GROUNDWATER AND SURFACE-WATER INTERACTION IN ROCK CREEK VALLEY BETWEEN RED LODGE AND ROCKVALE, CARBON COUNTY, MONTANA

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Front photo: Rock Creek at Joliet. Photo by Shawn Kuzara.

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ABSTRACT

Homes located in the Rock Creek Valley between Red Lodge and Rockvale, Montana depend upon groundwater for potable water supplies. Homes obtain water from public water supply wells or, at locations outside of municipal service areas, from domestic wells. Most of the public and domestic wells are in the alluvial valley, where irrigation operations dominate the hydrologic cycle. Unlined irrigation ditches convey water from Rock Creek to flood-irrigated fields. Ditch water also supplies several center pivot and sprinkler systems in the valley. Land-use changes from irrigated agriculture to residential development affect the hydrologic system; there are potential reductions in irrigation recharge to groundwater related to irrigation conversions from flood to sprinklers and center pivots. A reduction in recharge may reduce groundwater levels and subsequent groundwater discharge to Rock Creek.

The principal aquifers in the study area are the West Bench Alluvial, East Bench Alluvial, Valley Alluvial, Eagle, and Eagle/Telegraph Creek aquifers. The Valley Alluvial aquifer consists of thin sand and gravel deposits. Sandstone and shale bedrock of Tertiary and Cretaceous age underlie the sand and gravel, and form most of the valley margins. The West Bench Alluvial aquifer consists of sand and gravel alluvial deposits that form a continuous surface about 12 miles long from south of Red Lodge to north of Roberts. The East Bench Alluvial aquifer consists of sand and gravel deposits that are deeply incised in its northern half by several streams, creating a discontinuous aquifer. Minor aquifers in the study area include the Tongue River, Tullock, Lance/Hell Creek, and Judith River. The quality and quantity of water in the aquifers depend on location and geologic formation.

Water chemistry and stable isotopes from groundwater show the three alluvial aquifers are chemically similar to water in Rock Creek. This suggests that the West and East Bench Alluvial and the Valley Alluvial aquifers are recharged by flood irrigation and ditch leakage (because irrigation water comes from Rock Creek). Stable isotope analyses from groundwater in bedrock wells in Joliet show an isotopic similarity to the water in alluvial wells and Rock Creek. This suggests that irrigation water that originated from Rock Creek also recharges the Eagle and Eagle/Telegraph Creek aquifer in the Joliet area. This isotopic similarity is not found in Eagle aquifer samples collected in areas without irrigation influence.

Water levels in wells completed in the alluvial, Eagle, and Eagle/Telegraph Creek aquifers within the valley respond rapidly to changes in ditch stage; this indicates a close connection between ditch water and groundwater. Water levels in bedrock aquifers that are located topographically above or outside the valley are not influenced by irrigation and respond to precipitation events.

Synoptic flow measurements show that Rock Creek has an overall gain from Red Lodge to Rockvale. Irrigation return flow through the alluvium is an important source of this gain. Changes in irrigation practices that reduce shallow groundwater storage could reduce the discharge of Rock Creek, especially in periods of low flow.

INTRODUCTION

Project Purpose

To support understanding of changes in irrigation and groundwater future development in the Rock Creek Valley, the Montana Department of Natural Resources, the Carbon Conservation District, and the Montana Bureau of Mines and Geology (MBMG) collected data to characterize the hydrogeologic system (fig. 1). As subdivisions build beyond municipal service areas, they will require domestic wells. Also, irrigation techniques are changing from flood type to water-efficient center pivots. The center pivots apply less water to fields than flood irrigation, possibly reducing irrigation recharge to the aquifer. The purpose of this project was to characterize the major aquifers, determine sources of recharge, and understand the relationship between groundwater and surface water. This information will be useful for planners and residents to manage their water resources.

Funding Source

Funding for this project was provided by a Renewable Resources Grant to the Carbon Conservation District administered by the Montana Department of Natural Resources and Conservation. Technical assistance was provided by the Montana Bureau of Mines and Geology, a department of Montana Technological University. The project duration was Jan 1, 2014 to Dec 31, 2016.

Overview of the Project Area

Physiography

Rock Creek drains an area of approximately 105 mi^2 as it flows from its headwaters in the Beartooth Mountains to Rockvale, where it joins the Clarks Fork of the Yellowstone River. Rock Creek transitions from narrow, deep, glaciated canyons in the mountains to wide valleys with floodplains and terraces downstream.

Area Aquifers

The Quaternary alluvium (sand, gravel, and cobble) aquifers in the study area include the Valley Alluvial, West Bench Alluvial, and East Bench Alluvial aquifers. The Tertiary and Cretaceous sandstone (bedrock) aquifers include Tongue River, Tullock, Lance/Hell Creek, Judith River, Eagle, and Eagle/Telegraph Creek (see Hydrogeology section below).

Geology Overview

The geology of the project area is shown in figure 2. The area's structure is dominated by the Beartooth Uplift and the Nye–Bowler lineament. The Cretaceous units present include the Niobrara through Belle Fourche, Telegraph Creek, Eagle, Claggett, Judith River, Bearpaw, and Lance/Hell Creek Formations.

The Niobrara through the Belle Fourche Formations are primarily dark gray shales up to 1,000 ft thick. The Telegraph Creek Formation (150 ft thick) is shale and sandy shale near its base, but contains more sandstone as it grades upward into the Eagle Formation. The Eagle Formation is a light brownish gray, ledge-forming sandstone that crops out to the north and south of Joliet (150 ft thick). Coalbeds occur in the Eagle Sandstone and have been mined at depth. The 100- to 300-ft-thick Claggett Formation shale separates the Eagle Sandstone and Judith River Formations. The Judith River Formation, a brownish gray sandy shale with massive cliff-forming sandstones, ranges in thickness from 700 to 1,000 ft.

The Bearpaw Formation is dark gray shale with a thickness of 100 to 300 ft. The Lance Formation consists mainly of light brownish gray, fine-grained, ledge-forming, thick-bedded sandstone. The unit is interbedded with medium-gray shale. A change in facies occurs near Joliet where the sandstone beds become thinner and are mapped as the Hell Creek Formation on the north side of Red Lodge Creek. The total thickness of the Lance Formation is about 350 ft (Lopez, 2000, 2001, 2005). The Lance/Hell Creek are considered the same unit for this report.

The Tertiary Fort Union Formation is subdivided into the Tullock, Lebo, and Tongue River Members. The Tullock Member sandstones are interbedded with claystone, siltstone, and minor carbonaceous shale, and are 400 to 1,500 ft thick in the Bear Creek area southwest of Red Lodge. Both the Tongue River and Tullock Members contain fine- to medium-grained, ledge-forming sandstones that are gray to yellow in color. The Lebo member (200–500 ft thick) consists mostly of gray to olive green shale, with some thin interbeds of sandstone and siltstone. The Tongue River Member sandstones are interbedded with carbona-

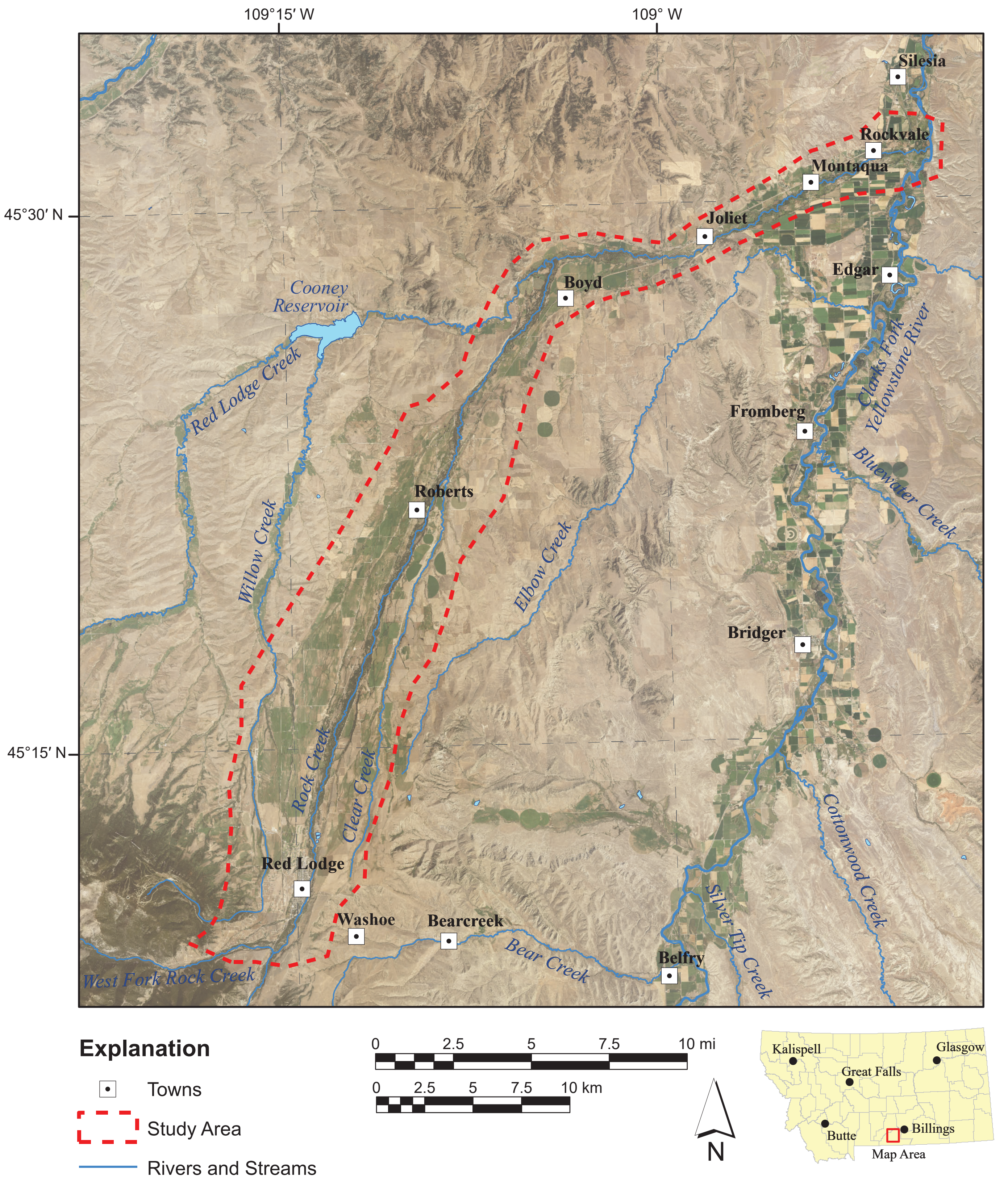


Figure 1. The dashed red line outlines the study area.

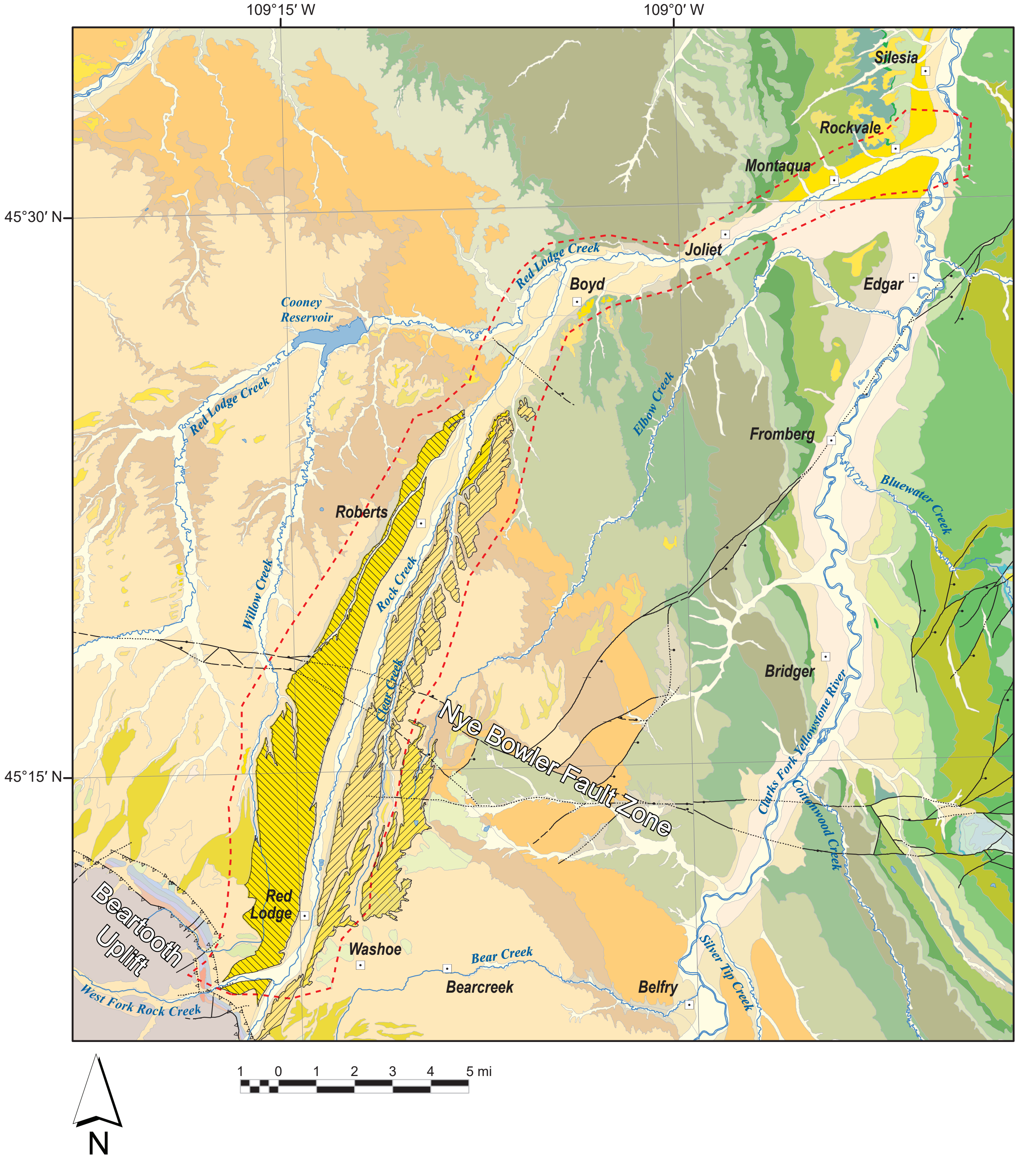


Figure 2 (including facing page). Geology of the study area (modified from Lopez, 2000, 2001, 2005).

Explanation

- **West Bench Alluvium**
- **East Bench Alluvium**
- **Towns**
- **Study Area**
- **Rivers and Streams**

Geology

Fault: unknown sense of movement; dotted where concealed

Normal fault: dotted where concealed; bar and ball on downthrown side

Reverse fault: open teeth on upthrown block

Reverse or thrust fault: teeth on upthrown block; dashed where approximately located; dotted where concealed

Quaternary

- Qal (Alluvium of modern channels)
- Qpg (Pediment gravel deposit)
- Qc (Colluvium)
- Qaf (Alluvial fan deposits)
- Qls (Landslide deposits)
- Qg (Glacial deposits, undivided)
- Qat (Alluvium of alluvial terrace)
- Qat1 (Alluvium of youngest alluvial terrace)
- Qat2 (Alluvium of second youngest alluvial terrace)
- Qat3 (Alluvium of third youngest alluvial terrace)
- Qat4 (Alluvium of fourth youngest alluvial terrace)
- Qat5 (Alluvium of fifth youngest alluvial terrace)

Tertiary

- Tflc (Linley Conglomerate of Fort Union Fm.
- Tftr (Tongue River Member of Fort Union Fm.)
- Tfle (Lebo Member of Fort Union Fm.)
- Tft (Tullock Member of Fort Union Fm.)
- TKi (Intermediate and felsic intrusive rocks)

Cretaceous

- Khc (Hell Creek Fm.)
- Kl (Lance Fm.)
- Kb (Bearpaw Shale)
- Kjr (Judith River Fm.)
- Kcl (Claggett Shale)
- Ke (Eagle Sandstone)
- Ktc (Telegraph Creek Fm.)
- Kn (Niobrara Shale)
- Kca (Carlile Shale)
- Kgr (Greenhorn Fm.)
- Kbf (Belle Fourche Shale)
- Kf (Frontier Fm.)
- Km (Mowry Shale)
- Ktf (Thermopolis, Fall River Fm.)
- Kk (Kootenai Formaion)

Jurassic

- JȾs (Sedimentary rocks, undivided)
- Jm (Morrison Fm.)
- Jsw (Swift Fm.)
- Jr (Rierdon Fm.)
- Jp (Piper Fm.)

Precambrian

- Ꞓs (Sedimentary rocks, undivided)
- Ⱦc (Chugwater Fm.)
- PMpa (Phosphoria, Quadrant, Amsden)
- Mm (Madison Group)
- DOs (Sedimentary Rocks)
- Agn (Gneissic Rocks)

ceous shale and siltstone and minor coalbeds. The thickness of this member is variable but is as much as 2,800 ft (Lopez, 2001, 2005).

Several Quaternary alluvial terrace deposits are present in the project area. The oldest terrace deposits rise 400 to 600 feet above the current creek level. They occur as erosional remnants on Tertiary and Cretaceous bedrock and contain mainly igneous and metamorphic clasts that range in size from cobbles to gravel and sand. The lower alluvial terraces occupy the inner valley of Rock Creek 90 to 300 ft above the current stream channel. These alluvial deposits range from about 10 to 40 ft thick and are dominated by igneous and metamorphic cobbles and pebbles with minor sand and silt (Lopez, 2000, 2001, 2005).

Lopez (2001, 2005) described the Holocene alluvium along the modern bed of Rock Creek as consisting of gravel, sand, silt, and clay. Igneous and metamorphic boulders, cobbles, and pebbles make up the bed of Rock Creek.

Climate

Climatic conditions in the project area vary from semi-arid at lower elevations to an alpine climate at higher elevations. A semi-arid climate is defined by average precipitation just below the potential evapotranspiration and has major diurnal and seasonal temperature changes. Alpine climates have a mean temperature below 50°F. Climate data from two stations were used in this study. The Joliet meteorological station is at an elevation of 3,776 ft and the Red Lodge meteorological station is at 5,500 ft. Most of the precipitation for the area occurs during spring and summer thunderstorms. May is typically the wettest month, while December is the driest (Western Regional Climate Center, 2016). Large amounts of snow accumulate in the adjacent Beartooth Mountains during the winter. Spring snowmelt feeds streams and recharges groundwater aquifers.

Precipitation

Precipitation records from 1952 to 2016 in Red Lodge and Joliet indicate average annual precipitation of 22.7 and 14.8 in, respectively (Western Regional Climate Center, 2016). Figure 3 illustrates an extended period of drought conditions from 1996 to 2007, especially in the Red Lodge area. Precipitation was also well below average in 2012.

Land Use

Land on the West and East Bench and the Rock Creek Valley is used mainly for irrigated agriculture. Although the growing season is only 90–120 days, the alfalfa and grassland hay typically receive two cuttings. Area ranches primarily raise cattle and/or sheep. Land use in the uplands outside of the valley is mainly dry-land pastures. In recent years, a patchwork of agricultural land in the valleys and uplands has been converted to residential subdivisions.

Irrigation practices dominate the hydrology in the Rock Creek Valley. Irrigation ditches convey water out of Rock Creek through weirs, then flows across fields through unlined ditches. Flood irrigation is the main form of irrigation; however, an increasing number of center pivots and sprinkler systems in the valley are also supplied by ditch water conveyed from Rock Creek.

Previous Hydrogeological Investigations

The MBMG characterized groundwater resources in Carbon and Stillwater Counties, collecting data from 2002 to 2005 (Blythe and LaFave, 2020). The project included collection of baseline groundwater data for alluvial and bedrock aquifers, to document groundwater quantity and quality. Information collected includes static water levels and measures of groundwater quality (such as pH, temperature, major ions, and trace elements). Blythe and Reiten (2015) presented a groundwater altitude map for these counties, including discussion of the surficial geology and groundwater occurrence. The regional-scale hydrogeologic setting and well characteristics (e.g., yield, depth, and well use) are described by Blythe and LaFave (2020).

In 2005, the Montana Department of Environmental Quality (DEQ) completed a Source Water Delineation and Assessment Report of the public water supply systems in Roberts and Joliet (Montana DEQ, 2005a,b). They determined that both the alluvial aquifer, which supports the Roberts public water supply wells, and the Eagle Formation aquifer, which supplies Joliet, are sensitive to potential contaminant sources.

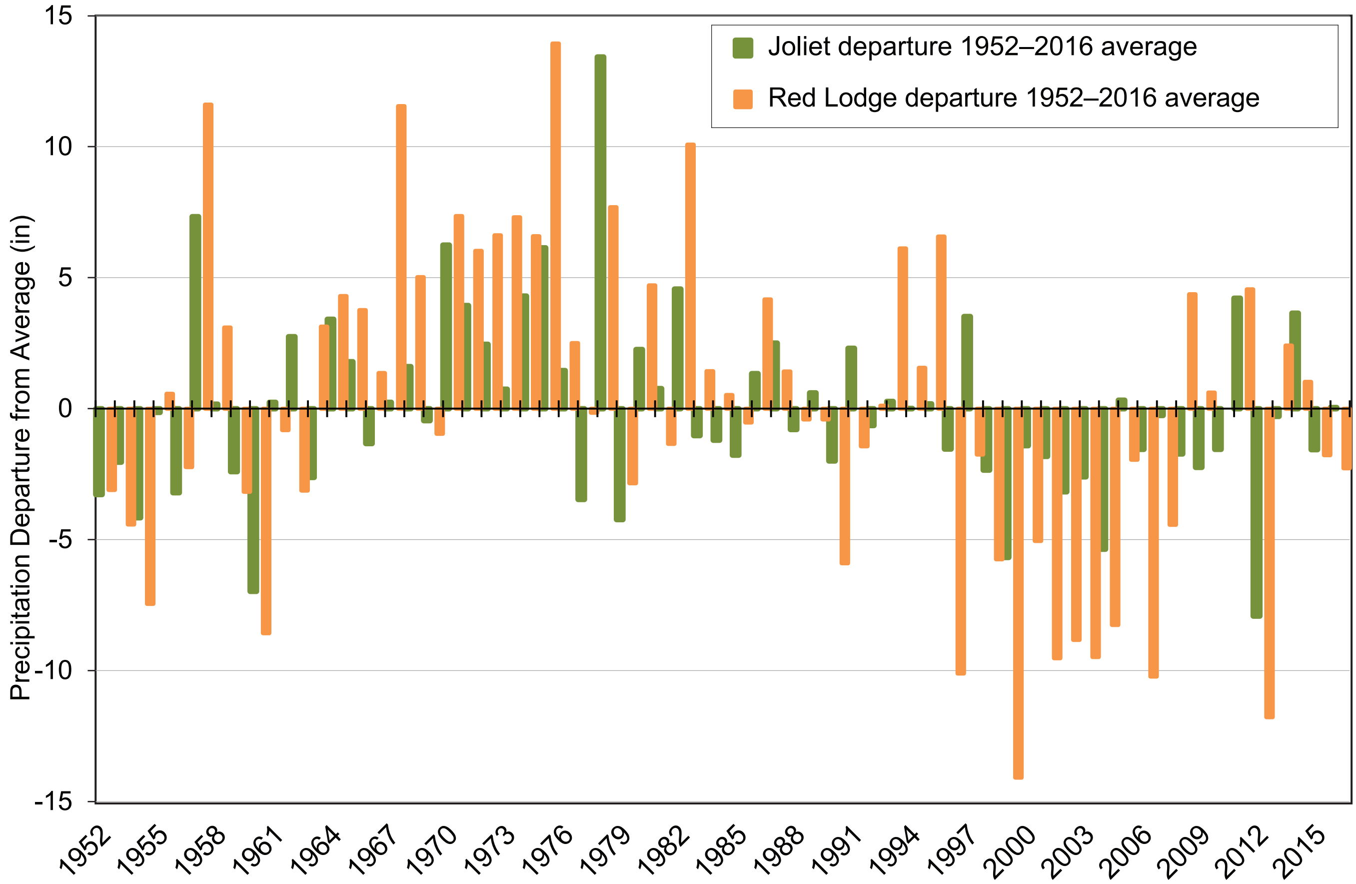


Figure 3. Red Lodge and Joliet departure from annual average precipitation.

The Montana Department of Natural Resources and Conservation (DNRC) investigated the West Bench Alluvial aquifer near Red Lodge and identified irrigation ditch leakage as the primary source of recharge to the aquifer (Waren, 2000). This inspired the Carbon Conservation District to partner with the MBMG in 2008 to conduct an assessment of the hydrology and water balance of the entire East and West Bench Alluvial aquifers. Results indicate that flood irrigation and ditch leakage are the major recharge sources for the East and West Bench Alluvial aquifers. Land-use changes from irrigated agriculture to residential and commercial use could affect recharge to the East and West Bench Alluvial aquifers and the underlying aquifers (Reiten, 2020).

A residential development in the Remington Ranch has raised concern about impact to groundwater quality and quantity. In response, the MBMG produced an information pamphlet to describe the hydrogeology of the south part of the West Bench Alluvial aquifer near Red Lodge (Carstarphen and others, 2014).

METHODS

Well Site Inventories

Inventory data gathered from the MBMG's Groundwater Information Center (GWIC) database include: static water level (SWL), total depth of well (TD), field pH, field specific conductance (SC) measured in µS/cm, water temperature (°C), and a global positioning system (GPS) location. Lithological well logs retrieved from the GWIC database were used to help determine geologic units and aquifer thickness (GWIC, 2016). All wells in the GWIC database are assigned an identification number (GWIC ID), and these numbers are used throughout this report to refer to specific wells.

Stream Flow Measurements

MBMG staff selected locations on streams where flow could be measured and used to assess stream gain or loss. Locations with straight channel shape and low roughness were chosen as recommended by Rantz and others (1982). The difference in flow rate between measurement sites is used to calculate the loss or gain between measurement locations. We completed these seepage runs within one day, to ensure that hydrologic conditions remained relatively constant throughout the period of measurement. Stream site locations were recorded with a handheld GPS. The water depth and time-averaged velocities were measured with a Teledyne StreamPro Acoustic Doppler Current Profiler, and a standard 5% error was used for accuracy (Gotkowitz, 2023).

Pressure Transducer Installation

Water-level data loggers (In-Situ® Level Troll 100 and 300 series) were installed in selected wells to measure and record hourly changes in groundwater level and temperature. The non-vented loggers record pressures that include barometric and water-level components. To measure groundwater head, the loggers were suspended inside well casings within the water column on vinyl-coated steel cable. For surface-water applications, the loggers were inserted inside 2-in PVC pipes that were secured to the stream or ditch bank.

Water-Quality Characteristics

Field parameters were periodically measured at groundwater and surface-water sites. Field parameters for groundwater were recorded (1) after pumping the well for a sufficient time to remove a volume of water approximately equal to three times the water column or (2) after measured parameters stabilized in situations where removing three casing volumes was impractical. At surface-water sites, field parameters were measured directly in the stream channel.

Field water-quality measurements included pH, SC, and temperature. These parameters were measured when springs and wells were inventoried or sampled, and when measuring stream flow. A handheld YSI multimeter was used to measure temperature, pH, and SC. The meter was calibrated daily using standardized calibration pH 4.0, 7.0, and 10.0 buffers. The SC meter was calibrated monthly in the laboratory to a known standard of 1,413 µS/cm. All SC values were automatically temperature-corrected to 25°C by the meter.

Inorganic Water-Quality Sampling

Water-quality samples were collected from wells, springs, and streams following MBMG standard sampling procedures. Groundwater samples were filtered, bottled, and acidified after purging approximately three well-casing volumes and observation of stable field parameters of ±10 percent difference between three readings in 15 min. A 0.45-µm filter was used to filter samples; then major ions and nutrients were preserved with with 1% HNO_3 and 0.5% H_2SO_4, respectively (Timmer, 2020). Deionized water was used to rinse sampling equipment between sample sites. Nitrile powderless gloves were worn to prevent sample contamination. Water samples were analyzed by the Analytical Laboratory at the MBMG in Butte, Montana for common ions and trace elements.

Isotope Sampling

Eighteen water samples were analyzed for tritium (^3H) to help determine groundwater residence times. After three casing volumes were purged and field parameters stabilized, water was pumped into a clean 1-gal bucket. To minimize atmospheric exposure, one 50-ml glass vial and one 500-ml plastic bottle were submerged in the bucket, filled, and capped underwater, ensuring that no air was trapped in the bottles. Bottles were then wrapped with Parafilm to prevent leakage and air exposure. Sampling at springs and surface-water sites followed the same procedure, but in these cases, containers were submerged, filled, and capped within the water body itself. Tritium isotope analyses were performed at the Tritium Laboratory at the University of Miami Rosenstiel School of Marine and Atmospheric Science.

Stable isotopes of oxygen and hydrogen were used to evaluate groundwater recharge sources in the study area. Sample collection protocol for oxygen and hydrogen isotopes follows that of the inorganic water-quality sampling. The samples were analyzed by the Analytical Laboratory at the MBMG. Collecting precipitation isotope samples requires gathering rain or snow quickly after falling to prevent evaporation. A landowner volunteered to collect the samples in Joliet. They set a container out at the beginning of the storm, then after the storm poured the precipitation into a sample vial. During snow events the precipitation was capped in a container, allowed to melt, then poured into the vial. Some evaporation will occur with this method. Precipitation samples collected in Joliet likely represent recharge for upland bedrock units near Joliet. The Local Meteoric Water Line for Joliet was created using 27 rain and snow samples collected between April 2014 and March 2015.

Altitude Surveys

MBMG staff used a Leica Geosystems professional-grade GPS survey to determine the elevation of monitored sites in Joliet. The sites included wells completed in the bedrock and alluvial aquifers in the Joliet area, Rock Creek, and Joliet Ditch. The system reported elevation precision in the centimeter range.

Well Installation

Most of the wells monitored during this project were private domestic or stock wells. Two monitoring wells (GWIC IDs 282122, 282123) were installed in the Eagle and Eagle/Telegraph Creek aquifer in Joliet. Pressure transducers were installed in the new monitoring wells.

HYDROGEOLOGY

Surface Water

The USGS has been recording river discharge rates at a gaging station (USGS 06209500) on Rock Creek south of Red Lodge since 1932, with real-time data available since 2007. The mean monthly low-flow rate is 29 cubic feet per second (cfs) in March and the mean monthly high-flow rate is 568 cfs in June when spring snowmelt occurs. The hydrograph in figure 4 illustrates the seasonal pattern of Rock Creek between December 2007 and December 2016. In 2011, the river discharge was 1,970 cfs, nearly double the usual, when a record amount of rain fell over a short time in the area (fig. 4).

<u>*Synoptic Flow Measurement Events*</u>

Synoptic flow measurements provide detailed information of gain or loss within a stretch of river at a point in time (Weight, 2008). Flow rates were measured at multiple locations along Rock Creek in a single day to determine if (gaining and losing) reaches of Rock Creek vary by year (fig. 5). Tributary creeks (Clear Creek and Red Lodge Creek) were also measured, and their contribution was accounted for in loss/gain calculations. Five percent error bars were added to figure 5 to account for standard measurement error. The synoptic flows were measured in February 2015, March 2015, and March 2016 when Rock Creek was considered to be at or near baseflow conditions. Data from 2015 synoptic flow events showed an overall gain from Red Lodge to Gibson Bridge (fig. 5). In 2015, Rock Creek had more water volume compared to 2016, and precipitation information from Joliet indicates that low-elevation precipitation in the first 2 months of 2015 was approximately three times that in 2016 (fig. 6).

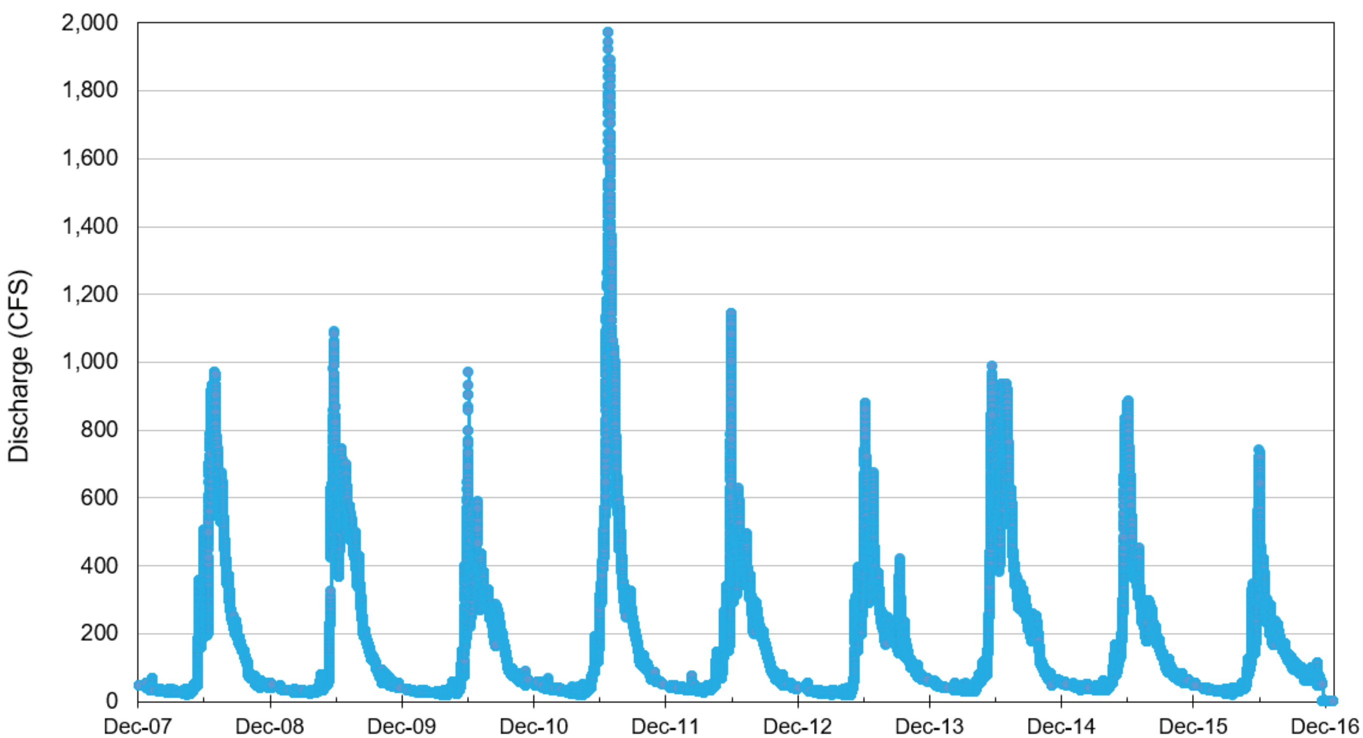
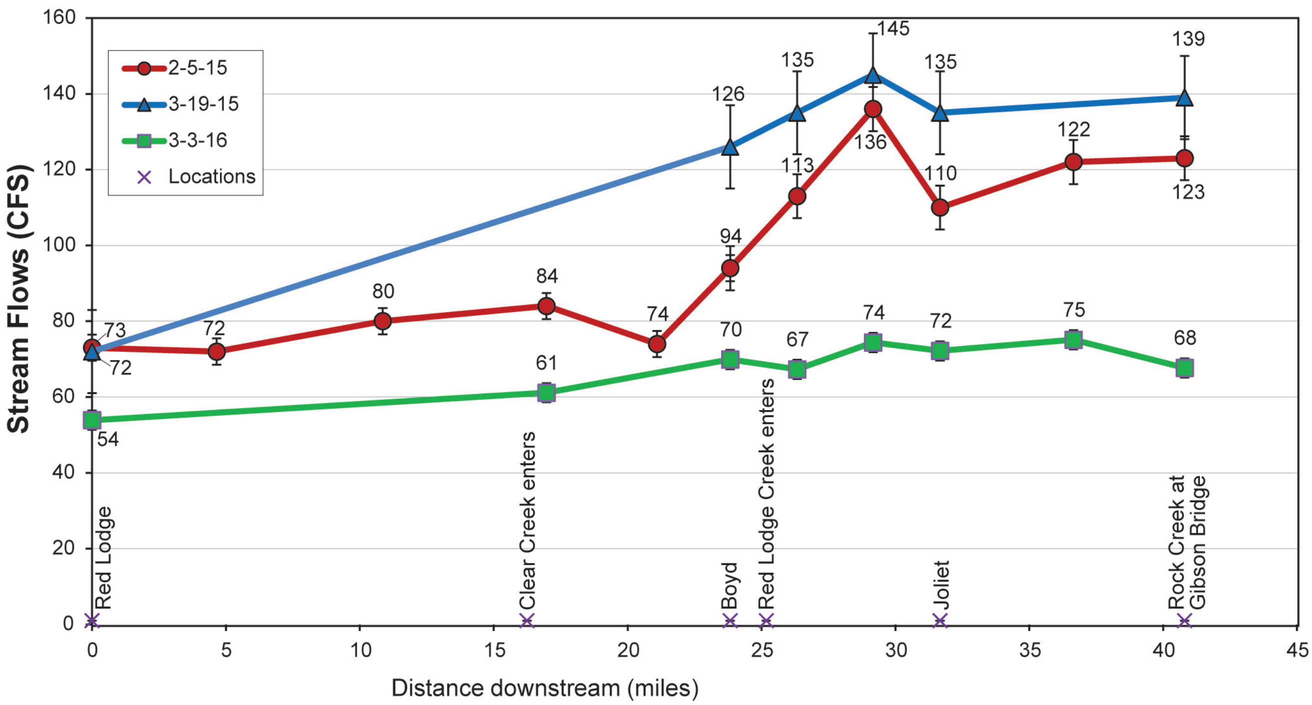


Figure 4. Nine-year hydrograph for Rock Creek (USGS 06209500).



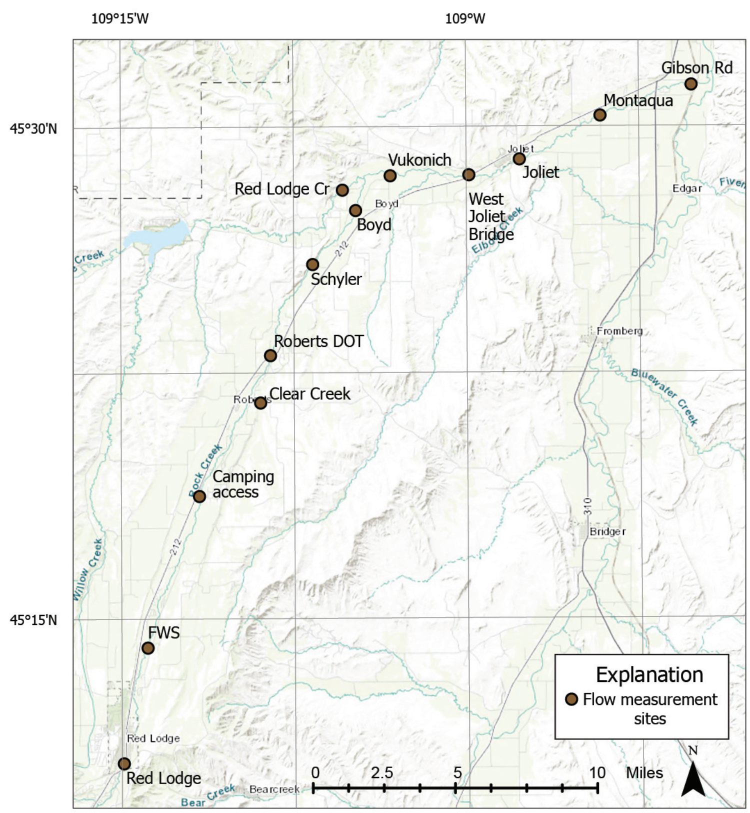


Figure 5 (above and right). Synoptic flow measurements indicate in 2016 Rock Creek gained from Red Lodge to Gibson Bridge.

Gains in Rock Creek near Boyd were present in 2015, but not significant in 2016. In this area, a number of watersheds join the Rock Creek drainage and may supply additional groundwater to the area. It is possible that low-elevation snowmelt recharge into the aquifer increases flow in Rock Creek. The lack of gain near Boyd in 2016 may be due to a lack of snowpack (fig 6).

Valley Alluvial Aquifer

The average thickness of the Valley Alluvial aquifer, estimated from well logs (GWIC, 2016), is about 40 ft. In the valley proper, most wells are completed in the alluvial aquifer, above the Tertiary and Cretaceous shale and sandstone layers. In Joliet, the alluvial deposits are too thin and shallow for well development, requiring well completions in the underlying bedrock.

Groundwater recharge to the Valley Alluvial aquifer is dominated by flood irrigation and leaky unlined ditches that convey water across the valley floor during the growing season. The water levels respond rapidly to the irrigation season (fig. 7, green, blue), and consequently irrigation has created an artificially high water table. The artificial water table acts as a temporary storage reservoir, slowly discharging groundwater back into the river system throughout the year. This is confirmed by synoptic flow measurements that show an overall gain from Red Lodge to Gibson Bridge (fig. 5).

Water levels in the aquifer reach their peak in June to August and then fall steadily until the next irrigation

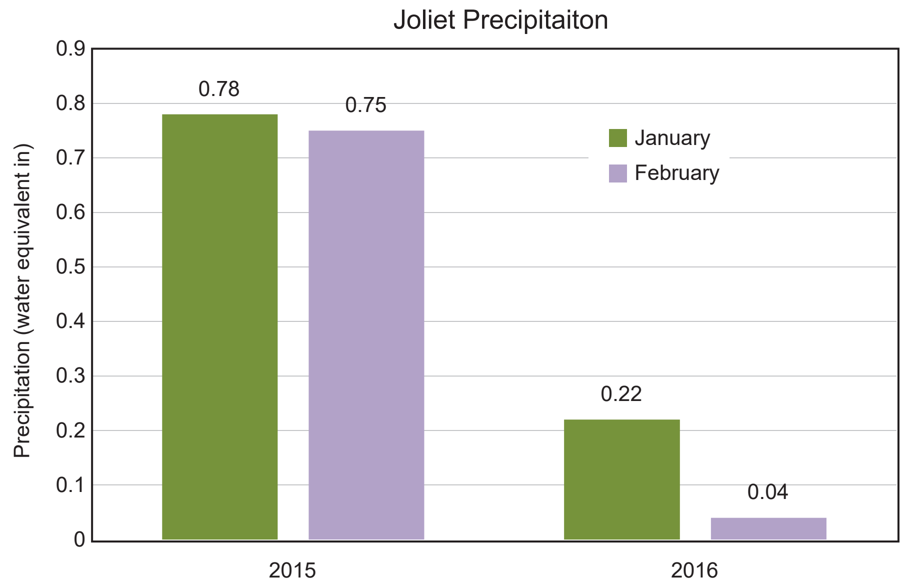


Figure 6. January and February 2015 had more precipitation available for groundwater recharge.

season (fig. 7). Along the margins of the Rock Creek Valley, groundwater levels seasonally fluctuate up to 8 ft. The wells that fluctuate the most are located downgradient of ditches near the valley margins (GWIC IDs 279363, 122624). Wells near the middle of the Rock Creek Valley (GWIC IDs 216141, 179434) have smaller water-level fluctuations compared to wells near the valley margins.

A potentiometric surface map of the Valley Alluvial aquifer and the West Bench Alluvial aquifer was constructed using groundwater-level elevations and the water-surface elevation of Rock Creek (fig. 8, black and red lines). Areas where water table contour lines are close together indicate higher potential groundwater velocities. In areas where lines are farther

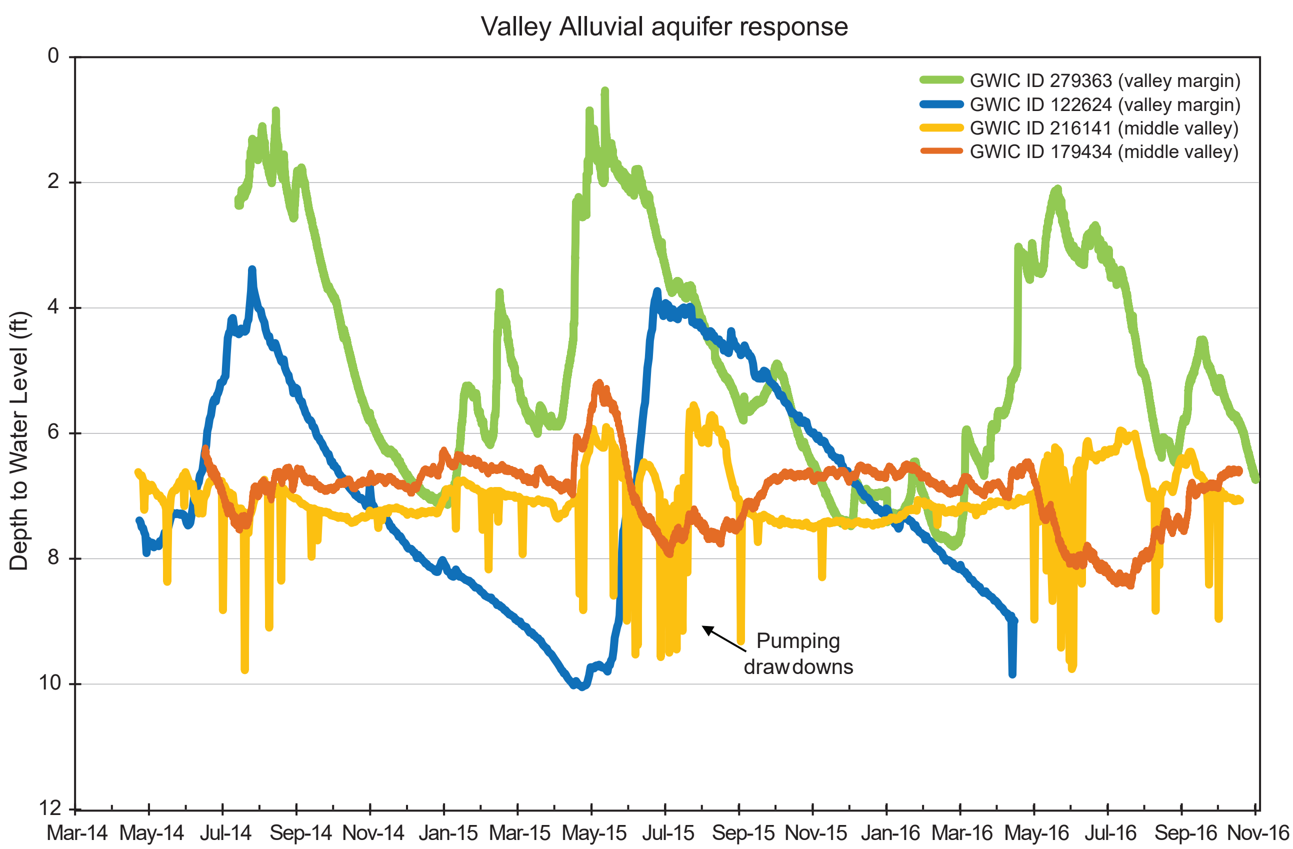


Figure 7. Valley alluvial aquifer water levels in wells located near the center of the valley and near valley margins.

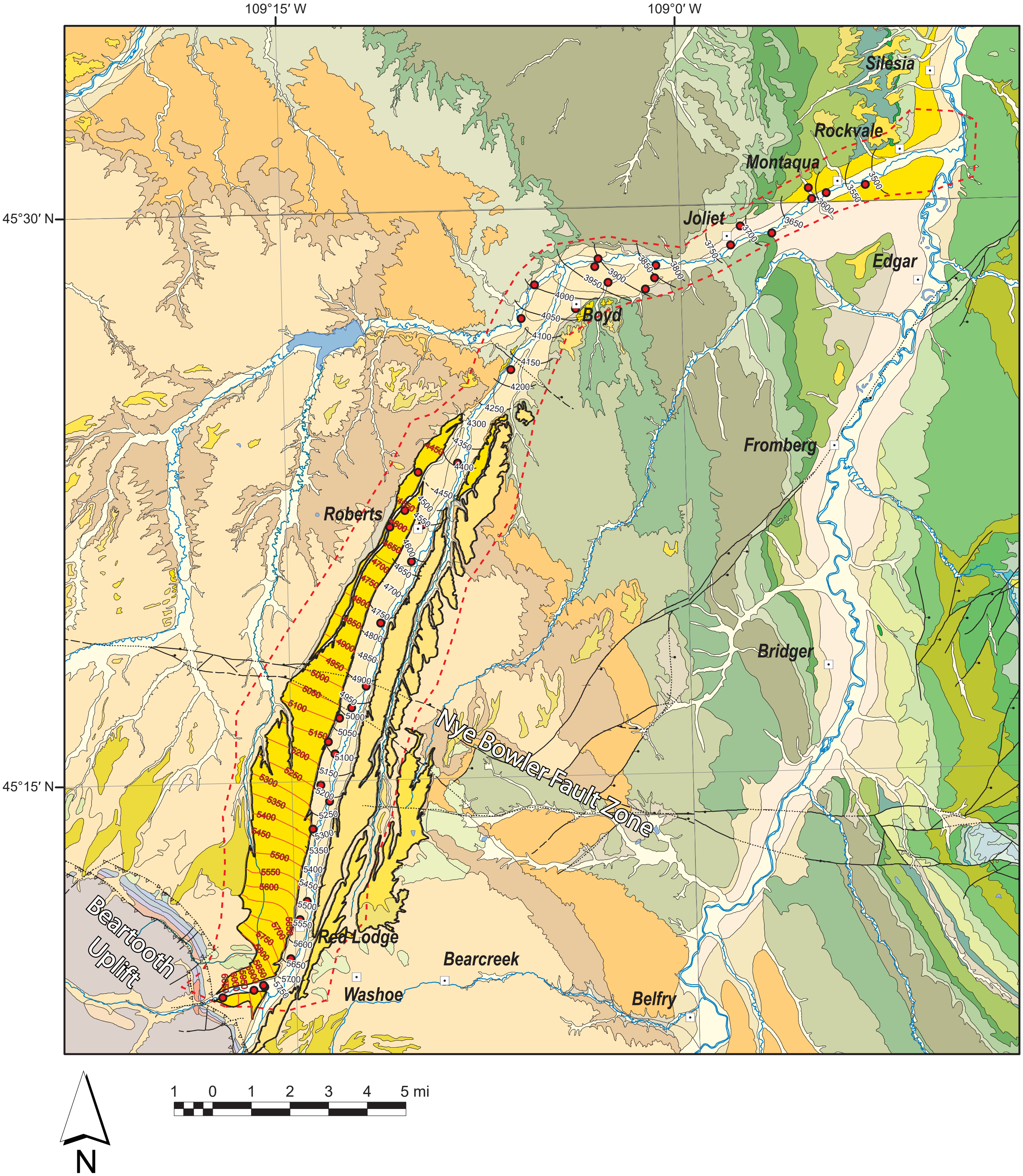


Figure 8 (this and facing page). A water-level elevation map shows that groundwater in the Valley Alluvial aquifer and the West Bench Alluvial aquifer are not connected. More detail can be found in Reiten (2020).

Explanation

- Groundwater Elevation Sites
- 4450 Reiten (2020)
- 3750 Potentiometric Lines (dashed where inferred)
- Towns
- Study Area
- Rivers and Streams

Geology

- Fault: unknown sense of movement; dotted where concealed
- Normal fault: dotted where concealed; bar and ball on downthrown side
- Reverse fault: open teeth on upthrown block
- Reverse or thrust fault: teeth on upthrown block; dashed where approximately located; dotted where concealed

Quaternary

- Qal (Alluvium of Modern channels)
- Qpg (Pediment gravel deposit)
- Qc (Colluvium)
- Qaf (Alluvial fan deposits)
- Qls (Landslide deposits)
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- Qat1 (Alluvium of youngest alluvial terrace)
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Tertiary

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- Tft (Tullock Member of Fort Union Fm.)
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- Kf (Frontier Fm.)
- Km (Mowry Shale)
- Ktf (Thermopolis, Fall River Fm.)
- Kk (Kootenai Formaion)

Jurassic

- J₮s (Sedimentary rocks, undivided)
- Jm (Morrison Fm.)
- Jsw (Swift Fm.)
- Jr (Rierdon Fm.)
- Jp (Piper Fm.)

Precambrian

- Ꞓs (Sedimentary rocks, undivided)
- ₮c (Chugwater Fm.)
- PMpa (Phosphoria, Quadrant, Amsden)
- Mm (Madison Group)
- DOs (Sedimentary Rocks)
- Agn (Gneissic Rocks)

apart, the groundwater moves more slowly, as seen where the Rock Creek Valley widens north of Roberts (fig. 8.) Groundwater flow direction is perpendicular to the contour lines. The black lines curve upstream near Rock Creek, indicating groundwater moves from the alluvium into the stream. Dissimilar aquifer water table contours and gradients between the West Bench Alluvial aquifer (Reiten, 2020) and the Valley Alluvial aquifer may indicate a lack of hydrologic connection south of Roberts (fig. 8). As the West Bench Alluvial aquifer pinches out north of Roberts, water levels and gradients suggest better connection.

West Bench Alluvial and East Bench Alluvial Aquifers

The West Bench Alluvial aquifer forms a continuous geologic surface from south of Red Lodge to north of Roberts and is dissected by minor drainages (Reiten, 2020). Well logs show that the alluvial deposits are thick (125 ft) near the mountain front and thin (less than 30 ft) downstream towards Roberts.

The hydrographs for most wells located on the West Bench Alluvial aquifer show several small rises in winter months followed by a large rise in spring. The greatest water-level fluctuations (fig. 9, GWIC IDs 251283, 191002) occur in the southern part of the West Bench Alluvial aquifer near areas of minimal irrigation. The water-level fluctuations decrease further north toward Roberts as the number of irrigated acres increase (Reiten, 2020; GWIC IDs 251298, 251299). The early seasonal rises are likely a result of recharge from winter snowmelt events followed by spring snowmelt and irrigation activation.

The East Bench Alluvial aquifer is deeply incised by Clear Creek and a few smaller streams, creating a discontinuous aquifer. Drill depths in the East Bench Alluvial aquifer range from about 30 to 90 ft. Further interpretation of the geology and aquifer properties of the West and East Bench Alluvial aquifers can be found in Reiten (2020).

Bedrock Aquifers

The bedrock formations considered aquifers in the study area include the Tongue River, Tullock, Lance/Hell Creek, Judith River, Eagle, and Eagle/Telegraph Creek. The thickness of each bedrock aquifer varies by location, but the average depth of wells completed in these formations is about 200 ft (GWIC, 2016). However, it is not unusual for wells to be over 500 ft deep. Well logs indicate few completions past the uppermost

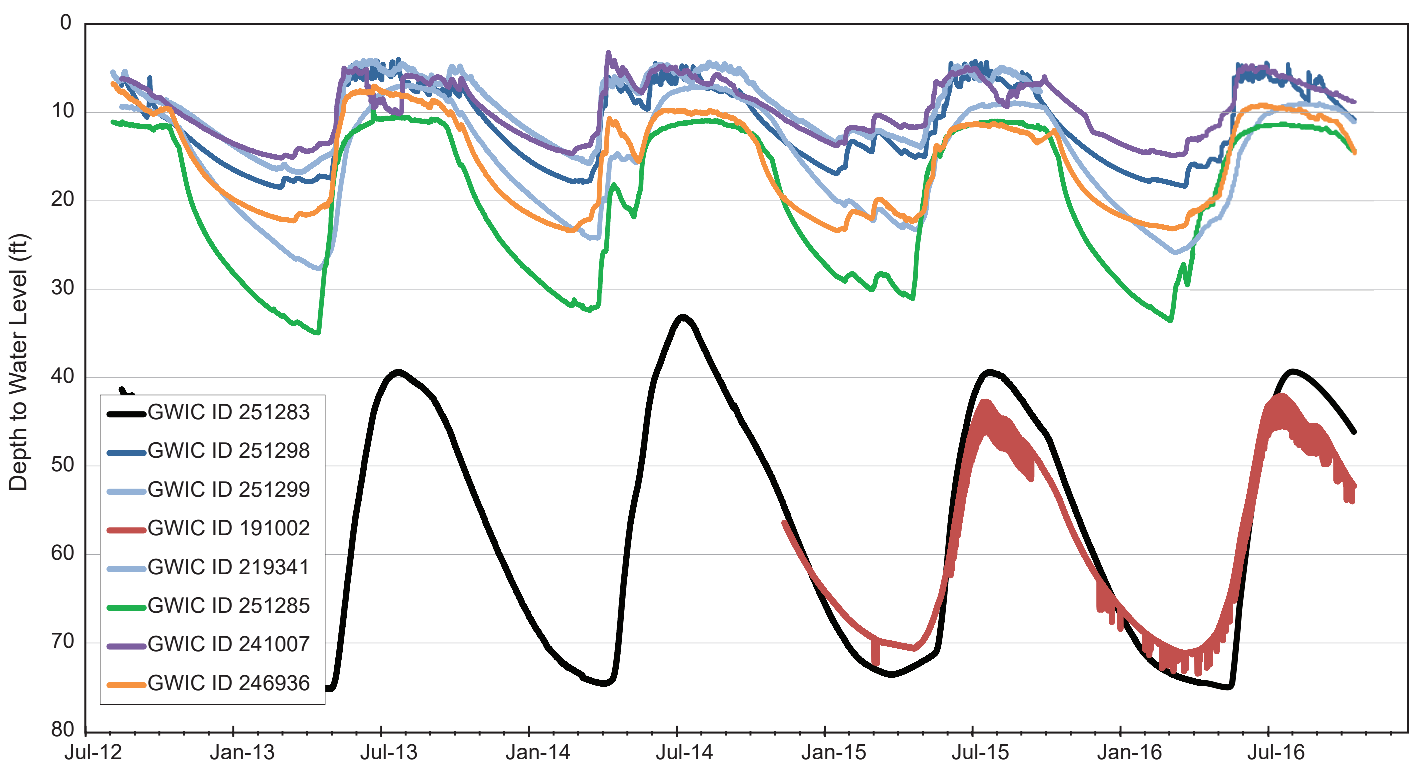

Figure 9. West Bench Alluvial aquifer seasonal response.

bedrock unit, which is the first productive aquifer encountered during drilling. The bedrock aquifers have small or discontinuous outcrops that can limit recharge. The yield of bedrock aquifers vary considerably, with a median yield of 10 to 15 gpm (Blythe and Reiten, 2015). Wells in Joliet, including the public water supply wells, are typically completed in the Eagle and upper Telegraph Creek sandstones; these sandstones are referred to in this report as the Eagle and Eagle/Telegraph Creek aquifer. Wells outside Joliet are typically completed in the Eagle sandstone; this aquifer is referred to as the Eagle aquifer.

Groundwater Response near Ditch

Flood irrigation and ditch leakage provide most of the recharge for the alluvial and bedrock aquifers within the Rock Creek Valley. Factors that contribute to amount of ditch loss are geologic material through which the ditch is constructed, sediment lining the bottom of the ditch, and wetted perimeter. Synoptic flow measurements were taken on Joliet Ditch. The ditch lost 2 cfs (about 13% of its flow) in a 0.2-mi section over thin-bedded fractured bedrock.

Three hydrographs comparing ditch stage elevation and water-level elevation in nearby wells are shown in figures 10–12. GWIC ID 279363 is a shallow, hand-dug well completed in the Valley Alluvial aquifer. The water level responded quickly to snowmelt in February and March 2015 and several times in early 2016. The level rose again rapidly in May when the irrigation ditch filled (fig. 10). The water level responds almost immediately to changes in ditch stage. During irrigation, the groundwater levels in this area are near ground surface.

An alluvial well (fig. 11; GWIC ID 235197) completed in a 14-ft-thick gravel bed beneath 47 ft of sandy loam, and a bedrock well (fig. 12; GWIC ID 101620) completed in sandstone at a depth of 80 ft, show the water levels in the wells respond rapidly to recharge from the nearby ditch. Once the ditch stage is lowered, the groundwater levels decline until the following irrigation season, suggesting groundwater in these locations is mainly recharged by ditch leakage.

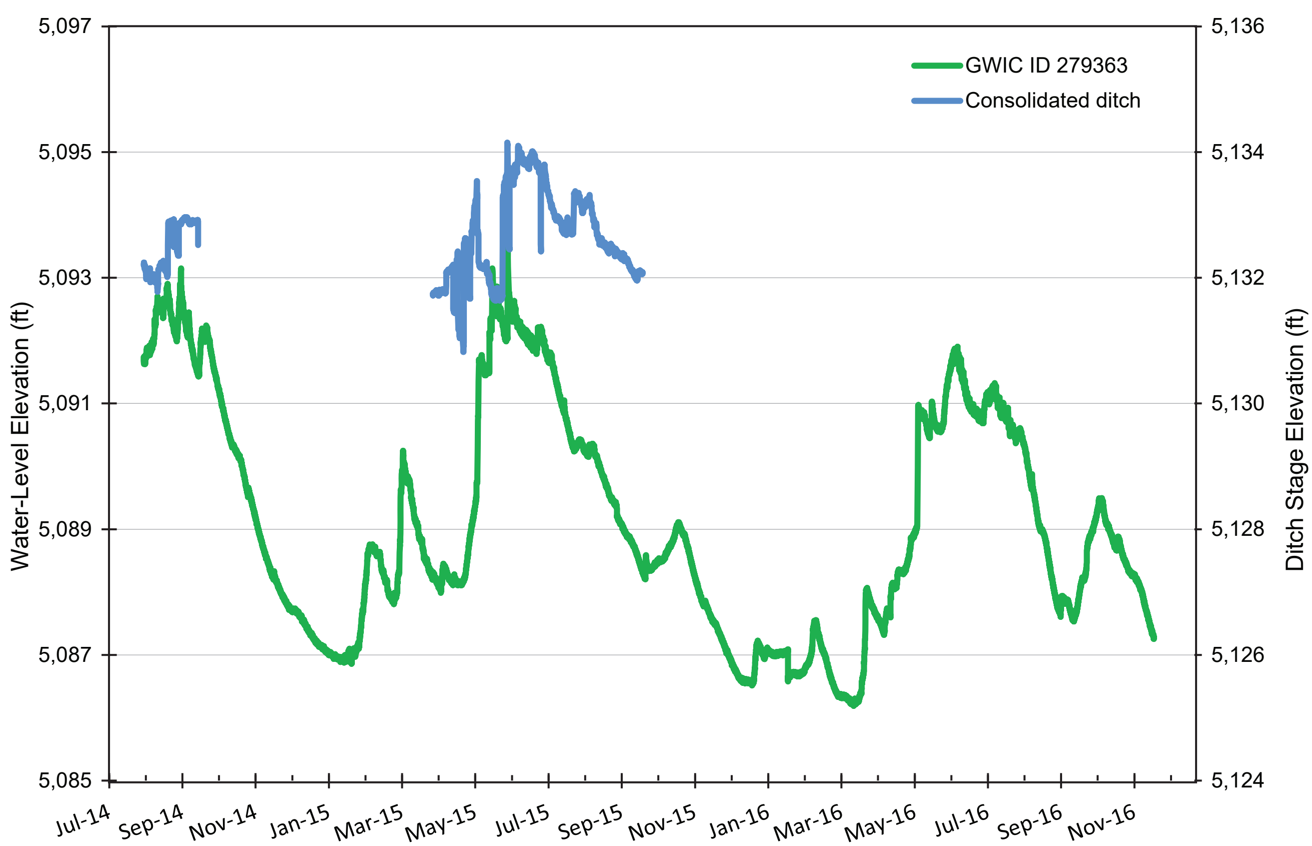

Figure 10. Shallow alluvial aquifer response to Consolidated Ditch. Location of ditch logger 45.2676, -109.2289.

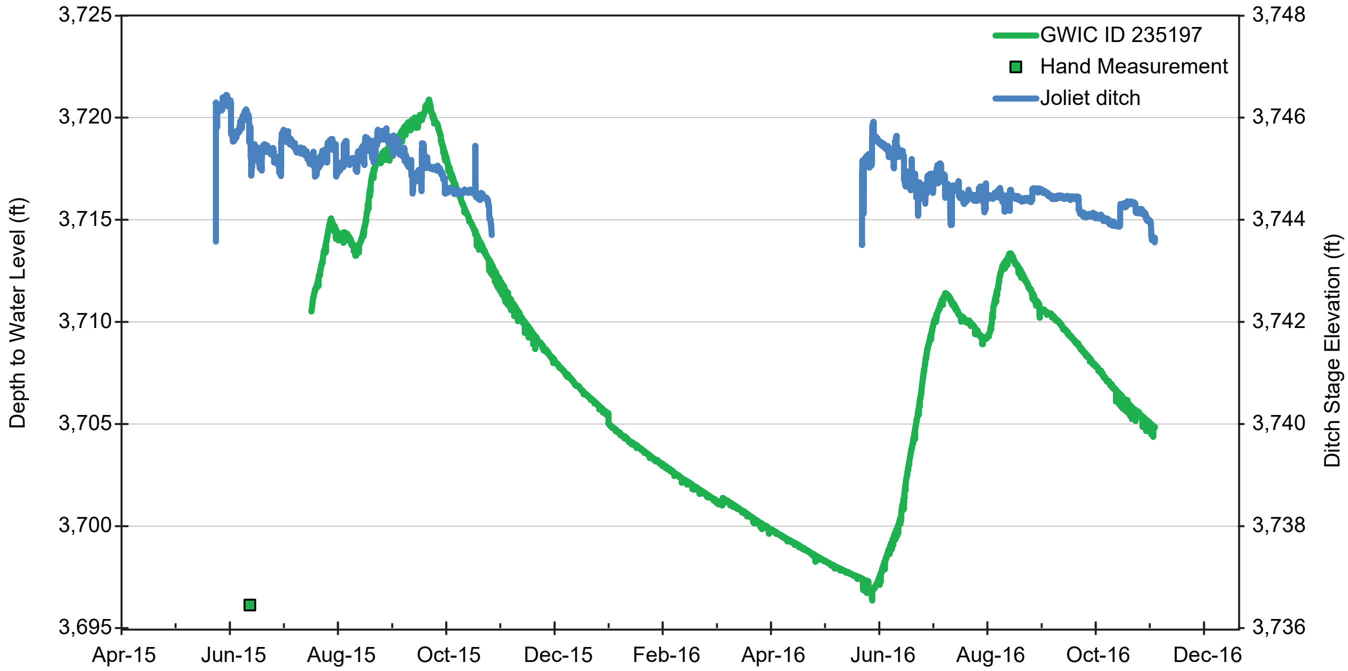

Figure 11. Deep alluvial aquifer response to Joliet Ditch. Location of ditch logger 45.4920, -108.9630.

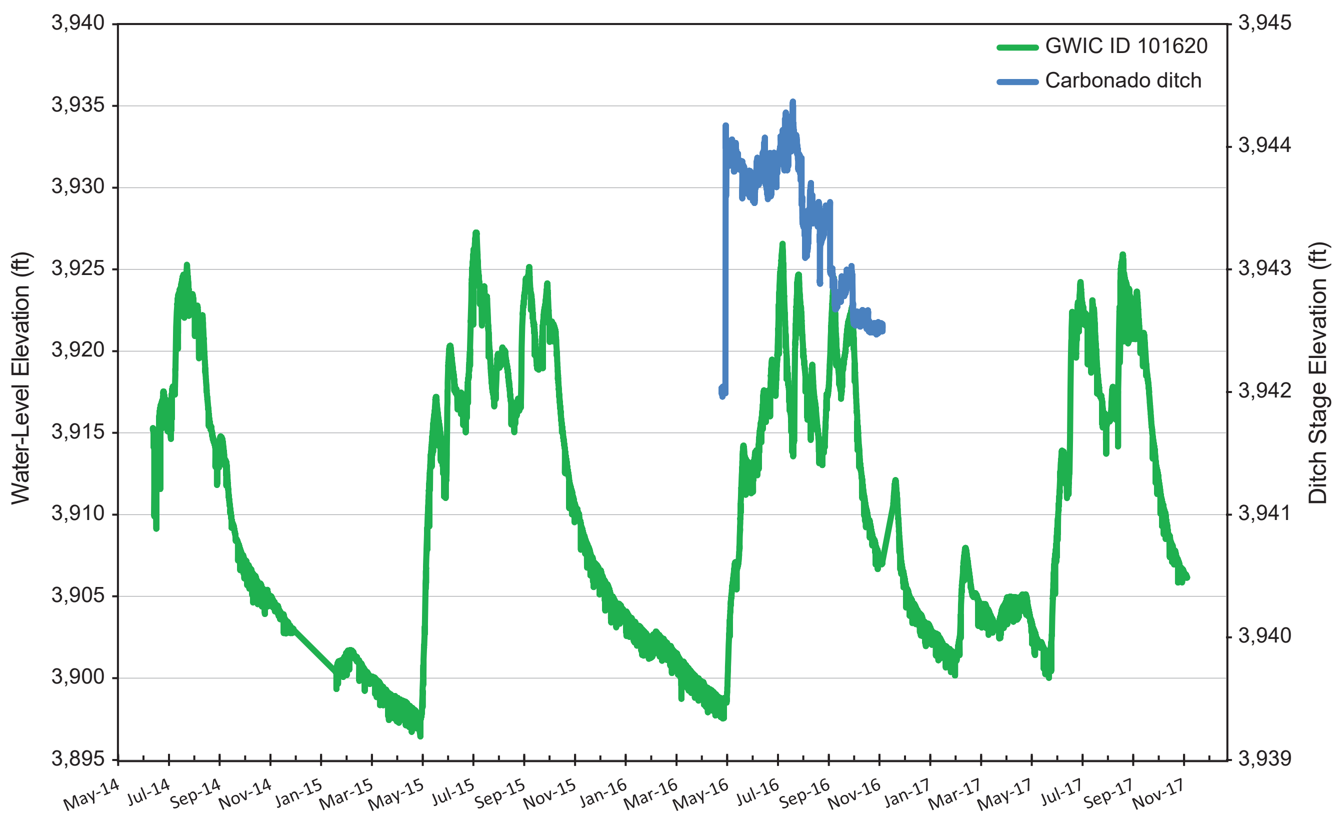

Figure 12. Bedrock aquifer response to Carbonado Ditch. Location of ditch logger 45.4605, -109.0138.

WATER CHEMISTRY

Specific Conductance

Specific conductance is a measure of water's ability to conduct an electric current and can be used to estimate the total dissolved solids (salinity) in a water sample. The higher the SC value, the more dissolved salts are present in the water. Typically, groundwater has higher SC values than surface waters because minerals (salts) are dissolved as groundwater moves through the soil and aquifer material.

Specific conductance measurements were collected along the length of Rock Creek. The values ranged from 83 µS/cm at the upgradient end near Red Lodge to 288 µS/cm at the downgradient end near Rockvale (fig. 13). Rock Creek's SC increased in mixing zones where the tributary creeks enter (e.g., Clear Creek and Red Lodge Creek). The low SC values in Rock Creek at the upgradient end is attributed to the contribution of water from high-elevation snowmelt from the Beartooth Mountains. The increase in SC downstream reflects tributary creek in-flow and groundwater discharge into the river. The groundwater may include a component of bedrock discharge. Tributary creeks in the study area have SC values between 264 and 460 µS/cm.

The specific conductance of groundwater from water wells was measured during this study and other groundwater projects in Carbon County (Carstarphen and Smith, 2007; Reiten, 2020). Figure 14 shows the SC values for aquifers in and around the project area in Carbon County. The Valley Alluvial, West Bench, and East Bench Alluvial aquifers have similar water quality, recharge source, and geologic deposition, and were lumped together for this analysis. The alluvial aquifers have the lowest average SC of 300 µS/cm (fig. 14), indicating that low-salinity irrigation water is the dominant source of recharge to the alluvial aquifers. The Judith River aquifer has the highest average SC of 2,397 µS/cm, which is attributed to rock–water interactions within the aquifer.

Oxygen Hydrogen Isotopes

Stable isotopes of oxygen and hydrogen can provide information about sources of groundwater recharge. Oxygen and hydrogen isotopes are measured as ratios of heavy isotope to light: $^{18}O/^{16}O$ and $^{2}H/^{1}H$. These ratios are then compared to the Vienna Standard Mean Ocean Water (VSMOW) standard, with the resulting δ-values indicating deviation from the standard. The δ notation is defined in the following equation (using O-isotopes as an example):

$$\delta^{18}O \text{ (in ‰)} = \left[\frac{\left(\frac{^{18}O}{^{16}O}\right)_{sample}}{\left(\frac{^{18}O}{^{16}O}\right)_{standard}} - 1\right] \times 1000$$

The δ-values are expressed as parts per thousand, or "per mil" (‰) because variations are small.

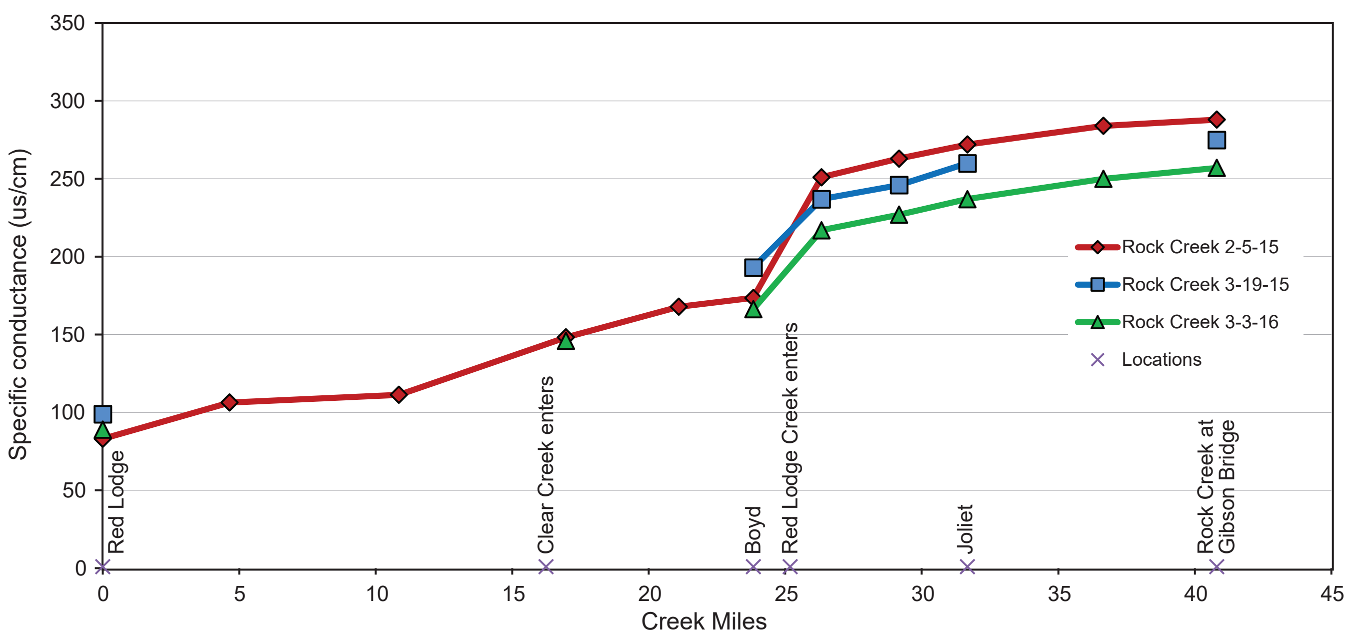

Figure 13. Specific conductance increases were measured where tributary creeks enter the Rock Creek drainage.

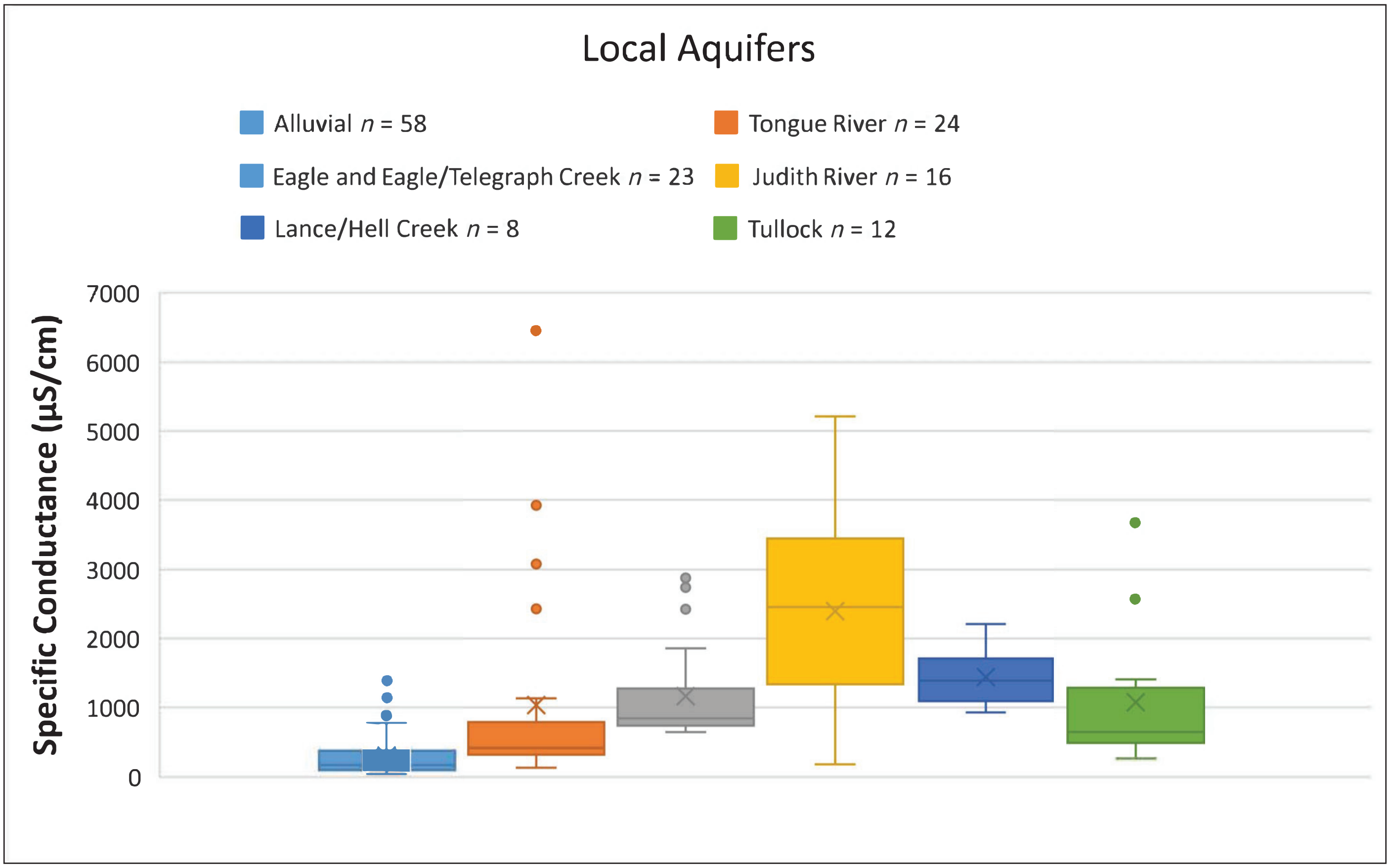

Figure 14. Box and whisker plot of specific conductance values for groundwater in wells inventoried in Carbon County. Boxes represent the 25th to 75th percentile, lines within the box are the median, whiskers represent the 10th to 90th percentile, and dots represent outliers.

The Global Meteoric Water Line (GMWL; Rozanski and others, 1993) is derived from a compilation of global precipitation and plotted in figures 15 and 16 as a reference line. Values of $\delta^{18}O$ and δ^2H in precipitation are influenced by meteorological processes, particularly by the temperature, elevation, and latitude of the rain or snowfall (Clark and Fritz, 1997). Precipitation in the form of snow in colder, higher latitude, and higher altitude areas have lower isotope ratios compared to warmer, lower latitude, and lower altitude rain. Warmer precipitation will have a more positive δ-value (more enriched in ^{18}O and ^2H) than the colder precipitation.

A Local Meteoric Water Line indicates the range of oxygen and hydrogen isotope values expected for the precipitation in a particular area. Defining the water line allows a more precise evaluation of isotopic deviation from precipitation that identifies processes, such as evaporation, that the water has undergone since recharge. The Joliet Meteoric Water Line (JMWL) was created using 27 rain and snow samples collected between April 2014 and March 2015. The inset chart in figure 15 shows the precipitation samples used to create the JMWL. Groundwater samples that deviate significantly from a JMWL may have recharge sources far removed from local precipitation, such as upward leakage from underlying aquifers.

Together with samples collected during this project and those available from the earlier work (Carstarphen and Smith, 2007), a total of 209 samples from the alluvial aquifers, bedrock aquifers, and surface water were analyzed for $^{18}O/^{16}O$ and $^2H/^1H$ (appendix A). The headwaters of Rock Creek, which is the irrigation supply water, is primarily composed of high-altitude snowmelt from the Beartooth Mountains and becomes evaporated downstream. Rock Creek samples collected at Gibson Bridge (fig. 15, diamonds) show evaporation (plot further away from JMWL) compared to samples at Red Lodge (fig. 15, circles). The alluvial groundwater is isotopically similar to that of Rock Creek (fig. 15), suggesting the aquifer is primarily recharged by flood irrigation and ditch leakage and less from lower elevation rain.

Figure 16 focuses on the source of recharge to the Eagle and Eagle/Telegraph Creek aquifer in the town

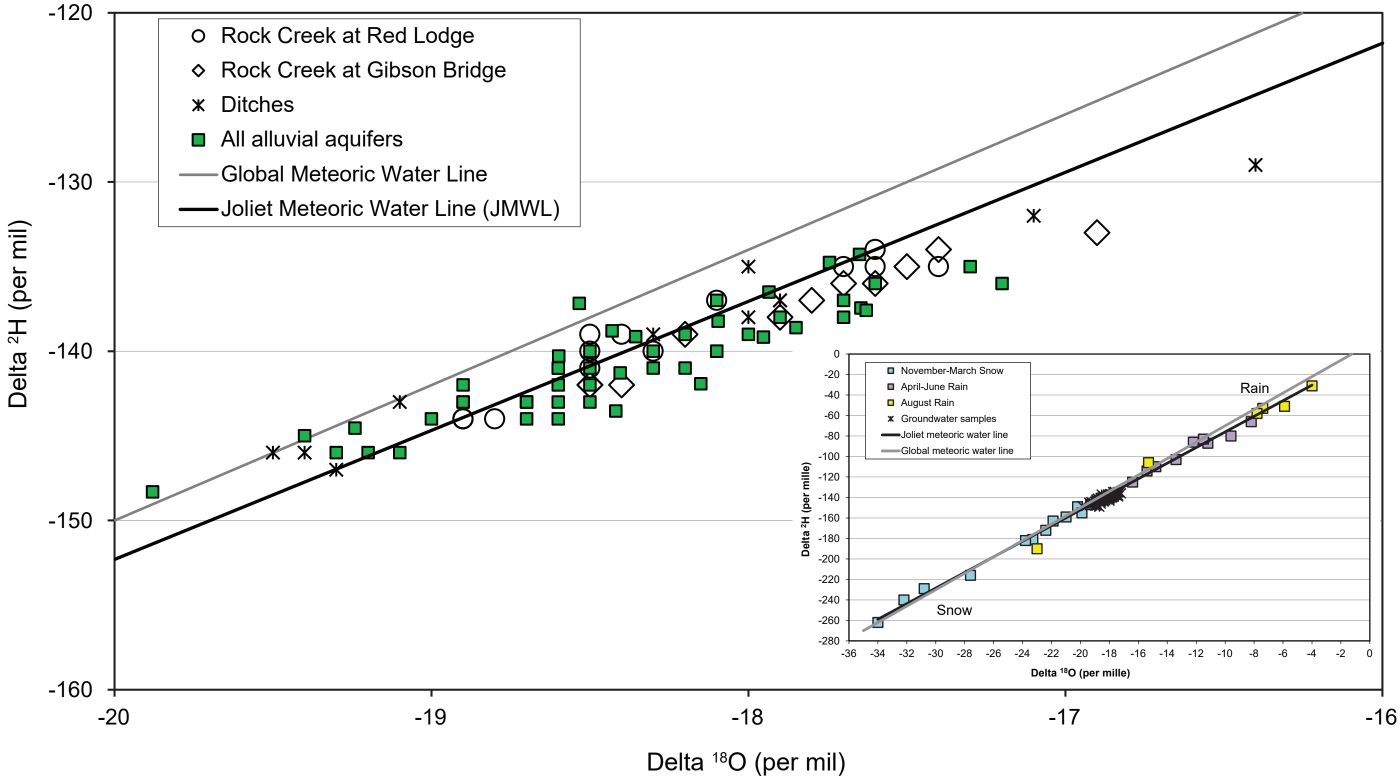

Figure 15. Oxygen and hydrogen isotopes of the local meteoric water line for Joliet are displayed on the inset graph. Samples from the alluvial aquifer and Rock Creek (the source of irrigation water) are isotopically similar.

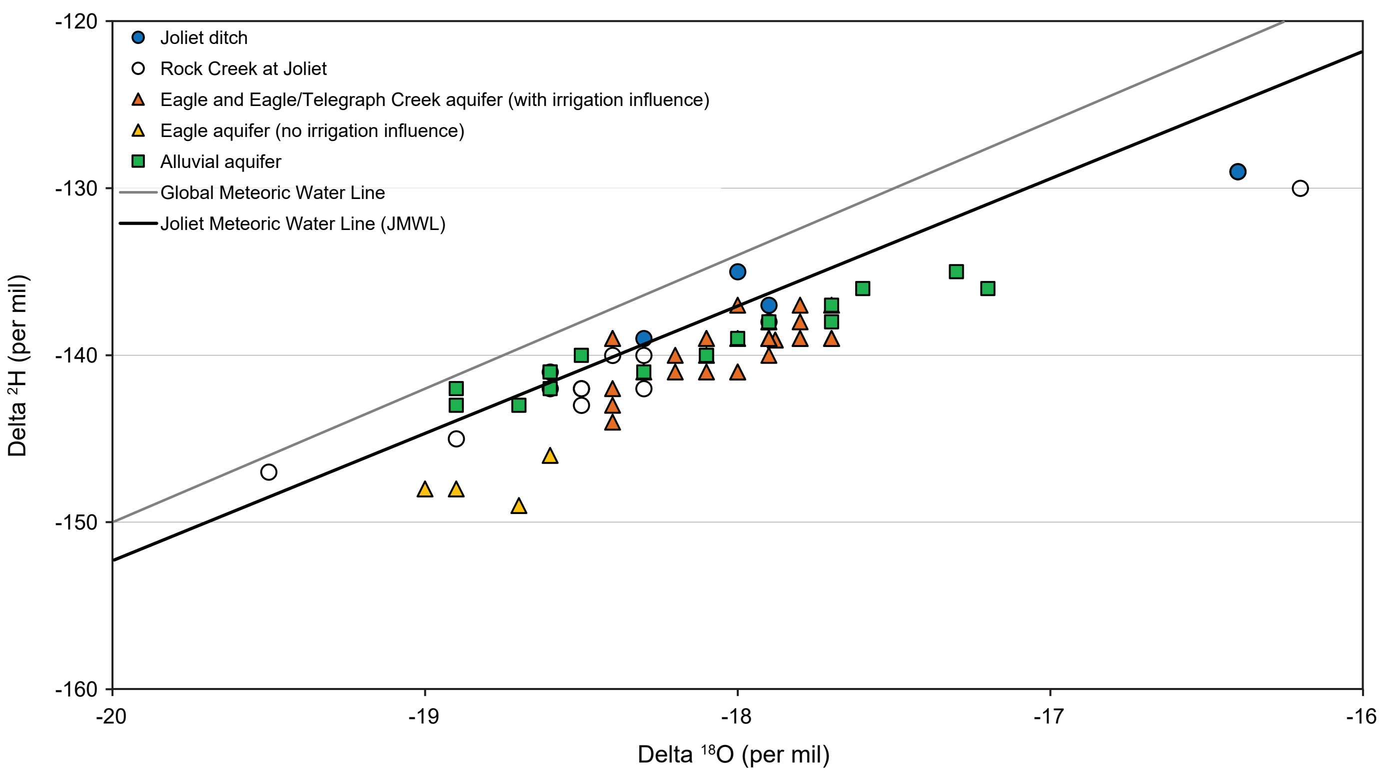

Figure 16. Eagle and Eagle/Telegraph Creek aquifer isotope samples in Joliet are similar to isotope ratios of irrigation water and Rock Creek.

of Joliet. Samples (dark orange triangles) from the Eagle and Eagle/Telegraph Creek aquifer, collected from Joliet water supply wells, show an isotopic similarity to the alluvial wells and Rock Creek with additional signature of evaporation. The Eagle aquifer samples collected from areas without irrigation influence (light orange triangles) plot further below the JMWL, which suggests water that underwent evaporation prior to infiltration and precipitation in the form of snow may be the dominant recharge sources. Isotopic analysis, therefore, suggests that the Eagle and Eagle/Telegraph Creek aquifer in Joliet is recharged from a mix of irrigation water and precipitation.

Residence Time of Groundwater

The concentrations of tritium, an isotope of hydrogen in groundwater, can be used to differentiate relative ages of groundwater and to identify potential recharge sources. The age of groundwater is defined as the time elapsed since the water was last in contact with the atmosphere and entered the ground. In the 1950s and 1960s, a substantial amount of tritium was released into the atmosphere as a result of nuclear weapons testing. The releases overwhelmed the natural atmospheric concentrations of tritium, and these higher concentrations in precipitation then infiltrated the groundwater. The atmospheric tritium levels measured in precipitation returned to natural background levels by the end of the 20th century, but vary with latitude, elevation, and seasonal weather patterns (Eastoe and others, 2012; Drever, 1997).

Water that has recently entered an aquifer should contain concentrations of tritium similar to current atmospheric levels of 5 to 15 tritium units (TU), depending on the season. Water that has been in the ground longer will have a lower concentration due to the decay of tritium. For the most part, water with less than 0.8 TU has a pre-1952 age; intermediate tritium concentrations of 0.8 to 4 TU are most likely from a mixture of modern and older water (that has been in the ground longer); and tritium concentrations in excess of 15 show the influence of bomb testing (labeled “bomb era” in fig. 17) in the 1950s (Clark and Fritz, 1997).

Tritium concentrations were measured in 16 groundwater (12 bedrock, 4 alluvial) and 2 surface-water sites. The sample analyses ranged between 2 and 16 TU (fig. 17 and appendix B). In general, most of the samples were interpreted to be young groundwater (modern).

Common Ion Geochemistry

The hydrogeologic processes of groundwater recharge and discharge contribute to the groundwater chemical composition. Changes in ion composition can provide additional information about groundwater flowpaths. Groundwater near the recharge source (younger water) is usually low in overall salinity, and the dominant cations and anion are calcium, magnesium, and bicarbonate from the soil and weathered bedrock. Older water is generally higher in relative concentrations of sodium and bicarbonate owing to sulfate reduction and ion exchange (Brinck and others, 2008).

Trilinear, or Piper, diagrams are commonly used to show the relative percent concentrations of major cations (magnesium, calcium, potassium, and sodium) and anions (sulfate, bicarbonate, carbonate, and chloride) in water samples. Piper diagrams can also show that two or more water types exist, and how mixing between those types influences groundwater evolution along flowpaths. Groundwater that undergoes a progression from high relative calcium and bicarbonate to high calcium and sulfate would suggest a flowpath from recharge areas to discharge areas; such trends may be apparent on a Piper diagram.

The Piper diagram in figure 18 displays the groundwater chemistry for the major and minor aquifers in the project and surrounding area (fig. 18 and appendix C). All alluvial aquifer samples were lumped together for this analysis. Surface-water chemistry was added to the diagram to display the irrigation recharge source from Rock Creek. The diagram shows the surface water and the alluvial groundwater (black and green circles, respectively) to be similar calcium–bicarbonate water, but with more variability in the alluvial groundwater. The bedrock aquifers show a progression from calcium-dominated cation chemistry to sodium-dominated anion.

Figure 19 shows the water chemistry for the Eagle and Eagle/Telegraph Creek aquifers and Rock Creek. The diamond plot in the center of the diagram displays three populations of water chemistry: (1) calcium–bicarbonate (black squares); (2) mixed-cation–sulfate (green triangles); and (3) a mixture between these two types of water (orange circles and triangles). This sug-

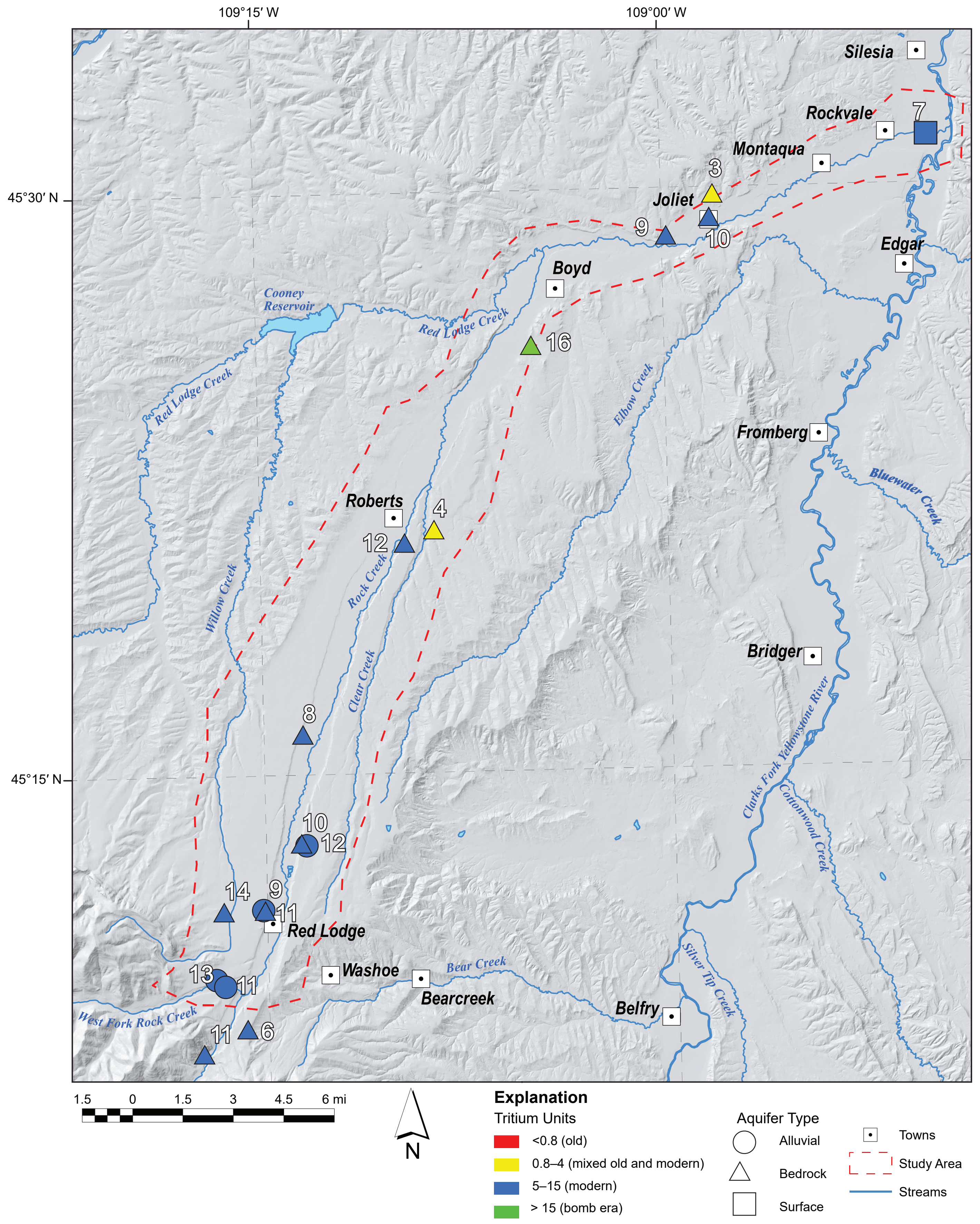

Figure 17. Tritium values indicate that the groundwater is mostly “modern.”

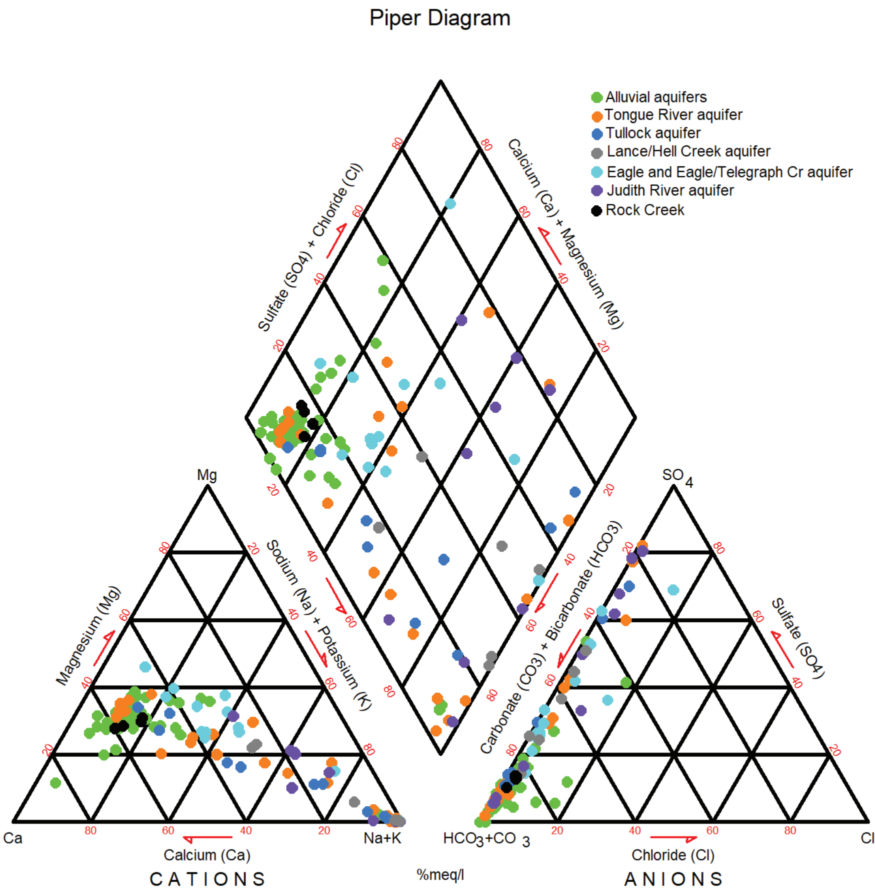

Figure 18. The water chemistry for major and minor aquifers in and around the project area.

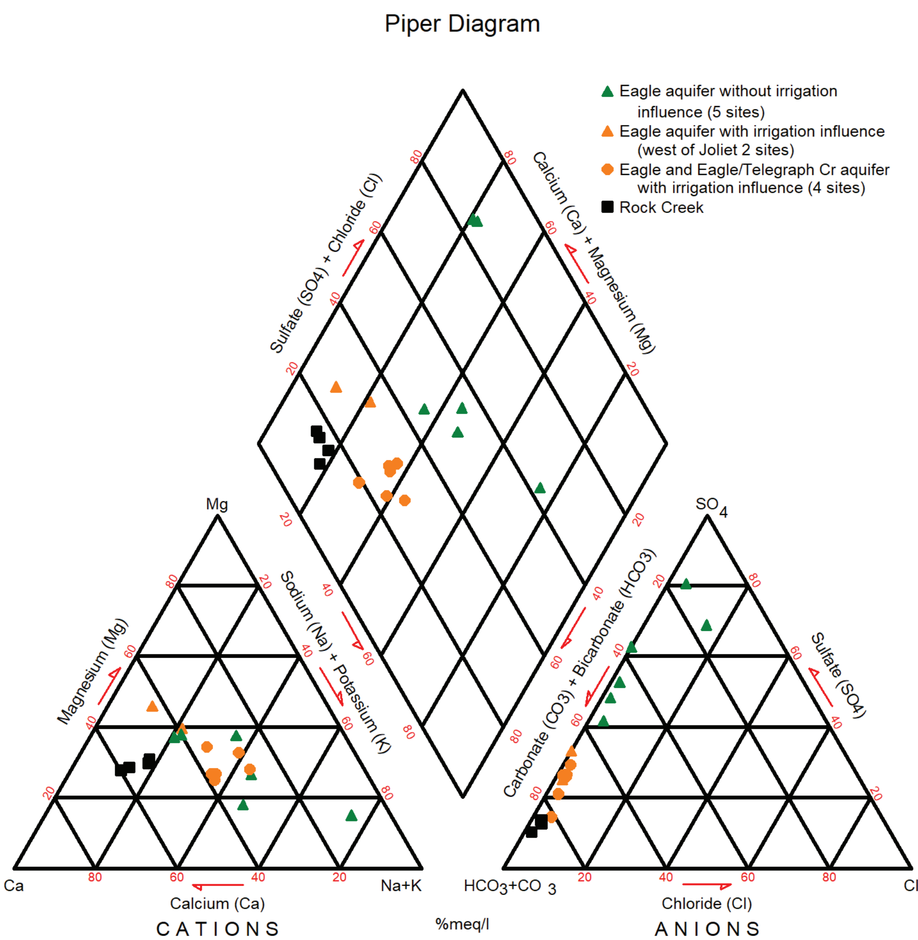

Figure 19. The Eagle and Eagle/Telegraph Creek aquifer in Joliet have a mixture of groundwater derived from precipitation and irrigation water (Rock Creek).

gests the Eagle and Eagle/Telegraph Creek aquifer in Joliet, located downgradient of irrigation, is a mixture of groundwater from precipitation and irrigation water.

Nitrate in Groundwater

Infants younger than 6 months may experience shortness of breath and blue-baby syndrome from drinking water containing greater than 10 mg/L nitrate [United States Environmental Protection Agency (EPA), 2017]. Potential anthropogenic sources of nitrate in groundwater include septic systems, sewage, agricultural fertilizers, and animal manure. The impacts of nitrate from septic systems depends upon soil characteristics, system design and efficiency, and housing density. The impacts of nitrate from other sources are largely affected by plant uptake, agricultural practices, and soil characteristics.

The nitrate concentrations in groundwater in the Valley Alluvial, West Bench Alluvial, and East Bench Alluvial aquifers range from 0.07 to 3.99 mg/L. The surrounding upland bedrock aquifer nitrate concentrations range from 0.02 to 5.21 mg/L, based on 110 groundwater samples (GWIC, 2016). One sample, at a concentration of 11.3 mg/L, exceeded the drinking water standard. The well is completed in the Lebo member above the valley. The Lebo member is a shale not typically considered an aquifer. The elevated level may be associated with local contamination.

Arsenic

The EPA's maximum contaminant level for arsenic in drinking water is 10 parts per billion (ppb) or 10 micrograms per liter (µg/L). An inventoried well completed in the Lance aquifer had elevated arsenic levels. The groundwater in the well was sampled in 2002 then again in 2015. The arsenic levels were 53.5 and 69.1 µg/L, respectively, and the pH value was 9.40.

ROBERTS PUBLIC WATER SUPPLY

The town of Roberts has two public water supply wells completed in the Valley Alluvial aquifer. According to the well logs, the alluvium is about 30 ft thick (GWIC IDs 206322, 206323). Water from these wells has a specific conductance of 295 µs/cm, pH of 6.26, and a temperature of 10.6°C. The static water levels were less than 5 ft below ground surface at the time of inventory in the irrigation season. Other well logs in Roberts report gravel thickness of up to 40 ft with static water levels only 4 ft below ground surface. Shallow water levels leave the alluvial aquifer vulnerable to surface contamination. More information is available on the Roberts public water supply from the Montana DEQ (2005a,b).

JOLIET PUBLIC WATER SUPPLY

Accurate well identification numbers (GWIC IDs) are in question regarding Joliet's public supply wells. Measuring total depths, casing size, drill dates, and by whom they were drilled can all be useful identification tools when the name of the well does not indicate it is a Joliet supply well. Attempts were made to measure total depths at all wells but were unsuccessful because of obstructions inside the well casing or sealed well caps.

Public water supply for the town of Joliet consists of three active and three inactive wells completed in sandstone of the Eagle Formation and possibly the top of the Telegraph Creek Formation. The oldest supply well was installed in 1948 and the newest in 1999. The well depths range from 105 to 265 ft. During the well inventory, field parameters were collected from the active wells. The specific conductance ranged from 744 to 844 µS/cm, pH ranged from 7.22 to 7.43, and temperature ranged from 11.0 to 12.7°C. Static water levels and total depths were not measured at the three active wells because sanitary seals precluded access. Water levels were measured and data loggers were installed in the three inactive wells. The field parameters were not collected because the well pumps are not active.

State Street Well Rehabilitation

The Joliet public water supply wells are susceptible to biological fouling (iron bacteria), which has caused Joliet to discontinue use of three of their supply wells. During this project, one of the three active wells (GWIC ID 187522) was rehabilitated. When it was drilled in 1999, the well produced 125 gpm, but as of July 2014 the production rate had dropped to 32 gpm. The highly corroded inner steel casing was removed (fig. 20) and the outer steel casing was cleaned through air bursting. The MBMG monitored a city-sponsored step drawdown test that indicated the rehabilitated well is now capable of producing 179 gpm with <30 ft drawdown (fig. 21). A periodic

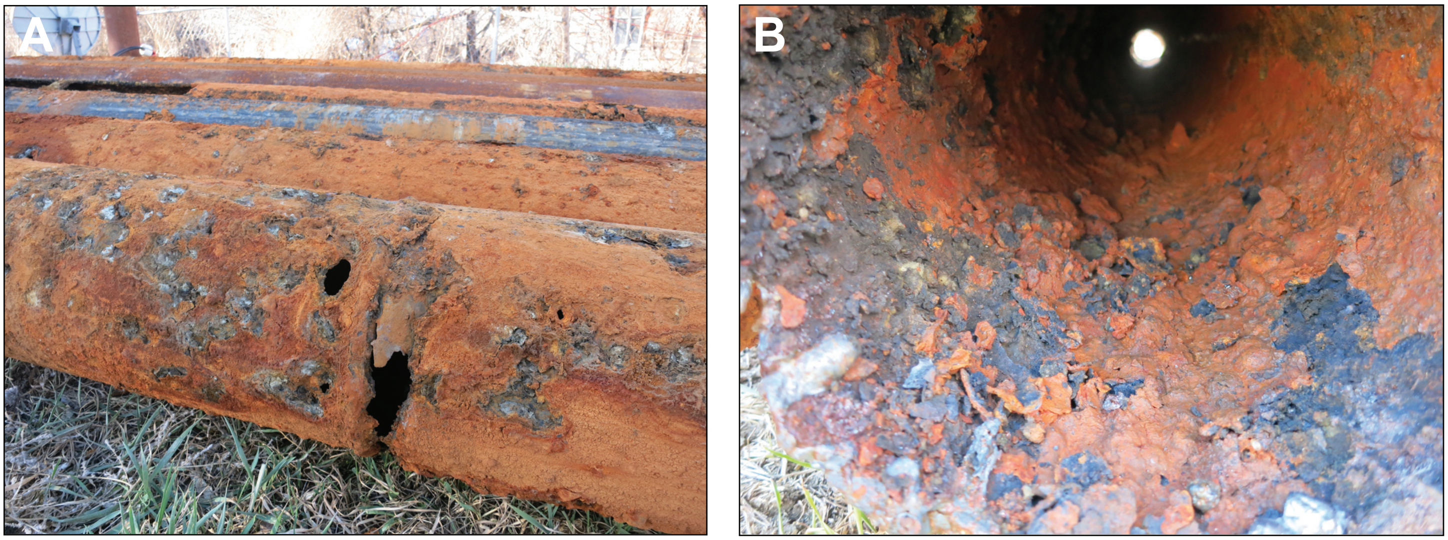

Figure 20. Degraded 8-inch well casing extracted from the State Street public water supply well in Joliet.

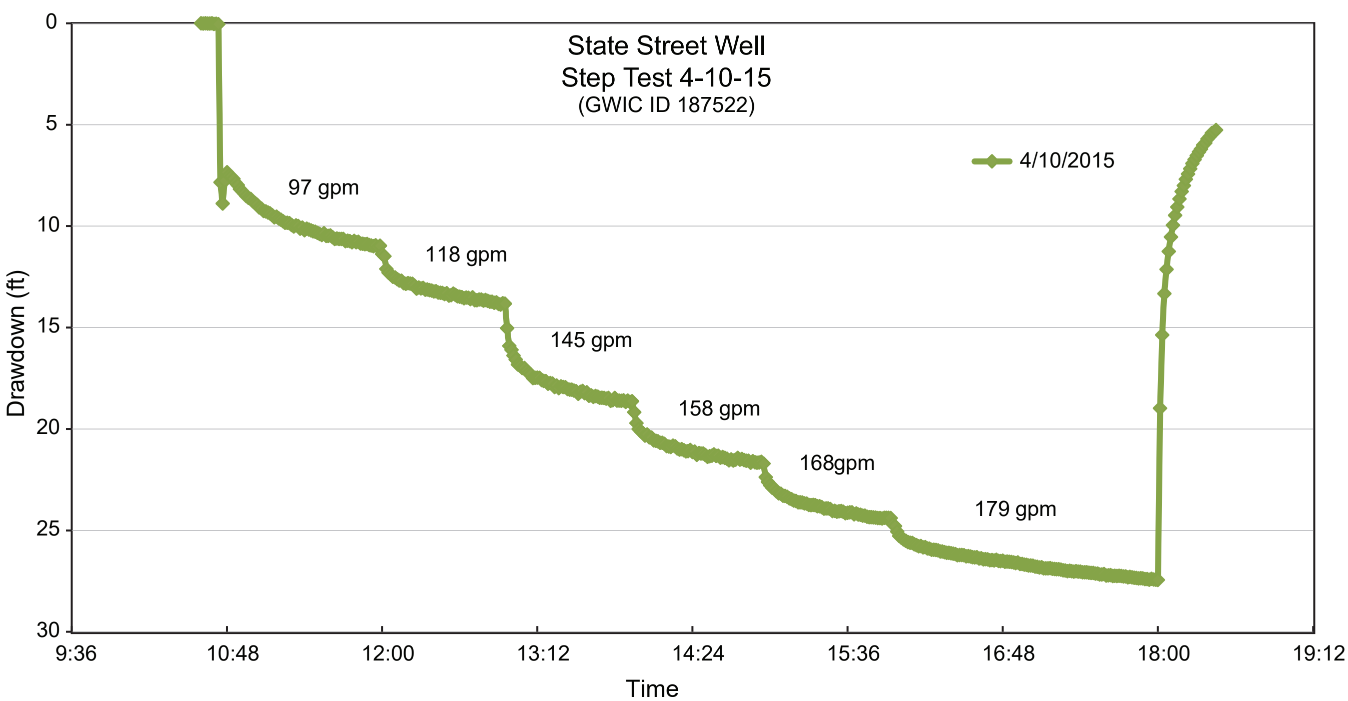

Figure 21. A step drawdown test indicates that the rehabilitated State Street public supply well can pump up to 179 gpm.

drawdown test or frequent water-level monitoring is recommended for all public supply wells to monitor well efficiency.

Joliet Water Levels

To understand the influences on the aquifer that supplies Joliet's public water supply, the MBMG monitored wells completed in the Eagle and Eagle/Telegraph Creek aquifer in Joliet and a well north of town in the Eagle aquifer where no irrigation occurs (fig. 22).

GWIC well 150036 (fig. 23, orange), outside of irrigation effects, is recharged by local precipitation. Hand measurements captured a water-level rise in the spring of 2016, but it was quickly overwhelmed by pumping drawdown. The water levels return to baseline from October to March when normal household use begins. Water levels fall during the summer when lawns are actively irrigated.

The Joliet town well "Hortsman" (fig. 23, green) shows water-level rise with irrigation activation. The timing of seasonal water-level rises was compared to Joliet precipitation and to activity of an upgradient,

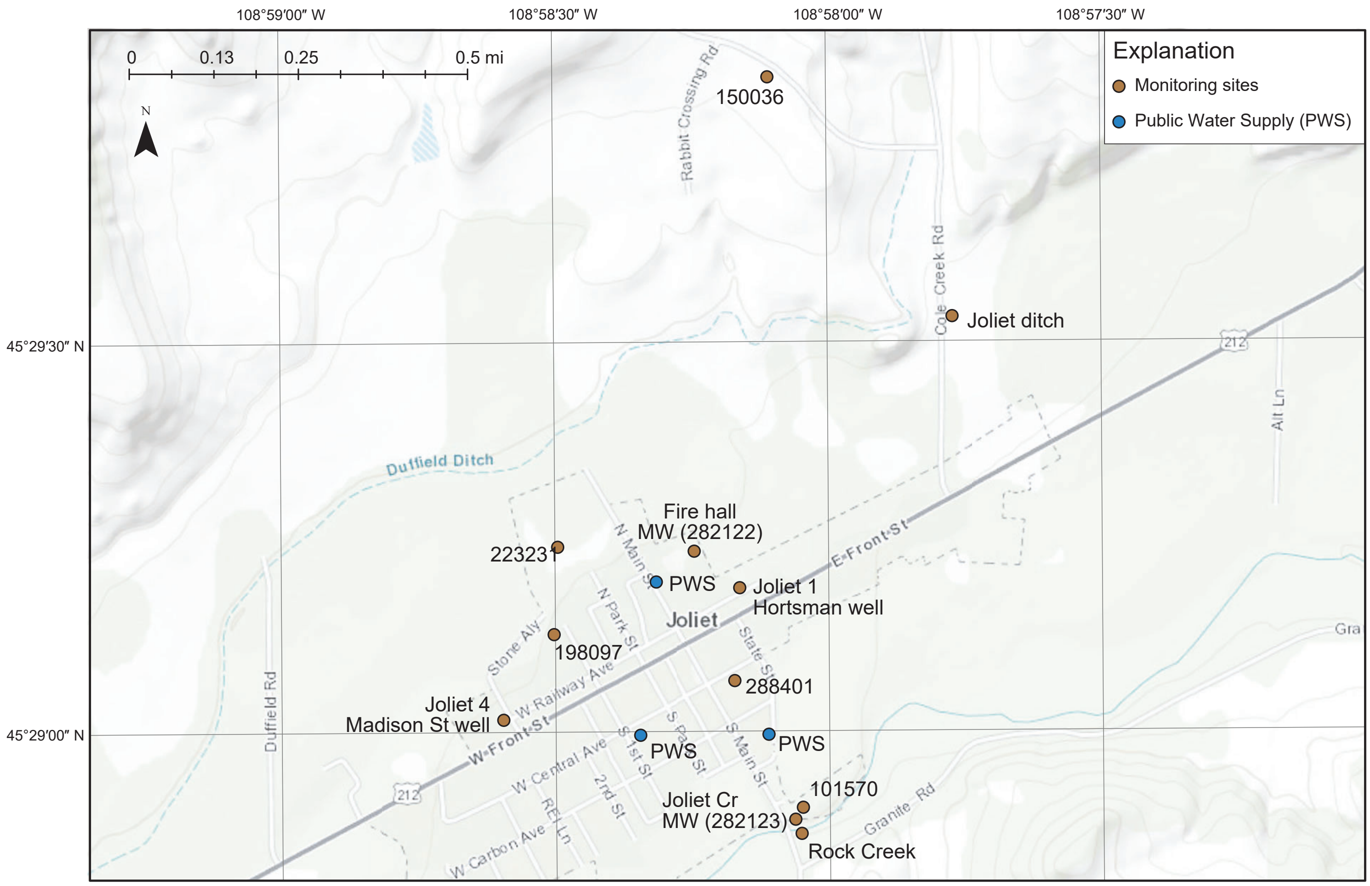

Figure 22. Location of monitored wells, ditch and Rock Creek at Joliet, Montana.

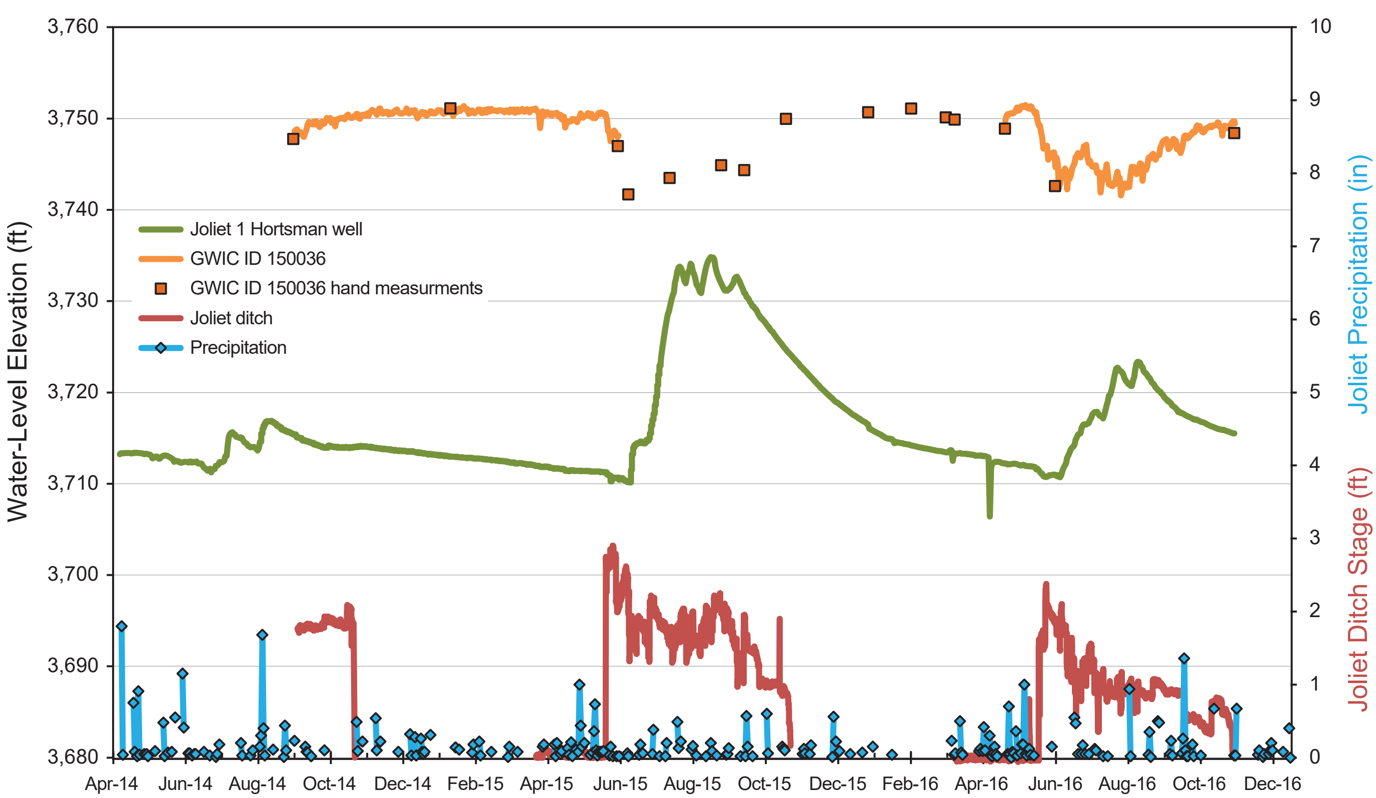

Figure 23. Water levels indicate the "Joliet 1 Hortsman" well receives recharge from irrigation activities and Joliet Ditch leakage.

leaky ditch. The groundwater level responds to the timing and duration of irrigation activities more than precipitation events.

Within the groundwater levels there are three distinctive groups: (1) Rock Creek and monitoring well GWIC ID 282123, located near the creek; (2) three shallow (70 ft) Eagle or Eagle/Telegraph Creek aquifer domestic wells (GWIC IDs 223231, 288401, and 198097); and (3) three deep (130–265 ft) Eagle or Eagle/Telegraph Creek aquifer unused city supply wells (1 Hortsman, Joliet 4 Madison St, and GWIC ID 101570). The wells have seasonal water-level fluctuations typical for irrigation recharge. Two of the three shallow wells (GWIC IDs 223231, 198097) have higher water-level elevations, indicating completions are in upper layers of the Eagle sandstone; these locations are possibly disconnected from the public water supply aquifer. The water levels in the three deep wells (fig. 24, green lines) respond rapidly to irrigation recharge. The water-level response was larger in 2015 and 2016 compared to 2014. The causes of this difference are unclear, but may be related to ditch maintenance, precipitation patterns, and/or irrigation timing.

CONCLUSIONS

Based on stable isotope, water-quality, and water-level data, infiltration from irrigation water and leakage from irrigation ditches are the dominant source of recharge to the Valley Alluvial, West Bench, and East Bench aquifer in the Rock Creek Valley. The Eagle and Eagle/Telegraph Creek aquifer located in Joliet also receives recharge from irrigation water.

The close interaction among the alluvial aquifers, irrigation water, and river water creates aquifers sensitive to change in irrigation practices. Water levels in the aquifer can potentially be affected by changes in land use and irrigation practice, such as converting irrigated land to non-irrigated use, residential development, ditch lining, or conversion from flood application to irrigation pivot systems. In addition, the aquifer material and relatively thin soil coverage suggest that the aquifers may be highly vulnerable to surface contamination.

Irrigation creates an artificially high water table in the Valley Alluvial aquifer, and this acts as a temporary storage reservoir for surface water. The storage

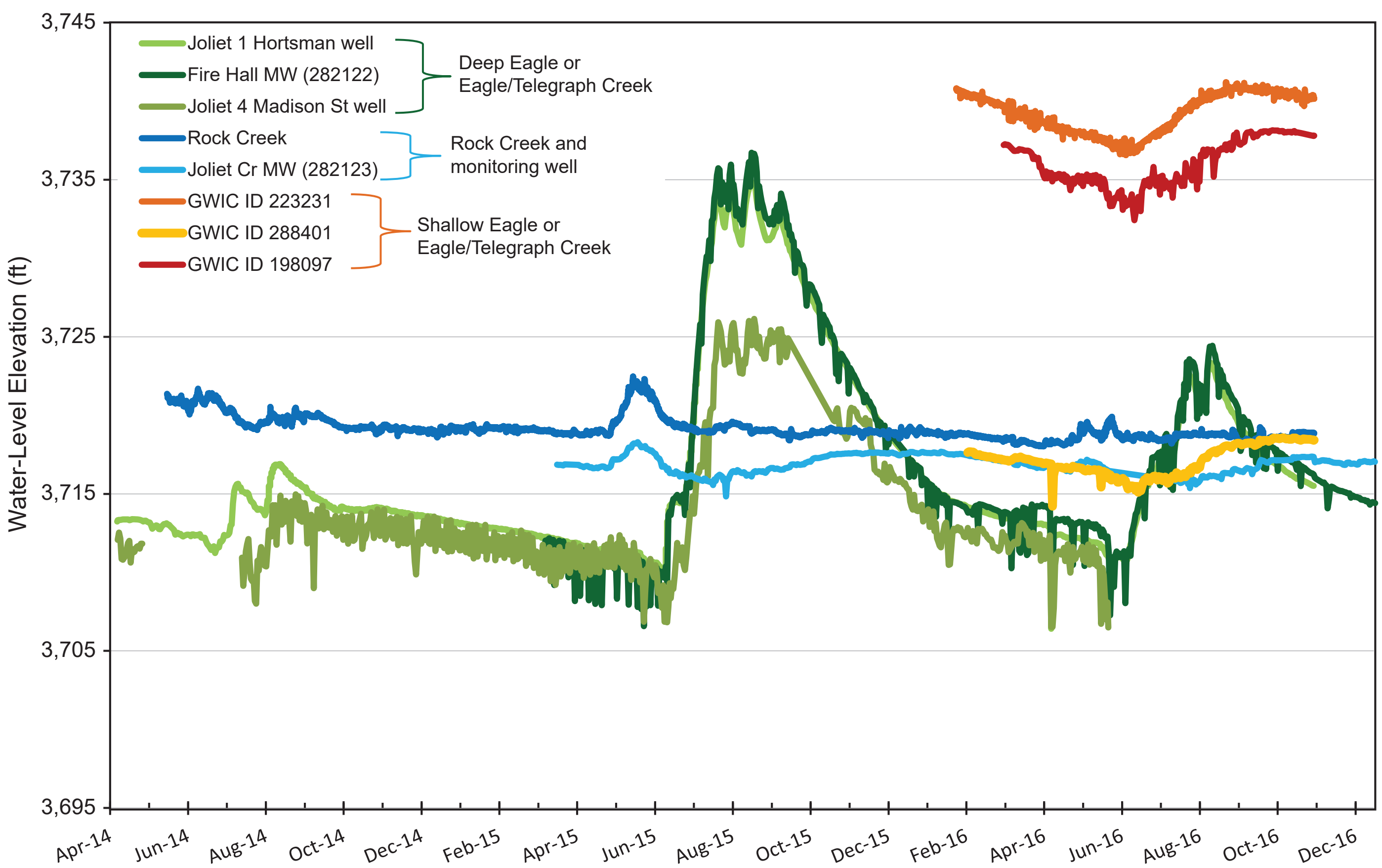

Figure 24. Three distinctive water-level hydrograph patterns were recorded in the Eagle and Eagle/Telegraph Creek aquifer.

reservoir then slowly discharges groundwater back into the river system throughout the year. A reduction in recharge to the Valley Alluvial aquifer could mean a loss of stored groundwater and therefore reduce baseflow to Rock Creek.

Bedrock aquifers located outside of Rock Creek Valley have small or discontinuous outcrops that can have limited recharge and low yields. The thickness of each bedrock aquifer varies by location. Recharge to the bedrock aquifers likely comes from local precipitation, because their surface exposures are not continuous over large areas. Water quality in the bedrock aquifers have much higher dissolved salts compared to the alluvial aquifers.

ACKNOWLEDGMENTS

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APPENDIX A:
WATER ISOTOPES

Appendix A. Water Isotopes

Gwic Id	Latitude	Longitude	Twn	Rng	Sec	Q Sec	Site Type	Sample Date	Oxygen-18	H-2
280050	45.4922	-108.9627	04S	22E	13	BBDB	DITCH OR CANAL	9/21/14	-18.3	-139
280050	45.4922	-108.9627	04S	22E	13	BBDB	DITCH OR CANAL	6/26/15	-17.9	-137
280050	45.4922	-108.9627	04S	22E	13	BBDB	DITCH OR CANAL	6/7/16	-18	-135
280050	45.4922	-108.9627	04S	22E	13	BBDB	DITCH OR CANAL	8/10/16	-16.4	-129
278914	45.4606	-109.0139	04S	22E	28	BA	DITCH OR CANAL	6/25/14	-19.3	-147
278914	45.4606	-109.0139	04S	22E	28	BA	DITCH OR CANAL	8/21/14	-19.1	-143
278914	45.4606	-109.0139	04S	22E	28	BA	DITCH OR CANAL	7/30/15	-17.9	-137
278914	45.4606	-109.0139	04S	22E	28	BA	DITCH OR CANAL	8/10/16	-17.1	-132
280048	45.3201	-109.1929	06S	21E	7	CBD	DITCH OR CANAL	8/8/14	-19.5	-146
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	4/16/14	-9.6	-80
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	4/18/14	-11.2	-87
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	5/15/14	-15.4	-114
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	5/31/14	-8.2	-66
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	6/1/14	-11.5	-83
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	6/8/14	-12.2	-86
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	8/4/14	-7.4	-53
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	8/14/14	-4	-31
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	8/20/14	-7.8	-58
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	8/22/14	-15.3	-106
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	8/24/14	-23	-190
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	11/11/14	-32.2	-240
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	11/14/14	-30.8	-229
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	11/29/14	-21.9	-163
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	12/14/14	-21	-159
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	12/28/14	-23.3	-181
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	1/8/15	-22.4	-172
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	1/31/15	-20.2	-149
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	2/17/15	-19.9	-155
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	2/20/15	-27.6	-216
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	3/2/15	-34	-262
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	4/5/15	-16.4	-125
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	8/3/15	-5.9	-51
278913	45.4853	-108.9759	04S	22E	14	CAB	PRECIP	3/23/16	-19.3	-147
281864	45.1786	-109.2463	07S	20E	34	ABDC	PRECIP	3/6/15	-23.8	-182
281864	45.1786	-109.2463	07S	20E	34	ABDC	PRECIP	3/19/15	-19.1	-145
281864	45.1786	-109.2463	07S	20E	34	ABDC	PRECIP	5/23/15	-14.8	-110
281864	45.1786	-109.2463	07S	20E	34	ABDC	PRECIP	5/26/15	-13.4	-103
281695	45.4300	-109.1074	05S	21E	3	ADDA	SPRING	2/23/16	-18.1	-138
285099	45.2118	-109.2448	07S	20E	15	CDD	SPRING	5/26/15	-19.6	-146
285099	45.2118	-109.2448	07S	20E	15	CDD	SPRING	7/23/15	-18.6	-143
285099	45.2118	-109.2448	07S	20E	15	CDD	SPRING	11/5/15	-18.8	-143
288255	45.4748	-109.0470	04S	22E	19	ADAD	SPRING	6/7/16	-18.2	-137
280049	45.4587	-109.0262	04S	22E	29	ACDD	SPRING	6/25/14	-19.7	-149
280047	45.2661	-109.2295	06S	20E	35	BAA	STREAM	8/12/14	-19.4	-146
280047	45.2661	-109.2295	06S	20E	35	BAA	STREAM	9/9/15	-18	-138
281834	45.2311	-109.2311	07S	20E	11	CBDD	STREAM	2/5/15	-18.9	-144
281835	45.3127	-109.1937	06S	21E	18	BBDC	STREAM	2/5/15	-18.9	-144
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	2/5/15	-18.5	-142
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	3/6/15	-18.4	-142
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	3/19/15	-18.5	-142
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	5/13/15	-18.2	-139
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	5/26/15	-17.9	-138
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	7/23/15	-17.6	-136
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	9/9/15	-16.9	-133
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	11/5/15	-17.7	-136
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	3/4/16	-17.8	-137
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	5/3/16	-17.5	-135
281830	45.5209	-108.8364	04S	23E	1	BBA	STREAM	10/27/16	-17.4	-134
280040	45.0564	-109.4132	09S	19E	8	BDA	STREAM	9/21/14	-18.5	-139
280040	45.0564	-109.4132	09S	19E	8	BDA	STREAM	5/25/15	-18.4	-139
280040	45.0564	-109.4132	09S	19E	8	BDA	STREAM	9/18/15	-17.6	-134

Appendix A. Water Isotopes

Gwic Id	Latitude	Longitude	Twn	Rng	Sec	Q Sec	Site Type	Sample Date	Oxygen-18	H-2
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	2/5/15	-18.9	-144
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	3/6/15	-18.9	-144
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	3/19/15	-18.9	-144
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	4/10/15	-18.8	-144
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	5/26/15	-18.5	-141
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	7/23/15	-18.1	-137
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	9/9/15	-17.7	-135
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	11/5/15	-17.4	-135
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	3/6/16	-18.3	-140
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	5/3/16	-18.5	-140
281833	45.1767	-109.2485	07S	20E	34	ACBC	STREAM	10/27/16	-17.6	-135
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	4/24/14	-18.5	-143
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	5/15/14	-18.9	-145
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	6/2/14	-19.5	-147
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	7/15/14	-18.3	-142
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	8/21/14	-18.6	-141
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	9/18/14	-18.4	-140
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	1/27/15	-18.5	-142
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	2/5/15	-18.5	-142
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	3/19/15	-18.6	-142
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	5/13/15	-18.3	-140
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	3/3/16	-17.9	-138
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	8/12/16	-16.2	-130
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	8/12/16	-16.4	-129
281831	45.5052	-108.9039	04S	23E	8	AAD	STREAM	2/5/15	-18.5	-143
281841	45.3843	-109.1421	05S	21E	21	CAB	STREAM	2/5/15	-18.8	-143
281841	45.3843	-109.1421	05S	21E	21	CAB	STREAM	5/26/15	-18.1	-137
281841	45.3843	-109.1421	05S	21E	21	CAB	STREAM	7/23/15	-18.4	-141
289925	45.3604	-109.1582	05S	21E	32	BADD	STREAM	10/27/16	-17.6	-135
281842	45.4304	-109.1116	05S	21E	3	ACAD	STREAM	2/5/15	-18.8	-143
281828	45.4759	-109.0564	04S	22E	19	BAD	STREAM	2/5/15	-18.5	-142
280052	45.4577	-109.0801	04S	21E	25	BDCD	STREAM	5/21/14	-19.6	-148
280052	45.4577	-109.0801	04S	21E	25	BDCD	STREAM	2/5/15	-18.8	-144
280052	45.4577	-109.0801	04S	21E	25	BDCD	STREAM	7/23/15	-18	-138
280052	45.4577	-109.0801	04S	21E	25	BDCD	STREAM	10/27/16	-17.7	-135
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	6/2/14	-19.5	-147
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	7/15/14	-18.3	-142
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	8/21/14	-18.6	-141
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	9/18/14	-18.4	-140
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	8/12/16	-16.2	-130
278903	45.4811	-108.9680	05S	22E	14	DCDA	STREAM	8/12/16	-16.4	-129
280046	45.3600	-109.1493	05S	21E	32	ADAB	STREAM	5/22/14	-18.6	-141
280046	45.3600	-109.1493	05S	21E	32	ADAB	STREAM	8/21/14	-19	-142
280046	45.3600	-109.1493	05S	21E	32	ADAB	STREAM	5/13/15	-17.6	-135
281840	45.3738	-109.1462	05S	21E	28	BCBA	STREAM	2/5/15	-18.8	-143
281840	45.3738	-109.1462	05S	21E	28	BCBA	STREAM	3/6/15	-18.6	-142
281840	45.3738	-109.1462	05S	21E	28	BCBA	STREAM	7/23/15	-18.1	-139
281840	45.3738	-109.1462	05S	21E	28	BCBA	STREAM	9/9/15	-17.8	-136
281840	45.3738	-109.1462	05S	21E	28	BCBA	STREAM	3/3/16	-17.9	-138
281840	45.3738	-109.1462	05S	21E	28	BCBA	STREAM	10/27/16	-17.4	-134
282265	45.3787	-109.1682	05S	21E	20	BBBB	STREAM	4/10/15	-18.1	-140
282265	45.3787	-109.1682	05S	21E	20	BBBB	STREAM	7/23/15	-17.8	-137
282265	45.3787	-109.1682	05S	21E	20	BBBB	STREAM	10/27/16	-17.8	-136
280042	45.4489	-109.1024	04S	21E	35	BACB	STREAM	5/21/14	-18.9	-144
280042	45.4489	-109.1024	04S	21E	35	BACB	STREAM	8/21/14	-18.4	-140
280042	45.4489	-109.1024	04S	21E	35	BACB	STREAM	2/5/15	-18.1	-140
280042	45.4489	-109.1024	04S	21E	35	BACB	STREAM	5/26/15	-17.6	-137
280042	45.4489	-109.1024	04S	21E	35	BACB	STREAM	3/3/16	-17.3	-135
281860	45.4682	-109.0895	04S	21E	23	DDBA	STREAM	3/6/15	-18	-139
281860	45.4682	-109.0895	04S	21E	23	DDBA	STREAM	7/23/15	-17.7	-136
281860	45.4682	-109.0895	04S	21E	23	DDBA	STREAM	9/9/15	-16.7	-132

Appendix A. Water Isotopes

Gwic Id	Latitude	Longitude	Twn	Rng	Sec	Q Sec	Site Type	Sample Date	Oxygen-18	H-2
281860	45.4682	-109.0895	04S	21E	23	DDBA	STREAM	9/20/16	-16.6	-130
281860	45.4682	-109.0895	04S	21E	23	DDBA	STREAM	10/27/16	-16.7	-130
281694							WELL	1/27/15	-18.2	-141
284846	45.4939	-108.9583	04S	22E	12	CDC	WELL	1/13/16	-17.7	-138
206912	45.3200	-109.1926	06S	21E	7	CBCA	WELL	8/8/14	-18.9	-143
206912	45.3200	-109.1926	06S	21E	7	CBCA	WELL	4/10/15	-18.6	-141
279457	45.4828	-108.9684	04S	22E	14	DACC	WELL	1/27/15	-18	-139
279457	45.4828	-108.9684	04S	22E	14	DACC	WELL	3/6/15	-18.1	-140
279457	45.4828	-108.9684	04S	22E	14	DACC	WELL	9/25/15	-17.2	-136
122624	45.4643	-109.0224	04S	22E	28	BBBD	WELL	5/22/14	-18.6	-141
122624	45.4643	-109.0224	04S	22E	28	BBBD	WELL	8/21/14	-18.9	-142
122624	45.4643	-109.0224	04S	22E	28	BBBD	WELL	1/27/15	-18.6	-142
122624	45.4643	-109.0224	04S	22E	28	BBBD	WELL	5/26/15	-18.7	-143
179434	45.5197	-108.8589	04S	23E	2	BBD	WELL	6/17/15	-17.6	-136
223039	45.5047	-108.9078	04S	23E	8	A	WELL	7/15/14	-17.9	-138
223039	45.5047	-108.9078	04S	23E	8	A	WELL	11/7/14	-18.1	-140
223039	45.5047	-108.9078	04S	23E	8	A	WELL	1/27/15	-18.3	-141
223039	45.5047	-108.9078	04S	23E	8	A	WELL	6/17/15	-17.7	-137
223039	45.5047	-108.9078	04S	23E	8	A	WELL	2/9/16	-17.3	-135
288258	45.4748	-109.0537	04S	22E	19	ACB	WELL	6/7/16	-18.5	-140
191002	45.1751	-109.2676	07S	20E	33	ACCA	WELL	4/20/15	-19.2	-146
277124	45.3573	-109.1701	05S	21E	32	BCBC	WELL	6/25/14	-18.1	-137
226244	45.3571	-109.1711	05S	21E	31	DAAC	WELL	6/25/14	-18.2	-139
216153	45.3897	-109.1422	05S	21E	21	BACC	WELL	8/8/14	-18.5	-141
103963	45.3297	-109.1846	06S	21E	7	BABB	WELL	10/2/14	-19	-144
216141	45.4302	-109.1076	05S	21E	3	ADDA	WELL	5/21/14	-18.7	-144
216141	45.4302	-109.1076	05S	21E	3	ADDA	WELL	8/21/14	-19.4	-145
216141	45.4302	-109.1076	05S	21E	3	ADDA	WELL	1/30/15	-18.7	-143
216141	45.4302	-109.1076	05S	21E	3	ADDA	WELL	2/5/15	-18.7	-143
216141	45.4302	-109.1076	05S	21E	3	ADDA	WELL	5/26/15	-18.6	-144
172583	45.2677	-109.2263	06S	20E	35	ABCC	WELL	8/12/14	-18.9	-143
172583	45.2677	-109.2263	06S	20E	35	ABCC	WELL	1/30/15	-18.6	-143
172583	45.2677	-109.2263	06S	20E	35	ABCC	WELL	9/9/15	-18.5	-142
279363	45.2682	-109.2270	06S	20E	35	ABCA	WELL	8/12/14	-19.3	-146
279363	45.2682	-109.2270	06S	20E	35	ABCA	WELL	1/30/15	-19.1	-146
279363	45.2682	-109.2270	06S	20E	35	ABCA	WELL	9/9/15	-18.5	-143
102937	45.3584	-109.1721	05S	21E	31	AD	WELL	6/25/14	-18.3	-140
198097	45.4838	-108.9747	04S	22E	14	CAD	WELL	3/18/16	-18.4	-144
187522	45.4853	-108.9697	04S	22E	14	DDBC	WELL	4/25/14	-17.9	-138
187522	45.4853	-108.9697	04S	22E	14	DDBC	WELL	8/21/14	-18.4	-139
187522	45.4853	-108.9697	04S	22E	14	DDBC	WELL	8/21/14	-18.4	-139
187522	45.4853	-108.9697	04S	22E	14	DDBC	WELL	9/25/14	-17.9	-138
187522	45.4853	-108.9697	04S	22E	14	DDBC	WELL	1/30/15	-18.2	-140
187522	45.4853	-108.9697	04S	22E	14	DDBC	WELL	4/10/15	-18.1	-139
187522	45.4853	-108.9697	04S	22E	14	DDBC	WELL	4/10/15	-18.1	-140
187522	45.4853	-108.9697	04S	22E	14	DDBC	WELL	1/13/16	-18.2	-141
187522	45.4853	-108.9697	04S	22E	14	DDBC	WELL	3/25/16	-17.9	-139
101574	45.4797	-108.9974	04S	22E	15	CDCC	WELL	9/8/02	-17.88	-139.09
101574	45.4797	-108.9974	04S	22E	15	CDCC	WELL	9/8/02	-17.88	-139.09
282122	45.4872	-108.9708	04S	22E	14	ACD	WELL	3/24/15	-18	-139
282122	45.4872	-108.9708	04S	22E	14	ACD	WELL	3/21/16	-17.9	-139
282122	45.4872	-108.9708	04S	22E	14	ACD	WELL	3/21/16	-17.8	-139
282123	45.4813	-108.9678	04S	22E	14	DDBC	WELL	3/24/15	-18.1	-141
282123	45.4813	-108.9678	04S	22E	14	DDBC	WELL	8/12/16	-17.8	-139
282123	45.4813	-108.9678	04S	22E	14	DDBC	WELL	8/12/16	-17.7	-139
282123	45.4813	-108.9678	04S	22E	14	DDBC	WELL	8/12/16	-17.7	-139
282123	45.4813	-108.9678	04S	22E	14	DDBC	WELL	8/12/16	-17.7	-139
223231	45.4875	-108.9747	04S	22E	14	BDD	WELL	2/9/16	-18.1	-139
244801	45.4865	-108.9757	04S	22E	14	CAA	WELL	2/9/16	-17.9	-140
288401	45.4844	-108.9696	04S	22E	14	DBDA	WELL	7/29/16	-18	-137
288401							WELL	2/18/16	-17.7	-137

Appendix A. Water Isotopes

Gwic Id	Latitude	Longitude	Twn	Rng	Sec	Q Sec	Site Type	Sample Date	Oxygen-18	H-2
228297	45.4844	-108.9762	04S	22E	14	CAC	WELL	10/2/14	-18.4	-143
228297	45.4844	-108.9762	04S	22E	14	CAC	WELL	7/29/16	-18.4	-142
101570	45.4817	-108.9675	04S	22E	14	DCAD	WELL	6/6/96		
101569	45.4868	-108.9720	04S	22E	14	ACCC	WELL	4/25/14	-17.8	-137
101569	45.4868	-108.9720	04S	22E	14	ACCC	WELL	3/23/16	-17.9	-139
101569	45.4868	-108.9720	04S	22E	14	ACCC	WELL	3/23/16	-17.9	-139
101569	45.4868	-108.9720	04S	22E	14	ACCC	WELL	3/24/16	-17.9	-139
101569	45.4868	-108.9720	04S	22E	14	ACCC	WELL	3/24/16	-17.9	-139
101564	45.4831	-108.9719	04S	22E	14	DCBB	WELL	6/6/96		
101564	45.4831	-108.9719	04S	22E	14	DCBB	WELL	4/25/14	-17.8	-138
101564	45.4831	-108.9719	04S	22E	14	DCBB	WELL	8/27/14	-18.3	-141
101564	45.4831	-108.9719	04S	22E	14	DCBB	WELL	1/30/15	-18	-141
101564	45.4831	-108.9719	04S	22E	14	DCBB	WELL	3/25/16	-18	-141
150036	45.4973	-108.9684	04S	22E	11	DCAA	WELL	6/17/15	-18.7	-149
150036	45.4973	-108.9684	04S	22E	11	DCAA	WELL	6/17/16	-19	-148
287268	45.4979	-108.9687	04S	22E	11	BDD	WELL	5/6/16	-18.6	-146
101707	45.4945	-108.8385	04S	23E	12	CCD	WELL	6/26/15	-18.6	-144
204130	45.4706	-108.9896	04S	22E	22	DBAD	WELL	5/15/14	-18.4	-140
204130	45.4706	-108.9896	04S	22E	22	DBAD	WELL	4/10/15	-18.7	-143
204130	45.4706	-108.9896	04S	22E	22	DBAD	WELL	5/13/15	-18.6	-143
204130	45.4706	-108.9896	04S	22E	22	DBAD	WELL	7/30/15	-18.3	-140
101620	45.4606	-109.0135	04S	22E	28	ACBC	WELL	5/22/14	-18	-141
101620	45.4606	-109.0135	04S	22E	28	ACBC	WELL	6/25/14	-18.5	-142
101620	45.4606	-109.0135	04S	22E	28	ACBC	WELL	8/21/14	-18.9	-142
101620	45.4606	-109.0135	04S	22E	28	ACBC	WELL	1/27/15	-18	-143
101620	45.4606	-109.0135	04S	22E	28	ACBC	WELL	7/30/15	-18.2	-140
101620	45.4606	-109.0135	04S	22E	28	ACBC	WELL	4/1/16	-18	-143
235197	45.4911	-108.9621	04S	22E	13	BBC	WELL	6/26/15	-18.3	-140
216145	45.2722	-109.2277	06S	20E	26	CDAD	WELL	8/12/14	-18.9	-143
216145	45.2722	-109.2277	06S	20E	26	CDAD	WELL	5/26/15	-18.9	-144
196630	45.2654	-109.2309	06S	20E	35	BDB	WELL	8/12/14	-18.8	-141
102991	45.4179	-108.9173	05S	23E	8	BA	WELL	5/13/15	-17.8	-137
214178	45.3550	-109.1435	05S	21E	33	CBAD	WELL	5/22/14	-17.4	-135
214178	45.3550	-109.1435	05S	21E	33	CBAD	WELL	5/13/15	-17.4	-138
214178	45.3550	-109.1435	05S	21E	33	CBAD	WELL	11/5/15	-17.7	-138
175243	45.4335	-109.0816	05S	21E	1	BBDD	WELL	9/11/02	-17.77	-138.41
175243	45.4335	-109.0816	05S	21E	1	BBDD	WELL	9/11/02	-17.77	-138.41
175243	45.4335	-109.0816	05S	21E	1	BBDD	WELL	7/15/14	-17.5	-138
175243	45.4335	-109.0816	05S	21E	1	BBDD	WELL	9/18/14	-17.8	-140
175243	45.4335	-109.0816	05S	21E	1	BBDD	WELL	5/13/15	-17.4	-139
161309	45.3851	-109.1387	05S	21E	21	CAAB	WELL	5/21/14	-17.6	-135
161309	45.3851	-109.1387	05S	21E	21	CAAB	WELL	7/23/15	-17.8	-137
161309	45.3851	-109.1387	05S	21E	21	CAAB	WELL	9/9/15	-17.5	-136
248967	45.5375	-108.9214	03S	23E	32	BBB	WELL	9/25/14	-16.7	-135

APPENDIX B:
TRITIUM

Appendix B. Tritium

GWIC ID	Latitude	Longitude	Type	Aquifer	Total depth (ft)	Sample date	Tritium (TU)	Error +/-	Approximate Age
150036	45.4973	-108.9684	WELL	211EGLE	245	6/17/15	3.0	2	mixture
214178	45.3550	-109.1435	WELL	125TLCK	265	11/5/15	4.0	2	mixture
161411	45.1411	-109.2636	WELL	120LNLY	405	8/6/02	5.9	1	modern
281830	45.5209	-108.8364	CREEK			1/13/16	7.0	2	modern
281830	45.5209	-108.8364	CREEK			10/18/16	8.0	2	modern
172583	45.2677	-109.2263	WELL	125TGRV	70	9/9/15	8.0	2	modern
101574	45.4797	-108.9974	WELL	211EGLE	210	9/8/02	8.9	1	modern
149925	45.1921	-109.2515	WELL	125TGRV	150	6/12/03	9.3	1	modern
282122	45.4872	-108.9708	WELL	211EGLE	130	3/21/16	10.0	2	modern
162756	45.2208	-109.2286	WELL	125TGRV	180	8/29/02	10.1	1	modern
154738	45.1626	-109.2820	WELL	112SNGR	122	4/15/04	10.9	1	modern
176387	45.1923	-109.2525	WELL	112SNGR	59	6/12/03	11.3	1	modern
173046	45.1307	-109.2904	WELL	341UDFD	345	4/22/04	11.4	1	modern
189951	45.2199	-109.2253	WELL	112SNGR	21	11/19/02	11.5	1	modern
154728	45.3495	-109.1617	WELL	125TLCK	220	9/8/02	11.7	1	modern
173039	45.1596	-109.2766	WELL	110SNGR	60	11/19/02	12.7	1	modern
150239	45.1918	-109.2767	WELL	125FRUN	330	8/20/02	14.0	1	modern
175243	45.4335	-109.0816	WELL	211LNCE	110	9/11/02	15.5	1	bomb era

APPENDIX C:
WATER QUALITY

Appendix C. Water Quality

GwicId	Latitude	Longitude	Ground	Twn	Rng	Sec	QSec	County	SiteType	Aquifer	Depth_ft_	SampleDate	WaterTemp
106078	45.0620	-109.4039	7140	09S	19E	8	ABDC	CARBON	WELL	110SNGR	46	5/17/04 0:00	3
173039	45.1596	-109.2766	5865	08S	20E	4	BCDC	CARBON	WELL	110SNGR	60	7/16/09 0:00	7
173039	45.1596	-109.2766	5865	08S	20E	4	BCDC	CARBON	WELL	110SNGR	60	11/19/02 0:00	8
102937	45.3584	-109.1721	4590	05S	21E	31	AD	CARBON	WELL	110TRRC	36	6/25/14 0:00	11
104893	45.2169	-108.9581	3725	07S	23E	19	BAAC	CARBON	WELL	111SNGR	42	7/13/04 0:00	10
105455	45.1213	-109.2959	6120	08S	20E	20	BBDB	CARBON	WELL	111SNGR	34	9/29/04 0:00	8
105523	45.1438	-109.0060	3845	08S	22E	15	AAAD	CARBON	WELL	111SNGR	55	8/20/09 0:00	11
105523	45.1438	-109.0060	3845	08S	22E	15	AAAD	CARBON	WELL	111SNGR	55	11/20/02 0:00	11
133465	45.0841	-109.0590	3995	09S	22E	5	BADC	CARBON	WELL	111SNGR	90	6/21/05 0:00	12
144132	45.3195	-109.2713	4720	06S	20E	9	CADB	CARBON	WELL	111SNGR	36	8/26/04 0:00	10
162212	45.4820	-108.9669	0	04S	22E	14	DDB	CARBON	WELL	111SNGR	70	1/27/15 0:00	0
216153	45.3897	-109.1422	4390	05S	21E	21	BACC	CARBON	WELL	111SNGR	12	8/8/14 0:00	0
172583	45.2677	-109.2263	5090	06S	20E	35	ABCC	CARBON	WELL	112ALVM	70	9/9/15 0:00	9
172583	45.2677	-109.2263	5090	06S	20E	35	ABCC	CARBON	WELL	112ALVM	70	1/30/15 0:00	8
172583	45.2677	-109.2263	5090	06S	20E	35	ABCC	CARBON	WELL	112ALVM	70	1/30/15 0:00	0
172583	45.2677	-109.2263	5090	06S	20E	35	ABCC	CARBON	WELL	112ALVM	70	8/12/14 0:00	0
8032	45.1617	-109.3914	6905	08S	19E	4	BDBC	CARBON	WELL	112SNGR	46	7/28/76 0:00	2
8033	45.0875	-109.3242	6370	08S	19E	36	ACCD	CARBON	WELL	112SNGR	40	7/28/76 0:00	3
101602	45.4692	-109.0164	3860	04S	22E	21	CADC	CARBON	WELL	112SNGR	22	6/19/04 0:00	9
103963	45.3297	-109.1846	4722	06S	21E	7	BABB	CARBON	WELL	112SNGR	26.5	10/2/14 0:00	11
104684	45.2148	-109.2718	5533	07S	20E	16	CADC	CARBON	WELL	112SNGR	33	3/20/07 0:00	9
104689	45.2124	-109.2702	5555	07S	20E	16	DCCB	CARBON	WELL	112SNGR	32.7	3/20/07 0:00	9
104689	45.2124	-109.2702	5555	07S	20E	16	DCCB	CARBON	WELL	112SNGR	32.7	8/14/02 0:00	10
104763	45.1903	-109.2467	5545	07S	20E	27	ACCA	CARBON	WELL	112SNGR	38	7/16/09 0:00	9
104763	45.1903	-109.2467	5545	07S	20E	27	ACCA	CARBON	WELL	112SNGR	38	8/14/02 0:00	9
105324	45.1622	-109.3930	6905	08S	19E	4	BCAA	CARBON	WELL	112SNGR	36	11/5/08 0:00	4
105324	45.1622	-109.3930	6905	08S	19E	4	BCAA	CARBON	WELL	112SNGR	36	9/15/04 0:00	6
122624	45.4643	-109.0224	3905	04S	22E	28	BBBD	CARBON	WELL	112SNGR	32	5/26/15 0:00	10
122624	45.4643	-109.0224	3905	04S	22E	28	BBBD	CARBON	WELL	112SNGR	32	1/27/15 0:00	11
122624	45.4643	-109.0224	3905	04S	22E	28	BBBD	CARBON	WELL	112SNGR	32	8/21/14 0:00	0
122624	45.4643	-109.0224	3905	04S	22E	28	BBBD	CARBON	WELL	112SNGR	32	5/22/14 0:00	10
154738	45.1626	-109.2820	5990	08S	20E	5	ADAB	CARBON	WELL	112SNGR	122	4/15/04 0:00	9
161253	45.4528	-109.1004	4070	04S	21E	26	CDCA	CARBON	WELL	112SNGR	35	7/7/11 0:00	11
161253	45.4528	-109.1004	4070	04S	21E	26	CDCA	CARBON	WELL	112SNGR	35	8/9/02 0:00	12
161403	45.0839	-109.3393	6540	08S	19E	35	DADC	CARBON	WELL	112SNGR	127	9/9/04 0:00	7
165323	45.2735	-109.2383	5150	06S	20E	26	CCBB	CARBON	WELL	112SNGR	30	9/13/04 0:00	9
170571	45.1940	-109.2642	5676	07S	20E	28	AACB	CARBON	WELL	112SNGR	58	7/9/05 0:00	8
170571	45.1940	-109.2642	5676	07S	20E	28	AACB	CARBON	WELL	112SNGR	58	7/9/05 0:00	8
176387	45.1923	-109.2525	5668	07S	20E	27	BDBA	CARBON	WELL	112SNGR	59	6/12/03 0:00	12
179434	45.5197	-108.8589	3473	04S	23E	2	BBD	CARBON	WELL	112SNGR	22	6/17/15 0:00	11
189951	45.2199	-109.2253	5490	07S	20E	14	ACDC	CARBON	WELL	112SNGR	21	11/19/02 0:00	10
191002	45.1751	-109.2676	5835	07S	20E	33	ACCA	CARBON	WELL	112SNGR	105	4/20/15 0:00	9
196860	45.3628	-109.1652	4555	05S	21E	32	BBAC	CARBON	WELL	112SNGR	40	8/14/03 0:00	14
206912	45.3200	-109.1926	4775	06S	21E	7	CBCA	CARBON	WELL	112SNGR	36	4/10/15 0:00	8
206912	45.3200	-109.1926	4775	06S	21E	7	CBCA	CARBON	WELL	112SNGR	36	8/8/14 0:00	0
211063	45.5023	-108.9171	3610	04S	23E	8	BDCB	CARBON	WELL	112SNGR	10	6/6/04 0:00	10
216141	45.4302	-109.1076	4170	05S	21E	3	ADDA	CARBON	WELL	112SNGR	26	5/26/15 0:00	9
216141	45.4302	-109.1076	4170	05S	21E	3	ADDA	CARBON	WELL	112SNGR	26	2/5/15 0:00	0
216141	45.4302	-109.1076	4170	05S	21E	3	ADDA	CARBON	WELL	112SNGR	26	1/30/15 0:00	8
216141	45.4302	-109.1076	4170	05S	21E	3	ADDA	CARBON	WELL	112SNGR	26	8/21/14 0:00	0
216141	45.4302	-109.1076	4170	05S	21E	3	ADDA	CARBON	WELL	112SNGR	26	5/21/14 0:00	8
223039	45.5047	-108.9078	3589	04S	23E	8	A	CARBON	WELL	112SNGR	18	2/9/16 0:00	9
223039	45.5047	-108.9078	3589	04S	23E	8	A	CARBON	WELL	112SNGR	18	6/17/15 0:00	12
223039	45.5047	-108.9078	3589	04S	23E	8	A	CARBON	WELL	112SNGR	18	1/27/15 0:00	0
223039	45.5047	-108.9078	3589	04S	23E	8	A	CARBON	WELL	112SNGR	18	11/7/14 0:00	0
223039	45.5047	-108.9078	3589	04S	23E	8	A	CARBON	WELL	112SNGR	18	7/15/14 0:00	0
226244	45.3571	-109.1711	4600	05S	21E	31	DAAC	CARBON	WELL	112SNGR	40	6/25/14 0:00	0
251283	45.1648	-109.2887	6040	08S	20E	5	ABBD	CARBON	WELL	112SNGR	80	8/3/11 0:00	8
251285	45.1914	-109.2589	5688	08S	20E	27	BCBB	CARBON	WELL	112SNGR	41	8/3/11 0:00	7
251297	45.1913	-109.2557	5681	08S	20E	27	BCBB	CARBON	WELL	112SNGR	57.5	8/3/11 0:00	8
251298	45.2364	-109.2615	5393	08S	20E	9	ACAA	CARBON	WELL	112SNGR	32.5	8/3/11 0:00	7
251299	45.2856	-109.2436	5088	06S	20E	27	DCCC	CARBON	WELL	112SNGR	32	8/4/11 0:00	7
251300	45.3364	-109.1977	4760	06S	20E	1	DAA	CARBON	WELL	112SNGR	41	8/4/11 0:00	8
251301	45.3856	-109.1668	4483	05S	21E	20	BCCC	CARBON	WELL	112SNGR	34.5	8/4/11 0:00	9
251302	45.2477	-109.2072	5308	07S	20E	1	CAD	CARBON	WELL	112SNGR	21	8/4/11 0:00	9
251313	45.2275	-109.2222	5454	07S	20E	11	DDCD	CARBON	WELL	112SNGR	31	8/4/11 0:00	11

Appendix C. Water Quality

GwicId	Latitude	Longitude	Ground	Twn	Rng	Sec	QSec	County	SiteType	Aquifer	Depth_ft_	SampleDate	WaterTemp
251314	45.2083	-109.2773	5576	07S	20E	21	BBCD	CARBON	WELL	112SNGR	41	8/3/11 0:00	10
251315	45.3216	-109.2160	4859	06S	20E	12	CBBB	CARBON	WELL	112SNGR	39	8/4/11 0:00	9
277124	45.3573	-109.1701	4597	05S	21E	32	BCBC	CARBON	WELL	112SNGR	30	6/25/14 0:00	0
279363	45.2682	-109.2270	5101	06S	20E	35	ABCA	CARBON	WELL	112SNGR	7.55	9/9/15 0:00	12
279363	45.2682	-109.2270	5101	06S	20E	35	ABCA	CARBON	WELL	112SNGR	7.55	1/30/15 0:00	3
279363	45.2682	-109.2270	5101	06S	20E	35	ABCA	CARBON	WELL	112SNGR	7.55	1/30/15 0:00	0
279363	45.2682	-109.2270	5101	06S	20E	35	ABCA	CARBON	WELL	112SNGR	7.55	8/12/14 0:00	0
279457	45.4828	-108.9684	3732	04S	22E	14	DACC	CARBON	WELL	112SNGR	7.33	3/6/15 0:00	7
150239	45.1918	-109.2767	5750	07S	20E	28	CBBB	CARBON	WELL	125FRUN	330	8/20/02 0:00	9
161298	45.3778	-109.4960	5080	05S	18E	22	CCDD	CARBON	WELL	125FRUN	170	7/20/04 0:00	10
192625	45.2959	-109.5327	5425	06S	18E	20	ABDA	CARBON	WELL	125FRUN	150	8/19/03 0:00	8
196630	45.2654	-109.2309	5178	06S	20E	35	BDB	CARBON	WELL	125FRUN	90	8/12/14 0:00	0
196630	45.2654	-109.2309	5178	06S	20E	35	BDB	CARBON	WELL	125FRUN	90	8/12/14 0:00	0
8343	45.0561	-108.9613	4110	09S	23E	18	BBDA	CARBON	WELL	125LEBO	60	7/6/84 0:00	14
104836	45.2205	-109.1292	4285	07S	21E	15	BDCC	CARBON	WELL	125LEBO	103	8/27/03 0:00	23
173009	45.3861	-109.1830	4550	05S	21E	19	BDCB	CARBON	WELL	125LEBO	280	8/20/04 0:00	13
191006	45.0842	-108.9491	4125	09S	23E	6	AACC	CARBON	WELL	125LEBO	60	10/24/02 0:00	11
220656	45.1840	-109.0932	4380	07S	21E	25	CCCC	CARBON	WELL	125LEBO	240	6/22/05 0:00	16
104686	45.2274	-109.2907	5410	07S	20E	8	CDDA	CARBON	WELL	125TGRV	150	7/16/09 0:00	9
104686	45.2274	-109.2907	5410	07S	20E	8	CDDA	CARBON	WELL	125TGRV	150	6/12/03 0:00	9
106097	45.0360	-109.0516	4070	09S	22E	20	DBAA	CARBON	WELL	125TGRV	160	10/24/02 0:00	12
127723	45.3184	-109.2777	4780	06S	20E	9	CBCC	CARBON	WELL	125TGRV	80	8/25/04 0:00	11
131617	45.2372	-109.2743	5410	07S	20E	9	BACC	CARBON	WELL	125TGRV	130	8/20/02 0:00	9
131660	45.0219	-109.2137	5660	09S	20E	24	CCCC	CARBON	WELL	125TGRV	272	11/9/04 0:00	13
149925	45.1921	-109.2515	5665	07S	20E	27	BDAB	CARBON	WELL	125TGRV	150	7/16/09 0:00	10
149925	45.1921	-109.2515	5665	07S	20E	27	BDAB	CARBON	WELL	125TGRV	150	6/12/03 0:00	9
155756	45.1110	-109.1144	4280	08S	21E	22	DDDB	CARBON	WELL	125TGRV	120	6/15/05 0:00	16
161429	45.0170	-109.1716	4960	09S	21E	29	BCCB	CARBON	WELL	125TGRV	190	8/20/09 0:00	12
161429	45.0170	-109.1716	4960	09S	21E	29	BCCB	CARBON	WELL	125TGRV	190	7/17/03 0:00	12
162756	45.2208	-109.2286	5504	07S	20E	14	BDDA	CARBON	WELL	125TGRV	180	8/29/02 0:00	9
173044	45.1472	-109.2556	5780	08S	20E	10	BCBD	CARBON	WELL	125TGRV	185	10/19/04 0:00	18
191004	45.0523	-109.1926	5200	09S	20E	12	DDDA	CARBON	WELL	125TGRV	330	7/30/03 0:00	13
193052	45.0556	-109.0028	4360	09S	22E	14	BBDC	CARBON	WELL	125TGRV	120	5/19/04 0:00	11
195934	45.0917	-109.0274	3885	08S	22E	33	DADD	CARBON	WELL	125TGRV	230	5/5/05 0:00	12
197444	45.3365	-109.1644	4775	06S	21E	5	CAAD	CARBON	WELL	125TGRV	160	5/15/08 0:00	10
199495	45.2249	-109.2225	5471	07S	20E	14	AABC	CARBON	WELL	125TGRV	70	7/16/09 0:00	9
199495	45.2249	-109.2225	5471	07S	20E	14	AABC	CARBON	WELL	125TGRV	70	7/8/03 0:00	9
199495	45.2249	-109.2225	5471	07S	20E	14	AABC	CARBON	WELL	125TGRV	70	7/8/03 0:00	9
216145	45.2722	-109.2277	5145	06S	20E	26	CDAD	CARBON	WELL	125TGRV	101	5/26/15 0:00	8
216145	45.2722	-109.2277	5145	06S	20E	26	CDAD	CARBON	WELL	125TGRV	101	8/12/14 0:00	0
144103	45.3557	-109.4581	4910	05S	18E	36	BCCC	CARBON	WELL	125TLCK	110	7/16/09 0:00	10
144103	45.3557	-109.4581	4910	05S	18E	36	BCCC	CARBON	WELL	125TLCK	110	8/28/02 0:00	11
150219	45.3775	-109.3195	4495	05S	19E	24	DDCC	CARBON	WELL	125TLCK	240	10/22/04 0:00	9
154728	45.3495	-109.1617	4710	05S	21E	32	CDCD	CARBON	WELL	125TLCK	220	9/8/02 0:00	11
161309	45.3851	-109.1387	4420	05S	21E	21	CAAB	CARBON	WELL	125TLCK	220	5/21/14 0:00	14
161309	45.3851	-109.1387	4420	05S	21E	21	CAAB	CARBON	WELL	125TLCK	220	8/28/02 0:00	11
179438	45.4461	-109.1871	4180	04S	21E	31	BCBA	CARBON	WELL	125TLCK	100	7/18/05 0:00	9
192348	45.5144	-109.1548	4910	04S	21E	5	DBAC	CARBON	WELL	125TLCK	190	7/27/04 0:00	10
192992	45.2336	-109.1038	4210	07S	21E	11	DBBC	CARBON	WELL	125TLCK	300	6/11/03 0:00	11
214178	45.3550	-109.1435	4670	05S	21E	33	CBAD	CARBON	WELL	125TLCK	265	5/13/15 0:00	10
214178	45.3550	-109.1435	4670	05S	21E	33	CBAD	CARBON	WELL	125TLCK	265	5/22/14 0:00	10
215313	45.0735	-108.8920	4357	09S	23E	3	DCCD	CARBON	WELL	125TLCK	146	11/9/04 0:00	12
7942	45.2512	-108.9249	3683	07S	23E	5	DADD	CARBON	WELL	211EGLE	100	6/20/84 0:00	11
100182	45.6005	-108.9766	3630	03S	22E	2	CADB	CARBON	WELL	211EGLE	266	11/15/84 0:00	12
101564	45.4831	-108.9719	0	04S	22E	14	DCBB	CARBON	WELL	211EGLE	178	1/30/15 0:00	0
101564	45.4831	-108.9719	0	04S	22E	14	DCBB	CARBON	WELL	211EGLE	178	8/27/14 0:00	0
101564	45.4831	-108.9719	0	04S	22E	14	DCBB	CARBON	WELL	211EGLE	178	4/25/14 0:00	11
101569	45.4868	-108.9720	0	04S	22E	14	ACCC	CARBON	WELL	211EGLE	105	3/24/16 0:00	12
101569	45.4868	-108.9720	0	04S	22E	14	ACCC	CARBON	WELL	211EGLE	105	4/25/14 0:00	13
101574	45.4797	-108.9974	3840	04S	22E	15	CDCC	CARBON	WELL	211EGLE	210	9/8/02 0:00	13
104058	45.2619	-108.9259	3695	06S	23E	32	DDDD	CARBON	WELL	211EGLE	125	8/26/03 0:00	13
138844	45.2752	-108.9237	3740	06S	23E	33	BBBB	CARBON	WELL	211EGLE	134	7/15/09 0:00	12
138844	45.2752	-108.9237	3740	06S	23E	33	BBBB	CARBON	WELL	211EGLE	134	8/6/03 0:00	12
150036	45.4973	-108.9684	3899	04S	22E	11	DCAA	CARBON	WELL	211EGLE	245	6/17/15 0:00	13
187522	45.4853	-108.9697	3730	04S	22E	14	DDBC	CARBON	WELL	211EGLE	128	4/10/15 0:00	11
187522	45.4853	-108.9697	3730	04S	22E	14	DDBC	CARBON	WELL	211EGLE	128	4/10/15 0:00	11

Appendix C. Water Quality

GwicId	Latitude	Longitude	Ground	Twn	Rng	Sec	QSec	County	SiteType	Aquifer	Depth_ft_	SampleDate	WaterTemp
187522	45.4853	-108.9697	3730	04S	22E	14	DDBC	CARBON	WELL	211EGLE	128	1/30/15 0:00	0
187522	45.4853	-108.9697	3730	04S	22E	14	DDBC	CARBON	WELL	211EGLE	128	9/25/14 0:00	12
187522	45.4853	-108.9697	3730	04S	22E	14	DDBC	CARBON	WELL	211EGLE	128	8/21/14 0:00	0
187522	45.4853	-108.9697	3730	04S	22E	14	DDBC	CARBON	WELL	211EGLE	128	4/25/14 0:00	11
204130	45.4706	-108.9896	3840	04S	22E	22	DBAD	CARBON	WELL	211EGLE	150	5/13/15 0:00	12
204130	45.4706	-108.9896	3840	04S	22E	22	DBAD	CARBON	WELL	211EGLE	150	4/10/15 0:00	11
204130	45.4706	-108.9896	3840	04S	22E	22	DBAD	CARBON	WELL	211EGLE	150	5/15/14 0:00	11
209163	45.5715	-108.9943	3620	03S	22E	15	DBCB	CARBON	WELL	211EGLE	90	6/18/04 0:00	11
228297	45.4844	-108.9762	3755	04S	22E	14	CAC	CARBON	WELL	211EGLE	90	10/2/14 0:00	11
282122	45.4872	-108.9708	3744	04S	22E	14	ACD	CARBON	WELL	211EGLE	130	3/24/15 0:00	12
282123	45.4813	-108.9678	3723	04S	22E	14	DDBC	CARBON	WELL	211EGLE	90	8/12/16 0:00	10
282123	45.4813	-108.9678	3723	04S	22E	14	DDBC	CARBON	WELL	211EGLE	90	8/12/16 0:00	10
282123	45.4813	-108.9678	3723	04S	22E	14	DDBC	CARBON	WELL	211EGLE	90	3/24/15 0:00	10
101494	45.4579	-109.1076	4060	04S	21E	27	ADDD	CARBON	WELL	211HLCK	50	10/7/04 0:00	0
7816	45.3149	-108.9845	3775	06S	22E	13	BCBB	CARBON	WELL	211JDRV	200	6/12/84 0:00	11
101620	45.4606	-109.0135	3945	04S	22E	28	ACBC	CARBON	WELL	211JDRV	80	1/27/15 0:00	11
101620	45.4606	-109.0135	3945	04S	22E	28	ACBC	CARBON	WELL	211JDRV	80	1/27/15 0:00	11
101620	45.4606	-109.0135	3945	04S	22E	28	ACBC	CARBON	WELL	211JDRV	80	8/21/14 0:00	12
101620	45.4606	-109.0135	3945	04S	22E	28	ACBC	CARBON	WELL	211JDRV	80	6/25/14 0:00	11
101620	45.4606	-109.0135	3945	04S	22E	28	ACBC	CARBON	WELL	211JDRV	80	5/22/14 0:00	11
101620	45.4606	-109.0135	3945	04S	22E	28	ACBC	CARBON	WELL	211JDRV	80	7/13/04 0:00	12
102813	45.3590	-109.5164	5085	05S	18E	33	BCAA	CARBON	WELL	211JDRV	75	5/18/05 0:00	8
102979	45.4057	-109.0427	4220	05S	22E	17	BBBD	CARBON	WELL	211JDRV	165	10/12/04 0:00	11
102981	45.3916	-109.0538	4450	05S	22E	19	ABBA	CARBON	WELL	211JDRV	187	10/2/04 0:00	0
105559	45.1487	-108.8703	3900	08S	23E	11	DCAB	CARBON	WELL	211JDRV	131	11/20/02 0:00	11
105560	45.1197	-108.8568	4000	08S	23E	24	CDBA	CARBON	WELL	211JDRV	164	11/14/02 0:00	12
106106	45.0710	-108.7870	4245	09S	24E	9	ACAB	CARBON	WELL	211JDRV	78	11/20/02 0:00	11
156956	45.3038	-109.5314	5385	06S	18E	17	DABB	CARBON	WELL	211JDRV	140	8/20/03 0:00	10
161333	45.3283	-109.4991	5405	06S	18E	3	CDBD	CARBON	WELL	211JDRV	180	10/1/03 0:00	10
183023	45.2231	-108.9013	3830	07S	23E	15	CBAC	CARBON	WELL	211JDRV	70	4/29/04 0:00	12
104852	45.2055	-108.9891	3845	07S	22E	23	DDBD	CARBON	WELL	211LNCE	123	7/30/84 0:00	0
167664	45.2066	-109.0014	3810	07S	22E	23	CCAA	CARBON	WELL	211LNCE	125	8/20/03 0:00	13
171663	45.1879	-108.9581	3835	07S	23E	31	BAAC	CARBON	WELL	211LNCE	133	4/1/04 0:00	13
175243	45.4335	-109.0816	4205	05S	21E	1	BBDD	CARBON	WELL	211LNCE	110	5/13/15 0:00	11
175243	45.4335	-109.0816	4205	05S	21E	1	BBDD	CARBON	WELL	211LNCE	110	5/13/15 0:00	11
175243	45.4335	-109.0816	4205	05S	21E	1	BBDD	CARBON	WELL	211LNCE	110	9/18/14 0:00	12
175243	45.4335	-109.0816	4205	05S	21E	1	BBDD	CARBON	WELL	211LNCE	110	7/15/14 0:00	11
175243	45.4335	-109.0816	4205	05S	21E	1	BBDD	CARBON	WELL	211LNCE	110	9/11/02 0:00	12
199749	45.0883	-108.8730	4300	08S	23E	35	DCCB	CARBON	WELL	211LNCE	72	11/14/02 0:00	11
152465	45.3912	-108.9167	3590	05S	23E	20	BABB	CARBON	WELL	211NBRR	150	6/26/03 0:00	12
100232	45.5518	-108.9435	3860	03S	23E	30	BBBB	CARBON	WELL	211TPCK	80	7/10/04 0:00	12
212212	45.5673	-108.9110	3720	03S	23E	17	DCCD	CARBON	WELL	217FLRV	1400	7/8/05 0:00	0
212212	45.5673	-108.9110	3720	03S	23E	17	DCCD	CARBON	WELL	217FLRV	1400	7/10/04 0:00	23
189096	45.2821	-109.5672	5705	06S	18E	30	BBBC	CARBON	WELL	221ELLS	150	8/20/03 0:00	9
173046	45.1307	-109.2904	6140	08S	20E	17	BDAD	CARBON	WELL	341UDFD	345	4/22/04 0:00	10
157952	45.1546	-109.3248	6425	08S	19E	1	DDBC	CARBON	WELL	500GNSC	130	9/16/04 0:00	14
102991	45.4179	-108.9173	0	05S	23E	8	BA	CARBON	WELL		75	5/13/15 0:00	12
278903	45.4811	-108.9680	3725	05S	22E	14	DCDA	CARBON	STREAM			5/13/15 0:00	10
278903	45.4811	-108.9680	3725	05S	22E	14	DCDA	CARBON	STREAM			3/19/15 0:00	10
278903	45.4811	-108.9680	3725	05S	22E	14	DCDA	CARBON	STREAM			2/5/15 0:00	1
278903	45.4811	-108.9680	3725	05S	22E	14	DCDA	CARBON	STREAM			1/27/15 0:00	2
278903	45.4811	-108.9680	3725	05S	22E	14	DCDA	CARBON	STREAM			9/18/14 0:00	14
278903	45.4811	-108.9680	3725	05S	22E	14	DCDA	CARBON	STREAM			8/21/14 0:00	18
278903	45.4811	-108.9680	3725	05S	22E	14	DCDA	CARBON	STREAM			7/15/14 0:00	16
278903	45.4811	-108.9680	3725	05S	22E	14	DCDA	CARBON	STREAM			6/2/14 0:00	11
278903	45.4811	-108.9680	3725	05S	22E	14	DCDA	CARBON	STREAM			5/15/14 0:00	13
278903	45.4811	-108.9680	3725	05S	22E	14	DCDA	CARBON	STREAM			4/24/14 0:00	12
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			4/5/15 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			3/2/15 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			2/20/15 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			2/17/15 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			1/31/15 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			1/8/15 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			12/28/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			12/14/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			11/29/14 0:00	0

Appendix C. Water Quality

GwicId	Latitude	Longitude	Ground	Twn	Rng	Sec	QSec	County	SiteType	Aquifer	Depth_ft_	SampleDate	WaterTemp
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			11/14/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			11/11/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			8/24/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			8/20/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			8/14/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			8/4/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			6/8/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			6/1/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			5/31/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			5/15/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			4/18/14 0:00	0
278913	45.4853	-108.9759	3768	04S	22E	14	CAB	CARBON	PRECIP			4/16/14 0:00	0
278914	45.4606	-109.0139	3947	04S	22E	28	BA	CARBON	DITCH OR CANAL			8/21/14 0:00	0
278914	45.4606	-109.0139	3947	04S	22E	28	BA	CARBON	DITCH OR CANAL			6/25/14 0:00	18
280040	45.0564	-109.4132	7203	09S	19E	8	BDA	CARBON	STREAM			5/25/15 0:00	0
280040	45.0564	-109.4132	7203	09S	19E	8	BDA	CARBON	STREAM			9/21/14 0:00	9
280042	45.4489	-109.1024	4075	04S	21E	35	BACB	CARBON	STREAM			5/26/15 0:00	14
280042	45.4489	-109.1024	4075	04S	21E	35	BACB	CARBON	STREAM			2/5/15 0:00	3
280042	45.4489	-109.1024	4075	04S	21E	35	BACB	CARBON	STREAM			8/21/14 0:00	21
280042	45.4489	-109.1024	4075	04S	21E	35	BACB	CARBON	STREAM			5/21/14 0:00	0
280046	45.3600	-109.1493	4547	05S	21E	32	ADAB	CARBON	STREAM			5/13/15 0:00	14
280046	45.3600	-109.1493	4547	05S	21E	32	ADAB	CARBON	STREAM			8/21/14 0:00	15
280046	45.3600	-109.1493	4547	05S	21E	32	ADAB	CARBON	STREAM			5/22/14 0:00	21
280047	45.2661	-109.2295	5143	06S	20E	35	BAA	CARBON	STREAM			8/12/14 0:00	17
280048	45.3201	-109.1929	5787	06S	21E	7	CBD	CARBON	DITCH OR CANAL			8/8/14 0:00	16
280049	45.4587	-109.0262	3936	04S	22E	29	ACDD	CARBON	SPRING			6/25/14 0:00	12
280050	45.4922	-108.9627	3757	04S	22E	13	BBDB	CARBON	DITCH OR CANAL			9/21/14 0:00	0
280052	45.4577	-109.0801	4028	04S	21E	25	BDCD	CARBON	STREAM			2/5/15 0:00	0
280052	45.4577	-109.0801	4028	04S	21E	25	BDCD	CARBON	STREAM			5/21/14 0:00	10
281828	45.4759	-109.0564	3921	04S	22E	19	BAD	CARBON	STREAM			2/5/15 0:00	1
281830	45.5209	-108.8364	3430	04S	23E	1	BBA	CARBON	STREAM			9/9/15 0:00	15
281830	45.5209	-108.8364	3430	04S	23E	1	BBA	CARBON	STREAM			5/26/15 0:00	15
281830	45.5209	-108.8364	3430	04S	23E	1	BBA	CARBON	STREAM			5/13/15 0:00	11
281830	45.5209	-108.8364	3430	04S	23E	1	BBA	CARBON	STREAM			3/19/15 0:00	10
281830	45.5209	-108.8364	3430	04S	23E	1	BBA	CARBON	STREAM			3/6/15 0:00	2
281830	45.5209	-108.8364	3430	04S	23E	1	BBA	CARBON	STREAM			2/5/15 0:00	0
281831	45.5052	-108.9039	3571	04S	23E	8	AAD	CARBON	STREAM			2/5/15 0:00	0
281833	45.1767	-109.2485	5612	07S	20E	34	ACBC	CARBON	STREAM			9/9/15 0:00	10
281833	45.1767	-109.2485	5612	07S	20E	34	ACBC	CARBON	STREAM			5/26/15 0:00	9
281833	45.1767	-109.2485	5612	07S	20E	34	ACBC	CARBON	STREAM			4/10/15 0:00	8
281833	45.1767	-109.2485	5612	07S	20E	34	ACBC	CARBON	STREAM			3/19/15 0:00	2
281833	45.1767	-109.2485	5612	07S	20E	34	ACBC	CARBON	STREAM			3/6/15 0:00	1
281833	45.1767	-109.2485	5612	07S	20E	34	ACBC	CARBON	STREAM			2/5/15 0:00	0
281834	45.2311	-109.2311	5250	07S	20E	11	CBDD	CARBON	STREAM			2/5/15 0:00	1
281835	45.3127	-109.1937	4802	06S	21E	18	BBDC	CARBON	STREAM			2/5/15 0:00	0
281840	45.3738	-109.1462	4472	05S	21E	28	BCBA	CARBON	STREAM			9/9/15 0:00	14
281840	45.3738	-109.1462	4472	05S	21E	28	BCBA	CARBON	STREAM			3/6/15 0:00	1
281840	45.3738	-109.1462	4472	05S	21E	28	BCBA	CARBON	STREAM			2/5/15 0:00	0
281841	45.3843	-109.1421	4411	05S	21E	21	CAB	CARBON	STREAM			2/5/15 0:00	0
281842	45.4304	-109.1116	4192	05S	21E	3	ACAD	CARBON	STREAM			2/5/15 0:00	0
281860	45.4682	-109.0895	4002	04S	21E	23	DDBA	CARBON	STREAM			3/6/15 0:00	6
281860	45.4682	-109.0895	4002	04S	21E	23	DDBA	CARBON	STREAM			9/9/15 0:00	16
281864	45.1786	-109.2463	5604	07S	20E	34	ABDC	CARBON	PRECIP			5/26/15 0:00	0
281864	45.1786	-109.2463	5604	07S	20E	34	ABDC	CARBON	PRECIP			5/23/15 0:00	0
281864	45.1786	-109.2463	5604	07S	20E	34	ABDC	CARBON	PRECIP			3/19/15 0:00	0
281864	45.1786	-109.2463	5604	07S	20E	34	ABDC	CARBON	PRECIP			3/6/15 0:00	7
282265	45.3787	-109.1682	4511	05S	21E	20	BBBB	CARBON	STREAM			4/10/15 0:00	13
161411	45.1411	-109.2636	6140	08S	20E	9	DCAB	CARBON	WELL	120LNLY	405	8/6/02 0:00	10
189175	45.1649	-109.2900	6060	08S	20E	5	ABCB	CARBON	WELL	120LNLY	250	10/7/04 0:00	8
197487	45.2807	-109.4190	5155	06S	19E	29	BACC	CARBON	WELL	120LNLY	90	9/11/02 0:00	11

Appendix C. Water Quality

GwicId	FldpH	FldSC	Ca_mg_l_	Mg_mg_l_	Na__mg_l_	K__mg_l_	Fe__mg_l_	Mn__mg_l_	SiO2__mg_l	HCO3__mg_l	CO3__mg_l_
106078	7	78	8.8	2.89	2.28	0.932	0.079	0.012	5.54	42.8	0
173039	8	61	10.4	3.56	1.93	0.82	0.158	0.032	17.1	46.2	0
173039	7	93	10.5	3.61	1.7	0.74	0.022	0.003	10.3	54.09	0
102937	6	295									
104893	7	678	70	26.5	56.8	2.82	0.019	<0.001	13.2	395.6	0
105455	7	107	10.6	3.63	2.73	1.03	<0.005	<0.001	9.45	57.8	0
105523	7	603	78.1	30.1	30.7	2.28	0.026	0.003	13.4	358.99	0
105523	7	882	86.3	36.4	40.2	2.51	0.036	0.003	12.5	440.01	0
133465	7	1580	108	74	159	4.6	0.009	<0.001	13.3	403.8	0
144132	7	380	47.1	13.9	7.47	1.3	0.01	<0.001	13.4	214.1	0
162212	0	0									
216153	0	0									
172583	9	317	3.4	0.97	74.83	1.19	0.020 J	0.007 J	8.04	194.61	5.43
172583	9	336	3.58	1	79.92	1.19	0.016 J	0.007 J	7.01	208.15	4.16
172583	0	0									
172583	0	0									
8032	7	50	5.9	1.8	1.6	0.8	0.1	0.05	6.8	28.5	0
8033	7	80	11	2	1.7	1.4	0.03	0.03	7.8	42.8	0
101602	8	183	60.3	32.7	42.3	2.04	0.024	<0.001	14.6	419.1	0
103963	7	201									
104684	7	137	13.4	4.23	3.3	0.657	<0.005	<0.001	12.6	53.2	0
104689	6	128	11.8	4.3	6.27	0.706	0.006	<0.001	12	56.2	0
104689	6	286	27.5	10.6	4.34	0.859	0.013	<0.001	10.9	49.3	0
104763	7	138	16.2	5.52	4.23	1.65	0.026	0.001	28.5	61.7	0
104763	7	133	14.5	4.83	3.22	1.56	0.02	<0.001	12.3	66.6	0
105324	8	87	6	2.22	2.1	0.824	0.042	0.013	7.84	32	0
105324	7	49	4.95	1.81	1.48	0.67	0.13	0.027	7.46	25.9	0
122624	7	597	43.94	30.37	51.24	1.78	<0.015 U	<0.002 U	14.95	375.74	0
122624	8	605									
122624	0	0									
122624	7	612									
154738	7	143	19.4	5.95	1.68	0.73	0.005	<0.001	10.2	83.4	0
161253	7	335	43.84	18.11	11.74	1.17	<0.004 U	<0.002 U	9.18	233.17	0
161253	7	245	27.7	10.9	7.52	1.04	0.008	<0.001	9.21	157.1	0
161403	7	81	10.7	2.22	2.2	1.47	0.014	0.001	11.5	47.8	0
165323	7	146	14.2	6.77	3.39	0.91	0.007	<0.001	18	82.2	0
170571	7	82	9.3	3.23	1.95	0.62	<0.005	<0.001	12.9	47.8	0
170571	7	82	9.3	3.23	1.95	0.62	<0.005	<0.001	12.9	47.8	0
176387	7	92	9	3.46	5.93	0.951	0.3	0.048	3.44	49.3	0
179434	7	1135	115.5	60.67	68.96	2.96	0.077 J	1.041	12.84	510.01	0
189951	8	312	35.3	10.6	8.03	0.361	0.02	0.018	15.5	184.46	0
191002	7	143									
196860	7	310	34.7	12.7	8.4	2.34	0.015	0.07	16.2	191.5	0
206912	7	260									
206912	0	0									
211063	8	1386	180	70.1	64.9	3.1	0.013	<0.001	15.7	497.8	0
216141	7	387	47.49	15.23	12	4.4	0.015 J	<0.002 U	10.59	232.74	0
216141	0	0									
216141	7	325									
216141	0	0									
216141	7	423									
223039	7	916	113.5	51.95	32.64	2.85	0.249	0.005 J	13.77	544.81	0
223039	7	774	90.1	42.67	32.59	2.48	0.141	0.005 J	14.72	402.12	0
223039	0	0									
223039	0	0									
223039	0	0									
226244	0	0									
251283	7	156	29.7	7.08	2.79	0.72	0.016	0.001 J	10.73	116.45	0
251285	6	43	5.99	2.23	1.51	0.61	0.008	0.005	10.52	29.58	0
251297	6	104	13.59	6.05	3.11	0.82	0.02	0.005	13.79	32.44	0
251298	6	85	13.18	4.47	2.86	0.88	0.081	0.008	13.92	62.5	0
251299	6	102	14.17	5.29	3.83	1.14	0.041	0.004	17.7	71.86	0
251300	6	166	24.98	8.15	5.08	1.52	0.239	0.011	14.55	117.23	0
251301	7	385	47.49	16.97	35.34	3.2	0.395	0.009	15.6	279.71	0
251302	7	286	65.55	5.57	4.05	0.83	0.059	0.015	11.35	212.82	0
251313	7	41	5.67	1.96	2.61	0.5	0.028	0.002 J	6.21	29.95	0

Appendix C. Water Quality

GwicId	FldpH	FldSC	Ca_mg_l_	Mg_mg_l_	Na__mg_l_	K__mg_l_	Fe__mg_l_	Mn__mg_l_	SiO2__mg_l	HCO3__mg_l	CO3__mg_l_
251314	6	134	23.96	6.41	2.71	0.8	0.112	0.006	10.71	104.8	0
251315	6	152	23.41	7.52	4.43	1.23	0.655	0.01	18.29	109.69	0
277124	0	0									
279363	7	185	22.29	6.36	4.79	1.64	<0.015 U	0.004 J	18.98	109.58	0
279363	7	100	23.47	6.32	3.91	0.8	<0.015 U	0.003 J	13.76	109.37	0
279363	0	0									
279363	0	0									
279457	7	746	61.45	41.08	62.29	2	<0.015 U	<0.002 U	11.53	441.8	0
150239	8	816	10.1	4.07	192	1.11	0.027	0.01	11.9	519.2	0
161298	9	323	1.28	0.08	81.2	0.222	<0.005	0.003	7.61	148.6	18.6
192625	9	304	1.7	0.104	68.7	0.224	<0.005	0.005	7.5	158.7	8.6
196630	0	0									
196630	0	0									
8343	8	5620	174	85.1	1067	5.8	0.15	0.086	7.9	413	0
104836	9	2420	11.5	1.04	478	2.07	0.071	0.002	7.17	522.5	0
173009	7	0	190	74.8	2026	8.04	0.033	0.081	6.16	577.1	0
191006	7	5380	168	139	1260	7.83	0.06	<0.01	7.65	488	0
220656	9	2670	1.71	2.92	700	3.09	0.029	0.003	6.88	1465.22	25.2
104686	7	702	96.2	37.4	19	1.74	0.013	0.003	20.4	435.8	0
104686	7	592	71.6	30.1	17.3	1.53	0.02	<0.001	3.99	383.9	0
106097	9	3920	7.07	5.95	1050	5.34	<0.05	0.017	5.36	821.06	50.4
127723	7	1132	85.8	38.2	104	4.05	0.011	<0.001	9.4	412.4	0
131617	10	513	3.05	1.28	121	1.15	0.008	0.005	6.53	309.1	20.4
131660	8	593	70.2	16.7	42.4	1.76	0.274	0.044	18.1	236.7	0
149925	8	267	14	5.57	44.8	2.04	0.004	0.013	24.5	168.4	0
149925	8	256	15.2	6.12	35.8	1.61	0.006	0.01	5.5	146.9	0
155756	7	6460	143	167	1302	6.27	0.123	0.011	9.14	813.7	0
161429	8	444	38.5	12.5	48.7	2.02	<0.037	<0.001	11.1	215.7	0
161429	8	434	43.3	14.6	38.9	1.12	0.017	<0.001	11.5	215.9	0
162756	8	385	24.8	9.19	21.8	2.35	0.032	0.036	11.6	170.5	0
173044	8	334	35.9	18.2	14.3	1.17	0.011	0.006	19.7	197.6	0
191004	9	402	1.28	0.05	95.5	0.241	<0.005	<0.001	8.86	178.1	12.5
193052	8	3080	185	142	419	7.56	0.057	0.145	8.72	523.4	0
195934	9	2430	2.24	1.38	577	1.69	<0.005	0.005	6.85	708.8	49.2
197444	8	350	14.9	7.98	95.4	2.31	0.034	0.017	6.29	296	0
199495	9	319	43.9	15.7	9.07	0.79	0.012	0.001	34.8	218.6	0
199495	8	327	41.4	15.2	10.3	0.716	0.016	0.031	15.2	211.5	0
199495	8	327	41.4	15.2	10.3	0.716	0.016	0.031	15.2	211.5	0
216145	6	136	15.9	5.22	3.07	0.67	<0.015 U	<0.002 U	17.9	82.28	0
216145	0	0									
144103	7	268	47.8	14.3	82	1.82	<0.002	<0.001	18.5	385.5	0
144103	8	712	54.2	16.1	78.5	1.75	0.008	<0.001	7.79	402.1	0
150219	8	1404	51.8	20.8	252	1.15	4.7	0.154	8.13	637	0
154728	7	524	57.2	19.4	31	1.94	0.008	<0.001	10.9	326	0
161309	7	574									
161309	8	746	67.5	27.5	21.4	2.58	0.021	0.105	8.57	402.1	0
179438	8	924	18.1	4.53	252	2.68	0.213	0.051	7.59	559.98	0
192348	8	554	51.6	23.2	30.5	3.66	0.019	<0.001	9.04	318.4	0
192992	8	3670	25.7	5.68	877	2.2	<0.05	0.03	3.31	649	0
214178	8	473	15.18	7.12	86.79	2.1	0.029 J	0.023 J	9.28	286.64	0
214178	8	467									
215313	8	2570	23	6.62	692	3.55	0.053	0.057	5.33	729.6	14.4
7942	7	1060	82.2	26	126	3.3	0.027	0.013	14	348	0
100182	9	2425	1.5	0.9	583	0.6	<.002	<.001	8	709	23.4
101564	0	0									
101564	0	0									
101564	7	844									
101569	7	930	49.49	34.55	75.94	2.33	<0.015 U	0.007 J	13.64	417	0
101569	7	744									
101574	7	813	71.4	44.2	43.5	2.73	0.023	0.002	11.3	395.3	0
104058	7	1857	42.2	40.1	375	2.77	0.01	0.114	13	533.1	0
138844	8	2877	352	189	195	6.17	0.063	0.009	28.6	422.1	0
138844	7	2740	354	204	221	5.94	0.151	0.016	12.5	417.2	0
150036	7	1219	84.22	47.98	150.22	2.73	0.393	0.123 J	16.64	424.59	0
187522	8	718									
187522	7	644									

Appendix C. Water Quality

GwicId	FldpH	FldSC	Ca_mg_l_	Mg_mg_l_	Na__mg_l_	K__mg_l_	Fe__mg_l_	Mn__mg_l_	SiO2__mg_l	HCO3__mg_l	CO3__mg_l_
187522	0	0									
187522	7	827	68.79	40.41	65.47	2.52	0.027 J	0.007 J	15.13	504.14	0
187522	0	0									
187522	7	786									
204130	7	705	73.67	47.89	19.74	2.85	<0.015 U	<0.002 U	10.92	387.74	0
204130	8	679									
204130	7	663									
209163	8	1309	91.6	78.5	138	4.16	0.049	0.002	13.5	582.7	0
228297	9	1275									
282122	9	738	45.24	27.57	80	1.92	<0.015 U	0.010 J	11.76	387.95	5.31
282123	7	1043	71.64	31.47	79.11	1.94	0.58	0.369	11.92	455.58	0
282123	7	1013	71.43	30.62	74.44	1.88	0.585	0.374	11.71	433.51	0
282123	8	836	74.18	29.41	80.82	1.83	0.101	0.306	11.94	438.37	0
101494	0	0	55.7	27.2	116	2.09	0.025	0.009	7.59	476.7	0
7816	8	5210	204	132	943	5.8	0.008	0.042		473	0
101620	8	3139	145.7	102.67	599.87	5.03	<0.075 U	<0.010 U	8.14	888.29	0
101620	8	3139									
101620	7	1812									
101620	7	1658									
101620	7	3235									
101620	7	1431	53.9	39.1	220	3.29	0.031	<0.001	7.42	445.9	0
102813	8	590	2.01	0.135	145	0.431	0.012	0.005	8.87	364.8	0
102979	9	1700	1.5	0.296	408	0.72	<0.005	0.001	6.53	512.9	21.6
102981	8	1307									
105559	7	3100	121	87.3	467	3.5	2.27	0.189	10.5	469.94	0
105560	8	3630	95.7	75.8	716	5	8.23	0.203	7.21	480.68	0
106106	7	3520	172	119	289	5.24	2.66	0.293	9.86	625.45	0
156956	9	212	11.7	3.11	38	1.13	0.021	0.001	14.9	143.2	0
161333	9	186	2.93	0.1	43.2	0.113	<0.005	<0.001	12.1	84.5	6.24
183023	7	4490	433	316	426	18	0.119	0.01	8.58	358.7	0
104852	0	0	61.2	51.7	307	3	0.008	0.001	10.2	612	0
167664	8	1760	38.4	14.9	401	2.97	0.046	0.05	8.17	729.8	0
171663	8	2210	6.54	1.71	528	1.73	0.014	0.019	7.67	568.5	54
175243	9	1248	2.18	1.03	315.07	0.82	<0.038 U	<0.005 U	4.52	564.04	36.63
175243	9	1248	2.18	1.03	315.07	0.82	<0.038 U	<0.005 U	4.52	564.04	36.63
175243	9	1530									
175243	9	1556									
175243	9	1040	1.03	0.289	237	0.521	<0.005	<0.001	4.62	423.7	42.4
199749	8	929	48.2	26.1	107	3.1	0.621	0.121	11.1	372.5	0
152465	7	3460	460	307	407	5.49	0.435	0.008	13.6	456.3	0
100232	7	1950	240	127	62.1	4.27	0.071	<0.001	11.6	361.1	0
212212	9	2500	1.02	0.155	670	1.01	0.008	0.003	12.7	1306.62	46.8
212212	9	2540	1.05	0.164	620	0.96	0.009	0.003	12.8	1356.6	90.4
189096	10	366	0.753	0.033	87.8	0.238	0.029	0.003	8.21	175.6	15.1
173046	8	398	52.1	17.1	6.45	3.57	0.009	<0.001	10.6	254.1	0
157952	7	146	14.3	6.9	7.1	1.08	0.008	<0.001	23.7	86.6	0
102991	7	2501	581.57	93.45	17.03	10.93	<0.075 U	<0.010 U	10.49	330.1	0
278903	8	224									
278903	0	260									
278903	0	263									
278903	8	265									
278903	8	304									
278903	8	321									
278903	7	186									
278903	7	124									
278903	9	304									
278903	0	209									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									

Appendix C. Water Quality

GwicId	FldpH	FldSC	Ca_mg_l_	Mg_mg_l_	Na__mg_l_	K__mg_l_	Fe__mg_l_	Mn__mg_l_	SiO2__mg_l	HCO3__mg_l	CO3__mg_l_
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278913	0	0									
278914	0	0									
278914	8	141									
280040	0	0									
280040	0	38									
280042	8	346									
280042	0	373									
280042	8	377									
280042	0	0									
280046	9	437									
280046	0	326									
280046	9	382									
280047	9	95									
280048	7	92									
280049	7	604									
280050	0	0									
280052	0	174									
280052	8	118									
281828	0	251									
281830	8	355	41.23	15.11	15.09	2.25	0.119	0.019 J	5.24	217.72	0.97
281830	8	248									
281830	8	251									
281830	0	275									
281830	6	316	31.39	10.87	11.36	1.79	0.019 J	0.015 J	7.61	157.48	0
281830	0	288									
281831	0	284									
281833	8	77	6.98	1.97	1.2	0.77	<0.015 U	<0.002 U	4.67	32.99	0
281833	7	78									
281833	8	100									
281833	0	99									
281833	7	110	9.77	2.95	2.14	1.01	<0.015 U	<0.002 U	6.88	49.6	0
281833	0	83									
281834	0	106									
281835	0	111									
281840	8	273	36.14	10.38	5.12	1.14	0.042 J	0.011 J	12.84	166.54	1.65
281840	8	363	47.05	15.5	10	1.84	<0.015 U	0.011 J	11.61	215.81	0
281840	0	368									
281841	0	148									
281842	0	168									
281860	0	371	45.46	14.59	16.1	2.2	<0.015 U	0.026 J	6.65	218.82	7.23
281860	9	309	37.61	12.39	11.83	1.97	<0.015 U	0.013 J	4.89	190.59	3.6
281864	0	0									
281864	0	0									
281864	0	0									
281864	8	38									
282265	9	253									
161411	7	307	39.5	13.4	7.21	0.669	0.014	0.01	24.4	187.4	0
189175	8	122	16.3	3.98	1.68	0.46	<0.005	<0.001	8.63	71.6	0
197487	8	455	53.4	15.7	26.5	0.823	0.027	0.006	8.71	313.8	0

Appendix C. Water Quality

GwicId	SO4__mg_l_	Cl__mg_l_	NO3_N__mg_	F__mg_l_	OPO4_P__mg	Ag__ug_l_	Al__ug_l_	As__ug_l_	B__ug_l_	Ba__ug_l_	Be__ug_l_
106078	<2.5	<0.5	<0.5 P	<0.05	<0.05	<1	<30	<1	<30	14.5	<2
173039	3.44	0.937	<0.5 P	0.163	<0.05	<0.04	<7.68	<0.10	1.77	9.71	<0.20
173039	3	1	<0.5 P	<0.05	<0.05		<30	<10	<30	11.2	<2
102937											
104893	73.7	2	3.83 P	0.322	<0.05	<1	<10	<1	80.7	46.7	<2
105455	4.07	0.507	0.24 P	<0.05	<0.05	<1	<10	<1	<30	26.6	<2
105523	61.5	<5.0	3.99 P	<0.5	<0.5	<0.13	<15.10	0.33	47.5	56.7	<0.14
105523	122	<5.0	3.0 P	<0.5	<0.5		<30	<10	75.5	50.6	<2
133465	493	9.32	2.06 P	<0.5	<0.5	<1	<10	<1	128	19.2	<2
144132	4.75	1.33	0.668 P	0.092	<0.05	<1	<10	<1	<30	68.1	<2
162212											
216153											
172583	11.44	1.29	0.07	0.47	<0.020 U	<0.100 U	<2.000 U	<0.100 U	51.61	100.11	<0.100 U
172583	9.86	1.2	0.050 J	0.47	<0.020 U	<0.100 U	<2.000 U	<0.100 U	58.41	110.39	<0.100 U
172583											
172583											
8032	2.6	0.45	0.097	<.1			<50.	<2.0			
8033	5	0.6	0.106	<.1			<50.	<2.0			
101602	24.5	2.22	<0.50 P	0.349	<0.05	<5	<30	<5	<150	60.7	<2
103963											
104684	3.04	6.59	0.728 P	<0.05	<0.05	<1	<30	<0.2	3.41	17.3	<0.1
104689	3.16	4.55	0.549 P	<0.05	<0.05	<1	<30	<0.2	2.58	16.1	<0.1
104689	4.57	61.3	<.5 P	0.069	<.05		<30		<30	36.8	<2
104763	8.08	8.29	1.72 P	0.117	<0.05	<0.04	<7.68	<0.10	13	32.1	<0.20
104763	6.42	2.46	1.07 P	0.088	<.05		<30		<30	30.8	<2
105324	4.94	0.484	<0.5 P	<0.05	<0.05	<0.11	<5.25	<0.58	<2.03	11.4	<0.30
105324	2.53	<0.5	0.157 P	<0.05	<0.05	<1	<10	<1	<30	9.1	<2
122624	38.75	4.26	0.87	0.52	0.020 J	<0.100 U	<2.000 U	0.220 J	155.62	55.01	<0.100 U
122624											
122624											
122624											
154738	<2.5	0.749	0.97 P	<0.05	<0.05	<1	<30	<1	<30	8.6	<2
161253	12.51	3.06	1.24	0.15	<0.100 U	<0.500 U	<2.000 U	<0.500 U	26.4	89.44	<0.500 U
161253	6.1	1.1	0.7 P	0.19	<0.05		<30	<10	<30	63.8	<2
161403	3.44	<0.5	0.108 P	<0.05	<0.05	<1	<10	<1	<30	12.7	<2
165323	3.98	2.26	0.803 P	<0.05	<0.05	<1	<10	<1	<30	24.2	<2
170571	<2.5	<0.5	0.785 P	<0.05	<0.05	<1	<10	<1	<30	10	<2
170571	<2.5	<0.5	0.785 P	<0.05	<0.05	<1	<10	<1	<30	10	<2
176387	9.16	0.646	<0.5 P	<0.05	<0.05	<1	<30	<1	<30	12.9	<2
179434	304.2	11.62	0.040 J	0.28	<0.020 U	<0.250 U	<5.000 U	0.660 J	243.16	70.76	<0.250 U
189951	6	1	1.01 P	0.2	<0.05		<30	<10	<30	80.5	<2
191002											
196860	7.46	8.03	<0.5 P	<0.05	<0.05	<1	<30	<1	<30	101	<2
206912											
206912											
211063	461	3.37	<0.5 P	0.242	<0.10	<1	<30	<1	240	15.7	<2
216141	18.4	5.28	0.73	0.18	0.020 J	<0.100 U	<2.000 U	<0.100 U	20.89	80.61	<0.100 U
216141											
216141											
216141											
216141											
223039	124.8	14.16	0.050 J	0.36	<0.020 U	<0.100 U	2.570 J	<0.100 U	143.62	32.95	<0.100 U
223039	126.9	19.42	0.08	0.4	<0.020 U	<0.100 U	<2.000 U	0.210 J	127.83	26.16	<0.100 U
223039											
223039											
223039											
226244											
251283	4.81	1.3	1.4	0.09	<0.020 U	<0.100 U	22.35	<0.100 U	2.04	14.72	<0.100 U
251285	3.04	0.51	0.21	0.07	<0.020 U	<0.100 U	3.26	<0.100 U	0.540 J	7.02	<0.100 U
251297	25.49	7.7	0.79	0.06	<0.020 U	<0.100 U	<0.400 U	<0.100 U	8.15	18.76	<0.100 U
251298	3.71	0.81	0.71	0.07	<0.020 U	<0.100 U	<0.400 U	<0.100 U	2.47	16.63	<0.100 U
251299	3.37	0.91	0.53	0.08	<0.020 U	<0.100 U	<0.400 U	<0.100 U	2.47	24.09	<0.100 U
251300	9.86	2.37	0.52	0.09	<0.020 U	<0.100 U	<0.400 U	<0.100 U	7.64	41.74	<0.100 U
251301	28.65	1.75	0.17	0.19	<0.020 U	<0.100 U	16.6	<0.100 U	57.84	90.27	<0.100 U
251302	5.73	0.83	1.92	0.1	<0.020 U	<0.100 U	21.87	0.380 J	3.73	165.13	<0.100 U
251313	2.98	<0.100 U	0.08	0.08	<0.020 U	<0.100 U	6.2	<0.100 U	1.510 J	12.07	<0.100 U

Appendix C. Water Quality

GwicId	SO4__mg_l_	Cl__mg_l_	NO3_N__mg_	F__mg_l_	OPO4_P__mg	Ag__ug_l_	Al__ug_l_	As__ug_l_	B__ug_l_	Ba__ug_l_	Be__ug_l_
251314	3.61	1.17	0.13	0.11	<0.020 U	<0.100 U	<0.400 U	<0.100 U	4.42	18.18	<0.100 U
251315	5.88	0.97	0.23	0.07	<0.020 U	<0.100 U	<0.400 U	<0.100 U	5.22	35.86	<0.100 U
277124											
279363	4.68	0.83	1.02	0.14	<0.020 U	<0.100 U	<2.000 U	<0.100 U	8.74	61.48	<0.100 U
279363	5.05	0.75	0.7	0.13	<0.020 U	<0.100 U	2.210 J	<0.100 U	5.24	58.51	<0.100 U
279363											
279363											
279457	71.25	13.86	0.44	0.37	<0.020 U	<0.100 U	<2.000 U	0.260 J	110.52	83	<0.100 U
150239	30.8	1.48	<.5 P	1.65	0.093		<30		225	47.1	<2
161298	7.58	1	<0.05 P	1.17	<0.05	<1	<10	1.55	63.9	6.11	<2
192625	9.57	0.703	<0.5 P	0.846	<0.05	<5	<30	<5	<30	<10	<2
196630											
196630											
8343	2340	252	0.54	0.1	<.1						
104836	446	208	2.97 P	2.02	<0.10	<5	<30	<5	75.6	16.1	<2
173009	4102	39.5	11.3 P	<0.10	<2.50	<10	<30	<10	278	6.96	<2
191006	3420	<50.0	<0.5 P	<5.0	<5.0		<300	<100	<300	<20	<20
220656	70.8	21.7	<0.5 P	<0.05	<0.05	<5	<30	<5	322	251	<2
104686	32	9.66	1.34 P	<0.5	<0.05	<0.04	<7.68	0.238	23	206	<0.02
104686	29	3.97	0.773 P	0.125	<0.05	<1	<30	<1	<30	191	<2
106097	1350	127	<0.5 P	<2.5	<0.5		<300	<100	382	<20	<20
127723	222	7.38	5.21 P	0.415	<0.10	<1	<10	<1	128	23.2	<2
131617	5.34	0.881	<.5 P	0.751	0.075		<30		142	84.7	<2
131660	142	5.1	<0.10 P	0.154	<0.05	<1	<10	<1	40.1	19.9	<2
149925	14.6	1.11	<0.5 P	0.284	<0.05	<0.04	<7.68	0.161	51.6	156	<0.20
149925	11.8	0.6	<0.5 P	0.176	<0.05	<1	<30	<1	44	115	<2
155756	3097	23	<5.0 P	<1.0	<1.0	<10	<100	<10	<300	<20	<20
161429	73.73	5.86	<0.5 P	<0.5	<0.5	<1.30	<151.00	<1.90	58.7	43	<1.40
161429	79.9	6.46	<0.5 P	0.198	<0.05	<1	<30	<1	37.9	42.9	<2
162756	11	0.7	<0.5 P	0.3	<0.05		<30	<10	<30	258	<2
173044	19.2	0.758	<0.05 P	0.125	<0.05	<1	<10	<1	<30	65.5	<2
191004	25.1	1.16	<0.5 P	0.102	<0.05	<1	<30	<1	<30	9.54	<2
193052	1458	9	<1.0 P	<0.5	<0.5	<5	<150	<5	200	15	<10
195934	489	26.8	<1.0 P	1.82	<1.0	<5	<30	<5	192	66.4	<2
197444	24.6	2.58	<0.5 P	0.806	<0.05	<0.5	<2.0	5.29	176	54.2	<0.1
199495	9.96	1.35	0.784 P	0.296	<0.05	<0.04	<7.68	<0.10	11.4	142	<0.20
199495	8.07	0.648	<0.5 P	0.197	<0.05	<1	<30	<1	<30	133	<2
199495	8.07	0.648	<0.5 P	0.197	<0.05	<1	<30	<1	<30	133	<2
216145	4.58	0.67	0.32	0.16	0.090 J	<0.100 U	<2.000 U	0.380 J	7.37	72.97	<0.100 U
216145											
144103	37.55	2.62	1.44 P	0.561	<0.05	<0.04	<7.68	0.136	21.4	46.6	<0.20
144103	55	2.5	<0.5 P	0.47	<0.05		<30	<10	<30	57.9	<2
150219	212	<2.5	<0.50 P	0.255	<0.25	<5	<30	<5	210	26.4	<2
154728	42.2	0.5	<0.5 P	0.26	<0.05		<30	<10	<30	132	<2
161309											
161309	18.9	1.6	<0.5 P	0.22	<0.05		<30	<10	50.3	442	<2
179438	83.7	15.1	<0.10 P	0.673	<0.05	<1	<10	<1	54	125	<2
192348	35.1	4.07	<0.05 P	0.216	<0.05	<1	<10	<1	62.4	89.4	<2
192992	1353	48.8	<0.5	<2.5	<2.5	<10	<300	<10	<300	<20	<20
214178	29.49	2.96	<0.010 U	0.8	<0.020 U	<0.100 U	<2.000 U	0.49	64.1	145.9	<0.100 U
214178											
215313	949	15.6	<1.25 P	1.06	<0.50	<5	<50	<5	212	13.6	<10
7942	268	8.4	0.76	0.2	0.1	<3.	<30.		190		
100182	441	133	0.02	1.7	<.1						
101564											
101564											
101564											
101569	91.34	9.27	0.69	0.33	<0.020 U	<0.100 U	<2.000 U	0.320 J	158.27	46.09	<0.100 U
101569											
101574	156	<5.0	<0.5 P	<0.5	<0.5		<30	<10	108	30.4	<2
104058	708	<10	<0.5 P	<1.0	<1.0	<5	60.8	<5	776	10.8	<2
138844	1462	239.8	3.19 P	<1.0	<1.0	<0.40	<76.76	<1.01	348	20	<2.02
138844	1781	72	2.56	3.3	<0.5	<5	<150	<5	456	20.8	<10
150036	391.9	11.56	<0.010 U	0.4	<0.020 U	<0.250 U	<5.000 U	<0.250 U	307.15	12.13	<0.250 U
187522											
187522											

Appendix C. Water Quality

GwicId	SO4__mg_l_	Cl__mg_l_	NO3_N__mg_	F__mg_l_	OPO4_P__mg	Ag__ug_l_	Al__ug_l_	As__ug_l_	B__ug_l_	Ba__ug_l_	Be__ug_l_
187522											
187522	71.73	16.31	1.56	0.29	<0.020 U	<0.100 U	<2.000 U	<0.100 U	130.28	129.95	<0.100 U
187522											
187522											
204130	105.7	5.59	0.84	0.24	0.050 J	<0.100 U	<2.000 U	0.210 J	68.4	36.93	<0.100 U
204130											
204130											
209163	353	22.4	0.261 P	0.501	<0.25	<1	<10	<1	300	38.5	<2
228297											
282122	114.8	4.72	0.21	0.24	<0.020 U	<0.100 U	<2.000 U	0.310 J	164.75	45.16	<0.100 U
282123	129.9	8.94	<0.010 U	0.18	<0.020 U	0.82	<2.000 U	<0.100 U	200.34	88.95	<0.100 U
282123	127.7	7.65	<0.010 U	0.17	<0.020 U	0.85	<2.000 U	<0.100 U	190.53	81.11	<0.100 U
282123	147.4	6.76	<0.010 U	0.1	<0.020 U	<0.100 U	<2.000 U	<0.100 U	205	70.9	<0.100 U
101494	65.8	11.2	0.472 P	0.144	<0.05	<1	<10	<1	186	56.7	<2
7816	2280	232	2.3	0.2	<.1						
101620	1262	57.07	1.14	0.32	<0.100 U	<0.500 U	34.280 J	<0.500 U	675.69	10.96	<0.500 U
101620											
101620											
101620											
101620											
101620	360	8.41	0.833 P	0.27	<0.25	<1	<10	<1	323	4.4	<2
102813	22.8	1.23	<0.5 P	0.193	<0.05	<1	<10	1.24	108	22	<2
102979	253	54	<0.50 P	1.41	<0.25	<5	<30	<5	1494	17.8	<2
102981											
105559	1345	<25.0	<0.5 P	<2.5	<2.5		<300	<100	<300	<20	<20
105560	1717	26	<0.5 P	<2.5	<2.5		<300	<100	<300	<20	<20
106106	1110	25	<0.5 P	<3.0	<3.0		<300	<100	<300	<20	<20
156956	6.87	0.864	<0.5 P	0.317	<0.05	<5	<30	<5	40.1	16.1	<2
161333	15.9	2.09	<0.05 P	<0.05	<1.0	<1	<30	<1	<30	<2	<2
183023	3106	<10.0	11.3 P	10	<1.0	<10	<300	<10	1042	<20	<20
104852	473	15.1	1.32	0.1	<.1	<2.	<30.		290		
167664	481	15.7	<0.5 P	<0.5	<0.5	<5	<30	<5	78.8	10.6	<2
171663	577	15.7	<0.5 P	<0.5	<0.5	<5	<30	<5	105	6.99	<2
175243	170	15.86	0.86	1.11	<0.020 U	<0.250 U	<5.000 U	53.48	810.03	19.38	<0.250 U
175243	170	15.86	0.86	1.11	<0.020 U	<0.250 U	<5.000 U	53.48	810.03	19.38	<0.250 U
175243											
175243											
175243	138	<5.0	<0.5 P	1.4	<0.5		<30	69.1	579	13.7	<2
199749	177	10	<0.5 P	<0.5	<0.5		<30	<10	35.4	21.6	<2
152465	2819	13.2	1.98 P	<1.25	<1.25	<5	<150	<5	718	<10	<10
100232	791	22.9	<0.50 P	<0.25	<0.25	<5	<30	<5	280	<10	<2
212212	<2.5	92.5	<0.05 P	10.2	<0.05	<1	<10	1.85	1762	130	<2
212212	<25.0	89	<0.50 P	12.5	<0.50	<5	<30	<5	1822	133	<2
189096	3.39	0.812	<0.5 P	1.23	<0.05	<5	<30	<5	45.9	8.79	<2
173046	21.9	0.62	<.5	0.088	<0.05	<1	<30	<1	<30	10.6	<2
157952	6.45	<0.5	0.359 P	0.11	<0.05	<1	<10	<1	<30	20.9	<2
102991	1509	2.44	0.05	0.28	0.030 J	<0.500 U	<10.000 U	<0.500 U	183.15	17.39	<0.500 U
278903											
278903											
278903											
278903											
278903											
278903											
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278913											
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Appendix C. Water Quality

GwicId	SO4__mg_l_	Cl__mg_l_	NO3_N__mg_	F__mg_l_	OPO4_P__mg	Ag__ug_l_	Al__ug_l_	As__ug_l_	B__ug_l_	Ba__ug_l_	Be__ug_l_
278913											
278913											
278913											
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278913											
278913											
278913											
278914											
278914											
280040											
280040											
280042											
280042											
280042											
280042											
280046											
280046											
280046											
280047											
280048											
280049											
280050											
280052											
280052											
281828											
281830	20.28	2.66	<0.010 U	0.22	<0.020 U	<0.100 U	<2.000 U	0.89	27.04	66.57	<0.100 U
281830											
281830											
281830											
281830	20.23	2.75	0.27	0.14	<0.020 U	<0.100 U	2.300 J	0.360 J	16.38	53.46	<0.100 U
281830											
281831											
281833	4.23	0.52	0.16	0.06	<0.020 U	<0.100 U	<2.000 U	<0.100 U	3.21	14.38	<0.100 U
281833											
281833											
281833											
281833	5.94	1.02	0.25	0.07	<0.020 U	<0.100 U	<2.000 U	<0.100 U	2.61	18.08	<0.100 U
281833											
281834											
281835											
281840	8.08	1.06	0.17	0.25	<0.020 U	<0.100 U	<2.000 U	0.41	10.96	55.34	<0.100 U
281840	21.32	2.62	0.65	0.25	<0.020 U	<0.100 U	<2.000 U	0.300 J	13.51	74.63	<0.100 U
281840											
281841											
281842											
281860	19.37	2.77	0.09	0.17	<0.020 U	<0.100 U	<2.000 U	0.59	18.94	70.18	<0.100 U
281860	12.3	1.91	<0.010 U	0.19	<0.020 U	<0.100 U	<2.000 U	1.13	19.42	63.99	<0.100 U
281864											
281864											
281864											
281864											
282265											
161411	22	1.5	<0.5 P	0.11	<0.05		<30	<10	<30	80.3	<2
189175	2.97	<0.5	0.179 P	<0.05	<0.05	<1	<10	<1	<30	13.8	<2
197487	5.6	0.6	<0.5 P	0.31	<0.05		<30	<10	44.8	42.6	<2

Appendix C. Water Quality

GwicId	Br__ug_l_	Cd__ug_l_	Co__ug_l_	Cr__ug_l_	Cu__ug_l_	Li__ug_l_	Mo__ug_l_	Ni__ug_l_	Pb__ug_l_	Sb__ug_l_	Se__ug_l_
106078	<50	<1	<2	<2	<2	<1	<10	<2	<2	<2	<1
173039	<50	<0.05	<0.10	<0.04	<0.40	0.58	0.238	<0.10	<0.15	<0.05	<0.10
173039	<50	<1	<2	<10	<5	1.13	<10	<2	<10	<10	<15
102937											
104893	<50	<1	<2	2.14	3.96	15.1	<10	<2	<2	<2	2.92
105455	<50	<1	<2	<2	3.6	<1	<10	<2	<2	<2	<1
105523	<500	<0.16	<0.10	0.325	1.67	10.5	0.552	<0.24	<0.14	<0.11	2.19
105523	<500	<1	<2	<10	<5	16.3	<10	<2	<10	<10	<15
133465	<500	<1	<2	<2	2.83	30.8	<10	<2	<2	<2	3.15
144132	<50	<1	<2	<2	2.87	62	<10	<2	<2	<2	<1
162212											
216153											
172583	<10.000 U	<0.100 U	<0.100 U	<0.100 U	<0.500 U	14.05	0.460 J	<0.100 U	<0.060 U	<0.100 U	<0.100 U
172583	<10.000 U	<0.100 U	<0.100 U	0.270 J	0.540 J	12.41	0.53	<0.100 U	<0.060 U	<0.100 U	<0.100 U
172583											
172583											
8032		<10.			<10.				<50.		
8033		<10.			10				<50.		
101602	<50	<1	<2	<10	<5	19.4	<10	<2	<10	<10	<5
103963											
104684	<50	<0.1	<0.1	0.273	2.81	1.55	<1	0.406	0.331	<0.1	<0.5
104689	<50	<0.1	<0.1	0.232	4.49	1.27	<1	0.392	<0.02	<0.1	<0.5
104689	<50	<1	<2	<10	<5	1.4	<10	<2		<10	<15
104763	<50	<0.05	<0.10	0.268	1.8	0.582	0.319	0.539	<0.15	<0.05	0.107
104763	<50	<1	<2	<10	<5	<1	<10	<2		<10	<15
105324	<50	<0.25	<0.08	<0.12	<1.98	<0.61	0.2	0.269	<0.11	<0.10	<0.91
105324	<50	<1	<2	<2	<2	<1	<10	<2	<2	<2	<1
122624	<10.000 U	<0.100 U	<0.100 U	1.07	5.03	13.89	<0.100 U	<0.100 U	0.140 J	<0.100 U	0.78
122624											
122624											
122624											
154738	<50	<1	<2	<2	2.68	<1	<10	<2	<2	<2	<1
161253	<50.000 U	<0.500 U	<0.500 U	<0.500 U	5.17	3.69	0.450 J	0.230 J	<0.200 U	<0.500 U	0.130 J
161253	<50	<1	<2	<10	8.3	2.54	<10	<2	<10	<10	<15
161403	<50	<1	<2	<2	<2	<1	<10	2.63	<2	<2	<1
165323	<50	<1	<2	<2	<2	<1	<10	<2	<2	<2	<1
170571	<50	<1	<2	<2	<2	<1	<10	<2	<2	<2	<1
170571	<50	<1	<2	<2	<2	<1	<10	<2	<2	<2	<1
176387	<50	<1	<2	<2	<2	1.32	<10	<2	<2	<2	<1
179434	69	<0.250 U	1.75	<0.250 U	1.340 J	11.940 J	3.4	2.59	<0.150 U	<0.250 U	<0.250 U
189951	<50	<1	<2	<10	<5	5.19	<10	<2	<10	<10	<15
191002											
196860	<50	<1	<2	<2	2.24	1.66	<10	2.31	<2	<2	<1
206912											
206912											
211063	<100	<1	<2	3.6	9.24	80	<10	<2	<2	<2	7.01
216141	<10.000 U	<0.100 U	<0.100 U	0.470 J	15.31	2.420 J	<0.100 U	0.86	<0.060 U	<0.100 U	<0.100 U
216141											
216141											
216141											
216141											
223039	<10.000 U	<0.100 U	<0.100 U	0.320 J	4.74	42.6	3.04	<0.100 U	<0.060 U	<0.100 U	<0.100 U
223039	<10.000 U	<0.100 U	0.290 J	<0.100 U	6.94	38.55	3.4	1.46	<0.060 U	<0.100 U	0.87
223039											
223039											
223039											
226244											
251283	<10.000 U	<0.100 U	<0.100 U	0.270 J	1.66	2.05	<0.100 U	<0.100 U	<0.040 U	<0.100 U	<0.100 U
251285	<10.000 U	<0.100 U	<0.100 U	0.240 J	0.400 J	<0.400 U	<0.100 U	0.420 J	<0.040 U	<0.100 U	<0.100 U
251297	<10.000 U	<0.100 U	<0.100 U	0.270 J	0.51	<0.400 U	<0.100 U	0.7	<0.040 U	<0.100 U	<0.100 U
251298	<10.000 U	<0.100 U	<0.100 U	0.230 J	0.340 J	<0.400 U	<0.100 U	0.420 J	<0.040 U	<0.100 U	<0.100 U
251299	<10.000 U	<0.100 U	<0.100 U	0.250 J	0.64	<0.400 U	<0.100 U	0.350 J	<0.040 U	<0.100 U	<0.100 U
251300	<10.000 U	<0.100 U	<0.100 U	0.170 J	0.73	<0.400 U	<0.100 U	0.65	<0.040 U	<0.100 U	<0.100 U
251301	<10.000 U	<0.100 U	<0.100 U	0.160 J	1.55	9.77	0.250 J	0.330 J	<0.040 U	<0.100 U	0.140 J
251302	<10.000 U	<0.100 U	0.130 J	0.220 J	2.17	<0.400 U	0.140 J	0.320 J	<0.040 U	<0.100 U	0.110 J
251313	<10.000 U	<0.100 U	<0.100 U	0.200 J	0.91	<0.400 U	0.170 J	0.58	<0.040 U	<0.100 U	<0.100 U

Appendix C. Water Quality

GwicId	Br__ug_l_	Cd__ug_l_	Co__ug_l_	Cr__ug_l_	Cu__ug_l_	Li__ug_l_	Mo__ug_l_	Ni__ug_l_	Pb__ug_l_	Sb__ug_l_	Se__ug_l_
251314	<10.000 U	<0.100 U	<0.100 U	0.150 J	1.01	<0.400 U	0.420 J	0.280 J	<0.040 U	<0.100 U	<0.100 U
251315	<10.000 U	<0.100 U	<0.100 U	0.170 J	0.360 J	<0.400 U	<0.100 U	0.330 J	<0.040 U	<0.100 U	<0.100 U
277124											
279363	<10.000 U	<0.100 U	<0.100 U	<0.100 U	1.340 J	2.890 J	0.230 J	0.76	<0.060 U	<0.100 U	<0.100 U
279363	<10.000 U	<0.100 U	<0.100 U	0.400 J	1.800 J	2.380 J	<0.100 U	0.67	<0.060 U	<0.100 U	<0.100 U
279363											
279363											
279457	<10.000 U	<0.100 U	<0.100 U	2.81	1.520 J	14.37	4.11	0.340 J	<0.060 U	<0.100 U	2.29
150239	<50	<1	<2	<10	<5	34.6	<10	<2		<10	<15
161298	<50	<1	<2	<2	<2	14.6	<10	<2	<2	<2	<1
192625	<50	<1	<2	<10	<5	5.38	<10	<2	<10	<10	<5
196630											
196630											
8343	1400										
104836	1260	<1	<2	<10	31.1	16	14	<2	<10	<10	9.1
173009	<2500	<1	<2	<10	<5	128	<10	<2	<10	<10	79.7
191006	<500	<10	<20	<100	<50	51.5	<100	<20	<100	<100	<150
220656	<50	<1	<2	<10	<5	78.4	<10	<2	<10	<10	<5
104686	<500	<0.05	0.129	0.182	2.54	7.29	0.302	0.493	0.668	0.083	0.488
104686	<50	<1	<2	<2	<2	9.29	<10	<2	<2	<2	<1
106097	<2500	<10	<20	<100	<50	100	<100	<20	<100	<100	<150
127723	<100	<1	<2	<2	14.9	112	<10	<2	<2	<2	3.74
131617	<50	<1	<2	<10	<5	13.5	<10	<2		<10	<15
131660	94	<1	<2	3.14	<2	8.47	<10	<2	<2	<2	<1
149925	<50	<0.05	<0.10	0.09	0.452	13.1	0.315	<0.10	<0.15	<0.05	<0.10
149925	<50	<1	<2	<2	<2	11.7	<10	<2	<2	<2	<1
155756	<1000	<10	<20	<20	<20	90.8	<100	<20	<20	<20	<10
161429	<2500	<1.60	<1.00	<1.00	<2.60	4.01	<1.60	<2.40	<1.40	<1.10	<2.60
161429	61.4	<1	<2	<2	<2	2.96	<10	<2	<2	<2	1.29
162756	<50	<1	<2	<10	<5	17.7	<10	<2	<10	<10	<15
173044	57	<1	<2	<2	9.85	42.5	<10	<2	<2	<2	<1
191004	<50	<1	<2	<2	<2	<1	<10	<2	<2	<2	<1
193052	<500	<5	<10	<10	<10	50.7	<50	<10	<10	<10	<5
195934	<1000	<1	<2	<10	<5	30.8	<10	<2	<10	<10	<5
197444	<100	<0.1	<0.1	<0.1	0.649	25	4.07	0.153	<0.2	<0.1	<0.5
199495	<50	<0.05	<0.10	0.064	2.14	5.97	0.765	0.213	0.374	<0.05	0.121
199495	<50	<1	<2	<2	<2	8.05	<10	<2	<2	<2	<1
199495	<50	<1	<2	<2	<2	8.05	<10	<2	<2	<2	<1
216145	<10.000 U	<0.100 U	<0.100 U	0.280 J	68.86	3.570 J	<0.100 U	0.310 J	<0.060 U	<0.100 U	<0.100 U
216145											
144103	<50	<0.05	<0.10	0.101	1.46	4.92	1.72	<0.10	<0.15	<0.05	1.93
144103	<50	<1	<2	<10	<5	7.07	<10	<2	<10	<10	<15
150219	<250	<1	<2	<10	<5	24.3	<10	<2	<10	<10	<5
154728	<50	<1	<2	<10	40.7	15.1	<10	<2	<10	<10	<15
161309											
161309	<50	<1	<2	<10	<5	17.2	<10	<2	<10	<10	<15
179438	78	<1	<2	2.61	<2	14.2	<10	<2	<2	<2	1.52
192348	<50	<1	<2	<2	<2	7.14	<10	4.31	<2	<2	<1
192992	<2500	<10	<20	<20	<20	51.9	<100	<20	<20	<20	<10
214178	<10.000 U	<0.100 U	<0.100 U	1.19	0.550 J	18.99	2.97	<0.100 U	<0.060 U	<0.100 U	<0.100 U
214178											
215313	<500	<5	<10	<10	<10	56.3	<50	<10	<10	<10	<5
7942	300	3		<3.	5	19	<20.	<10.			0.6
100182	1100										
101564											
101564											
101564											
101569	<10.000 U	<0.100 U	<0.100 U	0.95	4.92	31.45	2.15	<0.100 U	0.260 J	<0.100 U	1.41
101569											
101574	<500	<1	<2	<10	<5	29.5	<10	<2	<10	<10	<15
104058	<1000	<1	<2	<10	<5	74.3	<10	<2	<10	<10	<5
138844	<1000	<0.51	<1.01	<0.40	<4.04	49.9	<0.40	<1.01	<1.54	<0.48	8.77
138844	<500	<5	<10	<10	<10	68.8	<50	<10	<10	<10	<5
150036	70	<0.250 U	<0.250 U	<0.250 U	1.500 J	43.44	0.570 J	0.860 J	<0.150 U	<0.250 U	<0.250 U
187522											
187522											

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GwicId	Br__ug_l_	Cd__ug_l_	Co__ug_l_	Cr__ug_l_	Cu__ug_l_	Li__ug_l_	Mo__ug_l_	Ni__ug_l_	Pb__ug_l_	Sb__ug_l_	Se__ug_l_
187522											
187522	<10.000 U	<0.100 U	<0.100 U	<0.100 U	2.42	15.26	1.66	0.93	0.45	<0.100 U	0.99
187522											
187522											
204130	<10.000 U	<0.100 U	<0.100 U	2.51	6.66	22.56	2.65	<0.100 U	0.250 J	<0.100 U	2.53
204130											
204130											
209163	<250	<1	<2	2.14	5.91	45	<10	<2	<2	<2	8.53
228297											
282122	<10.000 U	<0.100 U	0.230 J	1.04	0.940 J	30.64	2.39	0.71	<0.060 U	<0.100 U	0.52
282123	<10.000 U	<0.100 U	<0.100 U	<0.100 U	<0.500 U	19.04	0.64	<0.100 U	0.49	<0.100 U	<0.100 U
282123	<10.000 U	<0.100 U	<0.100 U	<0.100 U	<0.500 U	16.63	0.84	<0.100 U	0.43	<0.100 U	<0.100 U
282123	<10.000 U	<0.100 U	0.240 J	1.23	<0.500 U	20.4	0.93	0.400 J	<0.060 U	<0.100 U	<0.100 U
101494	<50	<1	<2	<2	3.03	19.6	<10	2.15	<2	<2	1.46
7816	1300										
101620	419	<0.500 U	<0.500 U	1.170 J	4.790 J	46.950 J	<0.500 U	<0.500 U	<0.300 U	<0.500 U	2.020 J
101620											
101620											
101620											
101620											
101620		<1	<2	<2	3.39	26.9	<10	<2	<2	<2	1.6
102813	<50	<1	<2	3.24	8.37	15.8	<10	<2	<2	<2	<1
102979	<250	<1	<2	<10	<5	21.6	<10	<2	<10	<10	7.23
102981											
105559	<2500	<10	<20	<100	<50	46.7	<100	<20	<100	<100	<150
105560	<500	<10	<20	<100	<50	49.8	<100	<20	<100	<100	<150
106106	<500	<10	<20	<100	<50	50.8	<100	<20	<100	<100	<150
156956	<50	<1	<2	<10	<10	10.8	<10	<2	<10	<10	<5
161333	<50	<1	<2	<2	<2	5.65	<10	<2	<2	<2	<1
183023	<1000	<10	<20	<20	<20	376	<100	<20	<20	<20	97.8
104852	<100.	<2.		<2.	8	5	<20.	<10.			9.8
167664	<500	<1	<2	<10	<5	19.1	<10	<2	12.1	<10	<5
171663	<500	<1	<2	<10	<5	16.6	<10	<2	<10	<10	<5
175243	105	<0.250 U	<0.250 U	2.79	14.74	25.79	24.88	<0.250 U	<0.150 U	6.5	1.46
175243	105	<0.250 U	<0.250 U	2.79	14.74	25.79	24.88	<0.250 U	<0.150 U	6.5	1.46
175243											
175243											
175243	<500	<1	<2	<10	15.1	23	19.3	<2	<10	<10	<15
199749	<500	<1	<2	<10	<5	7.29	<10	<2	<10	<10	<15
152465	<1250	<5	<10	<10	<10	268	<50	<10	<10	<10	25.6
100232	<250	<1	<2	<10	<5	41.3	<10	<2	<10	<10	6.88
212212	872	<1	<2	7.39	5.55	386	<10	<2	<2	<2	8.36
212212	1020	<1	<2	<10	<5	379	<10	<2	<10	<10	9.89
189096	<50	<1	<2	<10	<5	3.25	10.6	<2	<10	<10	<5
173046	<50	<1	<2	<2	21.1	26.6	<10	2.68	<2	<2	<1
157952	<50	<1	<2	<2	2.66	5.34	<10	<2	<2	<2	<1
102991	<10.000 U	<0.500 U	1.250 J	1.830 J	2.800 J	93.9	2.85	<0.500 U	0.690 J	<0.500 U	<0.500 U
278903											
278903											
278903											
278903											
278903											
278903											
278903											
278903											
278903											
278903											
278913											
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Appendix C. Water Quality

GwicId	Br__ug_l_	Cd__ug_l_	Co__ug_l_	Cr__ug_l_	Cu__ug_l_	Li__ug_l_	Mo__ug_l_	Ni__ug_l_	Pb__ug_l_	Sb__ug_l_	Se__ug_l_
278913											
278913											
278913											
278913											
278913											
278913											
278913											
278913											
278913											
278913											
278913											
278913											
278914											
278914											
280040											
280040											
280042											
280042											
280042											
280042											
280046											
280046											
280046											
280047											
280048											
280049											
280050											
280052											
280052											
281828											
281830	<10.000 U	<0.100 U	<0.100 U	1.01	0.770 J	7.090 J	0.93	0.53	<0.060 U	<0.100 U	<0.100 U
281830											
281830											
281830											
281830	<10.000 U	<0.100 U	<0.100 U	0.91	1.330 J	3.240 J	1.02	0.320 J	<0.060 U	<0.100 U	<0.100 U
281830											
281831											
281833	<10.000 U	<0.100 U	<0.100 U	<0.100 U	<0.500 U	<2.000 U	0.62	<0.100 U	<0.060 U	<0.100 U	<0.100 U
281833											
281833											
281833											
281833	<10.000 U	<0.100 U	<0.100 U	0.57	0.520 J	<2.000 U	1.49	<0.100 U	<0.060 U	<0.100 U	<0.100 U
281833											
281834											
281835											
281840	<10.000 U	<0.100 U	<0.100 U	<0.100 U	<0.500 U	4.850 J	0.51	0.280 J	<0.060 U	<0.100 U	<0.100 U
281840	<10.000 U	<0.100 U	<0.100 U	1.14	1.210 J	6.490 J	1.07	0.270 J	<0.060 U	<0.100 U	<0.100 U
281840											
281841											
281842											
281860	<10.000 U	<0.100 U	0.200 J	1.13	1.060 J	4.540 J	0.87	0.380 J	<0.060 U	<0.100 U	<0.100 U
281860	<10.000 U	<0.100 U	<0.100 U	<0.100 U	<0.500 U	4.910 J	0.7	0.420 J	<0.060 U	<0.100 U	<0.100 U
281864											
281864											
281864											
281864											
282265											
161411	<50	<1	<2	<10	<5	13.8	<10	<2	<10	<10	<15
189175	<50	<1	<2	<2	<2	2.1	<10	<2	<2	<2	<1
197487	<50	<1	<2	<10	5.7	5.98	<10	<2	<10	<10	<15

Appendix C. Water Quality

GwicId	Sn__ug_l_	Sr__ug_l_	Ti__ug_l_	Tl__ug_l_	U__ug_l_	V__ug_l_	Zn__ug_l_	Zr__ug_l_	Ce__ug_l_	Cs__ug_l_	Ga__ug_l_	La__ug_l_
106078		119	<1	<5	4.7	<5	5.76	<2				
173039	0.049	56	<0.20	<0.03	0.504	0.102	<0.91	<0.05	<0.02	<0.04	<0.05	0.029
173039		57.7	<1	<20		<10	5.53	<2				
102937												
104893		685	<1	<5	11.5	<5	<2	<2				
105455		154	<1	<5	1.15	<5	4.16	<2				
105523	<0.80	114	2.61	<0.70	<0.55	<0.50	<4.45	<0.90	<0.10	<0.12	<0.10	<0.10
105523		881	<1	<20		<10	2.12	<2				
133465		1603	<1	<5	34.8	<5	2.9	<2				
144132		250	<1	<5	0.734	<5	24.1	<2				
162212												
216153												
172583	<0.100 U	78.26	1.74	<0.100 U	<0.100 U	<0.100 U	2.09	<0.100 U	<0.100 U	<0.100 U	5.5	<0.100 U
172583	<0.100 U	72.06	3.42	<0.100 U	<0.100 U	<0.100 U	1.930 J	<0.100 U	<0.100 U	<0.100 U	4.95	<0.100 U
172583												
172583												
8032							230					
8033							150					
101602		1090	<1	<20	8.37	<10	3.65	2.37				
103963												
104684		67.4	<1	<0.1	0.312	0.202	5.39	<0.1				
104689		73	<1	<0.1	0.144	0.158	9.23	<0.1				
104689		152	<1	<20		<10	10.7	<2				
104763	0.067	117	<0.20	<0.03	0.775	0.175	1.5	<0.05	<0.02	<0.04	<0.05	0.191
104763		117	<1	<20		<10	8.23	<2				
105324	<0.16	43.3	<0.40	<0.02	<0.06	<0.11	7.81	<0.08	<0.06	<0.07	<0.12	<0.05
105324		42.1	<1	<5	<1	<5	12.7	<2				
122624	<0.100 U	902.14	32.95	<0.100 U	6.28	1	14.51	<0.100 U	<0.100 U	<0.100 U	2	<0.100 U
122624												
122624												
122624												
154738		48.3	<1	<5	<1	<5	<2	<2				
161253	<0.500 U	286.4	0.100 J	<0.500 U	2.93	0.210 J	0.890 J	<0.500 U	<0.500 U	<0.500 U	<0.500 U	<0.500 U
161253		202	<1	<20		<10	3.52	<2				
161403		77.4	<1	<5	0.811	<5	<2	<2				
165323		98.7	<1	<5	<1	<5	<2	<2				
170571		82.5	<1	<5	<0.5	<5	35.2	<2				
170571		82.5	<1	<5	<0.5	<5	35.2	<2				
176387		52.4	<1	<5	<1	<5	3.38	<2				
179434	<0.250 U	979.71	101.36	<0.250 U	25.94	<0.250 U	<1.250 U	<0.250 U	<0.250 U	<0.250 U	3.01	<0.250 U
189951		132	<1	<20		<10	<2	<2				
191002												
196860		234	<1	<5	0.898	<5	9.6	<2				
206912												
206912												
211063		2478	<1	<5	14.5	<5	16.2	<2				
216141	<0.100 U	405.29	34.4	<0.100 U	1.27	0.64	28.62	<0.100 U	<0.100 U	<0.100 U	3.18	<0.100 U
216141												
216141												
216141												
216141												
223039	<0.100 U	1397.32	71.17	<0.100 U	7.47	0.380 J	14.83	<0.100 U	<0.100 U	<0.100 U	1.31	<0.100 U
223039	<0.100 U	1185.38	67.38	<0.100 U	5.3	<0.100 U	21.08	<0.100 U	<0.100 U	<0.100 U	1.07	<0.100 U
223039												
223039												
223039												
226244												
251283	<0.100 U	62.44	<0.100 U	<0.100 U	0.310 J	0.460 J	0.440 J	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251285	<0.100 U	35.03	<0.100 U	<0.100 U	<0.100 U	0.210 J	0.950 J	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251297	<0.100 U	68.65	0.130 J	<0.100 U	<0.100 U	0.190 J	2.67	<0.100 U	<0.100 U	<0.100 U	<0.100 U	0.160 J
251298	<0.100 U	63.4	<0.100 U	<0.100 U	0.130 J	0.250 J	5.89	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251299	<0.100 U	63.73	<0.100 U	<0.100 U	<0.100 U	0.480 J	8.62	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251300	<0.100 U	130.09	<0.100 U	<0.100 U	0.150 J	0.410 J	6.15	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251301	0.100 J	427.25	0.330 J	<0.100 U	1.27	0.160 J	0.790 J	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251302	<0.100 U	145.27	<0.100 U	<0.100 U	0.190 J	1.37	0.410 J	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251313	<0.100 U	28.87	0.100 J	<0.100 U	<0.100 U	0.470 J	2.18	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U

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GwicId	Sn__ug_l_	Sr__ug_l_	Ti__ug_l_	Tl__ug_l_	U__ug_l_	V__ug_l_	Zn__ug_l_	Zr__ug_l_	Ce__ug_l_	Cs__ug_l_	Ga__ug_l_	La__ug_l_
251314	<0.100 U	75.87	<0.100 U	<0.100 U	0.410 J	0.200 J	0.650 J	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251315	<0.100 U	109.17	<0.100 U	<0.100 U	0.240 J	0.250 J	0.360 J	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
277124												
279363	<0.100 U	73.92	13.73	<0.100 U	<0.100 U	0.67	16.27	<0.100 U	<0.100 U	<0.100 U	3.44	<0.100 U
279363	<0.100 U	62.89	18.22	<0.100 U	<0.100 U	0.230 J	13.37	<0.100 U	<0.100 U	<0.100 U	2.62	<0.100 U
279363												
279363												
279457	<0.100 U	628.42	42.65	<0.100 U	9.56	4.18	18.05	<0.100 U	<0.100 U	<0.100 U	4.1	<0.100 U
150239		304	<1	<20		<10	<2	<2				
161298		22.8	<1	<5	<1	<5	<2	<2				
192625		42.3	<1	20	<3	<10	<2	<2				
196630												
196630												
8343												
104836		508	<1	<20	14.8	<10	<10	<2				
173009		5985	<1	<20	10.1	<10	91.7	2.08				
191006		5440	<10	<200		<100	<20	<20				
220656		379	<1	<25	<2.5	<10	3.33	4.32				
104686	0.106	589	0.499	<0.03	4.66	0.173	38.6	<0.25	<0.02	<0.04	<0.05	<0.02
104686		568	<1	<5	4.2	<5	32.2	<2				
106097		1180	<10	<200		<100	<20	<20				
127723		1218	1.15	<5	3.73	<5	8.21	<2				
131617		110	<1	<20		<10	<2	<2				
131660		4826	<1	<5	<1	<5	99.5	<2				
149925	0.083	318	<0.20	<0.03	0.051	<0.10	1.37	<0.05	<0.02	<0.04	<0.05	<0.02
149925		296	<1	<5	<1	<5	4.02	<2				
155756		3982	<10	<50	18.8	<50	52	<20				
161429	<1.60	1482	<4.70	<1.40	2.86	<1.00	<8.90	<1.80	<1.00	<1.20	<1.00	<1.00
161429		829	<1	<5	3.24	<5	17.3	<2				
162756		1220	<1	<20		<10	2.5	<2				
173044		1564	<1	<5	0.65	<5	5.4	<2				
191004		62.4	<1	<5	<1	<5	<2	<2				
193052		5059	<5	<25	5.1	<25	42.9	<10				
195934		442	<1	<25	<2.5	<10	<2	<2				
197444	<0.1	363	<1.0	<0.1	0.113	<0.1	0.907	0.289	<0.1	<0.1	<0.1	<0.1
199495	0.074	303	<0.20	<0.03	0.314	<0.10	15.3	<0.05	<0.02	<0.04	<0.05	<0.02
199495		335	<1	<5	<1	<5	3.33	<2				
199495		335	<1	<5	<1	<5	3.33	<2				
216145	<0.100 U	86.28	12.15	<0.100 U	<0.100 U	0.330 J	15.33	0.51	<0.100 U	<0.100 U	2.91	<0.100 U
216145												
144103	0.14	1029	0.485	<0.03	2.77	<0.10	4.44	<0.05	<0.02	<0.04	<0.05	<0.02
144103		1260	<1	<20		<10	28.4	<2				
150219		643	<1	<20	4.4	<10	<2	<2				
154728		541	<1	<20		<10	11.7	<2				
161309												
161309		1050	<1	<20		<10	17.4	<2				
179438		947	<1	<5	1.22	<5	7.19	<2				
192348		2650	<1	<5	2.71	<5	<2	<2				
192992		1353	<10	<50	<5	<50	48.9	<20				
214178	<0.100 U	340.49	12.72	<0.100 U	0.360 J	0.400 J	1.470 J	<0.100 U	<0.100 U	<0.100 U	5.74	<0.100 U
214178												
215313		998	<5	<25	<3	<25	<10	<10				
7942		1760	10			<1.	18	<4.				
100182												
101564												
101564												
101564												
101569	<0.100 U	938.69	40.23	<0.100 U	2.98	0.360 J	29.72	<0.100 U	<0.100 U	<0.100 U	1.78	<0.100 U
101569												
101574		1720	<1	<20		<10	104	<2				
104058		2318	<1	<25	<3	<10	45.3	4.11				
138844	<0.41	3479	18.7	<0.33	13.8	<1.01	<9.09	<0.51	<0.20	<0.42	<0.51	<0.22
138844		4328	<5	<25	14.7	<25	<10	<10				
150036	<0.250 U	1626.67	84.39	<0.250 U	<0.250 U	<0.250 U	13.86	<0.250 U	<0.250 U	<0.250 U	0.520 J	<0.250 U
187522												
187522												

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GwicId	Sn__ug_l_	Sr__ug_l_	Ti__ug_l_	Tl__ug_l_	U__ug_l_	V__ug_l_	Zn__ug_l_	Zr__ug_l_	Ce__ug_l_	Cs__ug_l_	Ga__ug_l_	La__ug_l_
187522												
187522		914.25	0.66	<0.100 U		<0.100 U	17.49					
187522												
187522												
204130	<0.100 U	856.19	61.98	<0.100 U	4.4	0.72	7.04	<0.100 U	<0.100 U	<0.100 U	1.49	<0.100 U
204130												
204130												
209163		1773	<1	<5	6.42	<5	15.4	<2				
228297												
282122	<0.100 U	901.44	33.35	<0.100 U	2.62	0.370 J	2.83	<0.100 U	<0.100 U	<0.100 U	1.98	<0.100 U
282123	<0.100 U	976.1	4.36	<0.100 U	0.73	<0.100 U	4.34	<0.100 U	<0.100 U	<0.100 U	3.44	<0.100 U
282123	<0.100 U	941.65	4.5	<0.100 U	0.400 J	<0.100 U	4.93	<0.100 U	<0.100 U	<0.100 U	3.19	<0.100 U
282123	<0.100 U	1077.63	54.69	<0.100 U	0.390 J	0.350 J	2.84	<0.100 U	<0.100 U	<0.100 U	3.08	<0.100 U
101494		1125	<1	<5	3.72	<5	67.6	<2				
7816												
101620	<0.500 U	5132.55	170.57	<0.500 U	4.53	<0.500 U	95.99	5.36	<0.500 U	<0.500 U	<0.500 U	<0.500 U
101620												
101620												
101620												
101620												
101620		1932	<1	<5	2.64	<5	34.5	<2				
102813		43	<1	<5	1.33	<5	9.65	<2				
102979		105	<1	<25	<3	<10	<2	<2				
102981												
105559		3970	<10	<200		<100	<20	<20				
105560		3690	<10	<200		<100	<20	<20				
106106		5560	<10	<200		<100	<20	<20				
156956		115	<1	<20	<3	<10	3.76	2.13				
161333		15	<1	<5	<1	<5	<2	<2				
183023		6813	13.1	<50	39.9	<50	107	<20				
104852		1780	5			1	8	<4.				
167664		1592	<1	<25	<3	<10	26.2	<2				
171663		462	<1	<25	<3	<10	<2	<2				
175243	<0.250 U	105.65	8.15	<0.250 U	5.9	1.46	1.280 J	<0.250 U	<0.250 U	<0.250 U	0.900 J	<0.250 U
175243	<0.250 U	105.65	8.15	<0.250 U	5.9	1.46	1.280 J	<0.250 U	<0.250 U	<0.250 U	0.900 J	<0.250 U
175243												
175243												
175243		53.5	<1	<20		<10	<2	<2				
199749		2170	<1	<20		<10	<2	<2				
152465		8707	<5	<25	16.3	<25	<10	<10				
100232		2898	1.25	<20	3.12	<10	10.2	<10				
212212		127	<1	<5	<0.5	<5	<2	<2				
212212		124	<1	<25	<3	<10	2.06	<2				
189096		17.1	<1	<20	<3	<10	<2	<2				
173046		330	1.64	<5	30.8	<5	16.6	<2				
157952		112	<1	<5	2.5	<5	8.11	<2				
102991	<0.500 U	6349.01	557.84	<0.500 U	24.88	<0.500 U	188.15	<0.500 U	<0.500 U	<0.500 U	<0.500 U	<0.500 U
278903												
278903												
278903												
278903												
278903												
278903												
278903												
278903												
278903												
278903												
278913												
278913												
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278913												

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GwicId	Sn__ug_l_	Sr__ug_l_	Ti__ug_l_	Tl__ug_l_	U__ug_l_	V__ug_l_	Zn__ug_l_	Zr__ug_l_	Ce__ug_l_	Cs__ug_l_	Ga__ug_l_	La__ug_l_
278913												
278913												
278913												
278913												
278913												
278913												
278913												
278913												
278913												
278913												
278913												
278913												
278914												
278914												
280040												
280040												
280042												
280042												
280042												
280042												
280046												
280046												
280046												
280047												
280048												
280049												
280050												
280052												
280052												
281828												
281830	<0.100 U	364.76	26.61	<0.100 U	1.37	0.480 J	2.13	<0.100 U	<0.100 U	<0.100 U	3.72	<0.100 U
281830												
281830												
281830												
281830	<0.100 U	237.41	21.89	<0.100 U	1.47	0.470 J	2.53	<0.100 U	<0.100 U	<0.100 U	2.64	<0.100 U
281830												
281831												
281833	<0.100 U	62.91	3.49	<0.100 U	0.430 J	<0.100 U	1.780 J	<0.100 U	<0.100 U	<0.100 U	0.84	<0.100 U
281833												
281833												
281833												
281833	<0.100 U	80.45	6.93	<0.100 U	1.09	0.250 J	1.040 J	<0.100 U	<0.100 U	<0.100 U	0.95	<0.100 U
281833												
281834												
281835												
281840	<0.100 U	217.22	24.98	<0.100 U	0.58	0.410 J	2.48	<0.100 U	<0.100 U	<0.100 U	3.19	<0.100 U
281840	<0.100 U	276.62	33.19	<0.100 U	1.47	0.7	1.720 J	<0.100 U	<0.100 U	<0.100 U	3.71	<0.100 U
281840												
281841												
281842												
281860	<0.100 U	316.24	33.9	<0.100 U	1.38	0.79	0.760 J	<0.100 U	<0.100 U	<0.100 U	3.53	<0.100 U
281860	<0.100 U	301.7	27.2	<0.100 U	0.95	0.79	1.030 J	<0.100 U	<0.100 U	<0.100 U	3.6	<0.100 U
281864												
281864												
281864												
281864												
282265												
161411		392	<1	<20		<10	10.7	<2				
189175		96.6	<1	<5	<1	<5	<2	<2				
197487		347	<1	<20		<10	15.2	<2				

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GwicId	Nb__ug_l_	Nd__ug_l_	Pd__ug_l_	Pr__ug_l_	Rb__ug_l_	Th__ug_l_
106078						
173039	<0.04	<0.05	<0.10	<0.02	0.062	<0.02
173039						
102937						
104893						
105455						
105523	<0.34	<0.13	0.267	<0.10	0.502	<0.90
105523						
133465						
144132						
162212						
216153						
172583	<0.100 U	<0.100 U	<0.100 U	<0.100 U	0.68	<0.100 U
172583	<0.100 U	<0.100 U	<0.100 U	<0.100 U	0.64	<0.100 U
172583						
172583						
8032						
8033						
101602						
103963						
104684						
104689						
104689						
104763	<0.04	0.131	<0.10	0.034	0.037	<0.02
104763						
105324	<0.07	<0.15	<0.14	<0.04	<0.09	<0.09
105324						
122624	<0.100 U	<0.100 U	0.77	<0.100 U	<0.100 U	<0.100 U
122624						
122624						
122624						
154738						
161253	<0.500 U	<0.500 U	<0.500 U	<0.500 U	0.120 J	<0.500 U
161253						
161403						
165323						
170571						
170571						
176387						
179434	<0.250 U	<0.250 U	1.200 J	<0.250 U	<0.250 U	<0.250 U
189951						
191002						
196860						
206912						
206912						
211063						
216141	<0.100 U	<0.100 U	0.310 J	<0.100 U	<0.100 U	<0.100 U
216141						
216141						
216141						
216141						
223039	<0.100 U	<0.100 U	0.81	<0.100 U	<0.100 U	<0.100 U
223039	<0.100 U	<0.100 U	1.64	<0.100 U	<0.100 U	<0.100 U
223039						
223039						
223039						
226244						
251283	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251285	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251297	<0.100 U	<0.100 U	<0.100 U	<0.100 U	0.120 J	<0.100 U
251298	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251299	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
251300	<0.100 U	<0.100 U	<0.100 U	<0.100 U	0.120 J	<0.100 U
251301	<0.100 U	<0.100 U	0.310 J	<0.100 U	0.160 J	<0.100 U
251302	<0.100 U	<0.100 U	<0.100 U	<0.100 U	0.290 J	<0.100 U
251313	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U

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GwicId	Nb__ug_l_	Nd__ug_l_	Pd__ug_l_	Pr__ug_l_	Rb__ug_l_	Th__ug_l_
251314	<0.100 U	<0.100 U	<0.100 U	<0.100 U	0.150 J	<0.100 U
251315	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
277124						
279363	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
279363	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
279363						
279363						
279457	<0.100 U	<0.100 U	0.95	<0.100 U	<0.100 U	<0.100 U
150239						
161298						
192625						
196630						
196630						
8343						
104836						
173009						
191006						
220656						
104686	<0.04	<0.05	0.185	<0.02	0.613	<0.02
104686						
106097						
127723						
131617						
131660						
149925	<0.04	<0.05	<0.10	<0.02	1.65	<0.02
149925						
155756						
161429	<3.40	<1.30	<1.20	<1.00	<1.10	<1.80
161429						
162756						
173044						
191004						
193052						
195934						
197444	<0.1	<0.1	0.5	<0.1	0.97	<0.05
199495	<0.04	<0.05	0.12	<0.02	0.347	<0.02
199495						
199495						
216145	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U	<0.100 U
216145						
144103	<0.04	<0.05	0.32	<0.02	0.463	<0.02
144103						
150219						
154728						
161309						
161309						
179438						
192348						
192992						
214178	<0.100 U	<0.100 U	0.340 J	<0.100 U	1.19	<0.100 U
214178						
215313						
7942						
100182						
101564						
101564						
101564						
101569	<0.100 U	<0.100 U	0.65	<0.100 U	0.91	<0.100 U
101569						
101574						
104058						
138844	<0.40	<0.52	1.04	<0.21	2.72	<0.23
138844						
150036	<0.250 U	<0.250 U	2.03	<0.250 U	1.82	<0.250 U
187522						
187522						

Appendix C. Water Quality

GwicId	Nb__ug_l_	Nd__ug_l_	Pd__ug_l_	Pr__ug_l_	Rb__ug_l_	Th__ug_l_
187522						
187522						
187522						
187522						
204130	<0.100 U	<0.100 U	0.84	<0.100 U	0.66	<0.100 U
204130						
204130						
209163						
228297						
282122	<0.100 U	<0.100 U	0.94	<0.100 U	1.15	<0.100 U
282123	<0.100 U	<0.100 U	0.55	<0.100 U	0.98	<0.100 U
282123	<0.100 U	<0.100 U	0.53	<0.100 U	0.94	<0.100 U
282123	<0.100 U	<0.100 U	1.09	<0.100 U	1.16	<0.100 U
101494						
7816						
101620	<0.500 U	<0.500 U	4.71	<0.500 U	<0.500 U	<0.500 U
101620						
101620						
101620						
101620						
101620						
102813						
102979						
102981						
105559						
105560						
106106						
156956						
161333						
183023						
104852						
167664						
171663						
175243	<0.250 U	<0.250 U	<0.250 U	<0.250 U	<0.250 U	<0.250 U
175243	<0.250 U	<0.250 U	<0.250 U	<0.250 U	<0.250 U	<0.250 U
175243						
175243						
175243						
199749						
152465						
100232						
212212						
212212						
189096						
173046						
157952						
102991	<0.500 U	<0.500 U	6.05	<0.500 U	4.26	<0.500 U
278903						
278903						
278903						
278903						
278903						
278903						
278903						
278903						
278903						
278903						
278913						
278913						
278913						
278913						
278913						
278913						
278913						
278913						
278913						

Appendix C. Water Quality

GwicId	Nb__ug_l_	Nd__ug_l_	Pd__ug_l_	Pr__ug_l_	Rb__ug_l_	Th__ug_l_
278913						
278913						
278913						
278913						
278913						
278913						
278913						
278913						
278913						
278913						
278913						
278913						
278914						
278914						
280040						
280040						
280042						
280042						
280042						
280042						
280046						
280046						
280046						
280047						
280048						
280049						
280050						
280052						
280052						
281828						
281830	<0.100 U	<0.100 U	0.330 J	<0.100 U	0.61	<0.100 U
281830						
281830						
281830						
281830	<0.100 U	<0.100 U	0.280 J	<0.100 U	0.450 J	<0.100 U
281830						
281831						
281833	<0.100 U	<0.100 U	<0.100 U	<0.100 U	0.64	<0.100 U
281833						
281833						
281833						
281833	<0.100 U	<0.100 U	<0.100 U	<0.100 U	0.480 J	<0.100 U
281833						
281834						
281835						
281840	<0.100 U	<0.100 U	<0.100 U	<0.100 U	0.72	<0.100 U
281840	<0.100 U	<0.100 U	0.360 J	<0.100 U	0.6	<0.100 U
281840						
281841						
281842						
281860	<0.100 U	<0.100 U	0.380 J	<0.100 U	0.420 J	<0.100 U
281860	<0.100 U	<0.100 U	0.300 J	<0.100 U	0.6	<0.100 U
281864						
281864						
281864						
281864						
282265						
161411						
189175						
197487						

Appendix C. Water Quality

GwicId	W__ug_l_	NO2_N__mg_	NO3πô¡N__m	Total_N_as	OH__mg_l_	Total_Diss	Sum_Dissol	Hardness__	Alkalinity	SAR	Procedure
106078						42	64	34	35	0	DISSOLVED
173039	<0.05					61	84	41	38	0	DISSOLVED
173039						58	85	41	44	0	DISSOLVED
102937						0	0	0	0	0	DISSOLVED
104893						441	642	284	325	1	DISSOLVED
105455						61	90	41	48	0	DISSOLVED
105523	2.55					393	575	319	294	1	DISSOLVED
105523						517	741	365	361	1	DISSOLVED
133465						1060	1265	574	331	3	DISSOLVED
144132						193	302	175	176	0	DISSOLVED
162212						0	0	0	0	0	DISSOLVED
216153						0	0	0	0	0	DISSOLVED
172583	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	201	300	12	168	9	DISSOLVED
172583	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	210	316	13	177	10	DISSOLVED
172583						0	0	0	0	0	DISSOLVED
172583						0	0	0	0	0	DISSOLVED
8032						35	50	22	24	0	DISSOLVED
8033						51	73	36	35	0	DISSOLVED
101602						385	598	285	344	1	DISSOLVED
103963						0	0	0	0	0	DISSOLVED
104684						71	98	51	43	0	DISSOLVED
104689						71	99	47	46	0	DISSOLVED
104689						144	169	112	40	0	DISSOLVED
104763	<0.05					103	135	63	51	0	DISSOLVED
104763						77	111	56	55	0	DISSOLVED
105324	<0.11					40	56	24	26	0	DISSOLVED
105324						32	45	20	21	0	DISSOLVED
122624	<0.100 U	<0.010 U	0.81	1.29	0	373	563	235	308	1	DISSOLVED
122624						0	0	0	0	0	DISSOLVED
122624						0	0	0	0	0	DISSOLVED
122624						0	0	0	0	0	DISSOLVED
154738		<0.05				80	122	73	68	0	DISSOLVED
161253	<0.500 U	<0.050 U	1.47	1.6	0	216	334	184	191	0	DISSOLVED
161253						141	221	114	129	0	DISSOLVED
161403						55	79	36	39	0	DISSOLVED
165323						89	131	63	67	0	DISSOLVED
170571						52	77	37	39	0	DISSOLVED
170571						52	77	37	39	0	DISSOLVED
176387						57	81	37	40	0	DISSOLVED
179434	<0.250 U	<0.010 U	0.23	<1.000 U	0	829	1088	538	418	1	DISSOLVED
189951						168	261	132	151	0	DISSOLVED
191002						0	0	0	0	0	DISSOLVED
196860						183	280	139	157	0	DISSOLVED
206912						0	0	0	0	0	DISSOLVED
206912						0	0	0	0	0	DISSOLVED
211063						1043	1296	738	408	1	DISSOLVED
216141	<0.100 U	<0.010 U	0.65	1.47	0	229	347	181	191	0	DISSOLVED
216141						0	0	0	0	0	DISSOLVED
216141						0	0	0	0	0	DISSOLVED
216141						0	0	0	0	0	DISSOLVED
216141						0	0	0	0	0	DISSOLVED
223039	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	623	899	497	447	1	DISSOLVED
223039	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	527	731	401	330	1	DISSOLVED
223039						0	0	0	0	0	DISSOLVED
223039						0	0	0	0	0	DISSOLVED
223039						0	0	0	0	0	DISSOLVED
226244						0	0	0	0	0	DISSOLVED
251283	<0.100 U	<0.010 U	1.31	1.31	0	116	175	103	95	0	DISSOLVED
251285	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	41	56	24	25	0	DISSOLVED
251297	<0.100 U	<0.010 U	0.77	1.02	0	87	104	59	26	0	DISSOLVED
251298	<0.100 U	<0.010 U	0.71	1.44	0	73	105	51	52	0	DISSOLVED
251299	<0.100 U	<0.010 U	0.48	<1.000 U	0	83	119	57	59	0	DISSOLVED
251300	<0.100 U	<0.010 U	0.5	1.29	0	126	185	96	96	0	DISSOLVED
251301	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	287	429	188	230	1	DISSOLVED
251302	<0.100 U	<0.010 U	1.83	2.06	0	201	309	187	175	0	DISSOLVED
251313	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	35	51	22	25	0	DISSOLVED

Appendix C. Water Quality

GwicId	W__ug_l_	NO2_N__mg_	NO3πô¡N__m	Total_N_as	OH__mg_l_	Total_Diss	Sum_Dissol	Hardness__	Alkalinity	SAR	Procedure
251314	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	102	155	86	86	0	DISSOLVED
251315	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	116	172	89	90	0	DISSOLVED
277124						0	0	0	0	0	DISSOLVED
279363	<0.100 U	<0.010 U	0.86	1.44	0	116	172	82	90	0	DISSOLVED
279363	<0.100 U	<0.010 U	0.69	<1.000 U	0	109	165	85	89	0	DISSOLVED
279363						0	0	0	0	0	DISSOLVED
279363						0	0	0	0	0	DISSOLVED
279457	0.210 J	<0.010 U	0.4	<1.000 U	0	481	706	323	363	2	DISSOLVED
150239						509	772	42	426	13	DISSOLVED
161298						193	268	4	154	19	DISSOLVED
192625						178	259	5	145	14	DISSOLVED
196630						0	0	0	0	0	DISSOLVED
196630						0	0	0	0	0	DISSOLVED
8343						4137	4346	785	339	17	DISSOLVED
104836						1413	1679	33	429	36	DISSOLVED
173009						6731	7024	782	473	32	DISSOLVED
191006						5243	5491	992	400	17	DISSOLVED
220656						1554	2298	16	1243	75	DISSOLVED
104686	<0.05					431	653	394	358	0	DISSOLVED
104686						347	542	303	315	0	DISSOLVED
106097						3004	3421	42	757	70	DISSOLVED
127723						673	882	371	338	2	DISSOLVED
131617						313	469	13	287	15	DISSOLVED
131660						413	533	244	194	1	DISSOLVED
149925	<0.05					190	276	58	138	3	DISSOLVED
149925						151	225	63	121	2	DISSOLVED
155756						5148	5561	1044	668	18	DISSOLVED
161429	<1.30					299	409	148	177	2	DISSOLVED
161429						302	412	168	177	1	DISSOLVED
162756						166	253	100	140	1	DISSOLVED
173044						207	307	165	162	0	DISSOLVED
191004						233	323	3	168	23	DISSOLVED
193052						2488	2753	1046	429	6	DISSOLVED
195934						1506	1866	11	663	75	DISSOLVED
197444	<0.5					301	451	70	243	5	DISSOLVED
199495	<0.05					223	335	174	180	0	DISSOLVED
199495						196	304	166	174	0	DISSOLVED
199495						196	304	166	174	0	DISSOLVED
216145	<0.100 U	<0.010 U	0.29	<1.000 U	0	90	131	61	67	0	DISSOLVED
216145						0	0	0	0	0	DISSOLVED
144103	<0.05					397	593	178	317	3	DISSOLVED
144103						415	619	202	330	2	DISSOLVED
150219						864	1188	215	522	7	DISSOLVED
154728						324	490	223	267	1	DISSOLVED
161309						0	0	0	0	0	DISSOLVED
161309						347	551	282	330	1	DISSOLVED
179438						661	946	64	459	14	DISSOLVED
192348						314	476	224	261	1	DISSOLVED
192992						2635	2964	88	532	41	DISSOLVED
214178	0.260 J	<0.010 U	<0.200 U	<1.000 U	0	295	440	67	235	5	DISSOLVED
214178						0	0	0	0	0	DISSOLVED
215313						2070	2441	85	622	33	DISSOLVED
7942						700	876	312	285	3	DISSOLVED
100182						1543	1902	7	620	93	DISSOLVED
101564						0	0	0	0	0	DISSOLVED
101564						0	0	0	0	0	DISSOLVED
101564						0	0	0	0	0	DISSOLVED
101569	<0.100 U	<0.010 U	0.59	1.54	0	482	694	266	342	2	DISSOLVED
101569						0	0	0	0	0	DISSOLVED
101574						524	725	360	324	1	DISSOLVED
104058						1444	1714	270	437	10	DISSOLVED
138844	<0.51					2681	2895	1657	346	2	DISSOLVED
138844						2862	3074	1724	342	2	DISSOLVED
150036	<0.250 U	<0.010 U	<0.200 U	<1.000 U	0	916	1131	408	349	3	DISSOLVED
187522						0	0	0	0	0	DISSOLVED
187522						0	0	0	0	0	DISSOLVED

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GwicId	W__ug_l_	NO2_N__mg_	NO3πô¡N__m	Total_N_as	OH__mg_l_	Total_Diss	Sum_Dissol	Hardness__	Alkalinity	SAR	Procedure
187522						0	0	0	0	0	DISSOLVED
187522		<0.010 U	1.27	1.6	0	530	786	338	413	2	DISSOLVED
187522						0	0	0	0	0	DISSOLVED
187522						0	0	0	0	0	DISSOLVED
204130	0.210 J	<0.010 U	0.75	4.24	0	460	657	381	318	0	DISSOLVED
204130						0	0	0	0	0	DISSOLVED
204130						0	0	0	0	0	DISSOLVED
209163						989	1285	552	478	3	DISSOLVED
228297						0	0	0	0	0	DISSOLVED
282122	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	483	680	226	327	2	DISSOLVED
282123	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	561	792	308	374	2	DISSOLVED
282123	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	541	761	304	356	2	DISSOLVED
282123	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	568	791	306	359	2	DISSOLVED
101494						521	763	251	391	3	DISSOLVED
7816						4032	4272	1053	388	13	DISSOLVED
101620	<0.500 U	<0.050 U	1.11	1.11	0	2619	3069	786	728	9	DISSOLVED
101620						0	0	0	0	0	DISSOLVED
101620						0	0	0	0	0	DISSOLVED
101620						0	0	0	0	0	DISSOLVED
101620						0	0	0	0	0	DISSOLVED
101620						911	1137	296	366	6	DISSOLVED
102813						360	545	6	299	27	DISSOLVED
102979						1001	1261	5	457	80	DISSOLVED
102981						0	0	0	0	0	DISSOLVED
105559						2269	2507	661	385	8	DISSOLVED
105560						2887	3132	551	395	13	DISSOLVED
106106						2041	2358	919	513	4	DISSOLVED
156956						147	220	42	117	3	DISSOLVED
161333						124	167	8	80	7	DISSOLVED
183023		<5.0				4495	4677	2382	294	4	DISSOLVED
104852						1223	1534	366	502	7	DISSOLVED
167664						1322	1692	157	599	14	DISSOLVED
171663						1474	1762	23	557	48	DISSOLVED
175243	0.620 J	<0.010 U	1.09	1.21	0	827	1113	10	524	44	DISSOLVED
175243	0.620 J	<0.010 U	1.09	1.21	0	827	1113	10	524	44	DISSOLVED
175243						0	0	0	0	0	DISSOLVED
175243						0	0	0	0	0	DISSOLVED
175243						634	849	4	418	53	DISSOLVED
199749						567	756	228	306	3	DISSOLVED
152465						4250	4481	2412	374	4	DISSOLVED
100232						1437	1620	1122	296	1	DISSOLVED
212212						1479	2142	3	1150	163	DISSOLVED
212212						1496	2184	3	1263	149	DISSOLVED
189096						203	293	2	169	27	DISSOLVED
173046		<0.5				238	367	200	208	0	DISSOLVED
157952						102	146	64	71	0	DISSOLVED
102991	<0.500 U	0.05	<0.200 U	<1.000 U	0	2387	2554	1837	271	0	DISSOLVED
278903						0	0	0	0	0	DISSOLVED
278903						0	0	0	0	0	DISSOLVED
278903						0	0	0	0	0	DISSOLVED
278903						0	0	0	0	0	DISSOLVED
278903						0	0	0	0	0	DISSOLVED
278903						0	0	0	0	0	DISSOLVED
278903						0	0	0	0	0	DISSOLVED
278903						0	0	0	0	0	DISSOLVED
278903						0	0	0	0	0	DISSOLVED
278903						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED

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GwicId	W__ug_l_	NO2_N__mg_	NO3πô¡N__m	Total_N_as	OH__mg_l_	Total_Diss	Sum_Dissol	Hardness__	Alkalinity	SAR	Procedure
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278913						0	0	0	0	0	DISSOLVED
278914						0	0	0	0	0	DISSOLVED
278914						0	0	0	0	0	DISSOLVED
280040						0	0	0	0	0	DISSOLVED
280040						0	0	0	0	0	DISSOLVED
280042						0	0	0	0	0	DISSOLVED
280042						0	0	0	0	0	DISSOLVED
280042						0	0	0	0	0	DISSOLVED
280042						0	0	0	0	0	DISSOLVED
280046						0	0	0	0	0	DISSOLVED
280046						0	0	0	0	0	DISSOLVED
280046						0	0	0	0	0	DISSOLVED
280047						0	0	0	0	0	DISSOLVED
280048						0	0	0	0	0	DISSOLVED
280049						0	0	0	0	0	DISSOLVED
280050						0	0	0	0	0	DISSOLVED
280052						0	0	0	0	0	DISSOLVED
280052						0	0	0	0	0	DISSOLVED
281828						0	0	0	0	0	DISSOLVED
281830	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	210	320	165	180	1	DISSOLVED
281830						0	0	0	0	0	DISSOLVED
281830						0	0	0	0	0	DISSOLVED
281830						0	0	0	0	0	DISSOLVED
281830	<0.100 U	<0.010 U	0.28	<1.000 U	0	164	243	123	129	0	DISSOLVED
281830						0	0	0	0	0	DISSOLVED
281831						0	0	0	0	0	DISSOLVED
281833	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	37	54	26	27	0	DISSOLVED
281833						0	0	0	0	0	DISSOLVED
281833						0	0	0	0	0	DISSOLVED
281833						0	0	0	0	0	DISSOLVED
281833	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	54	80	37	41	0	DISSOLVED
281833						0	0	0	0	0	DISSOLVED
281834						0	0	0	0	0	DISSOLVED
281835						0	0	0	0	0	DISSOLVED
281840	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	159	244	133	140	0	DISSOLVED
281840	<0.100 U	<0.010 U	0.61	<1.000 U	0	218	328	181	177	0	DISSOLVED
281840						0	0	0	0	0	DISSOLVED
281841						0	0	0	0	0	DISSOLVED
281842						0	0	0	0	0	DISSOLVED
281860	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	222	333	174	191	1	DISSOLVED
281860	<0.100 U	<0.010 U	<0.200 U	<1.000 U	0	181	278	145	163	0	DISSOLVED
281864						0	0	0	0	0	DISSOLVED
281864						0	0	0	0	0	DISSOLVED
281864						0	0	0	0	0	DISSOLVED
281864						0	0	0	0	0	DISSOLVED
282265						0	0	0	0	0	DISSOLVED
161411						201	296	154	153	0	DISSOLVED
189175						70	106	57	59	0	DISSOLVED
197487						268	427	198	258	1	DISSOLVED