U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
TOOELE COUNTY;
UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY,
DIVISION OF WATER QUALITY; AND
UTAH DEPARTMENT OF NATURAL RESOURCES,
DIVISION OF WATER RIGHTS AND UTAH GEOLOGICAL SURVEY

WATER-RESOURCES INVESTIGATIONS REPORT 97–4005
Recharge and discharge areas—SHEET 1 of 4
Steiger, J.I., and Lowe, M., 1997, Reckarge and discharge areas and quality of ground water in Tooele Valley, Tooele County, Utah

INTRODUCTION

Tooele Valley is experiencing rapid population growth in its rural areas (fig. 1). Much of the population growth is in areas where municipal sewage-treatment facilities are not available and private septic tanks are used. A potential problem associated with sewage disposal in a large number of private septic tanks is increased nitrate plus nitrite concentrations in ground water. Ground water is the sole source of drinking water in much of Tooele Valley and protection of this valuable resource is important to valley residents and water-resources managers.

Figure 1. Location of Tooele Valley, Utah.

Water quality is variable throughout Tooele Valley. Ground water from springs and wells along the mountain fronts and at the mouths of Settlement and Middle Canyons has the lowest concentration of dissolved solids, less than 500 mg/L. Ground water at the north end of the basin near Great Salt Lake is brackish and has the highest concentration of dissolved solids, greater than 10,000 mg/L. A plume of trichloroethylene with concentrations in excess of the Utah water-quality standard of 5 µg/L (table 1) (Utah Department of Environmental Quality, Division of Water Quality, 1995) has been identified by the U.S. Army at Tooele Army Depot. The plume is being monitored and remediated by the U.S. Army. Also, water samples from several new domestic wells in the east Erda area had concentrations of nitrate plus nitrite that exceeded Utah water-quality standards. Tooele County Commissioners would like to determine possible sources of the nitrate plus nitrite and determine what problems are posed for public supply wells and future well development in the east Erda area.

To protect ground-water resources in the county, Tooele County Commissioners would like to classify their ground-water system according to the Ground Water Quality Protection Administrative Rule, R317-6 of the Utah Administrative Code (table 1, part A) (Utah Department of Environmental Quality, Division of Water Quality, 1995). The code states that when sufficient information is available, entire aquifers or parts of aquifers may be classified by the Utah Water Quality Board according to the quality of ground water contained within. After classification, ground-water protection levels are established and used to regulate existing and potential sources of contamination to ground water from new and existing facilities within the classified area. This study is a cooperative investigation between the U.S. Geological Survey; Tooele County; Utah Department of Environmental Quality, Division of Water Quality; and Utah Department of Natural Resources, Division of Water Rights and Utah Geological Survey.

Purpose and Scope

The purpose of this report is to provide Tooele County commissioners, officials, and planners with some of the hydrologic data required for petitioning the Utah Water Quality Board to classify the aquifer system and for establishing a protection plan for Tooele Valley. In the report, (1) the extent of the primary and secondary recharge areas and the discharge area in Tooele Valley are defined; (2) dissolved-solids concentrations in water from wells penetrating deposits of less than or equal to 150 feet of saturated thickness and from wells penetrating deposits of greater than 150 feet of saturated thickness are delineated; (3) tables showing water quality in selected wells and springs in Tooele Valley are compiled; and (4) some additional hydrologic information related to the occurrence and movement of ground water with high nitrate plus nitrite concentrations in the east Erda area is presented.

Acknowledgments

The water-sample analyses done by the Utah State Health Laboratory were greatly appreciated. Special thanks to William Duncan, who collected the water samples, and Kenneth H. Bousfield of the Utah Department of Environmental Quality, who obtained water-quality data from the State's computer data base. Recognition and thanks also are extended to all the well and property owners who allowed access to their wells and springs for sampling.

Numbering System for Hydrologic-Data Sites

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, which 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 well or spring within the 10-acre plot. The letter "S" preceding the serial number denotes a spring. Thus, (C-2-4)26caa-1 designates the first well constructed or visited in the NE 1/4 of the NE 1/4, of the SW 1/4, Sec. 26, T.2 S., R.4 W. (fig. 2). The capital letter C indicates that the township is south of the Salt Lake Base Line and the range is west of the Salt Lake Meridian.

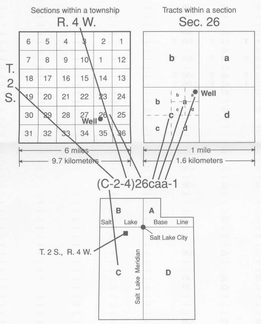

Figure 2. Numbering system for hydrologic-data sites.

[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.

HYDROLOGIC SYSTEM

Tooele Valley is in the northeastern part of Tooele County, about 30 mi southwest of Salt Lake City (fig. 1). Tooele Valley covers about 250 mi^2 and is a structural basin in the Basin and Range Physiographic Province (Fenneman, 1931). The principal water-yielding aquifer is an unconsolidated basin-fill aquifer. Sediments that make up the basin-fill aquifer are of Tertiary to Quaternary age and consist of multiple discontinuous layers of silt, sand, and gravel separated by less-permeable layers of clay and silt. The basin fill is a result of a complex sedimentation pattern of lake-bottom, lakeshore, stream, and alluvial-fan deposits. The basin-fill deposits reach a possible maximum thickness of 7,100 ft in the northern part of the basin and thin toward the basin margins (Razem and Steiger, 1981). The Oquirrh Mountains and South Mountain (fig. 3), east and south of the basin, are composed mainly of the Oquirrh Formation, which is predominantly made up of alternating quartzite and limestone beds. Numerous formations crop out in the Stansbury Mountains, west of the basin; the thickest are the Oquirrh Formation and the Tintic Quartzite (Razem and Steiger, 1981).

Generally, the deposits near the edges of the basin along the mountain fronts are coarser, consisting of gravels and sand with some silt and clay. Deposits are generally finer grained away from the mountains toward the middle of the basin and to the north. An example of this transition is shown in the diagrammatic section, A - A', created from drillers' logs of wells along Clayton Road in east Erda (fig. 4) (see fig. 5 for location of diagrammatic section). The deposits penetrated by (C-2-4)26caa-1, one of the wells closest to the mountains and in the primary recharge area, include a layer of gravel about 85 ft thick with streaks of clay. To the west along the section, in the secondary recharge area, clays and sands occur near the land surface and throughout the drillers' logs. Well (C- 2-4)26bcc-1 penetrates layers of clay and silt up to 56 ft thick with thinner layers of gravel 2 to 23 ft thick.

Ground water in Tooele Valley flows from the recharge areas along the east, south, and west edges of the basin toward the center of the basin and northward toward the discharge area and Great Salt Lake (Razem and Steiger, 1981). The direction of flow is generally parallel to the slope of the land surface. Stolp (1994) mapped ground-water flow in southeastern Tooele Valley and suggested that it was generally toward the northwest, away from the Oquirrh Mountains and toward the central and northern parts of the basin.

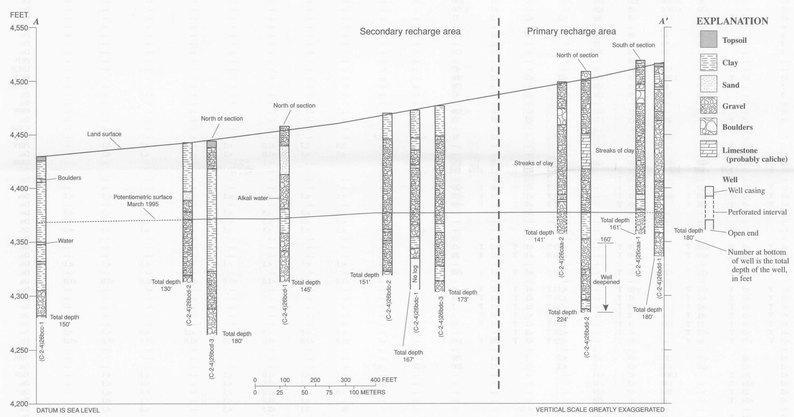

Figure 4. Diagrammatic section from drillers' logs along Clayton Road, east Erda area, Utah. (Location of diagrammatic section shown in fig. 5.)

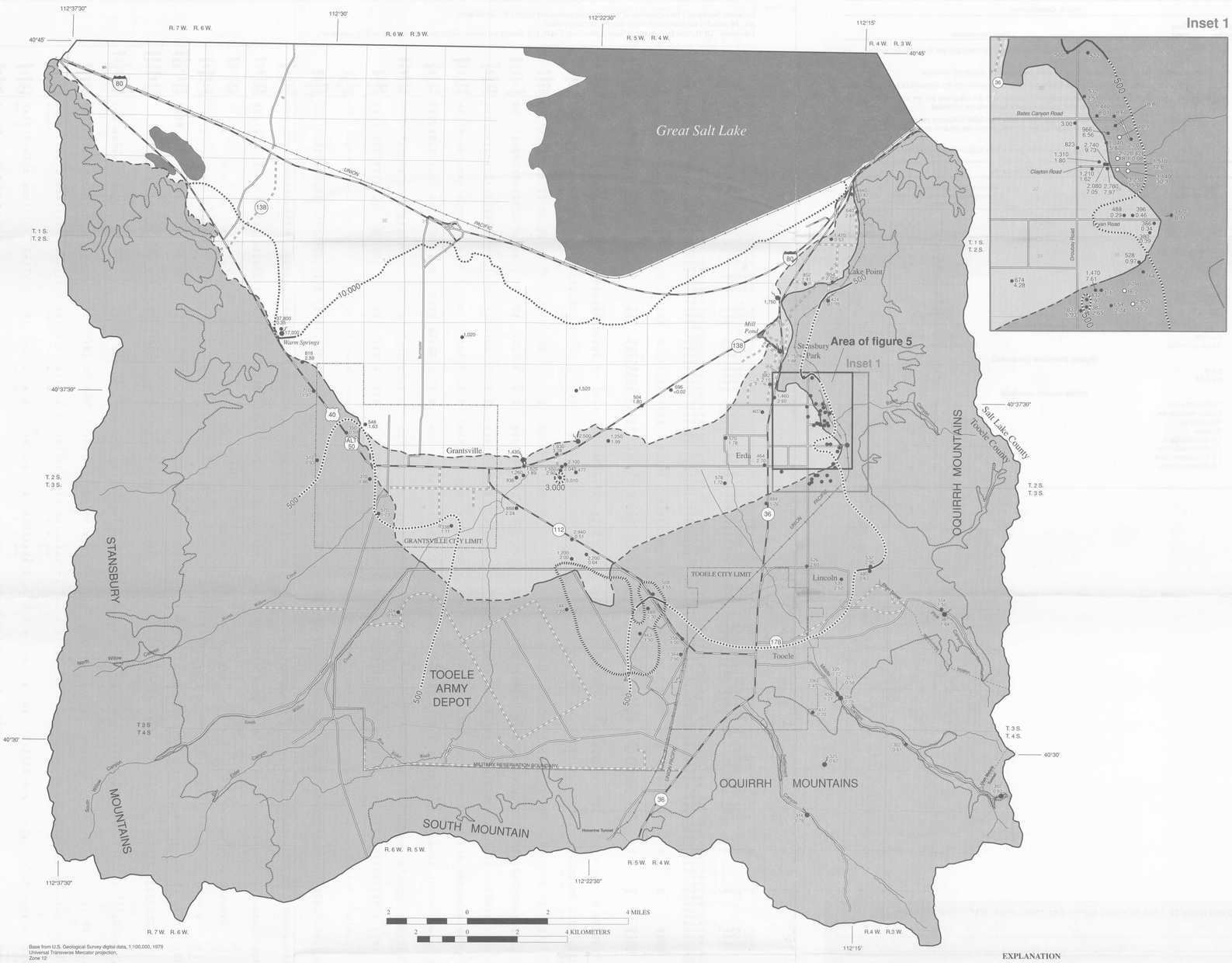

Figure 3. Recharge and discharge areas, spring and well locations, and dissolved-solids and nitrate plus nitrite concentrations in selected springs and wells penetrating deposits of saturated thickness less than or equal to 150 feet, Tooele Valley, Utah.

EXPLANATION

Primary recharge area—Confining layer not present; downward movement of water from surface sources not impeded

Secondary recharge area—Confining layer present; downward movement of water from surface sources to deeper ground water impeded. A shallow unconfined aquifer above confining layer could be present

Discharge area—Ground water discharges to surface through springs, seeps, or mudflat; or phreatophyte growth is well established

Boundary of study area

Boundary between primary and secondary recharge area and boundary between secondary recharge and discharge area—Dashed where approximate

Approximate boundary of basin-fill deposits

10,000 **Line of equal concentration of dissolved solids in water**—Dashed where approximate. Interval, in milligrams per liter, is variable. (10,000 milligrams per liter contour modified from Razem and Steiger, 1981, fig. 6)

Approximate extent of trichloroethylene concentration that equaled or exceeded Utah ground-water quality standard based on sampling of wells with saturated thickness less than or equal to 150 feet (modified from James M. Montgomery, Consulting Engineers Inc.,1989, and Metcalf and Eddy, 1995)

417 / 0.20 **Well**—Number on top is concentration of dissolved solids, in milligrams per liter; number on bottom is concentration of nitrate plus nitrite, in milligrams per liter. Blank where data not available

Well where concentration of nitrate plus nitrite is greater than 10 milligrams per liter

302 / 0.93 **Spring**—Number on top is concentration of dissolved solids, in milligrams per liter; number on bottom is concentration of nitrate plus nitrite, in milligrams per liter. Blank where data not available

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1997

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