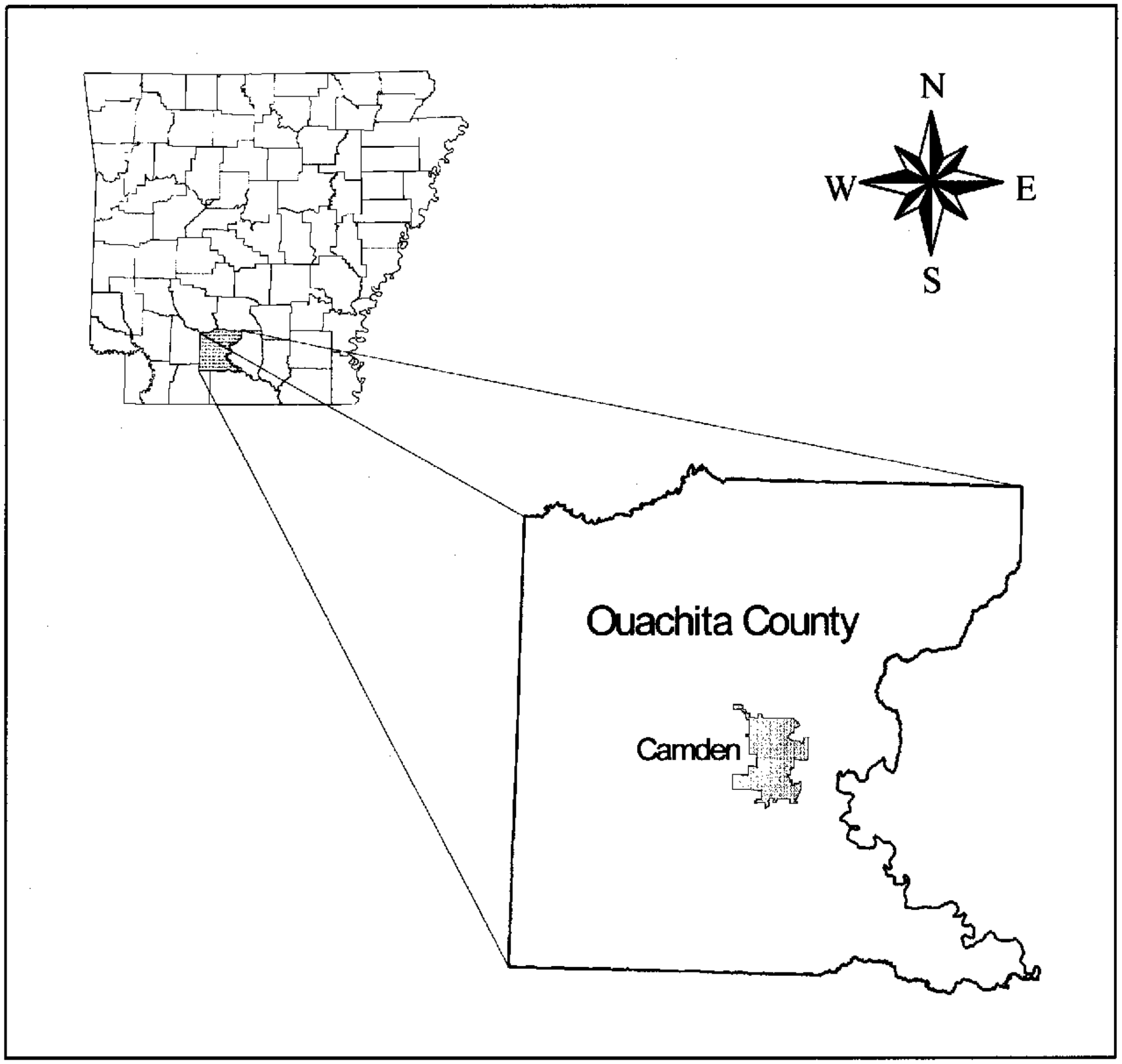
REPORT ON THE FOURTH SAMPLING OF THE OUACHITA MONITORING AREA (Sparta Aquifer)



ARKANSAS AMBIENT GROUND WATER MONITORING PROGRAM

Arkansas Department of Pollution Control & Ecology
Water Quality Report WQ98-06-1
June 1998

REPORT ON THE FOURTH SAMPLING
OF THE
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ARKANSAS AMBIENT GROUND WATER
MONITORING PROGRAM

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INTRODUCTION

The Arkansas Ambient Ground Water Monitoring Program was initiated by the Arkansas Department of Pollution Control and Ecology (ADPC&E) Water Division to obtain background data from various aquifers within Arkansas, with emphasis placed on those areas which are sensitive to ground-water contamination from anthropogenic impacts. Wells and/or springs within each of the monitoring areas are sampled on approximate three-year intervals to evaluate whether regional and/or local activities are impacting ground-water quality.

The Ouachita monitoring area is comprised of approximately 350 square miles located in Ouachita County, Arkansas (Figure 1), west of the Ouachita River. This area will be referred to as the study area in the remainder of this report. The study area is located in the Gulf Coastal Plain physiographic province. Area topography exhibits low to moderate relief with elevations ranging from approximately 400 feet above mean sea level (msl) in the northwestern portion of the study area to approximately 100 feet above msl in the southeastern portion of the study area along the Ouachita River. Surface water drainage is generally to the east towards the Ouachita River. The study area is underlain primarily by Tertiary-aged sedimentary deposits which dip to the southeast.

The study area was selected because it is within the recharge area of the Sparta aquifer, one of the most intensively-used aquifers in southern Arkansas. The aquifer is potentially threatened by pulp and paper mill activities in the vicinity of Camden and oil exploration activities in the southern part of the county. In addition, underground petroleum storage tanks, Resource Conservation and Recovery Act (RCRA) facilities, and landfills also potentially threaten ground water quality. Ground-water sampling was begun in January 1987, and has continued at approximately three-year intervals. Subsequent sampling events were conducted in October 1989 and October 1992. The most recent sampling event was conducted in June and July of 1996. Ground-water samples were obtained from a combination of public, domestic and industrial wells during all sampling events. Some of the earlier sampled wells have been closed or are currently unavailable for sampling; however, an attempt was made to find replacement wells within relatively close proximity to the original sampling locations.

STUDY OBJECTIVES

The study area is located in the recharge area of the Sparta aquifer. Several large municipalities and many smaller municipal cooperatives in southern and eastern Arkansas obtain drinking water from this aquifer. In addition, industrial use of this aquifer has increased dramatically in recent years. The Sparta aquifer was recently declared a critical ground-water use area in several counties by the Arkansas Soil and Water Conservation Commission. Aggressive protection of the recharge area is necessary to prevent degradation of ground-water quality in the aquifer and to protect the health of the population. As numerous potential contaminant sources exist in the study area, ground-water monitoring is critical for this area. This program was begun to monitor changes in ground-water chemistry over time, to detect significant impacts which may have occurred, and to describe the ambient ground-water quality in the Sparta aquifer.

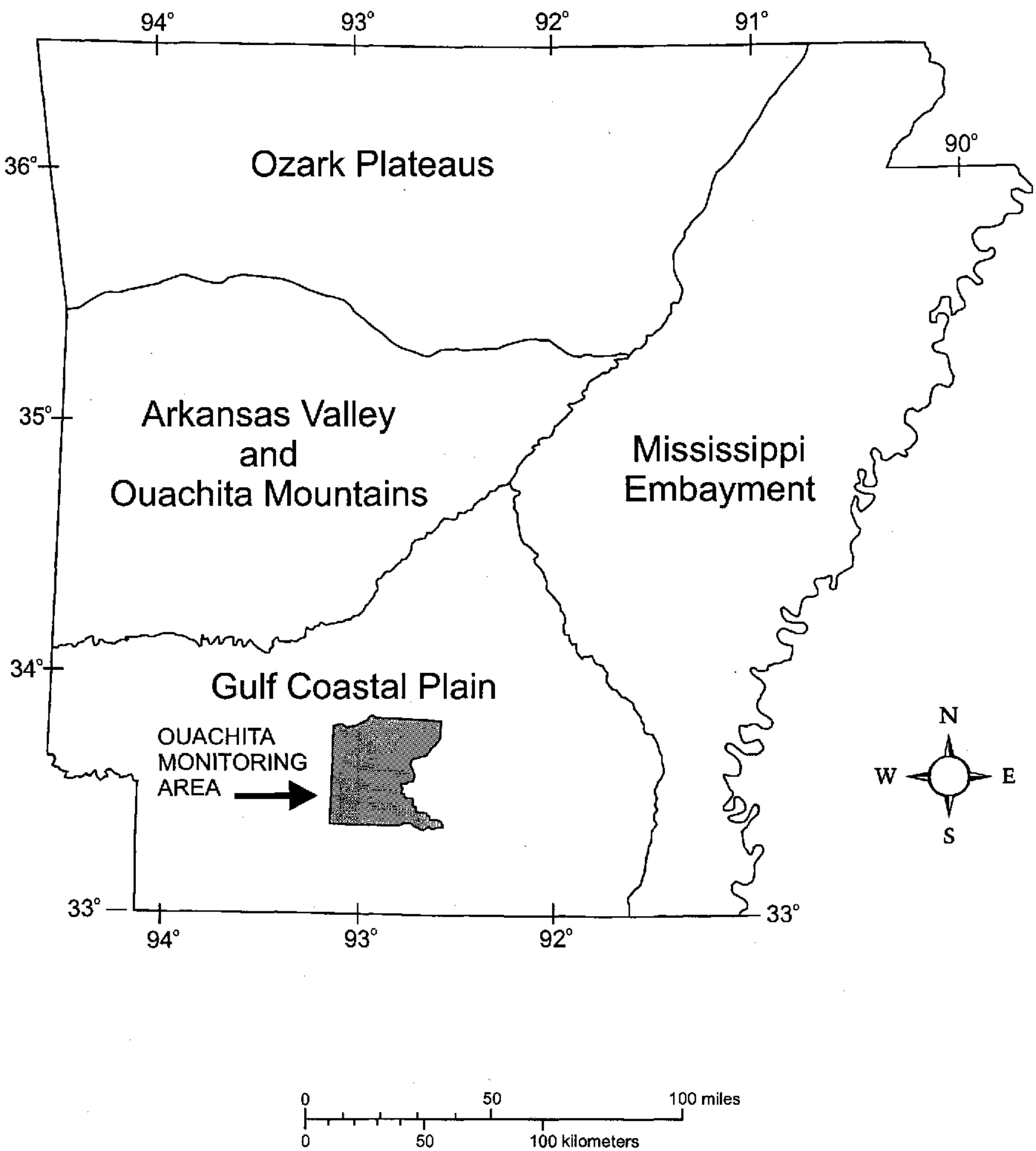

Figure 1 - Regional Physiographic Map and location of Ouachita Monitoring Area.

AREA GEOLOGY

The study area is located in the Gulf Coastal Plain physiographic province which extends west into Texas and south into Louisiana and is comprised of gently-dipping sedimentary deposits. The exposed rock units of the Gulf Coastal Plain in Arkansas range in age from the lower Cretaceous to recent. These deposits overlie Paleozoic-aged rocks which crop out to the northwest in the Ouachita Mountains physiographic province. The surface geology of the study area consists of Quaternary alluvium in river flood plains and Tertiary-aged deposits in uplands. Table 1 represents the generalized geology of southern Arkansas which includes the study area.

Several published sources, including Albin (1964), Haley et al. (1993), Hosman (1982) and Peterson et al. (1985) were used as references for the geology and hydrogeology of the study area. These references generally indicate the same geologic units; however, the mapped locations of these units varied significantly across Ouachita County. For this report, the authors have used Hosman's (1982) map of outcropping Tertiary units. His map and cross-section correlate well with Albin's (1964) maps, cross-sections and lithologic descriptions. The following sections detail the units exposed in the study area.

Table 1 - Generalized Stratigraphic Column of Southern Arkansas (modified from Fitzpatrick, et al., 1990)

Era	System	Series	Group	Formation
Cenozoic	Quaternary	Holocene		Alluvium
		Pleistocene		Terrace Deposits
	Tertiary	Eocene	Jackson	Undifferentiated
			Claiborne	Cockfield Formation
				Cook Mountain Formation
				Sparta Sand
				Cane River Formation
				Carrizo Sand
			Wilcox	Undifferentiated
		Paleocene	Midway	Undifferentiated
Mesozoic	Cretaceous	Upper Cretaceous		Arkadelphia Marl
				Nacatoch Sand
				Saratoga Chalk
				Marlbrook Marl
				Annona Chalk
				Ozan Formation
				Brownstown Marl
				Tokio Formation
				Woodbine Formation
		Lower Cretaceous		Undifferentiated

Tertiary System

The following sections detail the lithology of the outcropping Tertiary units in the study area. All of the units are of Eocene age and listed from oldest to youngest.

Wilcox Group

The oldest exposed unit in the study area is the lower Eocene-aged Wilcox Group which crops out in a narrow band in northwest Ouachita County. According to Albin (1964), this group consists of dark-gray to dark-brown swamp, or back-beach lignitic clay and lignite; light-gray to gray and brown, shallow marine sand and clay; and green, moderately deep-water glauconitic clay, which is indicative of a deltaic environment. Although the Wilcox Group is approximately 250 feet thick near its outcrop area, only a small area at the top of the group is exposed. A large area of the outcrop is covered by Quaternary alluvium to the north (Hosman, 1982). The Wilcox thickens towards the southeast, parallel to its dip direction.

Claiborne Group

The middle Eocene-aged Claiborne group unconformably overlies the Wilcox Group and consists of five formations. The formations are, from oldest to youngest, the Carrizo Sand, Cane River Formation, Sparta Sand, Cook Mountain Formation, and Cockfield Formation. The following sections detail the lithology of each formation.

The Carrizo Sand also outcrops in a narrow band which parallels and overlies the Wilcox outcrop in northwest Ouachita County. This unit averages 70 feet in thickness in the outcrop area and generally thickens towards the southeast (Hosman, 1982). This unit, a beach deposit, is typified by gray to brown very fine to medium sand, with some lignite and shallow-water clay (Albin, 1964).

The Cane River Formation overlies the Carrizo Sand and crops out in a wider band in northwestern Ouachita County (Hosman, 1982). This formation is characterized predominantly by shallow-water dark-gray to dark-brown silt and silty clay, but locally contains lignite and lignitic clay, clean sand and glauconite, indicating a fluctuating strand line (Albin, 1964).

The outcrop area of the Sparta Sand covers most of west and central Ouachita County. The Sparta Sand consists of gray, very fine to medium sand, and brown and gray sandy clay with interbeds of shallow-water clay, lignitic clay and lignite (Albin, 1964). Payne (1968) surmises that the Sparta Sand was deposited as a delta-fluvial plain complex. Although the Sparta Sand generally ranges in thickness from a thin veneer along the northwest edge of the outcrop area to approximately 500 feet in southeast Ouachita County, considerable variations in thickness and sand content occur throughout the unit. According to Payne (1968), predominantly sandy sections grade into predominantly shaly sections within very short distances.

The Cook Mountain Formation crops out in southern Ouachita County. This formation consists of near-shore shallow-water dark-gray to dark-brown silty clay with some silt, sand and lignitic clay deposited in a back-beach environment (Albin, 1964). This formation averages approximately 150 feet in thickness.

A small area of the Cockfield Formation was mapped by Hosman (1982) in southeast Ouachita County. This area is exposed in a northeast-trending graben bounded by two normal faults. Albin (1964) also suspected some exposures of the Cockfield Formation in southern Ouachita County and indicated some similar faulting. According to Albin, this unit consists predominantly of gray and brown, very fine to fine sand and silt and dark-gray, dark-brown, and green lignitic silty clay. Based on Hosman's map, this unit is approximately 160 feet thick in Ouachita County.

Quaternary System

The Quaternary units in the study area consist of Pleistocene terrace deposits and Holocene alluvium. These units cover a large portion of northeast Ouachita County but are limited in the study area. The Pleistocene-aged terrace deposits are predominantly located in northeast Ouachita County; however, several deposits are located in southern Ouachita County. These deposits consist mainly of gravel, poorly sorted sand, and some clay and average 35 to 40 feet in thickness (Albin, 1964). The Holocene-aged (Recent) alluvial deposits are located in all major and most minor stream channels and associated flood plains. This material consists of sandy clay, poorly sorted sand, and gravel and also averages between 35 and 40 feet in thickness (Albin, 1964).

AREA HYDROGEOLOGY

The formations underlying the study area traditionally have been called either aquifers or confining beds based on their inherent properties of storage, hydraulic conductivity and transmissivity. In reality, the confining beds usually function as aquitards, which retard, but do not fully prevent the flow of water between units. Many of the confining beds contain zones of sand and silt which can function as small aquifer systems. Similarly, the aquifers contain local zones of clays and silts which can impede ground water flow in a zone of otherwise high hydraulic conductivity. As mentioned above, the units range in age from Paleozoic to recent; however, the only units that are described in this section are those that crop out in the study area. The following sections detail the hydrogeologic units.

Tertiary Units

The most widely-used aquifers are located in the Tertiary-aged deposits. These units, as described above, dip to the southeast and generally thicken in the dip direction.

Wilcox Group

The Wilcox Group crops out in a thin band in northwest Ouachita County. Although the lower Wilcox is used heavily as an aquifer in some parts of Arkansas (and other states), the Wilcox is generally considered the lower confining bed of the overlying Carizzo Sand. The upper Wilcox does contain several minor aquifers in southwestern Arkansas which consist of thin sand beds interbedded with clay (Hosman, et al., 1968). These aquifers are used locally for domestic purposes, but are generally of limited areal extent. Recharge of these minor aquifers occurs by precipitation on the outcrop or by leakage from overlying beds. No published values for aquifer yield were available for these minor aquifers. The water composition in these minor aquifers is generally a sodium bicarbonate type when dissolved solids are low, and a sodium bicarbonate chloride type when dissolved solids are high (Hosman, et al., 1968).

Claiborne Group

The Claiborne Group consists of several important water-bearing units which are used in the study area and across southern and eastern Arkansas. The Claiborne, as discussed above, has been differentiated into five formations, each of which function primarily as either an aquifer or an aquitard.

The Carizzo Sand is the basal aquifer of the Claiborne Group. Recharge occurs from precipitation on the outcrop area and leakage from overlying beds. The Carizzo Sand is used for domestic purposes in the study area with yields ranging from 30 to 100 gpm (Hosman, et al., 1968). The water composition in the Carizzo Sand is generally a sodium bicarbonate type.

The Cane River Formation is considered the upper confining bed of the Carizzo Sand; however, substantial sand layers exist in this formation in the study area. Some domestic wells reportedly penetrate this formation which generally yield less than 500 gpm (Peterson, et al., 1985). In addition, although the Cane River Formation is generally considered the lower confining unit of the Sparta Sand, it is possible that several of the deeper wells in the study area have intercepted this formation. This assumption is based on altitude interpretation of wells from USGS 7.5 minute topographic maps and comparisons with Hosman's (1982) cross-section. The water composition in the Cane River Formation is generally a sodium bicarbonate type.

Most of the study area lies within the recharge zone of the Sparta aquifer. As previously mentioned, the Sparta aquifer is the most extensive and heavily-used aquifer in the Claiborne Group. Statewide, the Sparta aquifer is used by several large municipalities and industries. Within the study area, the Sparta aquifer is used for municipal, industrial and domestic purposes. Recharge of the aquifer is from vertical leakage and precipitation on the outcrop (Fitzpatrick et al., 1990). Wells penetrating the Sparta aquifer can yield up to 1000 gpm. According to Payne (1968), sand layers in the Sparta aquifer are highly variable. Additionally, although the Sparta is predominantly comprised of sand, zones of clay, silty clay and sandy clay are common, which locally affect hydraulic conductivity. Two separate Sparta aquifers, the Greensand and El Dorado, have been documented and are in use downdip of the study area (Union County, Arkansas). Broom et al. (1984) conducted a thorough investigation of salt-water intrusion into the lower Sparta (El Dorado) aquifer in Union County. Their cross-sections show a distinct confining bed separating the upper and lower Sparta aquifers. One of their cross-sections extends to the Union-Ouachita County border. It is likely therefore that the division of the Sparta aquifer into two distinct aquifers begins somewhere in Ouachita County. Although no divisions have been made of the Sparta aquifer in Ouachita County, well logs do indicate zones of lower hydraulic conductivity throughout the aquifer(Albin, 1964).

The geochemistry of the ground water in the Sparta aquifer is variable and has been divided by Payne (1968) into three chemical provinces: the bicarbonate water province, the chloride water province and the sulfate water province. The geochemistry of the ground water in the study area is considered to be in the bicarbonate province which is supported by geochemical data collected during this investigation. In Union County to the south/southeast, Broom et al. (1984) describes the upper

Sparta (Greensand) aquifer as a dilute sodium bicarbonate water type and the lower Sparta (El Dorado) aquifer as a dilute calcium sodium bicarbonate water type. Similarly, water types encountered during this investigation ranged from sodium to calcium bicarbonate with some mixed types observed.

The Cook Mountain Formation functions as the upper confining bed of the Sparta aquifer. This unit, being comprised mostly of clay, generally does not yield a significant volume of ground water. According to Fitzpatrick et al., (1990), this unit has a hydraulic conductivity of $9x10^{-6}$ feet per day.

As discussed previously, the Cockfield Formation has been determined to crop out in southern Ouachita County. This aquifer is the uppermost unit of the Claiborne Group. Use of this aquifer is minimal in the study area and is limited to domestic purposes. Some municipal and industrial use occurs in other areas. Yields of up to 400 gpm in areas to the east have been reported (Peterson et al., 1985). Recharge occurs in outcrop and subcrop areas.

Quaternary Units

Quaternary-aged flood plain and terrace deposits are located along the Ouachita River and its tributaries in the eastern and northern areas of the study area. These deposits form the Mississippi River Valley alluvial aquifer and yield 1000 to 3000 gpm (Peterson, et al., 1985). This aquifer is used for domestic and agricultural purposes in the study area.

METHODOLOGY

Ground-water samples analyzed for the investigation were obtained from a semi-random distribution of 26 domestic, public and industrial water-supply wells. Well logs were obtained from the Arkansas Geological Commission, where possible, to verify the depth of wells, water-bearing intervals, and well-construction information. However, the logs generally are not of sufficient detail to determine specific formations. Most of the wells penetrate the Sparta Sand; however, based on topographic and cross-sectional data, several of the deeper wells are likely penetrating the underlying Cane River Formation. The wells range in depth from 10 to 375 feet below the existing ground surface. The depth of two wells were undetermined. Figure 2 shows the location of wells sampled during the current sampling period. Refer to Van Schaik and Kresse (1994) for previous sampling locations. Table 2 lists the location and description of the current sampling sites. Wells in the study area generally are cased along their entire length with the exception of a screened interval located in the water-bearing formation.

All wells were sampled as near to the well head as possible through available faucets or other ports. In situations where a well had not been in operation prior to sampling, the well was allowed to run for a minimum of ten minutes prior to sampling. Conductance, temperature and pH were measured in the field until stabilized prior to obtaining all ground-water samples. A Beta Technology Incorporated Hydac conductivity-temperature-pH tester was used to measure the field parameters.

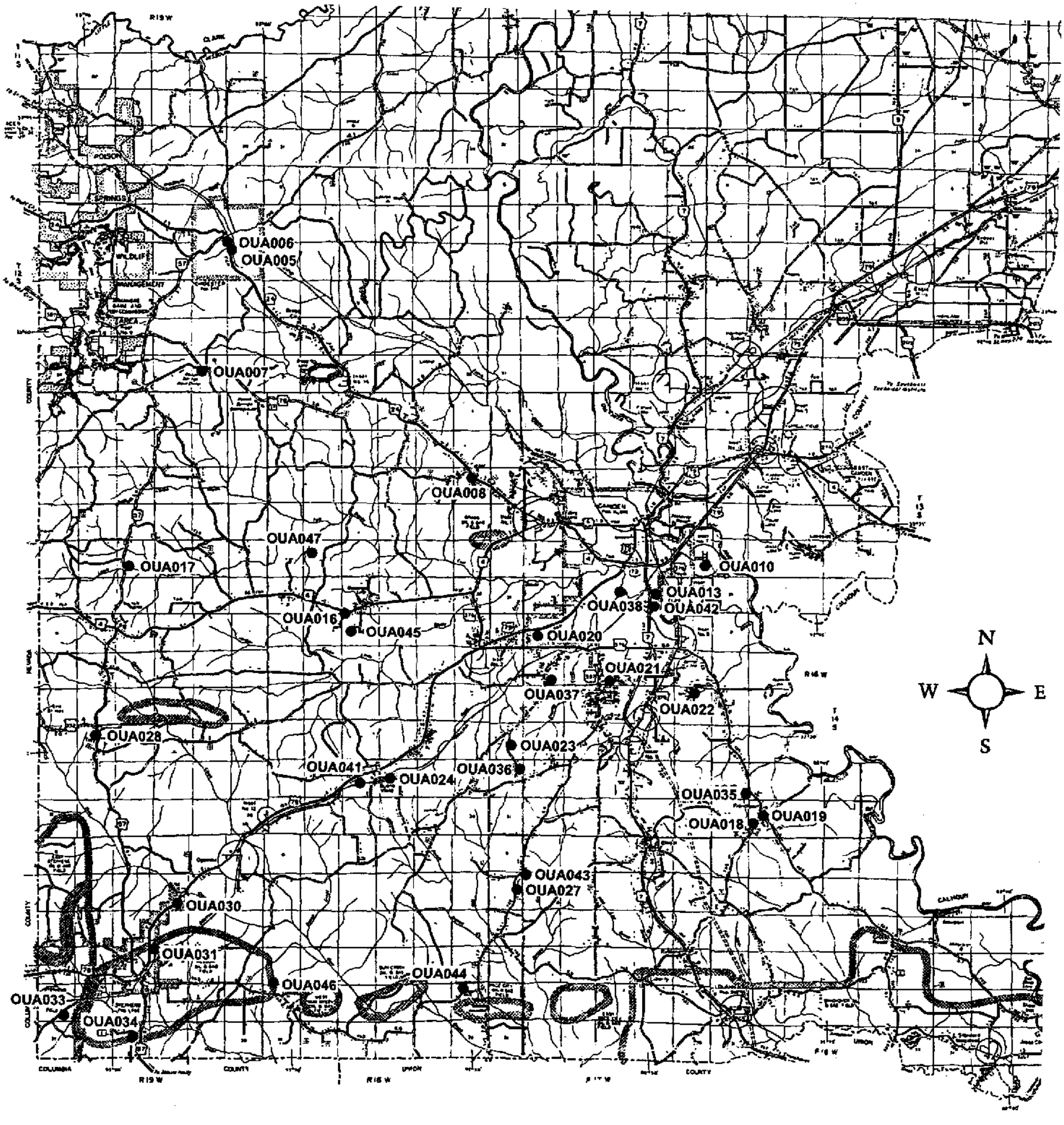

Figure 2 - Ouachita Monitoring Area sampling locations.

Table 2 - Summary of Current Sampling Sites

Sampling Site	Sample Date	T/R Location	Latitude	Longitude	Surface Elevation (ft.)	Well Depth (ft.)	Bottom Elevation (ft.)	Aquifer	Use
OUA005	06-25-96	12S19W13BCB1	33° 41' 42.4"	93° 01' 06.4"	240	60	180	Tcr	P
OUA006	06-25-96	12S19W13BBC1	33° 41' 44.3"	93° 01' 05.2"	230	52	178	Tcr	P
OUA007	06-25-96	12S19W35BDD1	33° 39' 01.2"	93° 01' 45.4"	360	174	186	Tcr	U
OUA008	07-11-96	13S17W28DDC1	33° 33' 50.7"	92° 51' 19.5"	115	137	-22	Ts	St
OUA013	06-26-96	13S17W35DBD1	33° 33' 14.2"	92° 49' 16.8"	102	274	-172	Ts/Tcr	I
OUA017	06-25-96	13S19W28BCD1	33° 34' 32.8"	93° 04' 16.9"	240	52	188	Ts	D
OUA021	06-24-96	14S17W10CDC1	33° 31' 19.1"	92° 50' 48.2"	210	90	120	Ts	D
OUA024	06-25-96	14S18W27BDC1	33° 29' 16.3"	92° 57' 06.6"	277	55	222	Ts	Sp
OUA028	07-10-96	14S19W20BAD1	33° 30' 26.0"	93° 05' 13.4"	322	61	261	Ts	Sp
OUA030	06-27-96	15S19W10DCC1	33° 26' 18.0"	93° 03' 18.4"	210	370	-160	Ts	P
OUA031	06-27-96	15S19W22CCC1	33° 24' 37.0"	93° 03' 50.3"	210	375	-165	Ts/Tcr	P
OUA033	06-25-96	15S19W30DBD1	33° 23' 56.7"	93° 06' 18.3"	245	59	186	Ts	D
OUA034	06-25-96	15S19W33BDB1	33° 23' 25.4"	93° 04' 43.4"	190	295	-105	Ts/Tcr	D
OUA035	06-24-96	14S16W29CCD1	33° 28' 32.1"	92° 46' 51.3"	214	254	-40	Ts	D
OUA036	06-26-96	14S17W30ACD1	33° 29' 10.2"	92° 53' 35.5"	300	52	248	Ts	D
OUA037	06-26-96	14S17W08CDA1	33° 31' 27.9"	92° 52' 43.2"	210	-	-	Ts?	D
OUA038	06-26-96	13S17W34DAC1	33° 33' 14.8"	92° 50' 16.9"	115	278	-163	Ts/Tcr	I
OUA039	06-27-96	15S19W22BDD1	33° 25' 00.9"	93° 03' 26.2"	285	294	-9	Ts/Tcr	I
OUA040	07-09-96	15S19W22ABC1	33° 25' 11.7"	93° 03' 15.5"	265	359	-94	Ts/Tcr	I
OUA041	07-10-96	14S18W28CAB1	33° 29' 16.3"	92° 58' 06.2"	298	10	288	Ts	U
OUA042	06-26-96	13S17W35DCC1	33° 33' 00.3"	92° 49' 26.2"	111	271	-160	Ts/Tcr	I
OUA043	07-10-96	15S17W07AAA1	33° 26' 54.5"	92° 53' 34.4"	250	80	170	Ts/Tcr	D
OUA044	07-10-96	15S18W25BCD1	33° 39' 57.0"	92° 55' 20.8"	200	335	-135	Ts	D
OUA045	07-10-96	14S18W04BCD1	33° 32' 49.0"	92° 58' 04.5"	225	48	177	Ts	D
OUA046	07-10-96	15S18W30BBA1	33° 24' 25.4"	93° 00' 33.4"	251	-	-	Ts?	D
OUA047	07-11-96	13S18W29BCD1	33° 34' 35.4"	92° 51' 10.2"	180	98	82	Ts	D

The ground-water samples were collected in approved containers which were supplied by the ADPC&E laboratory. Ground-water samples obtained for metals analysis were filtered in the field with a 0.45 μm pore-size disposable filter. The metals results are thus reported as dissolved metals. The remaining samples were unfiltered. All samples, with the exception of the filtered metals samples, were placed on ice, and transported to the ADPC&E laboratory in Little Rock. All ground-water samples were analyzed in the laboratory for total alkalinity, major and trace inorganic constituents, metals, nutrients and total organic carbon. In addition, volatile organic compound (VOC) analysis was conducted on selected ground-water samples. The results of the current and some previous chemical analyses are listed in Tables 4 through 6 in Appendix A of this report.

Ground-water quality analyses from the current and previous sampling events, and complete site descriptions have been placed in the U. S. Environmental Protection Agency (EPA) Storage and Retrieval (STORET) database. This information is available to all interested parties with access to STORET. In addition, copies of the laboratory analyses have been provided to all interested well owners. For the purposes of GIS data collection, all sample sites have been surveyed with the Magellan NAV 5000 PRO; a hand-held GPS C/A-code and carrier phase code receiver. This instrument generally has a horizontal accuracy of approximately 12 meters.

GROUND WATER QUALITY

Water-quality analyses interpretation was conducted by evaluating general water quality, geochemistry, and detection of VOCs. Individual parameters were compared to Federal drinking water standards and/or health advisory limits to evaluate the ground-water quality for use as a potential drinking water source. The type of ground water ranges from sodium bicarbonate to calcium bicarbonate with several mixed water types also observed. Generally, the sodium bicarbonate correlated to the deeper waters and the calcium bicarbonate correlated to the shallow waters. Analyses to date demonstrate that water is soft and the water quality is very good with total dissolved solids (TDS) ranging from 31 to 313 mg/L.

Conductance and pH were measured during the initial sampling event but were not measured during the second and third sampling events (with the exception of OUA017 and OUA021). Although there were a few exceptions, pH and conductance generally increased between the first and current sampling events (see Table 4 in Appendix A); however, without the data from the other two sampling events for comparison, potential instrument malfunction could account for the difference. Ten ground water samples had measured pH which was below the recommended range of 6.5 to 8.5 (standard units) as per the United States Environmental Protection Agency (USEPA) secondary maximum contaminant levels (MCLs).

Conventional parameters analyzed during the current sampling event included alkalinity, chloride, fluoride, ammonia, nitrate, ortho-phosphate, total phosphate, sulfate, total organic carbon (TOC), total suspended solids (TSS), total dissolved solids (TDS) and hardness. Several of these parameters were analyzed during the first sampling event but not during the second and third sampling events. In addition, several sampling sites have been added since previous sampling events. The parameters which have been consistently analyzed over time include chloride, nitrate-nitrogen, ammonia-nitrogen, ortho-phosphate and sulfate. Several of the sampling sites have shown concentration increases over time, while several sampling points have shown decreases. None of these changes appear to be significant. One ground-water sample had a nitrate concentration of 12.3 milligrams per liter (mg/L) which exceeded the USEPA primary MCL of 10.0 mg/L. The results of conventional parameter analysis for each sampling location, along with the above referenced constituents, are listed in Table 4 (Appendix A) of this report.

Other major and minor inorganic ions and metals were also analyzed. These included aluminum, arsenic, boron, barium, beryllium, bicarbonate, cadmium, calcium, chromium, copper, iron, fluoride, potassium, magnesium, manganese, sodium, nickel, lead, selenium, silica, vanadium and zinc. One ground-water sample had a beryllium concentration of 13.1 micrograms per liter (μg/L) which exceeded the primary MCL of 4 μg/L. Two ground-water samples had lead concentrations of 16.4 and 18.4 μg/L, respectively, which exceeded the primary MCL of 15 μg/L. In addition, sixteen ground-water samples had iron concentrations which exceeded the secondary MCL of 0.3 mg/L and eight ground-water samples had manganese concentrations which exceeded the secondary MCL of 0.05 mg/L. The metals and ions are listed in Table 5 (Appendix A) of this report.

Ground-water samples collected from wells located within close proximity to industrial areas around Camden and oil and gas fields in southwestern Ouachita County were analyzed for VOC constituents. Acetone and methylene chloride, common laboratory chemicals, were detected in several of the samples at low concentrations. These detections are most likely due to laboratory contamination and probably do not reflect actual ground water conditions. No other VOC constituents were detected above their respective detection limits in any of the samples. Table 6 in Appendix A of this report lists the sample locations and the analyzed VOC constituents.

Minimums, maximums, arithmetic and geometric means, and arithmetic and geometric standard deviations were calculated for some selected parameters from the current sampling event data. Table 3 below lists the descriptive statistics for the selected parameters. These statistics compare reasonably well (within the same order of magnitude) with data collected by Albin (1964) and Hosman et al. (1968), indicating no major changes or trends.

GROUND WATER GEOCHEMISTRY

The ground-water samples obtained throughout the Ouachita Monitoring Area are highly variable in geochemical composition. Generally, the ground water in the area cannot be grouped into a specific water type. A Piper diagram (Figure 3) showing all sampling points was constructed to show this variability. The major cations, which include sodium + potassium, calcium and magnesium, are plotted in the lower left triangle. The major anions, which include chloride, bicarbonate + carbonate, and sulfate, are plotted in the lower right triangle. Each point is then projected into the upper parallelogram to determine the type water. Samples obtained from specific aquifers often will plot within a relatively tight grouping; ie, a definable water type. Figure 3 shows that the cations are nearly evenly distributed between the calcium end-member and the sodium + potassium end-member with lesser amounts of magnesium. Calcium comprised over 50% of the cation concentration in meq/L in 13 out of 26 samples; sodium comprised over 50% of the cations in 11 of the 26 samples; and the remaining 2 samples were a mixed sodium-calcium type. Bicarbonate comprised over 50% of the total anion concentration in 20 of the 26 samples.

Table 3 - Selected Descriptive Statistics for the Sparta Aquifer

Sample Location	HCO_3 mg/L	Cl mg/L	NO_3-N mg/L	SO_4 mg/L	TDS mg/L	Cond. µS/cm	Ba µg/L	Ca mg/L	F mg/L	Fe µg/L	K mg/L	Mg mg/L	Na mg/L	SiO_2 mg/L
OUA005	9.8	4.1	0.42	6.0	31	42	33.6	0.9	0.04	158	0.7	0.6	3.7	8.4
OUA006	20.7	3.7	0.18	7.1	33	46	36.5	1.8	0.04	446	0.8	0.5	2.5	7.4
OUA007	18.3	3.2	0.10	3.6	49	130	25.2	1.0	0.04	51900	0.4	0.0	2.3	12.1
OUA008	28.1	6.8	0.07	19.5	91	121	88.9	5.9	0.05	4640	1.3	0.0	0.0	22.9
OUA013	178.1	45.9	0.10	13.4	258	458	117.3	10.7	0.13	203	2.0	2.3	69.1	16.6
OUA017	28.1	4.3	0.14	4.8	49	57	31.2	4.3	0.06	130	0.2	0.4	4.1	16.4
OUA021	133.0	2.9	0.25	54.2	207	295	106.9	37.6	0.12	681	2.5	5.0	13.6	18.7
OUA024	25.6	10.7	0.17	28.7	96	149	25.6	16.9	0.75	64	0.8	1.4	3.9	5.0
OUA028	37.8	3.4	0.09	16.7	136	119	73.3	12.2	0.10	1370	1.2	0.0	0.0	60.6
OUA030	91.5	5.3	0.10	16.3	132	195	137.0	17.4	0.10	4930	2.8	0.0	19.2	37.2
OUA031	128.1	6.1	0.09	13.4	147	251	152.6	14.0	0.09	2660	2.4	1.3	37.2	18.5
OUA033	42.7	24.7	1.56	13.4	145	193	91.7	15.0	0.09	96	1.2	2.0	11.8	25.3
OUA034	148.8	3.4	0.09	9.3	155	263	119.4	13.1	0.07	900	1.6	2.2	30.2	12.7
OUA035	203.7	80.6	0.09	6.0	313	598	178.5	18.0	0.09	137	1.8	2.9	86.3	10.3
OUA036	9.8	6.7	2.11	8.2	63	65	70.5	2.8	0.04	46	0.6	1.0	5.5	20.3
OUA037	17.1	3.2	0.88	6.0	46	60	185.3	13.8	0.05	66	2.0	2.6	8.3	39.3
OUA038	125.7	4.9	0.09	14.4	155	239	101.0	8.6	0.06	807	2.2	1.5	46.3	24.2
OUA039	102.5	5.6	0.10	10.3	126	213	159.8	16.7	0.11	4800	3.0	0.0	24.5	24.3
OUA040	98.8	6.5	0.08	22.2	133	235	120.2	13.9	0.10	3910	2.3	0.0	12.3	17.4
OUA041	6.1	3.2	0.52	3.2	45	46	24.8	1.0	0.05	1130	0.7	0.0	0.0	19.6
OUA042	156.2	58.8	0.10	19.1	263	490	292.4	30.2	0.07	929	3.6	5.8	88.0	23.4
OUA043	30.5	4.1	2.09	1.0	65	74	34.4	9.1	0.05	47	0.6	1.2	0.0	15.5
OUA044	30.5	12.6	0.45	7.1	223	393	186.8	19.6	0.10	656	1.6	2.7	51.8	13.0
OUA045	15.9	9.0	12.3	1.7	132	163	461.0	8.4	0.02	44	5.0	3.6	0.0	17.2
OUA046	140.3	3.1	0.45	5.9	136	266	67.9	37.9	0.10	1710	0.9	0.3	0.0	8.8
OUA047	15.9	4.3	0.08	4.6	41	49	28.6	2.1	0.05	1340	0.7	0.0	0.0	14.5
Minimum	6.1	2.9	0.07	1.0	31	42	24.8	0.9	0.04	44	0.2	0.0	0.0	5.0
Maximum	203.7	80.6	12.3	54.2	313	598	461.0	37.9	0.75	51900	5.0	5.8	88.0	60.6
Mean	70.9	12.6	0.87	12.2	125.8	200.4	113.5	12.8	0.11	3223	1.7	1.4	20.0	19.6
Std. Dev.	62.1	19.3	2.4	11.0	77.3	149.7	96.9	10.2	0.14	10052	1.1	1.6	27.0	11.7
Geometric Mean	44.4	6.9	0.24	8.7	102.7	150.3	83.3	8.3	0.08	577	1.3	1.5	14.9	17.0
Geo. Std. Dev.	2.9	2.6	3.8	2.4	1.97	2.2	2.3	3.0	1.9	6.2	2.1	2.3	3.4	1.7

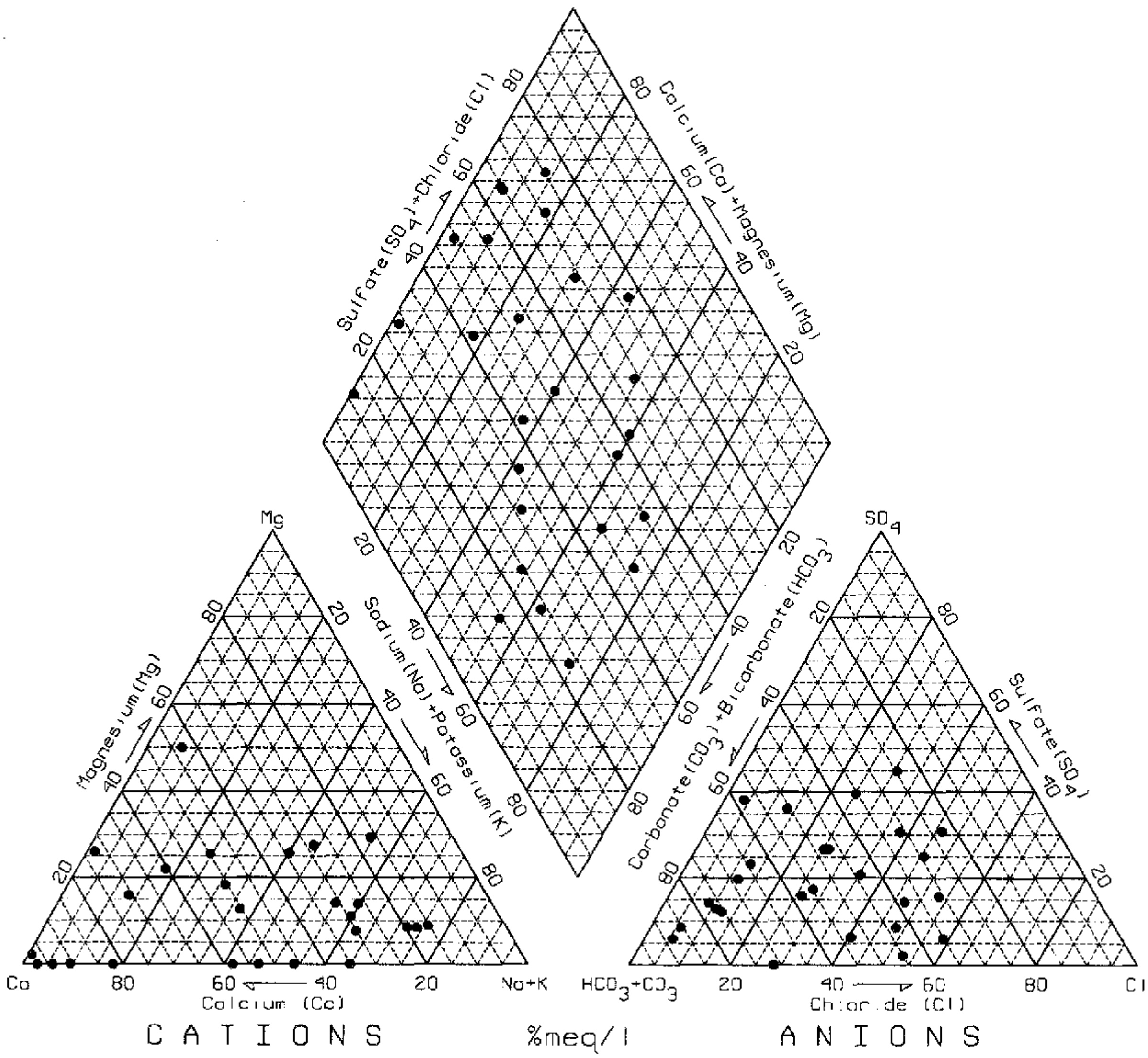

Figure 3 - Piper diagram showing all sampling locations. Each sample is plotted in the bottom triangles and is projected into the top parallelogram. Note the large variation and general scatter of points indicating the lack of definable water type.

Figure 4 illustrates stiff diagrams for each sample. The major cations are plotted on the left side of the diagram and the major anions are plotted on the right side of the diagram. A line is drawn connecting the points to form a six-sided polygon. The shapes are then compared to identify similarities or dissimilarities. For these stiff diagrams, the milliequivalent values were multiplied by a factor of five to increase clarity. Large variances in TDS create perceived differences in shapes, which do not necessarily correlate to chemical differences in ion percentages. Similarities are most evident in the strongly calcium-carbonate and sodium-carbonate water types.

Quattro Pro version 6.0 was used to construct bivariate plots to evaluate ion-pair relationships and trends in the ground-water chemistry. Least squares linear regression analysis was conducted on several plots to evaluate the linearity between the two variables. This method tests the variance between a set of independent and dependent variables. The r^2 value represents the reliability of the regression with a value between zero and unity. The linear relationship of the data set is more reliable as the r^2 value approaches unity.

Figure 5 is a bivariate plot of total cations versus total anions for all sampling points. When properly measured, total cations are approximately equal to total anions (within 2-5 percent). Although a strong linear relationship exists, several of the samples had low total ions with a corresponding large percent difference between total cations and anions, as reflected in the low r^2 value. Hem (1989) states that larger percent differences can be tolerated in low (<5 meq/L) TDS waters. The percent difference discrepancies will be addressed in the Quality Control section of this report.

Figure 6 is a bivariate plot of calcium plus magnesium versus bicarbonate. The plot reveals a poor relationship between the ions. Assuming a source of limestone and/or dolostone for the calcium, magnesium and bicarbonate, a 1:1 relationship should exist between the ions and plot along the dashed line in Figure 6. Although some of the points lie on the dashed line, a large percentage are above the line suggesting a depletion in calcium and magnesium with respect to bicarbonate. The graph demonstrates that other mechanisms besides simple dissolution are occurring which control the calcium and/or bicarbonate concentrations. Similarly, the bivariate plot of sodium versus chloride (Figure 7) shows that a mechanism other than halite dissolution is controlling sodium and chloride concentrations and that there is an enrichment of sodium with respect to chloride.

Figure 8 is a plot of calcium and magnesium divided by bicarbonate versus sulfate. This relationship was plotted to evaluate the potential contribution of calcium from gypsum dissolution. If gypsum was a source of additional calcium, the ratio of calcium and magnesium divided by bicarbonate should increase to values greater than one with increases in sulfate. This clearly is not occurring as shown by the random distribution of points within the graph. Figure 9, which adds sulfate to the calcium/bicarbonate relationship, supports this conclusion as indicated by an r^2 value of 0.42, which did not substantially improve over the r^2 of 0.38 in Figure 6.

Because of the potential for ion exchange to impact both the calcium/bicarbonate and sodium/chloride ratios depicted in Figures 6 and 7, a bivariate plot was constructed of calcium and magnesium divided by bicarbonate versus sodium divided by chloride. In the absence of ion exchange and other chemical reactions, all samples should plot near the intersection of 1.0 on each axis. The plot (Figure 10) clearly shows a trend of increasing sodium/chloride ratios >1 as calcium/bicarbonate ratios decrease <1. This situation indicates sodium is being enriched at the

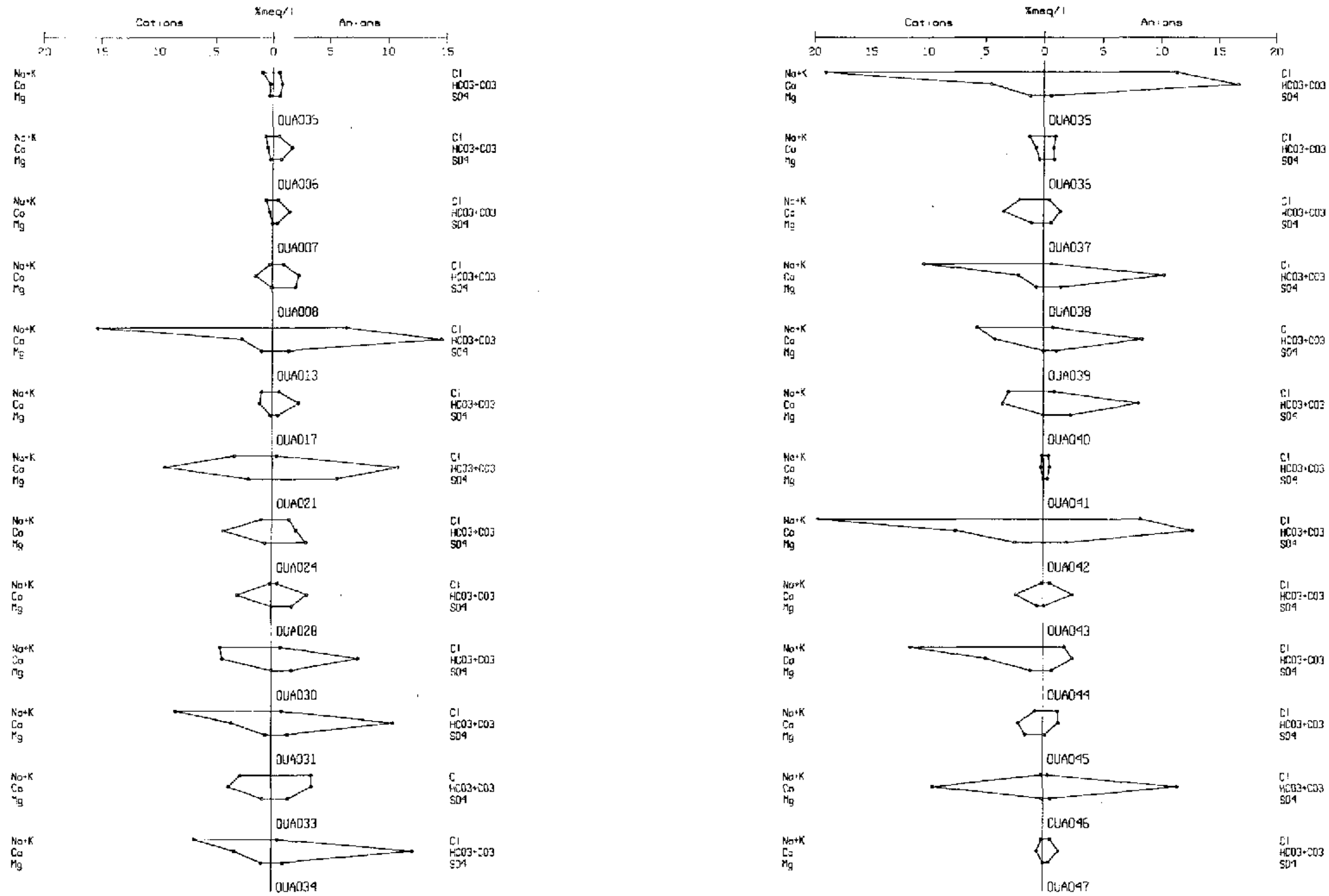

Figure 4 - Stiff diagrams for individual sampling points. Smaller shapes correlate with sampling sites having low TDS. Some sampling sites show shapes indicative of sodium-bicarbonate water or calcium-bicarbonate water. Ion values were multiplied by a factor of five to better show shape trends.

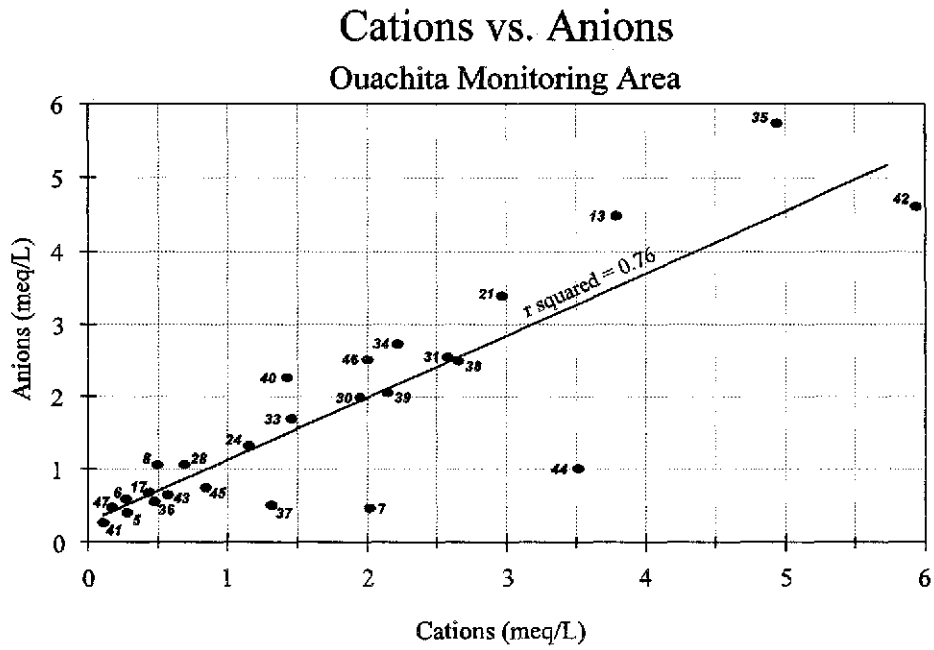

Figure 5 - Bivariate plot of cations versus anions. Number next to marker identifies sample. The moderate r-squared value is attributed to the poor balance of cations to anions.

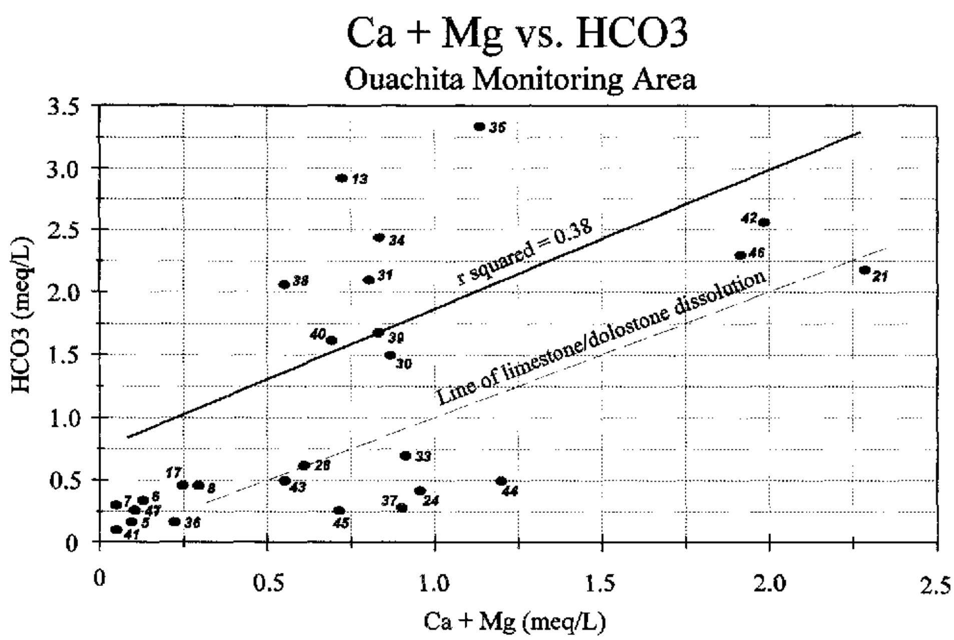

Figure 6 - Bivariate plot of calcium + magnesium versus bicarbonate. Number next to marker identifies sample.

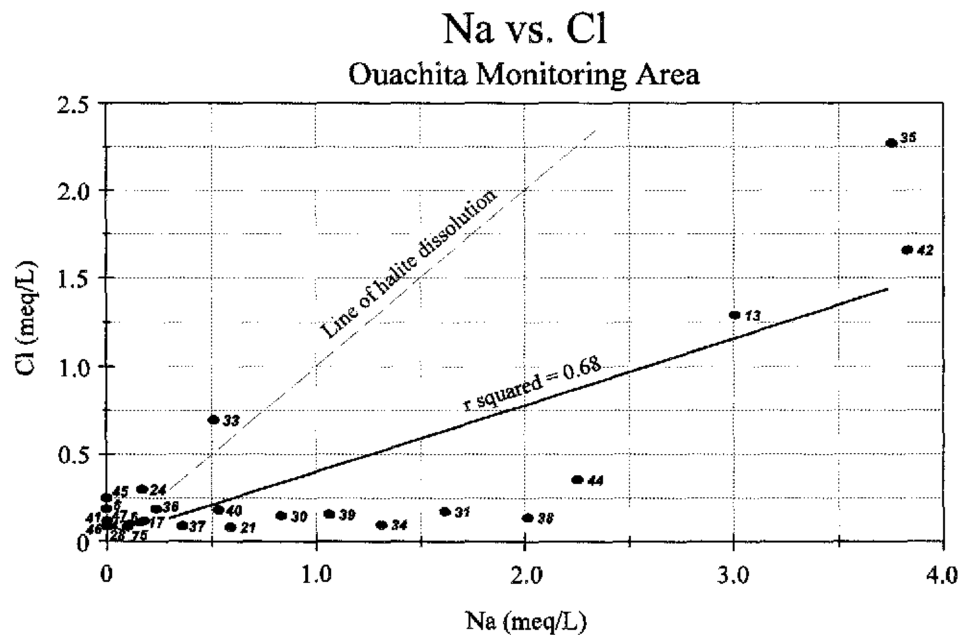

Figure 7 - Bivariate plot of sodium versus chloride. Number next to marker identifies sample.

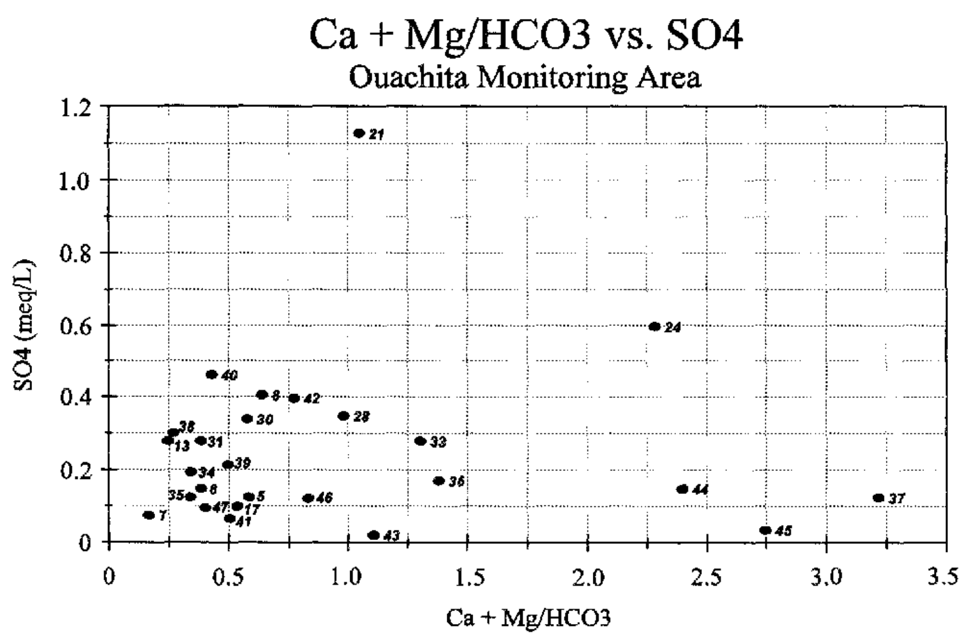

Figure 8 - Bivariate plot of the ratio calcium plus magnesium divided by bicarbonate versus sulfate. Number next to marker identifies sample.

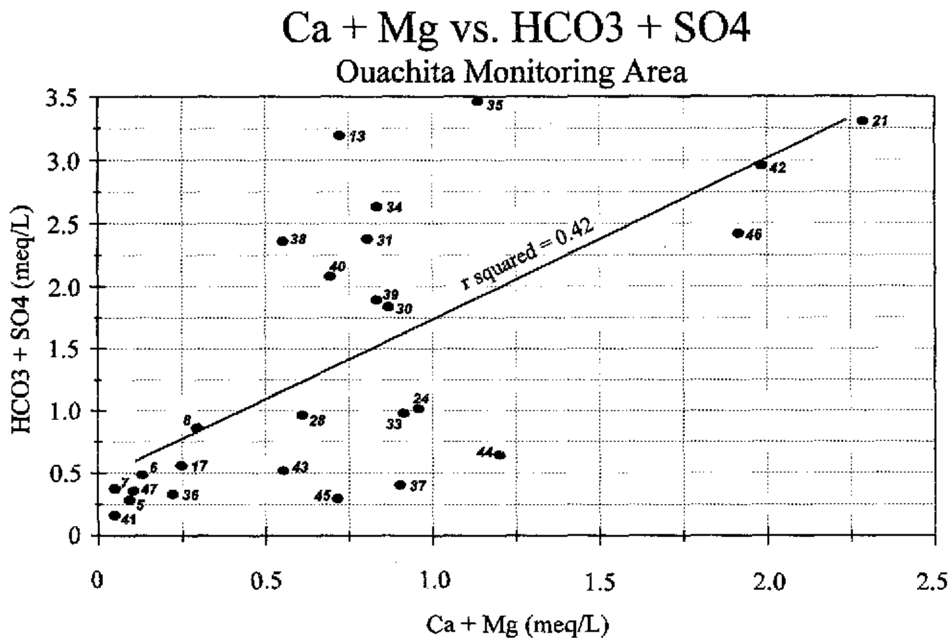

Figure 9 - Bivariate plot of calcium plus magnesium versus bicarbonate plus sulfate. Number next to marker identifies sample.

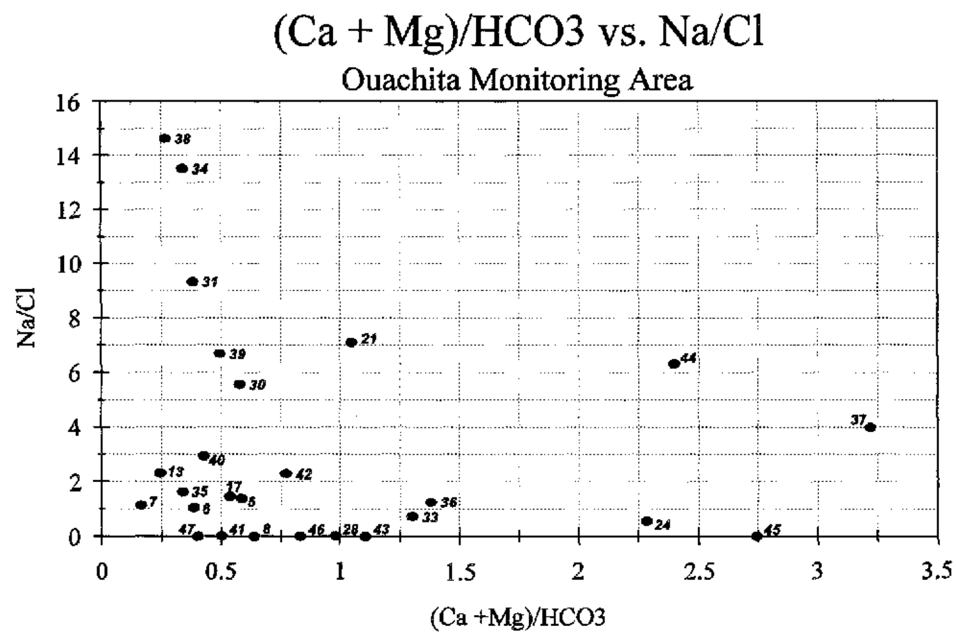

Figure 10 - Bivariate plot of the ratios calcium plus magnesium divided by bicarbonate versus sodium divided by chloride. Number next to marker identifies sample.

expense of calcium and provides strong evidence that cation exchange is occurring with calcium replacing sodium at the mineral site. Although leakage of sodium-bicarbonate ground water from a lower aquifer should be viewed as another possible explanation for the chemical variations, the fact that the ground water is from a recharge zone and generally contains low dissolved solids would tend to support ion exchange over mixing.

To further test the impact of ion exchange on calcium concentrations, a plot similar to Figure 9 was constructed by adding sodium and chloride to the calcium/bicarbonate ratio scheme. Figure 11 shows that the addition of sodium and chloride significantly improved the relationship, with a resulting r^2 value of 0.79 compared to 0.38 in Figure 6. In addition to showing an increased linear trend, the plotted points correlated closely to the line of limestone/halite dissolution.

Figure 12 is a bar plot showing total dissolved solids (TDS) versus well depth. The wells were arranged into eight groups based on depth. The average TDS was then calculated for each depth range. The most noticeable observation from this graph shows that for wells with a depth of less than 200 feet, the average TDS values range from 49 mg/L to 91 mg/L. The TDS increased substantially for wells greater than 250 feet, with average TDS values ranging from 137 mg/L to 223 mg/L. The higher TDS reflects more dissolution in concert with increased residence/travel time and also more opportunity for exchange processes and other chemical reactions. Figure 13 is a bivariate plot of TDS versus well depth. This graph supports Figure 12 by showing two distinct zones of TDS correlating with well depth. Although some TDS values in the upper left grouping are higher than those in the bottom grouping, a clear relationship between increased TDS and greater well depth is evident.

In view of the differences in TDS between shallow (<200 feet) and deep (>250 feet) wells, it was hypothesized that distinct aquifers might exist in the recharge area similar to the two aquifer systems described in section titled Area Hydrogeology. Because of the higher TDS and increased residence time associated with deeper ground water flow, calcium and sodium ratios were compared to well depths in order to investigate the potential for individual water types between the two systems. Figure 14 displays a bivariate plot of sodium divided by calcium versus well depth. Generally, shallow wells had ratios less than two, whereas deeper wells had ratios greater than two. An inspection of cation/anion percentages revealed that calcium comprised over 50% of the total cations in ten of the fourteen shallow wells; sodium comprised over 50% of the cations in three of the wells; and one well was a mixed calcium/sodium water. In the deep wells, calcium was over 50% of the total cations in only one well, whereas sodium comprised over 50% of the cations in eight of the ten deep wells with one well being a mixed water type. The shallow water in the Sparta recharge zone is viewed as dominantly a calcium carbonate water, and the deeper ground water clearly is a sodium bicarbonate water type. Although well logs from the surrounding recharge area did not consistently denote two separate sand units (sand units varied from one to several), the present data in conjunction with other sources (Broom et al., 1984) would seem to support at least two separate ground-water systems in the area. A less-permeable, clay-rich zone between the two systems would provide an excellent cation exchange membrane by which to account for the chemical variance within the two aquifer systems. It is possible that the less permeable zone (aquitard) correlates with the lack of occurrence of wells between 200 and 250 feet in depth (Figure 12).

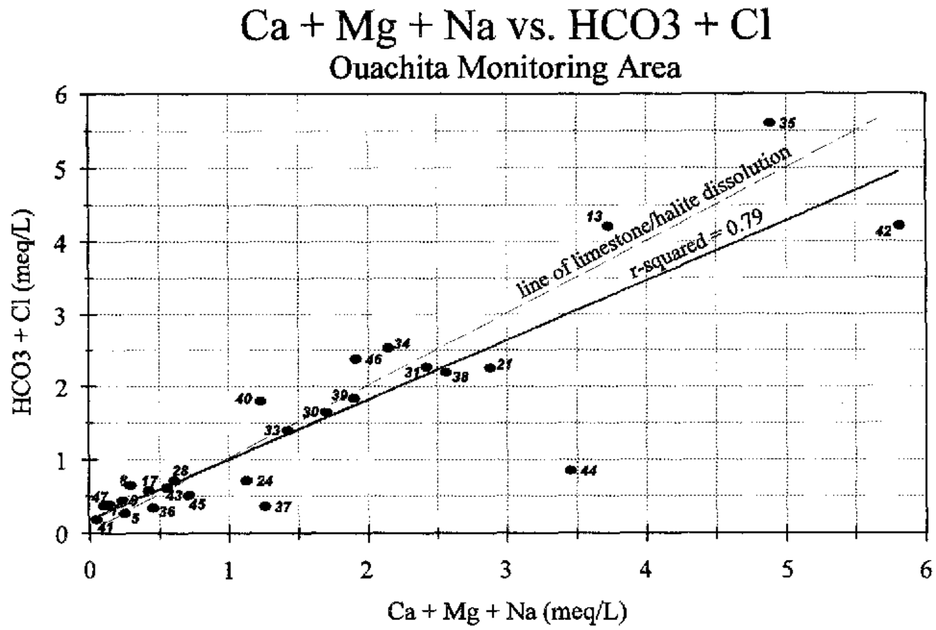

Figure 11 - Bivariate plot of calcium plus magnesium plus sodium versus bicarbonate plus chloride. Number next to marker identifies sample.

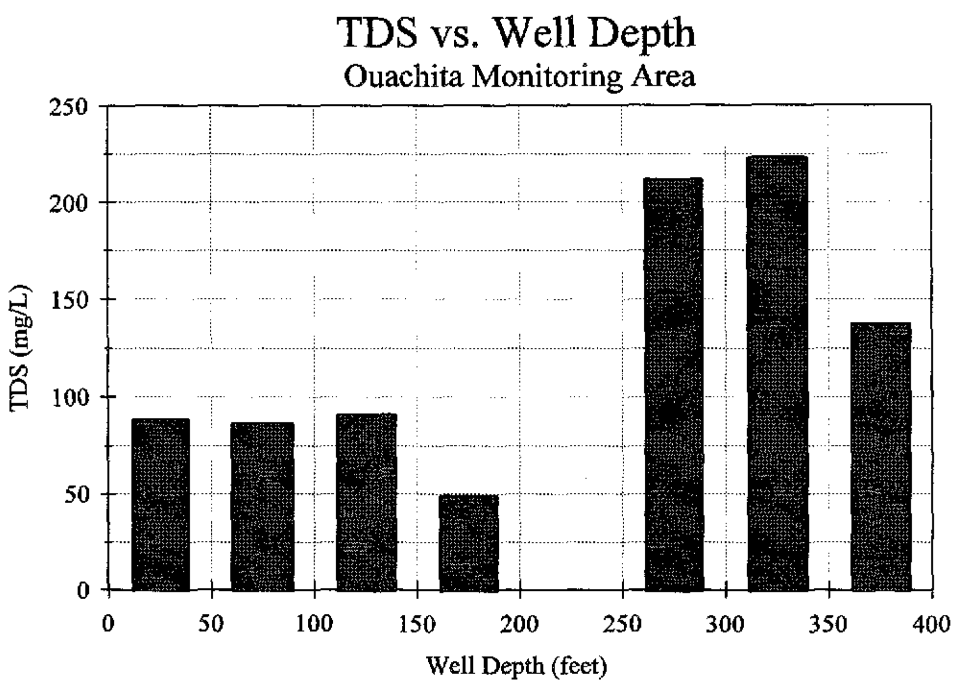

Figure 12 - Bar plot of total dissolved solids (TDS) versus well depth. Each bar indicates the average TDS for wells within the corresponding depth range. Average TDS increases substantially between the wells less than 200 feet and the wells greater than 250 feet. None of the sampled wells were between 200 and 250 feet in depth.

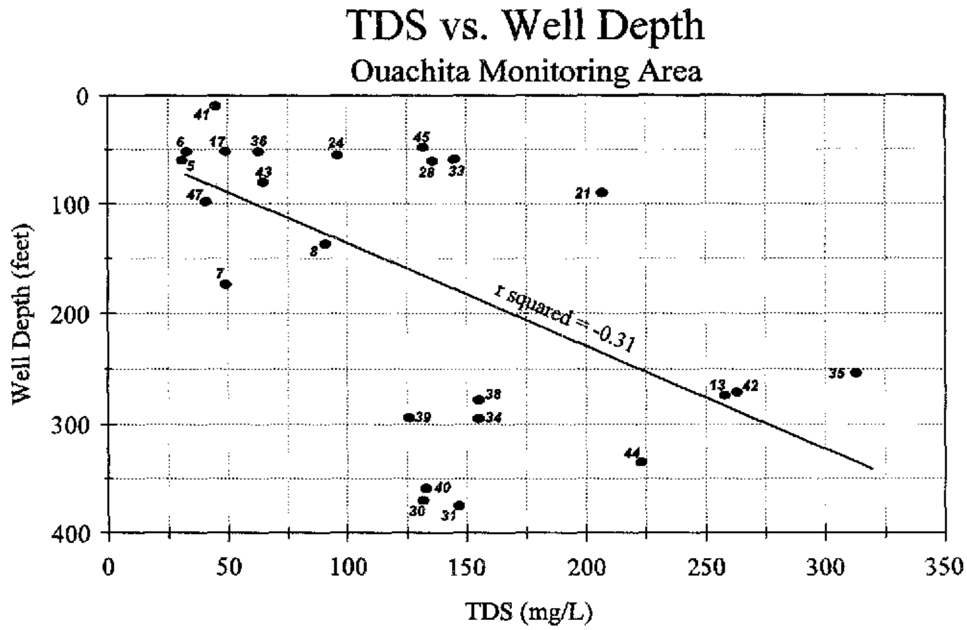

Figure 13 - Bivariate plot of total dissolved solids versus well depth. Number next to marker identifies sample. Two sampling points were not plotted because accurate well depths were unknown. Two distinct zones of TDS concentrations, showing general increase of TDS with depth, are clearly visible in this diagram.

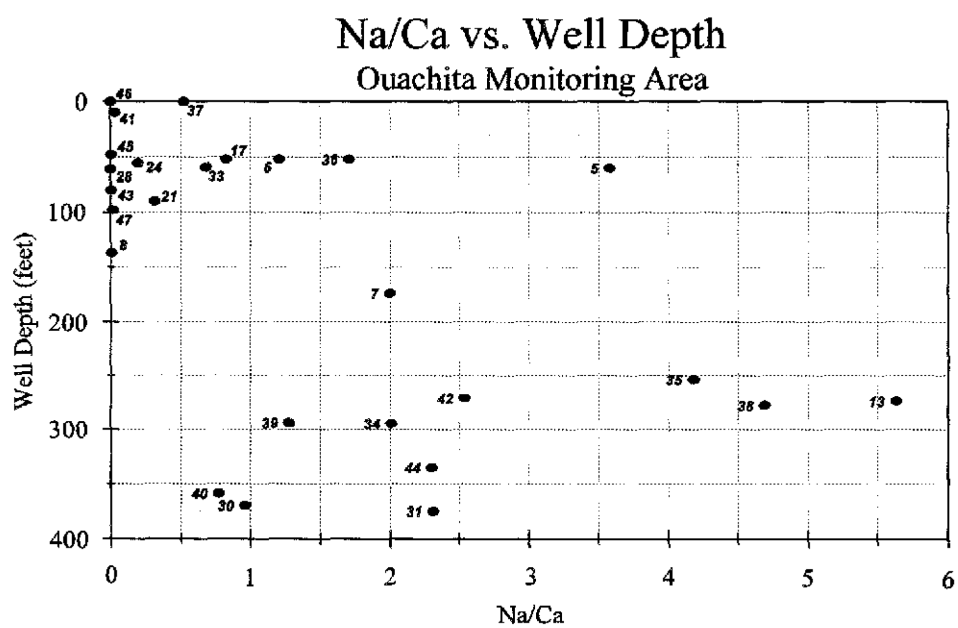

Figure 14 - Bivariate plot of the ratio of sodium to calcium to well depth. Number next to marker identifies sample. Although there is some overlap, the ratio of sodium to calcium generally increases with well depth.

QUALITY CONTROL

A procedure for checking correctness of analyses was used for data quality control, which was based on Section 1030 F of Standard Methods for the Examination of Water and Wastewater, 18th edition (Standard Methods). The procedure involves calculating the TDS, conductance and cation/anion balance for each sample. The calculated TDS and conductance were based on methods outlined in Standard Methods. Cations used for the calculations were Ca^{2+}, Mg^{2+}, K^{+} and Na^{+}; anions used were Cl^{-}, F^{-}, HCO_3^{-}, NO_3^{-} and SO_4^{2-}. Ratios of measured TDS/calculated TDS, calculated conductance/measured conductance, calculated TDS/calculated conductance, measured TDS/ measured conductance, cations/conductance and anions/conductance were calculated for each sample. These ratios were then compared to recommended ranges of values (Standard Methods) to evaluate laboratory efficiency. The calculations for each sampling point are listed in Appendix B. Bivariate plots graphically-representing some of the ratios were also constructed to visually display the relationships.

The most useful indicator of laboratory efficiency likely is the percent difference between the cation and anion sums. Hem (1989) states that for waters of moderate concentration (250-1,000 mg/L TDS), the percent difference should be less than two percent. Hem additionally states that a somewhat larger percent difference can be tolerated if the total of anions and cations is less than 5.00 meq/L. All but six of the water samples had total cation-anion sums less than 5.00 meq/L. Hem does not provide a recommended percent difference for values under 5.00 meq/L. Conversely, Standard Methods states that the error can be raised to five percent if the cation-anion sum is greater than 10 meq/L; however, only two ground-water samples had a cation-anion sum which exceeded ten meq/L. Two of the ground-water samples had a calculated percent difference which was under the recommended two percent error. Eight of the ground water samples had a calculated percent difference between two and ten percent. The remaining samples had a calculated percent difference greater than ten percent.

Figure 15 is a bivariate plot of laboratory-determined TDS versus calculated TDS. The r-squared value of 0.86 is relatively low for a plot of this type. Normally, the two TDS values should be very close with a resulting r-squared value greater than 0.95 percent. Several points are plotted significantly away (outliers) from the best fit line which is a result of the poor cation-anion balance for several points. The calculated TDS is most likely in error where discrepancies occur because of the poor cation-anion balance. Figure 16 is a bivariate plot of measured TDS versus measured conductivity which shows a stronger linear relationship. Several of the outliers seen in Figure 15 have moved closer to the fit, supporting the supposition that the laboratory TDS is more accurate than the calculated TDS. Figures 17 and 18 are bivariate plots of the total cations versus conductance and total anions versus conductance, respectively. Although these plots exhibit strong linear relationships with r-squared values of 0.89 and 0.84, higher values are usually to be expected.

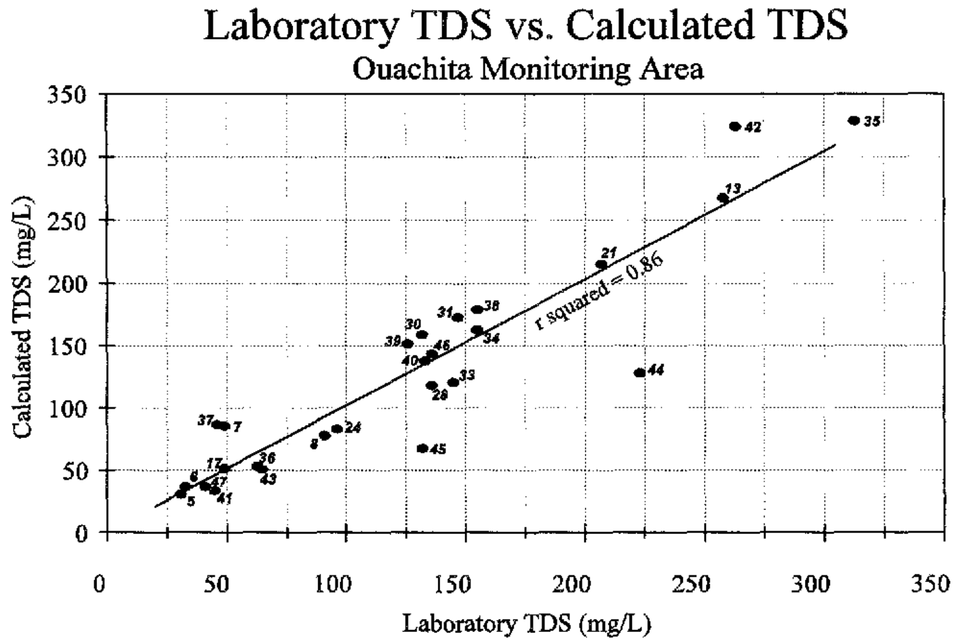

Figure 15 - Bivariate plot of laboratory weighed TDS versus mathematically calculated TDS (From cation-anion sums). Number next to marker identifies sample. Although generally considered a strong fit, the r-squared value of 0.86 is relatively low for this type of graph. The points should fall closer to the line. The marginal fit is attributed to the poor cation-anion balance.

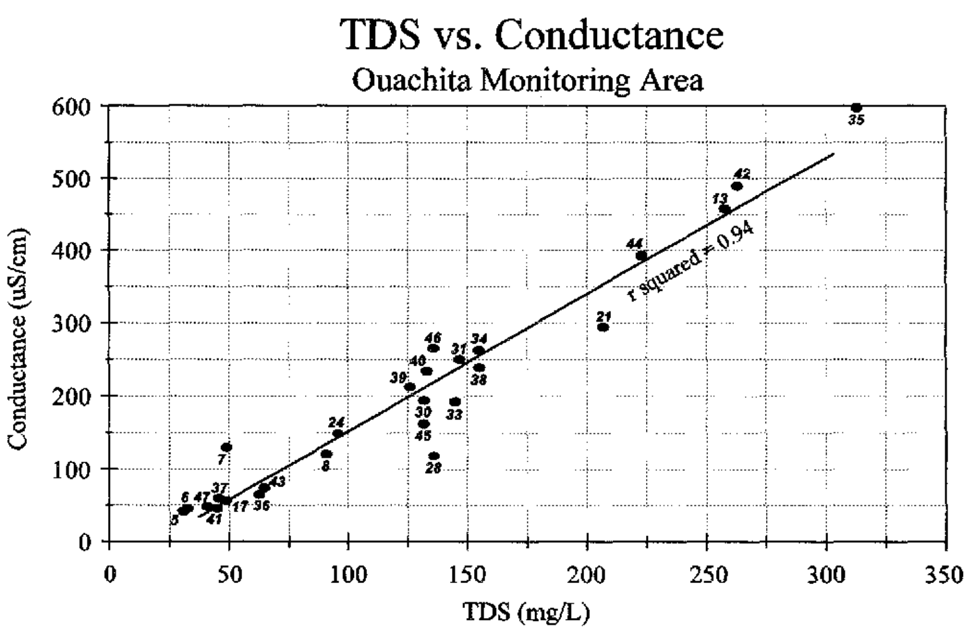

Figure 16 - Bivariate plot of total dissolved solids (TDS) versus conductance. Number next to marker identifies sample. The strong linear relationship is consistent with the expected increase of conductance with increased TDS.

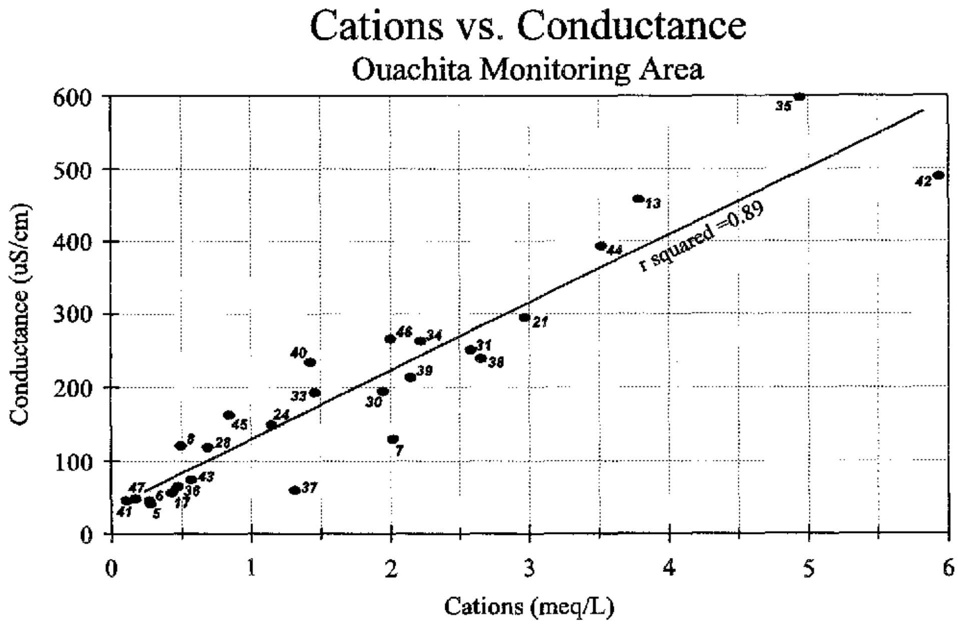

Figure 17 - Bivariate plot of cations versus conductance. Number next to marker indicates sample.

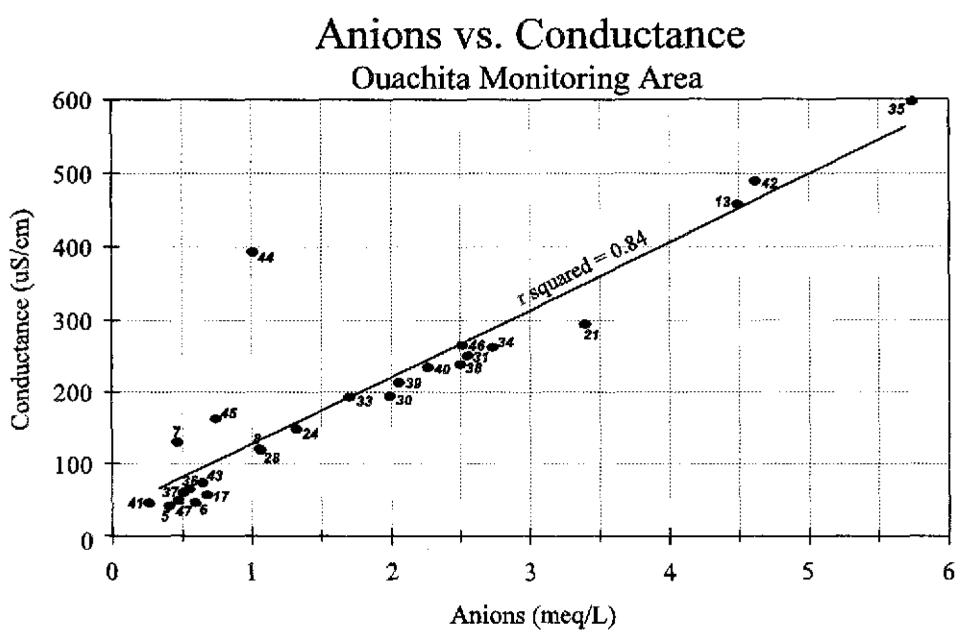

Figure 18 - Bivariate plot of anions versus conductance. Number next to marker identifies sample. The strong correlation between parameters is also expected.

SUMMARY AND CONCLUSIONS

The Ouachita Monitoring Area is located in the Gulf Coastal Plain physiographic province and is underlain predominantly by unconsolidated Tertiary sediments with some Quaternary alluvium and terrace deposits. The monitoring area is in the recharge area of the Sparta aquifer, which is the most heavily used aquifer in the state. Most of the wells in the monitoring area penetrate the Sparta aquifer; however, several wells appear to partially penetrate the underlying Cane River formation/aquifer. As it is the recharge area, the Sparta is unconfined in the monitoring area.

The ground-water quality is generally good in the monitoring area and ranges from a sodium bicarbonate type to a calcium bicarbonate type with several sites exhibiting a mix of ionic constituents. Water chemistry compared to well depth suggests that two separate aquifer systems are present; a shallow system, which is generally a calcium-bicarbonate water type, and a deep system, which is a sodium-bicarbonate water type. Evidence for cation exchange was observed through graphical methods and inspection of ion ratios. The low TDS values measured and calculated for the ground water samples are indicative of a relatively short residence time for the ground water which would be expected given that the monitoring area is in a recharge area.

Monitoring in Ouachita County will continue according to the three-year timetable. The next scheduled sampling event will take place during FY99. In addition to the currently analyzed parameters, semi-volatile organic compound analysis will be conducted on the collected samples.

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Appendix A - Summary of Analytical Data

Table 4 - Conventional Parameters

Sample Location	Sample Date	pH	Alkalinity mg/l	Cond. umhos	HCO3 mg/l	Cl mg/l	NH3-N mg/l	NO3-N mg/l	O-Phos. mg/l	T-Phos. mg/l	SO4 mg/l	Total Coliform col/100ml	Fecal Coliform col/100ml	TOC mg/l	TSS mg/l	TDS mg/l	Hardness mg/l
OUA005	870106	4.30	15	*		4.0	0.06	0.05	0.01K	*	4.0	4K	4K	1.7	*	33	12
	891205	*	*	*		5.0	0.11	0.27	0.07	*	9.0	*	*	*	*	*	*
	920000	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	960625	6.22	8	42	9.8	4.1	0.05K	0.42	0.03K	0.03K	6.0	*	*	1.6	1K	31	5
OUA006	870106	4.00	5	*		4.0	0.02	0.54	0.01K	*	3.0	4K	4K	1.0	*	24	12K
	891205	*	*	*		4.0	0.08	0.05	0.04	*	6.0	*	*	*	*	*	*
	920000	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	960625	6.91	17	46	20.7	3.7	0.05K	0.18	0.03K	0.03K	7.1	*	*	1.3	1K	33	6
OUA007	861216	5.50	13	30		3.0	0.06	0.04	0.01K	*	2.0	8.0	4K	1.7	*	39	10
	891031	*	*	*		3.0	*	0.02K	0.03K	*	4.0	*	*	*	*	*	*
	921101	*	*	*	*	3.0	0.05K	0.02K	0.05	*	1K	*	1K	*	*	*	*
	960625	6.20	15	130	18.3	3.1	0.06	0.10	0.03K	0.03K	3.6	*	*	1.2	54.5	49	6
OUA008	870106	5.00	20	*		6.0	0.12	0.01	0.04	*	29.0	4K	4K	2.2	*	12	30
	890000	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	920000	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	960711	6.13	23	121	28.1	6.8	0.10	0.07	0.03	0.07	19.5	*	*	1.8	4.0	91	9
OUA013	861215	*	118	430		40.0	0.74	0.01	0.28	*	10.0	4K	4K	3.6	*	270	36
	890000	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	920000	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	960626	8.05	146	458	178.1	45.9	0.69	0.10	0.23	0.26	13.4	*	*	1.3	1K	258	36
OUA017	861211	5.50	6	47		4.0	0.02	0.09	0.01K	*	11.0	*	*	2.1	*	35	12
	891024	5.57	*	*		4.0	0.05K	0.62	0.04	*	3.0	*	*	*	*	*	*
	921101	*	*	*	*	2.0	0.07	0.27	0.03	*	1K	*	*	*	*	*	*
	960625	5.80	23	57	28.1	4.3	0.05K	0.14	0.03K	0.03K	4.8	*	*	1.1	1K	49	12
OUA021	861216	7.10	86	333		3.0	0.02	0.17	0.09	*	49.0	12.0	4K	4.1	*	206	124
	891024	7.32	*	*		3.0	0.05K	0.08	0.10	*	56.0	*	*	*	*	*	*
	921012	*	*	*	*	4.0	0.05K	0.09	0.06	*	54.0	*	1K	*	*	*	*
	960624	8.00	109	285	133	2.9	0.05K	0.25	0.09	0.18	54.2	*	*	1K	1.0	207	114
OUA024	861215	6.10	19	73		5.0	0.15	0.14	0.03	*	2.0	240.0	4K	3.2	*	91	26
	890000	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	920000	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	960625	6.94	21	149	25.6	10.7	0.05K	0.17	0.11	0.16	28.7	*	*	2.5	1K	96	48
OUA028	861211	6.30	17	78		1.0	0.03	0.01	0.01	*	15.0	4K	4K	0.5	*	53	30
	891017	*	*	*		11.0	0.11	0.02K	*	*	54.0	*	*	*	*	*	*
	921101	*	*	*	*	6.0	0.07	0.10	0.14	*	15.0	*	1K	*	*	*	*
	960710	6.14	31	119	37.8	3.4	0.05K	0.09	0.03K	0.03K	16.7	*	*	1.4	2.5	136	29
OUA030	861210	5.60	59	180		5.0	0.23	0.01K	0.13	*	16.0	4K	4K	0.6	*	103	48
	891205	*	*	*	*	10.0	0.05K	0.02K	0.03	*	14.0	*	*	*	*	*	*
	921026	*	*	*	*	10.0	0.05K	0.04	0.04	*	14.0	*	1K	*	*	*	*
	960627	6.93	75	195	91.5	5.3	0.23	0.10	0.10	0.26	16.3	*	*	1K	3.0	132	43
OUA031	861210	7.10	88	228		5.0	0.39	0.01K	0.10	*	11.0	4K	4K	3.7	*	129	40
	891205	*	*	*	*	11.0	0.05	0.02K	0.03K	*	10.0	*	*	*	*	*	*
	921026	*	*	*	*	13.0	0.05K	0.04	0.03	*	11.0	*	1K	*	*	*	*
	960627	7.67	105	251	128.1	6.1	0.34	0.09	0.15	0.21	13.4	*	*	1.0	1K	147	40
OUA033	861215	5.65	13	197		35.0	0.04	1.60	0.10	*	7.0	8.0	4K	3.5	*	153	32
	891017	*	*	*	*	26.0	0.11	1.64	*	*	20.0	*	*	*	*	*	*
	921026	*	*	*	*	30.0	0.05K	3.33	0.37	*	5.0	*	1K	*	*	*	*
	960625	6.26	35	193	42.7	24.7	0.05K	1.56	0.03K	0.03K	13.4	*	*	1.3	1K	145	46
OUA034	861215	7.40	102	253		4.0	0.39	0.03	0.14	*	7.0	4.0	4K	9.2	*	176	50
	891017	*	*	*	*	3.0	0.36	0.02K	*	*	10.0	*	*	*	*	*	*
	921026	*	*	*	*	4.0	0.19	0.05	0.12	*	10.0	*	1K	*	*	*	*
	960625	7.62	122	263	148.8	3.4	0.37	0.09	0.07	0.13	9.3	*	*	1.5	1K	155	42
OUA035	960624	8.25	167	598	203.7	80.6	0.55	0.09	0.11	0.12	6.0	*	*	1.1	1K	313	57
OUA036	960626	6.21	8	65	9.8	6.7	0.05K	2.11	0.03	0.03K	8.2	*	*	1K	1K	63	11
OUA037	960626	6.42	14	60	17.1	3.2	0.05K	0.88	0.03K	0.03K	6.0	*	*	1.1	1K	46	45
OUA038	960626	7.50	103	239	125.7	4.9	0.71	0.09	0.26	0.28	14.4	*	*	1.3	1K	155	28
OUA039	960627	7.66	84	213	102.5	5.6	0.23	0.10	0.14	0.27	10.3	*	*	1K	1.5	126	42
OUA040	960709	6.97	81	235	98.8	6.5	0.16	0.08	0.06	0.14	22.2	*	*	1.1	4.0	133	35
OUA041	960710	5.49	5	46	6.1	3.2	0.05K	0.52	0.05	0.06	3.2	*	*	2.6	6.0	45	1
OUA042	960626	7.61	128	490	156.2	58.8	0.70	0.10	0.13	0.18	19.1	*	*	1K	1K	263	99
OUA043	960710	7.12	25	74	30.5	4.1	0.05K	2.09	0.03K	0.03K	1K	*	*	1.2	1K	65	28
OUA044	960710	7.90	168	393	30.5	12.6	0.05K	0.45	0.11	0.24	7.1	*	*	1.0	1.0	223	60
OUA045	960710	6.57	13	163	15.9	9.0	0.05K	12.30	0.03K	0.06	1.7	*	*	1.4	1K	132	36
OUA046	960710	7.32	115	266	140.3	3.1	0.05K	0.45	0.03K	0.05	5.9	*	*	2.0	8.5	136	96
OUA047	960711	5.74	13	49	15.86	4.3	0.05K	0.08	0.03K	0.03	4.6	*	*	1.3	2.0	41	4

Notes: * indicates no analyses conducted for the sample or no sample obtained on the given date
"K" indicates actual value is less than the given value

Table 5 - Total Metals, Cations & Anions

Sample Location	Sample Date	Al ug/l	As ug/l	B ug/l	Ba ug/l	Be ug/l	Ca mg/l	Cd ug/l	Co ug/l	Cr ug/l	Cu ug/l	Fe ug/l	F mg/l	K mg/l	Mg mg/l	Mn ug/l	Na mg/l	Ni ug/l	Pb ug/l	Se ug/l	SiO2 mg/l	V ug/l	Zn ug/l
OUA005	960625	215.0	5K	7.8	33.6	3.0K	0.9	0.5K	3.0K	1.3	2.0K	158	0.04	0.7	0.6	8.3	3.7	6.0K	2K	10K	8.4	5.3K	27.6
OUA006	960625	158.9	5K	11.4	36.5	3.0K	1.8	0.5K	3.8	1.0	2.0K	446	0.04	0.8	0.5	62.7	2.5	6.0K	2K	10K	7.4	5.3K	40.0
OUA007	960625	91.4	5K	3.4K	25.2	13.1	1.0	0.5K	3.0K	2.3	92.3	51900	0.04	0.4	0.006K	293.0	2.3	6.0K	11.3	10K	12.1	5.3K	1710.0
OUA008**	960711	21.3	5K	7.2	88.9	3.0K	5.9	0.5K	3.0K	1K	5.9	4640	0.1K	1.3	0.006K	47.4	0.038K	6.0K	2K	10K	22.9	5.3K	11.9
OUA013	960626	443.5	5K	157.7	117.3	3.0K	10.7	0.5K	3.0K	1K	2.0K	203	0.13	2.0	2.3	20.0	69.1	6.0K	2K	10K	16.6	5.3K	26.1
OUA017	960625	87.0	5K	6.1	31.2	3.0K	4.3	0.63	3.0K	1K	163.0	130	0.06	0.2	0.4	10.6	4.1	6.0K	3.4	10K	16.4	5.3K	2210.0
OUA021	960624	133.6	5K	37.4	106.9	3.0K	37.6	0.5K	3.0K	1.1	2.1	681	0.12	2.5	5.0	15.7	13.6	6.0K	2K	10K	18.7	5.3K	67.5
OUA024	960625	88.7	5K	12.8	25.6	3.0K	16.9	0.5K	3.0K	1K	16.7	64	0.75	0.8	1.4	2.0K	3.9	6.0K	2K	10K	5.0	5.3K	64.1
OUA028	960710	24.1	5K	6.3	73.3	3.0K	12.2	0.5K	3.0K	1K	48.6	1370	0.1	1.2	0.006K	29.3	0.038K	6.0K	2K	10K	60.6	5.3K	49.5
OUA030	960627	819.1	5K	29.1	137.0	3.0K	17.4	0.5K	3.0K	1.5	29.1	4930	0.1	2.8	0.006K	70.7	19.2	6.0K	2.7	10K	37.2	5.3K	58.3
OUA031	960627	486.8	5K	50.4	152.6	3.0K	14.0	0.5K	3.0K	1.2	2.0K	2660	0.09	2.4	1.3	27.6	37.2	6.0K	2K	10K	18.5	5.3K	40.0
OUA033	960625	93.9	5K	14.6	91.7	3.0K	15.0	0.5K	3.0K	1K	11.1	96	0.09	1.2	2.0	6.3	11.8	6.0K	2K	10K	25.3	5.3K	271.0
OUA034	960625	46.6	5K	47.7	119.4	3.0K	13.1	0.5K	3.0K	1K	2.0K	900	0.07	1.6	2.2	26.6	30.2	6.0K	2K	10K	12.7	5.3K	295.0
OUA035	960624	65.6	5k	65.0	178.5	3.0K	18.0	0.5K	3.0K	1K	2.0K	137	0.09	1.8	2.9	40.2	86.3	6.0K	2K	10K	10.3	5.3K	101.0
OUA036	960626	58.6	5k	15.4	70.5	3.0K	2.8	0.5K	3.0K	1K	30.6	46	0.04	0.6	1.0	7.1	5.5	6.0K	16.4	10K	20.3	5.3K	37.2
OUA037	960626	144.0	5k	29.1	185.3	3.0K	13.8	0.5K	3.0K	3.9	97.6	66	0.05	2.0	2.6	13.9	8.3	6.0K	7.3	10K	39.3	5.3K	75.7
OUA038	960626	524.7	5k	93.1	101.0	3.0K	8.6	0.5K	3.0K	4.6	2.0K	807	0.06	2.2	1.5	21.0	46.3	6.0K	2K	10K	24.2	5.3K	18.5
OUA039	960627	554.4	5k	40.4	159.8	3.0K	16.7	0.5K	3.0K	1.2	2.0K	4800	0.11	3.0	0.006K	67.7	24.5	6.0K	2K	10K	24.3	5.3K	13.5
OUA040	960709	33.7	5k	37.5	120.2	3.0K	13.9	0.5K	3.0K	1.5	2.0K	3910	0.1	2.3	0.006K	54.5	12.3	6.0K	2K	10K	17.4	5.3K	340.0
OUA041	960710	922.7	5k	9.9	24.8	3.0K	1.0	0.5K	3.0K	1K	2.0	1130	0.1K	0.7	0.006K	12.7	0.0	6.0K	2K	10K	19.6	5.3K	29.3
OUA042	960626	389.7	5k	165.2	292.4	3.0K	30.2	0.5K	3.0K	3.9	5.4	929	0.07	3.6	5.8	76.2	88.0	6.0K	2K	10K	23.4	5.3K	28.5
OUA043	960710	28.1	5k	6.4	34.4	3.0K	9.1	0.5K	3.0K	1K	215.0	47	0.1K	0.6	1.2	7.3	0.038K	6.7	4.3	10K	15.5	5.3K	118.0
OUA044	960710	16K	5k	43.9	186.8	3.0K	19.6	0.80	3.0K	1K	21.1	656	0.1	1.6	2.7	69.3	51.8	6.0K	8.7	10K	13.0	5.3K	619.0
OUA045	960710	358.3	5k	18.2	461.0	3.0K	8.4	0.5K	8.4	1K	10.2	44	0.2	5.0	3.6	89.5	0.038K	8.7	2K	10K	17.2	5.3K	68.7
OUA046	960710	578.2	5k	9.6	67.9	3.0K	37.9	0.5K	3.0K	1K	90.1	1710	0.1	0.9	0.3	35.1	0.038K	6.0K	18.4	10K	8.8	5.3K	3230.0
OUA047**	960711	150.1	5k	5.7	28.6	3.0K	2.1	0.5K	3.2	1K	3.9	1340	0.1K	0.7	0.006K	32.8	0.038K	6.0K	2K	10K	14.5	5.3K	34.2

Notes: * indicates no analyses conducted for the sample or no sample obtained on the given date

** ICAP metals also run on these samples. Values given are total metals.

"K" indicates actual value is less than the given value

Table 6 - Volatile Organic Compound Analyses

			Sample Location:										
Parameter	**D.L.**	**Units**	**OUA013**	**OUA028**	**OUA030**	**OUA031**	**OUA033**	**OUA034**	**OUA038**	**OUA039**	**OUA040**	**OUA044**	**OUA046**
Acetone	2.00	ug/l	*	20.12	*	*	*	*	*	*	*	20.78	31.04
Benzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Bromobenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Bromochloromethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Bromodichloromethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Bromoform	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Bromomethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Carbon Tetrachloride	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Chlorobenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Chloroethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Chloroform	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Chloromethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
2-Chlorotoluene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
4-Chlorotoluene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Dibromochloromethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,2-Dibromo-3-chloropropane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,2-Dibromoethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Dibromomethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,2-Dichlorobenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,3-Dichlorobenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,4-Dichlorobenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,1-Dichloroethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,2-Dichloroethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,1-Dichloroethene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Cis-1,2-Dichloroethene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Trans-1,2-Dichloroethene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,2-Dichloropropane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,3-Dichloropropane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
2,2-Dichloropropane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,1-Dichloropropene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Cis-1,3-Dichloropropene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Trans-1,3-Dichloropropene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Ethylbenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Hexachlorobutadiene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Isopropylbenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Meta-xylene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Methyl ethyl ketone	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Methylene Chloride	2.00	ug/l	*	18.65	*	2.79	*	*	*	*	6.95	25.94	31.52
N-Butyl benzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
N-Propyl benzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Napthalene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Orthoxylene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
P-Isopropyl toluene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Para-xylene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Sec-butyl benzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Styrene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Tert-butyl benzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,1,1,2-Tetrachlorethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,1,2,2-Tetrachloroethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Tetrachloroethene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Toluene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,2,3-Trichlorobenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,2,4-Trichlorobenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,1,1-Trichloroethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,1,2-Trichloroethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Trichloroethene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Trichloroflouromethane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,2,3-Trichloropropane	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,2,4-Trimethylbenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
1,3,5-Trimethylbenzene	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*
Vinyl Chloride	2.00	ug/l	*	*	*	*	*	*	*	*	*	*	*

Notes: * indicates constituent not detected for the sample

Appendix B - Correctness of Analysis Calculations

Sample Location: OUA005 Sample Date: 960625

Alkalinity (mg/l)	**8**	
SiO2 (mg/l)	**8.4**	
Measured conductivity (umho/cm)	**41.6**	
Infinite dilution conductivity (umho/cm)	41.47	
Ionic strength (M)	0.0005	
Monovalent ion activity coefficient	0.98	
Calculated conductivity (umho/cm)	**39.53**	
Measured TDS	**31**	
Calculated TDS	**29.80**	
Ratio: Meas TDS/Calc TDS	1.04	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.95	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.75	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.75	Should be between 0.55 and 0.7

	Constituent:									
	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**3.7**	**0.7**	**0.9**	**0.6**	**0.158**	**4.06**	**6.0**	**0.423**	**0.04**	**9.8**
Concentration (meq/L)	0.1610	0.0179	0.0449	0.0494	0.0057	0.1145	0.1249	0.0068	0.0021	0.1606
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.1610	0.0179	0.0225	0.0247	0.0028	0.1145	0.0625	0.0068	0.0021	0.1606
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	8.06	1.32	2.67	2.62	0.31	8.75	9.99	0.49	0.11	7.15
Ionic strength	8.05E-05	8.95E-06	4.49E-05	4.94E-05	5.66E-06	5.73E-05	1.25E-04	3.41E-06	1.05E-06	8.03E-05

Cation sum (meq/L)	0.28	
Anion sum (meq/L)	0.41	
% Difference	-18.93	Should be < 2%
Ion Difference	-0.13	
Ratio: Cation sum*(100)/Measured conductivity	0.67	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.98	Should be between 0.9 and 1.1

Sample Location: OUA006 Sample Date: 960625

Alkalinity (mg/l)	**17**	
SiO2 (mg/l)	**7.4**	
Measured conductivity (umho/cm)	**46**	
Infinite dilution conductivity (umho/cm)	50.46	
Ionic strength (M)	0.0006	
Monovalent ion activity coefficient	0.97	
Calculated conductivity (umho/cm)	**47.81**	
Measured TDS	**33**	
Calculated TDS	**34.59**	
Ratio: Meas TDS/Calc TDS	0.95	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	1.04	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.72	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.72	Should be between 0.55 and 0.7

	Constituent:									
	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**2.5**	**0.8**	**1.8**	**0.5**	**0.446**	**3.652**	**7.1**	**0.176**	**0.04**	**20.7**
Concentration (meq/L)	0.1087	0.0205	0.0898	0.0411	0.0160	0.1030	0.1478	0.0028	0.0021	0.3393
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.1087	0.0205	0.0449	0.0206	0.0080	0.1030	0.0739	0.0028	0.0021	0.3393
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	5.45	1.50	5.34	2.18	0.86	7.87	11.83	0.20	0.11	15.10
Ionic strength	5.44E-05	1.02E-05	8.98E-05	4.11E-05	1.60E-05	5.15E-05	1.48E-04	1.42E-06	1.05E-06	1.70E-04

Cation sum (meq/L)	0.28	
Anion sum (meq/L)	0.60	
% Difference	-36.61	Should be < 2%
Ion Difference	-0.32	
Ratio: Cation sum*(100)/Measured conductivity	0.60	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	1.29	Should be between 0.9 and 1.1

Sample Location: OUA005 Sample Date: 960625

Alkalinity (mg/l)	**8**	
SiO2 (mg/l)	**8.4**	
Measured conductivity (umho/cm)	**41.6**	
Infinite dilution conductivity (umho/cm)	41.47	
Ionic strength (M)	0.0005	
Monovalent ion activity coefficient	0.98	
Calculated conductivity (umho/cm)	**39.53**	
Measured TDS	**31**	
Calculated TDS	**29.80**	
Ratio: Meas TDS/Calc TDS	1.04	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.95	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.75	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.75	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**3.7**	**0.7**	**0.9**	**0.6**	**0.158**	**4.06**	**6.0**	**0.423**	**0.04**	**9.8**
Concentration (meq/L)	0.1610	0.0179	0.0449	0.0494	0.0057	0.1145	0.1249	0.0068	0.0021	0.1606
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.1610	0.0179	0.0225	0.0247	0.0028	0.1145	0.0625	0.0068	0.0021	0.1606
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	8.06	1.32	2.67	2.62	0.31	8.75	9.99	0.49	0.11	7.15
Ionic strength	8.05E-05	8.95E-06	4.49E-05	4.94E-05	5.66E-06	5.73E-05	1.25E-04	3.41E-06	1.05E-06	8.03E-05

Cation sum (meq/L)	0.28	
Anion sum (meq/L)	0.41	
% Difference	-18.93	Should be < 2%
Ion Difference	-0.13	
Ratio: Cation sum*(100)/Measured conductivity	0.67	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.98	Should be between 0.9 and 1.1

Sample Location: OUA006 Sample Date: 960625

Alkalinity (mg/l)	**17**	
SiO2 (mg/l)	**7.4**	
Measured conductivity (umho/cm)	**46**	
Infinite dilution conductivity (umho/cm)	50.46	
Ionic strength (M)	0.0006	
Monovalent ion activity coefficient	0.97	
Calculated conductivity (umho/cm)	**47.81**	
Measured TDS	**33**	
Calculated TDS	**34.59**	
Ratio: Meas TDS/Calc TDS	0.95	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	1.04	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.72	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.72	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**2.5**	**0.8**	**1.8**	**0.5**	**0.446**	**3.662**	**7.1**	**0.176**	**0.04**	**20.7**
Concentration (meq/L)	0.1087	0.0205	0.0898	0.0411	0.0160	0.1030	0.1478	0.0028	0.0021	0.3393
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.1087	0.0205	0.0449	0.0206	0.0080	0.1030	0.0739	0.0028	0.0021	0.3393
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	5.45	1.50	5.34	2.18	0.86	7.87	11.83	0.20	0.11	15.10
Ionic strength	5.44E-05	1.02E-05	8.98E-05	4.11E-05	1.60E-05	5.15E-05	1.48E-04	1.42E-06	1.05E-06	1.70E-04

Cation sum (meq/L)	0.28	
Anion sum (meq/L)	0.60	
% Difference	-36.61	Should be < 2%
Ion Difference	-0.32	
Ratio: Cation sum*(100)/Measured conductivity	0.60	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	1.29	Should be between 0.9 and 1.1

Sample Location: OUA007 Sample Date: 960625

Alkalinity (mg/l)	**15**	
SiO2 (mg/l)	**12.1**	
Measured conductivity (umho/cm)	**130**	
Infinite dilution conductivity (umho/cm)	135.44	
Ionic strength (M)	0.0022	
Monovalent ion activity coefficient	0.95	
Calculated conductivity (umho/cm)	**122.26**	
Measured TDS	**49**	
Calculated TDS	**83.56**	
Ratio: Meas TDS/Calc TDS	0.59	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.94	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.68	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.38	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**2.3**	**0.4**	**1.0**	**0.0**	**51.9**	**3.116**	**3.6**	**0.103**	**0.04**	**18.3**
Concentration (meq/L)	0.1001	0.0102	0.0499	0.0005	1.8585	0.0879	0.0750	0.0017	0.0021	0.2999
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.1001	0.0102	0.0250	0.0002	0.9295	0.0879	0.0375	0.0017	0.0021	0.2999
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	5.01	0.75	2.97	0.03	100.39	6.72	6.00	0.12	0.11	13.35
Ionic strength	5.00E-05	5.12E-06	4.99E-05	4.94E-07	1.86E-03	4.40E-05	7.50E-05	8.31E-07	1.05E-06	1.50E-04

Cation sum (meq/L)	2.02	
Anion sum (meq/L)	0.47	
% Difference	62.46	Should be < 2%
Ion Difference	1.55	
Ratio: Cation sum*(100)/Measured conductivity	1.55	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.36	Should be between 0.9 and 1.1

Sample Location: OUA008 Sample Date: 960711

Alkalinity (mg/l)	**23**	
SiO2 (mg/l)	**22.9**	
Measured conductivity (umho/cm)	**121**	
Infinite dilution conductivity (umho/cm)	96.97	
Ionic strength (M)	0.0012	
Monovalent ion activity coefficient	0.96	
Calculated conductivity (umho/cm)	**89.81**	
Measured TDS	**91**	
Calculated TDS	**75.04**	
Ratio: Meas TDS/Calc TDS	1.21	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.74	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.84	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.75	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**0.0**	**1.3**	**5.9**	**0.0**	**4.64**	**6.765**	**19.5**	**0.072**	**0.1**	**28.1**
Concentration (meq/L)	0.0017	0.0333	0.2944	0.0005	0.1662	0.1908	0.4060	0.0012	0.0053	0.4606
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.0017	0.0333	0.1472	0.0002	0.0831	0.1908	0.2030	0.0012	0.0053	0.4606
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	0.08	2.44	17.52	0.03	8.98	14.58	32.48	0.08	0.29	20.49
Ionic strength	8.26E-07	1.66E-05	2.94E-04	4.94E-07	1.66E-04	9.54E-05	4.06E-04	5.81E-07	2.63E-06	2.30E-04

Cation sum (meq/L)	0.50	
Anion sum (meq/L)	1.06	
% Difference	-36.41	Should be < 2%
Ion Difference	-0.57	
Ratio: Cation sum*(100)/Measured conductivity	0.41	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.88	Should be between 0.9 and 1.1

Sample Location: OUA013 Sample Date: 960626

Alkalinity (mg/l)	**146**	
SiO2 (mg/l)	**16.6**	
Measured conductivity (umho/cm)	**458**	
Infinite dilution conductivity (umho/cm)	448.10	
Ionic strength (M)	0.0046	
Monovalent ion activity coefficient	0.93	
Calculated conductivity (umho/cm)	**388.10**	
Measured TDS	**258**	
Calculated TDS	**247.96**	
Ratio: Meas TDS/Calc TDS	1.04	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.85	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.64	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.56	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**69.1**	**2.0**	**10.7**	**2.3**	**0.203**	**45.857**	**13.4**	**0.096**	**0.13**	**178.1**
Concentration (meq/L)	3.0059	0.0512	0.5339	0.1893	0.0073	1.2936	0.2790	0.0015	0.0068	2.9191
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	3.0059	0.0512	0.2670	0.0946	0.0036	1.2936	0.1395	0.0015	0.0068	2.9191
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	150.59	3.76	31.77	10.05	0.39	98.83	22.32	0.11	0.37	129.90
Ionic strength	1.50E-03	2.56E-05	5.34E-04	1.89E-04	7.27E-06	6.47E-04	2.79E-04	7.74E-07	3.42E-06	1.46E-03

Cation sum (meq/L)	3.79	
Anion sum (meq/L)	4.50	
% Difference	-8.60	Should be < 2%
Ion Difference	-0.71	
Ratio: Cation sum*(100)/Measured conductivity	0.83	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.98	Should be between 0.9 and 1.1

Sample Location: OUA017 Sample Date: 960625

Alkalinity (mg/l)	**23**	
SiO2 (mg/l)	**16.4**	
Measured conductivity (umho/cm)	**57**	
Infinite dilution conductivity (umho/cm)	62.11	
Ionic strength (M)	0.0007	
Monovalent ion activity coefficient	0.97	
Calculated conductivity (umho/cm)	**58.47**	
Measured TDS	**49**	
Calculated TDS	**48.62**	
Ratio: Meas TDS/Calc TDS	1.01	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	1.03	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.83	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.86	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**4.1**	**0.2**	**4.3**	**0.4**	**0.13**	**4.274**	**4.8**	**0.139**	**0.06**	**28.1**
Concentration (meq/L)	0.1784	0.0051	0.2146	0.0329	0.0047	0.1206	0.0999	0.0022	0.0032	0.4606
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.1784	0.0051	0.1073	0.0165	0.0023	0.1206	0.0500	0.0022	0.0032	0.4606
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	8.94	0.38	12.77	1.75	0.25	9.21	7.99	0.16	0.17	20.49
Ionic strength	8.92E-05	2.56E-06	2.15E-04	3.29E-05	4.66E-06	6.03E-05	9.99E-05	1.12E-06	1.58E-06	2.30E-04

Cation sum (meq/L)	0.44	
Anion sum (meq/L)	0.69	
% Difference	-22.36	Should be < 2%
Ion Difference	-0.25	
Ratio: Cation sum*(100)/Measured conductivity	0.76	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	1.20	Should be between 0.9 and 1.1

Sample Location: OUA021 Sample Date: 960624

Alkalinity (mg/l)	**109**	
SiO2 (mg/l)	**18.7**	
Measured conductivity (umho/cm)	**295**	
Infinite dilution conductivity (umho/cm)	363.41	
Ionic strength (M)	0.0049	
Monovalent ion activity coefficient	0.93	
Calculated conductivity (umho/cm)	**313.63**	
Measured TDS	**207**	
Calculated TDS	**201.00**	
Ratio: Meas TDS/Calc TDS	1.03	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	1.06	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.64	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.70	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**13.6**	**2.5**	**37.6**	**5.0**	**0.681**	**2.948**	**54.2**	**0.254**	**0.12**	**133**
Concentration (meq/L)	0.5916	0.0640	1.8762	0.4115	0.0244	0.0832	1.1284	0.0041	0.0063	2.1799
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.5916	0.0640	0.9381	0.2057	0.0122	0.0832	0.5642	0.0041	0.0063	2.1799
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	29.64	4.70	111.64	21.85	1.32	6.35	90.28	0.29	0.34	97.00
Ionic strength	2.96E-04	3.20E-05	1.88E-03	4.11E-04	2.44E-05	4.16E-05	1.13E-03	2.05E-06	3.16E-06	1.09E-03

Cation sum (meq/L)	2.97	
Anion sum (meq/L)	3.40	
% Difference	-6.82	Should be < 2%
Ion Difference	-0.43	
Ratio: Cation sum*(100)/Measured conductivity	1.01	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	1.15	Should be between 0.9 and 1.1

Sample Location: OUA024 Sample Date: 960625

Alkalinity (mg/l)	**21**	
SiO2 (mg/l)	**5**	
Measured conductivity (umho/cm)	**149**	
Infinite dilution conductivity (umho/cm)	158.25	
Ionic strength (M)	0.0020	
Monovalent ion activity coefficient	0.95	
Calculated conductivity (umho/cm)	**143.48**	
Measured TDS	**96**	
Calculated TDS	**80.95**	
Ratio: Meas TDS/Calc TDS	1.19	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.96	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.56	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.64	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**3.9**	**0.8**	**16.9**	**1.4**	**0.064**	**10.674**	**28.7**	**0.174**	**0.75**	**25.6**
Concentration (meq/L)	0.1697	0.0205	0.8433	0.1152	0.0023	0.3011	0.5975	0.0028	0.0395	0.4196
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.1697	0.0205	0.4217	0.0576	0.0011	0.3011	0.2988	0.0028	0.0395	0.4196
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	8.50	1.50	50.18	6.12	0.12	23.01	47.80	0.20	2.15	18.67
Ionic strength	8.48E-05	1.02E-05	8.43E-04	1.15E-04	2.29E-06	1.51E-04	5.98E-04	1.40E-06	1.97E-05	2.10E-04

Cation sum (meq/L)	1.15	
Anion sum (meq/L)	1.36	
% Difference	-8.35	Should be < 2%
Ion Difference	-0.21	
Ratio: Cation sum*(100)/Measured conductivity	0.77	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.91	Should be between 0.9 and 1.1

Sample Location: OUA028 Sample Date: 960710

Alkalinity (mg/l)	**31**	
SiO2 (mg/l)	**60.6**	
Measured conductivity (umho/cm)	**119**	
Infinite dilution conductivity (umho/cm)	104.24	
Ionic strength (M)	0.0014	
Monovalent ion activity coefficient	0.96	
Calculated conductivity (umho/cm)	**96.07**	
Measured TDS	**136**	
Calculated TDS	**114.25**	
Ratio: Meas TDS/Calc TDS	1.19	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.81	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	1.19	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	1.14	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**0.0**	**1.2**	**12.2**	**0.0**	**1.37**	**3.353**	**16.7**	**0.093**	**0.1**	**37.8**
Concentration (meq/L)	0.0017	0.0307	0.6088	0.0005	0.0491	0.0946	0.3477	0.0015	0.0053	0.6195
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.0017	0.0307	0.3044	0.0002	0.0245	0.0946	0.1738	0.0015	0.0053	0.6195
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	0.08	2.26	36.22	0.03	2.65	7.23	27.82	0.11	0.29	27.57
Ionic strength	8.26E-07	1.53E-05	6.09E-04	4.94E-07	4.91E-05	4.73E-05	3.48E-04	7.50E-07	2.63E-06	3.10E-04

Cation sum (meq/L)	0.69	
Anion sum (meq/L)	1.07	
% Difference	-21.48	Should be < 2%
Ion Difference	-0.38	
Ratio: Cation sum*(100)/Measured conductivity	0.58	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.90	Should be between 0.9 and 1.1

Sample Location: OUA030 Sample Date: 960627

Alkalinity (mg/l)	**75**	
SiO2 (mg/l)	**37.2**	
Measured conductivity (umho/cm)	**195**	
Infinite dilution conductivity (umho/cm)	214.06	
Ionic strength (M)	0.0027	
Monovalent ion activity coefficient	0.95	
Calculated conductivity (umho/cm)	**191.53**	
Measured TDS	**132**	
Calculated TDS	**148.33**	
Ratio: Meas TDS/Calc TDS	0.89	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.98	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.77	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.68	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**19.2**	**2.8**	**17.4**	**0.0**	**4.93**	**5.309**	**16.3**	**0.099**	**0.1**	**91.5**
Concentration (meq/L)	0.8352	0.0716	0.8683	0.0005	0.1765	0.1498	0.3394	0.0016	0.0053	1.4997
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.8352	0.0716	0.4341	0.0002	0.0883	0.1498	0.1697	0.0016	0.0053	1.4997
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	41.84	5.26	51.66	0.03	9.54	11.44	27.15	0.11	0.29	66.74
Ionic strength	4.18E-04	3.58E-05	8.68E-04	4.94E-07	1.77E-04	7.49E-05	3.39E-04	7.98E-07	2.63E-06	7.50E-04

Cation sum (meq/L)	1.95	
Anion sum (meq/L)	2.00	
% Difference	-1.10	Should be < 2%
Ion Difference	-0.04	
Ratio: Cation sum*(100)/Measured conductivity	1.00	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	1.02	Should be between 0.9 and 1.1

Sample Location: OUA031 Sample Date: 960627

Alkalinity (mg/l)	**105**	
SiO2 (mg/l)	**18.5**	
Measured conductivity (umho/cm)	**251**	
Infinite dilution conductivity (umho/cm)	267.33	
Ionic strength (M)	0.0032	
Monovalent ion activity coefficient	0.94	
Calculated conductivity (umho/cm)	**237.01**	
Measured TDS	**147**	
Calculated TDS	**158.77**	
Ratio: Meas TDS/Calc TDS	0.93	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.94	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.67	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.59	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**37.2**	**2.4**	**14.0**	**1.3**	**2.66**	**6.144**	**13.4**	**0.086**	**0.09**	**128.1**
Concentration (meq/L)	1.6182	0.0614	0.6986	0.1070	0.0953	0.1733	0.2790	0.0014	0.0047	2.0996
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	1.6182	0.0614	0.3493	0.0535	0.0476	0.1733	0.1395	0.0014	0.0047	2.0996
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	81.07	4.51	41.57	5.68	5.15	13.24	22.32	0.10	0.26	93.43
Ionic strength	8.09E-04	3.07E-05	6.99E-04	1.07E-04	9.53E-05	8.67E-05	2.79E-04	7.10E-07	2.37E-06	1.05E-03

Cation sum (meq/L)	2.58	
Anion sum (meq/L)	2.56	
% Difference	0.44	Should be < 2%
Ion Difference	0.02	
Ratio: Cation sum*(100)/Measured conductivity	1.03	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	1.02	Should be between 0.9 and 1.1

Sample Location: OUA033 Sample Date: 960625

Alkalinity (mg/l)	**35**	
SiO2 (mg/l)	**25.3**	
Measured conductivity (umho/cm)	**193**	
Infinite dilution conductivity (umho/cm)	190.22	
Ionic strength (M)	0.0022	
Monovalent ion activity coefficient	0.95	
Calculated conductivity (umho/cm)	**171.91**	
Measured TDS	**145**	
Calculated TDS	**116.16**	
Ratio: Meas TDS/Calc TDS	1.25	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.89	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.68	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.75	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**11.8**	**1.2**	**15.0**	**2.0**	**0.096**	**24.715**	**13.4**	**1.564**	**0.09**	**42.7**
Concentration (meq/L)	0.5133	0.0307	0.7485	0.1646	0.0034	0.6972	0.2790	0.0252	0.0047	0.6999
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.5133	0.0307	0.3743	0.0823	0.0017	0.6972	0.1395	0.0252	0.0047	0.6999
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	25.72	2.26	44.54	8.74	0.19	53.27	22.32	1.80	0.26	31.14
Ionic strength	2.57E-04	1.53E-05	7.49E-04	1.65E-04	3.44E-06	3.49E-04	2.79E-04	1.26E-05	2.37E-06	3.50E-04

Cation sum (meq/L)	1.46	
Anion sum (meq/L)	1.71	
% Difference	-7.75	Should be < 2%
Ion Difference	-0.25	
Ratio: Cation sum*(100)/Measured conductivity	0.76	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.88	Should be between 0.9 and 1.1

Sample Location: OUA034 Sample Date: 960625

Alkalinity (mg/l)	**122**	
SiO2 (mg/l)	**12.7**	
Measured conductivity (umho/cm)	**263**	
Infinite dilution conductivity (umho/cm)	250.82	
Ionic strength (M)	0.0030	
Monovalent ion activity coefficient	0.94	
Calculated conductivity (umho/cm)	**222.98**	
Measured TDS	**155**	
Calculated TDS	**146.77**	
Ratio: Meas TDS/Calc TDS	1.06	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.85	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.66	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.59	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**30.2**	**1.6**	**13.1**	**2.2**	**0.9**	**3.443**	**9.3**	**0.093**	**0.07**	**148.8**
Concentration (meq/L)	1.3137	0.0409	0.6537	0.1810	0.0322	0.0971	0.1936	0.0015	0.0037	2.4388
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	1.3137	0.0409	0.3268	0.0905	0.0161	0.0971	0.0968	0.0015	0.0037	2.4388
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	65.82	3.01	38.89	9.61	1.74	7.42	15.49	0.11	0.20	108.53
Ionic strength	6.57E-04	2.05E-05	6.54E-04	1.81E-04	3.22E-05	4.86E-05	1.94E-04	7.50E-07	1.84E-06	1.22E-03

Cation sum (meq/L)	2.22	
Anion sum (meq/L)	2.73	
% Difference	-10.35	Should be < 2%
Ion Difference	-0.51	
Ratio: Cation sum*(100)/Measured conductivity	0.84	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	1.04	Should be between 0.9 and 1.1

Sample Location: OUA035 Sample Date: 960624

Alkalinity (mg/l)	**167**	
SiO2 (mg/l)	**10.3**	
Measured conductivity (umho/cm)	**598**	
Infinite dilution conductivity (umho/cm)	590.44	
Ionic strength (M)	0.0060	
Monovalent ion activity coefficient	0.92	
Calculated conductivity (umho/cm)	**502.59**	
Measured TDS	**313**	
Calculated TDS	**306.36**	
Ratio: Meas TDS/Calc TDS	1.02	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.84	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.61	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.52	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**86.3**	**1.8**	**18.0**	**2.9**	**0.137**	**80.579**	**6.0**	**0.093**	**0.09**	**203.7**
Concentration (meq/L)	3.7540	0.0460	0.8982	0.2386	0.0049	2.2731	0.1249	0.0015	0.0047	3.3386
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	3.7540	0.0460	0.4491	0.1193	0.0025	2.2731	0.0625	0.0015	0.0047	3.3386
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	188.08	3.38	53.44	12.67	0.26	173.67	9.99	0.11	0.26	148.57
Ionic strength	1.88E-03	2.30E-05	8.98E-04	2.39E-04	4.91E-06	1.14E-03	1.25E-04	7.50E-07	2.37E-06	1.67E-03

Cation sum (meq/L)	4.94	
Anion sum (meq/L)	5.74	
% Difference	-7.50	Should be < 2%
Ion Difference	-0.80	
Ratio: Cation sum*(100)/Measured conductivity	0.83	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.96	Should be between 0.9 and 1.1

Sample Location: OUA036 Sample Date: 960626

Alkalinity (mg/l)	**8**	
SiO2 (mg/l)	**20.3**	
Measured conductivity (umho/cm)	**65**	
Infinite dilution conductivity (umho/cm)	63.68	
Ionic strength (M)	0.0007	
Monovalent ion activity coefficient	0.97	
Calculated conductivity (umho/cm)	**60.00**	
Measured TDS	**63**	
Calculated TDS	**52.11**	
Ratio: Meas TDS/Calc TDS	1.21	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.92	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.87	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.97	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**5.5**	**0.6**	**2.8**	**1.0**	**0.046**	**6.702**	**8.2**	**2.106**	**0.04**	**9.8**
Concentration (meq/L)	0.2393	0.0153	0.1397	0.0823	0.0016	0.1891	0.1707	0.0340	0.0021	0.1606
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55 8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.2393	0.0153	0.0699	0.0411	0.0008	0.1891	0.0854	0.0340	0.0021	0.1606
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	11.99	1.13	8.31	4.37	0.09	14.44	13.66	2.43	0.11	7.15
Ionic strength	1.20E-04	7.67E-06	1.40E-04	8.23E-05	1.65E-06	9.45E-05	1.71E-04	1.70E-05	1.05E-06	8.03E-05

Cation sum (meq/L)	0.48	
Anion sum (meq/L)	0.56	
% Difference	-7.56	Should be < 2%
Ion Difference	-0.08	
Ratio: Cation sum*(100)/Measured conductivity	0.74	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.86	Should be between 0.9 and 1.1

Sample Location: OUA037 Sample Date: 960626

Alkalinity (mg/l)	**14**	
SiO2 (mg/l)	**39.3**	
Measured conductivity (umho/cm)	**60**	
Infinite dilution conductivity (umho/cm)	104.83	
Ionic strength (M)	0.0014	
Monovalent ion activity coefficient	0.96	
Calculated conductivity (umho/cm)	**96.49**	
Measured TDS	**46**	
Calculated TDS	**84.61**	
Ratio: Meas TDS/Calc TDS	0.54	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	1.61	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.88	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.77	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**8.3**	**2.0**	**13.8**	**2.6**	**0.066**	**3.199**	**6.0**	**0.884**	**0.05**	**17.1**
Concentration (meq/L)	0.3611	0.0512	0.6886	0.2140	0.0024	0.0902	0.1249	0.0143	0.0026	0.2803
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.3611	0.0512	0.3443	0.1070	0.0012	0.0902	0.0625	0.0143	0.0026	0.2803
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	18.09	3.76	40.97	11.36	0.13	6.89	9.99	1.02	0.14	12.47
Ionic strength	1.81E-04	2.56E-05	6.89E-04	2.14E-04	2.36E-06	4.51E-05	1.25E-04	7.13E-06	1.32E-06	1.40E-04

Cation sum (meq/L)	1.32	
Anion sum (meq/L)	0.51	
% Difference	43.99	Should be < 2%
Ion Difference	0.80	
Ratio: Cation sum*(100)/Measured conductivity	2.20	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.85	Should be between 0.9 and 1.1

Sample Location: OUA038 Sample Date: 960626

Alkalinity (mg/l)	**103**	
SiO2 (mg/l)	**24.2**	
Measured conductivity (umho/cm)	**239**	
Infinite dilution conductivity (umho/cm)	265.12	
Ionic strength (M)	0.0030	
Monovalent ion activity coefficient	0.94	
Calculated conductivity (umho/cm)	**235.66**	
Measured TDS	**155**	
Calculated TDS	**164.83**	
Ratio: Meas TDS/Calc TDS	0.94	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.99	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.70	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.65	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**46.3**	**2.2**	**8.6**	**1.5**	**0.807**	**4.87**	**14.4**	**0.087**	**0.06**	**125.7**
Concentration (meq/L)	2.0141	0.0563	0.4291	0.1234	0.0289	0.1374	0.2998	0.0014	0.0032	2.0602
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	2.0141	0.0563	0.2146	0.0617	0.0145	0.1374	0.1499	0.0014	0.0032	2.0602
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	100.90	4.14	25.53	6.55	1.56	10.50	23.98	0.10	0.17	91.68
Ionic strength	1.01E-03	2.81E-05	4.29E-04	1.23E-04	2.89E-05	6.87E-05	3.00E-04	7.02E-07	1.58E-06	1.03E-03

Cation sum (meq/L)	2.65	
Anion sum (meq/L)	2.50	
% Difference	2.91	Should be < 2%
Ion Difference	0.15	
Ratio: Cation sum*(100)/Measured conductivity	1.11	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	1.05	Should be between 0.9 and 1.1

Sample Location: OUA039 Sample Date: 960627

Alkalinity (mg/l)	**84**	
SiO2 (mg/l)	**24.3**	
Measured conductivity (umho/cm)	**213**	
Infinite dilution conductivity (umho/cm)	222.42	
Ionic strength (M)	0.0027	
Monovalent ion activity coefficient	0.95	
Calculated conductivity (umho/cm)	**198.83**	
Measured TDS	**126**	
Calculated TDS	**139.85**	
Ratio: Meas TDS/Calc TDS	0.90	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.93	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.70	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.59	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**24.5**	**3.0**	**16.7**	**0.0**	**4.8**	**5.64**	**10.3**	**0.095**	**0.11**	**102.5**
Concentration (meq/L)	1.0658	0.0767	0.8333	0.0005	0.1719	0.1591	0.2144	0.0015	0.0058	1.6800
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	1.0658	0.0767	0.4167	0.0002	0.0860	0.1591	0.1072	0.0015	0.0058	1.6800
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	53.39	5.64	49.58	0.03	9.28	12.16	17.16	0.11	0.31	74.76
Ionic strength	5.33E-04	3.84E-05	8.33E-04	4.94E-07	1.72E-04	7.96E-05	2.14E-04	7.66E-07	2.90E-06	8.40E-04

Cation sum (meq/L)	2.15	
Anion sum (meq/L)	2.06	
% Difference	2.08	Should be < 2%
Ion Difference	0.09	
Ratio: Cation sum*(100)/Measured conductivity	1.01	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.97	Should be between 0.9 and 1.1

Sample Location: OUA040 Sample Date: 960709

Alkalinity (mg/l)	**81**	
SiO2 (mg/l)	**17.4**	
Measured conductivity (umho/cm)	**235**	
Infinite dilution conductivity (umho/cm)	203.32	
Ionic strength (M)	0.0025	
Monovalent ion activity coefficient	0.95	
Calculated conductivity (umho/cm)	**182.53**	
Measured TDS	**133**	
Calculated TDS	**127.23**	
Ratio: Meas TDS/Calc TDS	1.05	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.78	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.70	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.57	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**12.3**	**2.3**	**13.9**	**0.0**	**3.91**	**6.458**	**22.2**	**0.077**	**0.1**	**98.8**
Concentration (meq/L)	0.5351	0.0588	0.6936	0.0005	0.1400	0.1822	0.4622	0.0012	0.0053	1.6193
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.5351	0.0588	0.3468	0.0002	0.0700	0.1822	0.2311	0.0012	0.0053	1.6193
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	26.81	4.32	41.27	0.03	7.56	13.92	36.98	0.09	0.29	72.06
Ionic strength	2.68E-04	2.94E-05	6.94E-04	4.94E-07	1.40E-04	9.11E-05	4.62E-04	6.21E-07	2.63E-06	8.10E-04

Cation sum (meq/L)	1.43	
Anion sum (meq/L)	2.27	
% Difference	-22.77	Should be < 2%
Ion Difference	-0.84	
Ratio: Cation sum*(100)/Measured conductivity	0.61	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.97	Should be between 0.9 and 1.1

Sample Location: OUA041 Sample Date: 960710

Alkalinity (mg/l)	**5**	
SiO2 (mg/l)	**19.6**	
Measured conductivity (umho/cm)	**46**	
Infinite dilution conductivity (umho/cm)	24.10	
Ionic strength (M)	0.0003	
Monovalent ion activity coefficient	0.98	
Calculated conductivity (umho/cm)	**23.22**	
Measured TDS	**45**	
Calculated TDS	**32.47**	
Ratio: Meas TDS/Calc TDS	1.39	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.50	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	1.40	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.98	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**0.0**	**0.7**	**1.0**	**0.0**	**1.13**	**3.181**	**3.2**	**0.516**	**0.1**	**6.1**
Concentration (meq/L)	0.0017	0.0179	0.0499	0.0005	0.0405	0.0897	0.0666	0.0083	0.0053	0.1000
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.0017	0.0179	0.0250	0.0002	0.0202	0.0897	0.0333	0.0083	0.0053	0.1000
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	0.08	1.32	2.97	0.03	2.19	6.86	5.33	0.59	0.29	4.45
Ionic strength	8.26E-07	8.95E-06	4.99E-05	4.94E-07	4.05E-05	4.49E-05	6.66E-05	4.16E-06	2.63E-06	5.00E-05

Cation sum (meq/L)	0.11	
Anion sum (meq/L)	0.27	
% Difference	-41.94	Should be < 2%
Ion Difference	-0.16	
Ratio: Cation sum*(100)/Measured conductivity	0.24	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.59	Should be between 0.9 and 1.1

Sample Location: OUA042 Sample Date: 960626

Alkalinity (mg/l)	**128**	
SiO2 (mg/l)	**23.4**	
Measured conductivity (umho/cm)	**490**	
Infinite dilution conductivity (umho/cm)	588.12	
Ionic strength (M)	0.0065	
Monovalent ion activity coefficient	0.92	
Calculated conductivity (umho/cm)	**497.59**	
Measured TDS	**263**	
Calculated TDS	**306.80**	
Ratio: Meas TDS/Calc TDS	0.86	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	1.02	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.62	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.54	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**88.0**	**3.6**	**30.2**	**5.8**	**0.929**	**58.793**	**19.1**	**0.101**	**0.07**	**156.2**
Concentration (meq/L)	3.8280	0.0921	1.5070	0.4773	0.0333	1.6586	0.3977	0.0016	0.0037	2.5601
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	3.8280	0.0921	0.7535	0.2386	0.0166	1.6586	0.1988	0.0016	0.0037	2.5601
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	191.78	6.77	89.67	25.34	1.80	126.71	31.81	0.12	0.20	113.93
Ionic strength	1.91E-03	4.60E-05	1.51E-03	4.77E-04	3.33E-05	8.29E-04	3.98E-04	8.15E-07	1.84E-06	1.28E-03

Cation sum (meq/L)	5.94	
Anion sum (meq/L)	4.62	
% Difference	12.46	Should be < 2%
Ion Difference	1.32	
Ratio: Cation sum*(100)/Measured conductivity	1.21	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.94	Should be between 0.9 and 1.1

Sample Location: OUA043 Sample Date: 960710

Alkalinity (mg/l)	**25**	
SiO2 (mg/l)	**15.5**	
Measured conductivity (umho/cm)	**74**	
Infinite dilution conductivity (umho/cm)	69.00	
Ionic strength (M)	0.0009	
Monovalent ion activity coefficient	0.97	
Calculated conductivity (umho/cm)	**64.54**	
Measured TDS	**65**	
Calculated TDS	**48.77**	
Ratio: Meas TDS/Calc TDS	1.33	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.87	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.76	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.88	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**0.0**	**0.6**	**9.1**	**1.2**	**0.047**	**4.099**	**1.0**	**2.085**	**0.1**	**30.5**
Concentration (meq/L)	0.0017	0.0153	0.4541	0.0987	0.0017	0.1156	0.0208	0.0336	0.0053	0.4999
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.0017	0.0153	0.2270	0.0494	0.0008	0.1156	0.0104	0.0336	0.0053	0.4999
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	0.08	1.13	27.02	5.24	0.09	8.83	1.67	2.40	0.29	22.25
Ionic strength	8.26E-07	7.67E-06	4.54E-04	9.87E-05	1.68E-06	5.78E-05	2.08E-05	1.68E-05	2.63E-06	2.50E-04

Cation sum (meq/L)	0.57	
Anion sum (meq/L)	0.68	
% Difference	-8.32	Should be < 2%
Ion Difference	-0.10	
Ratio: Cation sum*(100)/Measured conductivity	0.77	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.91	Should be between 0.9 and 1.1

Sample Location: OUA044 Sample Date: 960710

Alkalinity (mg/l)	**168**	
SiO2 (mg/l)	**13**	
Measured conductivity (umho/cm)	**393**	
Infinite dilution conductivity (umho/cm)	249.27	
Ionic strength (M)	0.0030	
Monovalent ion activity coefficient	0.94	
Calculated conductivity (umho/cm)	**221.82**	
Measured TDS	**223**	
Calculated TDS	**124.64**	
Ratio: Meas TDS/Calc TDS	1.79	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.56	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.56	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.57	Should be between 0.55 and 0.7

Constituent:

	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**51.8**	**1.6**	**19.6**	**2.7**	**0.656**	**12.634**	**7.1**	**0.453**	**0.1**	**30.5**
Concentration (meq/L)	2.2533	0.0409	0.9780	0.2222	0.0235	0.3564	0.1478	0.0073	0.0053	0.4999
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	2.2533	0.0409	0.4890	0.1111	0.0117	0.3564	0.0739	0.0073	0.0053	0.4999
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	112.89	3.01	58.19	11.80	1.27	27.23	11.83	0.52	0.29	22.25
Ionic strength	1.13E-03	2.05E-05	9.78E-04	2.22E-04	2.35E-05	1.78E-04	1.48E-04	3.65E-06	2.63E-06	2.50E-04

Cation sum (meq/L)	3.52	
Anion sum (meq/L)	1.02	
% Difference	55.16	Should be < 2%
Ion Difference	2.50	
Ratio: Cation sum*(100)/Measured conductivity	0.90	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.26	Should be between 0.9 and 1.1

Sample Location: OUA045 Sample Date: 960710

Alkalinity (mg/l)	**13**	
SiO2 (mg/l)	**17.2**	
Measured conductivity (umho/cm)	**163**	
Infinite dilution conductivity (umho/cm)	98.72	
Ionic strength (M)	0.0012	
Monovalent ion activity coefficient	0.96	
Calculated conductivity (umho/cm)	**91.53**	
Measured TDS	**132**	
Calculated TDS	**65.26**	
Ratio: Meas TDS/Calc TDS	2.02	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.56	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.71	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.81	Should be between 0.55 and 0.7

Constituent:

	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**0.0**	**5.0**	**8.4**	**3.6**	**0.044**	**8.964**	**1.7**	**12.3**	**0.2**	**15.9**
Concentration (meq/L)	0.0017	0.1279	0.4192	0.2962	0.0016	0.2529	0.0354	0.1984	0.0105	0.2606
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.0017	0.1279	0.2096	0.1481	0.0008	0.2529	0.0177	0.1984	0.0105	0.2606
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	0.08	9.40	24.94	15.73	0.09	19.32	2.83	14.17	0.57	11.60
Ionic strength	8.26E-07	6.40E-05	4.19E-04	2.96E-04	1.58E-06	1.26E-04	3.54E-05	9.92E-05	5.26E-06	1.30E-04

Cation sum (meq/L)	0.85	
Anion sum (meq/L)	0.76	
% Difference	5.53	Should be < 2%
Ion Difference	0.09	
Ratio: Cation sum*(100)/Measured conductivity	0.52	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.46	Should be between 0.9 and 1.1

Sample Location: OUA046 Sample Date: 960710

Alkalinity (mg/l)	**115**	
SiO2 (mg/l)	**8.8**	
Measured conductivity (umho/cm)	**266**	
Infinite dilution conductivity (umho/cm)	238.46	
Ionic strength (M)	0.0033	
Monovalent ion activity coefficient	0.94	
Calculated conductivity (umho/cm)	**210.86**	
Measured TDS	**136**	
Calculated TDS	**128.14**	
Ratio: Meas TDS/Calc TDS	1.06	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.79	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.61	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.51	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**0.0**	**0.9**	**37.9**	**0.3**	**1.71**	**3.054**	**5.9**	**0.448**	**0.1**	**140.3**
Concentration (meq/L)	0.0017	0.0230	1.8912	0.0247	0.0612	0.0862	0.1228	0.0072	0.0053	2.2995
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.0017	0.0230	0.9456	0.0123	0.0306	0.0862	0.0614	0.0072	0.0053	2.2995
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	0.08	1.69	112.53	1.31	3.31	6.58	9.83	0.52	0.29	102.33
Ionic strength	8.26E-07	1.15E-05	1.89E-03	2.47E-05	6.13E-05	4.31E-05	1.23E-04	3.61E-06	2.63E-06	1.15E-03

Cation sum (meq/L)	2.00	
Anion sum (meq/L)	2.52	
% Difference	-11.48	Should be < 2%
Ion Difference	-0.52	
Ratio: Cation sum*(100)/Measured conductivity	0.75	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.95	Should be between 0.9 and 1.1

Sample Location: OUA047 Sample Date: 960711

Alkalinity (mg/l)	**13**	
SiO2 (mg/l)	**14.5**	
Measured conductivity (umho/cm)	**49**	
Infinite dilution conductivity (umho/cm)	39.10	
Ionic strength (M)	0.0005	
Monovalent ion activity coefficient	0.98	
Calculated conductivity (umho/cm)	**37.28**	
Measured TDS	**41**	
Calculated TDS	**35.55**	
Ratio: Meas TDS/Calc TDS	1.15	Should be between 0.9 and 1.1
Ratio: Calc cond/Meas cond	0.76	Should be between 0.9 and 1.1
Ratio: Calc TDS/Calc cond	0.95	Should be between 0.55 and 0.7
Ratio: Meas TDS/Meas cond	0.84	Should be between 0.55 and 0.7

Constituent:	Na	K	Ca	Mg	Fe	Cl	SO4	NO3	F	HCO3
Concentration (mg/L)	**0.0**	**0.7**	**2.1**	**0.0**	**1.34**	**4.289**	**4.6**	**0.077**	**0.1**	**15.86**
Concentration (meq/L)	0.0017	0.0179	0.1048	0.0005	0.0480	0.1210	0.0958	0.0012	0.0053	0.2599
Molecular weight (mg/mM)	22.9898	39.0983	40.0780	24.3050	55.8470	35.4527	96.0636	62.0049	18.9984	61.0171
Concentration (mM)	0.0017	0.0179	0.0524	0.0002	0.0240	0.1210	0.0479	0.0012	0.0053	0.2599
Charge z (absolute value)	1	1	2	2	2	1	2	1	1	1
Equivalent conductivity (mho-cm^2/equivalent)	50.1	73.5	59.5	53.1	54	76.4	80	71.4	54.4	44.5
Infinite dilution conductivity (umho/cm)	0.08	1.32	6.24	0.03	2.59	9.24	7.66	0.09	0.29	11.57
Ionic strength	8.26E-07	8.95E-06	1.05E-04	4.94E-07	4.80E-05	6.05E-05	9.58E-05	6.21E-07	2.63E-06	1.30E-04

Cation sum (meq/L)	0.17	
Anion sum (meq/L)	0.48	
% Difference	-47.31	Should be < 2%
Ion Difference	-0.31	
Ratio: Cation sum*(100)/Measured conductivity	0.35	Should be between 0.9 and 1.1
Ratio: Anion sum*(100)/Measured conductivity	0.99	Should be between 0.9 and 1.1