium will be continued for well 0540 and in downgradient well 0509 until DOE is confident that concentrations in well 0540 will remain below the MCL. If concentrations in well 0540 remain below the MCL for three consecutive sampling periods, monitoring of well 0509 will be discontinued. Uranium concentrations have remained below the MCL in well 0540 during 2004 and 2006; therefore, if this continues, well 0509 will be sampled for the last time in 2008.

Though other constituents, such as arsenic, boron, and molybdenum are somewhat elevated at some site locations, site concentrations are below geothermal concentrations. Therefore, monitoring for these constituents is not proposed.

Table 3–2. Summary of Monitoring Requirements

Location	Monitoring Purpose	Analytes	Frequency
LKV-0503	Well, downgradient raffinate ponds	Sulfate and Manganese. Uranium only for 0540. Uranium only for 0509 and discontinue after 2008 if levels remain below MCL in 0540	Biennial for 10 years after GCAP accepted; reevaluate requirements at that time
LKV-0505	Well, downgradient raffinate ponds		
LKV-0540	Well, downgradient of former tailings pile		
LKV-0543	Well, private, along Missouri Ave.		
LKV-0509	Well, downgradient of former tailings pile		

Decommissioning of all monitor wells that are no longer needed for compliance monitoring at the Lakeview site will be undertaken in accordance with applicable State of Oregon regulations. This decommissioning will be accomplished by a DOE Office of Legacy Management project.

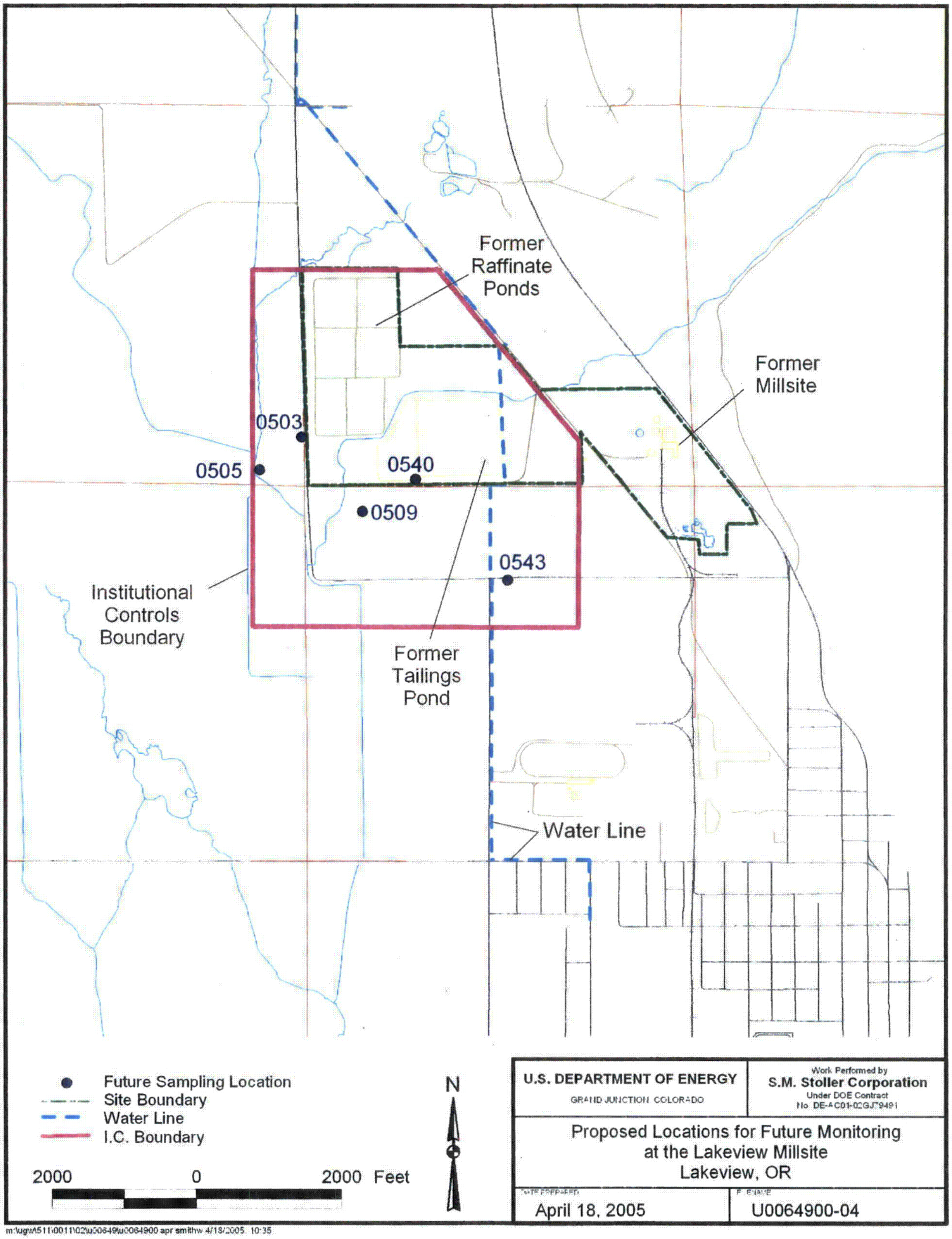

Figure 3–2. Proposed Locations for Future Monitoring at the Lakeview Millsite, Lakeview, Oregon

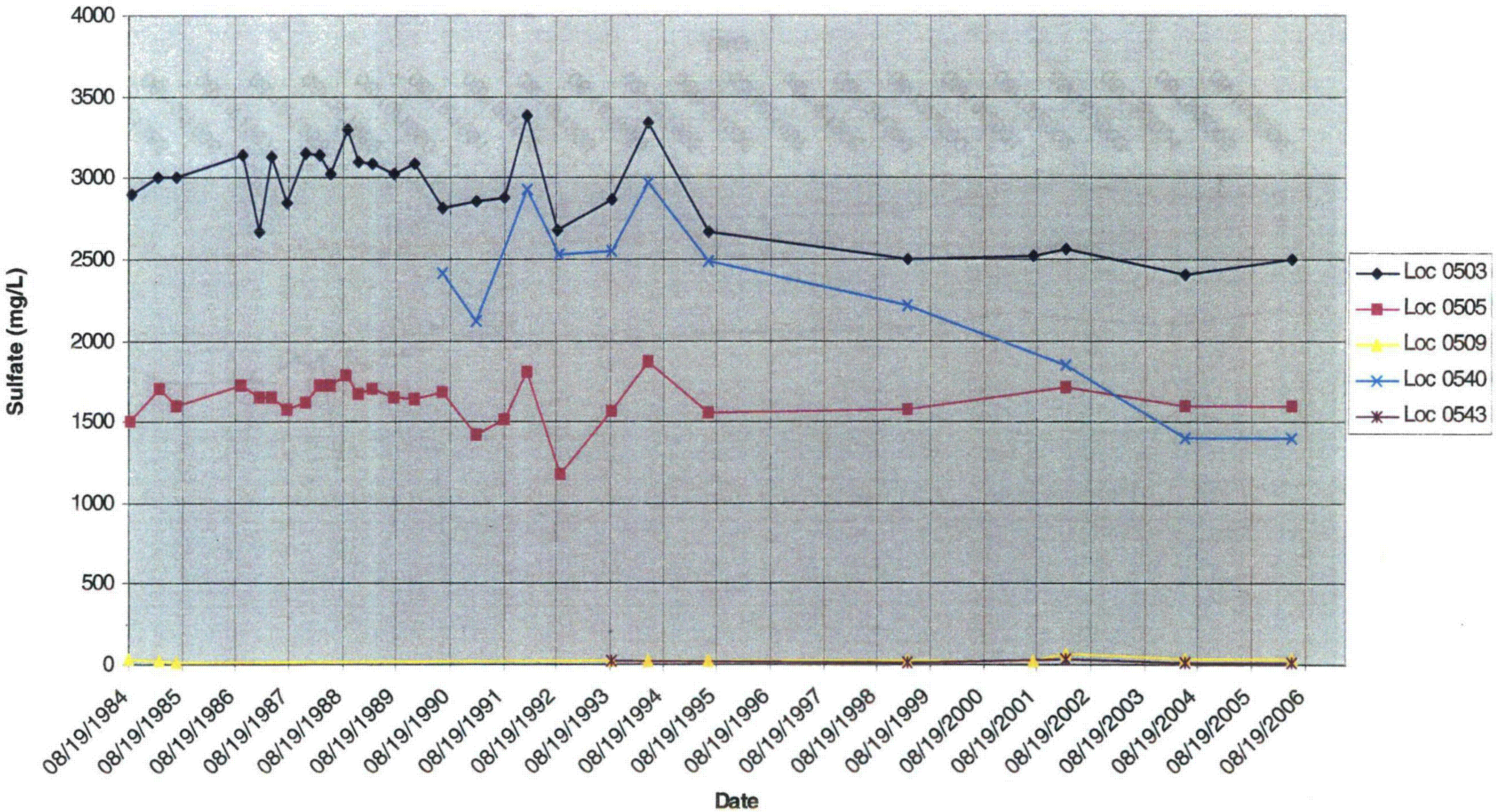

Figure 3–3. Sulfate Concentrations at the Lakeview, Oregon Site

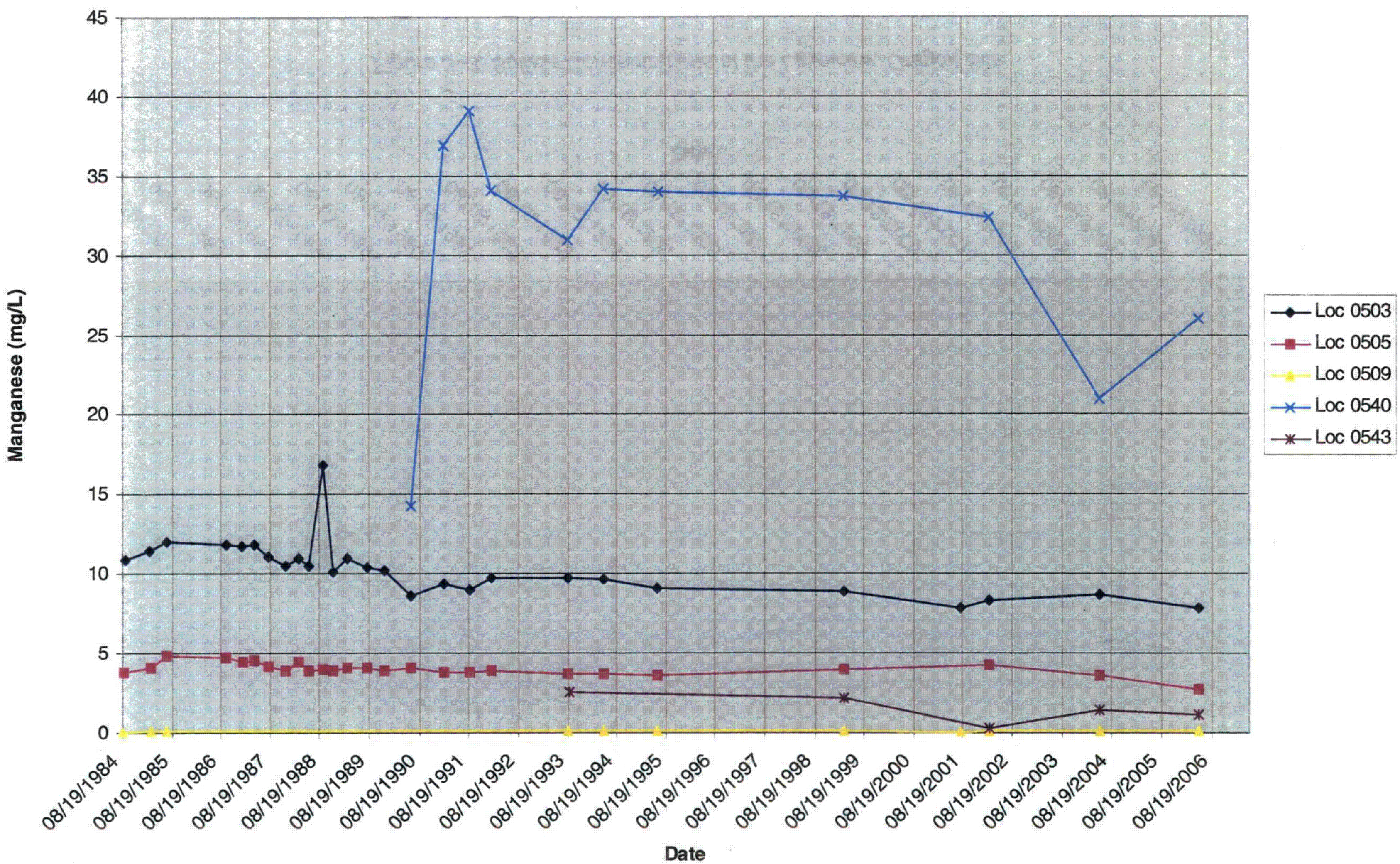

Figure 3–4. Manganese Concentrations at the Lakeview, Oregon Site

4.0 References

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Appendix A

Special Area Well Construction Standards

The Oregon Administrative Rules contain OARs filed through July 15, 2005

WATER RESOURCES DEPARTMENT

DIVISION 200

WELL CONSTRUCTION AND MAINTENANCE

Introduction

690-200-0005

Basis for Regulatory Authority

(1) The right to reasonable control of the ground waters of the State of Oregon has been declared to belong to the public. Through the provisions of the Ground Water Act of 1955, ORS 537.505 to 537.795, the Water Resources Commission has been charged with the administration of the rights of appropriation and use of the ground water resources of the state and the prevention of waste and contamination of ground water. This is primarily accomplished by the licensing of well constructors and the promulgation of rules governing well construction, alteration, abandonment, conversion, maintenance, and use. Ultimately the landowner of the property where the well is constructed is responsible for the condition, use, maintenance of setbacks, and abandonment of the well.

(2) The following rules apply to all wells which are constructed for the purpose of locating or obtaining water as defined in ORS 537.515(9) with the following exceptions:

(a) The construction, maintenance, conversion, and abandonment of monitoring wells, geotechnical holes, and other holes are regulated under OAR 690-240;

(b) Holes constructed under ORS Chapters 517, 520, 522, and rules promulgated from those statutes, are the responsibility of the Oregon Department of Geologic and Mineral Industries and are not subject to these rules. These include, but are not limited to, holes constructed for the purposes of exploring for, or producing, petroleum, minerals, or geothermal resources; and

(c) Underground Injection Systems, which are regulated by the Oregon Department of Environmental Quality under OAR 468B.

NOTE: Table 200-1 lists common subsurface borings and indicates which administrative rule governs the construction, conversion, maintenance, alteration, and abandonment of the boring. [Table not included. See ED. NOTE.]

(3) When natural flow of water occurs in holes not regulated under these rules, the Water Resources Commission may regulate under separate rules or statutes to protect the ground water from contamination or waste;

(4) In addition to regulating new well construction, alteration, abandonment, conversion, and maintenance actions, the Water Resources Commission may impose conditions upon the use of any existing water supply well as may be necessary to prevent waste, undue interference with other wells or contamination. When necessary, the Commission may order discontinuance of use, repair, temporary, or permanent abandonment of any well to accomplish the same objectives.

(5) Except for the Commission's power to adopt rules, the Commission may delegate to the Water Resources Director the exercise or discharge in the Commission's name of any power, duty or function of whatever character, vested in or imposed by law upon the Commission. The official act of the Director acting in the Commission's name and by the Commission's authority shall be considered to be an official act of the Commission. The Commission delegates to the Director full authority to act in the Commission's name where that delegation is reflected in these rules.

(6) Under the provisions of ORS 537.780, the Commission is authorized to adopt such procedural rules and regulations as deemed necessary to carry out its function in compliance with the Ground Water Act of 1955. In fulfillment of these responsibilities and to ensure the preservation of the public welfare, safety, and health, the Commission has established these rules and regulations as the minimum standards for the construction, alteration, conversion, abandonment and maintenance of water supply wells in Oregon.

(7) The rules and regulations set forth herein shall become effective upon adoption by the Commission.

[ED. NOTE: Tables referenced in this rule are available from the agency.]

Stat. Auth.: ORS 536.027, ORS 536.090 & ORS 537.505 - ORS 537.795
Stats. Implemented: ORS 536.090 & ORS 537.505 - ORS 537.795
Hist.: WRD 3, f. & ef. 2-18-77; WRD 9-1978, f. 12-12-78, ef. 1-1-79; Renumbered from 690-060-0005 by WRD 13-1986, f. 10-7-86, ef. 11-1-86; WRD 7-1988, f. & cert. ef. 6-29-88; WRD 8-1993, f. 12-14-93, cert. ef. 1-1-94; WRD 7-2001, f. & cert. ef. 11-15-01

690-200-0020

General Statement About the Standards

(1) The rules and regulations set forth herein provide the minimum standards for the construction, conversion, alteration, maintenance, and abandonment of water supply wells. After the effective date of adoption of these rules and regulations, no water supply well shall be constructed, altered, converted, or abandoned contrary to the provisions of these rules and regulations without prior approval from the Water Resources Department. Violation of these standards may result in enforcement under OAR chapter 690, division 225, including suspension or revocation of a constructor's license, imposition of civil penalties on the landowner or constructor, action on a bond, or other sanctions authorized by law.

(2) Every well shall be designed and constructed to adapt to the existing local geologic and ground water conditions at the well site and shall fully utilize every natural protection to the ground water supply. If prior to or during construction the well constructor becomes aware that specific site conditions will not allow adherence to the following minimum well standards, the constructor shall request and obtain written approval from the Director to use alternative construction methods, materials or standards. The

request shall be in writing and submitted to the Director as described in OAR 690-200-0021. Special standard approval from the Director must be obtained prior to completion of the well.

(3) Certain wells constructed under these rules may be suitable for use as public, community, municipal, or public utility supplies. Regulations administered by other agencies may apply in addition to those in this chapter (**see Appendix 1**).

[ED. NOTE: Appendix referenced in this rule are available from the agency.]

Stat. Auth.: ORS 536.027, ORS 536.090 & ORS 537.505 - ORS 537.795
Stats. Implemented: ORS 536.090 & ORS 537.505 - ORS 537.795
Hist.: WRD 9-1978, f. 12-12-78, ef. 1-1-79; Renumbered from 690-060-0008 & 690-060-0040 by WRD 13-1986, f. 10-7-86, ef. 11-1-86; WRD 7-1988, f. & cert. ef. 6-29-88; WRD 8-1993, f. 12-14-93, cert. ef. 1-1-94; WRD 7-2001, f. & cert. ef. 11-15-01

690-200-0021

Special Standards

(1) Site conditions may require specific design, construction, and abandonment procedures to adapt to the existing local geologic and ground water conditions to fully utilize every natural protection to the state's ground water. Specific site conditions may require different design, construction, setback, or abandonment standards than required by the Water Supply Well construction rules. Alternative technologies or methods not addressed in these rules may also exist which could be effectively utilized in the construction or abandonment of a water supply well. Prior to the completion of the well, a bonded constructor must request and receive approval from the Department to use methods or materials that do not meet the water supply well construction standards. The Department may approve such requests either orally or in writing. If oral approval is granted, the written request must be submitted to the Department within three working days of the date of the oral approval. Failure to submit a written request as described above may void the prior oral approval. The proposed methods or materials shall provide at least the same level of resource protection as that which is provided by these rules.

(2) The written request for special standards shall include:

(a) Name, license number and signature of the bonded well constructor;

(b) Location of the well by county, township, range, section, tax-lot (if assigned) and either the 1/4, 1/4 section or Latitude and Longitude as established by a global positioning system;

(c) Name and address of landowner;

(d) Address of the project/well site;

(e) Type of work;

(f) The distance to the nearest well and septic tank or drainfield;

(g) The reasons(s) that conformance to the rules and regulations for water supply wells cannot be met;

(h) A diagram and written description showing the proposed water supply well design, construction, or abandonment;

(i) A site map showing the relationship of the well to any existing septic systems, if the request is to place a well within the minimum setbacks described in OAR 690-210-0030;

(j)The well identification number, if assigned; and

(k) The start card number.

Stat. Auth.: ORS 536.027, 536.090 & 537.505 - 537.795
Stats. Implemented: ORS 536.090 & 537.505-537.795
Hist.: WRD 8-1993, f. 12-14-93, cert. ef. 1-1-94; Renumbered from 690-210-0015 by WRD 7-2001, f. & cert. ef. 11-15-01

690-200-0025

Special Area Standards

If at any time, the Commission finds that different or supplemental standards are required for the safe development of ground water from any aquifer or area, special area standards for the construction and maintenance of water supply wells within such areas may be adopted as rules by the Commission. In the absence of such special area standards, these rules constitute the sole administrative standards of the Water Resources Department governing construction, conversion, maintenance, alteration, and abandonment of water supply wells.

Stat. Auth.: ORS 536.027, ORS 536.090 & ORS 537.505 - ORS 537.795
Stats. Implemented: ORS 536.090 & ORS 537.505 - ORS 537.795
Hist.: WRD 9-1978, ef. 12-12-78, f. 1-1-79; Renumbered from 690-060-0045 by WRD 13-1986, f. 10-7-86, ef. 11-1-86; WRD 7-1988, f. & cert. ef. 6-29-88; WRD 8-1993, f. 12-14-93, cert. ef. 1-1-94; WRD 7-2001, f. & cert. ef. 11-15-01

690-200-0027

Restrictions on Water Supply Well Construction and Use in Critical Groundwater Areas or Areas Withdrawn by Commission Order

(1) The use of ground water is restricted in Critical Ground Water Areas or Withdrawal Areas established by Commission Order, under ORS 537.735 and 536.410. Before constructing a water supply well, the constructor shall determine whether the proposed well site is within a Critical Ground Water or Withdrawal Area. (Refer to **Figure 200-1**.)

(2) If the water supply well is within a Critical Ground Water or Withdrawal Area, the constructor shall contact the watermaster for the county where the water supply well is to be constructed for more information. (Refer to **Table 200-2**.)

(3) Construction of water supply wells in violation of a critical ground water or withdrawal order are subject to enforcement action as described in OAR chapter 690, division 225.

[ED. NOTE: Tables and Figures referenced are available from the agency.]

Stat. Auth.: ORS 536.027, ORS 536.090 & ORS 537.505 - ORS 537.795
Stats. Implemented: ORS 536.090 & ORS 537.505 - ORS 537.795
Hist.: WRD 7-1988, f. & cert. ef. 6-29-88; WRD 8-1993, f. 12-14-93, cert. ef. 1-1-94; WRD 7-2001, f. & cert. ef. 11-15-01

690-200-0028

Designated Special Area Standards

(1) Special Area Standards for the Construction and Alteration of Water Supply Wells in the Lakeview Area.

(A) As used in this rule and illustrated in Figure 200-3, "The Lakeview Area" includes the area located in Sections 4, 5, 8 and 9 of Township 39 South, Range 20 East of the Willamette Meridian, Lake County, Oregon. Beginning at a point on the West line of Section 4, said point bears South 1%40'45" East - 2245.31 feet from the Northwest Corner of Section 4; thence South 89%54'45" East- 1907.04 feet to the West right of way line of the Fremont Logging Road; thence South 39%26'40" East along the West right of way line of the Fremont Logging Road - 3095.16 feet; thence South 1%53'14" East - 617.32 feet to the South line of Section 4; thence continuing in Section 9 - South 00%13'8" West parallel to the North South centerline of Section 9 - 2649.14 feet to the East West centerline of Section 9; thence South 89%45'31" West along the East West centerline of Section 9 - 3782.55 feet more or less to the West line of Section 9; thence West along the East West centerline of Section 8 - 1320.00 feet more or less to the center East 1/16 corner of Section 8; thence North 2640.00 feet more or less to the East 1/16 corner common to Sections 5 and 8; thence North 1%41'33" West - 2630.48 feet more or less to the center East 1/16 corner of Section 5; thence North 1%40'45" West - 410.32 feet; thence South 59%54'45" East - 1307.02 feet more or less to the point of beginning.

(B) Any new, altered, deepened or converted well in the sedimentary units (clay, sand, silt, gravel) in the Lakeview Area shall be cased and sealed according to OAR 690, Division 210 with the following additional requirements:

(a) Unperforated casing and seal shall extend from land surface to a depth of 250 feet below land surface; and

(b) Perforated casing may extend below the seal.

(C) Liner installed in any new, altered, deepened or converted well in the sedimentary units (clay, sand, silt, gravel) in the Lakeview Area shall not extend more than 10 feet above the bottom of the unperforated casing.

(D) Alternatives to the special area standards shall be approved only if it can be demonstrated that the alternative techniques proposed to be used are as effective as the techniques required in subsection (1)(B) and (1)(C) above. Such alternatives require prior written approval by the Department and follow-up testing as may be required by the Department.

(E) Except as they may conflict with subsection (1) (B) and (1)(C), all other provisions of Oregon Administrative Rules for Well Construction and Maintenance Standards apply.

(F) This rule is applicable to wells for which construction, alteration, deepening or conversion began on or after April 1, 2004.

(G) This special area standard may be revised at a future date when additional information and analysis is provided from other agencies including the Oregon Department of Environmental Quality.

Stat. Auth.: ORS 537.780, 536.027, 536.090
Stats. Implemented: ORS 537.505 - 537.795, 537.780(1)
Hist.: WRD 2-2004, f. & cert. ef. 4-1-04

690-200-0030

Appendix B

UMTRA Ground Water Project Document Compilation for Lakeview, Oregon

August 1999

Contents

End of current text

1.0 Introduction

This appendix is a compilation of documents and correspondence completed under the Uranium Mill Tailings Remedial Action (UMTRA) Project for the Lakeview, Oregon, uranium mill tailings site. This document contains portions of UMTRA documents relevant to the UMTRA Ground Water Project at the Lakeview site.

1.1 Purpose

This appendix is a quick-reference document. Section 2 presents excerpts of documents relevant to the UMTRA Ground Water Project. The documents are in chronological order, beginning with the most recent.

1.2 Content

Each subsection includes a summary of the document, a cover sheet, table of contents for the complete document, and the portions of the document relevant to ground water.

Lakeview, Oregon,
Minutes of Public Meetings
July 1999

Two meetings were held on July 21, 1999: one with the Lake County Commissioners and one with the town of Lakeview. A quorum of county commissioners, three DOE representatives, and one State of Oregon representative from the Oregon Department of Energy were present for the first meeting. A DOE representative discussed supplemental standards, limited yield ground water, and widespread ambient contamination based on naturally occurring arsenic from the geothermal springs upgradient of the site. As a best management practice, it was recommended that IC be expanded to prevent domestic use of contaminated ground water from the former millsite. To accomplish this, DOE would fund an upgrade to a water line planned for installation along a downgradient side of the former millsite. In exchange, Lake County would require future land users in this area to obtain a tap to the new water line.

The second meeting was held at a public auditorium in Lakeview the same evening. One person from the community attended the meeting. He asked how long DOE would monitor ground water from the former millsite and was assured that DOE would monitor for at least 10 years or as long as necessary to ensure public health and safety.

Data Validation Package
Lakeview, Oregon, UMTRA Project Site
March 1999

This is a standard data package from the March 1999 sampling at the Lakeview site. It contains

A site hydrologist summary
A data package assessment
A data assessment summary
A report of suspected anomalies
UMTRA database printouts
A sampling and analysis work order and trip report.

Uranium Mill Tailings Remedial Action Ground Water Project Record of Decision April 28, 1997

The final Record of Decision (ROD) was published in the *Federal Register* (Vol. 62, No. 81). DOE prepared this ROD pursuant to the Council on Environmental Quality regulations for implementing DOE's NEPA regulations. The ROD is based on the *Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project* (PEIS) (DOE/EIS-0198), issued October 1996.

The proposed action (preferred alternative) in the PEIS establishes a consistent risk-based framework for implementing the UMTRA Ground Water Project and for determining appropriate strategies to comply with EPA ground water standards. Under the preferred alternative, DOE may use active, passive, and no-remediation strategies to comply with the standards. Before making site-specific decisions to implement the preferred alternative, DOE will prepare appropriate NEPA documentation.

If ground water at an UMTRA Project site is contaminated as a result of uranium-ore processing, and contaminant concentrations exceed background levels or EPA ground water standards, the next step is to determine whether compliance with the standards could be achieved by applying supplemental standards under 40 CFR 192.21(g). If the ground water meets EPA's definition of limited use ground water, and if supplemental standards are shown to be protective of human health and the environment, no remediation is required.

Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project October 1996

Sections 1 through 7 of the Final Programmatic Environmental Impact Statement (PEIS) are relevant to the proposed compliance strategy for the Lakeview UMTRA site and are included in this subsection. These portions describe the basis for UMTRA Ground Water Project alternatives, comparisons of the alternatives, site prioritization and risk assessment, ground water characterization and remedial actions, and environmental impacts and analysis of these impacts at each UMTRA site. The PEIS also discusses potentially unavoidable adverse environmental impacts of the preferred alternative; the short-term uses of the environment, including the maintenance and enhancement of long-term productivity at each site; and the irreversible and irretrievable commitment of resources.

DOE prepared the PEIS for the UMTRA Ground Water Project to comply with requirements of the National Environmental Policy Act (NEPA). The PEIS provides an analysis of potential effects of the ground water compliance strategies as well as potential cumulative effects. The document is a comprehensive planning and decision-making tool that provides a basis for determining the appropriate ground water compliance strategy at each UMTRA Project site, assesses the potential programmatic effects of the UMTRA Ground Water Project, and provides a tiering document for the site-specific NEPA documents. Preparation of the PEIS is consistent with the concept of tiering, in which broad-scope environmental impact statements analyze general policy or program issues to facilitate subsequent site-specific decision making. The Record of Decision issued for the PEIS further describes the purpose.

Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Lakeview, Oregon: Volume 1, Text and Appendices A through D. Final Report: Revision 1
July 1992

The Remedial Action Plan (RAP) assesses the risk for performing surface remedial action and discusses the proposed design for relocating the millsite materials to the Collins Ranch approximately 7 miles north of Lakeview. The RAP provides information to support a ground water compliance strategy at the former millsite but defers defining a specific strategy until after proposed EPA ground water standards are final. However, the report suggests that restoration of the aquifer beneath the site would not be warranted because

Except for arsenic, contaminants originating at the raffinate ponds and tailings pile are nontoxic. However, arsenic concentrations in the background geothermal ground water are greater than concentrations in the contaminant plume.
Ground water contamination is limited to a distance of about 800 feet downgradient of the site and to a depth of about 25 feet below ground surface.
Ground water within the contaminant plume is not used for any purpose.
Concentrations of site-related contaminants are expected to decrease over time because the tailings and other contaminated materials have been relocated.

Environmental Assessment of Remedial Action at the Lakeview Uranium Mill Tailings Site, Lakeview, Oregon Volume I: Text, and Appendix D: Hydrology April 1985

This subsection consists of Volume I of the Environmental Assessment (Surface EA) and the hydrologic data. These sections discuss the quality of ground water and the local hydrologic system at the former millsite and at the two proposed locations for the disposal cell. The Surface EA indicates that the uppermost aquifer is of naturally poor quality and that arsenic concentrations in samples from Hunters Hot Springs exceed all values in ground water samples at the former millsite. The document suggests that additional ground water characterization should be performed at the site before an adequate compliance strategy could be proposed. The Surface EA also discusses the high sulfate concentrations in ground water beneath and downgradient of the site. The high concentrations probably resulted from use of sulfuric acid during the milling operations.

Baseline Risk Assessment of Ground Water Contamination at the Uranium Mill Tailings Site Near Lakeview, Oregon (BLRA)
March 1996

The Baseline Risk Assessment (BLRA) addresses risks to human health and the environment from exposure to ground water contaminated by uranium-ore processing at the former millsite near Lakeview, Oregon. The assessment describes the source of contamination, the potential exposure pathways, the amount of contamination that could potentially reach people and the environment, and the health and ecological effects of exposure.

The study concluded that because ground water within the contaminant plume is not used for any purpose, there are no complete exposure pathways, and human health is not at risk. However, long-term use of contaminated ground water as a source of drinking water, especially water from the most contaminated portion of the plume, could present a risk to human health. Consequently, the BLRA recommends that site ground water not be used as drinking water in the future. The BLRA also indicates that because the source of contamination has been removed, contaminant concentrations in ground water should eventually decrease, and risk should become less with time.

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED: DRAWING NO.: U0064900-01, "PLATE 1: LAKEVIEW BASE MAP WITH 1994 PHOTO BASE"

WITHIN THIS PACKAGE... OR, BY SEARCHING USING THE DOCUMENT/REPORT DRAWING NO. U0064900-01

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