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Technical Report NPS/NRWRD/NRTR-97/128

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Technical Report NPS/NRWRD/NRTR-97/128

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United States Department of the Interior
National Park Service

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EXECUTIVE SUMMARY

U.S. Geological Survey scientists, in collaboration with personnel at Glen Canyon National Recreation Area, conducted an intensive assessment, funded by the National Park Service, of springs and seeps throughout the Recreation Area for the purpose of measuring and evaluating the water quality of the resource. This study was conducted to better understand the quantity and quality of water resources for recreational purposes. Selected springs and seeps were visited over a study period from 1994 to 1995, during, which measurements were made and samples were collected for subsequent chemical laboratory analysis.

Samples collected during this study were transported to U.S. Geological Survey laboratories in Boulder, Colorado, where analyses were performed using state-of-the-art technology. In addition to the location of principle springs and seeps, temperature, pH, specific conductance, alkalinity, observations on geological setting and an estimate of water discharge are tabulated in Appendix B. Laboratory analyses, including determinations for aluminum, ammonium, arsenic, barium, beryllium, boron, bromide, cadmium, calcium, cesium, chloride, chromium, cobalt, copper, dissolved organic carbon, fluoride, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, nitrate, nitrite, phosphate, potassium, rubidium, sodium, strontium, sulfate, thallium, uranium, vanadium, and zinc, of these springs and seeps are also tabulated in Appendix B of this report.

The principal investigators recommend that monitoring of the water quality of selected representative springs and seeps be performed on an annual basis. These springs and seeps should be selected based on a combination of water use criteria (recreational and non-recreational), geological formation from which the spring or seep originates, ease of access, and water quality characteristics.

INTRODUCTION

Glen Canyon National Recreation Area (GCNRA) was established by Congress in 1972 by Public Law 92-593. This law stated that the National Park Service would administer the area and "provide for public outdoor recreation use and enjoyment of Lake Powell and lands adjacent thereto.....and preserve scenic, scientific, and historical features contributing to public enjoyment of the area." The Park Service has formulated several objectives to be met in administering the recreation area. One objective is "to encourage the maintenance of high water quality in all bodies and sources of water and to perpetuate the natural flow of free water."

Springs in the arid regions of southern Utah and northern Arizona have a significant impact on both the ecology of the area and its recreational use. Springs and seeps, together with associated wetlands, are important riparian and aquatic habitat. Traditionally, much of the land encompassed by and bordering the recreation area has been used for livestock grazing. Springs are essential for commercial grazing. Unfortunately, livestock watering , if not managed properly, result in detrimental effects on the water quality of the resource. Finally, the increase in recreational use of the backcountry may adversly impact water quality and, therefore, the ecological impact on these springs and seeps.

BACKGROUND

Objectives of the study

Scientists from the U.S. Geological Survey (U.S.G.S.), in collaboration with personnel from Glen Canyon National Recreation Area, visited springs and seeps in the recreation area during the fall of 1994 and the winter and spring of 1995. The purpose of these visits were to make observations, measurements and to collect samples for the evaluation of water quality. This study was conducted to better understand the quantity and quality of water resources for recreational purposes and for the establishment of baseline information for future monitoring.

Previous water quality studies

The water quality of springs and seeps along the Colorado River corridor and in the boundaries of Glen Canyon National Recreation Area have been studied by several scientists including, Blanchard (1986) and Williamson (1985). Davis et al. (1963) and Kister and Hatchett (1963) provide data on a few of the springs in this area. Some limited data on springs and seeps is reported by Lively-Schall and Foust (1988). A description of many of the springs in the Glen Canyon region is tabulated in Cooley (1965), including discharge data, but no water quality information is provided. Potter and Drake (1989) in their monograph on Lake Powell make a passing reference to water quality of springs and seeps, but provide no data. None of these studies provide a comprehensive chemical profile on the trace elements at indigenous concentration levels.

Study area description

The springs and seeps selected for this study are located within the boundaries of Glen Canyon National Recreation Area (U.S.G.S. topographic map titled *Glen Canyon Recreation Area, Utah-Arizona, 1969*). Most of these springs and seeps emerge in tributaries to the Colorado River in close proximity (within 10 km) to Lake Powell. These springs and seeps often emanate from geological contacts between geological rock formations. Discharge from rock formations generally is from small springs and seeps (with discharges of less than 0.6 liters per second) from canyon walls in Glen Canyon, the canyon of the San Juan River and tributary canyons (Blanchard, 1986). Since the filling of Lake Powell, all springs occur at an altitude above about 3,700 feet, the nominal elevation of the lake. The springs and seeps considered in this study (and other selected sites) are listed in Table 1, and keyed to Figure 1.

Table 1. Site Identification and Map Key

Site Name	Map Key	Site Name	Map Key
Big Water Spring	2	Iceberg Stream (surface sample)	22
Bowns spring A	16	Kaiparowits Spring A	26
Bowns Spring B	17	Kaiparowits Spring B	27
Cottonwood Canyon Seep	34	Knowles Spring A	9
Cow Canyon Spring	14	Knowles Spring B	10
Coyote Arch Spring	15	Long Canyon Spring	18
First Gravel Bar Below Dam Spring	29	Moqui Spring A	12
Forgotton Spring	11	Moqui Spring B	13
Four Mile Spring (Below Dam)	33	Popcan Spring	19
French Spring	1	Power Lines Spring (Below Dam)	30
Frog Marsh Spring (Below Dam)	32	Rainbow Bridge Spring	28
Good Hope Spring A	7	San Juan MCO2	24
Good Hope Spring B	8	Sewage Ponds Spring (Below Dam)	31
Gypsum Spring A	3	Swett SE Spring	5
Gypsum Spring B	35	Swett Spring	4
Iceberg Canyon Isolated Pond	23	Ticaboo Spring	6
Iceberg Soilseep	20	Wilson Spring	25
Iceberg Spring	21		

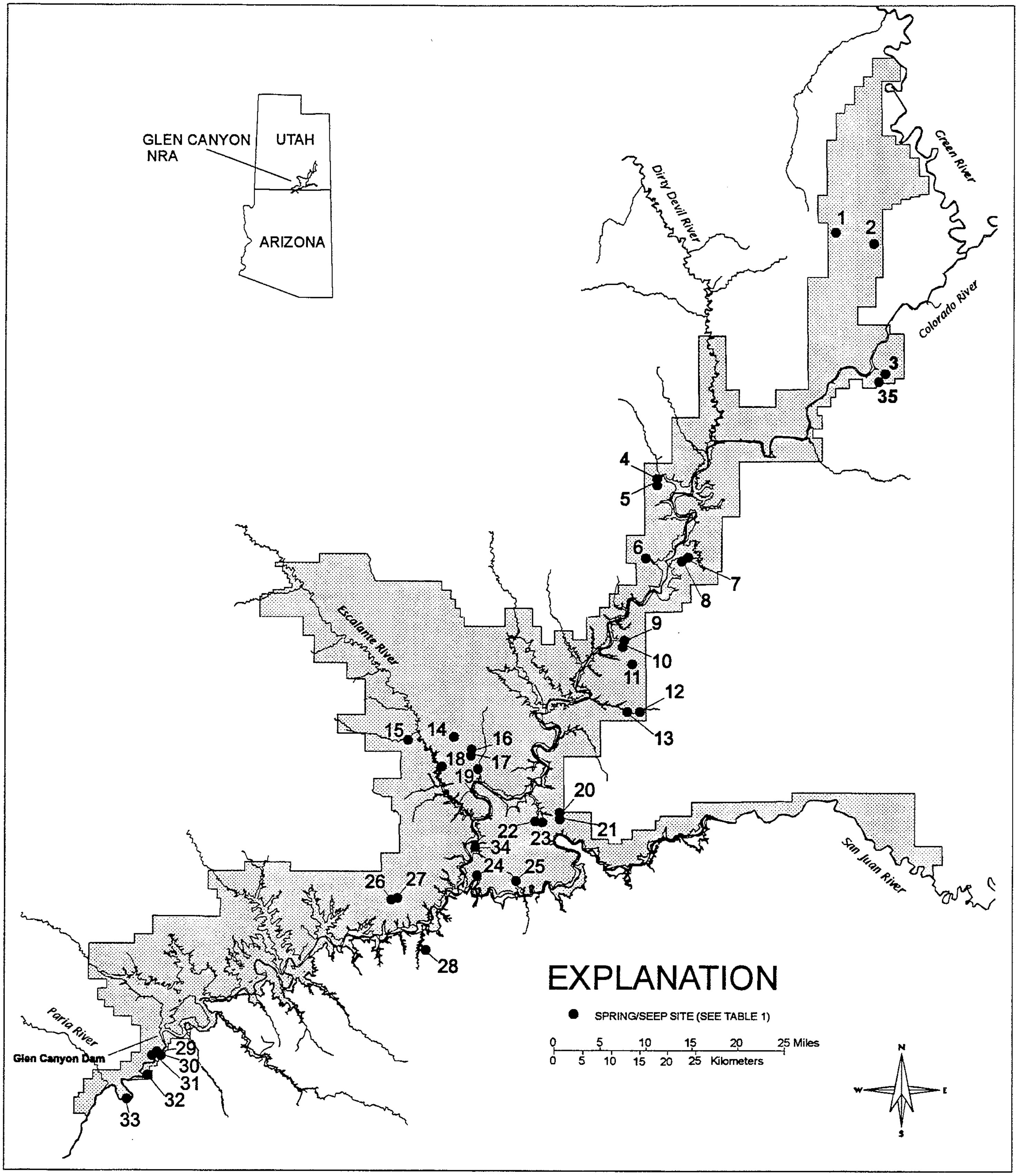


FIGURE 1 - GLEN CANYON NRA, 1994-95 SPRINGS AND SEEPS SURVEY

Study Design

Samples were collected during three periods: October 1994, February-March 1995 and May 1995. Prior to the first sampling period, all personnel were trained in the field sampling and field measurement technologies required for this project. Field instruction was performed at the Wilson Spring site.

The first two sampling efforts were performed by National Park Service (N.P.S.) personnel with consultation by U.S.G.S. scientists. Sampling sites were visited by both boat (from Lake Powell) and helicopter. The third sampling campaign was performed in May 1995 by U.S.G.S. scientists, primarily by helicopter. Sampling was staged from the Bullfrog Marina landing pad and all sample processing was performed at the N.P.S. Bullfrog Marina laboratory.

A total of 35 springs and seeps were measured and sampled at various times throughout the study. Because of water flow and access, some springs and seeps were only sampled once during the program.

METHODOLOGY

Field measurements

Several specific field measurements were made to characterize each site where water samples were collected. Water temperature was always measured in the field when collecting samples, whereas specific conductance and pH were measured in the field at each location when possible. At other times, water samples were transported to N.P.S. laboratories located at either Wahweap Marina or Bullfrog Marina, where pH and specific conductance was measured.

When moderate water flow (velocity from 5 - 75 centimeters per second) was observed in a channelized bed (depth 5 - 50 centimeters), a Price Pygmy current meter was used to measure water velocity for the subsequent calculation of water discharge (Buchanan and Somers, 1976). For smaller water discharges a direct measurement was made by collecting a volume of water flowing from the spring for a specific period of time. Water was collected directly into a volumetric container (graduated cylinder) or in a holding vessel (bucket or similar container) where the volume collected was subsequently measured by water transfer into a graduated cylinder or other calibrated container. To facilitate the collection of water for volume measurement, a temporary weir was sometimes constructed from plastic to constrict the flowing water to a fixed channel, facilitating collection for water discharge measurements, only.

Because the nominal flow of most of these springs (and seeps) were usually very low, <10 L/sec and frequently diffuse, quantitative measurements often were not possible. At locations where water discharge could not be directly measured, it was estimated using the area of the wetted rock or sand and the configuration of the topography surrounding the spring or seep as a guide.

The geological setting, contact zones and area surrounding the springs were described at the time of sampling. This information was recorded in field notes and is included in the database.

Sampling and sample handling

Sampling kits consisting of filtration equipment, precleaned bottles (some containing preservative) and labels, hermetically sealed in a plastic bag, were prepared in the laboratory prior to a sampling trip. Each sampling kit was designated for use only once at a specific site. New kits were used at each subsequent site. This approach eliminates the need for field cleaning of equipment and greatly improved the quality control of the process.

The filtration equipment consisted of one 60-ml polystyrene syringe that had been nitric acid soaked in the laboratory prior to inclusion in the field kit. Eight disposable polysulfone membrane syringe filters with a nominal pore size of 0.45 micrometers were also included in the kit, along with several polyvinylchloride gloves to reduce handling contamination.

Sample bottles included in the kit, were: one 60-ml baked glass bottle (for dissolved organic carbon determinations); one 30-ml deionized water-soaked opaque brown polyethylene bottle (for nutrient determinations); one deionized water-soaked clear polyethylene bottle (for major anion determinations); and one 125-ml nitric acid-soaked polyethylene bottle with 1 ml concentrated ultrapure nitric acid included in the bottle for trace metal determinations. In addition one 125-ml nitric acid-soaked glass bottle with 5 ml of a mixture of concentrated ultrapure nitric acid and 1 % w/v ultrapure potassium dichromate included in the bottle for mercury determinations was packaged separately from the kit to minimize cross-contamination problems.

The field procedure for processing samples was as follows:

1. The kit was unsealed and the PVC gloves were immediately placed on the hands of the person collecting the sample.
2. The 60-ml syringe was removed from its container and without a filter in place was filled with sample directly from the spring or seep. If it was not possible to fill the syringe from the back with the plunger removed, the syringe was filled by using the suction of the plunger to draw small volumes from shallow

depressions. This is a particularly important technique for sampling springs where no running water may be located.

3. The initial filling of the syringe was discarded as a sample rinse prior to the filtration step.
4. A disposable filter was placed on the syringe (using the Luer-lock connector) and a small quantitity of sample was forced through the filter to rinse it (approx. 10 ml).
5. After rinsing, the remainder of the sample in the syringe was filtered into the sample bottles.
6. The sample bottles were filled in the following order: 30-ml nutrient bottle, 60-ml DOC bottle, 60-ml anion bottle, 125 ml trace metal bottle and finally, the 125-ml mercury bottle. Each bottle was thoroughly sealed before a subsequent bottle was opened. Nutrient and DOC samples were immediately chilled.
7. As the disposable filters became clogged, reducing the filtration rate, the old filter was discarded and replaced with a new filter. Each new filter was rinsed as described in step 4 above.

For the May 1995 sampling event, special collection and processing procedures were employed. All samples were collected in the field in precleaned Teflon holding bottles. These bottles were transported within 1 - 2 hours to the N.P.S. laboratory at the Bullfrog Marina for special sample processing. Sample processing techniques were essentially the same as those reported previously by Kelly and Taylor (1996). Samples for trace metal analsysis including mercury were processed by vacuum filtration through 47-mm diameter, 0.4-micrometer pore-size Nuclepore membrane filters held in an all Teflon filtration apparatus. Dissolved organic carbon and nutrient samples were nitrogen gas pressure-filtered through 47-mm diameter 0.45-micrometer pore-size silver membrane filters held in a stainless steel apparatus. Samples were preserved as previously described and rapidly transported to the laboratory for analysis.

Laboratory analysis

All samples were analyzed at the U.S.G.S. laboratory located in Boulder, Colorado. Upon arrival at the laboratory, samples for nutrients and dissolved organic carbon were analyzed immediately. Ammonium, nitrate, nitrite and orthophosphate were determined by ultraviolet-visible absorption spectrophotometry. Measurements were made using a continuous-flow automated method described by Antweiler et al. (1994). Dissolved organic carbon was determined by oxidation of the organic carbon in the sample to carbon dioxide, which was measured using an infrared absorption spectrophotometric technique. The specific method is described by Wershaw et al. (1983).

Total alkalinity was determined on the unpreserved filtered sample by an automated Gran titrimetric procedure using sulfuric acid as the titrant (Skougstad et al., 1979). Alkalinity is expressed in the units of milliequivalents per liter and can be used in conjunction with pH to calculate carbonate and bicarbonate concentrations. Other anions, including chloride, fluoride and sulfate, were determined on the unpreserved filtered sample using an automated ion chromatographic technique (Brinton et al., 1996).

Major constiuents, including sodium, calcium, magnesium and silica (as SiO_2) were determined on the filtered and acidified sample using an inductively coupled plasma-atomic emission spectrometric method. The method has previously been described by Garbarino and Taylor (1979). Potassium was determined by an air-acetylene flame atomic absorption spectrophotometic procedure described by Skougstad et al. (1979).

Trace constituents, including aluminum, arsenic, barium, beryllium, boron, bromide, cadmium, cesium, chromium, cobalt, copper, lead, lithium, manganese, molybdenum, nickel, rubidium, selenium, silver, strontium, thallium, uranium, vanadium, and zinc; were determined by an inductively coupled plasma-mass spectrometric technique. These determinations were performed by methodology described by Taylor and Garbarino (1991) and Garbarino and Taylor (1994). A cold-vapor atomic fluorescence spectrometric technique reported by Roth (1994) was used for the trace determination of mercury. Iron was determined by the inductively coupled plasma-atomic emission technique previously described.

Quality control

All laboratory sample analyses were randomly performed in triplicate, and statistical outliers rejected. Calibration curves for instrumental determinations were established by the use of at least five separate concentration calibration standards, prepared gravimetrically from pure metals or metal salts. Laboratory reagent blanks and field process blanks were analyzed when appropriate and used to evaluate the integrity of sample determinations.

The accuracy of the determinations was further ensured by the periodic analysis of standard reference materials within each set of laboratory samples. Natural water matrix reference standards routinely comprised at least 20 percent of each batch of sample analysis. Different standard reference material were used for each analytical method. A number of separate reference samples, having constituent concentrations that bracketed the expected analyte concentrations in the spring and seeps samples, were routinely analyzed in an identical fashion to the samples. National Institute of Standards and Technology (N.I.S.T.), Standard Reference Materials and U.S.G.S., Standard Reference Water Samples were extensively used to evaluate the accuracy of all analytical trace element determinations. A summary of the results of these standards are shown on bar graphs in Appendix A. The white bars represent the certified or "most probable" value of the trace elements in the reference material. The dark bars are mean concentrations determined on the reference material during the analysis of the samples. The degree of agreement between the certified or "most probable" values and the measured values represent an estimate of the level of accuracy of these determinations.

RESULTS

A summary of all field measurements and the mean values of the replicate laboratory determinations are tabulated in Appendix B. Major anions and cations and dissolved organic carbon are reported in milligrams per liter. Alkalinity and specific conductance are reported in the units of milliequivalents per liter and microsiemens, respectively. All other trace constituents are tabulated in units of micrograms per liter. Where appropriate, detection limits are determined by the method described by Skogerboe and Grant (1970) and reported as "less than" values (>) in the table. Detection limits may vary for a given constituent based on factors such as variation in the sensitivity of the laboratory instrument or sample dilutions that were made at the time of analysis to minimize interelement interference effects. Observations including geological setting and physical characteristics of each spring and seep are also tabulated in Appendix B.

As expected, the water quality results tabulated from this study in Appendix B show that water discharge ranges from barely perceptible (seeps) to a high of about 42 liters per second at Gypsum spring. The magnitude of water discharge is highly variable dependent on the season of the year and the overall climatic and hydrologic conditions prior to measurement (Blanchard, 1986).

Hydrogen ion concentration, expressed in pH, is alkaline and fairly consistent, ranging from 7.11 to 8.53. Alkalinity is variable ranging from 1 to 8 milliequivalents per liter, suggesting significant variation in the bicarbonate contributions. Specific conductance (an indication of dissolved solids content) is also variable, ranging from 143 microsiemens at Bowns Canyon Spring to 5090 microsiemens at Gypsum Spring. Other major water quality constituents such as, Ca, K, Mg, Na, Cl and SO_4 show a similar distribution to the specific conductance, indicating that the majority of the springs are freshwater, with a few springs having nominally high salinity (i.e. Gypsum Spring). Nutrients, including ammonium ion, nitrate, nitrite and phosphate, were observed at very low and variable concentrations.

Several of the trace elements seldom were observed at concentrations above their respective detection limits (usually low nanogram per liter levels). These included Ag, Be, Co, Cu, Ni, Pb and Tl. Concentrations of other trace elements including Br, Cd, Cr, Cs, F, Fe, Hg, Mo, Se and Zn ranged from their respective detection limit to nominally moderate values depending on the specific spring sampled. Finally, elements including Al, As, B, Ba, DOC, Li, Mn, Rb, Sr, U and V were present at measureable concentrations in essentially all springs and seeps sampled. Silica (SiO_2) ranged from 7.1 to 29 milligrams per liter.

CONCLUSIONS

Water is a critical, limited resource in the arid environment of the national parks on the Colorado Plateau. Although many of these springs and seeps are small and sometimes temporary, collectively they result in the greatest and most widespread source of surface water in Glen Canyon National Recreation Area away from Lake Powell and the major river channels. Because of the presence and range of these ground water sources of surface water, they are an essential resource to maintain the riparian and aquatic habitat that supports the local flora and fauna of the high desert. The ecosystems that develop around the springs and seeps represent a unique environment in the desert. This study represents the assessment of selected springs and seeps that were flowing at the time of sampling and that were accessible with reasonable effort. Additional sampling and assessment of these and other springs and seeps in the future is warranted to identify potentially unique floral and faunal species that may be present and provide information to assist in the management of this important resource.

LITERATURE CITED

Antweiler. R.C., Patton, C.J., and Taylor, H.E.. 1993. Automated, colorimetric methods for determination of nitrate plus nitrite, nitrite, ammonium and orthophosphate ions in natural water samples. U.S. Geological Survey Open-File Report No. 93-638. 40 p.

Blanchard, P.J. 1986. Ground-water conditions in the Lake Powell area, Utah. Utah Department of Natural Resources, Technical Publication No. 84. 64 pp.

Brinton, T.I., Antweiter, R.C., and Taylor, H.E., 1996. Method for the determination of dissolved chloride, nitrate and sulfate in natural water using ion chromatography. U.S. Geological Survey Open-File Report 95-426A, 16 p.

Buchanan, T. J. and Somers, W.P., 1976. *Discharge Measurements at Gaging Stations.* U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chap. A8, 65 p.

Cooley, M.E. 1965. *Stratigraphic sections and records of springs in the Glen Canyon region of Utah and Arizona.* Museum of Northern Arizona, Technical Series No. 6, Flagstaff, AZ. Northern Society of Science and Art. 140 pp.

Davis, G.E., Hardt, W.F., Thompson, L.K. and M.E. Cooley. 1963. Geohydrologic data in the Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah. Part I, Records of ground-water supplies, Tucson, AZ, Arizona State Land Department Water Resources Report No. 12-A. 159 pp.

Garbarino, J.R. and Taylor, H.E.. 1979. An inductively-coupled plasma atomic emission spectrometric method for routine water quality testing. Applied. Spectroscopy, 33, p. 220.

Garbarino, J.R. and Taylor, H.E. 1994. Inductively coupled plasma-mass spectrometric method for the determination of dissolved trace elements in natural water. U.S. Geological Survey Open-File Report No. 94-358, 88 p.

Kelly, T. and Taylor, H.E. 1996. Concentrations and loads of selected trace elements and other constituents in the Rio Grande, in the vicinity of Albuquerque, New Mexico, 1994. U.S. Geological Survey Open-File Report 96-126, p. 1-45.

Kister, L.R. and J.L. Hatchett, 1963. Geohydrologic data in the Navajo and Hopi Indian Reservations, Arizona, New Mexico, and Utah. Part II, Selected chemical analysis of the ground water, Tucson, AZ, Arizona State Land Department Water Resources Report No. 12-B. 58pp.

Lively-Schall, W. and R.D. Foust, Jr. 1988. Surface water within Glen Canyon National Recreation Area. Report from Ralph M. Bilby Research Center, Northern Arizona University, Flagstaff, AZ. 56 pp.

Potter, L.D. and C.L. Drake. 1989. *Lake Powell Virgin Flow to Dynamo*. Albuquerque, NM.University of New Mexico Press, p. 289.

Roth, D.A. 1994. *Ultratrace analysis of mercury and its distribution in some natural waters in the United States*. Ft. Collins, CO. Colorado State University, Department of Chemistry. Ph.D. dissertation, 309 p.

Skogerboe, R.K. and C.L. Grant. 1970. Comments on the definitions of terms sensitivity and detection limit. Spectroscopy Letters, v. 3, no. 8/9, p. 215-219.

Skougstad, M.W., Fishman, M.J., Friedman, L.C., Erdman, D.E., and S.S. Duncan. 1979. *Methods for the determination of inorganic substances in water and fluvial sediments.* U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chap. A1, 626 p.

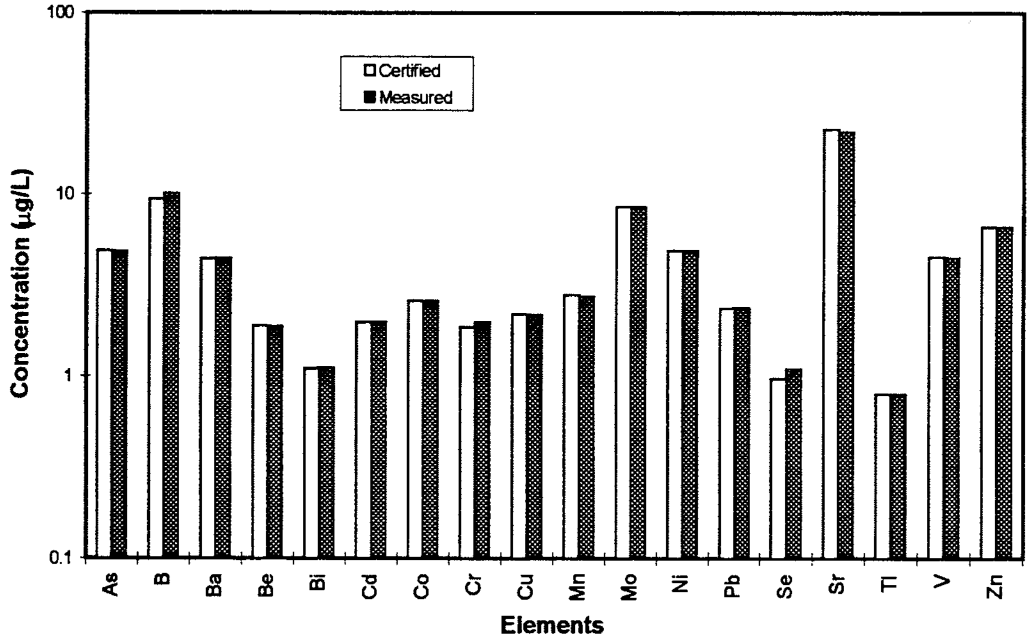
Taylor, H.E., and Garbarino, J.R. 1991. The measurement of trace metals in water resource monitoring samples by inductively-coupled plasma mass spectrometry. Spectrochimica Acta Reviews, 14, p. 33.

Wershaw, R.L., Fishman, M.J., Grabbe, R.R., and L.E. Lowe. 1983. *Methods for the determination of organic substances in water and fluvial sediments.* U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chap. A3, p. 22.

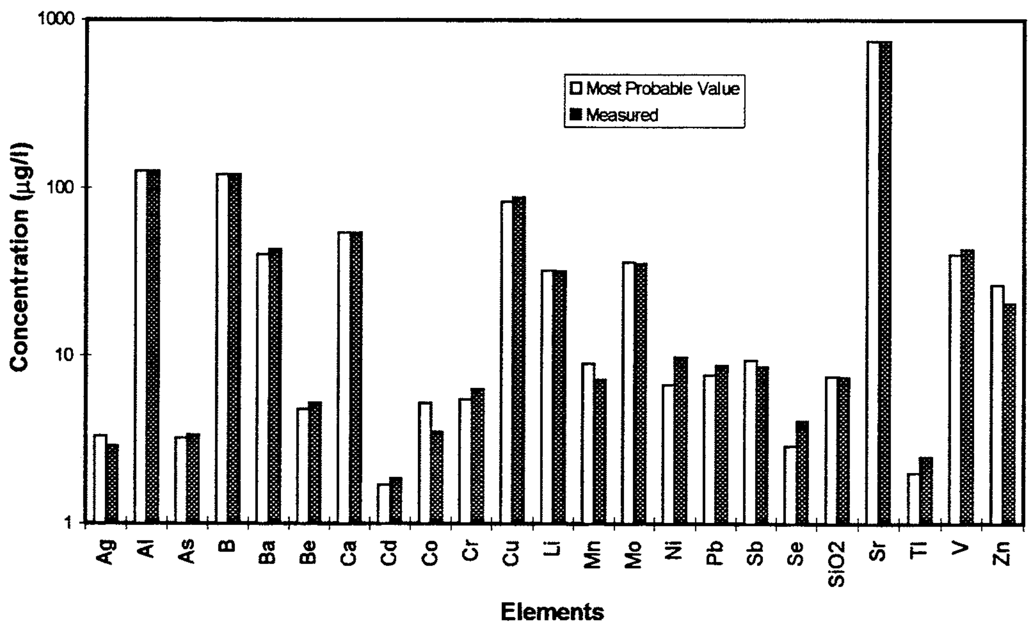
Williamson, R.R. 1985. A baseline chemical analysis of selected springs in Glen Canyon National Recreation Area. Written communication, 22 pp.

Appendix A
Bar graphs of Standard Reference Materials used for Demonstration of Accuracy

Comparison of Certified versus Measured Values for NIST 1643b (1:10 dilution) (As, Bi and B are Most Probable Values)



Comparison of Most Probable Value versus Measured Value for USGS SRWS T103 (in µg/L, except Ca and SiO2 in mg/L)



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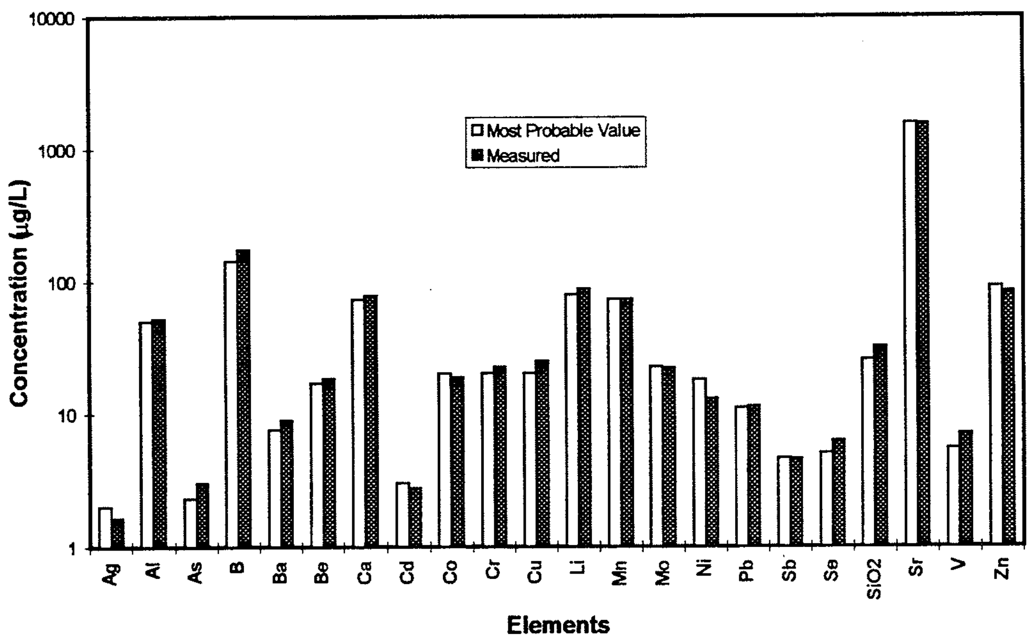
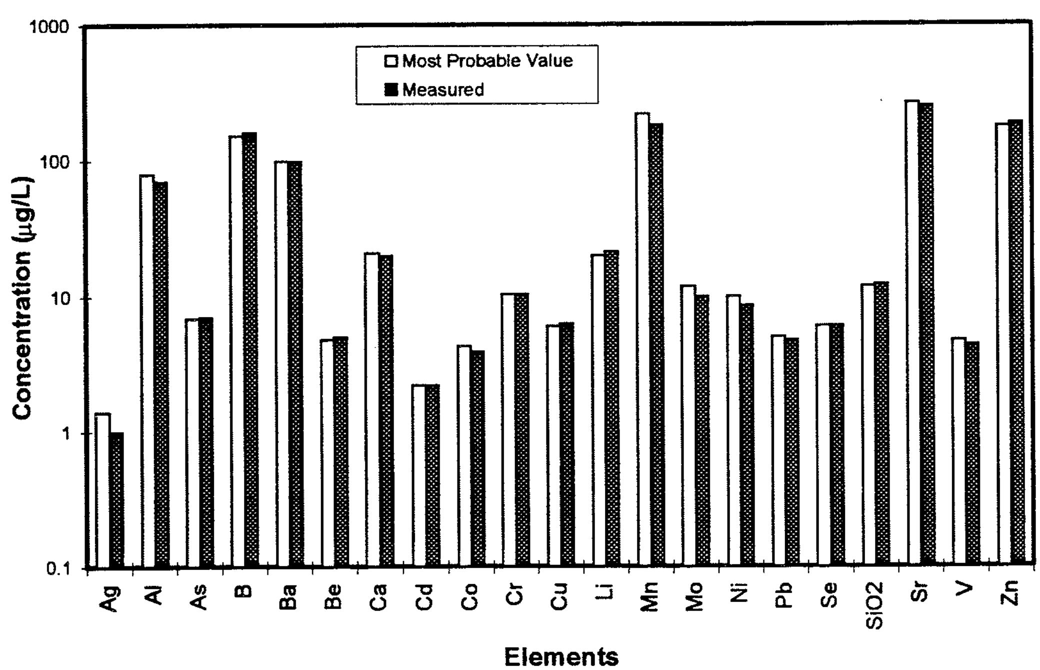


Comparison of Most Probable versus Measured Values for USGS SRWS T117 (in µg/L, except Ca and SiO2 in mg/L)



APPENDIX B
Summary of field and laboratory data

Site	Date	Time	Latitude	Longitude	Water discharge	Temp	pH	Specific conductance	Calcium	Potassium	Magnesium	Sodium
					L/Sec	°C		µS	mg/L	mg/L	mg/L	mg/L
Big Water Spring	18-Oct-94	---	38° 12' 53.4"	110° 4' 2.5"	---	---	---	---	260	18	152	98
Big Water Spring	27-Feb-95	1300	38° 12' 53.4"	110° 4' 2.5"	---	---	---	---	220	19	125	69
Big Water Spring	03-May-95	1115	38° 12' 53.4"	110° 4' 2.5"	0.1	21.0	7.56	1896	210	23	123	73
Bowns Spring A	19-Oct-94	---	37° 24' 14.7"	110° 52' 57.8"	---	---	---	---	13	0.8	8.1	1.3
Bowns Spring A	28-Feb-95	1415	37° 24' 14.7"	110° 52' 57.8"	---	---	---	---	13	1	7.8	1.1
Bowns Spring A	04-May-95	1015	37° 24' 14.7"	110° 52' 57.8"	0.5	13.6	7.92	129	12	0.6	7.9	0.9
Bowns Spring B	19-Oct-94	---	37° 23' 45.3"	110° 52' 27.3"	---	---	---	---	14	1.0	8.8	1.4
Bowns Spring B	28-Feb-95	1445	37° 23' 45.3"	110° 52' 27.3"	---	---	---	---	15	1.1	8.8	1.3
Bowns Spring B	04-May-95	1100	37° 23' 45.3"	110° 52' 27.3"	0.8	14.9	8.26	143	13	0.86	7.4	0.9
Cottonwood Canyon Seep	04-Jul-95	---	37° 13' 54.6"	110° 51' 35.3"	---	---	---	---	31	1	13	2.8
Cow Canyon Spring	19-Oct-94	---	37° 25' 20.6"	110° 55' 7.2"	---	---	---	---	18	1.1	13	2.1
Cow Canyon Spring	28-Feb-95	1550	37° 25' 20.6"	110° 55' 7.2"	---	---	---	---	17	1.2	12	1.9
Cow Canyon Spring	04-May-95	1150	37° 25' 20.6"	110° 55' 7.2"	---	13.0	8.39	258	22	2.7	17	2.8
Cow Canyon Spring	19-Oct-94	---	37° 25' 20.6"	110° 55' 7.2"	---	---	---	---	17	1.0	8	1.8
Coyote Arch Spring	01-Mar-95	955	37° 25' 14.1"	111° 00' 17.4"	---	---	---	---	20	1.2	9.5	2.1
Coyote Arch Spring	04-May-95	950	37° 25' 14.1"	111° 00' 17.4"	< 2	13.1	7.48	194	20	1.1	7.7	1.5
Forgotten Spring	01-Mar-95	1200	37° 32' 30"	110° 34' 24"	---	---	---	---	36	0.64	19	4.1
Forgotten Spring	02-May-95	1145	37° 32' 30"	110° 34' 24"	< 0.1	12.8	8.53	353	38	1.1	20	4.0
French Spring	18-Oct-94	---	38° 14' 12.3"	110° 8' 52.7"	---	---	---	---	37	2.0	9.8	5.0
French Spring	27-Feb-95	1230	38° 14' 12.3"	110° 8' 52.7"	---	---	---	---	37	2.2	8.7	4.2
French Spring	03-May-95	1030	38° 14' 12.3"	110° 8' 52.7"	< 0.1	13.0	8.14	267	35	2.1	9.7	3.9
Good Hope Spring A	27-Feb-95	1620	37° 44' 10.7"	110° 24' 42.8"	---	---	---	---	24	1.4	13	23
Good Hope Spring A	03-May-95	1100	37° 44' 10.7"	110° 24' 42.8"	0.5	15.6	8.26	300	20	1.3	12	19
Good Hope Spring B	03-May-95	1140	37° 42' 21.9"	110° 25' 18.9"	28	17.1	8.18	293	21	1.2	12	15
Gypsum Spring A	18-Oct-94	---	38° 0' 41.1"	110° 3' 46.9"	---	---	---	---	740	11	191	1360
Gypsum Spring A	27-Feb-95	1330	38° 0' 41.1"	110° 3' 46.9"	---	---	---	---	390	8.3	101	720
Gypsum Spring A	03-May-95	1200	38° 0' 41.1"	110° 3' 46.9"	0.1	22.0	7.11	5090	360	7.4	97	700
Gypsum Spring B	03-May-95	1200	38° 0' 41.1"	110° 3' 46.9"	42	22.0	8.19	1480	143	3.7	63	87
Iceberg Spring	20-Oct-94	---	37° 17' 52.4"	110° 42' 58.2"	---	---	---	---	72	1.3	21	5.0
Iceberg Spring	04-May-95	---	37° 17' 52.4"	110° 42' 58.2"	---	15.0	8.08	558	52	0.48	39	7.8
Iceberg Spring	05-Mar-95	---	37° 17' 52.4"	110° 42' 58.2"	---	---	---	---	58	0.63	42	8.2
Iceberg Soil Seep	04-May-95	1620	37° 17' 25.3"	110° 43' 49"	---	20.7	8.39	365	56	0.67	21	5.5
Iceberg Stream	02-May-95	1140	37° 17' 25.3"	110° 43' 49"	7	16.0	7.81	184	22	1.8	6.4	1.3
Iceberg Canyon Isolated Pond	02-May-95	1100	---	---	---	17.0	8.35	375	41	5.1	27	7.0
Kaiparowits Spring A	04-May-95	900	37° 8' 55.9"	111° 1' 58.8"	< 0.1	6.0	8.19	629	67	0.88	33	9.9
Kaiparowits Spring B	04-May-95	900	37° 8' 55.9"	111° 1' 58.8"	< 0.1	9.0	7.56	1266	102	1.9	113	45

Site	Date	Time	Latitude	Longitude	Water discharge L/Sec	Temp °C	pH	Specific conductance µS	Calcium mg/L	Potassium mg/L	Magnesium mg/L	Sodium mg/L
Knowles Spring A	17-Oct-94	---	37° 35' 6.6"	110° 32' 29.6"	---	---	---	---	18	1.5	9.7	2.2
Knowles Spring A	01-Mar-95	1230	37° 35' 6.6"	110° 32' 29.6"	---	---	---	---	19	1.4	10	2.2
Knowles Spring A	03-May-95	1450	37° 34' 30.6"	110° 32' 29.6"	< 0.1	9.8	7.67	232	26	1.1	13	2.5
Knowles Spring B	03-May-95	1405	37° 34' 14.8"	110° 34' 38.5"	0.2	13.7	7.98	192	17	1.4	8.6	1.8
Long Canyon Spring	19-Oct-94	---	37° 22' 48.8"	110° 51' 42.2"	---	---	---	---	13	1	7.7	1.8
Long Canyon Spring	28-Feb-95	1320	37° 22' 48.8"	110° 51' 42.2"	---	---	---	--	13	1.1	7.5	1.6
Long Canyon Spring	04-May-95	1130	37° 22' 48.8"	110° 51' 42.2"	0.5	17.9	8.03	138	13	0.98	7.6	1.8
Moqui Spring A	17-Oct-94	---	37° 28' 10.2"	110° 25' 12"	---	---	---	---	37	0.4	22	10
Moqui Spring A	01-Mar-95	1105	37° 28' 10.2"	110° 25' 12"	---	---	---	---	20	0.38	11	3.7
Moqui Spring A	04-May-95	1000	37° 28' 10.2"	110° 25' 12"	---	21.0	8.20	227	28	0.34	15	5.7
Moqui Spring B	25-Feb-95	1200	37° 27' 30"	110° 32' 48"	---	---	---	---	27	1.2	9.7	4.9
Moqui Spring B	02-May-95	1300	37° 27' 30"	110° 32' 48"	0.1	25.4	8.38	260	31	1.4	12	6.1
Popcan Spring	16-May-95	1500	37° 20' 14.6"	110° 52' 26.1"	14	---	---	---	20	1.6	11	2.1
Popcan Spring	04-Jul-95	---	37° 20' 14.6"	110° 52' 26.1"	---	16.5	---	---	28	0.85	16	3.0
Four Mile Spring	02-Mar-95	1210	36° 52' 30.4"	111° 30' 25.6"	---	---	---	---	18	1.1	9.2	8.7
Four Mile Spring	01-May-95	1425	36° 52' 30.4"	111° 30' 25.6"	0.8	21.0	8.49	244	20	1.2	10	9.4
Frog Marsh Spring	02-Mar-95	1530	36° 50' 44.9"	111° 33' 26.1"	---	---	---	---	14	1.3	7.6	8.9
Frog Marsh Spring	01-May-95	1330	36° 50' 44.9"	111° 33' 26.1"	1.5	21.0	8.49	213	14	1.2	7.4	9.1
Power Lines Spring	20-Oct-94	---	36° 55' 37.1"	111° 29' 31.6"	---	---	---	---	36	2.3	15	8.6
Power Lines Spring	02-Mar-95	1500	36° 55' 37.1"	111° 29' 31.6"	---	---	---	---	35	2.4	14	7.9
Power Lines Spring	01-May-95	1540	36° 55' 37.1"	111° 29' 31.6"	4	21.0	8.37	351	36	2.3	15	8.2
Sewage Ponds Spring	20-Oct-94	---	36° 54' 42.5"	111° 28' 41.9"	---	---	---	---	38	2	17	26
Sewage Ponds Spring	02-Mar-95	1020	36° 54' 42.5"	111° 28' 41.9"	---	---	---	---	38	2	16	24
Sewage Ponds Spring	01-May-95	1515	36° 54' 42.5"	111° 28' 41.9"	1.6	22.0	8.38	468	37	1.9	16	23
San Juan MCO2	27-Jul-94	---	37° 12' 1.9"	110° 52' 10"	---	---	---	---	17	1.1	7.9	2.2
San Juan MCO2	02-May-95	1010	37° 12' 1.9"	110° 52' 10"	0.2	18.0	8.34	170	19	0.38	8.7	1.6
Swett Spring	18-Oct-94	---	37° 49' 47.7"	110° 30' 11.6"	---	---	---	---	46	5.2	16	42
Swett Spring	27-Feb-95	1440	37° 49' 47.7"	110° 30' 11.6"	---	---	---	---	53	3.0	28	25
Swett Spring	03-May-95	1400	37° 49' 47.7"	110° 30' 11.6"	0.5	23.0	8	552	46	4.7	22	23
Swett SE Spring	18-Oct-94	---	37° 49' 14.3"	110° 33' 11.1"	---	---	---	---	44	11	43	170
Swett SE Spring	27-Feb-95	1410	37° 49' 14.3"	110° 33' 11.1"	---	---	---	---	41	10	42	164
Swett SE Spring	03-May-95	1325	37° 49' 14.3"	110° 33' 11.1"	< 0.1	20.0	7.88	1352	46	13	49	187
Ticaboo Spring	03-May-95	1145	37° 42' 25.0"	110° 31' 8.1"	1	17.0	7.98	430	33	2.8	23	21
Wilson Spring	27-Jul-94	---	37° 11' 38"	110° 47' 23.5"	---	---	---	---	21	1.2	9.5	7.2
Wilson Spring	01-Mar-95	1410	37° 11' 38"	110° 47' 23.5"	---	---	---	---	23	1.2	11	7.5
Wilson Spring	02-May-95	1110	37° 11' 38"	110° 47' 23.5"	28	19.0	7.30	219	65	1.10	24	14

Site	Date	Silica	Strontium	Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Cesium	Chromium	Cobalt	Copper
		mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Big Water Spring	18-Oct-94	13	2.6	4.0	3.3	73	< 0.005	130	< 0.05	0.05	3.8	14	2.1
Big Water Spring	27-Feb-95	11	2.2	1.2	1.5	40	< 0.006	150	0.004	0.009	2.1	4.2	< 0.1
Big Water Spring	03-May-95	13	2.4	0.91	0.7	31	< 0.006	170	0.013	0.012	< 0.8	< 0.1	< 0.1
Bowns Spring A	19-Oct-94	8.5	0.06	0.9	0.1	35	< 0.005	7	< 0.05	0.03	0.5	< 0.1	0.11
Bowns Spring A	28-Feb-95	8.3	0.06	2.4	< 0.1	33	< 0.006	8	0.007	0.006	< 1	< 0.1	< 0.1
Bowns Spring A	04-May-95	7.7	0.05	0.97	< 0.1	27	< 0.006	9	< 0.004	0.006	< 0.8	< 0.1	< 0.1
Bowns Spring B	19-Oct-94	8.4	0.07	1.7	0.11	34	< 0.005	8	< 0.05	0.03	0.6	< 0.1	0.15
Bowns Spring B	28-Feb-95	9.0	0.06	2.1	< 0.1	31	< 0.006	11	0.010	0.013	< 1	< 0.1	< 0.1
Bowns Spring B	04-May-95	7.1	0.06	3.7	0.1	27	< 0.006	12	0.015	0.007	1.1	< 0.1	< 0.1
Cottonwood Canyon Seep	04-Jul-95	10	0.13	20	1.1	79	< 0.006	13	0.035	0.006	2.3	< 0.1	0.8
Cow Canyon Spring	19-Oct-94	10	0.12	0.5	0.2	117	< 0.005	11	< 0.05	0.1	0.8	0.06	< 0.02
Cow Canyon Spring	28-Feb-95	9.6	0.11	0.82	0.1	108	< 0.006	12	< 0.004	0.036	< 1	< 0.1	< 0.1
Cow Canyon Spring	04-May-95	15	0.15	3.0	0.4	116	< 0.006	24	0.005	0.004	< 0.8	< 0.1	< 0.1
Cow Canyon Spring	19-Oct-94	10	0.06	1.1	2.2	29	< 0.005	13	< 0.05	0.07	0.5	0.08	< 0.1
Coyote Arch Spring	01-Mar-95	10	0.06	0.86	1.5	33	< 0.006	14	< 0.004	0.022	< 1	< 0.1	< 0.1
Coyote Arch Spring	04-May-95	8.6	0.05	1.2	1.7	21	< 0.006	14	0.004	0.028	< 0.8	< 0.1	< 0.1
Forgotten Spring	01-Mar-95	15	0.17	3.3	0.4	157	< 0.006	8	0.006	< 0.002	< 1	< 0.1	< 0.1
Forgotten Spring	02-May-95	17	0.19	1.0	0.5	175	< 0.006	16	0.005	< 0.002	< 0.8	< 0.1	< 0.1
French Spring	18-Oct-94	8.1	0.11	1.4	0.1	57	< 0.005	16	< 0.05	0.05	0.7	0.16	0.21
French Spring	27-Feb-95	7.9	0.10	2.2	< 0.1	50	< 0.006	19	0.005	0.015	< 1	< 0.1	< 0.1
French Spring	03-May-95	7.8	0.10	4.2	< 0.1	49	< 0.006	18	< 0.004	0.005	< 0.8	< 0.1	< 0.1
Good Hope Spring A	27-Feb-95	16	0.22	2.2	3.0	137	< 0.006	32	< 0.004	< 0.002	1.2	< 0.1	< 0.1
Good Hope Spring A	03-May-95	14	0.22	1.3	3.2	135	< 0.006	35	< 0.004	< 0.002	< 0.8	< 0.1	< 0.1
Good Hope Spring B	03-May-95	14	0.2	1.1	3.1	145	< 0.006	25	< 0.004	0.003	< 0.8	< 0.1	< 0.1
Gypsum Spring A	18-Oct-94	14	14	0.9	---	39	< 0.005	590	< 0.05	0.04	---	0.93	---
Gypsum Spring A	27-Feb-95	13	9.6	1.7	4.7	36	0.009	470	0.016	0.008	3.2	< 0.1	< 0.1
Gypsum Spring A	03-May-95	11.0	8.7	1.3	5.9	43	< 0.006	480	0.004	0.008	1.2	< 0.1	< 0.1
Gypsum Spring B	03-May-95	7.0	1.9	8.5	1.2	56	< 0.006	160	0.006	0.005	< 0.8	< 0.1	< 0.1
Iceberg Spring	20-Oct-94	13	0.52	0.8	0.6	131	< 0.005	18	< 0.05	0.04	1.4	0.49	< 0.1
Iceberg Spring	04-May-95	26	0.55	0.72	1.4	126	< 0.006	25	< 0.004	< 0.002	< 0.8	< 0.1	< 0.1
Iceberg Spring	05-Mar-95	29	0.56	0.51	1.6	125	< 0.006	23	< 0.004	< 0.002	< 1	< 0.1	< 0.1
Iceberg Soil Seep	04-May-95	14	0.46	0.99	0.7	95	< 0.006	17	0.004	< 0.002	0.8	< 0.1	< 0.1
Iceberg Stream	02-May-95	4.9	0.09	22	1.1	57	< 0.006	19	0.005	< 0.002	< 0.8	< 0.1	0.4
Iceberg Canyon Isolated Pond	02-May-95	8.5	0.24	19	1.7	121	< 0.006	65	0.120	0.003	< 0.8	0.1	< 0.12
Kaiparowits Spring A	04-May-95	13	0.19	1.3	1.5	120	< 0.006	62	< 0.004	< 0.002	< 0.8	< 0.1	< 0.1
Kaiparowits Spring B	04-May-95	16	0.33	0.96	0.4	38	< 0.006	140	< 0.004	0.14	< 0.8	< 0.1	< 0.1

Site	Date	Silica	Strontium	Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Cesium	Chromium	Cobalt	Copper
		mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Knowles Spring A	17-Oct-94	9.3	0.09	1.5	0.7	290	< 0.005	9	< 0.05	0.03	0.8	< 0.1	0.1
Knowles Spring A	01-Mar-95	9.6	0.08	1.1	0.6	250	< 0.006	9	0.004	0.006	< 1	< 0.1	< 0.1
Knowles Spring A	03-May-95	9.2	0.10	0.97	0.3	186	< 0.006	10	0.006	< 0.002	< 0.8	< 0.1	< 0.1
Knowles Spring B	03-May-95	8.5	0.08	0.66	0.5	260	< 0.006	9	< 0.004	0.005	< 0.8	< 0.1	< 0.1
Long Canyon Spring	19-Oct-94	9	0.08	0.6	0.1	29	< 0.005	11	< 0.05	0.07	0.8	< 0.1	< 0.1
Long Canyon Spring	28-Feb-95	9.1	0.07	1.1	< 0.1	27	< 0.006	12	0.007	0.031	< 1	< 0.1	< 0.1
Long Canyon Spring	04-May-95	9.1	0.07	0.69	< 0.1	27	< 0.006	12	< 0.004	0.027	< 0.8	< 0.1	< 0.1
Moqui Spring A	17-Oct-94	30	0.24	3.4	3.2	116	< 0.005	7	< 0.05	0.05	0.9	0.18	3.6
Moqui Spring A	01-Mar-95	15	0.11	2.2	1.2	59	< 0.006	9	0.008	< 0.002	1.1	< 0.1	< 0.1
Moqui Spring A	04-May-95	19	0.13	1.7	1.4	70	0.008	12	0.007	< 0.002	< 0.8	< 0.1	< 0.1
Moqui Spring B	25-Feb-95	15	0.13	1.5	0.6	68	0.007	17	< 0.004	< 0.002	< 1	< 0.1	< 0.1
Moqui Spring B	02-May-95	20	0.14	1.6	0.7	73	< 0.006	20	0.008	< 0.002	< 0.8	< 0.1	< 0.1
Popcan Spring	16-May-95	9.4	0.11	4.0	0.7	45	< 0.006	11	0.029	0.009	< 1.1	< 0.1	3.1
Popcan Spring	04-Jul-95	15	0.20	6.5	3.6	143	< 0.006	21	0.023	0.002	2.6	< 0.1	7.3
Four Mile Spring	02-Mar-95	12	0.15	1.5	4	290	< 0.006	34	< 0.004	0.021	1.2	< 0.1	< 0.1
Four Mile Spring	01-May-95	12	0.15	1.5	4.2	290	< 0.006	34	0.005	0.018	0.8	< 0.1	< 0.1
Frog Marsh Spring	02-Mar-95	10	0.17	1.8	5.3	140	< 0.006	34	0.007	0.014	1.6	< 0.1	< 0.1
Frog Marsh Spring	01-May-95	11	0.16	1.5	5.1	134	< 0.006	34	0.008	0.017	0.8	< 0.1	< 0.1
Power Lines Spring	20-Oct-94	11	0.24	1.0	12	120	< 0.005	29	< 0.05	0.29	1.2	0.14	0.16
Power Lines Spring	02-Mar-95	11	0.22	1.7	12	111	< 0.006	31	< 0.004	0.17	1.1	< 0.1	< 0.1
Power Lines Spring	01-May-95	10	0.22	0.96	13	110	< 0.006	32	0.005	0.17	< 0.8	< 0.1	< 0.1
Sewage Ponds Spring	20-Oct-94	12	0.40	13	3.9	57	< 0.005	54	< 0.05	0.28	2.1	0.15	0.4
Sewage Ponds Spring	02-Mar-95	11	0.40	1.1	3.8	53	< 0.006	63	< 0.004	0.16	1.6	< 0.1	< 0.1
Sewage Ponds Spring	01-May-95	11	0.40	1.1	3.8	54	< 0.006	60	< 0.004	0.16	< 0.8	< 0.1	< 0.1
San Juan MCO2	27-Jul-94	9	0.10	1.3	1.5	60	< 0.005	9	< 0.05	0.04	0.5	< 0.1	< 0.1
San Juan MCO2	02-May-95	8.4	---	0.77	1.2	56	< 0.006	11	< 0.004	< 0.002	< 1	< 0.1	< 0.1
Swett Spring	18-Oct-94	11	0.68	10	2.7	137	< 0.005	72	< 0.05	0.01	1	0.28	2.0
Swett Spring	27-Feb-95	16	0.4	1.9	1.6	152	< 0.006	36	0.005	0.004	< 1	< 0.1	< 0.1
Swett Spring	03-May-95	16	0.54	3.8	2.9	148	< 0.006	56	< 0.004	0.008	< 0.8	< 0.1	< 0.1
Swett SE Spring	18-Oct-94	14	1.2	14	2.8	95	< 0.005	260	< 0.05	0.07	2.7	0.22	3.2
Swett SE Spring	27-Feb-95	11	1.2	8.6	2	85	< 0.006	200	< 0.004	0.037	1.6	< 0.1	< 0.1
Swett SE Spring	03-May-95	13	1.4	1.5	2.1	127	< 0.006	250	< 0.004	0.031	< 0.8	< 0.1	< 0.1
Ticaboo Spring	03-May-95	17	0.34	0.94	1.7	128	< 0.006	41	< 0.004	0.01	1.3	< 0.1	< 0.1
Wilson Spring	27-Jul-94	14	0.15	1.5	1.3	126	< 0.005	12	< 0.05	0.04	0.7	< 0.1	< 0.1
Wilson Spring	01-Mar-95	15	0.14	7.2	1.3	113	< 0.006	13	0.004	0.006	< 1	< 0.1	< 0.1
Wilson Spring	02-May-95	12	0.29	0.84	0.9	147	< 0.006	19	0.006	< 0.002	< 0.8	< 0.1	< 0.1

Site	Date	Iron	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Rubidium	Selenium	Silver	Thallium
		mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Big Water Spring	18-Oct-94	0.69	0.021	110	2890	0.0007	4.0	16	3.3	2.9	< 0.04	0.031
Big Water Spring	27-Feb-95	0.19	< 0.02	93	680	0.0009	2.0	< 1	3.2	0.8	< 0.04	0.038
Big Water Spring	03-May-95	< 0.007	< 0.02	96	94	0.0004	1.3	< 1	5.2	2.1	< 0.04	0.041
Bowns Spring A	19-Oct-94	0.006	< 0.005	2.2	3.2	0.0005	0.11	< 0.1	0.6	0.3	< 0.04	< 0.001
Bowns Spring A	28-Feb-95	0.011	< 0.02	2.4	2.9	0.0006	< 0.1	< 1	0.7	0.4	< 0.04	< 0.003
Bowns Spring A	04-May-95	< 0.007	< 0.02	2.3	3.4	< 0.0004	< 0.1	< 1	0.5	< 0.2	< 0.04	< 0.003
Bowns Spring B	19-Oct-94	< 0.005	< 0.005	2.5	1.0	0.0011	0.08	< 0.1	0.8	0.3	< 0.04	< 0.001
Bowns Spring B	28-Feb-95	0.016	< 0.02	3.1	7.7	0.0007	< 0.1	< 1	0.8	0.6	< 0.04	< 0.003
Bowns Spring B	04-May-95	0.031	< 0.02	2.8	13	0.0011	< 0.1	< 1	0.6	0.6	< 0.04	< 0.003
Cottonwood Canyon Seep	04-Jul-95	0.011	0.15	8.2	1.1	---	< 0.1	< 1	0.3	0.4	< 0.04	< 0.003
Cow Canyon Spring	19-Oct-94	< 0.005	< 0.005	5	0.01	0.0006	0.11	< 0.1	1.3	0.5	< 0.04	< 0.001
Cow Canyon Spring	28-Feb-95	< 0.009	< 0.02	5.6	0.1	< 0.0004	< 0.1	< 1	1.3	0.3	< 0.04	< 0.003
Cow Canyon Spring	04-May-95	< 0.007	< 0.02	10	3.3	0.0005	0.34	< 1	1.6	0.4	< 0.04	< 0.003
Cow Canyon Spring	19-Oct-94	0.01	< 0.005	3.5	0.17	0.0008	0.16	0.1	1.4	0.3	< 0.04	< 0.001
Coyote Arch Spring	01-Mar-95	0.021	< 0.02	4.4	0.4	< 0.0004	0.13	< 1	1.4	0.3	< 0.04	< 0.003
Coyote Arch Spring	04-May-95	0.072	< 0.02	3.9	160	0.0008	< 0.1	< 1	1.4	< 0.2	< 0.04	< 0.003
Forgotten Spring	01-Mar-95	< 0.009	< 0.02	5.4	0.5	< 0.0004	0.12	< 1	0.1	0.4	< 0.04	< 0.003
Forgotten Spring	02-May-95	< 0.007	< 0.02	6.5	0.2	0.0012	< 0.1	< 1	0.2	< 0.2	< 0.04	< 0.003
French Spring	18-Oct-94	< 0.005	< 0.02	2.5	0.5	0.0005	0.09	0.2	2.4	0.6	< 0.04	< 0.001
French Spring	27-Feb-95	< 0.009	< 0.02	2.9	0.5	< 0.0004	< 0.1	< 1	2.3	0.3	< 0.04	< 0.003
French Spring	03-May-95	< 0.007	< 0.02	2.7	0.8	0.0006	< 0.1	< 1	2.3	< 0.2	< 0.04	< 0.003
Good Hope Spring A	27-Feb-95	< 0.009	< 0.02	17	2.4	< 0.0004	0.41	< 1	0.6	0.7	< 0.04	< 0.003
Good Hope Spring A	03-May-95	< 0.01	< 0.02	18	0.6	< 0.0004	0.45	< 1	0.6	0.8	< 0.04	< 0.003
Good Hope Spring B	03-May-95	< 0.007	< 0.02	13	0.1	0.0008	0.33	< 1	0.6	0.8	< 0.04	< 0.003
Gypsum Spring A	18-Oct-94	0.21	< 0.005	97	46	0.0009	6.7	0.8	3.1	9.3	0.06	0.005
Gypsum Spring A	27-Feb-95	0.082	< 0.02	65	16	0.0049	4.2	< 1	2.6	3.9	0.04	0.010
Gypsum Spring A	03-May-95	0.037	< 0.02	67	31	0.0013	3.8	< 1	2.4	3.6	0.04	0.005
Gypsum Spring B	03-May-95	< 0.007	< 0.02	24	4.2	0.0010	2.5	< 1	1.3	1.9	< 0.04	0.007
Iceberg Spring	20-Oct-94	0.31	< 0.005	6.9	39	0.074	0.53	1.3	0.1	< 0.3	0.13	< 0.001
Iceberg Spring	04-May-95	0.012	< 0.02	13	21	0.0010	1.4	< 1	0.1	0.3	< 0.04	< 0.003
Iceberg Spring	05-Mar-95	0.012	< 0.02	13	9.1	0.0005	2.1	< 1	0.1	0.9	< 0.04	< 0.003
Iceberg Soil Seep	04-May-95	0.009	< 0.02	8.4	27	< 0.0004	0.78	< 1	0.1	0.2	< 0.04	< 0.003
Iceberg Stream	02-May-95	0.012	< 0.023	2.7	19	0.0020	0.16	< 1	0.3	< 0.2	< 0.04	< 0.003
Iceberg Canyon Isolated Pond	02-May-95	0.025	0.10	12	59	0.0019	0.87	< 1	0.7	< 0.2	< 0.04	< 0.003
Kaiparowits Spring A	04-May-95	< 0.007	< 0.02	3.4	56	< 0.0004	0.65	< 1	0.2	0.8	< 0.04	0.003
Kaiparowits Spring B	04-May-95	< 0.01	< 0.02	22	0.3	0.0008	1.1	< 1	1.7	4.7	< 0.04	0.003

Site	Date	Iron	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Rubidium	Selenium	Silver	Thallium
		mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Knowles Spring A	17-Oct-94	< 0.005	0.019	2.5	< 0.04	0.0008	0.11	< 0.1	0.9	0.6	0.04	< 0.001
Knowles Spring A	01-Mar-95	< 0.009	< 0.02	2.7	< 0.04	< 0.0004	< 0.1	< 1	0.9	0.6	< 0.04	< 0.003
Knowles Spring A	03-May-95	< 0.007	< 0.02	3.3	2.1	0.0005	0.13	< 1	0.3	0.6	< 0.04	< 0.003
Knowles Spring B	03-May-95	< 0.007	< 0.02	2.7	0.04	< 0.0004	< 0.1	< 1	0.8	0.3	< 0.04	< 0.003
Long Canyon Spring	19-Oct-94	< 0.005	< 0.005	3.8	0.04	0.0014	0.15	< 0.1	1.1	0.5	< 0.04	< 0.001
Long Canyon Spring	28-Feb-95	< 0.009	< 0.02	4.1	0.04	< 0.0004	< 0.1	< 1	1.1	< 0.2	< 0.04	< 0.003
Long Canyon Spring	04-May-95	< 0.01	< 0.02	4.1	0.1	< 0.0004	< 0.1	< 1	0.9	< 0.2	< 0.04	< 0.003
Moqui Spring A	17-Oct-94	0.008	0.017	12	0.45	0.0017	0.78	0.20	0.1	0.9	< 0.04	< 0.003
Moqui Spring A	01-Mar-95	< 0.009	< 0.02	5.1	0.2	0.0008	0.12	< 1	0.1	< 0.2	< 0.04	< 0.003
Moqui Spring A	04-May-95	< 0.007	< 0.02	6.5	0.3	0.0007	0.12	< 1	0.1	< 0.2	< 0.04	< 0.003
Moqui Spring B	25-Feb-95	< 0.009	< 0.02	4.1	2.2	0.0006	0.14	< 1	0.2	< 0.2	< 0.04	< 0.003
Moqui Spring B	02-May-95	0.009	0.03	5.1	3.4	0.0017	0.17	< 1	0.3	< 0.2	< 0.04	< 0.003
Popcan Spring	16-May-95	< 0.009	< 0.02	4.5	0.4	< 0.0004	< 0.1	< 1	1.2	0.4	< 0.04	< 0.003
Popcan Spring	04-Jul-95	< 0.009	0.08	7.9	1.4	0.0014	0.34	< 1	0.4	0.2	< 0.04	< 0.003
Four Mile Spring	02-Mar-95	< 0.009	< 0.02	8.6	< 0.04	< 0.0004	0.14	< 1	1.1	1.6	< 0.04	< 0.003
Four Mile Spring	01-May-95	< 0.007	< 0.02	8.7	0.04	0.0006	0.13	< 1	1.2	1.8	< 0.04	< 0.003
Frog Marsh Spring	02-Mar-95	< 0.009	< 0.02	11	1.1	< 0.0004	0.20	< 1	1.1	1.4	< 0.04	< 0.003
Frog Marsh Spring	01-May-95	< 0.007	0.09	11	0.1	0.0008	0.18	< 1	1.1	1.5	< 0.04	< 0.003
Power Lines Spring	20-Oct-94	< 0.005	< 0.005	24	0.19	0.0297	0.33	0.1	4.8	1.5	< 0.04	< 0.003
Power Lines Spring	02-Mar-95	< 0.009	< 0.02	26	0.1	0.0014	0.27	< 1	4.9	1.4	< 0.04	< 0.003
Power Lines Spring	01-May-95	< 0.007	0.23	26	0.2	0.0015	0.25	< 1	4.9	1.3	< 0.04	< 0.003
Sewage Ponds Spring	20-Oct-94	0.006	< 0.005	43	0.02	0.0021	0.24	0.1	2.5	2.5	< 0.04	< 0.003
Sewage Ponds Spring	02-Mar-95	< 0.009	< 0.02	48	< 0.04	0.0020	0.17	< 1	2.4	2.1	< 0.04	< 0.003
Sewage Ponds Spring	01-May-95	< 0.007	< 0.02	48	< 0.04	0.0010	0.18	< 1	2.5	2.3	< 0.04	< 0.003
San Juan MCO2	27-Jul-94	< 0.005	< 0.005	3.3	0.05	0.0004	0.19	< 0.1	1.0	0.6	< 0.04	< 0.001
San Juan MCO2	02-May-95	< 0.007	< 0.02	3.8	0.07	0.0006	< 0.1	< 1	0.3	< 0.2	< 0.04	< 0.003
Swett Spring	18-Oct-94	0.014	0.005	27	2.5	0.0023	3.6	0.5	1.2	7.4	< 0.04	0.009
Swett Spring	27-Feb-95	< 0.009	< 0.02	23	1.2	< 0.0004	0.75	< 1	0.9	1.1	< 0.04	0.003
Swett Spring	03-May-95	0.007	< 0.02	26	23	0.0019	1.20	< 1	1.4	0.3	< 0.04	0.004
Swett SE Spring	18-Oct-94	0.018	< 0.005	140	3.9	0.0014	2.04	0.4	4.0	5.3	< 0.04	0.029
Swett SE Spring	27-Feb-95	< 0.009	< 0.02	150	0.3	< 0.0004	1.70	< 1	3.4	6.4	< 0.04	0.016
Swett SE Spring	03-May-95	< 0.01	< 0.02	160	3.0	0.0009	1.80	< 1	3.5	0.9	< 0.04	0.012
Ticaboo Spring	03-May-95	< 0.007	< 0.02	22	< 0.04	0.0005	1.50	< 1	1.6	1.7	< 0.04	< 0.003
Wilson Spring	27-Jul-94	< 0.005	0.013	4.6	0.45	0.0006	0.18	< 0.1	0.7	0.6	< 0.04	< 0.001
Wilson Spring	01-Mar-95	0.045	0.05	5.1	5.7	< 0.0004	< 0.1	< 1	0.6	0.3	< 0.04	< 0.003
Wilson Spring	02-May-95	0.007	< 0.02	18	10	0.0005	0.22	< 1	0.2	< 0.2	< 0.04	< 0.003

Site	Date	Uranium	Vanadium	Zinc	Alkalinity	Chloride	Sulfate	Bromide	Fluoride	Nitrate	Nitrite	Ammonium
		µg/L	µg/L	µg/L	meq/L	mg/L	mg/L	mg/L	mg/L	mg N/L	mg N/L	mg N/L
Big Water Spring	18-Oct-94	9.0	1.2	7.7	4.47	48	1230	0.33	0.85	< 0.01	< 0.002	0.2
Big Water Spring	27-Feb-95	9.2	0.4	< 0.3	2.02	40	970	0.091	< 2	0.02	< 0.001	0.08
Big Water Spring	03-May-95	9.4	0.4	< 0.1	4.8	48	910	0.069	na	< 0.003	< 0.003	0.076
Bowns Spring A	19-Oct-94	0.25	4.8	1.7	1.31	1.4	2.6	< 0.01	0.10	0.19	< 0.002	< 0.005
Bowns Spring A	28-Feb-95	0.36	6.4	5.1	1.3	1.5	4.6	0.013	0.03	0.22	< 0.001	0.008
Bowns Spring A	04-May-95	0.21	5.4	< 0.1	1.25	0.8	1.7	< 0.001	0.04	0.09	0.001	0.016
Bowns Spring B	19-Oct-94	0.34	4.9	7.2	1.17	1.2	2.6	< 0.01	0.10	0.21	0.004	< 0.005
Bowns Spring B	28-Feb-95	0.41	6.3	2.0	1.47	1.3	3.1	< 0.01	0.06	0.14	0.001	< 0.005
Bowns Spring B	04-May-95	0.31	4.2	< 0.1	1.39	0.9	2.1	0.010	0.05	0.09	0.001	0.030
Cottonwood Canyon Seep	04-Jul-95	0.076	3.8	3.3	2.97	2.5	4.1	0.017	< 2	---	---	---
Cow Canyon Spring	19-Oct-94	0.26	4.3	0.7	1.87	2.7	4.7	< 0.01	0.12	0.36	< 0.002	< 0.005
Cow Canyon Spring	28-Feb-95	0.46	4.0	< 0.1	1.84	2.9	4.6	0.015	0.1	0.38	< 0.001	< 0.005
Cow Canyon Spring	04-May-95	1.7	10	< 0.1	2.54	3.1	5.2	0.013	0.10	0.34	< 0.001	< 0.005
Cow Canyon Spring	19-Oct-94	0.002	2.4	2.1	1.49	1.8	2.2	< 0.01	0.12	0.10	0.002	< 0.005
Coyote Arch Spring	01-Mar-95	0.04	1.6	2.4	1.75	2.5	3.7	0.014	0.06	0.15	< 0.001	< 0.005
Coyote Arch Spring	04-May-95	0.03	0.9	0.6	1.86	1.7	2.6	< 0.001	0.07	0.05	0.001	0.098
Forgotten Spring	01-Mar-95	0.26	3.7	< 0.1	2.97	5.9	13	0.017	< 2	< 0.01	< 0.001	0.005
Forgotten Spring	02-May-95	0.2	3.8	< 0.1	3.57	4.9	9.2	0.012	< 2	< 0.003	0.001	< 0.005
French Spring	18-Oct-94	0.67	0.6	8.5	2.36	6.3	14	0.040	0.19	0.35	< 0.002	< 0.005
French Spring	27-Feb-95	0.67	0.6	1.1	2.50	6.4	17	0.030	< 2	0.36	< 0.001	0.005
French Spring	03-May-95	0.58	0.7	< 0.1	2.39	5.5	12	0.016	0.12	0.36	0.001	0.009
Good Hope Spring A	27-Feb-95	1.3	11	< 0.1	2.73	8.2	14	0.027	0.1	0.50	< 0.001	< 0.005
Good Hope Spring A	03-May-95	1.3	11	< 0.1	2.59	7.8	14	0.024	0.12	0.74	0.001	< 0.005
Good Hope Spring B	03-May-95	1.2	10	< 0.1	2.51	7.5	13	0.021	0.12	0.82	< 0.001	0.007
Gypsum Spring A	18-Oct-94	17	---	6.4	4.39	2460	2260	1.2	3.5	< 0.01	< 0.002	0.5
Gypsum Spring A	27-Feb-95	11.4	2.3	< 0.1	1.25	1260	1520	0.39	< 20	0.11	0.001	0.22
Gypsum Spring A	03-May-95	9.2	1.9	< 0.1	4.55	1180	1160	0.35	< 20	0.015	< 0.001	0.22
Gypsum Spring B	03-May-95	6.1	1.3	< 0.1	3.82	130	390	0.11	< 20	0.290	0.002	0.029
Iceberg Spring	20-Oct-94	0.41	0.5	4.1	4.74	3.2	24	< 0.01	0.11	< 0.01	< 0.002	< 0.005
Iceberg Spring	04-May-95	2.1	1.7	0.8	5.89	5.4	9.3	0.016	0.3	< 0.003	< 0.003	0.006
Iceberg Spring	05-Mar-95	4.2	2.3	0.18	6.02	6.3	11	0.024	0.26	< 0.013	< 0.001	0.005
Iceberg Soil Seep	04-May-95	1.6	1.2	< 0.1	4.82	5.9	14	0.012	0.13	< 0.003	< 0.003	0.006
Iceberg Stream	02-May-95	0.29	2.0	< 0.1	1.57	1.8	6.4	0.006	0.05	0.24	0.008	0.008
Iceberg Canyon Isolated Pond	02-May-95	1.2	1.5	< 0.1	4.07	8.1	20	0.019	0.18	0.003	0.003	0.009
Kaiparowits Spring A	04-May-95	2.3	1.1	< 0.1	5.56	11	47	0.058	0.17	0.01	< 0.001	0.008
Kaiparowits Spring B	04-May-95	4.7	0.5	< 0.1	6.30	39	380	0.190	0.28	0.096	< 0.001	0.014

Site	Date	Uranium	Vanadium	Zinc	Alkalinity	Chloride	Sulfate	Bromide	Fluoride	Nitrate	Nitrite	Ammonium
		µg/L	µg/L	µg/L	meq/L	mg/L	mg/L	mg/L	mg/L	mg N/L	mg N/L	mg N/L
Knowles Spring A	17-Oct-94	0.27	5.4	7.2	1.55	3.6	6.0	0.030	< 0.10	1.160	< 0.002	< 0.005
Knowles Spring A	01-Mar-95	0.23	5.1	< 0.1	1.59	3.9	6.1	0.020	0.04	1.1	< 0.001	< 0.005
Knowles Spring A	03-May-95	0.36	4.1	< 0.1	2.15	3.8	6.5	0.010	0.050	0.39	< 0.001	< 0.005
Knowles Spring B	03-May-95	0.25	4.9	< 0.1	1.58	3.9	6.0	0.011	0.040	1.1	< 0.001	< 0.005
Long Canyon Spring	19-Oct-94	0.19	4.9	1.8	1.16	2	3.6	< 0.01	< 0.1	0.61	< 0.002	< 0.005
Long Canyon Spring	28-Feb-95	0.27	4.6	5.7	1.23	2.2	3.6	0.012	0.060	0.6	< 0.001	< 0.005
Long Canyon Spring	04-May-95	0.22	4.5	< 0.1	1.23	2.2	3.7	< 0.01	0.060	0.53	< 0.001	< 0.005
Moqui Spring A	17-Oct-94	0.46	7.0	4.2	3.55	9.2	14	0.03	0.290	< 0.01	< 0.002	< 0.005
Moqui Spring A	01-Mar-95	0.07	3.5	3.9	1.79	3.9	7.0	0.016	0.090	0.032	< 0.001	< 0.005
Moqui Spring A	04-May-95	0.10	4.5	2.4	2.11	4.3	9.3	0.013	0.090	< 0.003	< 0.003	< 0.005
Moqui Spring B	25-Feb-95	0.08	1.9	< 0.1	2.25	4.4	7.0	0.016	0.10	0.068	< 0.001	0.005
Moqui Spring B	02-May-95	0.07	1.8	< 0.1	2.27	5.5	9.4	0.019	< 2	< 0.003	0.001	0.007
Popcan Spring	16-May-95	0.36	4.3	1.8	1.71	2.7	5.7	0.014	< 2	---	---	---
Popcan Spring	04-Jul-95	0.32	5.4	6.7	4.95	6.0	11	0.034	0.24	---	---	---
Four Mile Spring	02-Mar-95	1.0	8.3	< 0.1	1.62	7.7	9.6	0.038	0.04	2.3	< 0.001	< 0.005
Four Mile Spring	01-May-95	0.92	8.8	< 0.1	1.62	7.7	9.7	0.031	0.04	2.4	0.001	0.009
Frog Marsh Spring	02-Mar-95	0.63	13	4.4	1.43	7.4	9.6	0.033	0.05	2.3	< 0.001	< 0.005
Frog Marsh Spring	01-May-95	0.6	12	< 0.1	1.41	7.3	9.5	0.027	0.05	2.3	0.001	< 0.005
Power Lines Spring	20-Oct-94	1.1	1.8	2.0	2.11	16	45	0.03	0.10	1.8	< 0.002	< 0.005
Power Lines Spring	02-Mar-95	1.1	1.7	0.67	2.13	14	43	0.030	---	1.7	< 0.001	< 0.005
Power Lines Spring	01-May-95	1.1	1.6	< 0.1	2.14	14	43	0.018	---	1.7	0.001	< 0.005
Sewage Ponds Spring	20-Oct-94	2.6	26	2.8	2.03	31	83	0.08	0.21	1.6	< 0.002	< 0.005
Sewage Ponds Spring	02-Mar-95	2.8	26	0.4	2.06	29	78	0.040	na	1.6	< 0.001	< 0.005
Sewage Ponds Spring	01-May-95	2.8	26	< 0.1	2.07	28	78	0.027	na	1.5	< 0.001	< 0.005
San Juan MCO2	27-Jul-94	0.18	3.7	1.0	1.46	2.7	4.6	0.01	0.12	< 0.01	< 0.002	< 0.005
San Juan MCO2	02-May-95	0.17	3.4	< 0.1	1.64	1.1	4.0	6.7	0.08	0.16	0.003	< 0.005
Swett Spring	18-Oct-94	3.5	5.9	2.2	3.50	17	76	< 0.01	0.39	2.2	< 0.002	< 0.005
Swett Spring	27-Feb-95	2.0	7.9	< 0.1	4.39	10	24	0.017	< 2	< 0.01	< 0.001	0.006
Swett Spring	03-May-95	2.4	4.9	< 0.1	5.34	9.1	24	0.013	0.23	0.005	0.001	0.006
Swett SE Spring	18-Oct-94	17	9.7	3.3	7.47	64	220	0.23	0.26	0.04	< 0.002	< 0.005
Swett SE Spring	27-Feb-95	22	7.5	< 0.1	7.71	73	230	0.091	na	< 0.01	< 0.001	< 0.005
Swett SE Spring	03-May-95	21	8.3	< 0.1	8.00	81	240	0.087	2.3	< 0.003	< 0.003	0.006
Ticaboo Spring	03-May-95	2.3	5.1	< 0.1	3.81	9.3	24	0.018	0.17	0.63	< 0.001	< 0.005
Wilson Spring	27-Jul-94	0.57	4.5	3.8	1.92	3.4	5.4	< 0.01	0.10	< 0.01	< 0.002	< 0.005
Wilson Spring	01-Mar-95	0.6	4.0	2.1	2.00	3.6	5.6	0.015	0.05	0.67	0.001	< 0.005
Wilson Spring	02-May-95	1.4	0.3	< 0.1	5.53	---	23	0.022	0.11	0.034	< 0.001	0.009

Site	Date	Uranium	Vanadium	Zinc	Alkalinity	Chloride	Sulfate	Bromide	Fluoride	Nitrate	Nitrite	Ammonium
		µg/L	µg/L	µg/L	meq/L	mg/L	mg/L	mg/L	mg/L	mg N/L	mg N/L	mg N/L
Knowles Spring A	17-Oct-94	0.27	5.4	7.2	1.55	3.6	6.0	0.030	< 0.10	1.160	< 0.002	< 0.005
Knowles Spring A	01-Mar-95	0.23	5.1	< 0.1	1.59	3.9	6.1	0.020	0.04	1.1	< 0.001	< 0.005
Knowles Spring A	03-May-95	0.36	4.1	< 0.1	2.15	3.8	6.5	0.010	0.050	0.39	< 0.001	< 0.005
Knowles Spring B	03-May-95	0.25	4.9	< 0.1	1.58	3.9	6.0	0.011	0.040	1.1	< 0.001	< 0.005
Long Canyon Spring	19-Oct-94	0.19	4.9	1.8	1.16	2	3.6	< 0.01	< 0.1	0.61	< 0.002	< 0.005
Long Canyon Spring	28-Feb-95	0.27	4.6	5.7	1.23	2.2	3.6	0.012	0.060	0.6	< 0.001	< 0.005
Long Canyon Spring	04-May-95	0.22	4.5	< 0.1	1.23	2.2	3.7	< 0.01	0.060	0.53	< 0.001	< 0.005
Moqui Spring A	17-Oct-94	0.46	7.0	4.2	3.55	9.2	14	0.03	0.290	< 0.01	< 0.002	< 0.005
Moqui Spring A	01-Mar-95	0.07	3.5	3.9	1.79	3.9	7.0	0.016	0.090	0.032	< 0.001	< 0.005
Moqui Spring A	04-May-95	0.10	4.5	2.4	2.11	4.3	9.3	0.013	0.090	< 0.003	< 0.003	< 0.005
Moqui Spring B	25-Feb-95	0.08	1.9	< 0.1	2.25	4.4	7.0	0.016	0.10	0.068	< 0.001	0.005
Moqui Spring B	02-May-95	0.07	1.8	< 0.1	2.27	5.5	9.4	0.019	< 2	< 0.003	0.001	0.007
Popcan Spring	16-May-95	0.36	4.3	1.8	1.71	2.7	5.7	0.014	< 2	—	—	—
Popcan Spring	04-Jul-95	0.32	5.4	6.7	4.95	6.0	11	0.034	0.24	—	—	—
Four Mile Spring	02-Mar-95	1.0	8.3	< 0.1	1.62	7.7	9.6	0.038	0.04	2.3	< 0.001	< 0.005
Four Mile Spring	01-May-95	0.92	8.8	< 0.1	1.62	7.7	9.7	0.031	0.04	2.4	0.001	0.009
Frog Marsh Spring	02-Mar-95	0.63	13	4.4	1.43	7.4	9.6	0.033	0.05	2.3	< 0.001	< 0.005
Frog Marsh Spring	01-May-95	0.6	12	< 0.1	1.41	7.3	9.5	0.027	0.05	2.3	0.001	< 0.005
Power Lines Spring	20-Oct-94	1.1	1.8	2.0	2.11	16	45	0.03	0.10	1.8	< 0.002	< 0.005
Power Lines Spring	02-Mar-95	1.1	1.7	0.67	2.13	14	43	0.030	—	1.7	< 0.001	< 0.005
Power Lines Spring	01-May-95	1.1	1.6	< 0.1	2.14	14	43	0.018	—	1.7	0.001	< 0.005
Sewage Ponds Spring	20-Oct-94	2.6	26	2.8	2.03	31	83	0.08	0.21	1.6	< 0.002	< 0.005
Sewage Ponds Spring	02-Mar-95	2.8	26	0.4	2.06	29	78	0.040	na	1.6	< 0.001	< 0.005
Sewage Ponds Spring	01-May-95	2.8	26	< 0.1	2.07	28	78	0.027	na	1.5	< 0.001	< 0.005
San Juan MCO2	27-Jul-94	0.18	3.7	1.0	1.46	2.7	4.6	0.01	0.12	< 0.01	< 0.002	< 0.005
San Juan MCO2	02-May-95	0.17	3.4	< 0.1	1.64	1.1	4.0	6.7	0.08	0.16	0.003	< 0.005
Swett Spring	18-Oct-94	3.5	5.9	2.2	3.50	17	76	< 0.01	0.39	2.2	< 0.002	< 0.005
Swett Spring	27-Feb-95	2.0	7.9	< 0.1	4.39	10	24	0.017	< 2	< 0.01	< 0.001	0.006
Swett Spring	03-May-95	2.4	4.9	< 0.1	5.34	9.1	24	0.013	0.23	0.005	0.001	0.006
Swett SE Spring	18-Oct-94	17	9.7	3.3	7.47	64	220	0.23	0.26	0.04	< 0.002	< 0.005
Swett SE Spring	27-Feb-95	22	7.5	< 0.1	7.71	73	230	0.091	na	< 0.01	< 0.001	< 0.005
Swett SE Spring	03-May-95	21	8.3	< 0.1	8.00	81	240	0.087	2.3	< 0.003	< 0.003	0.006
Ticaboo Spring	03-May-95	2.3	5.1	< 0.1	3.81	9.3	24	0.018	0.17	0.63	< 0.001	< 0.005
Wilson Spring	27-Jul-94	0.57	4.5	3.8	1.92	3.4	5.4	< 0.01	0.10	< 0.01	< 0.002	< 0.005
Wilson Spring	01-Mar-95	0.6	4.0	2.1	2.00	3.6	5.6	0.015	0.05	0.67	0.001	< 0.005
Wilson Spring	02-May-95	1.4	0.3	< 0.1	5.53	—	23	0.022	0.11	0.034	< 0.001	0.009

Site	Date	Phosphate mg P/L	Dissolved Organic Carbon mg C/L	Formation/Type of spring	Collected	Notes
Big Water Spring	18-Oct-94	0.002	3.0	Entrada/Cedar Mesa Contact	Emerges from pool in bed of Big Water Ck.	
Big Water Spring	27-Feb-95	< 0.008	2.3	Entrada/Cedar Mesa Contact		
Big Water Spring	03-May-95	0.005	2.3	Entrada/Cedar Mesa Contact		Aeolian SS with cross-bedding
Bowns Spring A	19-Oct-94	< 0.002	0.6	Navajo		
Bowns Spring A	28-Feb-95	< 0.008	1.0	Navajo		
Bowns Spring A	04-May-95	0.007	1.2	Navajo	Pool adjoining rockwall where water emanated	
Bowns Spring B	19-Oct-94	< 0.002	1.6	Navajo		
Bowns Spring B	28-Feb-95	< 0.008	---	Navajo		
Bowns Spring B	04-May-95	0.009	1.9	Navajo	In a 3 m. deep pool adjoining rockwall	
Cottonwood Canyon Seep	04-Jul-95	---	---	Navajo	Collected from trench after 10 min filling	Filter clogged rapidly
Cow Canyon Spring	19-Oct-94	< 0.002	0.3	Navajo	Grassy slope slide area	
Cow Canyon Spring	28-Feb-95	< 0.008	0.4	Navajo		
Cow Canyon Spring	04-May-95	0.007	1.4	Navajo/Kayenta Contact		pH measured at 1840
Cow Canyon Spring	19-Oct-94	< 0.002	1.0	Navajo/Kayenta Contact		
Coyote Arch Spring	01-Mar-95	< 0.008	1.6	Navajo/Kayenta Contact		
Coyote Arch Spring	04-May-95	0.012	1.3	Navajo/Kayenta Contact	Passes thru some vegetation	pH measured at 1840
Forgotten Spring	01-Mar-95	< 0.008	2.1	Navajo/Kayenta Contact		
Forgotten Spring	02-May-95	< 0.004	2.1	Navajo/Kayenta Contact	From seep ~20 m from rock face	
French Spring	18-Oct-94	< 0.002	0.9	Alluvium and aeolian sand overlying Navajo		
French Spring	27-Feb-95	< 0.008	1.2	Alluvium and aeolian sand overlying Navajo		
French Spring	03-May-95	0.019	1.1	Alluvium and aeolian sand overlying Navajo	Seep above cattle trough	Not a contact spring - significant animal activity
Good Hope Spring A	27-Feb-95	< 0.008	0.7	Wingate/Chinle Contact		
Good Hope Spring A	03-May-95	< 0.004	0.6	Wingate/Chinle Contact	Taken from drift ~35 m from rock wall	East spring (SE side of GHBay)
Good Hope Spring B	03-May-95	0.009	0.7	Wingate/Chinle Contact	Taken from drift ~35 m from rock wall	SE side of GHBay, middle spring - W of GHBay A
Gypsum Spring A	18-Oct-94	< 0.002	1.0	Alluvium overlying Parodox		
Gypsum Spring A	27-Feb-95	< 0.008	1.5	Alluvium overlying Parodox		
Gypsum Spring A	03-May-95	0.018	2.4	Alluvium overlying Parodox	Pool by large rock ~ 3/4 mile above CR	
Gypsum Spring B	03-May-95	0.008	4.6	Alluvium overlying Parodox	Stream	
Iceberg Spring	20-Oct-94	0.002	0.9	Navajo/Kayenta Contact		
Iceberg Spring	04-May-95	< 0.004	2.9	Navajo/Kayenta Contact		
Iceberg Spring	05-Mar-95	< 0.008	3.0	Navajo/Kayenta Contact		
Iceberg Soil Seep	04-May-95	< 0.004	2.7	Navajo/Kayenta Contact		
Iceberg Stream	02-May-95	0.013	3.9			pH measured at ~1500
Iceberg Canyon Isolated Pond	02-May-95	0.012	10.1			pH measured at ~1500
Kaiparowits Spring A	04-May-95	0.032	4.5	Straight Cliffs		Cattle grazing

Site	Date	Phosphate mg P/L	Dissolved Organic Carbon mg C/L	Formation/Type of spring	Collected	Notes
Knowles Spring A	17-Oct-94	< 0.002	0.1	Navajo/Kayenta Contact	Bedding plane contact	
Knowles Spring A	01-Mar-95	0.010	0.3	Navajo/Kayenta Contact		
Knowles Spring A	03-May-95	< 0.004	0.7	Navajo/Kayenta Contact	~20 m from cliff face emanating thru minimal drift	
Knowles Spring B	03-May-95	0.005	0.5	Navajo/Kayenta Contact	~20 m from cliff face emanating thru minimal drift	
Long Canyon Spring	19-Oct-94	0.003	0.2	Navajo/Kayenta Contact		
Long Canyon Spring	28-Feb-95	< 0.008	0.3	Navajo/Kayenta Contact		
Long Canyon Spring	04-May-95	0.005	0.6	Navajo/Kayenta Contact	10 m from rockwall in drift	
Moqui Spring A	17-Oct-94	< 0.002	4.6	Navajo	Combination spring	
Moqui Spring A	01-Mar-95	< 0.008	1.8	Navajo		
Moqui Spring A	04-May-95	0.007	2.6	Navajo	Dripping from rock face	pH measured at 1320
Moqui Spring B	25-Feb-95	< 0.008	1.7	Navajo		
Moqui Spring B	02-May-95	< 0.004	5.8	Navajo	Taken 100m from cliff face	
Popcan Spring	16-May-95	---	---	Navajo/Kayenta Contact		
Popcan Spring	04-Jul-95	---	---	Navajo/Kayenta Contact	Spring dripping from overhang	On lakeshore - sampled from boat
Four Mile Spring	02-Mar-95	< 0.008	0.7			
Four Mile Spring	01-May-95	0.019	0.4		Base of alluvial fan at bottom of wash/ravine very near river	
Frog Marsh Spring	02-Mar-95	< 0.008	0.4			
Frog Marsh Spring	01-May-95	0.015	0.4		Alluvial fan below canyon walls	pH measured on 5/2/95 at 1000
Power Lines Spring	20-Oct-94	< 0.002	0.2			
Power Lines Spring	02-Mar-95	< 0.008	0.4			
Power Lines Spring	01-May-95	< 0.004	0.7		Directly out of crack in ss wall 5' above river	pH measured on 5/2/95 at 1000
Sewage Ponds Spring	20-Oct-94	< 0.002	0.4			
Sewage Ponds Spring	02-Mar-95	< 0.008	0.9			
Sewage Ponds Spring	01-May-95	0.005	0.7		Directly out of crack in ss wall 20' above river	pH measured on 5/2/95 at 1000
San Juan MCO2	27-Jul-94	< 0.002	< 0.1	Navajo		
San Juan MCO2	02-May-95	< 0.004	1.1	Navajo	GW seepage flows over rock	pH measured at ~1500
Swett Spring	18-Oct-94	< 0.002	4.7	Wingate/Chinle Contact	Pool present	
Swett Spring	27-Feb-95	< 0.008	1.5	Wingate/Chinle Contact		
Swett Spring	03-May-95	< 0.004	2.4	Wingate/Chinle Contact	Spring flows into Ck. on each side of Hoskinninni Monu	Cattle tracks and manure in area
Swett SE Spring	18-Oct-94	< 0.002	2.8	Wingate/Chinle Contact	Pool intermitent	
Swett SE Spring	27-Feb-95	< 0.008	3.2	Wingate/Chinle Contact		
Swett SE Spring	03-May-95	0.037	4.8	Wingate/Chinle Contact		Cattle tracks and manure in area
Ticaboo Spring	03-May-95	< 0.004	0.6	Wingate/Chinle Contact	Coming out of cliff face 1 m above stream channel	pH measured at 1300
Wilson Spring	27-Jul-94	< 0.002	< 0.1	Navajo/Kayenta Contact		
Wilson Spring	01-Mar-95	0.008	0.4	Navajo/Kayenta Contact		
Wilson Spring	02-May-95	< 0.004	2.1	Navajo/Kayenta Contact	~ 30 m from base of cliff coming thru thick vegetation	pH measured ~ 1.25 hours after collection

As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The Department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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