Susong, D.D., 1997, Chemical quality of water in consolidated rock and the basin-fill aquifer, west side of the Oquirrh Mountains, Tooele County, Utah

INTRODUCTION

Consolidated rock and the basin-fill aquifer along the west side of the Oquirrh Mountains in eastern Tooele Valley, Utah, provide ground water for municipal, agricultural, industrial, and rural residential use. Water in some areas in the basin-fill aquifer does not meet State of Utah water-quality standards (Steiger and Lowe, 1997). The two constituents of concern are nitrate and dissolved solids. The areas where nitrate concentrations exceeded State standards are on the east side of Tooele Valley in the Lincoln-Erda area adjacent to the mountain front, and the areas of elevated dissolved-solids concentrations are at the north end of the valley near Great Salt Lake.

The basin-fill aquifer is recharged in part by subsurface inflow of water from consolidated rock in the Oquirrh Mountains (Stolp, 1994; Steiger and Lowe, 1997). Some consolidated rock in the Oquirrh Mountains is a highly mineralized ore. If water associated with these deposits is discharged to the basin-fill aquifer, it could be a natural source of contamination to water in the basin-fill aquifer. There is a long history of mining activity in the Oquirrh Mountains, which includes construction of tunnels connecting Salt Lake and Tooele Valleys, mine dewatering operations, smelting and processing operations, and mine tailings disposal. These activities also may have affected the quality of water in the basin-fill aquifer.

The purpose of this study was to document the water quality in the consolidated rock and adjacent basin-fill aquifer on the east side of Tooele Valley between Great Salt Lake and Settlement Canyon and assess if water moving from the consolidated rock in the Oquirrh Mountains to the basin-fill aquifer is contributing to water-quality problems in the basin-fill aquifer. The location of this area is shown in figure 1. The U.S. Geological Survey in cooperation with Tooele City and Tooele County, Utah, conducted the study during 1996-97.

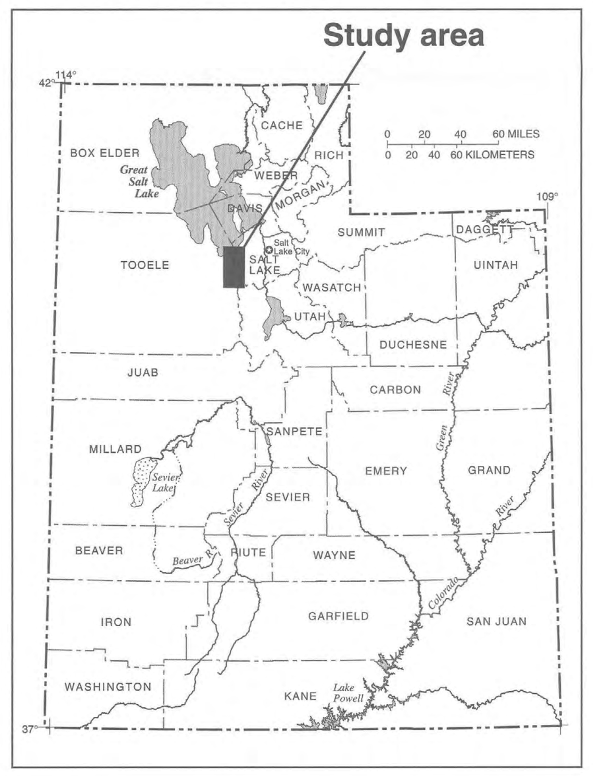

Figure 1. Location of study area, Tooele County, Utah.

Purpose and Scope

This report documents the water quality in the consolidated rock and in the basin-fill aquifer between Lake Point and Settlement Canyon along the east side of Tooele Valley in northern Utah, and assesses whether ground water moving from consolidated rock to the basin-fill aquifer is contributing to the water-quality problems observed in the basin-fill aquifer. Water-quality data from wells completed in or near, or springs and streams discharging from, consolidated rock are presented on a map and in a table.

Acknowledgments

The cooperation and assistance of Tooele City in providing water-quality data is greatly appreciated. Recognition and thanks are extended to landowners for granting access to their wells for sample collection.

WATER QUALITY IN THE CONSOLIDATED ROCK AND ADJACENT BASIN-FILL AQUIFER

Water-quality data for water from wells, springs, surface water, and tunnels yielding water from the consolidated rock and the basin-fill aquifer near the front of the Oquirrh Mountains were compiled from U.S. Geological Survey and Utah Department of Environmental Quality data bases. Tooele City Water Department data were compiled from a U.S. Geological Survey report by Stolp (1994) and from Steiger and Lowe (1997). Six additional samples were collected from wells and springs in the consolidated rock in areas where data were not available and were analyzed for common ions, nutrients, and metals.

Previous studies have determined that the nitrate plus nitrite concentration in water from eight wells in the upper part (less than 200 ft below land surface) of the basin-fill aquifer to the east of Erda exceeded the State standard for total nitrate plus nitrite of 10 mg/L (Steiger and Lowe, 1997). The source of elevated nitrate plus nitrite concentrations could be natural, private septic systems, mining activities or other unknown sources (Steiger and Lowe, 1997). Nitrate plus nitrite concentrations of 3 to 8 mg/L were common in the area. Generally, a nitrate concentration of greater than 3 mg/L in ground water is considered to be greater than natural background conditions (Madison and Brunett, 1984).

Nitrate plus nitrite concentrations in water from consolidated rock, predominantly Pennsylvanian and Permian limestones, sandstones, and quartzites, in the study area ranged from less than 0.05 to 2.9 mg/L (fig. 2 and table 1), values that are in the range of natural background concentrations. If the consolidated rock were the source of nitrate, then higher concentrations would be expected. Water from consolidated rock also did not exceed State standards for metals. Again, if ore bodies in consolidated rocks were sources of contamination for the basin-fill aquifer, high concentrations of metals would be expected in water in the consolidated rock. Water from the consolidated rock in the Oquirrh Mountains therefore is probably not a source of the high nitrate plus nitrite concentration measured in the basin-fill aquifer. However, other sources of nitrate plus nitrite such as septic systems, and mining activities such as processing and smelting in the Pine Canyon area, cannot be ruled out as sources of nitrate plus nitrite in ground water in the Erda area.

The dissolved-solids concentration, measured as the sum of constituents or as solids residue, of water from the consolidated rock and basin-fill deposits adjacent to the consolidated rock was generally less than 1,000 mg/L and in many samples was less than 500 mg/L (fig. 2 and table 1). The State of Utah secondary drinking-water standard for dissolved-solids concentration is 500 mg/L. The dissolved-solids concentrations measured in water from the consolidated rock are equal to or less than dissolved-solids concentrations measured in water from the basin-fill aquifer. This indicates that the consolidated rock is probably not contributing water with a high dissolved-solids concentration. The exception to this is water from wells at the north end of the Oquirrh Mountains, near Great Salt Lake, where the dissolved-solids concentration of water in one well in the Lake Point area was 2,050 mg/L (fig. 2 and table 1). Water quality in these wells is probably affected by proximity to Great Salt Lake. Water from wells completed in the basin-fill aquifer near Great Salt Lake have had a measured dissolved-solids concentration as high as 17,000 mg/L (Steiger and Lowe, 1997).

Nitrate plus nitrite and dissolved-solids concentrations are shown next to the location of the data site in figure 2. The results of chemical analyses for water from each site are listed in table 1. State of Utah water-quality standards are listed in table 2.

REFERENCES

Madison, R.J., and Brunett, J.O., 1984, Overview of the occurrence of nitrate in ground water of the United States in hydrologic events, selected water-quality trends, and ground-water resources: U.S. Geological Survey Water-Supply Paper 2275, 467 p.

Steiger, J.I., and Lowe, Mike, 1997, Recharge and discharge areas and quality of ground water in Tooele Valley, Tooele County, Utah: U.S. Geological Survey Water-Resources Investigations Report 97-4005, 2 sheets.

Stolp, B.J., 1994, Hydrology and potential for ground-water development in southeastern Tooele Valley and adjacent areas in the Oquirrh Mountains, Tooele County, Utah: Utah Department of Natural Resources Technical Publication No. 107, 67 p.

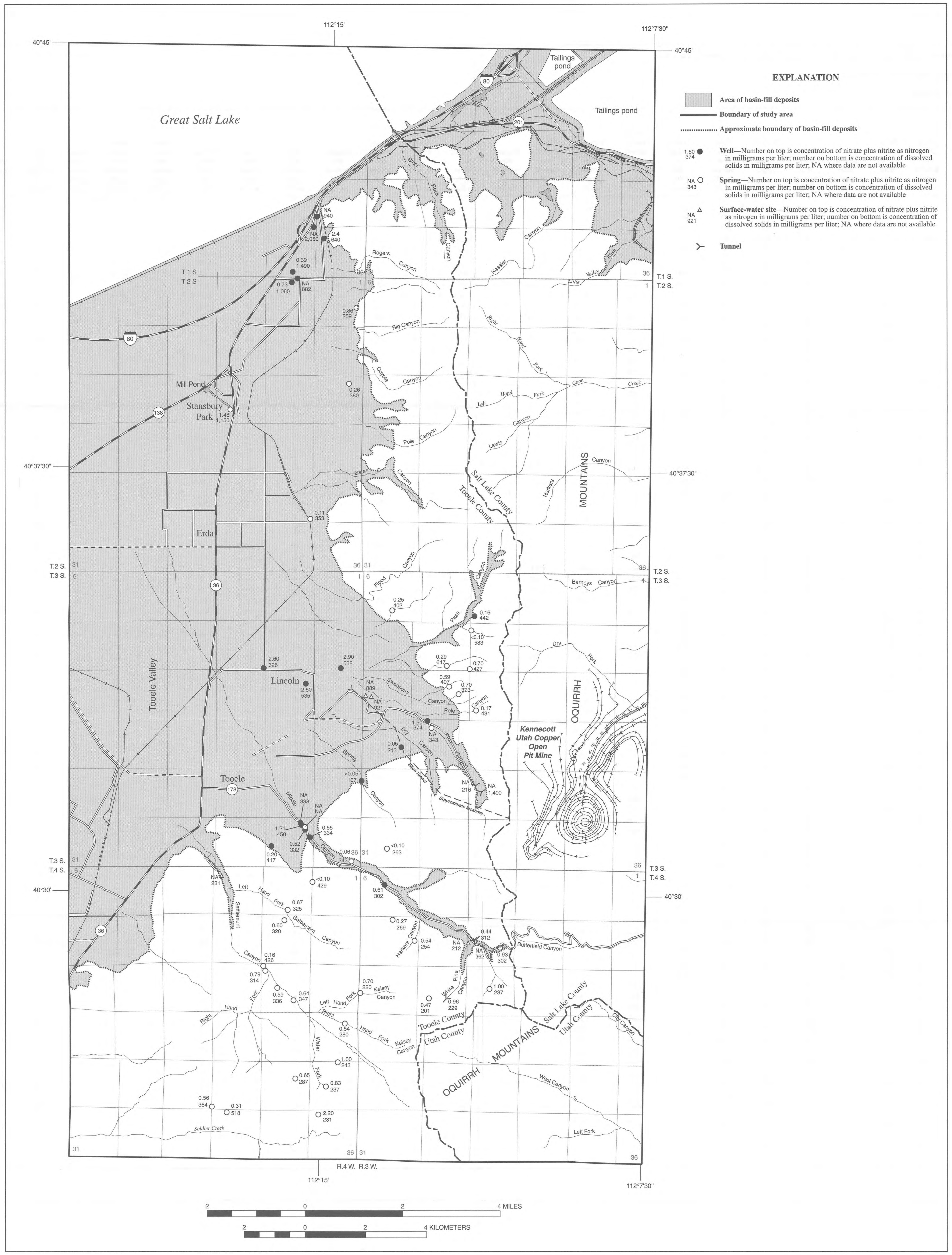

Figure 2. Location of sampling sites, and nitrate plus nitrite as nitrogen and dissolved-solids concentration for water from selected sites in the study area, eastern Tooele County, Utah.

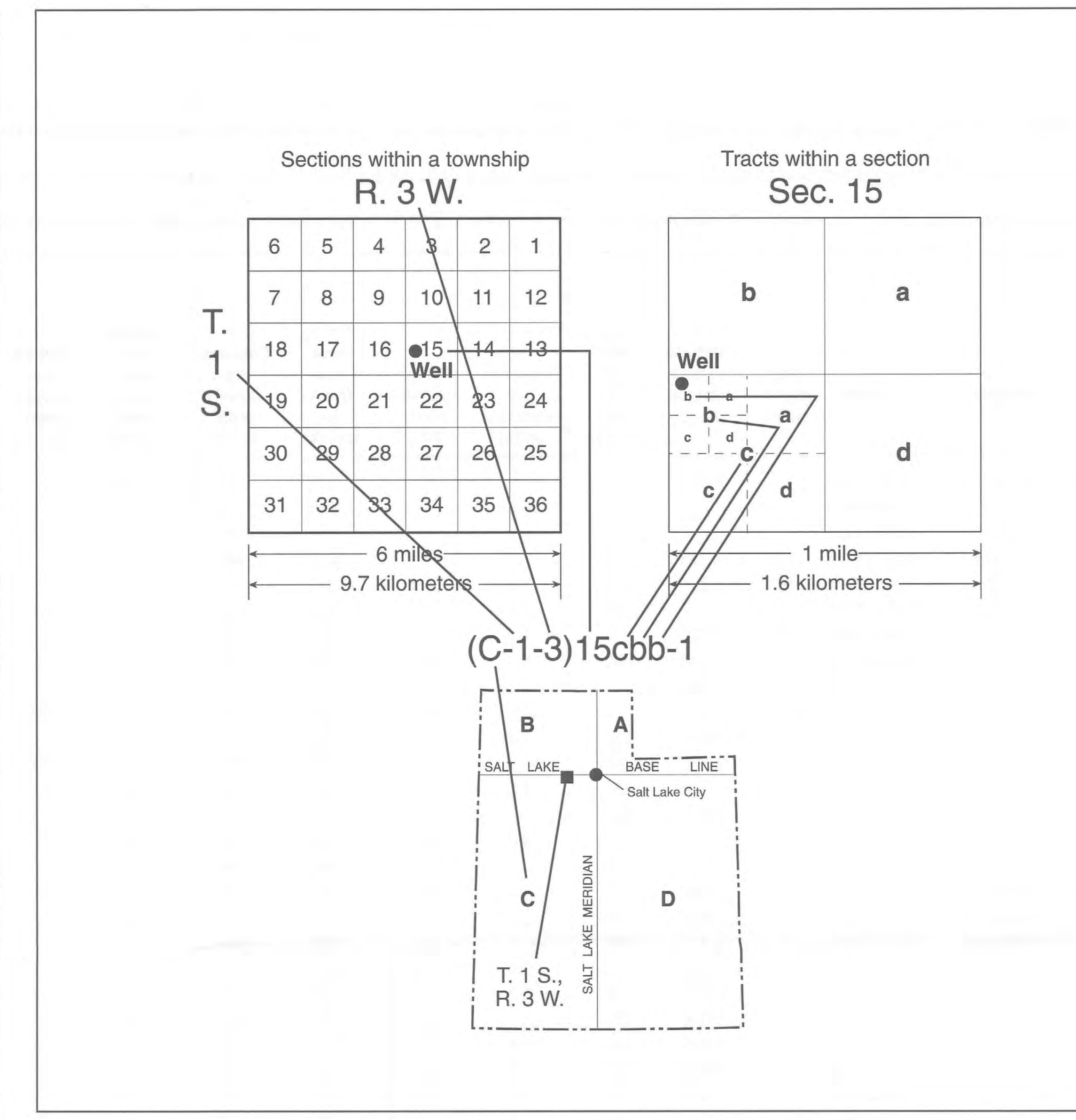

Figure 3. Numbering system used in this report for hydrologic-data sites.

Numbering System for Hydrologic-Data Sites in Utah

The system of numbering wells, springs, and other hydrologic-data sites in Utah is based on the cadastral land-survey system of the U.S. Government. The number, in addition to designating the site, describes its position in the land net. The land-survey system divides the State of Utah into four quadrants by the Salt Lake Base Line and the Salt Lake Meridian. These quadrants are designated by the uppercase letters A, B, C, and D, that indicate, respectively, the northeast, northwest, southwest, and southeast quadrants. Numbers that designate the township and range (in that order) follow the quadrant letter, and all three are enclosed in parentheses. The number after the parentheses indicates the section and is followed by three lowercase letters that indicate the quarter section, the quarter-quarter section and the quarter-quarter-quarter section-generally 10 acres for regular sections.[1] The lowercase letters a, b, c, and d indicate, respectively, the northeast, northwest, southwest, and southeast quarters of each subdivision. The number after the letters is the serial number of the site within the 10-acre plot. The uppercase letter "S" preceding the serial number denotes a spring. Thus, (C-1-3)15cbb-1 designates the first well constructed or visited in the NE 1/4 NE 1/4 SW 1/4 Sec. 26, T.2 S., R.4 W (fig. 3). The uppercase letter C indicates that the township is south of the Salt Lake Base Line and the range is west of the Salt Lake Meridian.

[1]Although the basic land unit, the section, is theoretically 1 square mile, many sections are irregular. Such sections are subdivided into 10-acre tracts, generally beginning at the southeast corner, and the surplus or shortage is taken up in the tracts along the north and west sides of the section.

Conversion Factors, Vertical Datum, and Abbreviated Water-Quality Units

Multiply	By	To obtain
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer

Water temperature is reported in degrees Celsius (°C), which can be converted to degrees Fahrenheit (°F) by using the following equation:

$$^{\circ}F = 9/5(^{\circ}C) + 32.$$

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Chemical concentration and water temperature are reported only in metric units. Chemical concentration is reported in milligrams per liter (mg/L) or micrograms per liter (µg/L). Milligrams per liter is a unit expressing the solute mass per unit volume (liter) of water. One thousand micrograms per liter is equivalent to 1 milligram per liter. For concentrations less than 7,000 milligrams per liter, the numerical value is about the same as for concentrations in parts per million. Specific conductance is reported in microsiemens per centimeter at 25 degrees Celsius (µS/cm).

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