The State
of Wyoming

Department of Environmental Quality

Jim Geringer, Governor

Herschler Building • 122 West 25th Street • Cheyenne, Wyoming 82002

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May 3, 1999

Received 5/12/99

CERTIFIED MAIL, RETURN RECEIPT NO. Z 375 129 011

Orig to Findley/CF
Copy to Jane Glenn

Mr. Ernie Scott
Union Pacific Resources - Mineral
2515 Foothill Blvd., Suite 300
Rock Springs, Wyoming 82901

Re: Long-Term Ground Water Quality Concerns based on
Review of the Application for Alternate Concentration Limits (ACLs)
TFN 3 3/122

Dear Mr. Scott:

The Land Quality Division (LQD) of the Wyoming Department of Environmental Quality (WDEQ) has reviewed the information submitted by Bear Creek Uranium Company (Bear Creek) on their ground water restoration efforts to date and long-term plans for ground water restoration and monitoring. The information reviewed included the application for ground water ACLs submitted to the Nuclear Regulatory Commission (NRC). The NRC granted Bear Creek's request to terminate active restoration efforts at the site and the request for ACLs for radium, uranium, and nickel.

The LQD does not accept applications for ACLs in ground water, in part because the LQD does not believe such an approach is sufficiently protective of ground water resources in rural areas. However, the LQD does concur with the NRC's decision that active restoration efforts are no longer necessary at the site, *provided* the following safeguards are implemented:

- in Section 9, Township 38 North, Range 73 West, the land owned by Bear Creek, which is not already incorporated into the proposed U.S. Department of Energy (DOE) Long-Term Care Boundary, must be incorporated within that boundary;
- periodic ground water sampling along the two delineated flowpaths, as well as at the 'ends' of the flowpaths;
- analyses of the above samples for nonradiological parameters, such as sulfate and chloride, as well as the parameters for which ACLs were approved; and
- periodic review of well permits in the Wyoming State Engineer's Office to evaluate the changes in water demands in the vicinity of the site.

The LQD believes these safeguards will ensure that ground water resources, even close to the Long-Term Care Boundary, will remain within 'class-of-use' standards developed by the Water Quality Division of the WDEQ and that there will be a 'buffer' and opportunity to implement additional safeguards should long-term water quality predictions prove inaccurate.

A copy of LQD's review, which provides more detail about the safeguards, is attached. For permitting purposes, please submit a letter outlining Bear Creek's commitment to implement these safeguards. This letter will be incorporated into the Permit 399 Adjudication File to ensure that these issues are addressed during LQD bond release and title transfer to the DOE. We would be happy to meet with you and NRC and DOE personnel to discuss these safeguards and permitting issues, if necessary.

If you have any questions or need additional information, please call.

Sincerely,

Georgia A. Cash
District I Supervisor

cc (with attachment):
Richard A. Chancellor, LQD
Mark Moxley, LQD
Jake Strohman, WQD
N. King Stablein, NRC
Jack Tillman, DOE
Milton Lammering, EPA

MEMORANDUM

TO: Georgia A. Cash, District I Supervisor
FROM: Roberta N. Hoy, Geohydrologist
DATE: May 1, 1999
RE: Review of Bear Creek ACL Application - TFN 3 3/122

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1.0 INTRODUCTION

In February 1997, the Bear Creek Uranium Company (Bear Creek) submitted an application to the Nuclear Regulatory Commission (NRC) for Alternate Concentration Limits (ACLs) for ground water, as part of the company's plan for closure of their uranium tailings impoundment in Converse County, Wyoming (Figure 1). ACLs for ground water are designed to be set on a parameter-by-parameter basis to allow variation from specific standards at a Point of Compliance (POC) while still ensuring protection of human health and the environment at a Point of Exposure (POE). Maps of the site, showing the site boundaries and the locations of the POCs and POEs accepted by NRC, are included as Figures 2 and 3. In June 1997, the NRC approved Bear Creek's request for ACLs (letter of June 30, 1997 from J. Holonich (NRC) to G. Chase (Bear Creek)).

Although the ACL application addressed standards for water quality parameters of concern to the NRC, specifically radionuclides and select toxic metals[1], the application did not address ground water quality standards for non-radiological parameters which are also of concern to the Wyoming Department of Environmental Quality (WDEQ). Therefore, in June 1997, the Land Quality Division (LQD) of WDEQ requested additional information from Bear Creek, and in June 1998, Bear Creek submitted the requested information. In the LQD's subsequent review of Bear Creek's ACL application and the additional information, several questions arose. Bear Creek was able to address these questions through various telephone conversations, meetings, and correspondence.

Based upon all of the information submitted by Bear Creek, both for this TFN and for Permit 399, the LQD believes that additional 'active' ground water restoration efforts are not necessary at this time, although Bear Creek does need to extend the northern boundary of the proposed Long-Term Care Boundary (Figures 2 and 3). This boundary encompasses the actual tailings disposal site and any additional area that will be transferred to the Department of Energy (DOE) for long-term care, including maintenance and monitoring.[2] The extension of the boundary is considered necessary by the LQD to help ensure the water quality along the northern boundary remains within the Class-of-Use standards established by the WDEQ Water Quality Division (WQD), which are included in Appendix A. It must be noted that the LQD's reasons for this decision differ somewhat from the NRC's reasons for granting the ACLs. Therefore, this review outlines some of the differences between the State and NRC reviews. This review also summarizes questions raised by the LQD during their review and Bear Creek's responses.

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[1] The radionuclides include Radium-226 and 228 and Thorium-230. The toxic metals include: Beryllium; Cadmium; Chromium; Molybdenum; Nickel; Selenium; and Uranium.

[2] The State of Wyoming had the option for accepting title to this site, once the NRC license was terminated, but declined the option. Therefore, the federal agency which will take title is the U.S. Department of Energy (DOE).

2.0 REVIEW FOCUS

The NRC's review process for ACL applications is outlined in their January 1996 Staff Technical Position Paper titled "Alternate Concentration Limits for Title II Uranium Mills". The LQD's concerns in review of mine-related ground water issues are outlined in the Wyoming Statutes, LQD's Rules and Regulations, and general guidelines (e.g., Guideline 8 - Hydrology).

2.1 Focus of the LQD Review. The LQD's primary concern in this review is that the long-term water quality in the vicinity of this site support proposed post-mining land uses. The land use within the Long-Term Care Boundary will be controlled by the DOE, once the NRC's requirements for site closure have been met. However, the LQD believes that land use outside this boundary should not be restricted. The available water supply, even close to the boundary, should be of sufficient quality to support the same uses the water was used for prior to tailings disposal and any other uses for which the water could have been used prior to tailings disposal, based on WQD Class-of-Use standards.[3] Therefore, LQD considers the primary ground water restoration goal to be baseline conditions and the secondary goal to be 'class-of-use'. The prior land use at this site, and the long-term land use proposed by Bear Creek outside of the Long-Term Care Boundary, is livestock and wildlife grazing.

Another LQD concern is that the technical support is adequate for the proposed ACLs and termination of active ground water restoration efforts. Many mining-related activities in Wyoming began before, or about the time, regulations were developed for site characterization and reclamation. Therefore, characterization of the pre-mining ('baseline') site conditions and conditions during the early stages of tailings disposal are generally limited. As a result, the predictions of long-term ground water conditions are often based on assumptions about site conditions before and during tailings disposal. In addition, the predictions must also be based on 'simplified' conditions because of mathematical limitations. Therefore, the LQD considers evaluation of the assumptions and conditions on which the predictions are based a critical aspect of the review.

2.2 Differences between LQD and NRC Reviews. As noted in the first section, the parameters of concern to the federal and state agencies differ. Other differences also occur, most of which are attributable to three factors: (1) the predominant rural setting in Wyoming; (2) the anti-degradation provisions of the Wyoming statutes; and (3) water rights concerns. For example, with respect to the first factor, the LQD has not considered risk assessment a suitable approach for ground water issues to date because the LQD does not believe the available risk assessment methods adequately address items such as: low population; unrestricted future use; and environmental versus human risks. With respect to the second factor, the LQD has not considered natural attenuation, when it is dependent *solely* on dilution, as a suitable reclamation approach. Similarly, with respect to water rights, the LQD has not considered reliance solely on state institutional controls, such as restrictions on well permits from the Wyoming State Engineer's Office, as a suitable approach.

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[3] This is similar to the approach outlined on Page 8 of NRC's Position Paper, which states that "the licensee cannot rely on natural flushing beyond the POE to...attenuate contamination...."

3.0 BEAR CREEK SITE CONDITIONS & PREDICTIONS

The Bear Creek Uranium Company (BCUC) site is in Converse County, about 60 miles north-northwest of Douglas, Wyoming (Figure 1). Of the nine sites in the State regulated under Title II of the Uranium Mill Tailings Radiation Control Act (42 USC §7901 *et seq.*), this is one of the two youngest sites. Mill operations began in 1977 and were shut down in 1986.

Use of the mill tailings pond began in 1977, and seepage from the pond was first noted in early 1978. In 1979, a seepage control dam was installed about 600 feet downstream of the tailings dam, and a 'pump-back' system was started to recover seepage and return it to the tailings impoundment for evaporation. Subsequent efforts included pumping of wells downgradient of the tailings dam to recover seepage, and pumping of wells completed in the tailings sand to dewater the tailings. The water recovered from these wells was evaporated, through various enhanced evaporation systems, on top of the tailings. An NRC requirement for a Corrective Action Plan, which was also based on a 'pump-back' system and tailings dewatering, was implemented in 1986 and operated until 1996. Clay capping of the tailings began in 1988, and by 1991, the tailings were capped and water from the recovery system was evaporated in clay-lined ponds on top of the tailings, significantly improving the dewatering rate of the tailings.

Well locations in the vicinity of the tailings are shown on Figure 3. The hydrogeologic setting of the site is briefly described first to provide reference for the subsequent discussions. The questions that arose about the Bear Creek setting are then described.

3.1 Overview of Hydrogeologic Conditions. The Wasatch Formation (Wasatch) underlies the Bear Creek site, although relatively thin deposits of alluvial material overlie the Wasatch along surface water drainages. Three sandstone layers of importance in the upper portion of the Wasatch in this area include, from shallower to deeper, the K Sand, the N Sand, and the Ore Sand. The Wasatch is in turn conformably underlain by the Fort Union Formation.

The Ore Sand is separated from the shallower sands by claystones and siltstones (Figure 4). Hydrogeologic and water quality data collected throughout the area during the Bear Creek operations indicates this material is an effective aquitard. (Concerns about the sulfate concentrations in Well MW-2, an Ore Sand well, are discussed in the next section.) In addition, there are no indications that mining activities have created communication through the aquitard in the potential area of impact of the tailings. Therefore, only the sandstone layers in the Wasatch above the Ore Sand were considered in this review.

The N-Sand ranges from about 5 to 50 feet thick in the vicinity of the tailings. Although the N-Sand is separated from the tailings by siltstones and claystones, a lens of "highly weathered sandstone" beneath the northeast portion of the tailings dam cut-off trench allowed for leakage from the impoundment into the N-Sand and alluvium along the Lang Draw Flowpath and into the N-Sand along the Northern Flowpath.[4] (Wells MW-12 and MW-74 are the POCs along on the Lang Draw and Northern

[4] The leakage underneath the cut-off trench is discussed in detail in Appendix A (Page A3-2) of the November 1981 Application for Permit Revision 399-R3, although the labeling scheme for the various sands, e.g., N-Sand, was not used.

Flowpaths, respectively (Figure 3).) The K-Sand ranges from 5 to 40 feet thick in the vicinity of the tailings. It is a limited path for ground water flow because: it has been removed by erosion along Lang Draw; is of limited areal extent; and is generally above the level of the tailings. Alluvial deposits are on the order of 20 to 40 feet thick along Lang Draw.

3.2 Questions about the Site Conditions & Predictions. To date, the LQD has reviewed the hydrogeologic conditions at four of the nine Title II tailings disposal sites (including the Bear Creek site) in the State. In these reviews, the LQD has relied heavily upon evaluation of graphs of concentration versus time for select parameters to determine if historic changes in water quality support the assumptions and predictions about site conditions. To assist the LQD in these evaluations, Bear Creek provided water quality data electronically. In the review of the information provided by Bear Creek, including the electronic data, the LQD questioned three aspects of Bear Creek's conclusions. First, Bear Creek indicated that the ground water quality in the aquifers above the Ore Sand was Class IV (Industrial) rather than Class III (Livestock). Second, the concentration histories in individual wells raised concerns about Bear Creek's interpretations of current contaminant extent. Third, the LQD was concerned about how 'conservative' Bear Creek had been in predicting long-term water quality conditions. The resolution of these questions are outlined in the following sections.

4.0 EVALUATION OF 'BASELINE' WATER QUALITY

In reviewing Bear Creek's ACL application and the supplemental material, LQD had several questions about how 'baseline' water quality was established for the site. Ideally, the baseline water quality should be determined from ground water sampling of all potentially affected aquifers on and in the vicinity of the site prior to any impacts by mining/milling activity. However, many tailings sites were in place before regulations requiring collection of such information. The Bear Creek site was put into use when such regulations were being developed; therefore, at this site, a limited amount of pre-mining information is available.

After mining/milling activities have started, different methods can be used to acquire or augment baseline water quality data. In this instance, the LQD has relied upon the water quality data collected before mining/milling activities started, as well as data collected after mining/milling activities started, as long as it was evident that the activities had not impacted the wells from which the data was collected.

4.1 Baseline Wells. Baseline information for all the aquifers at this site is limited not only because of the age of the site, but also because of the remoteness of the site. Initial baseline evaluations (e.g, the June 1977 Environmental Impact Statement) relied on collection of data from existing wells, which were few in number. Of the eleven wells which were sampled prior to mining or milling activities (the 'GW' wells), all but two (GW-5 and GW-15) were completed in the Ore Sand.[5] The two wells completed in shallower deposits are in the general vicinity of the Bear Creek site - Well GW-5 is about 3 miles north-northeast of the tailings, and Well GW-15 is about 1.5 miles northwest of the tailings (Figure 2). These wells are considered to be completed in the N-Sand and Alluvium, although

[5] Note - Sites GW-11, 12, 13, & 14 were surface water sampling sites.

not necessarily in direct connection with deposits near tailings. Three wells installed in 1976 (Wells MW-1 through MW-3) were also completed in the Ore Sand. No other wells were installed in the vicinity until after mining/milling activities began.

In their evaluation, the NRC relied upon data from Well MW-9. This well is more representative of the shallow conditions in the immediate vicinity of the tailings. However, this well was not installed until after the tailings dam was in place. In addition, due to its proximity downgradient of the tailings, it was eventually impacted by the tailings leakage, based on the water quality changes in the well in early 1993 (Figure 5). Therefore, only the earlier data from this well is considered potentially representative of baseline conditions.

4.2 Baseline Class-of-Use. Ground water is classified by the WQD on the basis of use and, if the water is not in use, then available water quality data is averaged and compared with WQD standards (Appendix A). Review of the well permits for Wells GW-5 and GW-15, available information on Well GW-5, and comparison of the water quality data from Wells GW-5, GW-15, and MW-9 (early data only) indicates that the water in the shallow deposits meets Livestock Class-of-Use (Class III) standards. This differs from Bear Creek's assessment of the classification (Class IV - Industrial) for the following reasons.

First, the permits for the two wells (which are included in Appendix B) indicate that the water was used for livestock watering. Both wells were eventually abandoned because of the unreliable quantities of water that could be produced from the wells and the availability of more water of better quality from deeper deposits.[6] However, the Class-of-Use determination does not generally take the reliability of the water supply into account, only the quality of the water. Second, the water quality data does not indicate Class III criteria are consistently exceeded in the available data from Wells GW-5, GW-15, and MW-9. For example, the laboratory methodologies and detection limits for some parameters, such as mercury, have improved so earlier data is less precise. In addition, natural variability of the water quality is taken into account by averaging available data. Even though one or two sample results for a specific parameter may exceed a Class-of-Use criteria for that parameter, the overall average may be less than that criteria, and the classification is based on the average. Variability may be particularly significant in shallower deposits due to proximity to outcrops and recharge areas, or in the case of Well MW-9, completion of the well through a lignite stringer.

5.0 CONTAMINANT EXTENT

During the review, the LQD had several questions about changes in contaminant concentrations over time in specific wells. In several cases, as outlined below, the changes could be differentiated from predicted (or expected) changes due to well-specific factors, such as changes in sampling methodology or well reconstruction. In the other cases, the changes proved to be in agreement with predicted changes.

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[6] Well GW-5 was abandoned after it went dry in 1977/78, and Well GW-15 was replaced with a deeper well in 1981 (with the same well number).

5.1 Lang Draw. Concentration changes in three wells, Wells MW-9, MW-14, and MW-23, raised concern about some of the simplifying assumptions on ground water movement in Lang Draw. For example, the sulfate concentrations in Well MW-9 were relatively steady over time, while the concentrations in Well MW-14 fluctuated significantly, even though both are alluvial wells and are within about 100 feet of one another. The difference was of particular concern because these two wells are near the POC well in Lang Draw (Figure 3). However, Well MW-14 is located in a portion of the draw in which snow drifts, while Well MW-9 is located on the bank of the draw. Therefore, the fluctuations are probably due in part to variations in recharge along the draw during snowmelt. As areal recharge was not taken into account in the predictions of contaminant movement along Lang Draw, the difference between the two wells was not considered critical to the predictions. (Section 6.0 provides additional discussion of the assumptions and conditions used in the predictions.)

The rapid decline in the sulfate concentration in Well MW-23 was also of concern in case it represented movement of a 'slug' of higher contaminant concentrations past the well (Figure 6). However, Bear Creek indicated that the change in the sulfate concentrations was due to well redevelopment. Prior to 1991, the well was hand-bailed and the samples were described as black, brackish water. After well redevelopment and changing the sampling technique, more consistent data was obtained which was comparable to other wells in the vicinity.

5.2 Northern Flow Path. Concentration increases of parameters, such as sulfate, in Well MW-43 were more rapid than would be expected from the ACL evaluation, potentially indicating the ground water flow rates used in the predictions were too low (Figure 7). However, the initial concentration changes in this well are attributable to a spill at the mill site; therefore, they cannot be used as a 'tracer' of contaminant movement from the tailings.

5.3 Lateral Migration. The limited lateral migration is best illustrated by wells along the western edge of the tailings, in particular Wells MW-56, MW-57, MW-58, MW-60, MW-61, and MW-64 (Figure 3). Wells MW-56 and MW-57 are both K-Sand wells completed within the tailings impoundment area. Well MW-58 is a K-Sand well just west of Wells MW-56 and MW-57, but outside of the tailings impoundment area. Water levels in both Wells MW-56 and MW-57 declined rapidly during the tailings dewatering, but the water level in Well MW-58 has remained relatively constant (Figure 8). Sulfate concentrations in all three wells are relatively low, on the order 1,000 to 3,000 milligrams per liter (mg/l), in comparison with the sulfate concentrations in the tailings solution on the order of 18,000 to 20,000 mg/l (Figure 9).

Wells MW-60, MW-61, and MW-64 are all completed in the N-Sand. Well MW-60 is just north of the tailings dam; Well MW-61 is on the northwest corner of the tailings dam; and Well MW-64 is to the west of the tailings. Water levels in all three wells have declined rapidly during the seepage recovery (Figure 10). The sulfate concentrations in Well MW-60 are the highest, on the order of 1,500 to 2,000 mg/l, and the concentrations in Well MW-61 and MW-64, which are on the order of 500 to 1,000 mg/l (Figure 11). These concentrations are an order of magnitude less than the sulfate concentrations in the tailings solution (18,000 to 20,000 mg/l) and in Well MW-77 (10,000 to 14,000 mg/l), which is an N-Sand well in the vicinity of the dam leak (Figure 3).

5.4 Ore Sand. Although the aquitard between the Ore Sand and the N-Sand was considered to be an effective aquitard, the increase in sulfate concentrations in Well MW-2 was of concern (Figure 12). The increase could be due to the influence of mining of the Ore Sand; however, it could have also been due to leakage through the aquitard in the vicinity of the well or due to poor well completion. However, there was no corresponding increase in chloride concentrations in the well. Therefore, the increase is considered to be due to the influence of mining, not due to the influence of tailings leakage.

6.0 WATER QUALITY PREDICTIONS

In the tailings site assessments that the LQD has reviewed, the long-term influence of the tailings on ground water quality has generally been predicted using a series of computer models. The series usually includes: (a) a ground water flow model to determine flow directions and rates; (b) a model of the geochemical attenuation; and (c) a chemical transport model, based upon results of (a) and (b). Within this series, a variety of approaches have been used to characterize the future site conditions for the 'set-up' of the models. Neither the NRC or LQD specify 'correct' approaches for characterizing these conditions. However, if the LQD believes the approach used is a less conservative approach than other possible approaches, the LQD considers the potential impacts of the less conservative approach. For example, in evaluating the water balance for the tailings disposal, Bear Creek used a pan evaporation value of 36 inches per year, in comparison with 42 inches per year, which is the value reported by the National Weather Service for the closest station, Casper, Wyoming. Therefore, the evaporation estimate is conservative because it potentially underestimates the evaporation, resulting in higher losses elsewhere, such as the amount of seepage from the tailings.

One condition affecting the model set-up is continued infiltration of precipitation through the tailings. The approaches used to characterize this condition range from eliminating long-term infiltration through the tailings (because of the clay radon barrier) to the more conservative approach of including long-term infiltration. Another condition is desaturation of the materials under the tailings once the tailings drain and are capped. Infiltration of precipitation outside of the tailings area is another condition that has been evaluated differently in the assessments.

6.1 Long-Term Infiltration through the Tailings. In the ground water flow model, Bear Creek has isolated the tailings from long-term infiltration from the surface (Page 19, 1st ¶, ACL Attachment 2). The LQD considered two potential impacts from this approach: (1) the long-term loading of sulfate; and (2) the acidity of the water in residual saturation. To evaluate the first impact, the LQD used the PLUME2D model to estimate the incremental increases in sulfate concentrations from leakage through the tailings. To evaluate the second impact, the LQD assumed that the acidity of all of the pore fluid in residual saturation would need to be neutralized.

Even without considering leakage through the tailings, the LQD was concerned that the conditions at the Long-Term Care Boundary proposed in the ACL application (Figure 3) would not be in compliance with LQD's goals for baseline conditions or, at a minimum, 'class-of-use' conditions at the boundary. The concentrations of the ACL parameters, radium, uranium, and nickel, were of some concern; however, the potential concentrations of nonradiological parameters, such as sulfate and chloride, were of greater concern.

Radium baseline concentrations in Wells GW-5, GW-15, and MW-9 were less than the WQD Livestock (Class III) standard of 5 picoCuries per liter (pCi/l); however, predicted concentrations at the POEs ranged up to about 15 pCi/l, and the proposed ACL is 46 pCi/l.[7] While the highest predicted nickel concentration at the POEs was 0.055 mg/l, the requested ACL is 3.8 mg/l, which is higher than baseline nickel concentrations. Assuming the 'early' nickel concentrations in Well MW-9 are representative of baseline conditions, the highest nickel concentration was 0.07 mg/l, and Bear Creek used a value of 0.05 mg/l for baseline.[8] Predicted uranium concentrations at the POEs and the requested ACL for uranium were within baseline and 'class-of-use' criteria.[9]

Concentrations of sulfate at the POC wells, particularly along the Northern Flowpath, appear to be increasing. In addition, the distance from these wells to wells with much higher sulfate concentrations (e.g. Well MW-77) are generally less than 1,000 feet. Therefore, even without incremental leakage through the tailings, pumping of a well installed near the outside of the Long-Term Care Boundary proposed in the ACL application could 'pull' contamination from within the boundary. With incremental leakage, the potential for exceeding the WQD Class-of-Use criteria increased for parameters such as sulfate, as illustrated by the PLUME2D model runs (Appendix C). In addition, if it is assumed that the acidity of the residual tailings fluid would need to be neutralized, then the potential for exceeding the WQD criteria for parameters influenced by acidity (e.g., metals) is increased (Appendix D). However, if the Long-Term Care Boundary were moved to the Bear Creek property line in Section 9 (Figure 2), then the potential for exceeding the WQD Class-of-Use criteria is substantially reduced.

6.2 Unsaturated Zone beneath the Tailings. Most of the assessments, including Bear Creek's, acknowledge that the materials under the tailings will eventually be unsaturated, and recent water level measurements indicate the water level has declined below the tailings in some locations. However, the more conservative approach, i.e., assuming continued saturation, is used. Therefore, predicted migration rates and quantities should be more than actual rates and quantities.

6.3 Long-Term Infiltration outside the Tailings. The transport model used by Bear Creek is a one-dimensional model; therefore, the number of fluxes into the model is limited. Bear Creek did apply a correction to the model results to account for dilution by ground water flow from the west into the Lang Draw flowpath. However, infiltration (e.g., recharge) was not taken into account, which would further dilute the concentrations, so the transport predictions are relatively conservative (Page 22, carryover ¶ from Page 21, of ACL Attachment 2).

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[7] The WQD will take into account 'treatability' of radium up to 100 pCi/l in classification of Domestic (Class I) waters (WQD R&R Ch. VIII, §5(a)), although a similar provision has not been implemented for Class III.

[8] The WQD has only established a 'class-of-use' criteria of 0.2 mg/l for nickel for Agricultural (Class II) waters. The Environmental Protection Agency did have a Maximum Contaminant Level of 0.1 mg/l, which was subsequently remanded, for Drinking Water.

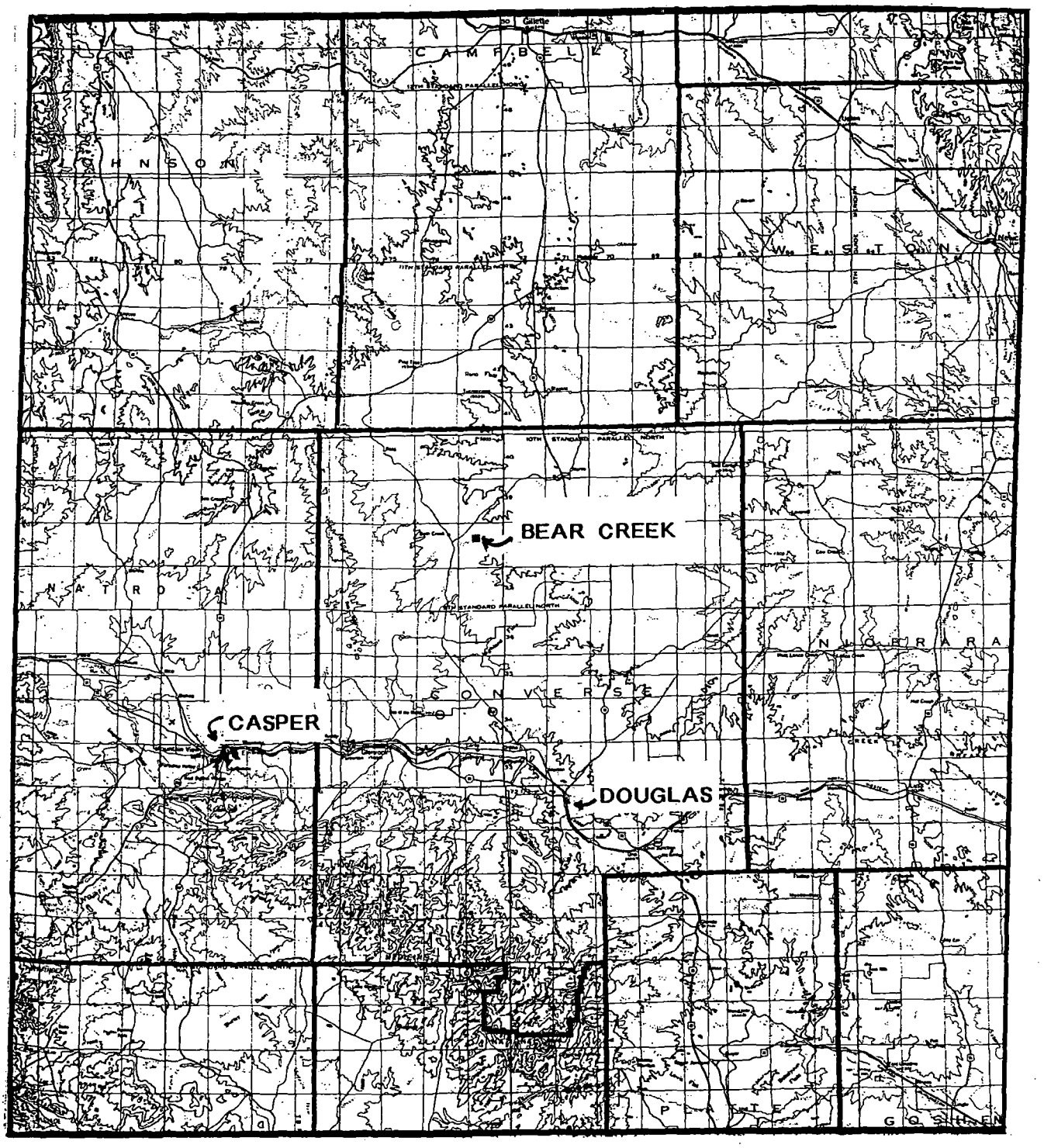
[9] The WQD standards for uranium are expressed in mg/l because metal toxicity, rather than the radioactivity, is the greater concern. The conversion factor applied is that used by Bear Creek, from 10 CFR Part 20, Appendix B, Footnote 3, Page 368 of the January 1, 1996 edition. Using this conversion, the proposed ACL concentration is about 3 mg/l, which is less than the WQD standard of 5 mg/l.

7.0 LQD Requirements

Based on the review outlined above, the LQD concurs with the NRC's and Bear Creek's determination that no additional active restoration of the ground water in the vicinity of the mill tailings is necessary at this time, although LQD's basis for this determination differs somewhat from that of the NRC and Bear Creek. LQD's primary considerations in this determination are the importance of ground water in the State and the potential for access to the contaminated ground water. LQD would prefer that the ground water even within the Long-Term Care Boundary be returned to pre-mining and milling conditions. However, the LQD also recognizes that access to this area will be restricted, i.e., the LQD believes the federal institutional controls that will be in place when the site is transferred to the DOE are sufficient to prevent access to the contaminated ground water within the Long-Term Care Boundary. However, the presence of contaminated ground water within the Long-Term Care Boundary leads to two additional concerns.

The first of these concerns is the potential for contaminated ground water to migrate outside the Long-Term Care Boundary. The second is the potential for a change in conditions along the perimeter of the boundary which could induce migration of contaminated ground water outside of the boundary. The best example of this concern would be the installation of a well near the boundary, and the gradient under pumping conditions increasing the migration rate. The LQD acknowledges that it is unlikely that a well would be completed solely in the N-sand or the Alluvium at the site boundary because the water quantities in these two units are unreliable. (For example the two older wells, Wells GW-5 and GW-15, which were completed in the shallower units were abandoned because of unreliable supply). However, the LQD wants to avoid the scenario of a landowner completing a well through a shallow contaminant plume to tap a deeper aquifer. It is also possible that a well at the boundary would be open to both shallow and deeper aquifers. Such wells are not acceptable to the SEO; however, wells are still completed in this fashion either because lack of awareness of the potential problems or because of misguided efforts to obtain as much water as possible from a single well.

The LQD believes four safeguards are necessary to ensure that contaminant movement does not extend outside the boundary. The first safeguard is incorporating additional area into the Long-Term Care Boundary, specifically the area of Section 9 currently owned by Bear Creek, to the north of the Long-Term Care Boundary proposed in the ACL application (Figures 2 and 3). This additional area will provide a 'buffer' for continued geochemical attenuation by calcium carbonate within the aquifer materials and a 'margin of error' if some of the predictions prove incorrect. The second safeguard is for ground water monitoring along the two flowpaths, preferably in at least two locations along each flowpath, as well as monitoring the 'endpoints'. This monitoring will provide information to evaluate the accuracy of the predicted contaminant movement. The third safeguard is to include analyses of 'conservative' parameters, such as sulfate and chloride, as well as parameters that should be attenuated in the aquifer. This will allow for evaluation of alternatives if it later appears that concentrations of parameters of concern to the State, as well as those of concern to the NRC, will be exceeded. The fourth safeguard is for a periodic check, such as once every ten years, of the SEO's records to evaluate the changes in water demands in the vicinity of the site. At present, this information can be readily obtained by submitting the location of interest to the SEO. This periodic check will help determine is any new demands on the local aquifers are of concern.



N

0 25 MILES

APPROXIMATE SCALE

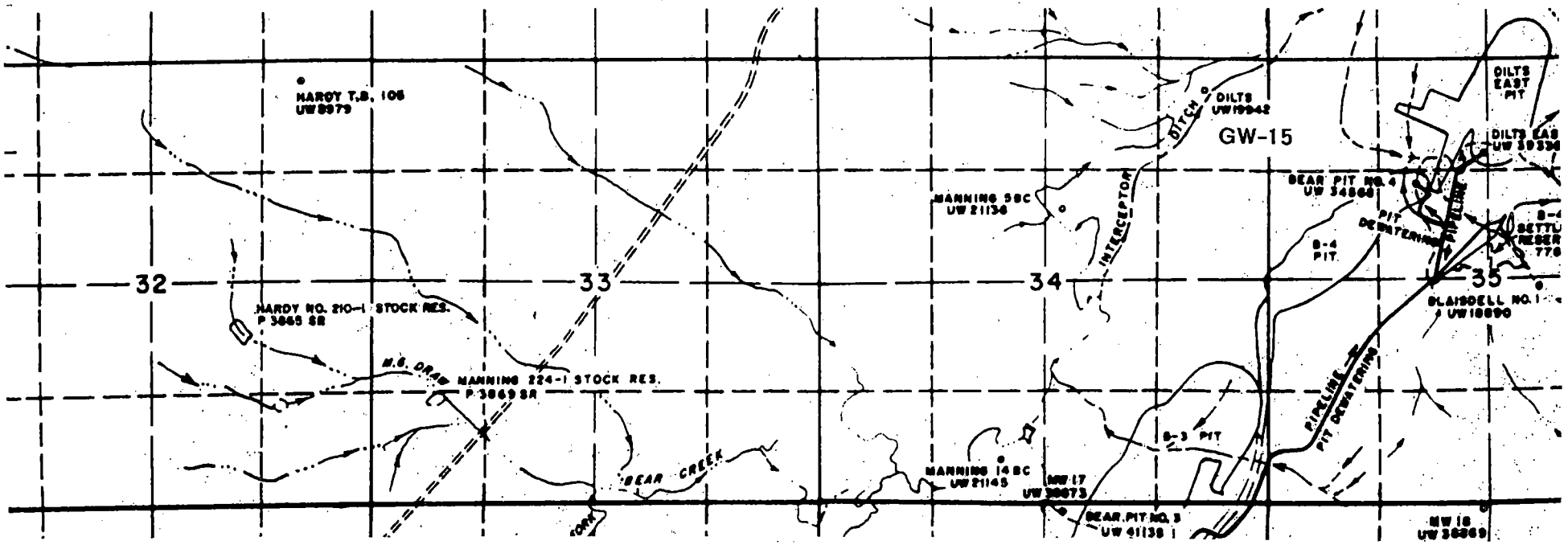
FIGURE 1

LOCATION MAP

BEAR CREEK URANIUM CO. TFN 3 3/122

PREPARED BY WDEQ/LQD 2/99

Source: Modified from Plate 2, July 1975 EIS by Dames & Moore.



N

2000 1000 0 2000

APPROXIMATE SCALE

FIGURE 2

SITE MAP

Source: Modified from Sheet 1/3 of Map in Appendix D-6 of Mill Expansion Supplement, Permit 399-A3.

BEAR CREEK URANIUM CO. TFN 3 3/122

PREPARED BY WDEQ/LQD 2/99

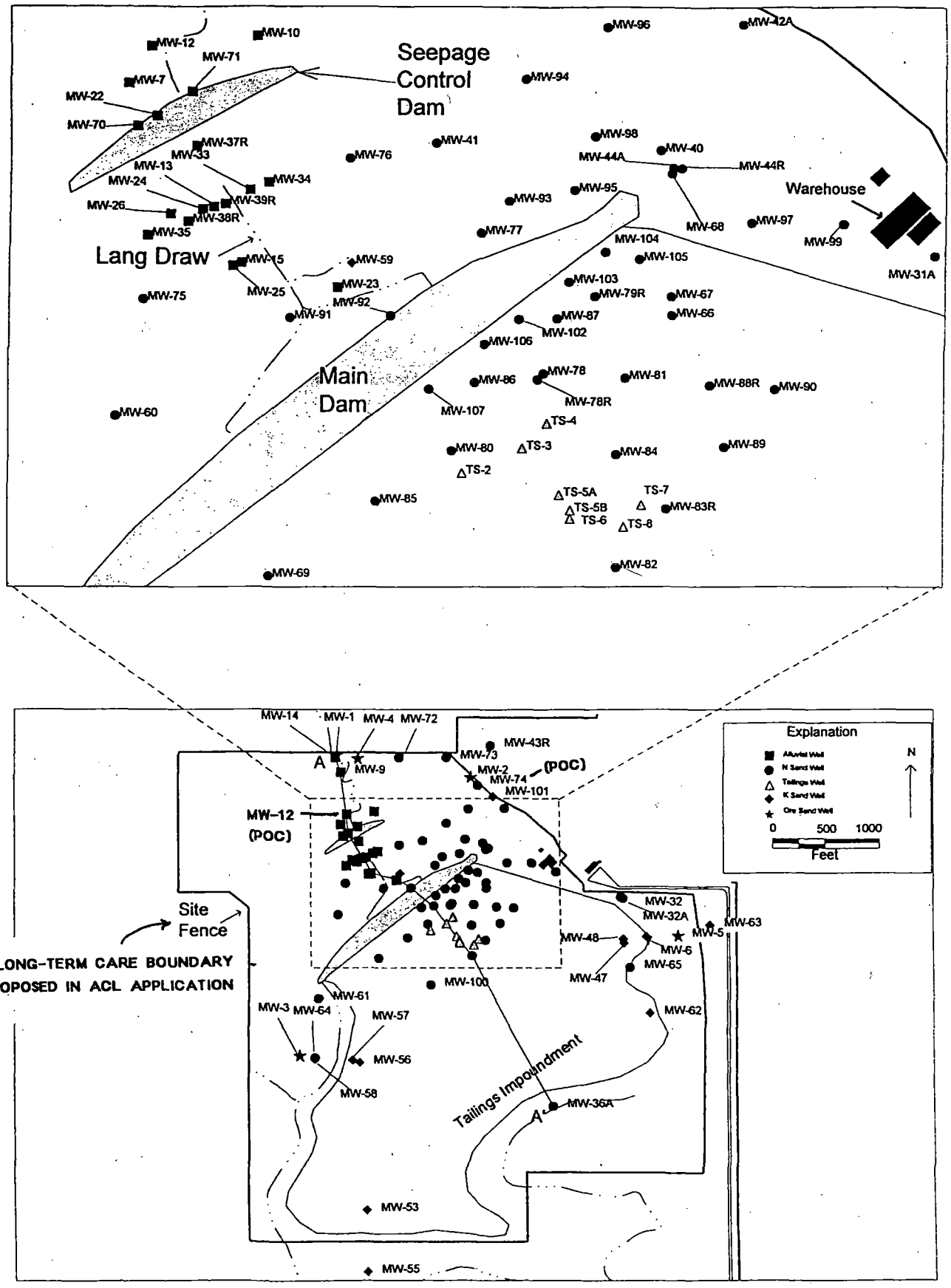
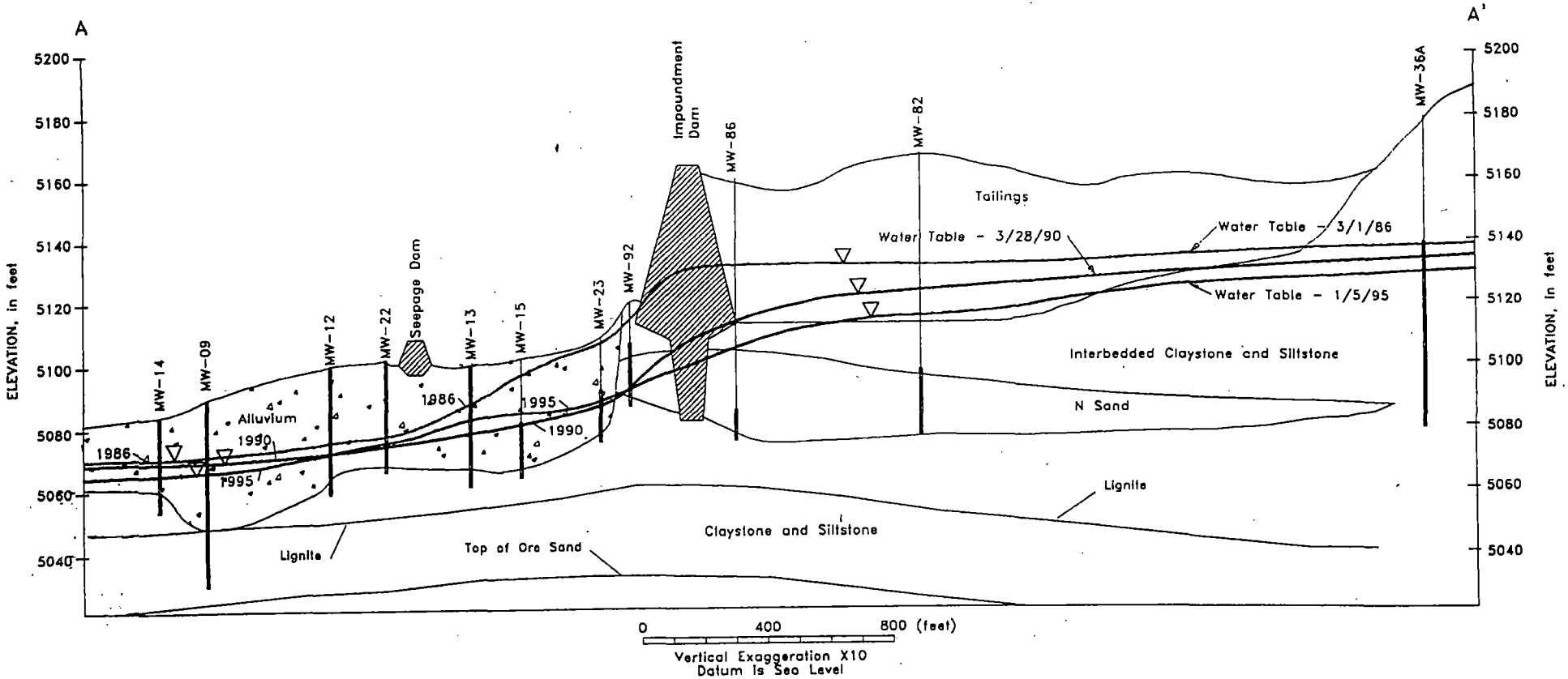


FIGURE 3

WELL LOCATIONS NEAR TAILINGS

Source: Modified from Figure 1.2.2 in Bear Creek's February 1997 ACL Application.

BEAR CREEK URANIUM CO. TFN 3 3/122



N Sand/alluvium potentiometric-surface elevations for 1986, 1990, and 1995 along geologic section A-A'.

Location of Cross-Section A-A' is shown on Figure 3.

FIGURE 4

GENERALIZED HYDROGEOLOGIC CROSS-SECTION

Source: Modified from Figure 1.2.1 in Bear Creek's February 1997 ACL Application.

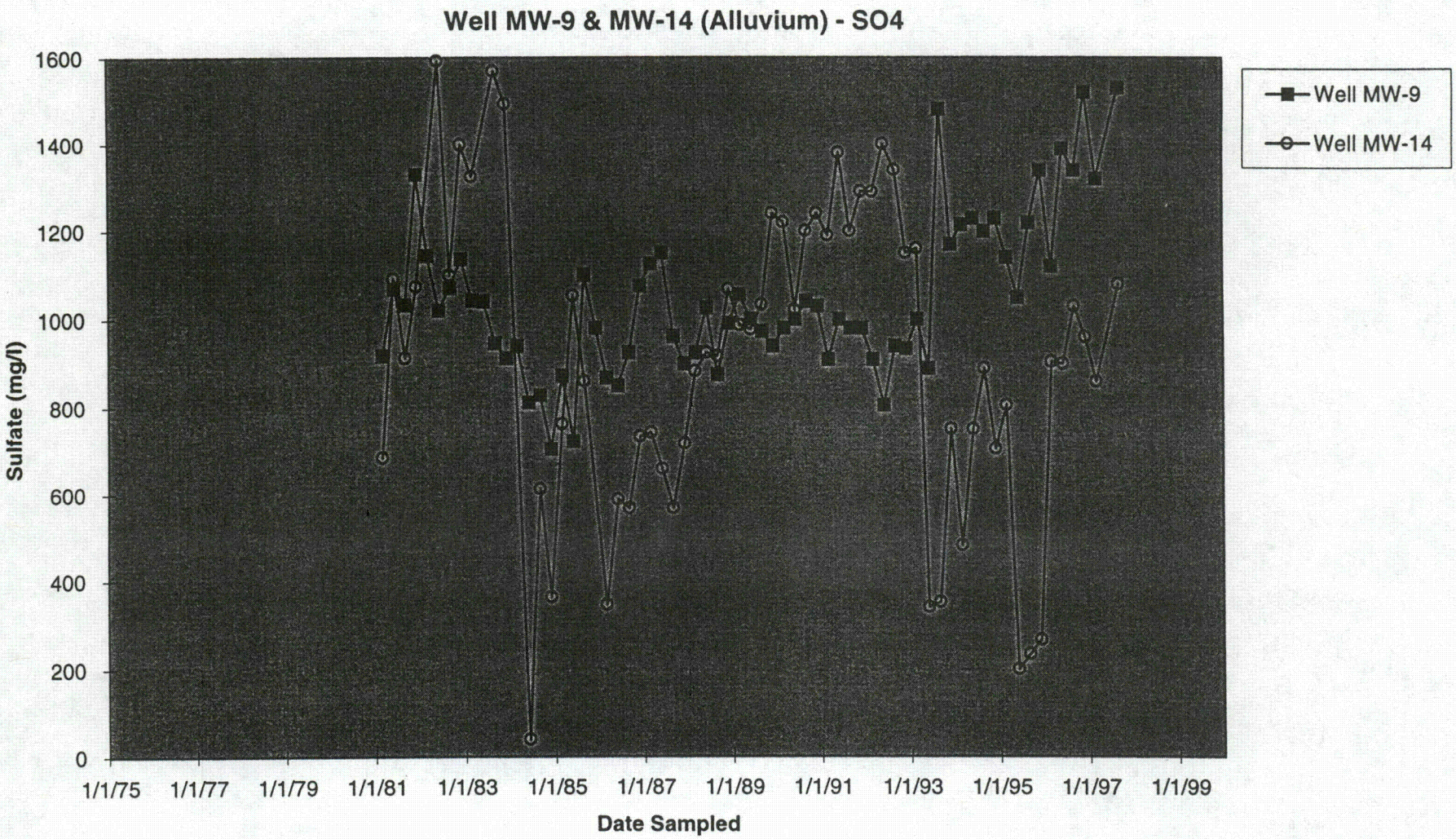


Figure 5
SO4 Concentrations vs. Time
Bear Creek - TFN 3 3/122
February 1999

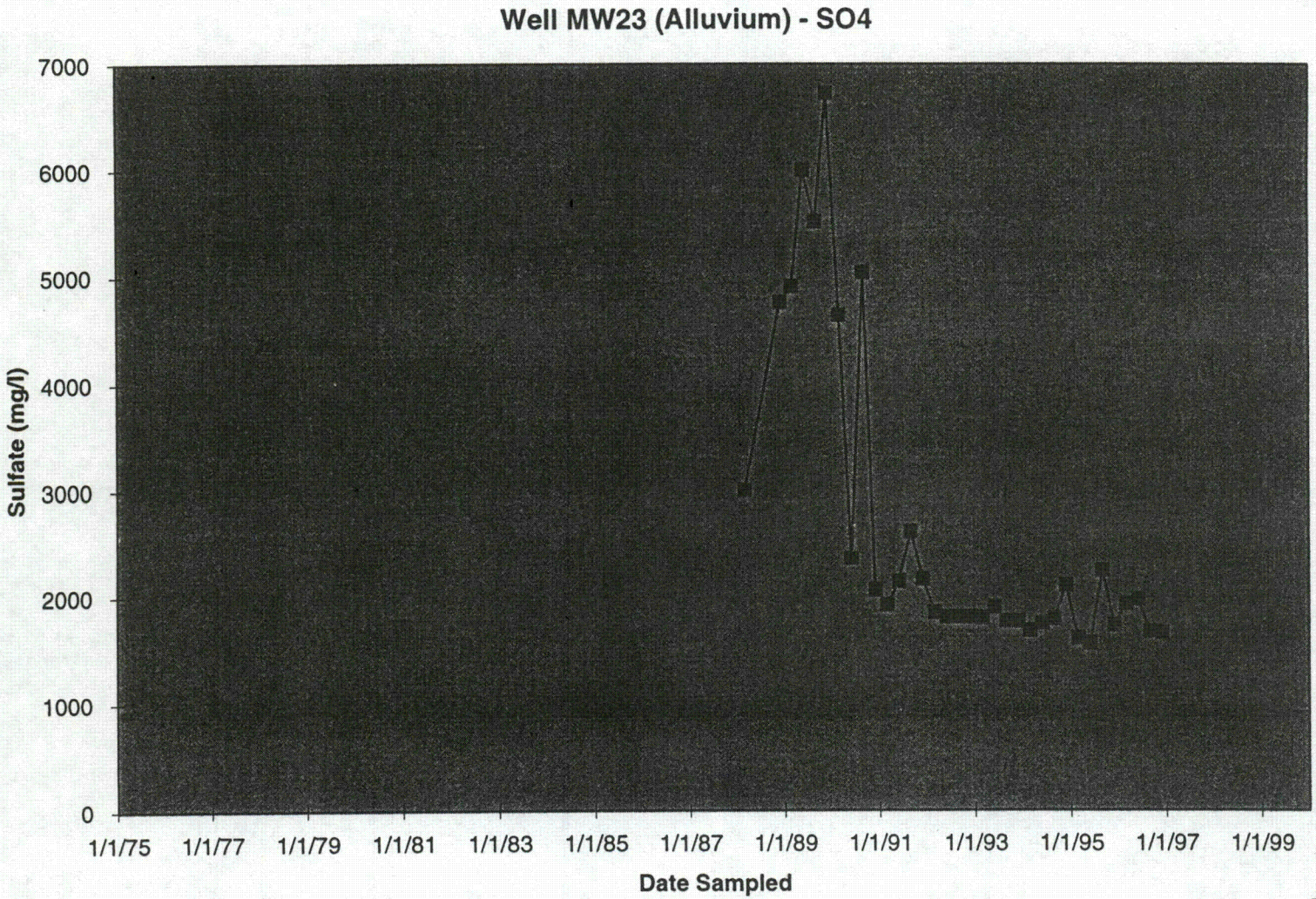


Figure 6
SO4 Concentrations vs. Time
Bear Creek - TFN 3 3/122
February 1999

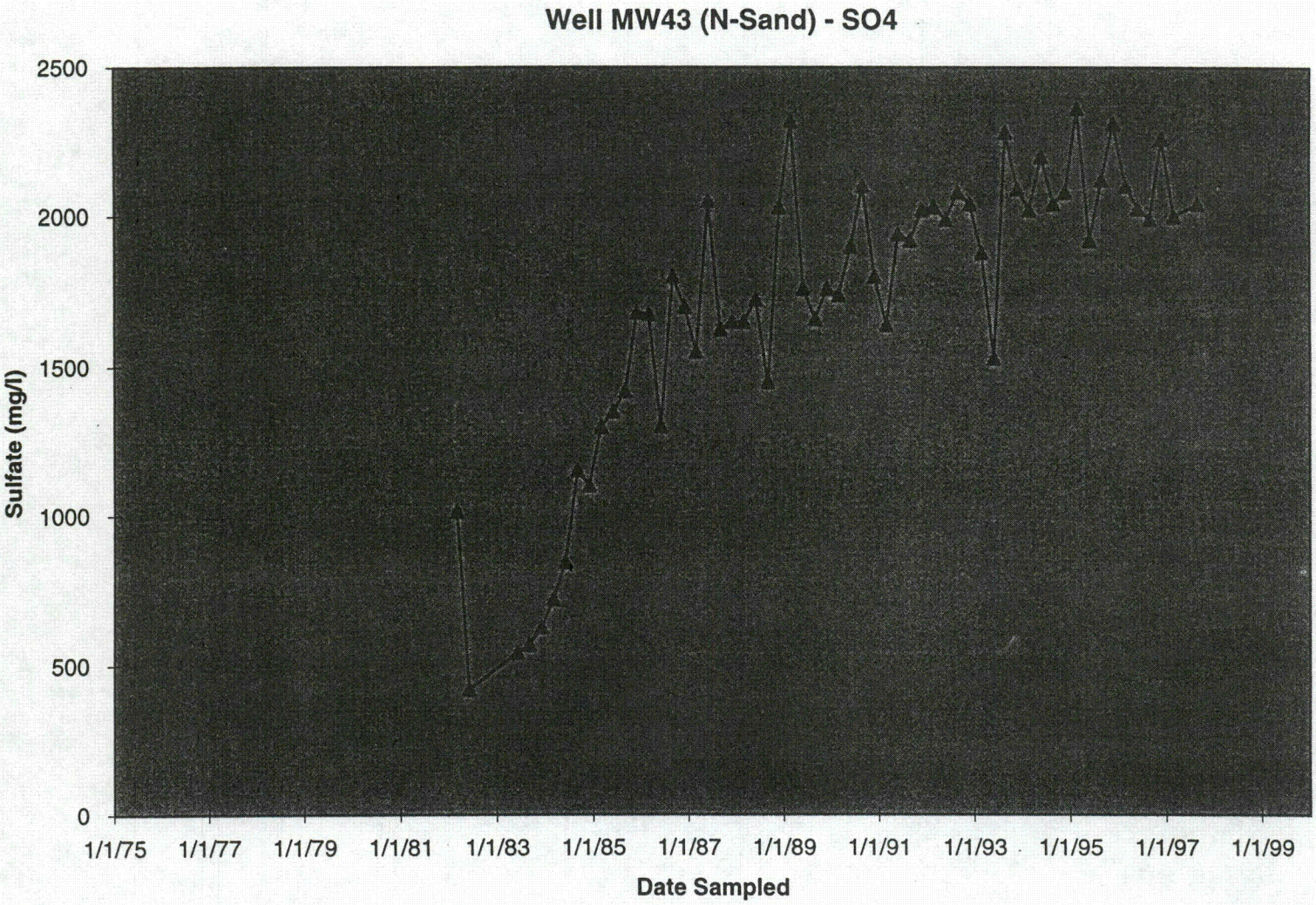


Figure 7
SO4 Concentrations vs. Time
Bear Creek - TFN 3 3/122
February 1999

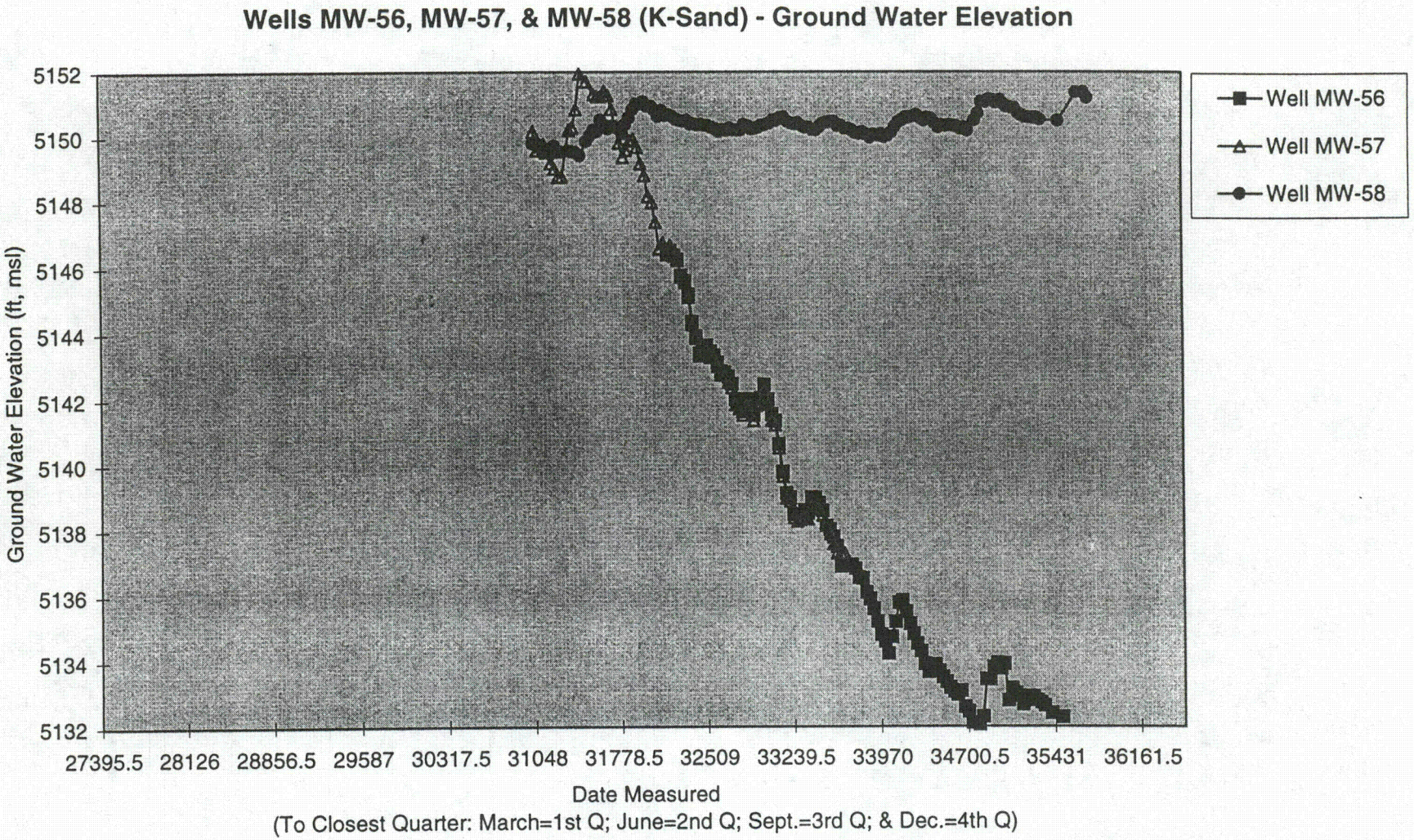


Figure 8
Ground Water Elevations vs. Time
Bear Creek - TFN 3 3/122
February 1999

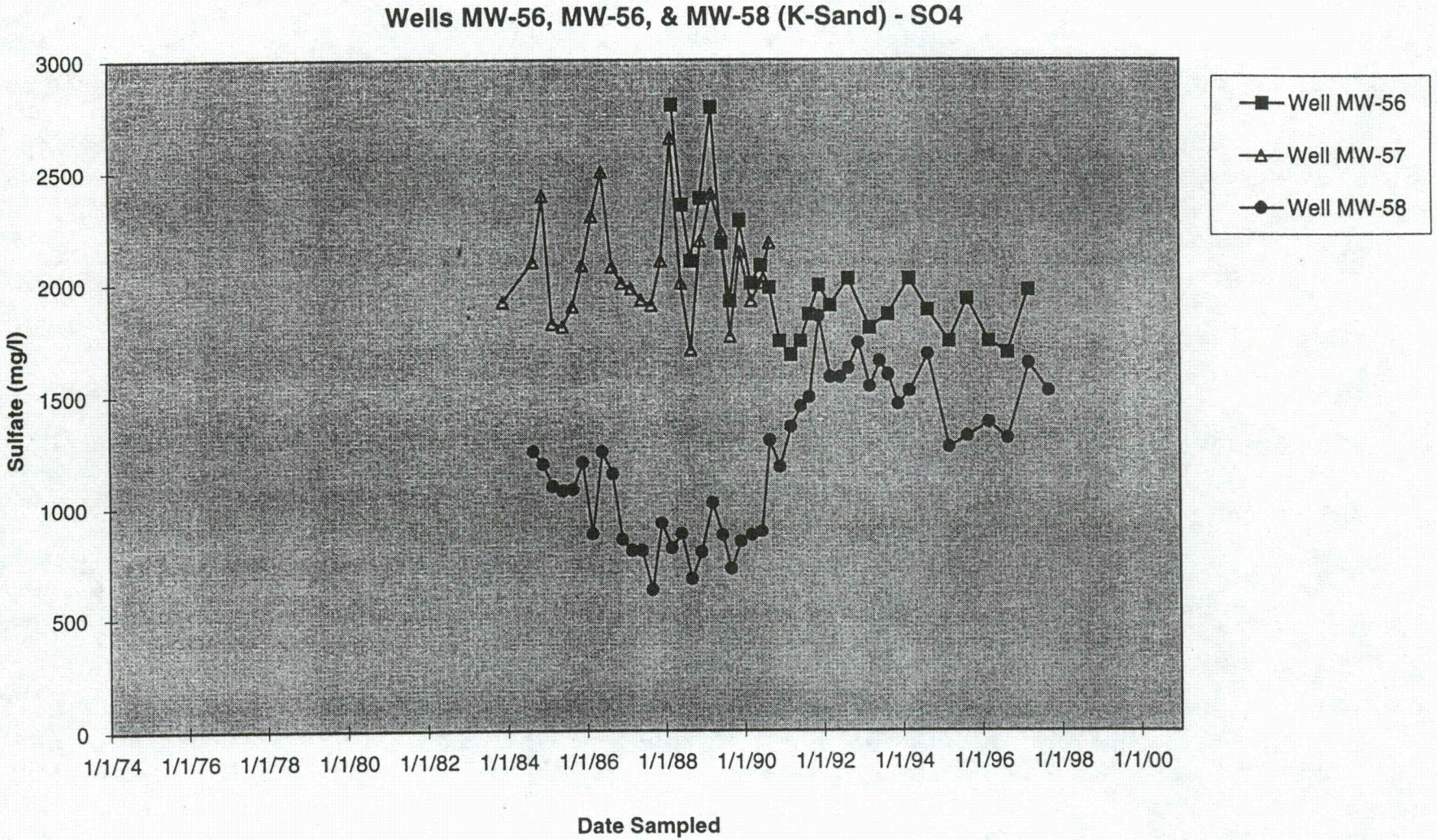


Figure 9
SO4 Concentrations vs. Time
Bear Creek - TFN 3 3/122
February 1999

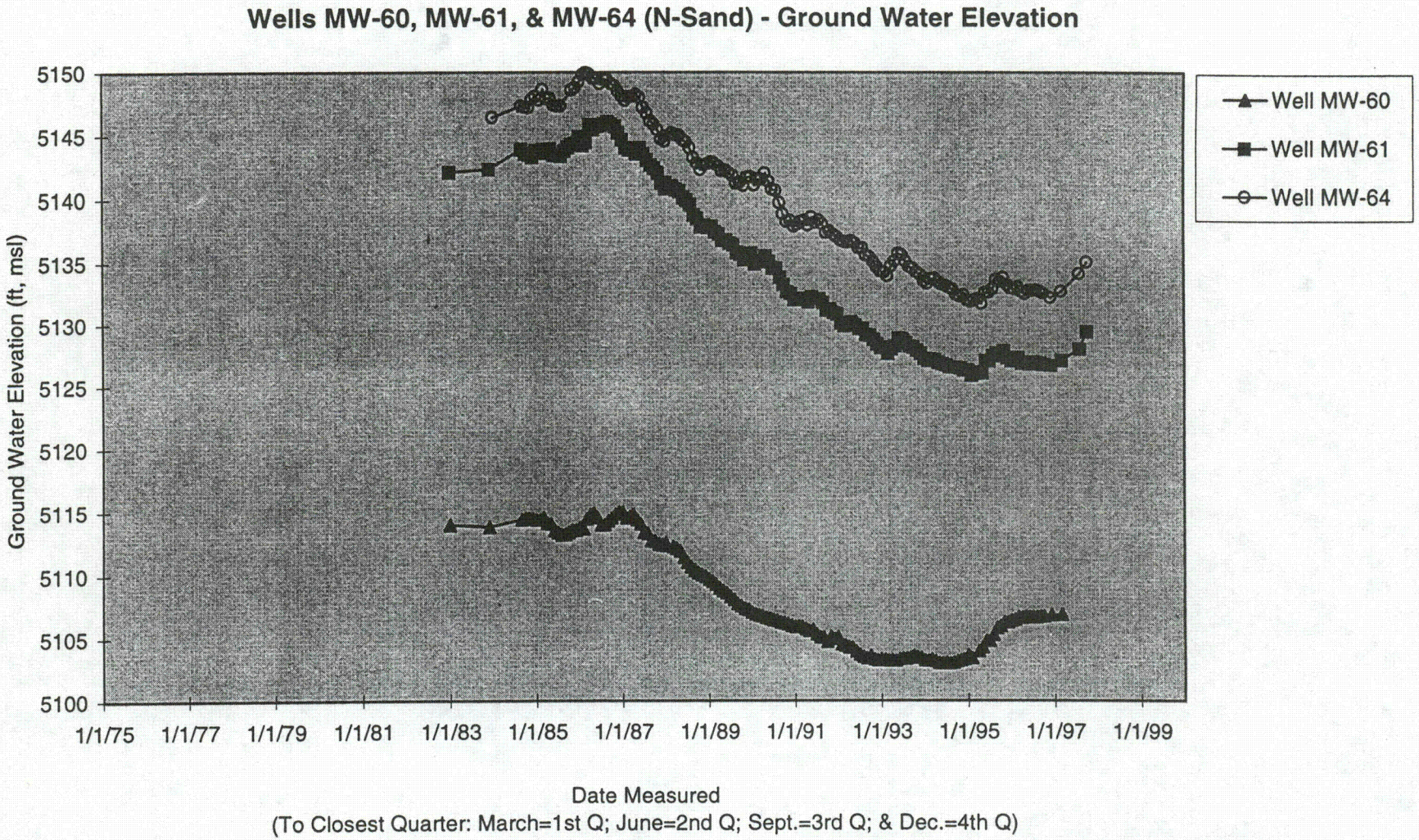


Figure 10
Ground Water Elevations vs. Time
Bear Creek - TFN 3 3/122
February 1999

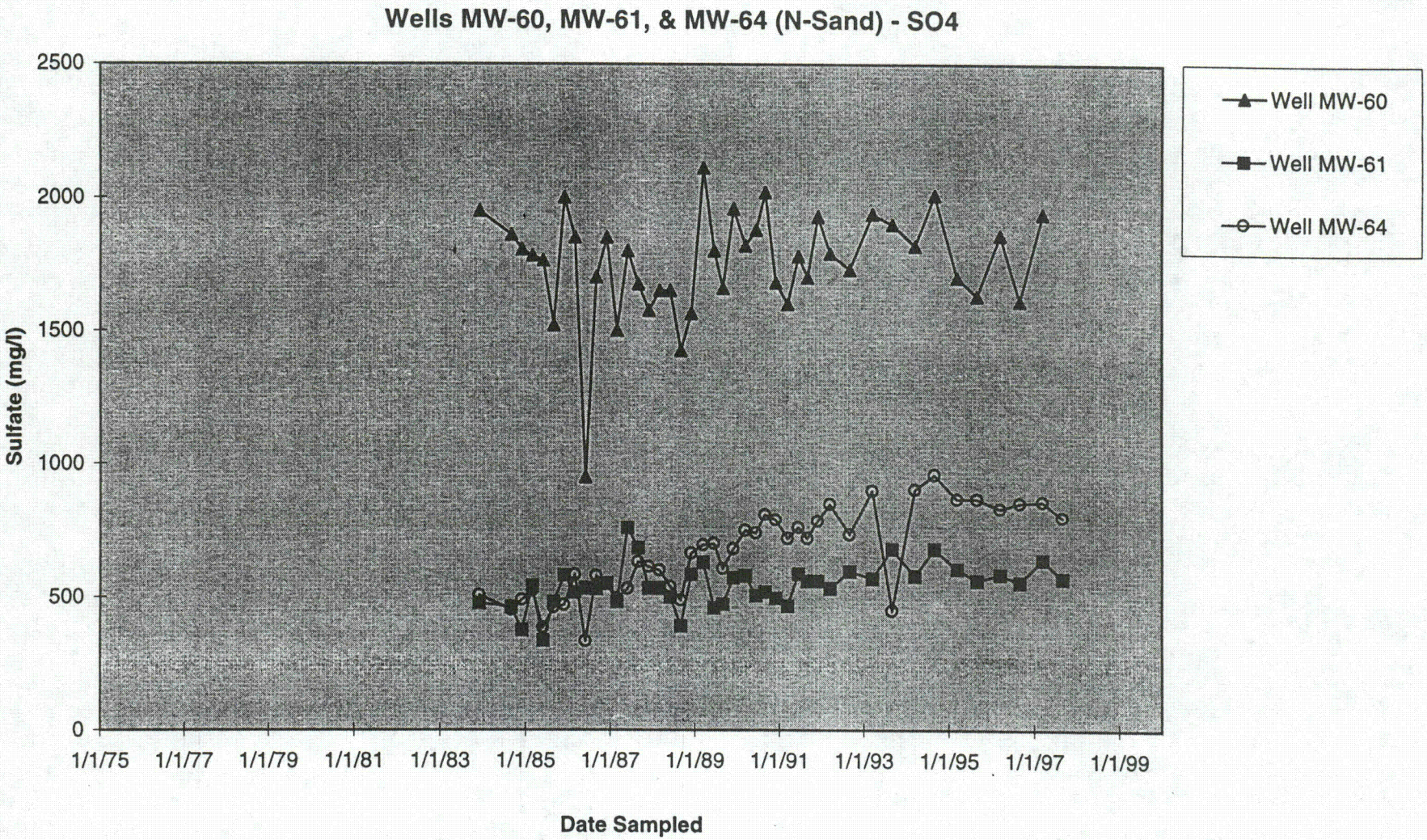


Figure 11
SO4 Concentrations vs. Time
Bear Creek - TFN 3 3/122
February 1999

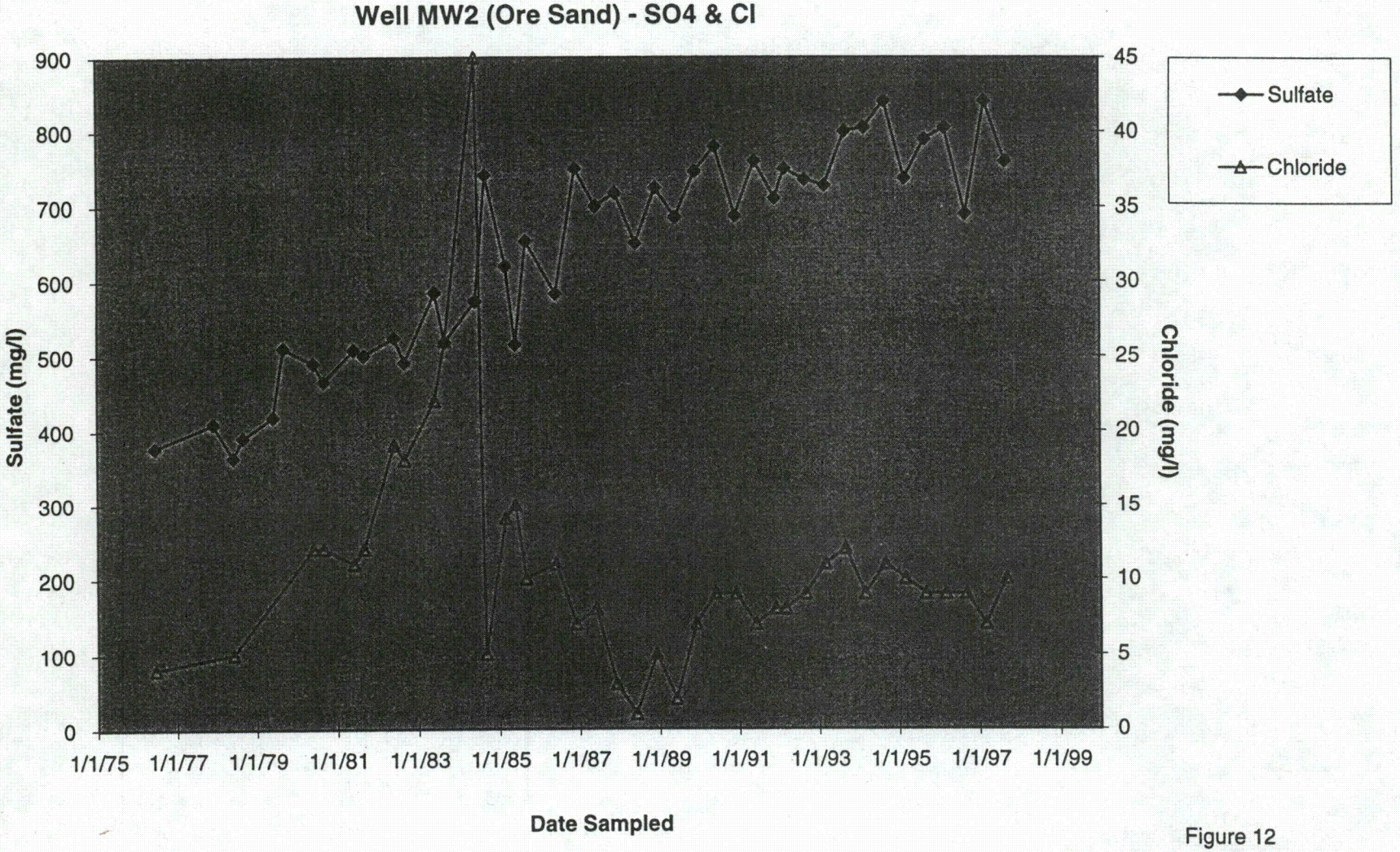


Figure 12
SO4 & Cl Concentrations vs. Time
Bear Creek - TFN 3 3/122
February 1999

Table I
Baseline Water Quality Data - Site 5 (Well GW-5)[1]
Bear Creek Uranium - Converse County, Wyoming

WDEQ Class III[2]		Pre-Mining & Pre-Milling	Pre-Milling					During Milling		
Parameter[3]	Concentration Limit (mg/l)[4]	10/24/74	6/3/75	8/23/75	3/24/76	6/22/76	9/15/76	3/23/77	6/29/77	10/4/77[5]
Metals & Radionuclides										
Aluminum	5.0	<1.0	<1.0	0.5	<0.01	0.08	--[6]	--	--	0.2
Arsenic	0.2	0.05	<0.01	<0.01	0.02	0.01	--	--	--	<0.01
Boron	5.0	0.1	1.0	0.1	0.2	0.2	--	--	--	0.8
Cadmium	0.05	<0.01	<0.01	<0.01	0.006	0.004	--	--	--	<0.001
Chromium	0.05	0.01	0.001	<0.001	0.03	<0.005	--	--	--	0.003
Copper	0.5	0.028	0.01	0.005	0.70[7]	0.02	--	--	--	0.003
Gross Alpha	15 pCi/l	8.6	--	8.6	--	5.9+/-2.8	--	0.4+/-1.8	2.9+/-2.5	13+/-7
Gross Beta	--	1	--	--	--	0+/-11	--	0+/-15	7+/-15	9+/-2
Iron	--	2.2	--	--	95	2.0	--	--	--	7.39
Lead	0.1	0.05	<0.005	<0.005	0.06	0.02	--	--	--	<0.001
Magnesium	--	58.0	--	--	59	59	--	--	--	62
Manganese	--	0.09	--	--	0.37	0.08	--	--	--	0.046
Mercury	0.00005	0.0003	<0.001	<0.002	<0.0001	<0.0001	--	--	--	0.0012
Molybdenum	--	<0.005	--	--	<0.01	<0.01	--	--	--	<0.001
Nickel	--	0.034	--	--	0.10	0.02	--	--	--	<0.01

Continued on next page...

Table I (cont'd)
Baseline Water Quality Data - Site 5 (Well GW-5)
Bear Creek Uranium - Converse County, Wyoming

WDEQ Class III		Pre-Mining & Pre-Milling	Pre-Milling							
Parameter	Concentration Limit (mg/l)	10/24/74	6/3/75	8/23/75	3/24/76	6/22/76	9/15/76	3/23/77	6/29/77	10/4/77
Metals & Radionuclides (cont'd)										
Ra-226	5 pCi/l	1.1[8]	--	1.1+/-?[8]	--	1.5+/-1.0	0.7+/-1.2	0.7+/-1.2	1.0+/-0.8	2.5+/-1.0
Selenium	0.05	<0.02	<0.01	<0.01	<0.005	<0.005	--	--	--	0.01
Silver	--	<0.01	--	--	0.004	0.003	--	--	--	<0.01
Sodium	--	57	--	--	51	50	--	--	--	50.7
Thorium-230	--	--	--	--	--	--	0.3+/-0.8	--	--	--
Uranium	5.0	<0.001	--	--	0.008	<0.002	<0.002	0.004	0.068	0.007
Vanadium	0.1	0.001	--	<0.001	<0.002	<0.002	--	--	--	0.01
Zinc	25.0	0.084	<0.01	<0.01	1.5	0.54	--	--	--	0.01
Parameters other than Metals & Radionuclides										
Alkalinity	--	268	--	--	196	270	--	--	--	293
Ammonia	--	<0.05	--	--	<0.1	<0.1	--	--	--	0.11
Bicarbonate	--	327	--	--	196	270	--	--	--	293
Calcium	--	329	--	--	315	370	--	--	--	316
Carbonate	--	0.0	--	--	0	0	--	--	--	0

Continued on next page...

Table I (cont'd)
Baseline Water Quality Data - Site 5 (Well GW-5)
Bear Creek Uranium - Converse County, Wyoming

Parameter	WDEQ Class III Concentration Limit (mg/l)	Pre-Mining & Pre-Milling	Pre-Milling							
		10/24/74	6/3/75	8/23/75	3/24/76	6/22/76	9/15/76	3/23/77	6/29/77	10/4/77
Parameters other than Metals & Radionuclides (cont'd)										
Chemical Oxygen Demand	--	<1	--	--	38	7.4	--	--	--	3.9
Chloride	2000.0	11.5	16	<1.0	10	12	--	--	--	13.5
Conductance (umhos/cm)	--	2080	--	--	1740	1950	2040	1650[9]	791	1830
Cyanide	--	<0.05	--	--	<0.005	0.005	--	--	--	<0.1
Dissolved Oxygen	--	3	--	--	--	--	--	--	--	--
Fecal Coliform/100ml	--	15	--	--	--	--	--	--	--	--
Fluoride	--	0.11	--	--	0.14	0.11	--	--	--	0.03
Hardness	--	1140	--	--	1030	1080	--	--	--	1124
Nitrate	--	1.22	--	--	<0.05	<0.1	--	--	--	5.6
pH	6.5-8.5	7.3	7.4	7.4	7.3	--	7.3	--	7.1	7.1
Phosphorus	--	0.08	--	--	0.11	0.02	--	--	--	<0.1
Potassium	--	17	--	--	12	12	--	--	--	11.2
Silica	--	17	--	--	10	16	--	--	--	21
Sulfate	3000.0	360	860	610	899	929	--	--	--	963

Continued on next page...

Table I (cont'd)
Baseline Water Quality Data - Site 5 (Well GW-5)
Bear Creek Uranium - Converse County, Wyoming

WDEQ Class III		Pre-Mining & Pre-Milling	Pre-Milling							
Parameter	Concentration Limit (mg/l)	10/24/74	6/3/75	8/23/75	3/24/76	6/22/76	9/15/76	3/23/77	6/29/77	10/4/77
Parameters other than Metals & Radionuclides (cont'd)										
Temperature (°C)	--	10	--	--	--	--	--	--	--	--
Total Dissolved Solids	5000.0	1680	1550	1310	1620	1720	1630	2140	--	1714
Total Suspended Solids	--	<10	--	--	92	7	--	--	--	17

[1] Date Sources: Table IV-7 in Environmental Report of July 1975 prepared by Dames & Moore, Inc. for Rocky Mountain Energy Co. and Table 2.7 in June 1977 NTIS Report PB-267 375 on Operation of Bear Creek Project, NRC Docket No. 40-8452; 6/3/75, 8/23/75, 3/24/76, 6/22/76, and 9/15/76 - 1975-76 Annual Report for Permit 399; and 3/23/77, 6/28/77 and 10/24/77 - 1976-77 Annual Report.
[2] Table I in Chapter VIII of the WDEQ Water Quality Division Rules & Regulations.
[3] The samples were not analyzed for the following Ch. VIII parameters: cobalt; nitrite; oil & grease; & strontium-90.
[4] Unless otherwise noted.
[5] Well reported as dry in 1978.
[6] "–" = No Limit or Not Analyzed.
[7] Concentration is excess of, or equal to, Ch. VIII, Class III (Livestock) criteria. However, at least for mercury, laboratory methods have improved new detection limits are less than old detection limits.
[8] Reported as Radium, so not clear if it includes just Ra-226 or Ra-226 & 228.
[9] Reported as 1,650,000, assumed units error.

Table II
Baseline Water Quality Data - Site 15 (Well GW-15)[1]
Bear Creek Uranium - Converse County, Wyoming

WDEQ Class III[2]		Pre-Mining & Pre-Milling	Pre-Milling				During Milling					
Parameter[3]	Concentration Limit (mg/l)[4]	10/24/74	3/24/76	6/22/76	9/15/76	12/22/76	3/23/77	6/29/77	9/28/77	6/6/78	6/29/79	6/4/80
Metals & Radionuclides												
Aluminum	5.0	<1.0	0.02	0.10	--[5]	--	--	--	0.5	0.2	--	<0.1
Arsenic	0.2	<0.01	<0.01	<0.01	--	--	--	--	<0.01	<0.01	<0.01	<0.01
Boron	5.0	2.0	0.19	<0.1	--	--	--	--	0.7	0.5	--	<1.0
Cadmium	0.05	<0.01	<0.004	<0.004	--	--	--	--	<0.001	<0.001	<0.01	<0.01
Chromium	0.05	0.01	0.006	0.005	--	--	--	--	0.004	0.072[6]	--	<0.05
Copper	0.5	0.030	0.02	0.01	--	--	--	--	0.021	0.002	--	<0.02
Gross Alpha	15 pCi/l	--	42+/-8	14+/-4	--	--	--	0.9+/-3.3	<2	21+/-11	0+/-4	18+/-2
Gross Beta	--	--	0+/-52	0+/-17	--	--	--	28+/-41	6+/-2	10+/-2	28+/-4	72+/-8
Iron	--	10.6	6.5	2.0	--	--	--	--	0.98	5.7	1.81	2.8
Lead	0.1	0.10	0.03	0.04	--	--	--	--	0.010	<0.001	--	<0.05
Magnesium	--	184.0	165	90	--	--	--	--	28.4	79	--	0.12
Manganese	--	0.12	0.13	0.08	--	--	--	--	0.022	0.24	0.07	150
Mercury	0.00005	0.001	<0.0001	<0.0001	--	--	--	--	0.0013	<0.0004	--	<0.001
Molybdenum	--	<0.005	<0.02	0.01	--	--	--	--	0.004	0.043	--	<0.1
Nickel	--	0.030	0.02	0.03	--	--	--	--	0.01	0.10	--	<0.04

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Table II (cont'd)
Baseline Water Quality Data - Site 15 (Well GW-15)
Bear Creek Uranium - Converse County, Wyoming

Parameter	WDEQ Class III Concentration Limit (mg/l)	Pre-Mining & Pre-Milling	Pre-Milling				During Milling					
		10/24/74	3/24/76	6/22/76	9/15/76	12/22/76	3/23/77	6/29/77	9/28/77	6/6/78	6/29/79	6/4/80
Metals & Radionuclides (cont'd)												
Ra-226	5 pCi/l	--	1.7+/-1.1	1.6+/-1.1	1.9+/-0.8	3.4+/-1.6	--	2.8+/-1.1	2.5+/-1.1	2.0+/-0.4	0+/-0.03	2.0+/-0.1
Selenium	0.05	<0.02	<0.005	<0.005	--	--	--	--	0.01	<0.01	<0.01	<0.01
Silver	--	0.02	0.0003	0.005	--	--	--	--	<0.01	--	--	95
Sodium	--	137	145	73	--	--	--	---	56.4	61	81	--
Thorium-230	--	--	--	--	0.0+/-0.7	0.6+/-0.4	--	--	--	--	--	--
Uranium	5.0	0.003	0.033	0.007	0.0007	<0.001	--	0.003	<0.001	0.012	0+/-0.009	0.016+/-0.001
Vanadium	0.1	0.022	0.001	<0.002	--	--	--	--	0.01	<0.01	<0.05	<0.03
Zinc	25.0	0.11	0.52	0.09	--	--	--	--	0.09	0.03	--	0.05
Parameters other than Metals & Radionuclides												
Alkalinity	--	304	293	270	--	--	--	--	291	--	--	280
Ammonia	--	<0.05	0.1	<0.1	--	--	--	--	1.03	0.07	--	<0.1
Bicarbonate	--	371	293	270	--	--	--	--	75.2	151	--	342
Calcium	--	680	695	525	--	--	--	--	106	630	477	412
Carbonate	--	0.0	0	0	--	--	--	--	0	0	--	0

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Table II (cont'd)
Baseline Water Quality Data - Site 15 (Well GW-15)
Bear Creek Uranium - Converse County, Wyoming

WDEQ Class III		Pre-Mining & Pre-Milling	Pre-Milling				During Milling					
Parameter	Concentration Limit (mg/l)	10/24/74	3/24/76	6/22/76	9/15/76	12/22/76	3/23/77	6/29/77	9/28/77	6/6/78	6/29/79	6/4/80
Parameters other than Metals & Radionuclides (cont'd)												
Chemical Oxygen Demand	--	69	17	8	--	--	--	--	27.7	--	--	--
Chloride	2000.0	29.1	29	12	--	--	--	--	11.0	18	--	22
Conductance (umhos/cm)	--	4400	3240	2520	2560	2000	3840	--	2250	2500	--	2500(F) 2300(L)
Cyanide	--	--	<0.005	<0.005	--	--	--	--	<0.1	--	--	--
Dissolved Oxygen	--	1	--	--	--	--	--	--	--	--	--	--
Fluoride	--	0.10	0.25	0.26	--	--	--	--	0.08	0.13	--	0.18
Hardness	--	2284	2300	1500	--	--	--	--	1462	--	1622	1645
Nitrate	--	1.20	<0.1	<0.05	--	0.7	--	--	2.0	--	2.2	<0.01
Nitrite		--	--	--	--	--	--	--	--	<0.1	--	<0.01
pH	6.5-8.5	7.0	6.9	7.2	7.4	7.5	--	6.6	7.0	7.3	7.4	8.0(F) 7.4(L)
Phosphorus	--	<0.01	0.01	0.02	--	--	--	--	<0.1	--	--	--
Potassium	--	11	13	13	--	--	--	--	9.3	8.5	--	16
Silica	--	9	8	13	--	--	--	--	16	--	--	--

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Table II (cont'd)
Baseline Water Quality Data - Site 15 (Well GW-15)
Bear Creek Uranium - Converse County, Wyoming

Parameter	WDEQ Class III Concentration Limit (mg/l)	Pre-Mining & Pre-Milling	Pre-Mining				During Milling					
		10/24/74	3/24/76	6/22/76	9/15/76	12/22/76	3/23/77	6/29/77	9/28/77	6/6/78	6/29/79	6/4/80
Parameters other than Metals & Radionuclides (cont'd)												
Sulfate	3000.0	800	2070	1340	--	--	--	--	384	1360	1425	1500
Temperature (°C)	--	10	--	--	--	--	--	--	--	--	--	13
Total Dissolved Solids	5000.0	4349	3730	2320	2150	2231	--	3520	1339	2280	2250	2362(F) 2460(L)
Total Suspended Solids	--	32	25	7	--	--	--	--	1.0	--	2466	--

[1] Date Sources: 10/24/74 - Table IV-7 in Environmental Report of July 1975 prepared by Dames & Moore, Inc. for Rocky Mountain Energy Co. and Table 2.7 in June 1977 NTIS Report PB-267 375 on Operation of Bear Creek Project, NRC Docket No. 40-8452; 3/24/76 and 6/22/76 - 1975-76 Annual Report for Permit 399; 12/22/76, 3/23/77, 6/27/77 and 9/28/77 - 1976-77 Annual Report; 6/6/78 - 1977-78 Annual Report; and 6/29/79 and 6/4/80 - 1980-81 Annual Report.
[2] Table I in Chapter VIII of the WDEQ Water Quality Division Rules & Regulations.
[3] The samples were not analyzed for the following Ch. VIII parameters: cobalt; nitrite; oil & grease; & strontium-90.
[4] Unless otherwise noted.
[5] "–" = No Limit or Not Analyzed.
[6] Concentration is excess of, or equal to, Ch. VIII, Class III (Livestock) criteria. However, at least for mercury, laboratory methods have improved and new detection limits are less than old detection limits.

Table III
Water Quality Data - Well MW-9
Bear Creek Uranium - Converse County, Wyoming
(Source: Electronic Data provided by Bear Creek)

DATE	12/1/80	3/1/81	6/1/81	9/1/81	12/1/81	3/1/82	6/1/82	9/1/82
pH		8.4	8.5		7.9			7.0
COND		1850	2250					2750
TDS		1544	1738	1803	2360	2280	1960	2150
Cl		47	56	65	94	99	137	97
SO4		918	1068	1032	1329	1143	1020	1071
NO3								
As								
Be								
Cd								
Cr								
Pb								
Mo								
Ni								
Se								
U-nat	34.4	21.7	29.1	25.0	33.2	29.1	17.6	14.9
Ra-226	1.4							0.1
Ra-228	1.33							
Th-230								
YEAR		81	81	82	82	83	83	84
Th-230		1.03				1.2	0.3	0.4
Pb-210						2.0	1.2	2.0
Ra-228								

Table III
Water Quality Data - Well MW-9
Bear Creek Uranium - Converse County, Wyoming

DATE	12/1/82	3/1/83	6/1/83	9/1/83	12/1/83	3/1/84	6/1/84	9/1/84
pH	6.9	7.0	6.7	6.9	7.2	6.7	7.2	7.2
COND	2875	2250	2500	1750	1300	1125	1100	
TDS	2088	2072	2055	1925	1560	2080	1580	1540
Cl	109	55	107	105	110	109	64	22
SO4	1135	1042	1040	946	912	940	811	827
NO3								
As			<.01	<0.004	<0.005	0.001	<0.001	0.004
Be								
Cd								
Cr								
Pb								
Mo								
Ni								
Se			<.01	<0.005	0.020	<0.001	<0.001	<0.004
U-nat	17.6	10.8	31.0	16.0	15.7	43.3	12.0	16.9
Ra-226			1.1	1.1	0.8	0.1	1.0	0.3
Ra-228								
Th-230		1.2		0.3		0.4		2.9
YEAR	84	85	85	86	86	87	87	88
Th-230	2.9	1.2	1.2	0.6	1.2	0.2	1.3	0.0
Pb-210	5.2	2.5	3.1	2.3	1.0	0.7	-0.2	0.6
Ra-228								

Table III
Water Quality Data - Well MW-9
Bear Creek Uranium - Converse County, Wyoming

DATE	12/1/84	3/1/85	6/1/85	9/1/85	12/1/85	3/1/86	6/1/86	9/1/86
pH	7.5	7.4	7.6	7.7	7.2	7.0	7.0	7.1
COND	950	1400	1575	1525	1225	1475	1550	1500
TDS	1360	1720	1870		2023	1764	1975	1601
Cl	59	77	81	99	88	75	67	58
SO4	704	872	722	1100	980	868	850	925
NO3								
As	<0.004	<0.004	<0.003	<0.004	<0.004	<0.004	<0.004	<0.004
Be								
Cd								
Cr								
Pb								
Mo								
Ni								
Se	<0.004	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001
U-nat	11.0	13.5	24.1	57.4	30.5	17.2	4.1	17.2
Ra-226	2.4	0.5	4.8	0.4	0.5	1.2	0.4	6.6
Ra-228								
Th-230		1.2		1.2		0.6		1.2
YEAR	88	89	89	90	90	91	91	92
Th-230	0.2	0.8	0.9	2.7	2.0	0.5		
Pb-210	-0.5							
Ra-228	0.7	2.3	-0.1	1.1	1.9	2.5		

Table III
Water Quality Data - Well MW-9
Bear Creek Uranium - Converse County, Wyoming

DATE	12/1/86	3/1/87	6/1/87	9/1/87	12/1/87	3/1/88	6/1/88	9/1/88
pH	7.1	7.3	7.4	7.2	7.3	7.1	7.4	7.4
COND	1700	1675	1575	1675	1525	1500	1650	1700
TDS	1950	2052	1996	1940	1904	1848	1994	1868
Cl	74	74	69	68	68	81	88	85
SO4	1075	1125	1150	962	900	925	1025	875
NO3								
As	<0.005	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Be						<0.01		
Cd						<0.01		
Cr						<0.05		
Pb						<0.05		
Mo						<0.02		
Ni						<0.05		
Se	<0.005	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001
U-nat	40.2	28.7	51.7	11.5	91.8	23.0	40.0	40.0
Ra-226	1.3	0.4	0.6	1.0	0.1	0.3	2.0	2.5
Ra-228					1.33			0.7
Th-230		0.2		1.3		0.0		0.2
YEAR								
Th-230								
Pb-210								
Ra-228								

Table III
Water Quality Data - Well MW-9
Bear Creek Uranium - Converse County, Wyoming

DATE	12/1/88	3/1/89	6/1/89	9/1/89	12/1/89	3/1/90	6/1/90	9/1/90
pH	7.4	7.4	7.3	7.1	7.1	7.3	7.3	7.3
COND	1500	1575	1750	1700	1600	1525	1500	1700
TDS	1864	2171	1930	1896	1850	1880	1836	2050
Cl	73	83	84	84	83	100	83	90
SO4	991	1055	1000	973	940	980	1000	1040
NO3	2.4	3.9	2.3	1.9	1.2	1.0	1.1	0.2
As	<0.004	<0.004		<0.002		<0.004		<0.004
Be	<0.01	<0.01		0.04		<0.01		<0.01
Cd	<0.01	<0.01		0.006		<0.01		<0.01
Cr	<0.05	<0.05		<0.01		<0.05		<0.05
Pb	0.10	<0.05		0.07		<0.05		<0.05
Mo	<0.1	<0.02		<0.02		0.02		<0.02
Ni	0.06	0.07		0.05		<0.05		<0.05
Se	<0.001	<0.001		<0.001		0.001		0.002
U-nat	11.0	224.0		106.0		46.6		44.8
Ra-226	0.6	1.1		0.4		2.3		0.4
Ra-228		2.3		-0.1		1.1		1.9
Th-230		0.8		0.9		2.7		2.0
YEAR								
Th-230								
Pb-210								
Ra-228								

Table III
Water Quality Data - Well MW-9
Bear Creek Uranium - Converse County, Wyoming

DATE	12/1/90	3/1/91	6/1/91	9/1/91	12/1/91	3/1/92	6/1/92	9/1/92
pH	7.2	7.1	7.2	7.0	7.0	7.0	7.1	7.0
COND	1600	1575	1675	1675	1400	1420	1450	1580
TDS	1846	1814	1910	1810	1640	1820	1940	1920
Cl	78	80	81	83	80	82	85	76
SO4	1030	910	1000	980	980	910	805	940
NO3	1.0	1.1	1.3	0.8	0.3	1	1	0.2
As		<0.004		<0.005		<0.005		<0.005
Be		<0.01		<0.01		<0.01		<0.01
Cd		<0.01		<0.01		<0.01		<0.01
Cr		<0.05		<0.05		<0.05		<0.05
Pb		<0.05		<0.05		<0.05		<0.05
Mo		<0.02		<0.02		<0.02		<0.02
Ni		<0.05		<0.05		<0.05		<0.05
Se		<0.001		<0.001		0.030		0.015
U-nat		67.7		94.8		54.2		21.7
Ra-226		8.2		3.7		0.5		0.9
Ra-228		2.5		2.3		0.8		1.3
Th-230		0.5		0.0		0.0		0.0
YEAR								
Th-230								
Pb-210								
Ra-228								

Table III
Water Quality Data - Well MW-9
Bear Creek Uranium - Converse County, Wyoming

DATE	12/1/92	3/1/93	6/1/93	9/1/93	12/1/93	3/1/94	6/1/94	9/1/94
pH	7.0	7.2	7.2	7.2	7.4	7.4	7.1	7.1
COND	1380	1400	1600	1680	1650	1400	1500	1540
TDS	1850	1810	1660	2310	2180	2220	2240	2250
Cl	82	88	85	110	110	92	105	100
SO4	934	1000	890	1480	1170	1215	1230	1200
NO3	0.7	0.7	2.2	1.8	2.2	2.8	0.6	0.8
As		<0.005		<0.005		<0.005		<0.005
Be		<0.01		<0.01		<0.01		<0.01
Cd		<0.01		<0.01		<0.01		<0.01
Cr		<0.05		<0.05		<0.05		<0.05
Pb		<0.05		<0.05		<0.05		<0.05
Mo		<0.02		<0.02		<0.02		<0.02
Ni		<0.05		<0.05		<0.05		<0.05
Se		<0.001		0.050		0.060		0.092
U-nat		6.0		10.8		12.2		12.1
Ra-226		0.7		2.3		1.6		1.0
Ra-228		0.3		1.7		2.2		1.1
Th-230		0.0		0.2		0.1		0.1
YEAR								
Th-230								
Pb-210								
Ra-228								

Table III
Water Quality Data - Well MW-9
Bear Creek Uranium - Converse County, Wyoming

DATE	12/1/94	3/1/95	6/1/95	9/1/95	12/1/95	3/1/96	6/1/96	9/1/96
pH	7.1	7.2	7.0	7.0	7.2	7.1	6.9	6.9
COND	1480	1450	1440	1580	1600	1450	1510	1300
TDS	2000	2030	2160	2170	2500	2430	2620	2270
Cl	95	135	102	105	112	145	145	140
SO4	1230	1140	1050	1220	1340	1120	1390	1340
NO3	1.0	1.4	1.6	4.1	1.0	0.6	0.4	0.6
As		<0.005	<0.005	<0.005	<0.005	<0.005		<0.005
Be		<0.01	<0.01	<0.01	<0.01	<0.01		<0.01
Cd		<0.01	<0.01	<0.01	<0.01	<0.01		<0.01
Cr		<0.05	<0.05	<0.05	<0.05	<0.05		<0.05
Pb		<0.05	<0.05	<0.05	<0.05	<0.05		<0.05
Mo		<0.02	<0.02	<0.02	<0.02	<0.02		<0.02
Ni		<0.05	<0.05	<0.05	<0.05	<0.05		<0.05
Se		0.002	0.051	<0.001	0.008	0.003		<0.001
U-nat		37.20	74.5	33.8	20.3	54.2	81.2	37.2
Ra-226		0.5	0.9	0.3	1.0	0.5		2.5
Ra-228		1.6	0.7	2.9	2.2	0.3		2.5
Th-230		0.3	0.0	0.4	0.7	0.2		1.6
YEAR								
Th-230								
Pb-210								
Ra-228								

Table III
Water Quality Data - Well MW-9
Bear Creek Uranium - Converse County, Wyoming

DATE	12/1/96	3/1/97	6/1/97	9/1/97	12/1/97
pH	7.1	7.2		7.0	
COND	1580	1400		910	
TDS	2890	2830		2820	
Cl	160	150		150	
SO4	1520	1320		1530	
NO3	0.5	0.7		1.0	
As					
Be				<0.01	
Cd				<0.01	
Cr				<0.05	
Pb				<0.05	
Mo				<0.02	
Ni		<0.05		<0.05	
Se		<0.001			
U-nat		73.8		42.0	
Ra-226		0.5		1.4	
Ra-228		2.2		2.0	
Th-230		0.2		0.1	
YEAR					
Th-230					
Pb-210					
Ra-228					

Appendix A
WQD Rules & Regulations - Chapter VIII

Bear Creek Uranium Co. - TFN 3 3/122
LQD Review of ACL Application - May 1999

CHAPTER VIII

QUALITY STANDARDS FOR WYOMING GROUNDWATERS

Section 1. Authority. These regulations are promulgated pursuant to Sections 35-11-101 through 1104 of the Wyoming Statutes, specifically Section 35-11-302, and no person shall cause, threaten or allow violation of any water quality standard or provision contained herein.

Section 2. Definitions. The following definitions supplement those definitions contained in Section 35-11-103 of the Wyoming Environmental Quality Act.

(a) "Aquifer" means a zone, stratum or group of strata that can store and transmit water in sufficient quantities for a specific use.

(b) "Background" means the constituents or parameters and the concentrations or measurements which describe water quality and water quality variability prior to a subsurface discharge.

(c) "Below-Surface Receiver (Receiver)" means any zone, interval, formation or unit in the subsurface which can accept water or fluid from other sources.

(d) "Domestic Water" means a water which is suitable for uses, including but not limited to, drinking, gardening and other household uses, municipal uses and farmstead uses, including water used in the washing or hydro-cooling of farm products destined for human consumption on the farm, for sale on the fresh food market or for delivery to a processing plant for canning, freezing or other type of preparation prior to marketing.

(e) "Fluid" means any material which flows or moves whether semisolid liquid, sludge, gas or any other form or state.

(f) "Groundwater" means subsurface water that fills available openings in rock or soil materials such that they may be considered water saturated under hydrostatic pressure.

(g) "Groundwaters of the State" are all bodies of underground water which are wholly or partially within the boundaries of the State; Groundwaters of the State is synonymous with Groundwaters of Wyoming.

where ion concentrations are expressed in milliequivalents per liter. The SAR predicts, reasonably well the degree to which irrigation water tends to enter into cation-exchange reactions in soil.

(p) "Standard Unit", abbreviated s.u., is the unit of measurement used to describe the numerical pH of a solution, fluid or pollutant.

(q) "Subsurface Discharge" means a discharge to a below-surface receiver.

(r) "Total Dissolved Solids", abbreviated TDS, is the sum of the dissolved mineral constituents in water, expressed as mg/l.

(s) "Toxic Materials (Substances)" are those materials (substances) or combinations of materials (substances), including disease causing agents, which, after discharge and upon exposure, ingestion, inhalation or assimilation into any environmentally significant organism, either directly from the environment or indirectly by ingestion through food chains, may cause death, disease, behavioral abnormalities, cancer, genetic malfunctions, physiological malfunctions (including malfunctions in reproduction of offspring) or physical deformations in such organisms or their offspring; and includes all materials (substances) so designated as toxic by the U.S. Environmental Protection Agency in the Federal Register for December 24, 1975 (Part IV), Water Programs, National Interim Primary Drinking Water Regulations.

(t) "Underground Water" means subsurface water, which is any body of water under the surface of the earth, including water in the vadose zone and groundwater.

(u) "Vadose Zone" means the unsaturated zone in the earth, between the land surface and the top of the first saturated aquifer which is not a perched water aquifer. The vadose zone characteristically contains liquid water under less than atmospheric pressure, and water vapor and air or other gases at atmospheric pressure. Perched water bodies exist within the vadose zone.

(v) "Virtually Free" means a concentration less than the concentration which is the lower limit of detection.

Section 3. Underground Water Protected.

(a) All waters, including groundwaters of the State, within the boundaries of the State of Wyoming are the property

its intended use or uses, at any place or places of withdrawal or natural flow to the surface.

(d) Unappropriated waters are classified by ambient water quality.

(i) Class I Groundwater of the State - This water is suitable for domestic use. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class I Groundwater of the State (see Table I, page 9).

(ii) Class II Groundwater of the State - This water is suitable for agricultural use where soil conditions and other factors are adequate. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class II Groundwater of the State (see Table I, page 9).

(iii) Class III Groundwater of the State - This water is suitable for livestock. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class III Groundwater of the State (see Table I, page 9).

(iv) Class Special (A) Groundwater of the State - This water is suitable for fish and aquatic life. The ambient quality of underground water of this suitability does not have a concentration in excess of any of the standards for Class Special (A) Groundwater of the State (see Table I, page 10).

(v) Underground water of Class I, II, III or Special (A) shall not contain biological, hazardous, toxic or potentially toxic materials or substances in concentrations or amounts which exceed maximum allowable concentrations based upon information of the EPA in the Federal Register for December 24, 1975 (Part IV), Water Programs, National Interim Primary Drinking Water Regulations; and in the Federal Register for March 13, 1978 (Part II), Water Programs, Hazardous Substances.

In addition, underground water of Class I, II, III or Special (A) shall not contain any biological, hazardous, toxic or potentially toxic materials or substances in concentrations or amounts which, based upon the latest available scientific information and as determined by the Administrator, will impair this water for its use suitability or which may contribute to a condition in contravention of groundwater quality standards or to any toxic or hazardous effect on natural biota.

concentrations or amounts which exceed maximum allowable concentrations, based upon information of the EPA in the Federal Register for December 24, 1975 (Part IV), Water Programs, National Interim Primary Drinking Water Regulations, and in the Federal Register for March 13, 1978 (Part II), Water Programs, Hazardous Substances; or which exceed background concentrations of the underground water, whichever is greater, at any place or places of withdrawal or natural flow to the surface.

In addition, a discharge shall not result in any biological, hazardous, toxic or potentially toxic materials or substances, in concentrations or amounts which, based on the latest available scientific information and as determined by the Administrator, will impair the quality of ambient groundwaters of the State of this Class; or which may contribute to a condition in contravention of groundwater quality standards or cause, allow or permit any deleterious effect on natural biota.

(viii) Groundwater of the State found closely associated with commercial deposits of hydrocarbons and/or other minerals, or which is considered a geothermal resource, is Class V (Hydrocarbon Commercial), Class V (Mineral Commercial) or Class V (Geothermal) Groundwater of the State.

(A) A discharge into a Class V (Hydrocarbon Commercial) Groundwater of the State shall be for the purpose of the production of oil and gas and shall not result in the degradation or pollution or waste of other water resources.

(B) A discharge into a Class V (Mineral Commercial) Groundwater of the State shall be for the purpose of mineral production and shall not result in the degradation or pollution of the associated or other groundwater unless the affected groundwater quality can be returned to background or better quality after mining ceases, by a reduction or elimination of pollution; or in the waste of other water resources. If it has been determined by the Administrator that a return to background quality cannot be achieved, the affected groundwater will, at a minimum, be returned to a condition and quality consistent with the pre-discharge use suitability of the water.

(C) A discharge into a Class V (Geothermal) Groundwater of the State shall be for the purpose of the production of geothermal resources and shall not result in the degradation or pollution or waste of other water resources.

(ix) Class VI Groundwater of the State may be unusable or unsuitable for use:

TABLE I

UNDERGROUND WATER CLASS Use Suitability Constituent or Parameter	I Domestic Concentration*	II Agriculture Concent.*	III Livestock Concent.*
Aluminum (Al)	---	5.0	5.0
Ammonia (NH_3-N)	0.5[8]	---	---
Arsenic (AS)	0.05	0.1	0.2
Barium (Ba)	1.0	---	---
Beryllium (Be)	---	0.1	---
Boron (B)	0.75	0.75	5.0
Cadmium (Cd)	0.01	0.01	0.05
Chloride (Cl)	250.0	100.0	2000.0
Chromium (Cr)	0.05	0.1	0.05
Cobalt (Co)	---	0.05	1.0
Copper (Cu)	1.0	0.2	0.5
Cyanide (CN)	0.2	---	---
Fluoride (F)	1.4-2.4[7]	---	---
Hydrogen Sulfide (H_2S)	0.05	---	---
Iron (Fe)	0.3	5.0	---
Lead (Pb)	0.05	5.0	0.1
Lithium (Li)	---	2.5	---
Manganese (Mn)	0.05	0.2	---
Mercury (Hg)	0.002	---	0.00005
Nickel (Ni)	---	0.2	---
Nitrate (NO_3-N)	10.0	---	---
Nitrite (NO_2-N)	1.0	---	10.0
(NO_3+NO_2)-N	---	---	100.0
Oil & Grease	Virtually Free	10.0	10.0
Phenol	0.001	---	---
Selenium (Se)	0.01	0.02	0.05
Silver (Ag)	0.05	---	---
Sulfate (SO_4)	250.0	200.0	3000.0
Total Dissolved Solids (TDS)	500.0	2000.0	5000.0
Uranium (U)	5.0	5.0	5.0
Vanadium (V)	---	0.1	0.1
Zinc (Zn)	5.0	2.0	25.0
pH	6.5-9.0s.u.	4.5-9.0s.u.	6.5-8.5s.u
SAR	---	8	---
RSC	---	1.25 meq/l	---
Combined Total Radium 226 and Radium 228[9]	5pCi/l	5pCi/l	5pCi/l
Total Strontium 90	8pCi/l	8pCi/l	8pCi/l
Gross alpha particle radioactivity (including Radium 226 but excluding Radon and Uranium)[9]	15pCi/l	15pCi/l	15pCi/l

*mg/l, unless other wise indicated

TABLE I

Explanation for Superscript Used in Table I

[1]Unionized ammonia: When ammonia dissolves in water, some of the ammonia reacts with water to form ammonium ions. A chemical equilibrium is established which contains unionized ammonia (NH_3), ionized ammonia (NH_4+) and hydroxide ions (OH^-). The toxicity of aqueous solutions of ammonia is attributed to NH_3; therefore, the standard is for unionized ammonia. (Note: 0.02 mg/l NH_3 is equivalent to 0.016 NH_3 as N.)

[2]Undissociated H_2S: The toxicity of sulfides derives primarily from H_2S, rather than from the dissociated (HS) or (S) ions; therefore, the standard is for the toxic undissociated H_2S.

[3]Dependent on hardness: The toxicity of metals in natural waters varies with the hardness of the water; generally, the limiting concentration is greater in hard water than in soft water.

[4]Egg hatching

[5]Fish rearing

[6]Fish and aquatic life

[7]Dependent on the annual average of the maximum daily air temperature: 1.4 mg/l corresponds with a temperature range of 26.3 to 32.5 degrees C and 2.4 mg/l corresponds with a temperature of 12.0 degrees C (53.7 degrees F) and below.

[8]Total ammonianitrogen

[9]Requirements and procedures for the measurement and analysis of gross alpha particle activity, Radium 226 and Radium 228 shall be the same as requirements and procedures of the U.S. Environmental Protection Agency, National Interim Primary Drinking Water Regulations; EPA-570/9-76-003, effective June 24, 1977.

(f) An underground water may be reclassified if new or additional data warrant reclassification.

Section 6. Standards for the Underground Management of Hazardous or Toxic Wastes. The underground management of wastes includes the temporary storage and the ultimate disposal of all hazardous or toxic wastes in below-surface

(iii) Is compatible with the receiver and ambient water; and

(iv) Can be controlled at all times.

Section 7. Testing Procedures.

(a) For determination of the parameters involved in the standards, analysis will be in accord with test procedures as defined pursuant to: Title 40, Code of Federal Regulations, Part 136, or any modifications thereto. For test procedures not listed in the Code of Federal Regulations, test procedures outlined in EPA Methods for Chemical Analysis of Water and Wastes (March, 1979); or Standard Methods for the Examination of Water and Wastewaters (1975); or, A.S.T.M. Standards, Part 31 (1979), Water shall be used.

(b) The analytical technique for total uranium (as U) shall be the fluorometric method as referenced in Methods for Determination of Radioactive Substances in Water and Fluvial Sediments, Techniques of Water - Resource Investigations of the U.S. Geological Survey, Book 5, Chapter A-5 (1977).

(c) Where standard methods of testing have not been established, the suitability of testing procedures shall be determined by the Department.

Section 8. Limit of Detection. Where the standard is below the lower limit of detection given in EPA Methods for Chemical Analysis of Water and Wastes (March, 1979), or Standard Methods for the Examination of Water and Wastewaters (1975), or, A.S.T.M. Standards, Part 31 (1979), Water, the standard shall be the lower limit of detection, unless otherwise provided by the Council.

/jn
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Appendix B
Well Permit for Wells GW-5 & GW-15

Bear Creek Uranium Co. - TFN 3 3/122
LQD Review of ACL Application - May 1999

MICRO FILMED APR 2'73

Form U.W. 7

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

IF WELL IS TO BE ABANDONED, SEE ITEM 20

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER

Bear Creek Well GW-5

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL

for Domestic or Stock Watering Use Only

A preferred water right is given to such use when the yield or flow does not exceed .056 cubic feet per second or 25 gallons per minute. Domestic use refers to household use and the watering of lawns and gardens for family use, not to exceed one acre.

Permit No. U.W. 19942

Temporary Filing No. 7-11-75

Water Division No. 2(1)

U.W. District Converse Co.

**Completed Prior to May 24, 1969 [X]

NAME OF WELL Dilts No. 34-39-73

1. Owner John C. Dilts
2. Address Douglas, Wyoming 82633
3. Agent to receive correspondence John A. Lambert Box 34, Douglas, Wyoming 82633
4. Name & address of driller Unknown
5. Well is constructed on lands owned by John C. Dilts (Obtaining of easement or right of way is the responsibility of the applicant's. Include copy if land is privately owned and owner is not a co-applicant.)
6. Type of construction: Dug ☐ Drilled ☒ Rotary (Type of Rig)
   Driven ☐ Jet ☐ Other
7. Use of Water—Domestic ☐ Stock ☒
8. Means of conveyance, distance and direction to point of use: Point of use at well
9. Date started , 19 35
10. Date completed , 19 35 (including pump)
11. Date after completion when water was used , 19 35
12. WELL DESCRIPTION
    Total Depth ~~unknown~~ 80 Depth to Water Level 10 ft.
13. TEST DATA
    Yield ____ How Tested ____
    Drawdown ____ Length of Test ____
14. PUMP DATA
    Type ____ (Turbine, Centrifugal, etc.) Power Source Windmill (Elec., Gas, etc.)
    Horsepower ____ Amount of Water Being Used 3 gal./min. (Gallons per Minute)
15. CASING RECORD

Plain Casing

Size ____	Kind unknown	from ____ ft.	to ____ ft.
Size ____	Kind ____	from ____ ft.	to ____ ft.
Size ____	Kind ____	from ____ ft.	to ____ ft.

Perforated Casing

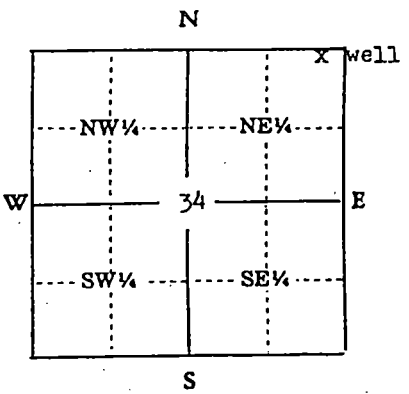
Size ____	Kind ____	from ____ ft.	to ____ ft.
Size ____	Kind ____	from ____ ft.	to ____ ft.

WELL LOCATION

Converse County

NE ¼ of NE ¼ of Sec. 34

T. 39 N., R. 73 W.



Scale: 2" = 1 mile

Above diagram represents one full section. Locate well accurately in small square representing 40 ac.
or
fill in the following:

Lot ____ & Block ____ or Tract ____

of the ____ (Subdivision or Addition)

of ____ (City, Town or County)

Section ____, T. ____ N., R. ____ W.

**For wells constructed after May 24, 1969, Application Form U.W. 5 must be submitted prior to construction.

Permit No. U.W. 19942

Book No. 104 Page No. 180

Form U.W. 7
**Completed Prior to May 24, 1969 [X]

NOTE: Do not fold this form. Use typewriter or ball point pen.

STATE OF WYOMING

BEAR CREEK
GW-15

OFFICE OF THE STATE ENGINEER

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL

for Domestic or Stock Watering Use Only

A preferred water right is given to such use when the yield or flow does not exceed .056 cubic feet per second or 25 gallons per minute. Domestic use refers to household use and the watering of lawns and gardens for family use, not to exceed one acre.

Permit No. U.W. 9000 Temporary Filing No. 5-12-153

Water Division No. 2 (1)

U.W. District Converse County

Name of Well Manning # T.B. 138

IF WELL IS TO BE ABANDONED, SEE ITEM 21

1. Owner United States of America, Forest Service
2. Address Box 129, Douglas, Wyoming 82633
3. Agent to receive correspondence Douglas P. Fuller District Ranger Thunder Basin National Grassland, Box 129, Douglas, Wyo. 82633
4. Name & address of driller Ruby Drilling Co. Gillette, Wyoming
5. Well is constructed on lands owned by Same as # 1
   (Obtaining of easement or right of way is the responsibility of the applicant's. Include copy if land is privately owned and owner is not a co-applicant.)
6. Type of construction: Dug ☐ Drilled ☒ Rotary (Type of Rig)
   Driven ☐ Jet ☐ Other
7. Use of Water—Domestic ☐ Stock ☒
8. Means of conveyance, distance and direction to point of use
9. Date started Jan. 20, 1969
10. Date completed Jan. 21, 1969 (including pump)
11. Date after completion when water was used Jan. 21, 1969
12. WELL DESCRIPTION
    Total Depth 126 ft. Depth to Static Water Level 100 ft.
13. TEST DATA
    Yield 3 gpm. How Tested Bailing
    Drawdown 20 ft. Length of Test 2 hrs.
14. PUMP DATA
    Type windmill (Turbine, Centrifugal, etc.) Power Source Windmill (Elec., Gas, etc.)
    Horsepower N/A. Yield 4 (Gallons per Minute)
15. CASING RECORD

Plain Casing

Size 5 3/4"	Kind	from 0	ft. to 85	ft.
Size	Kind	from	ft. to	ft.
Size	Kind	from	ft. to	ft.

Perforated Casing

Size 5 3/4"	Kind	from 85	ft. to 126	ft.
Size	Kind	from	ft. to	ft.

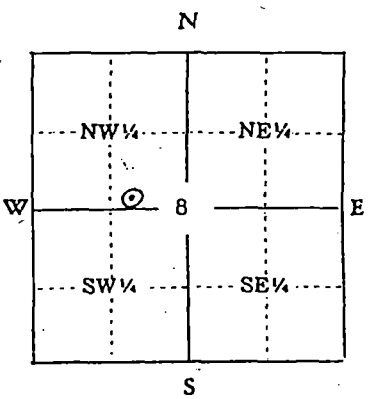
16. CONSTRUCTION
    Was surface seal provided? Yes ☒ No ☐ To What Depth 4 feet Material used: concrete
    Was surface casing used? Yes ☒ No ☐ Was it cemented in place? Yes ☒ No ☐
17. FLOWING WELL (Owner is responsible for installing control device on flowing well.)
    Controlled by: Valve ☐ Cap ☐ Plug ☐ Does well leak around casing? Yes ☐ No ☐

WELL LOCATION

Converse County

SE ¼ of NW ¼ of Sec. 8

T. 38 N., R. 73 W.



Scale: 2" = 1 mile

Above diagram represents one full section. Locate well accurately in small square representing 40 ac.
or
if the above does not apply fill in the following:

Lot Block

City, Town or Subdivision:

(Include filing or number)

**For wells constructed after May 24, 1969, Application Form U.W. 5 must be submitted prior to construction.

Permit No. U.W. 9000 Book No. 50 Page No. 46

Appendix C
PLUME2D Simulations

Bear Creek Uranium Co. - TFN 3 3/122
LQD Review of ACL Application - May 1999

INTERNATIONAL GROUND WATER MODELING CENTER
INST. FOR GROUND-WATER RESEARCH AND EDUCATION
COLORADO SCHOOL OF MINES
GOLDEN, COLORADO 80401, USA.

SOLUTE

Version 2.03 September 1991

ANALYTICAL MODELS FOR SOLUTE TRANSPORT

PLUME2D: EDITING DATA

	Run 1	Same as Run 1 except: Run 3	Run 4	Run 5	Run 6	Run 7
1. PROJECT TITLE (max 15 char.)	= Bear Creek					
2. USER NAME	= RHoy					
3. DATE	= 02-09-1999					
4. GROUNDWATER VELOCITY	= 0.04 [ft/d]		0.1			
5. AQUIFER THICKNESS	= 40 [ft]					
6. POROSITY	= 0.3			0.15		
7. LONGITUDINAL DISPERSIVITY	= 160 [ft]				300	100
8. LATERAL DISPERSIVITY	= 16 [ft]				30	10
9. RETARDATION FACTOR	= 1		2			
10. HALF-LIFE	= 0 [d]					
11. NUMBER OF POINT SOURCES	= 4					

Same as Run 1 except:
Run 2

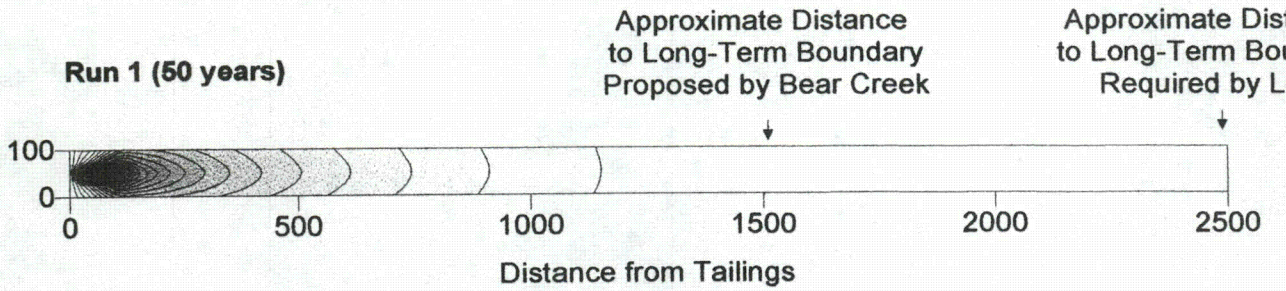
SOURCE NO. 1:
1. X-COORDINATE OF THE SOURCE... = 45 [ft]
2. Y-COORDINATE OF THE SOURCE... = 45 [ft]
3. SOURCE STRENGTH..... = 16 [lb/d]
4. ELAPSED TIME..... = 18250 [d].....9125

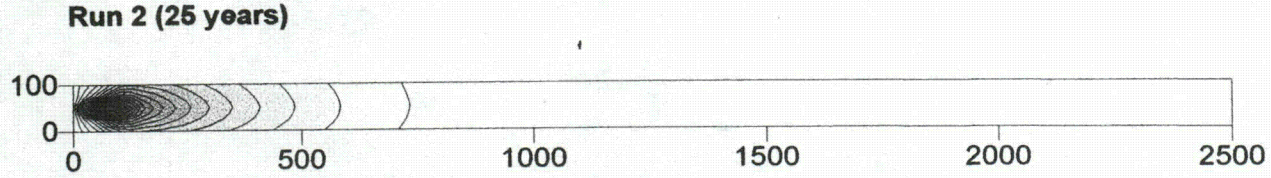
SOURCE NO. 2:
1. X-COORDINATE OF THE SOURCE... = 55 [ft]
2. Y-COORDINATE OF THE SOURCE... = 55 [ft]
3. SOURCE STRENGTH..... = 16 [lb/d]
4. ELAPSED TIME..... = 18250 [d].....9125

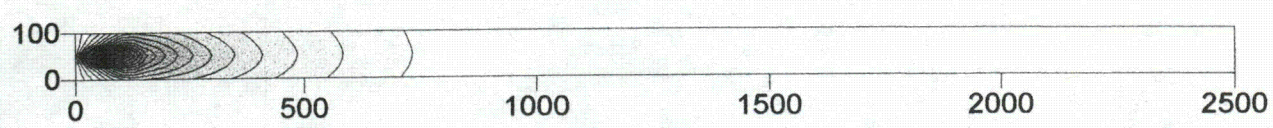
SOURCE NO. 3:
1. X-COORDINATE OF THE SOURCE... = 45 [ft]
2. Y-COORDINATE OF THE SOURCE... = 55 [ft]
3. SOURCE STRENGTH..... = 16 [lb/d]
4. ELAPSED TIME..... = 18250 [d].....9125

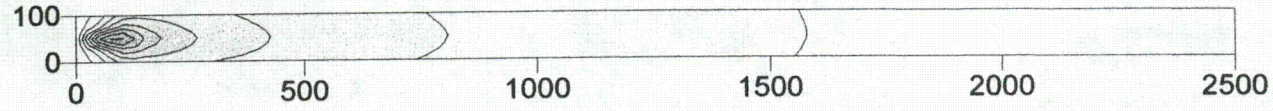
SOURCE NO. 4:
1. X-COORDINATE OF THE SOURCE... = 55 [ft]
2. Y-COORDINATE OF THE SOURCE... = 45 [ft]
3. SOURCE STRENGTH..... = 16 [lb/d]
4. ELAPSED TIME..... = 18250 [d].....9125

GRID DATA:
1. X-COORDINATE OF GRID ORIGIN..... = 0 [ft]
2. Y-COORDINATE OF GRID ORIGIN..... = 0 [ft]
3. DISTANCE INCREMENT DELX..... = 50 [ft]
4. DISTANCE INCREMENT DELY..... = 10 [ft]
5. NUMBER OF NODES IN X-DIRECTION... = 50
6. NUMBER OF NODES IN Y-DIRECTION... = 10









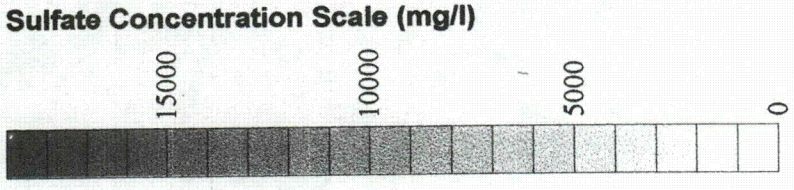
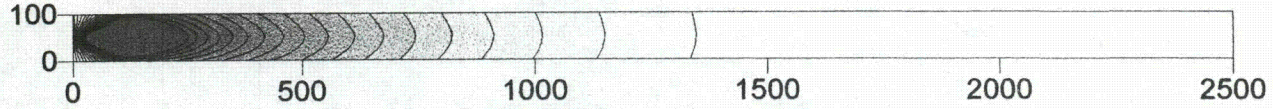


Figure 1A - Appendix B
Estimated Additional Sulfate Concentratio
including Leakage through Tailings
(Plume2D Model Results)
Bear Creek ACL Evaluation - TFN 3 3/12
May 1999

Approximate Distance to Long-Term Boundary Proposed by Bear Creek

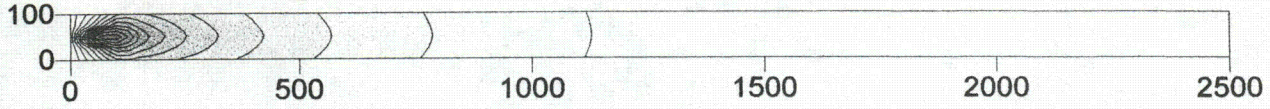
Approximate Distance to Long-Term Boundary Required by LQD

Run 5 (50 years with Porosity of 0.15 rather than 0.3)

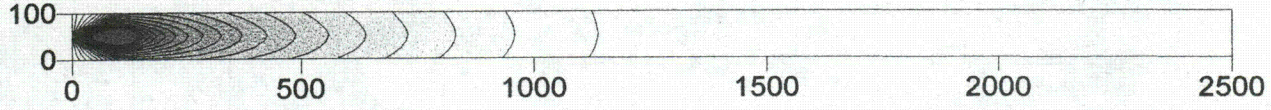


Distance from Tailings

Run 6
(50 years with Longitudinal & Lateral Dispersivity of 300 and 30 feet, respectively, rather than 160 and 16 feet)



Run 7
(50 years with Longitudinal & Lateral Dispersivity of 100 and 10 feet, respectively, rather than 160 and 16 feet)



Sulfate Concentration Scale (mg/l)

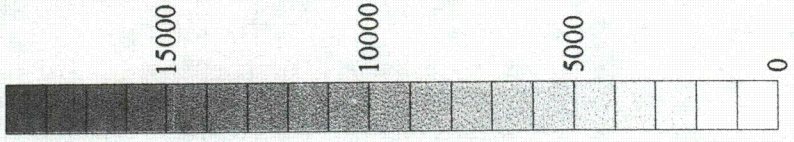


Figure 1B - Appendix B
Estimated Additional Sulfate Concentration
including Leakage through Tailings
(Plume2D Model Results)
Bear Creek ACL Evaluation - TFN 3 3/122
May 1999