SUBSECTION 2.4.12 TABLE OF CONTENTS

Section		Title	Page
2.4.12	Groundwater		2.4.12-1
	2.4.12.1	Description and Onsite Use	2.4.12-1
	2.4.12.2	Groundwater Sources	2.4.12-12
	2.4.12.3	Subsurface Pathways	2.4.12-21
	2.4.12.4	Monitoring or Safeguard Requirements	2.4.12-22
	2.4.12.5	Site Characteristics for Subsurface Hydrostatic Loading	2.4.12-23
	2.4.12.6	Construction Dewatering	2.4.12-25
	2.4.12.7	References	2.4.12-25

SUBSECTION 2.4.12 LIST OF TABLES

Number	**Title**
2.4.12-1	A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results
2.4.12-2	Summary of Hydrogeologic Properties on the ORR
2.4.12-3	Clinch River Breeder Reactor Project Investigation Packer Test Results
2.4.12-4	Well Construction Summary
2.4.12-5	Groundwater Withdrawals from Five Counties Surrounding the Clinch River Nuclear Site by Use Category
2.4.12-6	Summary of Water Systems Using Groundwater for Supply
2.4.12-7	Nearby Public Water Systems Using Groundwater for Supply
2.4.12-8	Horizontal Hydraulic Gradients
2.4.12-9	Vertical Hydraulic Gradients
2.4.12-10	Borehole Packer Test Results Summary
2.4.12-11	Well Slug Test Results Summary
2.4.12-12	Clinch River Nuclear Site Constant Rate Aquifer Pumping Test Results
2.4.12-13	Rock Effective Porosity Measurements on the Oak Ridge Reservation
2.4.12-14	Representative Soil and Rock Properties
2.4.12-15	Field Geochemical Results
2.4.12-16	Laboratory Geochemical Results
2.4.12-17	Groundwater Linear Velocity and Travel Time
2.4.12-18	Characteristics of Individual Wells Located Within a 1.5-mile Radius of the CRN Site

SUBSECTION 2.4.12 LIST OF FIGURES

Number	Title
2.4.12-1	(Sheet 1 of 2) Location Map—Oak Ridge Reservation and the Clinch River Nuclear Site
2.4.12-1	(Sheet 2 of 2) Location Map—Oak Ridge Reservation and the Clinch River Nuclear Site
2.4.12-2	Physiographic Provinces in Tennessee
2.4.12-3	Preconstruction Topographic and Geologic Map and Cross-Section
2.4.12-4	Current Site Topography and Observation Well Locations
2.4.12-5	Clinch River Breeder Reactor Project Fill and Excavation Areas
2.4.12-6	Cambrian and Ordovician Aquifers
2.4.12-7	Typical Cross-Section of the East Tennessee Aquifer System
2.4.12-8	Water Use Study Area
2.4.12-9	Site Area Hydrogeostratigraphy
2.4.12-10	Bethel Valley Chickamauga Group Stratigraphy
2.4.12-11	Sole Source Aquifers in EPA Region IV
2.4.12-12	Oak Ridge Reservation Vertical Flow
2.4.12-13	Oak Ridge Reservation Historic Bedrock Hydraulic Conductivity Test Data
2.4.12-14	Oak Ridge Reservation Aquifer Pumping Test Results
2.4.12-15	Clinch River Breeder Reactor Project Bedrock Packer Hydraulic Conductivity Tests
2.4.12-16	Groundwater Levels Adjacent to the Clinch River
2.4.12-17	Groundwater Use by Category in the Study Area for 2000, 2005, and 2010
2.4.12-18	Bethel Valley Flow Conceptualization
2.4.12-19	Potentiometric Surface Map for September 24, 2013
2.4.12-20	Potentiometric Surface Map for December 20, 2013
2.4.12-21	Potentiometric Surface Map for January 13, 2014
2.4.12-22	Potentiometric Surface Map for March 16, 2014
2.4.12-23	Potentiometric Surface Map for May 15, 2014
2.4.12-24	Potentiometric Surface Map for August 18, 2014
2.4.12-25	Potentiometric Surface Map for November 4, 2014
2.4.12-26	Potentiometric Surface Map for February 12, 2015
2.4.12-27	Potentiometric Surface Map for May 19, 2015
2.4.12-28	Potentiometric Surface Map for August 10, 2015

SUBSECTION 2.4.12 LIST OF FIGURES (CONTINUED)

Number	**Title**
2.4.12-29	Snapshot in Time Showing Equipotential Lines in the Vertical Plane Along the Strike of the Bedding Plane on June 13, 2014
2.4.12-30	U.S. Geological Survey Regional Hydrograph
2.4.12-31	U.S. Geological Survey Hydrograph Near the Clinch River Nuclear Site
2.4.12-32	(Sheet 1 of 14) Hydrograph of OW-101 Well Cluster
2.4.12-32	(Sheet 2 of 14) Hydrograph of OW-202 Well Cluster
2.4.12-32	(Sheet 3 of 14) Hydrograph of OW-401 Well Cluster
2.4.12-32	(Sheet 4 of 14) Hydrograph of OW-409 Well Cluster
2.4.12-32	(Sheet 5 of 14) Hydrograph of OW-415 Well Cluster
2.4.12-32	(Sheet 6 of 14) Hydrograph of OW-416 Well Cluster
2.4.12-32	(Sheet 7 of 14) Hydrograph of OW-417 Well Cluster
2.4.12-32	(Sheet 8 of 14) Hydrograph of OW-418 Well Cluster
2.4.12-32	(Sheet 9 of 14) Hydrograph of OW-419 Well Cluster
2.4.12-32	(Sheet 10 of 14) Hydrograph of OW-420 Well Cluster
2.4.12-32	(Sheet 11 of 14) Hydrograph of OW-421 Well Cluster
2.4.12-32	(Sheet 12 of 14) Hydrograph of OW-423 Well Cluster
2.4.12-32	(Sheet 13 of 14) Hydrograph of OW-428 Well Cluster
2.4.12-32	(Sheet 14 of 14) Hydrograph of OW-429 Well Cluster
2.4.12-33	Fracture Frequency Histogram
2.4.12-34	Example Acoustic Televiewer Geophysical Log
2.4.12-35	Clinch River Nuclear Site Borehole Packer Test Results Box and Whisker Plots
2.4.12-36	Scatter Plot of Clinch River Nuclear Site Packer Test Hydraulic Conductivity Results with Depth
2.4.12-37	Slug Test Results for the Clinch River Nuclear Site
2.4.12-38	Comparison of Slug and Packer Test Results
2.4.12-39	Piper Trilinear Diagram
2.4.12-40	Plan View of the Profile Model with Grids
2.4.12-41	Maximum Hydrostatic Pressure
2.4.12-42	Individual Well Locations Within a 1.5-mile Radius of the CRN Site

2.4.12 Groundwater

This subsection contains a description of the hydrogeologic conditions at and in the vicinity of the Clinch River Nuclear (CRN) Site.

Regional and local groundwater resources that could be affected by the construction and operation of small modular reactors (SMRs) are described below. The regional and site-specific data on the physical and hydrologic characterization of these groundwater resources are summarized in order to provide the basic data for an evaluation of impacts on the aquifers in the area.

Regional and local surface water features are described in Subsection 2.4.1, a geologic overview is presented in Subsection 2.5.1, and a geotechnical description for plant construction is presented in Subsection 2.5.4.

Note that all references to elevation given in this subsection are to North American Vertical Datum of 1988 (NAVD88) unless otherwise specified.

2.4.12.1 Description and Onsite Use

This subsection contains a description of the regional and local physiography and geomorphology, groundwater aquifers, and groundwater sources and sinks. Onsite uses of groundwater and groundwater requirements are also described. Information regarding geologic formations (e.g., Blackford and Rockdell) is provided in Subsection 2.5.1.

The hydrogeologic conceptual model presented in this subsection was developed from multiple conceptual hydrogeologic models that vary in scale and hydrostratigraphic framework. Considerations of the scale and framework were not mutually exclusive, but were intertwined during a series of steps designed to develop a tenable site hydrogeologic conceptual model. Five steps were involved in the development of the scale-dependent conceptual models, and include:

- A regional desktop study based on published state; Federal, including Tennessee Valley Authority (TVA) and the Department of Energy (DOE) Oak Ridge Reservation (ORR) studies; and other sources;

- A review of documentation addressing the former Clinch River Breeder Reactor Project (CRBRP), including site-specific studies performed for the purpose of the CRBRP (Reference 2.4.12-1);

- Review of preliminary SMR site layout, plot plans and excavation plans for the CRN Site;

- A site-specific geotechnical, geologic, and hydrogeologic field study conducted for the proposed CRN Site (Reference 2.4.12-13);

- An evaluation of site-specific data in conjunction with regional and local information.

The first step of site model conceptualization involved formulating an understanding of the hydrogeologic conditions near the CRN Site including the ORR and surrounding areas. Regional geologic and hydrogeologic information available from the U.S. Geological Survey (USGS), the state of Tennessee Department of Environment and Conservation (TDEC), DOE, TVA, and other sources were reviewed to identify the hydrogeologic framework of the area. The second step involved a review of documentation addressing local hydrogeologic conditions such as that available from DOE and the subsurface studies performed in support of the demonstration CRBRP previously proposed at the CRN Site. The third step was a review of the preliminary

SMR site layout, plot plans and excavation plans developed for the conceptual placement of the SMRs that could be constructed at the CRN Site.

During the fourth step, a site-specific subsurface investigation (SI) was implemented at the proposed CRN Site. The hydrogeologic aspects of the SI were based on the preliminary conceptual model (developed as described above) and were modified when appropriate during the field program (as field data were collected and evaluated), as the understanding of site-specific conditions for SMR construction evolved.

The fifth step involved analysis of the SI field data with the regional and local information. From this effort, site-specific data were integrated with existing CRN Site information and local and regional information to formulate the conceptual site model described in the following sections. The conceptual model was then evaluated to determine potential changes to the hydrogeologic system as the result of constructing and operating the SMR units.

2.4.12.1.1 Physiography and Geomorphology

The CRN Site is located in Roane County, Tennessee (see Figure 2.4.12-1). The CRN Site is approximately 10 miles (mi) southwest of the center of the City of Oak Ridge, with the site and the city center separated by the ORR. The City of Kingston is approximately 7 mi west of the CRN Site. The closest major metropolitan center is Knoxville, approximately 25 mi to the east-northeast of the CRN Site.

The site is located on a peninsula formed by a meander of the Clinch River arm of the Watts Bar Reservoir between approximately Clinch River Miles (CRM) 14.5 and 19.0. Headwaters of the Clinch River are in Tazewell County, Virginia. From its headwater, the Clinch River flows approximately 350 mi in a southwesterly direction to its confluence with the Tennessee River near Kingston, Tennessee approximately 6 mi west of the CRN Site. The Clinch River basin lies in an area of comparatively narrow parallel ridges and somewhat broader intervening valleys oriented in a northeast-southwest direction. The northwestern boundary of the basin is formed by the Cumberland Mountains, which range up to 4200 feet (ft) in elevation; the southeastern boundary follows Clinch Mountain and Black Oak Ridge with elevations ranging up to 4700 ft. (Reference 2.4.12-1)

Water levels in the Clinch River arm of the Watts Bar Reservoir, which surrounds the CRN Site to the east, south, and west, are regulated by TVA. The normal summer pool water level elevation of the Clinch River arm of the Watts Bar Reservoir at the site is approximately 740 ft (Reference 2.4.12-1). Plant grade is at approximately 821 ft, placing the SMRs about 81 ft above the water level of the river.

The CRN Site is located in eastern Tennessee near the western boundary of the Valley and Ridge Physiographic Province. The Valley and Ridge Physiographic Province is characterized by folded and faulted sedimentary geologic units of Paleozoic age, which produces a series of valleys and ridges. This province extends south through Georgia and Alabama and north to Pennsylvania and New Jersey (Reference 2.4.12-2).

In eastern Tennessee, the processes of folding, faulting, and erosion have resulted in a series of northeast trending ridges and valleys. As described by Reference 2.4.12-2, compressive forces from the southeast have caused these rocks to yield, first by folding and subsequently by repeated breaking along a series of thrust faults. This successive faulting has resulted in several outcropping units in the area that occur in parallel belts aligned roughly with the topography. The folding/faulting process has produced a repeated sequence of outcropping units. Major units present in the area include, from youngest to oldest, the Chickamauga Group, the Knox Group, the Conasauga Group, and the Rome Formation. All are composed primarily of Ordovician and

Cambrian carbonate rocks. The dip of these formations is to the southeast. In nearby Melton Valley in the ORR (east of the CRN Site), Reference 2.4.12-3 reports that rock units generally strike between 50 and 60 degrees northeast, while dips vary with proximity to faults. Dips in Melton Valley are more gentle (10 to 20 degrees) away from the fault and steeper close to faults (45 to 90 degrees) (Reference 2.4.12-3). The extent of the Valley and Ridge Province in eastern Tennessee is shown in Figure 2.4.12-2.

The topography of the site has been altered by anthropogenic changes. In 1972, the site was selected for permitting and construction of the CRBRP (Reference 2.4.12-4). Site preparation for the CRBRP began in September 1982. A Limited Work Authorization was granted by NRC in May 1983. Excavation for the nuclear island was completed in September 1983. Approximately three million cubic yards of earth and rock were excavated from the site (Reference 2.4.12-4). The Secretary of Energy issued a statement in October 1983 that the department would terminate the project. In November of that year, an agreement was reached by DOE, TVA, the affected utilities and project stakeholders to begin an orderly termination of the project (Reference 2.4.12-4).

The topography of the site prior to alteration as the result of the CRBRP site preparation is described in the CRBRP Preliminary Safety Analysis Report (CRBRP PSAR) (Reference 2.4.12-1). A representation of the pre-construction topography and site geology is shown in Figure 2.4.12-3. The site was characterized as a series of parallel ridges separated by long, narrow valleys extending in a northeast-southwest direction. It was reported that there were no perennial streams on the site; however, after a heavy rain, surface water flowed from the ridges into the valleys and subsequently into the river. It was anticipated that construction of the CRBRP would not significantly alter the drainage pattern of the site (Reference 2.4.12-1).

The topography of the approximately 935-acre CRN Site is shown in Figure 2.4.12-4 as a hillshade map based on a recent LiDAR (Light Detection And Ranging) survey of the site current area. Areas of disturbance as the result of CRBRP site preparation and excavation can be seen by the flattened hillshade areas in Figure 2.4.12-5. The ground surface elevation varies from approximately 740 ft at the Clinch River arm of the Watts Bar Reservoir to over 1100 ft along Chestnut Ridge at the northwestern Site Boundary. At the power block area (Figure 2.4.12-4), the ground surface elevation is approximately 800 ft with the exception of the CRBRP partially backfilled excavation area.

A more detailed discussion of the regional and local surface water features and geologic descriptions, including landforms, is presented in Subsections 2.4.1 and 2.5.1, respectively.

2.4.12.1.2 Regional Hydrogeology and Groundwater Aquifers

As previously stated, the Valley and Ridge Physiographic Province is characterized by a sequence of folded and faulted, northeast-trending Paleozoic sedimentary rocks that form a series of alternating valleys and ridges. The Valley and Ridge Province in the eastern part of Tennessee is underlain by rocks that are primarily Cambrian and Ordovician in age. Minor Silurian, Devonian, and Mississippian rocks also are present in the province. In general, soluble carbonate rocks and easily eroded shale underlie the valleys in the province, and more erosion-resistant siltstone, sandstone, and some cherty dolomite underlie ridges (Reference 2.4.12-2).

The arrangement of the northeast-trending valleys and ridges and the broad expanse of the Cambrian and the Ordovician rocks are the result of a combination of folding, thrust faulting, and erosion. Compressive forces from the southeast have caused these rocks to yield, first by folding and subsequently by repeatedly breaking along a series of thrust faults (Reference 2.4.12-2). The result of this faulting is that geologic formations can be repeated several times across the faults. In eastern Tennessee, the thrust faults are closely spaced and are more responsible than the folds for the present distribution of the rocks. Following the folding and thrusting, erosion produced the sequence of ridges and valleys on the present land surface.

The principal aquifers in the Valley and Ridge Province consist of carbonate rocks that are Cambrian, Ordovician, and Mississippian in age as shown in Figure 2.4.12-6. These aquifers are typically present in valleys and rarely present on broad, dissected ridges; and underlie more than half of the Valley and Ridge Province in Tennessee. Most of the carbonate-rock aquifers are directly connected to sources of recharge, such as rivers or lakes, and solution activity has enlarged the original openings in the carbonate rocks. Other types of rocks in the province can yield large quantities of water to wells where they are fractured or contain solution openings or are directly hydraulically connected to sources of recharge (Reference 2.4.12-2).

Groundwater in aquifers primarily is stored in and moves through fractures, bedding planes, and solution openings in the rocks. These types of openings are secondary features that developed after the rocks were deposited and lithified. Little primary porosity and permeability remain in these rocks after the process of lithification. Some groundwater moves through primary pore spaces between the particles that constitute the alluvium along streams and the residuum of weathered material that overlies most of the rocks in the area (Reference 2.4.12-2).

In the carbonate rocks, the fractures and bedding planes have been enlarged by dissolution of part of the rocks. Slightly acidic water, especially that circulating in the upper 200 to 300 ft of the zone of saturation, dissolves some of the calcite and dolomite that compose the principal aquifers. Most of this dissolution takes place along fractures and bedding planes where the largest volumes of acidic groundwater flow (Reference 2.4.12-2).

Groundwater movement in the Valley and Ridge Province in eastern Tennessee is localized, in part, by the repeating lithology created by thrust faulting and, in part, by streams. Major streams are parallel to the northeast-trending valleys and ridges, and tributary streams are perpendicular to the valleys and ridges. Older rocks (primarily the Conasauga Group and the Rome Formation) have been displaced upward over the top of younger rocks (the Chickamauga and the Knox Groups) along thrust fault planes, forming a repeating sequence of permeable and less permeable hydrogeologic units. The repeating sequence, coupled with the stream network, divides the area into a series of adjacent, isolated, shallow groundwater flow systems (Reference 2.4.12-2). Within these local flow systems, most of the groundwater movement takes place within 300 ft of land surface. In recharge areas, most of the groundwater flows across the strike of the rocks. The water moves from the ridges, where the water levels are high, toward lower water levels adjacent to major streams that flow parallel to the long axes of the valleys as shown on Figure 2.4.12-7. Most of the groundwater is discharged directly to local springs or streams, but some of it moves along the strike of the rocks, following highly permeable fractures, bedding planes, and solution zones to finally discharge at more distant springs or streams. Although fracture zones locally are present in the clastic rocks, the highly permeable zones, which are primarily present in the carbonate rocks, act as collectors and conduits for the water (Reference 2.4.12-2).

The most important aquifers in the Valley and Ridge Province in eastern Tennessee are the carbonate rocks underlying the majority of the province. The Knox Group is the most important aquifer in eastern Tennessee. Of particular interest, near the CRN Site, are the Chickamauga Group and the Knox Group (Reference 2.4.12-1).

Most of the carbonate-rock aquifers are directly connected to surface water such as rivers and lakes. Other types of rocks can yield large quantities of water to wells where they are fractured, contain solution openings, or are hydraulically connected to a source of recharge (Reference 2.4.12-2).

Secondary porosity features, in the form of bedding planes, fractures, and solution openings, comprise the primary flow pathways in the Valley and Ridge Province, as most rocks in the province have low primary porosity. Regolith layers are composed of clayey soils and saprolite. Typical conceptual cross-sections in the province consist of a stormflow zone near the surface, a less permeable vadose zone, and a groundwater zone consisting of fractured bedrock with fracture density decreasing with depth (Reference 2.4.12-5). Groundwater flow is generally from recharge areas at high elevation (ridges) to local streams and rivers at lower elevations.

Long-term average annual precipitation is approximately 50 inches (in.) in the vicinity of the CRN Site, with an estimated long-term average runoff of 25 to 30 in. (Reference 2.4.12-2). Most of the precipitation that percolates downward becomes groundwater recharge to the shallow aquifers; a small portion enters the deep aquifer. Mixing at depth in carbonate formations has been studied as presented in Reference 2.4.12-6.

Well yields in the Valley and Ridge Province vary from 1 to 2500 gallons per minute (gpm) (Reference 2.4.12-2). The largest yields are from wells completed in Ordovician and Cambrian carbonate rocks (e.g., the Knox Group). Wells completed in the middle and lower parts of the Chickamauga Group, the Knox Group, and the upper part of the Conasauga Group have reported yields around 500 gpm in some locations. The median yield of wells completed in the principal aquifers range from about 11 to 350 gpm (Reference 2.4.12-2).

Spring discharges also vary greatly across the Valley and Ridge Province, ranging from about 1 to 5000 gpm, with median discharges from the principal aquifers varying from 20 to 175 gpm (Reference 2.4.12-2). The largest spring discharges issue from limestone formations of the Chickamauga Group; springs from the Knox Group have reported discharges as high as 4000 gpm (Reference 2.4.12-2). Spring discharges can be highly dependent on rainfall with some springs discharging as much as 10 times more water during high precipitation events as compared to periods of little rainfall (Reference 2.4.12-2). Wet-weather perched water tables and intermittent springs have been noted to occur (Reference 2.4.12-5). Fresh groundwater withdrawals from aquifers in the Valley and Ridge Province in eastern Tennessee totaled about 82 million gallons per day (mgd) in 1985 with public supply as the leading use (Reference 2.4.12-2). In the five-county area near the CRN Site (green shaded area in Figure 2.4.12-8); fresh groundwater withdrawals during 1985 were between 0 and 5 mgd per county in Loudon, Roane, Morgan, and Anderson Counties and between 5 and 10 mgd in Knox County (Reference 2.4.12-2).

Groundwater on the ORR, which is adjacent to the CRN Site, occurs in the unsaturated zone as transient, shallow subsurface stormflow as well as within the deeper saturated zone as summarized in Reference 2.4.12-7. An unsaturated zone of variable thickness separates the stormflow zone and water table. Adjacent to surface water features or in valley floors, the water table is found at shallow depths where the stormflow and unsaturated zones are undistinguishable. Along the ridge tops or near high topographic areas, the unsaturated zone is thick, and the water table often lies at considerable depths (greater than approximately 50 ft).

Recharge of the groundwater system is reported to be strongly seasonal at the ORR. The amount of water that recharges the groundwater zone is highly variable depending on the shallow soil characteristics, permeability and degree of regolith fracturing, and the presence of dolines and man-made paved or covered areas. Higher recharge is expected in areas of karst hydrogeology such as the Knox aquifer. In the ORR aquitards, groundwater is transmitted through fractures (Reference 2.4.12-7).

The chemical quality of water in the freshwater parts of the Valley and Ridge aquifers is similar for shallow wells and springs. The water is hard, a calcium-magnesium-bicarbonate type, and typically has a dissolved-solids concentration of 170 milligrams per liter (mg/L) or less. The ranges of concentrations are thought to be indicators of the depth and rate at which groundwater flows through the carbonate-rock aquifers. In general, the smaller values for a constituent represent water that is moving rapidly along shallow, short flow paths from recharge areas to points of discharge. This water has been in the aquifers for a short time and has accordingly dissolved only small quantities of aquifer material. Conversely, the larger values represent water that is moving more slowly along deep, long flow paths. Such water has been in contact with aquifer minerals for a longer time and thus has had greater opportunity to dissolve the minerals. Also, water that moves into deeper parts of the aquifers can mix with saltwater (brine) that might be present at depth (Reference 2.4.12-2).

The chemical characteristics of the groundwater in the ORR aquitards range from a mixed-cation-bicarbonate water type at shallow depths to a sodium-bicarbonate water type at deeper depths, to sodium-calcium-chloride water type as evidenced from very deep wells. These chloride-rich waters appear to be a zone of dilution on top of deeper saline sodium-calcium-chloride brines, similar to those encountered within the Conasauga Group at depths greater than 1000 ft in Melton Valley (Reference 2.4.12-6). The Knox aquifer is characterized by a calcium-magnesium-bicarbonate water type.

The hydrogeologic conditions at the CRN Site are similar to those observed at the ORR with the exception of land disturbance areas resulting from earlier site work performed for the CRBRP where excavations and fill material are present.

2.4.12.1.2.1 Bedrock Formations

Figure 2.4.12-9 presents a stratigraphic column of the bedrock formations present in the site area. The following sections briefly describe these formations.

Chickamauga Group

The Middle to Upper Ordovician age Chickamauga Group consists of limestone, shale, and siltstone. In eastern Tennessee it is subdivided into upper, middle, and lower parts. The upper part of the Chickamauga consists of 700 to 1000 ft of limestone and shale. The middle and lower parts, together, range in thickness from about 2000 to 6000 ft, consisting of limestones, shales, and siltstones (Reference 2.4.12-1). However, due to thrust faulting, the entire sequence is frequently not present (Figure 2.4.12-6). The lower and middle parts of the Chickamauga Group are generally considered to be better aquifers than the upper part (Reference 2.4.12-1). Figure 2.4.12-10 presents the subdivisions of the Chickamauga Group based on the stratigraphy of Bethel Valley in the ORR as defined by Reference 2.4.12-8. The unit designations shown on the figure were developed by Reference 2.4.12-9 and were used during the CRBRP investigation. The formation names shown on the figure are the names used in this investigation.

Groundwater in the Chickamauga Group is largely restricted to fractures which have been enlarged by solutioning. The fracturing of the formation by folding has resulted in a system of cavities which are more or less interconnected. The quality of water in the Chickamauga Group is varied and is influenced by local topography, local land-use patterns, depth below ground surface at which the formation is encountered, and small scale geologic considerations (Reference 2.4.12-1). Many springs occur at the shale-limestone contacts and where solution-widened joints or fractures extend to ground surface in topographic lows. In the lower and middle parts of the Chickamauga limestones, small springs are common, and several can yield more than 450 gpm. Wells in these rocks usually have low yields when located on hills or other topographic highs and have larger yields when located near permanent streams. In the upper part of the Chickamauga limestones, some springs can yield more than 100 gpm (Reference 2.4.12-1).

Knox Group

The Upper Cambrian to Lower Ordovician age Knox Group is the most important aquifer in eastern Tennessee. The Knox Group consists of 2000 to 3000 ft thickness of dolomites, limestones, and sandstones. The Knox Group in eastern Tennessee is subdivided into five formations (Reference 2.4.12-8):

- Mascot Dolomite
- Kingsport Formation
- Longview Dolomite
- Chepultepec Dolomite
- Copper Ridge Dolomite

The occurrence of water is controlled by the extent of solution enlargement of fractures (that are the result of ancient folding and faulting). Numerous springs are found in these rocks and the water is generally of good quality. The yield of water to wells ranges from small to large. Generally the largest fractures and thus greatest well yields are found in the first few hundred feet of formation depth (Reference 2.4.12-1).

Conasauga Group

The Middle to Upper Cambrian age Conasauga Group shows lithofacies changes along north-south trending belts from clastics in the west to carbonates in the east. The site area falls within the central area of the group, which exhibits an interfingering of clastic and carbonate deposits. Six formations can be identified within the group:

- Maynardville Limestone
- Nolichucky Shale
- Dismal Gap formation (formerly Maryville Limestone)
- Rodgersville Shale
- Friendship formation (formerly Rutledge Limestone)
- Pumpkin Valley Shale

The Conasauga Group has an average thickness of approximately 549 meters (m) (1801 ft) in Melton and Bear Creek Valleys. The Maynardville Limestone is associated with the overlying Knox Group and functions as a single hydrologic unit known as the Knox aquifer. The remainder of the group is considered to be an aquitard (Reference 2.4.12-8).

Rome Formation

The Early Cambrian age Rome Formation is the oldest bedrock unit exposed in the site area. The Rome Formation consists of mixed siliciclastic and carbonate rocks. The lithologies represented in the formation include sandstone, siltstone, and shale with dolomite and dolomitic sandstone intervals. Studies have suggested that the true stratigraphic thickness of this formation is between 90 and 125 m (295 and 410 ft). This formation is considered to be an aquitard (Reference 2.4.12-8).

2.4.12.1.2.2 Unconsolidated Deposits

The unconsolidated deposits in the CRN Site area typically consist of four types: residuum, colluvium, alluvium, and anthropogenic materials.

Residuum

The residuum is composed of the remains of bedrock weathering. In the site area, bedrock weathers to a clayey residual soil, which locally contains chert gravel. During the CRBRP investigation, the thickness of the residuum was found to vary from 1 to 78 ft, depending on the type of underlying bedrock (Reference 2.4.12-1).

Colluvium

Colluvium is an unconsolidated deposit sometimes found at the toe of a slope, and it represents material that has been moved by gravity. Colluvial deposits are generally identified by a lack of residual rock structure (bedding or joints) with disoriented rock fragments. This material tends to have more rock fragments than either residuum or alluvium. Colluvial deposits may be reworked by surface water action resulting in a hybrid colluvium-alluvium mixture (Reference 2.4.12-8)

Alluvium

The alluvium includes deposits by the Clinch River and smaller tributary streams. During the CRBRP investigation, alluvial terrace deposits were identified on the site. These deposits consisted of silty clay with thin layers of rounded quartz, chert, and quartzite gravel. Additionally a sand and clay alluvial layer was found to occur in the Clinch River floodplain, with a thickness of approximately 32 ft (Reference 2.4.12-1).

Anthropogenic Materials

Anthropogenic materials are primarily associated with artificial backfill. These materials include overburden and shot-rock (i.e., rock that has been excavated by blasting). Materials were excavated during site preparation for the CRBRP. These materials were moved and placed to facilitate laydown and parking area construction and to implement the site redress plan, when the project was canceled (Reference 2.4.12-4).

2.4.12.1.2.3 Sole-Source Aquifers

A sole-source aquifer is defined as the sole or principal source of drinking water that supplies 50 percent or more of drinking water for an area, with no reasonable available alternative sources should the aquifer becomes contaminated. Figure 2.4.12-11 shows the location of sole-source aquifers in EPA Region 4, which encompasses Tennessee. The identified sole-source aquifers in EPA Region 4 are beyond the boundaries of the local and regional hydrogeologic systems associated with the CRN Site. Therefore, the CRN Site does not impact any identified sole-source aquifer.

2.4.12.1.3 Local Hydrogeology

Description of the local hydrogeology is based on information from the adjacent ORR. The hydrogeology of the ORR (Reference 2.4.12-11) is defined by two broad hydrogeologic groups: the Knox aquifer consisting of the Knox Group and the Maynardville Limestone and the ORR aquitards, which include the Chickamauga Group, Conasauga Group, and the Rome Formation. In the vertical dimension, the Knox aquifer and the ORR aquitards include:

- The stormflow zone, which is a thin region near the surface where transient, precipitation generated flow accounts for 90 percent or more of the water moving through the subsurface.

- The vadose zone (the unsaturated zone above the water table) which varies in thickness from nearly non-existent along stream channels to greater than 100 ft beneath ridges underlain by the Knox aquifer.

- The groundwater zone, which is continuously saturated and is the region where most of the remaining 10 percent of subsurface flow occurs. This zone is typically encountered near the top of bedrock.

- An underlying aquiclude within the bedrock, within which water movement, if it occurs, probably is on the scale of thousands of years or more.

Figure 2.4.12-12 shows the vertical relationship of these subdivisions for the Knox aquifer and the ORR aquitards. The figure indicates that fracture frequency decreases and the concentrations of sodium and chloride increase in the groundwater with increasing depth.

Numerous groundwater investigations have been performed at the ORR providing hydrogeologic property data for the bedrock units. Testing has included slug tests in wells, packer tests in boreholes, aquifer pumping tests, and tracer tests. Table 2.4.12-1 presents a summary of selected tests performed to determine the hydraulic conductivity, transmissivity, and storage coefficient of the bedrock units. Figure 2.4.12-13 summarizes the hydraulic conductivity test results (box and whisker plot and hydraulic conductivity versus depth) by geologic formation and by depth below ground surface. The hydraulic conductivity by depth graph suggests that at approximately 100 ft below ground surface, hydraulic conductivities decrease with depth, although this trend is less obvious in the Knox aquifer, since both fracturing and solutioning are active in this unit. Figure 2.4.12-14 summarizes the results of the aquifer pumping tests identified on Table 2.4.12-1. The statistics presented on the table indicate a geometric mean transmissivity of 32.5 square ft per day (ft^2/d) and a storage coefficient of 5.9×10^{-4} for the Conasauga Group tests.

Additional hydrogeologic parameters for the stormflow and groundwater zones on the ORR are summarized on Table 2.4.12-2 and are based on information presented in Reference 2.4.12-12. The information presented in Table 2.4.12-2 suggests the transmissivity values for the ORR aquitards are approximately one order of magnitude less than those of the Knox aquifer.

2.4.12.1.4 Site-Specific Hydrogeology

Site-specific hydrogeology has been investigated during the CRBRP licensing effort and preparation for the ESPA.

2.4.12.1.4.1 CRBRP Investigation

As part of the licensing activities for the CRBRP, the site was investigated by drilling 129 borings, installing 37 observation wells, installing 11 piezometers, and performing 117 bedrock packer permeability tests in boreholes. The investigation also included collection of groundwater level data and performing a survey of local groundwater users (Reference 2.4.12-1). Abandoned wells from the CRBRP were identified on site. The identified CRBRP wells will be evaluated for closure in accordance with applicable TVA and TDEC requirements.

The CRBRP SI (Reference 2.4.12-1) identified four bedrock joint set orientations at the site:

- N52°E 37°SE
- N52°E 58°NW
- N25°W 80°SW
- N65°W 75°NE

The predominant joint set is oriented N52°E 37°SE, which corresponds with the bedding plane partings in bedrock. The N52°E 58°NW joint set has a joint spacing of between one and six ft (Reference 2.4.12-1).

The results of the packer hydraulic conductivity tests are summarized on Table 2.4.12-3. Figure 2.4.12-15 presents summary plots (box and whisker and hydraulic conductivity vs. depth) of the packer test results. The results can be classified in three groups: the Chickamauga long interval tests (test section length 40 ft and greater), the Chickamauga discrete interval tests (test section length less than 40 ft), and the Knox Group tests. The CRBRP packer test derived hydraulic conductivity results are similar to hydraulic conductivity test results from the ORR. Both sets of results indicate a decreasing trend in hydraulic conductivity at depths greater than approximately 100 ft below ground surface.

Water level measurements on the CRN Site indicated as much as a 20 ft fluctuation in water levels. Maximum water levels were observed in January and February and minimum water levels were observed in October and November. Movement of groundwater is described as generally from topographically high areas to topographic lows; however, this pattern is modulated by the extent of weathering in the bedrock. Ultimately, the Clinch River arm of the Watts Bar Reservoir acts as a sink for site groundwater flow. The investigation concluded that major ridges on the site may be regarded as approximate locations of groundwater divides (Reference 2.4.12-1).

The groundwater use survey performed for the CRBRP determined that present groundwater use is limited primarily to agricultural and single-family wells. The study concluded that due to the abundance of surface water supplies and the relatively low yield of bedrock aquifers, future groundwater use is unlikely to be significantly different than the present groundwater use (Reference 2.4.12-1).

2.4.12.1.4.2 CRN Site Investigation

The CRN Site field investigation included drilling 82 borings, 3 test pits, installation of 44 wells, and in situ/ex situ tests on soil, rock, and groundwater. Additional information on the borings, test pits and testing of soil and rock are presented in Section 2.5. Groundwater characterization activities included groundwater level monitoring, performing packer tests in boreholes, performing slug tests in monitoring wells, performing an aquifer pumping test, and groundwater geochemical sampling. Groundwater level monitoring is discussed in Subsections 2.4.12.2.2 and 2.4.12.2.3, aquifer properties are discussed in Subsection 2.4.12.2.4, and geochemical results are discussed in Subsection 2.4.12.2.5. The locations of observation wells installed during this investigation are shown on Figure 2.4.12-4 and well installation details are provided on Table 2.4.12-4. The figure and table include permanent observation wells (OW prefix) and supplemental wells (PT-OW and PT-PW prefixes) installed for the aquifer pumping test. Well suffixes of U, L, and D were assigned to wells to designate the upper, lower, and deeper monitoring zones, respectively. The screened depth intervals for the site observation wells for the upper monitoring zone range from 15 to 105 ft below ground surface, the lower monitoring zone range from 89 to 178 ft below ground surface, and the deeper monitoring zone range from 176 to 297 ft below ground surface.

A three-well cluster was installed east of the OW-101 well cluster, at boring location MP-422 (OW-422 U, L and D). During well completion, groundwater contamination was observed in OW-422L, and TVA notified TDEC and provided it with results of well sampling. The contamination was determined to be non-radiological petroleum products (gasoline range organics). Due to the contamination in OW-422L, this well cluster (OW-422 U, L and D) was not developed; however, it remains in place, locked and under TVA control. TVA has no plans to perform any additional work in the location, and TDEC will make a determination regarding the disposition of the well. Because the wells were not developed and monitoring of water levels in these wells was not performed, the OW-422 well series is not included in the discussion of site observation wells. Well clusters OW-428 and OW-429 (installed north and south of the OW-422 cluster) were installed to provide replacement geological/groundwater data.

Additional as-built information for the site wells is presented in Reference 2.4.12-13. Some permanent observation wells at the CRN Site were sampled after well development and no evidence of petroleum products (gasoline range organics) was observed in the wells. The contamination seems to be restricted to the immediate well OW-422 area since no evidence of petroleum products (gasoline range organics) were observed before and after the 72-hour pumping test conducted near the OW-423 U, L, and D well cluster (up dip of OW-422L). Water quality sampling in discharge water from 72-hour pumping test showed no detection of volatile organic compounds. Gross alpha and beta radionuclides were below minimum detectable concentration levels in the discharge water from pumping test.

The hydrogeology of the CRN Site is expected to be similar to the hydrogeology of the ORR as a result of the site's physical proximity and similarity in geology. The primary differences are in the stormflow and vadose zones at the CRN Site. The extensive excavation and reworking of unconsolidated and weathered bedrock materials associated with the CRBRP site preparation has either significantly modified or obliterated these zones at the CRN Site.

2.4.12.1.5 Groundwater Sources and Sinks

This subsection describes the regional, local, and site-specific discharge and recharge areas, mechanisms, and characteristics of the different aquifer units.

2.4.12.1.5.1 Groundwater Recharge

Groundwater recharge is derived primarily from precipitation. Although periodic recharge from the Clinch River arm of the Watts Bar Reservoir during high stages of the reservoir may also be occurring, this is not considered to represent a significant part of the recharge to the aquifer. Recharge is most effective in those areas where the overburden soils are thin and permeable. Recharge may also occur through sinkholes that penetrate relatively thick and impervious formations (Reference 2.4.12-1).

2.4.12.1.5.2 Groundwater Discharge

Natural discharge of the Valley and Ridge Province aquifers is primarily through streams, rivers, springs and evapotranspiration. In the area of the Clinch River Site, the Clinch River arm of the Watts Bar Reservoir acts as a sink to which all groundwater at the site migrates (Reference 2.4.12-1).

Studies performed by DOE for the Melton Valley offsite monitoring system (Reference 2.4.12-14), which is located approximately 2 mi east of the CRN Site, investigated the groundwater flow relationship with the Clinch River arm of the Watts Bar Reservoir. Figure 2.4.12-16 presents a section through the river showing the head distribution. This head distribution suggests discharge to the Clinch River from the surrounding groundwater system.

2.4.12.1.6 On-Site Groundwater Use

Groundwater flow occurs at the CRN Site primarily through fractures and joints, with active flow primarily at shallow depths (generally at the interface of soil and weathered bedrock) where fractures/joints are denser and closely spaced. Groundwater flows from the ridges at higher elevations north of the site toward the Clinch River arm of the Watts Bar Reservoir. The reservoir abuts the site on the east, south, and west sides and acts as a main discharge point for the active flow system and is generally considered to be a hydrologic boundary for the site.

Borings performed for subsurface investigations at the CRBRP site and in the river (Reference 2.4.12-15 and Reference 2.4.12-1) show that the elevation of the top of continuous rock lies at about 700 ft National Geodetic Vertical Datum of 1929 (NGVD29). The frequency of fractures/joints decreases significantly at depth and the predominant groundwater flow at the site occurs close to the surface, as has been reported for ORR at large (Reference 2.4.12-11). As such, surface disturbance at the site is not expected to affect the recharge zones for those nor any private wells across the river from the site or past the site boundaries.

2.4.12.1.6.1 Current Site Groundwater Use

There are no current groundwater users at the CRN Site.

2.4.12.1.6.2 Plant Groundwater Use

The CRN Site plant design does not require groundwater as a source for cooling water, potable water, or other plant needs. Makeup water for the closed-cycle cooling system will be sourced from the Clinch River arm of Watts Bar Reservoir, while potable and other water will come from the Oak Ridge Department of Public Works. As such, there are no anticipated plant operation impacts to local groundwater resources due to plant use.

2.4.12.2 Groundwater Sources

This subsection contains a description of the present and projected regional groundwater use at and in the vicinity of the CRN Site. Specifically, the description contains information pertaining to existing users, historical groundwater levels, groundwater flow directions and hydraulic gradients, seasonal and long-term variations of groundwater levels, horizontal and vertical hydraulic conductivity and total and effective porosity of the geologic formations, reversibility of groundwater flow, the effects of water use on hydraulic gradients and groundwater levels beneath the site, and groundwater recharge areas. This information has been organized into five subcategories: (1) historical and projected groundwater use, (2) groundwater flow directions, (3) temporal groundwater trends, (4) aquifer properties, and (5) hydrogeochemical characteristics.

2.4.12.2.1 Historical and Projected Groundwater Use

Historical, current, and projected groundwater use in the vicinity of the CRN Site is evaluated in the following subsections using information from TVA, EPA, and USGS.

2.4.12.2.1.1 Historical Groundwater Use

In support of the CRBRP licensing activities, TVA conducted a survey (completed in June 1973) to locate wells and springs within a 2-mi radius of the site. The TVA survey reported that 110 wells and springs were located within 2 mi of the CRBRP site. All of the wells were located across the Clinch River arm of the Watts Bar Reservoir from the site, and nearly all of the wells inspected were small domestic wells of limited capacity (Reference 2.4.12-1). Reported well usage rates were generally less than 10 gpm, and reported well depths ranged from approximately 20 to 700 ft below ground surface. Publicly available data regarding current and projected future residential well/spring use were not found at this time.

Water use in the Tennessee Valley, which includes the Clinch River watershed, has been estimated for the years 2000, 2005, and 2010 (Reference 2.4.12-16; Reference 2.4.12-17; and

Reference 2.4.12-18, respectively). These reports tabulate water use on a variety of scales and serve as the primary basis for the estimation of present water use in the area of the CRN Site.

To characterize groundwater use in the area surrounding the site, data from these reports were totaled for Anderson, Knox, Loudon, Morgan, and Roane Counties (henceforth referred to as the study area). Figure 2.4.12-8, adapted from Reference 2.4.12-18, shows the location of the site and the five counties that comprise the study area for water use characterization.

Surface water is by far the predominant source of water for all uses in the Tennessee Valley at large (see Figure 2.4.12-8 for Tennessee River watershed extent), accounting for 98.3 percent of total withdrawals in 2010 (Reference 2.4.12-18). Groundwater provided the remaining 1.7 percent, or about 205 mgd of withdrawals in the Tennessee Valley. In the study area, surface water accounted for 99.7 percent of total withdrawals in 2010. Because surface water is abundant in the area, EPA's Sole Source Aquifer Program has not identified any sole source aquifers in Tennessee as shown in Figure 2.4.12-11 (Reference 2.4.12-10).

Thermoelectric power generation, which uses water exclusively from surface water withdrawals in the Tennessee Valley, is the dominant use category in the Tennessee Valley, as well as in the study area. Excluding thermoelectric power generation, water withdrawals in 2010 for other use categories (i.e., industrial, public supply and irrigation) were 97 percent from surface water and 3 percent from groundwater in the study area.

In the study area, total groundwater withdrawals for 2010 were 3.5 mgd (Reference 2.4.12-18), up from 3.3 mgd in 2005 (Reference 2.4.12-17). This also reflects a decrease in groundwater withdrawals relative to the estimates of withdrawals for 1985 given in Reference 2.4.12-2, which indicated withdrawals of at least 5 mgd. Table 2.4.12-5 presents groundwater withdrawals for the five counties in the study area for 2000, 2005, and 2010 by category (industrial, public supply, and irrigation); total withdrawals by category are shown in Figure 2.4.12-17. The largest category of use for groundwater withdrawals for 2010 was public water supply (66 percent), followed by industrial use (33 percent), and irrigation (less than 1 percent) (Reference 2.4.12-18).

As shown in Figure 2.4.12-17, there has been an increase in industrial use and a decrease in use for public supply since 2000. These changes have primarily occurred in Knox County, which increased industrial use from 0.13 mgd to 1.13 mgd from 2000 to 2010 while reducing the use of groundwater as a source of public supply (Table 2.4.12-5). Only Roane County has seen a significant increase in reported groundwater withdrawals since 2000, almost exclusively for public supply. No groundwater withdrawals were reported for Morgan County.

2.4.12.2.1.2 Current Groundwater Use

EPA's Safe Drinking Water Information System (SDWIS) database was queried for the five counties in the study area to identify public drinking water systems that utilize groundwater for supply (Reference 2.4.12-19). The database uses results as of July 2013 and classifies water systems into three categories:

- Community water systems, which serve the same people year round (e.g., homes)
- Non-transient non-community water systems, which serve the same people but not year round (e.g., schools that have their own water supply)
- Transient non-community water systems, which do not consistently serve the same people (e.g., rest stops, campgrounds)

The results of the queries are provided in Appendix 2.4.12A and summarized in Table 2.4.12-6.

Three community water systems in the study area were identified that use groundwater as the primary source of supply (Table 2.4.12-6). The town of Norris, Tennessee, located more than 20 mi northeast of the site in Anderson County, serves the largest population of the three systems, while Johnson University, located east of Knoxville and Creekside Mobile Homes in Loudon County serve the next two larger populations. Two water systems were classified as non-transient, non-community water systems that rely on groundwater, both of which appear to be industrial users in Knox County. Four transient non-community systems were identified consisting of two campgrounds, a marina, and a yacht club.

TVA has identified additional groundwater users that were not included in the results obtained from queries in SDWIS. These are also provided in Table 2.4.12-6.

TDEC produced a source water assessment report in 2003 (Reference 2.4.12-20), which was submitted to EPA in compliance with the 1996 Safe Drinking Water Acts Amendments. Appendix A of the assessment report lists water systems and sources by county (Reference 2.4.12-20). This list indicates whether a water system uses multiple sources of water as opposed to the SDWIS database, which only reports the primary water source. However, Reference 2.4.12-20 does not indicate in what proportion the water sources are used. The community water systems that use groundwater (as of 2003) via wells or springs for at least part of their water supply are listed in Table 2.4.12-7.

A later report by TDEC published in 2009 (Reference 2.4.12-21) assesses Tennessee drinking water sources and potential threats to drinking water quality and quantity. The report states that a recent drought impacted 30 groundwater systems throughout the state, including the Oliver Springs Water Board in Roane County. The town of Oliver Springs is located approximately 2 mi northwest of Oak Ridge, Tennessee, and utilizes Bacon Spring for a portion of its water supply (Reference 2.4.12-21).

The report also notes the complicated geology of Middle and East Tennessee (karst, faulting, etc.) and urges additional assessment of groundwater resources in the state. In addition, the report notes the close interaction of surface water and groundwater in the region (Reference 2.4.12-21):

> *Approximately 2/3 of the community public water systems using ground water in Middle and East Tennessee have had at least one source determined under the direct influence of surface water. This means that these sources of groundwater are located close enough to a source of surface water to receive direct surface water recharge and are thus considered at risk from surface water contaminants and pathogens.*

Information pertaining to individual wells in the vicinity of the CRN Site was obtained from TDEC, Division of Water Resources, Drinking Water Unit. This information was derived from water well driller reports submitted to TDEC following completion of water well drilling. Such reports include well location by either latitude and longitude or street address, date completed, static level, total depth, estimated yield, proposed use of well, casing depth, and finish type (i.e., open hole or screened). Figure 2.4.12-42 shows the location of individual wells within a 1.5-mile radius of the CRN Site, all of which are located in Roane County. Table 2.4.12-18 lists for each well the proposed use, estimated yield, total depth, casing depth, expected geologic unit in which the wells are completed, and finish type. There are 32 residential wells, three commercial wells, and one farm well for a total of 36 individual wells. Estimated well yields range from 0.5 to 75 gallons per minute (three wells had no estimated well yield). Total depths range from 42 to 900 feet below grade, while casing depths range from 20 to 190 feet below grade. Twenty-eight of the wells are finished as open hole wells, while no finish type information was available for the remaining wells. The geologic unit in which wells are completed was inferred from regional geological mapping, as this information was not available from TDEC. The actual geologic unit(s) from which a well obtains water may differ from what is shown in Table 2.4.12-18, depending on the exact well location and the well and casing depths.

2.4.12.2.1.3 Projected Groundwater Use

General future water use projections are provided in Reference 2.4.12-18 through 2035, which predict a decrease of 21 percent in total withdrawals (surface water and groundwater), mostly due to the retirement of aging power plants. Industrial and public supply water uses are expected to increase by 31 percent and 30 percent, respectively. Groundwater uses may not increase in kind since the vast majority of users in the Tennessee Valley rely on surface water as a primary source. No groundwater-specific projections for water use are available in Reference 2.4.12-18.

The CRN Site SMR plant design does not require groundwater as a source for cooling water, potable water, or other plant needs. Makeup water for the closed-cycle cooling system will be sourced from the Clinch River arm of Watts Bar Reservoir, while potable and other water will come from the Oak Ridge Department of Public Works. In addition, surface disturbance is not expected to affect the recharge zones for those users shown in Table 2.4.12-7. As such, there are no anticipated plant operation impacts to local groundwater resources due to plant use.

2.4.12.2.1.4 CRN Site Groundwater Use Summary

Groundwater is not a primary source of water in the region as surface water is abundant and provides nearly all of the supply for users in the area.

Total groundwater withdrawals in the five counties surrounding the CRN Site have been fairly constant from 2000 to 2010, though the uses have changed and evolved in each county. The leading use of groundwater in the study area is for public supply, followed by industrial use. From 2000 to 2010, industrial use has increased while public supply withdrawals have decreased in the five counties surrounding the CRN Site.

The current CRN Site SMR design does not rely on groundwater for any part of its operating supply. Thus, there is no groundwater demand due to the CRN Site SMR plant. There are no active groundwater current or projected users for the CRN Site.

2.4.12.2.2 Groundwater Flow Directions

Groundwater flow directions in the ORR are generally characterized as from the ridge tops to drainages within the adjacent valley or as a subdued replica of topography. Figure 2.4.12-18 presents conceptual block flow diagrams for Bethel Valley, which has similar geology as the CRN Site (Reference 2.4.12-22). The figure indicates localized influences such as springs, discontinuity orientations (fractures and bedding planes), man-made features (pipelines, tank farms, and building basements), and solution features have an impact on flow directions.

Groundwater flow directions were evaluated during the CRBRP PSAR by preparing two groundwater contour maps, one for December 24, 1973 and one for January 2, 1974 (Reference 2.4.12-1). Both maps indicate a general flow direction toward the southeast or southwest in the area of the proposed nuclear island. An average hydraulic gradient of approximately 0.007 ft/ft is reported for the two maps (Reference 2.4.12-1). It should be noted that these maps were prepared using water level measurements from observation wells with long screened intervals and thus the equipotentials represent a vertically averaged head.

The CRN Site investigation included synoptic measurements of groundwater levels in the site observation wells. These measurements were used to prepare maximum potentiometric surface maps for the site. The maximum potentiometric surface maps used the maximum groundwater level elevation at each well cluster. Figure 2.4.12-19 through 2.4.12-28 present the potentiometric surface maps. The maps indicate a southwest to southeast flow direction in the area of the power block area. Hydraulic gradients were measured along selected flow lines on each figure. Table 2.4.12-8 presents the horizontal hydraulic gradients for the ten potentiometric surface maps. The horizontal hydraulic gradients range from 0.03 to 0.12 ft/ft. Horizontal gradients were also evaluated using just the upper site observation wells for the eight quarters of December 2013, March 2014, May 2014, August 2014, November 2014, February 2015, May 2015, and August 2015), resulting in horizontal gradients ranging from 0.05 to 0.17 ft/ft. For comparison the average, hydraulic gradient between the maximum water level at OW-101U and OW-202U and the Clinch River arm of the Watts Bar Reservoir is 0.05 ft/ft. This is derived based on a shortest distance of 1400 ft from the reactor locations to the edge of the Clinch River arm of the Watts Bar Reservoir; lowest stage of the reservoir at 735 ft NAVD88 (during the monitoring period); and the maximum water levels at OW-101U and OW-202U of 798.99 and 800.30 ft NAVD88. Due to the complexity of the subsurface hydrogeologic conditions at the CRN Site, the maximum potentiometric groundwater elevation at each well cluster is used, representing a single hydrogeological unit. Given that the U, L, and D wells generally screened within different hydrogeologic units, the maximum potentiometric surface maps do not represent a true potentiometric surface. These maps can, however, be considered bounding in terms of depicting the maximum groundwater elevations at the site.

Vertical hydraulic gradients were determined at each well cluster to evaluate the potential for vertical movement in the subsurface. Table 2.4.12-9 presents the vertical hydraulic gradients for the well clusters. The average vertical hydraulic gradients range from -0.69 to 1.03 ft/ft. A negative vertical hydraulic gradient indicates an upward flow potential and a positive one indicates a downward flow potential. The upward flow potential would suggest groundwater discharge and the downward flow potential would suggest groundwater recharge. A majority of the wells with upward flow potential are located on the western and eastern sides of the site suggesting discharge towards incised site drainage features or to the Clinch River arm of the Watts Bar Reservoir. The exception to this is well cluster OW-409U/L, which is located near the center of the site. This cluster may be indicating groundwater discharge to the adjacent CRBRP excavation. The cluster with the highest downward flow potential is OW-429U/L, suggesting a recharge area. Figure 2.4.12-29 represents the spatial variation of equipotential in the vertical plane in a cross-section along the strike of the bedding plane based on June 13, 2014 observations. Groundwater discharges from the higher equipotential area (at OW-202) to the Clinch River arm of the Watts Bar Reservoir, with OW-202 at the center of the CRS peninsula as a likely location of the groundwater divide.

2.4.12.2.3 Temporal Groundwater Trends

The USGS maintains a network of observation wells in Tennessee to monitor trends in water levels. The closest permanent observation well is approximately 48 mi southeast of the CRN Site as shown on Figure 2.4.12-30 (Reference 2.4.12-23). This observation well is screened in the Great Smoky Group aquifer and is approximately 220 ft deep. The well indicates typical annual fluctuations of between 1 and 3 ft. The USGS also presents data from a manual water level measurement well located approximately 0.5 miles east of the CRN Site as shown on Figure 2.4.12-31 (Reference 2.4.12-24). This well is screened in the Valley and Ridge aquifer and is approximately 610 ft deep. The period of record is only approximately 3 months; however the hydrograph shows an approximate 5 ft range of water levels fluctuations. Neither of these USGS wells monitor the hydrogeologic units relevant to the site.

During the CRBRP investigation, periodic water level measurements were made in the site observation wells and piezometers. Examination of these measurements suggests an annual fluctuation of 10 to 25 ft with maximum water levels occurring in January and February and minimum water levels occurring in October and November (Reference 2.4.12-1).

The CRN Site hydrogeologic characterization program included measurement of groundwater levels in the site observation wells. This included continuous measurements with a recording pressure transducer in select wells and periodic manual measurements in all wells (except the OW-422 well cluster). The water level measurement program collected two years of groundwater levels. The following well clusters were equipped with recording pressure transducers:

- OW-101
- OW-202
- OW-409
- OW-417
- OW-423

The recording pressure transducer logs were started on November 23-24, 2013. Figure 2.4.12-32 presents hydrographs for the site well clusters, along with Clinch River arm of the Watts Bar Reservoir stage and site precipitation data for comparison. Water level responses from wells OW-101D, OW-409U, OW-416U/L, OW-420L, and OW-421D show correspondence to the Watts Bar Reservoir stage with periodic deviations that appear to be associated with precipitation events. All of the site wells show a response to precipitation events, with OW-417L and OW-421U showing the most subdued response to precipitation. The location of well clusters OW-417 and OW-421 in proximity to the Clinch River arm of the Watts Bar Reservoir may explain the subdued responses in these wells. Further, OW-417U/L wells are closest to the Clinch River arm of the Watts Bar Reservoir and lie in the topographically low area where groundwater discharges to the river, resulting in upward flow of groundwater from OW-417L to OW-417U. OW-421U/L is screened within the Blackford formation whereas OW-412D is screened within Newala formation, which has slightly different hydrogeologic properties than the Blackford formation. The combination of different hydrogeologic properties and close proximity to the Clinch River arm of the Watts Bar Reservoir results in subdued water level response at the OW-421 well cluster. OW-423U is screened within the Eidson formation and OW-423L/D is screened within Blackford formation. The difference in hydrogeologic characteristics of the formations in which the wells are screened is likely to result in a different groundwater level response. The tighter formation (with lower hydraulic conductivity) may result in higher groundwater levels than the formation with higher hydraulic conductivity. The heterogeneity within the formation, both laterally and vertically would also result in different water elevations in wells screened at different depths within the same formation. Thus, the upward vertical gradient in OW-423 well clusters is a result of wells screened in two different formations and the effects of heterogeneity within a formation with depth.

Observation wells: OW-202L, OW-421L, OW-421D, OW-428U, OW-428L, and OW-428D show water level artifacts from well installation, development, and water sampling; these wells are excluded for the purpose of characterizing the range of fluctuation. The range of water level elevation fluctuations in the site observation wells was from approximately 1 ft (OW-421U) to 25 ft (OW-409U). These fluctuations appear to be associated with precipitation events. The large magnitude of fluctuation at OW-409U may be further indication that this well is located in a recharge area.

2.4.12.2.4 Aquifer Properties

Aquifer properties at the CRN Site were determined by in situ testing and from laboratory testing of rock core and soil samples collected during the investigation. The following sections present the results of this testing.

2.4.12.2.4.1 Hydrogeological Properties

The primary hydrogeological properties of interest at the site are the hydraulic conductivity and effective porosity of the bedrock. Hydraulic conductivity was evaluated qualitatively through fracture frequency analysis and quantitatively through in situ testing. The in situ tests performed were borehole packer tests, well slug tests, and an aquifer pumping test. Effective porosity is based on a series of studies performed on the ORR.

Fracture Frequency Analysis

Fracture frequency analysis was performed by plotting the open fractures identified on the acoustic televiewer borehole geophysical logs. Figure 2.4.12-33 presents the resulting frequency distribution histogram. The histogram shows three general areas: 1) from elevation 812 to 712 ft, a pervasively fractured zone; 2) from elevation 712 to 612 ft, a moderately fractured zone; and 3) from 612 to 487 ft, a slightly fractured zone. It should be noted that the upper elevation of the pervasively fractured zone is somewhat biased, since most boreholes were cased into the top of bedrock prior to performing the geophysical surveys, and thus the number of open fractures at the top of rock is not accurately represented and likely under-reported. Figure 2.4.12-34 presents an example geophysical log demonstrating this bias.

The fracture distribution identified at the CRN Site is consistent with observations at the ORR. Information presented in Reference 2.4.12-11 indicates that in nearby Melton and Bethel Valleys, the transition from fractured to less fractured bedrock occurs at approximately 45 m (150 ft) below ground surface. Figure 2.4.12-13, which is a plot of ORR hydraulic conductivity test results, indicates a generalized decrease in hydraulic conductivity at approximately 100 ft below ground surface.

Borehole Packer Tests

A borehole packer test is a constant head test of an isolated interval in a borehole to determine the hydraulic conductivity. For the CRN Site investigation, a double packer arrangement was used to isolate the test zone. A total of 41 packer tests were performed in 12 open boreholes during the field investigation. Of these tests, 5 exhibited evidence of flow by-passing around the packers and 14 had flow rates less than the quantifiable rate for the test, and thus were not analyzed. The flow by-passing is a result of hydraulic connection between the packer isolated test interval and the borehole (i.e., communication with the borehole above and/or below the packers). Fourteen test intervals were not able to achieve quantifiable flow (≤ 10 gallons per minute during the test) using a standard flow meter. Table 2.4.12-10 presents the test results.

The tests were performed and interpreted using Reference 2.4.12-25 method 381-80. The borehole packer test results were arranged by geologic unit and are presented in a box and whisker plot on Figure 2.4.12-35. Summary statistics for these tests are included on the figure. The results were also compared with the packer tests performed during the CRBRP investigation as shown on Figure 2.4.12-35. In general the two data sets agree; however, the CRBRP Chickamauga long interval and CRBRP Knox tests exhibit an order of magnitude, or more, lower range of values. This may in part be due to the deeper test intervals selected during the CRBRP investigation. The upper range of values is similar for both data sets.

The CRN Site packer results were plotted versus depth below ground surface as shown on Figure 2.4.12-36. The results show a similar pattern as the CRBRP tests (Figure 2.4.12-15) and the ORR hydraulic conductivity tests (Figure 2.4.12-13). The hydraulic conductivities decrease below 150 ft below ground surface. This is most probably the result of the decreased frequency of open fractures below this depth.

Well Slug Tests

The slug test method involves creating a sudden water level displacement in the observation well and observing the water level change as it returns to the pre-test level. Slug tests were performed in selected site observation wells. Observation wells excluded from testing include OW-202U, OW-402U, and OW-429L because of low water levels in the wells and OW-428D because the well was still recovering from development activities. Slug tests used either a solid slug or pneumatic slug to induce the water level change. Two tests were performed in each well, one where the water level was raised in the well and allowed to fall back to the pre-test level (falling head) and one test where the water level in the well was lowered and allowed to rise back to the pre-test level (rising head). A recording pressure transducer was placed in the well to monitor the water level changes. Slug test results were entered into the AQTESOLV (Reference 2.4.12-26) computer program and the Bouwer and Rice (Reference 2.4.12-27) method was used for interpretation.

The slug test solution is a porous medium method and is applied to fractured bedrock. Reference 2.4.12-28 compared porous medium slug test method results with discrete fracture interval method results. Their comparison found that using porous medium methods, the results were on the same order of magnitude as the results for the discrete fracture interval methods. Reference 2.4.12-29 indicates that a porous medium assumption is appropriate in highly fractured materials and where fluid exchange between the fractures and the rock matrix is either very limited or very rapid. The observation wells were located in the most fractured intervals identified in the borehole logs. Information from the ORR on Table 2.4.12-2 indicates that a matrix hydraulic conductivity of 8.7×10^{-8} m/d (2.8×10^{-7} ft/d) is representative of the ORR Aquitards, which includes the Chickamauga Group. This matrix hydraulic conductivity suggests that the rock matrix is not contributing significantly to flow. These studies suggest that the use of the porous medium assumption is reasonable for the CRN Site tests.

Table 2.4.12-11 presents the results of the slug test interpretations. Examination of the table indicates that the test results from four wells (OW-202L, OW-401D, OW-415U, and OW-421D) could not be interpreted. Additionally, the results from five wells (OW-409U, OW-415L, OW-421L, OW-423D, and OW-429U) had one test (falling or rising head) that could not be interpreted. For those wells with one test, the average hydraulic conductivity is equivalent to the results of the test (falling or rising head) that could be interpreted.

Figure 2.4.12-37 presents the slug test results graphically. The figure includes a box and whisker plot of hydraulic conductivity by observation well monitoring zone and a scatter plot of hydraulic conductivity versus depth below ground surface. The box and whisker plot indicates that the hydraulic conductivities in the upper and lower zones are similar, while those in the deep zone are lower. The scatter plot of hydraulic conductivity versus depth below ground surface in general shows a pattern of decreasing range in hydraulic conductivity with depth similar to plots in Figure 2.4.12-15 and Figure 2.4.12-36. Figure 2.4.12-38 is a box and whisker plot comparing the slug test results with the CRN Site packer test results for the two major geologic units (Chickamauga Group and Knox Group) present at the site. The figure indicates a similar central tendency in the results of both tests, but the slug tests have a much broader range of values. The may be due to the longer test intervals for the slug tests as compared to the packer test intervals.

Aquifer Pumping Test

An aquifer pumping test was performed at the CRN Site and a description of the test and interpretation of the data is presented in Appendix 2.4.12B. The aquifer pumping test array consisted of a pumping well (PT-PW) and nine proximal observation wells (PT-OW-U1, PT-OW-L1, PT-OW-U2, PT-OW-L2, PT-OW-U3, PT-OW-L3, OW-423U, OW-423L, and OW-423D) as shown on Figure 2.4.12-4. The completion data for these wells are included on

Table 2.4.12-4. The pumping well was screened in the Fleanor and Eidson members of the Lincolnshire formation and the Blackford formation. The upper zone observation wells were screened in the Eidson member of the Lincolnshire formation and the lower and deep zone observation wells were screened in the Blackford formation. A constant rate pumping test was performed in the pumping well for a period of 72 hours with an average pumping rate of 14.5 gpm.

Pumping and observation well responses were reviewed and diagnostic plots of each well were prepared. Based on a review of the observation well water level responses, a portion of the observation wells were discarded from further analysis due to inadequate or erratic response as explained in Appendix 2.4.12B. Interpretation of the diagnostic plots for the results that were retained indicated that a leaky aquifer model most accurately represents the observed response. The water level response and pumping rate data were entered into the AQTESOLV (Reference 2.4.12-26) computer program for analysis. The solution method used was that presented in Reference 2.4.12-30.

Table 2.4.12-12 presents the results of the constant rate pumping test interpretation. Examination of the results suggests the maximum transmissivity and hydraulic conductivity is observed at OW-423L, which is oriented with the N52°E strike of the bedding planes (the principal flow direction) relative to the pumping well. The observation wells (PT-OW-U2 and PT-OW-L2) oriented perpendicular (N38°W) to the strike of the bedding planes show approximately an order of magnitude lower transmissivity and hydraulic conductivity. Comparison of the results of this aquifer pumping test with tests performed on the ORR, as shown on Figure 2.4.12-14, indicates that the transmissivities are within the same range, but the storage coefficient values have a greater range for the CRN Site aquifer pumping test.

Effective Porosity

Petrophysical testing of rock samples to determine the effective porosity of rock from the Conasauga and Knox Groups on the ORR were reported by Reference 2.4.12-31 and Reference 2.4.12-32. Table 2.4.12-13 summarizes the results of these tests. The test methods used include helium, mercury, and immersion-saturation porosimetry. The authors indicate that the immersion-saturation method would produce the results that most accurately approach the true value of effective porosity. The mean effective porosity of bedrock determined from these tests is approximately 4 percent. This is similar to the bedrock effective porosity (1 percent) used in Reference 2.4.12-33 and Reference 2.4.12-11.

2.4.12.2.4.2 Geotechnical and Geological Properties

During the CRN Site investigation, soil and rock samples were collected and tested as described in Subsection 2.5.4. Interpretation of the test results has resulted in best estimates of properties of the different materials that are present or may be present in the future at the site. Table 2.4.12-14 summarizes the representative soil and rock properties.

2.4.12.2.4.3 Summary of Representative Properties of Hydrogeologic Units

Hydrogeologic testing information for the CRN Site area were obtained from: 1) published bedrock aquifer testing from the ORR area; 2) CRBRP investigation packer tests; 3) CRN Site packer tests; 4) CRN Site slug tests: and 5) the CRN Site aquifer pumping test. The Conasauga Group, Knox Group, and the Chickamauga Group are the three major geologic strata in which the hydrogeologic testing were undertaken. Evaluation of these results suggests that hydraulic conductivity, in the bedrock, generally decreases with depth irrespective of the lithology.

Additional petrophysical testing, such as bulk density and porosity has been performed at the ORR and at the CRN Site. The results of these tests show generally uniform properties in the bedrock units.

2.4.12.2.5 Hydrogeochemical Characteristics

The hydrogeochemical characteristics of the groundwater were described in general terms in Subsection 2.4.12.1.2 and summarized on Figure 2.4.12-12. The shallow groundwater is characterized by mixed cation-bicarbonate type water, intermediate depth sodium-bicarbonate water, and deep sodium-chloride type water. The transition to sodium-chloride type water occurs below approximately 100 m (328 ft) and thus is not intercepted by on-site monitoring wells. A study of groundwater circulation in the deep system was conducted on the ORR (Reference 2.4.12-34), which included one well adjacent to the site (GW-214). This well appears to be at the top of the saline zone (sodium-chloride type water) at a depth of 126 m (413 ft) with a total dissolved solids measurement of 1693 mg/L. The results of this study indicated that some active exchange of water from the shallower groundwater is occurring. This exchange was characterized as highly variable as a result of the paucity of vertically interconnecting fractures. A more recent study performed as part of the Melton Valley exit pathway monitoring program (Reference 2.4.12-14) indicated a similar depth to saline groundwater (385 ft for monitoring well OMW1c).

Site-specific groundwater chemistry data were collected from selected on-site observation wells (Reference 2.4.12-13). Table 2.4.12-15 summarizes the field parameter measurements for the selected wells. Table 2.4.12-16 summarizes the analytical results. Regional groundwater chemistry information was obtained from the USGS National Water-Quality Assessment Program (NAWQA) website (Reference 2.4.12-35) for groundwater analyses from Roane, Anderson, and Knox counties to compare with the site-specific data. The results of these analyses are presented on Figure 2.4.12-39, which is a Piper trilinear diagram. The site groundwater ranges mostly from calcium-bicarbonate to magnesium-bicarbonate type. The water is generally near neutral pH with a total dissolved solids concentration of less than 500 mg/L. Examination of the figure indicates that, in general, the site groundwater chemistry is similar to the regional information from NAWQA. A notable exception is OW-202L, which is based on water chemistry, appears to be associated with the intermediate depth groundwater zone as defined on the ORR with a sodium-bicarbonate water type, alkaline pH, and higher total dissolved solids concentration. OW-202L was purged dry during sampling and had the highest field turbidity and pH measurement of the wells sampled (Table 2.4.12-15).

2.4.12.3 Subsurface Pathways

2.4.12.3.1 Exposure Point and Pathway Evaluation

The CRN Site is surrounded on three sides by the Clinch River arm of the Watts Bar Reservoir, which is interpreted to be the discharge area for site groundwater. The most likely pathway for groundwater flow is recharge in the upland areas of the site with discharge to the Clinch River arm of the Watts Bar Reservoir. An alternate groundwater pathway is recharge in the upland areas with seepage to onsite drainages and surface water discharge into the Clinch River arm of the Watts Bar Reservoir. It is very unlikely that there is shallow groundwater flow underneath the Clinch River arm of the Watts Bar Reservoir and exposure to water users on the opposite side of the Reservoir. This conclusion is based on 1) the absence of cavities and contiguous fractures below elevation 720 ft, 2) the head relationships observed at the Melton Valley Exit Pathway monitoring wells (Reference 2.4.12-14), and 3) the observed vertical hydraulic gradients demonstrate that the Clinch River arm of the Watts Bar Reservoir acts as a hydrologic sink. This is further supported by the following observations:

- There is no evidence of contiguous cavities or fractures originating from the power block area and extending below the Clinch River arm of the Watts Bar Reservoir, based on geologic core analysis from subsurface investigations;
- The CRBRP excavation, completed to an elevation of 714 ft NGVD29 and 6 ft below the invert elevation of the Clinch River arm of the Watts Bar Reservoir, showed no evidence of any continuous groundwater flow; this is likely due to an absence of cavities and continuous fractures below elevation 720 ft;
- Only 5 percent of the observed cavities fall below elevation 718.4 ft with the average elevation of observed cavities being 782.6 ft;
- An analysis of site-specific geologic core analysis, fracture frequency analysis, and groundwater vertical gradient data provides no evidence supporting a pathway for radionuclide transport occurring underneath the Clinch River arm of the Watts Bar Reservoir within the shallow groundwater system.

2.4.12.3.2 Advective Transport

Advective transport in groundwater is assumed to occur in an equivalent porous medium. This assumption is based on the findings of the aquifer pumping test and other hydraulic conductivity tests and is restricted to the shallow groundwater system. In the deeper groundwater system, that is not pervasively fractured, discrete fractures control the movement of groundwater. However, as discussed in Subsection 2.4.12.1.3 and shown on Figure 2.4.12-12, greater than 90 percent of groundwater flow occurs in the shallow zone.

The porous medium flow is represented by Darcy's law, when written in terms of linear velocity (Reference 2.4.12-36) is:

$$v = -K/n_e \times dh/dl$$

Where:

v	=	linear groundwater velocity [L/T]
K	=	hydraulic conductivity [L/T]
n_e	=	effective porosity
dh/dl	=	hydraulic gradient (change in head over change in length)

The travel time (T) is determined by dividing the distance to the receptor (D) (Clinch River arm of the Watts Bar Reservoir) by the linear groundwater velocity (v):

$$T = D/v$$

Table 2.4.12-17 presents a summary of these parameters and the linear velocity and travel times determined from these parameters. Using the representative parameter values, a travel time of 359 days is determined (Table 2.4.12-17).

2.4.12.4 Monitoring or Safeguard Requirements

Groundwater levels at the CRN Site were determined through the use of groundwater observation wells installed in 2013 as part of the site subsurface investigation. Consistent with Regulatory Guide 4.21, *Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning*, and the Nuclear Energy Institute (NEI) groundwater initiatives (Reference 2.4.12-50), the existing groundwater observation well network is evaluated and an environmental monitoring program developed as part of detailed design activities for the CRN Site. The groundwater monitoring program considers the following components:

- Periodic water level measurements in observation wells and geochemical sampling and analysis are made to detect changes in the bedrock aquifer and granular backfill that may impact groundwater levels or the accidental release analysis.
- Operational accident monitoring—the effluent and process monitoring program is addressed in the combined license application.

Groundwater level measurements in bedrock aquifer and granular backfill observation wells (existing or future) are made during construction and operation. Selection of observation wells included in the program is made before the start of operation based on well condition, position relative to plant site and other observation wells (provide optimal spatial distribution for potentiometric map preparation and vertical hydraulic gradient assessment), and long-term viability of the observation well (likelihood that the well will not be damaged or destroyed).

Geochemical sampling and analysis of the bedrock aquifer and granular backfill wells are performed during construction and operation. Analysis includes field parameters (pH, temperature, specific conductance, oxidation-reduction potential, and dissolved oxygen), major cations, major anions, total dissolved solids, silica, and any additional water quality parameters as needed.

Operational accident monitoring is initiated in the unlikely event of a release of liquid effluent from the plant. Quarterly groundwater samples are collected from downgradient bedrock aquifer and granular backfill observation wells as needed to identify impact. Selection of downgradient observation wells is based on flow directions determined from the most recent groundwater level measurements.

Safeguards are used to minimize the potential for adverse impacts to the groundwater caused by construction and operation of the CRN Site. These safeguards include the use of emergency cleanup procedures to capture and remove surface contaminants, and other measures deemed necessary to prevent or minimize adverse impacts to the groundwater beneath the site.

2.4.12.5 Site Characteristics for Subsurface Hydrostatic Loading

2.4.12.5.1 Groundwater Flow Model

Two-dimensional, vertical profile, groundwater models (profile models) were developed along the geologic strike of the bedding planes (principal flow direction) at the CRN Site. The purpose of the profile models is to evaluate maximum groundwater level as a result of construction and operation of the units at the CRN Site.

Two profile models were developed – one within the northern sector and the other along the southern sector of the power block area, both oriented along a strike of the bedding planes. Both profile models encompass the Chickamauga Group of interbedded siltstone and limestone, which includes the Fleanor Shale member (in the northern profile model – Profile A) and the Benbolt Formation (in the southern profile model- Profile C), Figure 2.4.12-40. A detailed discussion of the groundwater flow modeling is presented in Appendix 2.4.12C and summarized as follows.

The profile models were developed based on the conceptual understanding of the hydrogeologic features of the site. This included interpretation of the hydrogeologic subsurface investigations at the CRN Site; modeling studies conducted at the ORR area; and an understanding that the site has undergone significant disturbance as a result of CRBRP site preparation activities. A total of six active layers were simulated: Layer 1 was simulated as a fill layer based on CRBRP land disturbance; Layer 2 was simulated as a soil layer representing the vadose zone; Layer 3 represents the highly fractured bedrock encompassing the interface between soil and competent bedrock; and Layers 4 to 6 represent the competent bedrock with fracture density deceasing with depth.

The profile models were calibrated by matching the simulated heads against the maximum observed heads within the power block area measured during the subsurface investigations at the CRN Site. Sensitivity of model parameters (hydraulic conductivity and recharge) to simulated heads was evaluated during the calibration phase of the model. Alternate conceptual models were also simulated: 1) a preferential flow zone in Layer 3 was simulated by assuming a very high hydraulic conductivity for this layer; 2) the impact of spatially variable recharge rates was assessed; and 3) the impact of using a uniform recharge rate was assessed. A uniform recharge rate of 8.76 in./yr provided the most conservative estimate for the maximum groundwater heads at the power block area. This pre-construction model with a uniform recharge of 8.76 in./yr served as the base for the post-construction model simulations. The hydraulic conductivity values assigned in the model layers were within the range of values obtained from the packer, slug, and aquifer performance tests at the CRN Site and from literature studies at ORR.

The post-construction model included a surface elevation of approximately 821 ft NAVD88 and is based on the CRN Plant Parameter Envelope (PPE) conceptual design grade in the power block area. The post-construction models included two embedment depths: a shallow reactor building embedment depth of about 50 ft below grade, and a deep reactor building embedment depth of about 140 ft below grade. The grade elevation at the power block area at the reactor building was assigned a value of 821 ft NAVD88. A uniform recharge of 8.76 in./yr was assigned in the post-construction models except at the power block area and part of the turbine area (which are comprised of paved areas and buildings). Model sensitivity to variation of granular backfill hydraulic conductivity with regard to simulated groundwater heads was evaluated. Higher granular backfill hydraulic conductivity resulted in lower groundwater heads at the power block area. The model simulated groundwater heads underneath the foundation embedment structure ranging from 802.3 to 810.9 ft NAVD88 for Profile A and from 807.3 to 816.1 ft NAVD88 for Profile C.

2.4.12.5.2 Hydrostatic Loading

Subsurface hydrostatic loading estimates for plant structures at the CRN Site were evaluated using the range of simulated maximum groundwater heads underneath the foundation. The maximum hydrostatic loading is estimated using the following formula:

$$p_w = z_w \times \gamma_w \qquad \text{Equation 2.4.12-1}$$

Where:

p_w = hydrostatic pressure (pounds per square ft)

z_w = depth below groundwater level (ft)

γ_w = unit weight of water (62.4 pounds per cubic ft)

Figure 2.4.12-41 presents a graph of structure elevation versus hydrostatic pressure for structures within the PPE.

2.4.12.6 Construction Dewatering

No permanent dewatering system is employed to lower design basis groundwater levels; however, temporary dewatering is required to maintain dry excavations for the construction of the required foundations for the CRN Site plant structures. It is anticipated that dewatering will be accomplished using similar techniques as were used during the CRBRP excavation activities. This included installation of horizontal gravity drains in the excavated rock faces and pumping from sumps located around the perimeter of the excavation and at the base of excavation. Grouting of localized areas would be performed if higher water inflow is encountered (Reference 2.4.12-1). These methods are localized to the power block area excavation and therefore would limit the impact of dewatering and associated drawdown to the areas immediately in the vicinity of the power block area excavation and within the CRN Site.

As indicated in Subsection 2.4.12.1.6, there are no current groundwater uses at the CRN Site and the CRN Site plant design does not require groundwater as a source for cooling water, potable water, or other plant needs.

As discussed in Subsection 2.4.12.1.6, groundwater flow occurs at the CRN Site primarily through fractures and joints, with active flow primarily at shallow depths where fractures/joints are denser and closely spaced. The frequency of fractures/joints decreases significantly at depth such that the top of continuous rock lies at about 700 ft. Groundwater flows from the ridges at higher elevations north of the site toward the Clinch River arm of the Watts Bar Reservoir. The reservoir abuts the site on the east, south, and west sides and acts as the main discharge area for the shallow groundwater flow system, thus forming a hydrologic boundary for the site. Given these hydrogeologic considerations along with measures taken to mitigate the influx of groundwater to the excavation, the areal extent of any drawdown resulting from temporary dewatering would be limited to the CRN Site; therefore, recharge zones for existing or future offsite groundwater users, either across the river or past the site boundaries, are not expected to be impacted by temporary dewatering.

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Table 2.4.12-1 (Sheet 1 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[(d)] (ft^2/d)	Storage Coefficient[(d)]
55-1A	A	Nolichucky Shale	Conasauga	14.3	19.3	16.8	Slug	Hvorslev	4.2E-04	1.2	NA	NA
55-1B	A	Nolichucky Shale	Conasauga	33.8	38.8	36.3	Slug	Hvorslev	3.9E-04	1.1	NA	NA
55-1C	A	Nolichucky Shale	Conasauga	70.7	75.7	73.2	Slug	Hvorslev	1.2E-04	0.34	NA	NA
55-2C	A	Nolichucky Shale	Conasauga	71	76	73.5	Slug	Hvorslev	4.9E-04	1.4	NA	NA
55-3A	A	Nolichucky Shale	Conasauga	9.3	14.3	11.8	Slug	Hvorslev	6.0E-04	1.7	NA	NA
55-3B	A	Nolichucky Shale	Conasauga	33.1	38.1	35.6	Slug	Hvorslev	1.6E-03	4.6	NA	NA
55-3C	A	Nolichucky Shale	Conasauga	72.5	77.5	75	Slug	Hvorslev	6.7E-05	0.19	NA	NA
55-4B	A	Nolichucky Shale	Conasauga	20.5	25.5	23	Slug	Hvorslev	4.6E-04	1.3	NA	NA
55-4C	A	Nolichucky Shale	Conasauga	67.6	72.6	70.1	Slug	Hvorslev	1.7E-04	0.49	NA	NA
56-1A	A	Nolichucky Shale	Conasauga	14	19	16.5	Slug	Hvorslev	4.9E-05	0.14	NA	NA
56-1C	A	Nolichucky Shale	Conasauga	70.3	75.3	72.8	Slug	Hvorslev	6.7E-04	1.9	NA	NA
56-2A	A	Nolichucky Shale	Conasauga	10.1	15.1	12.6	Slug	Hvorslev	8.1E-04	2.3	NA	NA
56-2B	A	Nolichucky Shale	Conasauga	33.8	38.8	36.3	Slug	Hvorslev	3.0E-04	0.84	NA	NA
56-2C	A	Nolichucky Shale	Conasauga	72.3	77.3	74.8	Slug	Hvorslev	1.6E-04	0.45	NA	NA
56-3A	A	Nolichucky Shale	Conasauga	12.8	17.8	15.3	Slug	Hvorslev	2.8E-04	0.8	NA	NA
56-3C	A	Nolichucky Shale	Conasauga	50.5	55.5	53	Slug	Hvorslev	5.6E-04	1.6	NA	NA
56-4C	A	Nolichucky Shale	Conasauga	71.3	76.3	73.8	Slug	Hvorslev	1.3E-03	3.6	NA	NA
56-5C	A	Maynardville Limestone	Conasauga	66.6	71.6	69.1	Slug	Hvorslev	2.5E-02	70	NA	NA
GW-1	A	Dismal Gap Formation	Conasauga	14.4	25.7	20.1	Bailer-Rec	Not Specified	2.6E-05	0.074	NA	NA
GW-2	A	Dismal Gap Formation	Conasauga	47.8	60	53.9	Packer	Not Specified	1.1E-05	0.03	NA	NA
GW-2	A	Dismal Gap Formation	Conasauga	38.9	60	49.5	Packer	Not Specified	4.9E-06	0.014	NA	NA
GW-2	A	Dismal Gap Formation	Conasauga	39.6	46.7	43.2	Packer	Not Specified	9.5E-06	0.027	NA	NA
GW-2	A	Dismal Gap Formation	Conasauga	34.8	41.9	38.4	Packer	Not Specified	2.8E-06	0.008	NA	NA
GW-3	A	Nolichucky Shale	Conasauga	23.9	35	29.5	Packer	Not Specified	5.1E-05	0.145	NA	NA
GW-3	A	Nolichucky Shale	Conasauga	20.9	32	26.5	Packer	Not Specified	4.1E-05	0.115	NA	NA
GW-3	A	Nolichucky Shale	Conasauga	18	23	20.5	Bailer-Rec	Not Specified	1.3E-05	0.038	NA	NA
GW-4	A	Nolichucky Shale	Conasauga	17	27.2	22.1	Packer	Not Specified	1.1E-03	3.23	NA	NA
GW-4	A	Nolichucky Shale	Conasauga	27.2	50.6	38.9	Packer	Not Specified	7.2E-04	2.05	NA	NA
GW-5	A	Nolichucky Shale	Conasauga	3	12.5	7.8	Bailer-Rec	Not Specified	2.0E-04	0.575	NA	NA
GW-6	A	Nolichucky Shale	Conasauga	35.7	46.8	41.3	Packer	Not Specified	6.7E-05	0.189	NA	NA
GW-6	A	Nolichucky Shale	Conasauga	15.3	31.5	23.4	Bailer-Rec	Not Specified	3.1E-05	0.088	NA	NA

Table 2.4.12-1 (Sheet 2 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[(d)] (ft^2/d)	Storage Coefficient[(d)]
GW-7	A	Nolichucky Shale	Conasauga	8.7	16.5	12.6	Bailer-Rec	Not Specified	1.9E-04	0.548	NA	NA
GW-8	A	Nolichucky Shale	Conasauga	13	21.9	17.5	Bailer-Rec	Not Specified	1.5E-04	0.438	NA	NA
GW-9	A	Nolichucky Shale	Conasauga	51.5	55.3	53.4	Packer	Not Specified	6.8E-05	0.192	NA	NA
GW-9	A	Nolichucky Shale	Conasauga	39.6	49.8	44.7	Packer	Not Specified	9.0E-05	0.255	NA	NA
GW-9	A	Nolichucky Shale	Conasauga	30.4	40.6	35.5	Packer	Not Specified	7.9E-04	2.25	NA	NA
GW-9	A	Nolichucky Shale	Conasauga	20.5	30.7	25.6	Packer	Not Specified	2.8E-04	0.795	NA	NA
GW-10	A	Nolichucky Shale	Conasauga	9.6	15	12.3	Bailer-Rec	Not Specified	8.0E-05	0.222	NA	NA
GW-11	A	Nolichucky Shale	Conasauga	27.8	39.5	33.7	Packer	Not Specified	2.4E-04	0.685	NA	NA
GW-11	A	Nolichucky Shale	Conasauga	19.7	31.4	25.6	Packer	Not Specified	4.6E-04	1.29	NA	NA
GW-11	A	Nolichucky Shale	Conasauga	48.7	60.8	54.8	Packer	Not Specified	5.0E-05	0.137	NA	NA
GW-11	A	Nolichucky Shale	Conasauga	39	50.8	44.9	Packer	Not Specified	4.2E-05	0.118	NA	NA
GW-12	A	Nolichucky Shale	Conasauga	8.7	14.7	11.7	Bailer-Rec	Not Specified	3.4E-05	0.096	NA	NA
GW-13	A	Nolichucky Shale	Conasauga	6	14	10	Bailer-Rec	Not Specified	3.3E-05	0.093	NA	NA
GW-13	A	Nolichucky Shale	Conasauga	22.5	33.9	28.2	Packer	Not Specified	5.8E-04	1.64	NA	NA
GW-13	A	Nolichucky Shale	Conasauga	15.6	27.4	21.5	Packer	Not Specified	6.0E-04	1.7	NA	NA
GW-43	A	Dismal Gap Formation	Conasauga	28.6	35	31.8	Bailer-Rec	Not Specified	5.0E-05	0.14	NA	NA
GW-44	A	Dismal Gap Formation	Conasauga	27.1	38.7	32.9	Packer	Not Specified	1.3E-04	0.381	NA	NA
GW-44	A	Dismal Gap Formation	Conasauga	58	64	61	Packer	Not Specified	2.1E-05	0.06	NA	NA
GW-44	A	Dismal Gap Formation	Conasauga	47.5	64	55.8	Packer	Not Specified	6.3E-05	0.178	NA	NA
GW-44	A	Dismal Gap Formation	Conasauga	47.6	64	55.8	Packer	Not Specified	1.8E-04	0.521	NA	NA
GW-44	A	Dismal Gap Formation	Conasauga	35.3	46.9	41.1	Packer	Not Specified	8.7E-05	0.247	NA	NA
GW-58	A	Maynardville Limestone	Conasauga	21.5	33.2	27.4	Packer	Not Specified	3.7E-04	1.036	NA	NA
GW-58	A	Maynardville Limestone	Conasauga	30.2	41.9	36.1	Packer	Not Specified	2.0E-03	5.81	NA	NA
GW-59	A	Maynardville Limestone	Conasauga	18.2	27	22.6	Packer	Not Specified	4.1E-03	11.63	NA	NA
GW-62	A	Maynardville Limestone	Conasauga	22.5	32.5	27.5	Packer	Not Specified	3.3E-03	9.3	NA	NA
GW-62	A	Maynardville Limestone	Conasauga	34	44	39	Packer	Not Specified	8.9E-05	0.252	NA	NA
GW-62	A	Maynardville Limestone	Conasauga	44	54	49	Packer	Not Specified	4.6E-05	0.129	NA	NA
GW-131	A	Knox Group	Knox	120	147	133.5	Packer	Homer Semi-Log	4.6E-04	1.3	NA	NA
GW-131	A	Knox Group	Knox	240	267	253.5	Packer	Homer Semi-Log	1.3E-03	3.67	NA	NA
GW-131	A	Knox Group	Knox	290	317	303.5	Packer	Homer Semi-Log	7.0E-08	0.0002	NA	NA
GW-131	A	Knox Group	Knox	370	397	383.5	Packer	Homer Semi-Log	4.4E-05	0.124	NA	NA
GW-131	A	Knox Group	Knox	450	477	463.5	Packer	Homer Semi-Log	1.9E-04	0.544	NA	NA

Table 2.4.12-1 (Sheet 3 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[(d)] (ft^2/d)	Storage Coefficient[(d)]
GW-131	A	Knox Group	Knox	490	517	503.5	Packer	Homer Semi-Log	1.1E-06	0.003	NA	NA
GW-131	A	Maynardville Limestone	Conasauga	665	692	678.5	Packer	Homer Semi-Log	1.0E-05	0.029	NA	NA
GW-131	A	Maynardville Limestone	Conasauga	765	792	778.5	Packer	Homer Semi-Log	3.5E-06	0.01	NA	NA
GW-131	A	Maynardville Limestone	Conasauga	892	919	905.5	Packer	Homer Semi-Log	7.0E-08	0.0002	NA	NA
GW-131	A	Maynardville Limestone	Conasauga	988	1015	1001.5	Packer	Homer Semi-Log	3.3E-04	0.932	NA	NA
GW-132	A	Friendship Formation	Conasauga	145	172	158.5	Packer	Homer Semi-Log	1.1E-08	0.00003	NA	NA
GW-132	A	Pumpkin Valley Shale	Conasauga	305	332	318.5	Packer	Homer Semi-Log	3.5E-06	0.01	NA	NA
GW-132	A	Pumpkin Valley Shale	Conasauga	347	374	360.5	Packer	Homer Semi-Log	3.5E-06	0.01	NA	NA
GW-132	A	Pumpkin Valley Shale	Conasauga	490	517	503.5	Packer	Homer Semi-Log	2.1E-06	0.006	NA	NA
GW-132	A	Pumpkin Valley Shale	Conasauga	557	584	570.5	Packer	Homer Semi-Log	1.5E-05	0.042	NA	NA
GW-132	A	Rome Formation	Rome	642	669	655.5	Packer	Homer Semi-Log	3.9E-04	1.1	NA	NA
GW-132	A	Rome Formation	Rome	690	717	703.5	Packer	Homer Semi-Log	3.2E-07	0.0009	NA	NA
GW-133	A	Dismal Gap Formation	Conasauga	105	132	118.5	Packer	Homer Semi-Log	1.1E-07	0.0003	NA	NA
GW-133	A	Dismal Gap Formation	Conasauga	148	175	161.5	Packer	Homer Semi-Log	1.1E-06	0.003	NA	NA
GW-133	A	Dismal Gap Formation	Conasauga	230	257	243.5	Packer	Homer Semi-Log	1.8E-07	0.0005	NA	NA
GW-133	A	Dismal Gap Formation	Conasauga	305	332	318.5	Packer	Homer Semi-Log	1.4E-06	0.004	NA	NA
GW-133	A	Rogersville Shale	Conasauga	428	455	441.5	Packer	Homer Semi-Log	7.1E-07	0.002	NA	NA
GW-133	A	Friendship Formation	Conasauga	543	570	556.5	Packer	Homer Semi-Log	2.1E-07	0.0006	NA	NA
GW-134	A	Maynardville Limestone	Conasauga	75	102	88.5	Packer	Homer Semi-Log	2.4E-04	0.67	NA	NA
GW-134	A	Nolichucky Shale	Conasauga	173	200	186.5	Packer	Homer Semi-Log	2.8E-06	0.008	NA	NA
GW-134	A	Nolichucky Shale	Conasauga	270	297	283.5	Packer	Homer Semi-Log	1.8E-06	0.005	NA	NA
GW-134	A	Nolichucky Shale	Conasauga	360	387	373.5	Packer	Homer Semi-Log	3.5E-08	0.0001	NA	NA
GW-134	A	Nolichucky Shale	Conasauga	450	477	463.5	Packer	Homer Semi-Log	3.2E-07	0.0009	NA	NA
GW-134	A	Nolichucky Shale	Conasauga	560	587	573.5	Packer	Homer Semi-Log	3.5E-07	0.001	NA	NA
GW-134	A	Dismal Gap Formation	Conasauga	730	757	743.5	Packer	Homer Semi-Log	7.1E-07	0.002	NA	NA
GW-134	A	Dismal Gap Formation	Conasauga	793	820	806.5	Packer	Homer Semi-Log	1.4E-07	0.0004	NA	NA
GW-135	A	Knox undifferentiated	Knox	190	217	203.5	Packer	Homer Semi-Log	5.6E-06	0.016	NA	NA
GW-135	A	Knox undifferentiated	Knox	324	351	337.5	Packer	Homer Semi-Log	7.2E-05	0.203	NA	NA
GW-135	A	Knox undifferentiated	Knox	397	425	411	Packer	Homer Semi-Log	9.6E-05	0.272	NA	NA
GW-135	A	Knox undifferentiated	Knox	446	473	459.5	Packer	Homer Semi-Log	7.8E-05	0.222	NA	NA
GW-135	A	Knox undifferentiated	Knox	588	615	601.5	Packer	Homer Semi-Log	3.5E-06	0.01	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	710	737	723.5	Packer	Homer Semi-Log	1.8E-06	0.005	NA	NA

Table 2.4.12-1 (Sheet 4 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[d] (ft^2/d)	Storage Coefficient[d]
GW-135	A	Maynardville Limestone	Conasauga	832	859	845.5	Packer	Homer Semi-Log	1.8E-05	0.052	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	945	972	958.5	Packer	Homer Semi-Log	3.5E-07	0.001	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	990	1017	1003.5	Packer	Homer Semi-Log	2.5E-06	0.007	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	1124	1151	1137.5	Packer	Homer Semi-Log	1.5E-04	0.411	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	1185	1212	1198.5	Packer	Homer Semi-Log	2.5E-06	0.007	NA	NA
GW-157	A	Knox undifferentiated	Knox	145	157	151	Packer	Homer Semi-Log	8.5E-05	0.24	NA	NA
GW-157	A	Knox undifferentiated	Knox	215	227	221	Packer	Homer Semi-Log	1.8E-04	0.502	NA	NA
GW-157	A	Knox undifferentiated	Knox	265	277	271	Packer	Homer Semi-Log	1.1E-03	3.03	NA	NA
GW-157	A	Knox undifferentiated	Knox	282	294	288	Packer	Homer Semi-Log	2.0E-04	0.561	NA	NA
GW-157	A	Knox undifferentiated	Knox	314	326	320	Packer	Homer Semi-Log	3.2E-06	0.009	NA	NA
GW-157	A	Knox undifferentiated	Knox	326	338	332	Packer	Homer Semi-Log	3.1E-04	0.89	NA	NA
GW-157	A	Knox undifferentiated	Knox	344	356	350	Packer	Homer Semi-Log	7.1E-08	0.0002	NA	NA
GW-157	A	Knox undifferentiated	Knox	392	404	398	Packer	Homer Semi-Log	2.8E-07	0.0008	NA	NA
GW-157	A	Knox undifferentiated	Knox	432	444	438	Packer	Homer Semi-Log	7.4E-05	0.209	NA	NA
GW-157	A	Knox undifferentiated	Knox	468	480	474	Packer	Homer Semi-Log	1.5E-04	0.417	NA	NA
GW-456[a]	A	Nolichucky Shale	Conasauga	Not Specified	Not Specified	Not Specified	Pump	Theis	9.2E-04	2.6	180	0.0021
GW-457[a]	A	Nolichucky Shale	Conasauga	Not Specified	Not Specified	Not Specified	Pump	Theis	1.2E-04	0.34	24	0.00046
GW-458[a]	A	Nolichucky Shale	Conasauga	Not Specified	Not Specified	Not Specified	Pump	Theis	1.1E-04	0.31	13	0.00088
GW-459[a]	A	Nolichucky Shale	Conasauga	Not Specified	Not Specified	Not Specified	Pump	Theis	2.5E-03	7.1	530	0.0048
GW-460[a]	A	Nolichucky Shale	Conasauga	Not Specified	Not Specified	Not Specified	Pump	Theis	3.3E-04	0.96	61	0.0013
GW-461[a]	A	Nolichucky Shale	Conasauga	Not Specified	Not Specified	Not Specified	Pump	Theis	9.9E-04	2.8	138	0.0018
GW-462[a]	A	Nolichucky Shale	Conasauga	Not Specified	Not Specified	Not Specified	Pump	Theis	5.6E-05	0.16	17	NA
GW-427	A	Maynardville Limestone	Conasauga	38	48	43	Pump	Theis	3.5E-02	99	7690	0.000056
GW-428[a]	A	Maynardville Limestone	Conasauga	Not Specified	Not Specified	Not Specified	Pump	Theis	1.6E-02	45	NA	NA
GW-463	A	Maynardville Limestone	Conasauga	45.8	55.8	50.8	Pump	Theis	8.1E-03	23	950	0.0004
GW-464[a]	A	Maynardville Limestone	Conasauga	Not Specified	Not Specified	Not Specified	Pump	Theis	7.4E-03	21	1037	0.00083
GW-465	A	Maynardville Limestone	Conasauga	31	41	36	Pump	Theis	2.2E-03	6.2	372	0.0023
GW-466	A	Maynardville Limestone	Conasauga	32	42	37	Pump	Theis	5.3E-03	15	631	0.00046
GW-467	A	Maynardville Limestone	Conasauga	38.5	58.5	48.5	Pump	Theis	7.4E-03	21	NA	NA
1063	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	NA	NA	12	0.00024
1062/OB-4	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	NA	NA	68	0.0066
1061/OB-5	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	NA	NA	51	0.0041

Table 2.4.12-1 (Sheet 5 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity(d) (ft^2/d)	Storage Coefficient(d)
1060/OB-8	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	NA	NA	38	0.0006
1059/OB-1	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	NA	NA	19	NA
1058/OB-3	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	NA	NA	18	0.00013
1057/OB-7	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	NA	NA	17	0.00019
1056/OB-2	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	NA	NA	18	0.00025
1055/OB-6	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	NA	NA	25	0.0007
1002/AP-2	A	Dismal Gap Formation	Conasauga	35	45	40	Slug	Not Specified	7.3E-04	2.08	NA	NA
1003/AP-3	A	Nolichucky Shale	Conasauga	27	37	32	Slug	Not Specified	9.4E-05	0.266	NA	NA
1027/BG-1	A	Dismal Gap Formation	Conasauga	20	30	25	Packer	Not Specified	1.0E-04	0.296	NA	NA
1027/BG-1	A	Dismal Gap Formation	Conasauga	30	40	35	Packer	Not Specified	6.7E-04	1.9	NA	NA
1027/BG-1	A	Dismal Gap Formation	Conasauga	40	50	45	Packer	Not Specified	1.3E-04	0.381	NA	NA
1032/BG-6	A	Maynardville Limestone	Conasauga	43	53	48	Slug	Not Specified	2.3E-04	0.66	NA	NA
1032/BG-6	A	Maynardville Limestone	Conasauga	43	53	48	Slug	Not Specified	1.8E-04	0.507	NA	NA
1035/BG-9	A	Pumpkin Valley Shale	Conasauga	20	30	25	Packer	Not Specified	2.3E-05	0.066	NA	NA
1035/BG-9	A	Pumpkin Valley Shale	Conasauga	30	40	35	Packer	Not Specified	1.2E-04	0.334	NA	NA
1035/BG-9	A	Pumpkin Valley Shale	Conasauga	35	45	40	Packer	Not Specified	9.8E-05	0.279	NA	NA
1035/BG-9	A	Pumpkin Valley Shale	Conasauga	35	45	40	Packer	Not Specified	1.2E-04	0.331	NA	NA
1035/BG-9	A	Pumpkin Valley Shale	Conasauga	40	50	45	Packer	Not Specified	1.2E-04	0.331	NA	NA
1035/BG-9	A	Pumpkin Valley Shale	Conasauga	40	50	45	Packer	Not Specified	1.0E-04	0.29	NA	NA
1051/OD-4	A	Nolichucky Shale	Conasauga	18	28	23	Slug	Not Specified	6.0E-04	1.69	NA	NA
1051/OD-4	A	Nolichucky Shale	Conasauga	18	28	23	Slug	Not Specified	3.7E-04	1.06	NA	NA
1095/SD-1	A	Knox undifferentiated	Knox	108	118	113	Slug	Not Specified	3.1E-04	0.874	NA	NA
1055/OB-6	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	1.9E-04	0.54	10	0.0009
1056/OB-2	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	1.7E-04	0.48	16.7	0.0072
1057/OB-7	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	9.4E-04	2.66	4.7	0.00041
1058/OB-3	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	4.9E-05	0.14	NA	0.00053
1059/OB-1	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	1.7E-04	0.48	32.2	0.0013
1060/OB-8	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	9.2E-04	2.6	20.7	0.0017
1061/OB-5	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	1.3E-03	3.67	NA	0.0047
1062/OB-4	A	Nolichucky Shale	Conasauga	20	70	45	Pump	Theis	8.6E-04	2.44	39.4	0.0054
1044/BG18	A	Maynardville Limestone	Conasauga	100	160	130	Pump	Hantush	NA	NA	16	NA
1031/BG8	A	Nolichucky Shale	Conasauga	37	47	42	Pump	Hantush	1.1E-07	0.0003	41	0.0003

Table 2.4.12-1 (Sheet 6 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[(d)] (ft^2/d)	Storage Coefficient[(d)]
1034/BG5	A	Nolichucky Shale	Conasauga	35	45	40	Pump	Hantush	3.2E-09	0.000009	20	0.000009
GW-104	A	Nolichucky Shale	Conasauga	51	74	62.5	Pump	Jacob	NA	NA	37	NA
GW-245	A	Nolichucky Shale	Conasauga	30	75	52.5	Pump	Theis	NA	NA	13.4	NA
GW-246	A	Nolichucky Shale	Conasauga	30	75	52.5	Pump	Theis	NA	NA	28	0.001
GW-247	A	Nolichucky Shale	Conasauga	30	75	52.5	Pump	Theis	NA	NA	16	0.0004
GW-122	A	Maynardville Limestone	Conasauga	92	142	117	Not Specified	Not Specified	9.7E-06	0.0274	NA	NA
GW-120	A	Nolichucky Shale	Conasauga	130	180	155	Not Specified	Not Specified	1.9E-06	0.0055	NA	NA
GW-117	A	Nolichucky Shale	Conasauga	480	530	505	Not Specified	Not Specified	7.1E-08	0.0002	NA	NA
GW-123	A	Nolichucky Shale	Conasauga	525	575	550	Not Specified	Not Specified	1.8E-08	0.00005	NA	NA
GW-473	A	Not Specified	Not Specified	30	45	37.5	Pump	Chow	7.0E-05	0.1984	NA	NA
GW-132	A	Friendship Formation	Conasauga	850	Not Specified	850	Packer	Not Specified	1.02E-06	0.0029	NA	NA
GW-132	A	Pumpkin Valley Shale	Conasauga	720	Not Specified	720	Packer	Not Specified	3.75E-06	0.0106	NA	NA
GW-132	A	Pumpkin Valley Shale	Conasauga	650	Not Specified	650	Packer	Not Specified	4.04E-06	0.0115	NA	NA
GW-132	A	Pumpkin Valley Shale	Conasauga	520	Not Specified	520	Packer	Not Specified	1.99E-06	0.0056	NA	NA
GW-132	A	Pumpkin Valley Shale	Conasauga	450	Not Specified	450	Packer	Not Specified	1.47E-05	0.0417	NA	NA
GW-132	A	Rome Formation	Rome	380	Not Specified	380	Packer	Not Specified	4.08E-04	1.1565	NA	NA
GW-132	A	Rome Formation	Rome	320	Not Specified	320	Packer	Not Specified	3.05E-07	0.0009	NA	NA
GW-133	A	Dismal Gap Formation	Conasauga	920	Not Specified	920	Packer	Not Specified	1.0E-07	0.0003	NA	NA
GW-133	A	Dismal Gap Formation	Conasauga	850	Not Specified	850	Packer	Not Specified	1.07E-06	0.003	NA	NA
GW-133	A	Dismal Gap Formation	Conasauga	760	Not Specified	760	Packer	Not Specified	1.7E-07	0.0005	NA	NA
GW-133	A	Dismal Gap Formation	Conasauga	680	Not Specified	680	Packer	Not Specified	1.49E-06	0.0042	NA	NA
GW-133	A	Rogersville Shale	Conasauga	550	Not Specified	550	Packer	Not Specified	6.42E-07	0.0018	NA	NA
GW-133	A	Friendship Formation	Conasauga	450	Not Specified	450	Packer	Not Specified	1.98E-07	0.0006	NA	NA
GW-134	A	Maynardville Limestone	Conasauga	920	Not Specified	920	Packer	Not Specified	2.37E-04	0.6718	NA	NA
GW-134	A	Maynardville Limestone	Conasauga	800	Not Specified	800	Packer	Not Specified	2.87E-06	0.0081	NA	NA
GW-134	A	Nolichucky Shale	Conasauga	650	Not Specified	650	Packer	Not Specified	1.74E-06	0.0049	NA	NA
GW-134	A	Nolichucky Shale	Conasauga	560	Not Specified	560	Packer	Not Specified	5.14E-06	0.0145	NA	NA
GW-134	A	Nolichucky Shale	Conasauga	500	Not Specified	500	Packer	Not Specified	3.17E-07	0.0009	NA	NA
GW-134	A	Nolichucky Shale	Conasauga	400	Not Specified	400	Packer	Not Specified	4.26E-07	0.0012	NA	NA
GW-134	A	Dismal Gap Formation	Conasauga	240	Not Specified	240	Packer	Not Specified	5.55E-07	0.0016	NA	NA
GW-134	A	Dismal Gap Formation	Conasauga	200	Not Specified	200	Packer	Not Specified	1.33E-07	0.0004	NA	NA
GW-135	A	Knox undifferentiated	Knox	950	Not Specified	950	Packer	Not Specified	5.49E-06	0.0156	NA	NA

Table 2.4.12-1 (Sheet 7 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[d] (ft^2/d)	Storage Coefficient[d]
GW-135	A	Knox undifferentiated	Knox	820	Not Specified	820	Packer	Not Specified	7.15E-05	0.2027	NA	NA
GW-135	A	Knox undifferentiated	Knox	750	Not Specified	750	Packer	Not Specified	9.61E-05	0.2724	NA	NA
GW-135	A	Knox undifferentiated	Knox	700	Not Specified	700	Packer	Not Specified	7.84E-05	0.2222	NA	NA
GW-135	A	Knox undifferentiated	Knox	550	Not Specified	550	Packer	Not Specified	3.55E-06	0.0101	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	400	Not Specified	400	Packer	Not Specified	1.69E-04	0.0048	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	300	Not Specified	300	Packer	Not Specified	1.83E-05	0.0519	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	150	Not Specified	150	Packer	Not Specified	4.30E-07	0.0012	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	100	Not Specified	100	Packer	Not Specified	2.30E-06	0.0065	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	50	Not Specified	50	Packer	Not Specified	1.45E-04	0.411	NA	NA
GW-135	A	Maynardville Limestone	Conasauga	100	Not Specified	100	Packer	Not Specified	2.55E-06	0.0072	NA	NA
458	B	Not Specified	Conasauga	150	203	176.5	Slug	Not Specified	1.06E-05	0.03	1.6	1.50E-08
458	B	Not Specified	Conasauga	190	203	196.5	Slug	Not Specified	1.06E-05	0.03	0.3	1.60E-12
458	B	Not Specified	Conasauga	150	203	176.5	Pump	Not Specified	1.06E-05	0.03	1.6	1.60E-05
459	B	Not Specified	Conasauga	100	150	125	Slug	Not Specified	7.06E-08	0.0002	0.011	1.60E-04
459	B	Not Specified	Conasauga	136	150	143	Slug	Not Specified	2.86E-05	0.081	1.1	1.60E-05
460	B	Not Specified	Conasauga	44	100	72	Slug	Not Specified	7.06E-06	0.020	1.4	1.60E-04
460	B	Not Specified	Conasauga	84	100	92	Slug	Not Specified	5.29E-06	0.015	0.2	1.40E-04
460	B	Not Specified	Conasauga	44	100	72	Pump	Not Specified	1.06E-05	0.03	1.6	7.50E-04
439	B	Not Specified	Conasauga	24	34	29	Slug	Not Specified	2.05E-04	0.58	NA	NA
440	B	Not Specified	Conasauga	26	36	31	Slug	Not Specified	1.87E-05	0.053	NA	NA
472	B	Not Specified	Conasauga	15	20	17.5	Slug	Not Specified	1.16E-04	0.33	NA	NA
464	B	Not Specified	Conasauga	6	11	8.5	Slug	Not Specified	2.68E-04	0.76	NA	NA
468	B	Not Specified	Conasauga	10	15	12.5	Slug	Not Specified	1.73E-04	0.49	NA	NA
OMW-01A	C	Not Specified	Conasauga[f]	210	258	234	Slug	Bouwer-Rice	1.05E-05	0.03	NA	NA
OMW-01AA	C	Not Specified	Conasauga[f]	120	170	145	Slug	Bouwer-Rice	8.91E-06	0.025	NA	NA
OMW-02A	C	Not Specified	Conasauga[f]	200	250	225	Slug	Bouwer-Rice	1.20E-05	0.034	NA	NA
OMW-02AA	C	Not Specified	Conasauga[f]	120	170	145	Slug	Bouwer-Rice	1.49E-05	0.042	NA	NA
OMW-02B	C	Not Specified	Conasauga[f]	300	350	325	Slug	Bouwer-Rice	9.84E-06	0.028	NA	NA
OMW-03A	C	Not Specified	Conasauga[f]	60	120	90	Slug	Bouwer-Rice	2.46E-04	0.697	NA	NA
OMW-03B[b]	C	Not Specified	Conasauga[f]	152.7	177.7	165.2	Slug	Bouwer-Rice	4.12E-05	0.117	NA	NA
OMW-04A[b]	C	Not Specified	Conasauga[f]	30	90	60	Slug	Bouwer-Rice	5.81E-04	1.646	NA	NA
OMW-04B	C	Not Specified	Conasauga[f]	119	164	141.5	Slug	Bouwer-Rice	4.40E-06	0.012	NA	NA

Table 2.4.12-1 (Sheet 8 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity(d) (ft^2/d)	Storage Coefficient(d)
OMW-04C	C	Not Specified	Conasauga(f)	182.7	217.7	200.2	Slug	Bouwer-Rice	1.58E-04	0.448	NA	NA
7-1(c)	D	Not Specified	Conasauga	60	120	90	Slug	Hvorslev	3.86E-06	0.011	NA	NA
7-2(c)	D	Not Specified	Conasauga	35	95	65	Slug	Hvorslev	5.10E-05	0.145	NA	NA
7-3	D	Not Specified	Conasauga	68	88	78	Slug	Hvorslev	2.98E-04	0.845	NA	NA
7-4	D	Not Specified	Conasauga	70	90	80	Slug	Hvorslev	1.05E-05	0.030	NA	NA
7-5	D	Not Specified	Conasauga	76	95	85.5	Slug	Hvorslev	3.84E-05	0.109	NA	NA
7-7	D	Not Specified	Conasauga	18	28	23	Slug	Hvorslev	1.12E-04	0.317	NA	NA
7-8	D	Not Specified	Conasauga	20	30	25	Slug	Hvorslev	2.29E-05	0.065	NA	NA
7-9	D	Not Specified	Conasauga	20	30	25	Slug	Hvorslev	6.59E-05	0.187	NA	NA
7-11(c)	D	Not Specified	Conasauga	38	86	62	Slug	Hvorslev	1.42E-05	0.040	NA	NA
7-12	D	Not Specified	Conasauga	60	70	65	Slug	Hvorslev	1.13E-06	0.003	NA	NA
7-13(c)	D	Not Specified	Conasauga	10	28	19	Slug	Hvorslev	1.47E-04	0.417	NA	NA
7-14	D	Not Specified	Conasauga	60	70	65	Slug	Hvorslev	8.21E-06	0.023	NA	NA
ETF-1	E	Dismal Gap Formation	Conasauga	24.8	28.7	26.7	Slug/Pump	Hvorslev	3.10E-04	0.879	24.6	5.12E-04
ETF-2	E	Dismal Gap Formation	Conasauga	27.9	31.8	29.8	Slug	Hvorslev	2.30E-05	0.065	NA	NA
ETF-3	E	Dismal Gap Formation	Conasauga	26.9	30.8	28.9	Slug/Pump	Hvorslev	5.00E-05	0.142	67.6	0.01
ETF-4	E	Dismal Gap Formation	Conasauga	26.8	30.8	28.8	Slug	Hvorslev	1.30E-04	0.369	NA	NA
ETF-5	E	Dismal Gap Formation	Conasauga	26.3	30.2	28.3	Slug	Hvorslev	3.00E-04	0.850	NA	NA
ETF-6	E	Dismal Gap Formation	Conasauga	26.2	30.1	28.1	Slug	Hvorslev	3.90E-04	1.106	NA	NA
ETF-7	E	Dismal Gap Formation	Conasauga	26.5	30.4	28.4	Slug	Hvorslev	2.00E-04	0.567	NA	NA
ETF-8	E	Dismal Gap Formation	Conasauga	25.8	29.8	27.8	Slug/Pump	Hvorslev	3.10E-04	0.879	58	0.03
ETF-9	E	Dismal Gap Formation	Conasauga	27	30.9	28.9	Slug/Pump	Hvorslev	5.10E-05	0.145	19.4	0.01
ETF-10	E	Dismal Gap Formation	Conasauga	27.1	31.1	29.1	Pump	Theis	NA	NA	27	3.34E-04
ETF-11	E	Dismal Gap Formation	Conasauga	41.7	49.6	45.6	Slug	Hvorslev	2.40E-04	0.680	NA	NA
ETF-12	E	Dismal Gap Formation	Conasauga	42.2	50.1	46.2	Slug	Hvorslev	4.10E-04	1.162	NA	NA
ETF-13	E	Dismal Gap Formation	Conasauga	240.9	250.7	245.8	Slug	Hvorslev	1.70E-05	0.048	NA	NA
ETF-14	E	Dismal Gap Formation	Conasauga	84.7	94.6	89.7	Slug	Hvorslev	2.30E-05	0.065	NA	NA
ETF-15	E	Dismal Gap Formation	Conasauga	36.9	46.8	41.8	Slug	Hvorslev	6.60E-06	0.019	NA	NA
ETF-16	E	Dismal Gap Formation	Conasauga	234.6	244.5	239.6	Slug	Hvorslev	2.90E-05	0.082	NA	NA
ETF-17	E	Dismal Gap Formation	Conasauga	12.8	18.7	15.8	Slug	Hvorslev	9.60E-06	0.027	NA	NA
ETF-20	E	Dismal Gap Formation	Conasauga	15.9	21.8	18.9	Slug	Hvorslev	2.30E-04	0.652	NA	NA
ETF-21	E	Dismal Gap Formation	Conasauga	14.5	20.4	17.5	Slug	Hvorslev	1.10E-05	0.031	NA	NA

Table 2.4.12-1 (Sheet 9 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[(d)] (ft^2/d)	Storage Coefficient[(d)]
ETF-22	E	Dismal Gap Formation	Conasauga	16.6	22.5	19.6	Slug	Hvorslev	4.50E-05	0.128	NA	NA
ETF-23	E	Dismal Gap Formation	Conasauga	14.4	20.3	17.4	Slug	Hvorslev	6.00E-05	0.170	NA	NA
ETF-24	E	Dismal Gap Formation	Conasauga	15.7	21.7	18.7	Slug	Hvorslev	6.00E-04	1.701	NA	NA
ETF-25	E	Dismal Gap Formation	Conasauga	15.7	21.6	18.6	Slug	Hvorslev	7.60E-05	0.215	NA	NA
ETF-26	E	Dismal Gap Formation	Conasauga	15.3	21.2	18.2	Slug	Hvorslev	4.70E-05	0.133	NA	NA
ETF-27	E	Dismal Gap Formation	Conasauga	14.5	20.4	17.5	Slug	Hvorslev	2.20E-05	0.062	NA	NA
ETF-28	E	Dismal Gap Formation	Conasauga	14.4	20.3	17.4	Slug	Hvorslev	9.20E-06	0.026	NA	NA
ETF-29	E	Dismal Gap Formation	Conasauga	14.8	20.7	17.8	Slug	Hvorslev	2.20E-05	0.062	NA	NA
ETF-31	E	Dismal Gap Formation	Conasauga	11.4	17.3	14.3	Slug	Hvorslev	2.40E-05	0.068	NA	NA
ETF-32	E	Dismal Gap Formation	Conasauga	13.9	19.8	16.9	Slug	Hvorslev	2.90E-05	0.082	NA	NA
ETF-33	E	Dismal Gap Formation	Conasauga	14.1	20	17.1	Slug	Hvorslev	2.38E-03	6.746	NA	NA
ETF-34	E	Dismal Gap Formation	Conasauga	16	21.9	19.0	Slug	Hvorslev	2.10E-05	0.060	NA	NA
ETF-35	E	Dismal Gap Formation	Conasauga	14.7	20.6	17.7	Slug	Hvorslev	1.50E-05	0.043	NA	NA
ETF-36	E	Dismal Gap Formation	Conasauga	15.3	21.2	18.2	Slug	Hvorslev	3.00E-05	0.085	NA	NA
ETF-37	E	Dismal Gap Formation	Conasauga	15.5	21.4	18.5	Slug	Hvorslev	7.90E-05	0.224	NA	NA
ETF-38	E	Dismal Gap Formation	Conasauga	16.1	22	19.1	Slug	Hvorslev	9.70E-05	0.275	NA	NA
ETF-39	E	Dismal Gap Formation	Conasauga	16.3	22.2	19.2	Slug	Hvorslev	4.30E-05	0.122	NA	NA
ETF-40	E	Dismal Gap Formation	Conasauga	14.8	20.7	17.7	Slug	Hvorslev	5.60E-05	0.159	NA	NA
668	F	Not Specified	Conasauga	11	13	12.0	Injection	Not Specified	5.21E-05	0.148	0.301	NA
668	F	Not Specified	Conasauga	13	15	14.0	Injection	Not Specified	1.40E-06	0.004	0.080	NA
669	F	Not Specified	Conasauga	7.5	8.5	8.0	Injection	Not Specified	9.84E-05	0.279	0.28	NA
739	F	Not Specified	Conasauga	25	27.5	26.3	Injection	Not Specified	4.75E-04	1.345	3.34	NA
741	F	Not Specified	Conasauga	15	21	18.0	Injection	Not Specified	2.31E-04	0.656	3.98	NA
747	F	Not Specified	Conasauga	16	24	20.0	Injection	Not Specified	3.82E-05	0.108	0.872	NA
748	F	Not Specified	Conasauga	14.5	23.5	19.0	Injection	Not Specified	5.09E-05	0.144	1.292	NA
749	F	Not Specified	Conasauga	14	16	15.0	Injection	Not Specified	1.97E-05	0.056	0.118	NA
749	F	Not Specified	Conasauga	18	21	19.5	Injection	Not Specified	7.64E-05	0.217	0.646	NA
756	F	Not Specified	Conasauga	18	20.5	19.3	Injection	Not Specified	2.55E-03	7.218	18.3	NA
757	F	Not Specified	Conasauga	12	16	14.0	Injection	Not Specified	2.78E-05	0.079	0.312	NA
757	F	Not Specified	Conasauga	16	22	19.0	Injection	Not Specified	6.94E-05	0.197	1.184	NA
758	F	Not Specified	Conasauga	14	23	18.5	Injection	Not Specified	9.72E-06	0.028	0.248	NA
759	F	Not Specified	Conasauga	14	15.5	14.8	Injection	Not Specified	4.05E-04	1.148	1.722	NA

Table 2.4.12-1 (Sheet 10 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity(d) (ft^2/d)	Storage Coefficient(d)
759	F	Not Specified	Conasauga	20	23	21.5	Injection	Not Specified	1.74E-04	0.492	1.507	NA
760	F	Not Specified	Conasauga	14	23	18.5	Injection	Not Specified	6.37E-05	0.180	1.615	NA
766	F	Not Specified	Conasauga	10	13.5	11.8	Injection	Not Specified	2.20E-04	0.623	2.153	NA
767	F	Not Specified	Conasauga	38	40	39.0	Injection	Not Specified	5.09E-05	0.144	0.291	NA
768	F	Not Specified	Conasauga	7	15	11.0	Injection	Not Specified	1.09E-05	0.031	0.248	NA
774	F	Not Specified	Conasauga	8	10	9.0	Injection	Not Specified	6.83E-03	19.357	38.75	NA
775	F	Not Specified	Conasauga	39	40	39.5	Injection	Not Specified	2.89E-04	0.820	0.818	NA
775	F	Not Specified	Conasauga	40	42	41.0	Injection	Not Specified	8.45E-05	0.240	0.474	NA
777	F	Not Specified	Conasauga	37	38	37.5	Injection	Not Specified	3.59E-05	0.102	0.103	NA
779	F	Not Specified	Conasauga	39	41	40.0	Injection	Not Specified	3.36E-04	0.951	1.938	NA
779	F	Not Specified	Conasauga	41	43	42.0	Injection	Not Specified	7.99E-05	0.226	0.452	NA
781	F	Not Specified	Conasauga	29	33	31.0	Injection	Not Specified	3.70E-05	0.105	0.431	NA
781	F	Not Specified	Conasauga	33	35	34.0	Injection	Not Specified	2.66E-04	0.755	1.507	NA
782	F	Not Specified	Conasauga	12	14	13	Injection	Not Specified	5.90E-04	1.673	3.552	NA
783	F	Not Specified	Conasauga	28	29	28.5	Injection	Not Specified	4.51E-04	1.28	1.292	NA
904	F	Not Specified	Conasauga	41	44	42.5	Injection	Not Specified	1.62E-03	4.593	13.993	NA
905	F	Not Specified	Conasauga	36	37.5	36.8	Injection	Not Specified	2.78E-04	0.787	1.184	NA
1118	F	Not Specified	Conasauga	8	12	10	Injection	Not Specified	6.60E-05	0.187	0.743	NA
1119	F	Not Specified	Conasauga	24.5	27	25.8	Injection	Not Specified	2.55E-04	0.722	1.830	NA
1119	F	Not Specified	Conasauga	30.5	33	31.8	Injection	Not Specified	1.74E-04	0.492	1.184	NA
1121	F	Not Specified	Conasauga	8.5	9.5	9	Injection	Not Specified	7.18E-04	2.034	2.045	NA
1121	F	Not Specified	Conasauga	9.5	11.5	10.5	Injection	Not Specified	2.20E-04	0.623	1.184	NA
1122	F	Not Specified	Conasauga	38	41	39.5	Injection	Not Specified	3.36E-05	0.095	0.280	NA
1122	F	Not Specified	Conasauga	41	42.5	41.8	Injection	Not Specified	2.08E-04	0.591	0.883	NA
1122	F	Not Specified	Conasauga	44	46	45	Injection	Not Specified	4.17E-05	0.118	0.237	NA
1126	F	Not Specified	Conasauga	48	49.5	48.8	Injection	Not Specified	8.91E-04	2.526	3.767	NA
1126	F	Not Specified	Conasauga	56	57	56.5	Injection	Not Specified	3.36E-04	0.951	0.947	NA
1127	F	Not Specified	Conasauga	17.5	19	18.3	Injection	Not Specified	3.24E-04	0.919	1.399	NA
1127	F	Not Specified	Conasauga	20.2	21	20.6	Injection	Not Specified	5.21E-04	1.476	1.184	NA
1128	F	Not Specified	Conasauga	46	52	49.0	Injection	Not Specified	6.13E-05	0.174	1.055	NA
1128	F	Not Specified	Conasauga	56	57	56.5	Injection	Not Specified	4.63E-05	0.131	0.129	NA
1129	F	Not Specified	Conasauga	32	33	32.5	Injection	Not Specified	6.25E-05	0.177	0.172	NA

Table 2.4.12-1 (Sheet 11 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[d] (ft^2/d)	Storage Coefficient[d]
1129	F	Not Specified	Conasauga	35.5	36.5	36	Injection	Not Specified	2.20E-04	0.623	0.614	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	26.5	38.5	32.5	Packer	Multiple	1.90E-05	0.054	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	38	50	44	Packer	Multiple	9.40E-06	0.027	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	50	62	56	Packer	Multiple	9.36E-06	0.027	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	62	74	68	Packer	Multiple	7.00E-06	0.020	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	74	86	80	Packer	Multiple	4.30E-05	0.122	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	86	98	92	Packer	Multiple	5.42E-06	0.015	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	98	110	104	Packer	Multiple	6.57E-05	0.186	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	110	122	116	Packer	Multiple	1.72E-04	0.488	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	122	134	128	Packer	Multiple	2.90E-05	0.082	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	134	146	140	Packer	Multiple	5.86E-05	0.166	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	146	158	152	Packer	Multiple	5.44E-06	0.015	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	158	170	164	Packer	Multiple	4.07E-05	0.115	NA	NA
GW-404[b]	G	Dismal Gap Formation	Conasauga	170	182	176	Packer	Multiple	2.77E-06	0.008	NA	NA
GW-455[b]	G	Nolichucky Shale	Conasauga	65	87	76	Packer	Multiple	6.47E-05	0.183	NA	NA
GW-455[b]	G	Nolichucky Shale	Conasauga	87	109	98	Packer	Multiple	1.60E-05	0.045	NA	NA
GW-455[b]	G	Dismal Gap Formation/ Nolichucky Shale	Conasauga	109	131	120	Packer	Multiple	4.64E-07	0.001	NA	NA
GW-455[b]	G	Dismal Gap Formation	Conasauga	138	160	149	Packer	Multiple	2.61E-05	0.074	NA	NA
GW-455[b]	G	Dismal Gap Formation	Conasauga	152.8	174.8	163.8	Packer	Multiple	6.41E-05	0.182	NA	NA
GW-471[b]	G	Dismal Gap Formation	Conasauga	33	45	39	Packer	Multiple	3.09E-04	0.876	NA	NA
GW-471[b]	G	Dismal Gap Formation	Conasauga	45	57	51	Packer	Multiple	2.29E-04	0.649	NA	NA
GW-471[b]	G	Dismal Gap Formation	Conasauga	57	69	63	Packer	Multiple	4.61E-05	0.131	NA	NA
GW-471[b]	G	Dismal Gap Formation	Conasauga	69	81	75	Packer	Multiple	5.80E-06	0.016	NA	NA
GW-471[b]	G	Dismal Gap Formation	Conasauga	81	93	87	Packer	Multiple	5.39E-06	0.015	NA	NA
GW-471[b]	G	Dismal Gap Formation	Conasauga	84.4	96.4	90.4	Packer	Multiple	7.10E-05	0.201	NA	NA
GW-403	G	Dismal Gap Formation	Conasauga	306	328	317	Packer	Multiple	4.90E-08	0.0001	NA	NA
GW-403	G	Dismal Gap Formation	Conasauga	387	409	398	Packer	Multiple	1.37E-07	0.0004	NA	NA
GW-455	G	Dismal Gap Formation	Conasauga	157.7	185.8	171.8	Slug	Hvorslev	4.57E-05	0.130	NA	NA
GW-471	G	Dismal Gap Formation	Conasauga	89.7	103.4	96.6	Slug	Hvorslev	1.18E-06	0.003	NA	NA
GW-473	G	Dismal Gap Formation	Conasauga	68.4	94.4	81.4	Slug	Hvorslev	3.93E-05	0.111	NA	NA
GW-474	G	Dismal Gap Formation	Conasauga	27.9	45.1	36.5	Slug	Hvorslev	3.33E-05	0.094	NA	NA

Table 2.4.12-1 (Sheet 12 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[(d)] (ft^2/d)	Storage Coefficient[(d)]
GW-475A	G	Dismal Gap Formation	Conasauga	86.4	99.7	93.1	Slug	Hvorslev	7.85E-07	0.002	NA	NA
GW-475B	G	Dismal Gap Formation	Conasauga	49.9	62.9	56.4	Slug	Hvorslev	6.96E-05	0.197	NA	NA
GW-476A	G	Dismal Gap Formation	Conasauga	69.9	83	76.5	Slug	Hvorslev	6.61E-06	0.019	NA	NA
GW-476B	G	Dismal Gap Formation	Conasauga	36.9	49.4	43.2	Slug	Hvorslev	7.96E-05	0.226	NA	NA
GW-477A	G	Dismal Gap Formation	Conasauga	54.7	68.7	61.7	Slug	Hvorslev	1.37E-05	0.039	NA	NA
GW-477B	G	Maynardville Limestone	Conasauga	22.3	34.9	28.6	Slug	Hvorslev	1.12E-05	0.032	NA	NA
GW-478A	G	Dismal Gap Formation	Conasauga	66.9	81.3	74.1	Slug	Hvorslev	9.81E-06	0.028	NA	NA
GW-478B	G	Dismal Gap Formation	Conasauga	35.2	47.2	41.2	Slug	Hvorslev	2.35E-05	0.067	NA	NA
GW-480A	G	Dismal Gap Formation	Conasauga	33.6	37.6	35.6	Slug	Hvorslev	2.86E-06	0.008	NA	NA
GW-480B	G	Maynardville Limestone	Conasauga	28.6	32.6	30.6	Slug	Hvorslev	5.23E-06	0.015	NA	NA
GW-481A	G	Dismal Gap Formation	Conasauga	31.4	35.1	33.3	Slug	Hvorslev	1.81E-04	0.513	NA	NA
GW-481B	G	Maynardville Limestone	Conasauga	28.6	32.6	30.6	Slug	Hvorslev	6.76E-06	0.019	NA	NA
GW-482A	G	Dismal Gap Formation	Conasauga	32.7	36.7	34.7	Slug	Hvorslev	1.82E-06	0.005	NA	NA
GW-482B	G	Maynardville Limestone	Conasauga	26.2	30.2	28.2	Slug	Hvorslev	2.29E-05	0.065	NA	NA
GW-483	G	Maynardville Limestone	Conasauga	18.4	28	23.2	Slug	Hvorslev	3.27E-05	0.093	NA	NA
GW-474	G	Dismal Gap Formation	Conasauga	27.9	45.1	36.5	Pump	Multiple	2.66E-05	0.075	2.26	NA
GW-475B	G	Dismal Gap Formation	Conasauga	49.9	62.9	56.4	Pump	Multiple	2.88E-05	0.082	2.45	1.35E-04
GW-476B	G	Dismal Gap Formation	Conasauga	36.9	49.4	43.2	Pump	Multiple	6.47E-05	0.183	5.50	2.38E-04
GW-477B	G	Maynardville Limestone	Conasauga	22.3	34.9	28.6	Pump	Multiple	7.48E-05	0.212	6.36	7.92E-04
GW-478B	G	Dismal Gap Formation	Conasauga	35.2	47.2	41.2	Pump	Multiple	3.54E-05	0.100	3.01	1.64E-04
GW-471	G	Dismal Gap Formation	Conasauga	89.7	105.6	97.7	Pump	Multiple	1.28E-05	0.036	0.72	1.47E-04
GW-473	G	Dismal Gap Formation	Conasauga	68.4	94.4	81.4	Pump	Multiple	1.01E-05	0.029	0.57	NA
GW-475A	G	Dismal Gap Formation	Conasauga	86.4	99.7	93.1	Pump	Multiple	1.23E-05	0.035	0.70	1.65E-03
GW-476A	G	Dismal Gap Formation	Conasauga	69.9	83	76.5	Pump	Multiple	1.14E-05	0.032	0.65	3.60E-05
GW-477A	G	Dismal Gap Formation	Conasauga	54.7	68.7	61.7	Pump	Multiple	1.63E-05	0.046	0.92	1.51E-04
GW-478A	G	Dismal Gap Formation	Conasauga	67.9	81.3	74.6	Pump	Multiple	1.00E-05	0.028	0.57	1.62E-04
GW-136	H	Nolichucky Shale	Conasauga	53	80	66.5	Packer	Log-Log	6.10E-06	0.173	NA	NA
GW-136	H	Nolichucky Shale	Conasauga	113	140	126.5	Packer	Log-Log	4.40E-06	0.012	NA	NA
GW-136	H	Nolichucky Shale	Conasauga	175	202	188.5	Packer	Log-Log	4.50E-06	0.013	NA	NA
GW-136	H	Nolichucky Shale	Conasauga	216	243	229.5	Packer	Log-Log	1.50E-06	0.004	NA	NA
GW-136	H	Nolichucky Shale	Conasauga	221	248	234.5	Packer	Log-Log	2.80E-07	0.001	NA	NA
GW-136	H	Nolichucky Shale	Conasauga	283	310	296.5	Packer	Log-Log	2.40E-05	0.068	NA	NA

**Table 2.4.12-1 (Sheet 13 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results**

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[d] (ft^2/d)	Storage Coefficient[d]
GW-136	H	Nolichucky Shale	Conasauga	288	315	301.5	Packer	Log-Log	3.90E-05	0.111	NA	NA
GW-136	H	Nolichucky Shale	Conasauga	420	447	433.5	Packer	Log-Log	1.00E-05	0.028	NA	NA
GW-136	H	Nolichucky Shale	Conasauga	501	528	514.5	Packer	Log-Log	4.20E-07	0.001	NA	NA
GW-137	H	Nolichucky Shale	Conasauga	337	364	350.5	Packer	Log-Log	1.40E-04	0.397	NA	NA
GW-137	H	Nolichucky Shale	Conasauga	675	702	688.5	Packer	Log-Log	1.30E-07	0.0004	NA	NA
GW-139	H	Nolichucky Shale	Conasauga	195	217	206.0	Packer	Log-Log	5.90E-06	0.017	NA	NA
GW-139	H	Nolichucky Shale	Conasauga	300	322	311.0	Packer	Log-Log	1.70E-06	0.005	NA	NA
GW-139	H	Nolichucky Shale	Conasauga	382	404	393.0	Packer	Log-Log	2.70E-07	0.001	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	125	147	136.0	Packer	Log-Log	8.20E-06	0.023	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	244	266	255.0	Packer	Log-Log	1.50E-06	0.004	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	266	288	277.0	Packer	Log-Log	6.50E-06	0.018	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	317	339	328.0	Packer	Log-Log	7.80E-07	0.002	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	386	408	397.0	Packer	Log-Log	1.00E-05	0.028	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	266	273	269.5	Packer	Log-Log	9.50E-06	0.027	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	273	280	276.5	Packer	Log-Log	5.30E-05	0.150	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	280	287	283.5	Packer	Log-Log	3.00E-05	0.085	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	386	393	389.5	Packer	Log-Log	1.60E-05	0.045	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	393	400	396.5	Packer	Log-Log	2.70E-05	0.077	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	400	407	403.5	Packer	Log-Log	4.80E-07	0.001	NA	NA
GW-401	H	Nolichucky Shale	Conasauga	448	455	451.5	Packer	Log-Log	3.80E-05	0.108	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	110	137	123.5	Packer	Log-Log	1.30E-05	0.037	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	150	177	163.5	Packer	Log-Log	2.50E-05	0.071	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	192	219	205.5	Packer	Log-Log	1.20E-06	0.003	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	243	270	256.5	Packer	Log-Log	2.40E-06	0.007	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	270	297	283.5	Packer	Log-Log	2.90E-07	0.001	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	302	329	315.5	Packer	Log-Log	4.60E-08	0.0001	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	333	360	346.5	Packer	Log-Log	5.50E-08	0.0002	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	373	400	386.5	Packer	Log-Log	1.20E-07	0.0003	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	403	430	416.5	Packer	Log-Log	2.70E-07	0.001	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	525	552	538.5	Packer	Log-Log	2.00E-07	0.001	NA	NA
GW-402	H	Nolichucky Shale	Conasauga	559	586	572.5	Packer	Log-Log	4.40E-08	0.0001	NA	NA
GW-403	H	Nolichucky Shale	Conasauga	92	114	103	Packer	Log-Log	1.60E-03	4.535	NA	NA

Table 2.4.12-1 (Sheet 14 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[d] (ft^2/d)	Storage Coefficient[d]
GW-403	H	Nolichucky Shale	Conasauga	160	182	171	Packer	Log-Log	7.80E-06	0.022	NA	NA
GW-403	H	Nolichucky Shale	Conasauga	234	256	245	Packer	Log-Log	9.10E-05	0.258	NA	NA
GW-403	H	Nolichucky Shale	Conasauga	275	297	286	Packer	Log-Log	3.50E-05	0.099	NA	NA
GW-403	H	Nolichucky Shale	Conasauga	306	328	317	Packer	Log-Log	4.90E-08	0.0001	NA	NA
GW-468	H	Nolichucky Shale	Conasauga	109	131	120	Packer	Log-Log	1.70E-05	0.048	NA	NA
GW-468	H	Nolichucky Shale	Conasauga	138	160	149	Packer	Log-Log	9.00E-05	0.255	NA	NA
GW-468	H	Nolichucky Shale	Conasauga	210	232	221	Packer	Log-Log	3.40E-06	0.010	NA	NA
GW-468	H	Nolichucky Shale	Conasauga	279	301	290	Packer	Log-Log	1.40E-06	0.004	NA	NA
GW-468	H	Nolichucky Shale	Conasauga	355	377	366	Packer	Log-Log	1.80E-05	0.051	NA	NA
GW-468	H	Nolichucky Shale	Conasauga	413	435	424	Packer	Log-Log	9.40E-09	0.00003	NA	NA
GW-468	H	Nolichucky Shale	Conasauga	465	487	476	Packer	Log-Log	1.00E-07	0.0003	NA	NA
GW-468	H	Nolichucky Shale	Conasauga	109	116	112.5	Packer	Log-Log	4.40E-05	0.125	NA	NA
GW-134	H	Nolichucky Shale	Conasauga	173	200	186.5	Packer	Not Specified	2.87E-06	0.0081	NA	NA
GW-134	H	Nolichucky Shale	Conasauga	270	297	283.5	Packer	Not Specified	1.74E-06	0.0049	NA	NA
GW-134	H	Nolichucky Shale	Conasauga	360	387	373.5	Packer	Not Specified	5.14E-08	0.0001	NA	NA
GW-134	H	Nolichucky Shale	Conasauga	450	477	463.5	Packer	Not Specified	3.17E-07	0.0009	NA	NA
GW-134	H	Nolichucky Shale	Conasauga	560	587	573.5	Packer	Not Specified	4.26E-07	0.0012	NA	NA
GW-381	I	Maynardville Limestone	Conasauga	46.3	60.4	53.4	Pump	Theis	3.33E-03	9.45	2834.78	2.78E-03
GW-153	I	Maynardville Limestone	Conasauga	49.5	59.5	54.5	Pump	Theis	1.08E-02	30.52	9156.35	6.00E-03
GW-223	I	Maynardville Limestone	Conasauga	80	90	85.0	Pump	Theis	1.51E-03	4.28	1284.16	1.62E-03
GW-151	I	Maynardville Limestone	Conasauga	86	96	91.0	Pump	Theis	7.94E-04	2.25	674.68	4.72E-04
GW-750	I	Maynardville Limestone	Conasauga	61.2	72.7	67.0	Pump	Theis	6.53E-04	1.85	555.62	1.93E-03
GW-735	I	Maynardville Limestone	Conasauga	67.9	78.1	73.0	Pump	Theis	5.86E-04	1.66	498.92	1.50E-03
GW-734	I	Maynardville Limestone	Conasauga	59.4	Not Specified	59.4	Pump	Theis	1.20E-03	3.40	1020.52	1.40E-03
GW-168	I	Maynardville Limestone	Conasauga	104	135.4	119.7	Pump	Theis	2.65E-04	0.75	223.95	9.50E-05
GW-733	I	Maynardville Limestone	Conasauga	240.1	256.5	248.3	Pump	Theis	1.48E-04	0.42	125.30	3.80E-04
GW-722	I	Maynardville Limestone	Conasauga	333	333	333.0	Pump	Theis	9.17E-05	0.26	78.52	1.69E-05
4434	J	Rome Formation[f]	Rome[f]	49.75[e]	83.35[e]	66.6[e]	Slug	Bouwer-Rice	4.57E-04	1.30	NA	NA
4435	J	Rome Formation[f]	Rome[f]	62.41[e]	79.9[e]	71.2[e]	Slug	Bouwer-Rice	7.70E-04	2.18	NA	NA
4436	J	Rome Formation[f]	Rome[f]	46.17[e]	65[e]	55.6[e]	Slug	Bouwer-Rice	5.83E-05	0.17	NA	NA
4437	J	Rome Formation[f]	Rome[f]	43.47[e]	63.77[e]	53.6[e]	Slug	Bouwer-Rice	8.33E-04	2.36	NA	NA
GW-838	J	Rome Formation[f]	Rome[f]	19.12[e]	35.45[e]	27.3[e]	Slug	Bouwer-Rice	7.58E-04	2.15	NA	NA

Table 2.4.12-1 (Sheet 15 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[d] (ft^2/d)	Storage Coefficient[d]
BRW-115[b]	K	Not Specified	Knox[f]	88.8	98.8	93.8	Slug	Bouwer-Rice	1.08E-03	3.06	NA	NA
BRW-116[b]	K	Not Specified	Knox[f]	45	55	50.0	Slug	Bouwer-Rice	3.73E-03	10.56	NA	NA
BRW-117[b]	K	Not Specified	Knox[f]	38.1	43.1	40.6	Slug	Bouwer-Rice	2.35E-02	66.76	NA	NA
BRW-118[b]	K	Rome Formation[f]	Rome[f]	45	65	55.0	Slug	Bouwer-Rice	6.48E-05	0.18	NA	NA
UA-1	L	Not Specified	Conasauga[f]	41.6	50.5	46.1	Slug	Cooper	2.26E-05	0.064	0.57	NA
UA-2	L	Not Specified	Conasauga[f]	142	169	155.5	Slug	Cooper	3.88E-09	0.00001	0.0003	NA
UB-1	L	Dismal Gap Formation[f]	Conasauga[f]	25.9	35.5	30.7	Slug	Cooper	1.48E-04	0.420	4	NA
UB-2	L	Dismal Gap Formation[f]	Conasauga[f]	101	126.1	113.6	Slug	Cooper	5.29E-07	0.002	0.037	NA
UC-1	L	Rome Formation[f]	Rome[f]	77	86.2	81.6	Slug	Cooper	9.17E-05	0.260	2.4	NA
UC-2	L	Not Specified	Chickamauga[f]	188.2	206.7	197.5	Slug	Cooper	8.11E-06	0.023	0.42	NA
UD-2	L	Pumpkin Valley Shale[f]	Conasauga[f]	180	205	192.5	Slug	Cooper	3.32E-09	0.00001	0.00023	NA
UE-1	L	Dismal Gap Formation[f]	Conasauga[f]	69.2	76.7	73.0	Slug	Cooper	1.59E-04	0.450	3.4	NA
UE-2	L	Dismal Gap Formation[f]	Conasauga[f]	175.7	197.7	186.7	Slug	Cooper	3.88E-08	0.0001	0.0023	NA
UF-1	L	Dismal Gap Formation[f]	Conasauga[f]	16.5	23.5	20.0	Slug	Cooper	8.47E-04	2.400	17	NA
UG-1	L	Nolichucky Shale[f]	Conasauga[f]	25	32	28.5	Slug	Cooper	3.03E-04	0.860	6.1	NA
UG-2	L	Dismal Gap Formation[f]	Conasauga[f]	242	300	271.0	Slug	Cooper	1.73E-09	0.000005	0.00028	NA
UG-3	L	Dismal Gap Formation[f]	Conasauga[f]	180	200	190.0	Slug	Cooper	1.09E-06	0.003	0.063	NA
UH-1	L	Nolichucky Shale[f]	Conasauga[f]	19	26	22.5	Slug	Cooper	1.06E-04	0.30	2.1	NA
UH-2	L	Nolichucky Shale[f]	Conasauga[f]	231	288	259.5	Slug	Cooper	3.53E-09	0.00001	0.00059	NA
UI-1	L	Nolichucky Shale[f]	Conasauga[f]	18	25	21.5	Slug	Cooper	2.65E-04	0.75	5.2	NA
UI-2	L	Nolichucky Shale[f]	Conasauga[f]	188	210	199.0	Slug	Cooper	5.29E-08	0.0002	0.0034	NA
HHMS1B	L	Not Specified	Conasauga[f]	182.3	201.2	191.8	Slug	Cooper	2.01E-05	0.057	1.1	NA
HHMS1C	L	Not Specified	Conasauga[f]	63.7	101	82.4	Slug	Cooper	2.82E-05	0.08	3	NA
HHMS2A	L	Not Specified	Conasauga[f]	380	400.6	390.3	Slug	Cooper	1.38E-07	0.0004	0.008	NA
HHMS2B	L	Not Specified	Conasauga[f]	180.6	200.6	190.6	Slug	Cooper	2.29E-06	0.007	0.13	NA
HHMS2C	L	Not Specified	Conasauga[f]	62.3	81.1	71.7	Slug	Cooper	1.34E-05	0.038	0.72	NA
HHMS3A	L	Not Specified	Conasauga[f]	380.5	399.1	389.8	Slug	Cooper	1.90E-07	0.0005	0.01	NA
HHMS3B	L	Not Specified	Conasauga[f]	189.7	211.6	200.7	Slug	Cooper	2.36E-07	0.0007	0.0015	NA
HHMS3C	L	Not Specified	Conasauga[f]	62	80.6	71.3	Slug	Cooper	1.48E-05	0.042	0.78	NA
HHMS4B	L	Not Specified	Conasauga[f]	174.3	215.3	194.8	Slug	Cooper	1.13E-05	0.032	1.3	NA
HHMS5B	L	Not Specified	Conasauga[f]	196.1	219.5	207.8	Slug	Cooper	4.23E-06	0.012	0.29	NA
HHMS5C	L	Not Specified	Conasauga[f]	42.1	63	52.6	Slug	Cooper	5.64E-05	0.16	3.4	NA

Table 2.4.12-1 (Sheet 16 of 16)
A Selection of Oak Ridge Reservation Published Bedrock Aquifer Testing Results

Well	Data Source	Geologic Unit	Group	Top Depth (ft bgs)	Bottom Depth (ft bgs)	Interval Midpoint (ft bgs)	Test Type	Interpretation Method	Hydraulic Cond. K_{avg} (cm/s)	Hydraulic Cond. K_{avg} (ft/d)	Transmissivity[d] (ft^2/d)	Storage Coefficient[d]
HHMS6B	L	Not Specified	Conasauga[f]	145	165.4	155.2	Slug	Cooper	5.64E-06	0.016	0.32	NA
HHMS6C	L	Not Specified	Conasauga[f]	40.8	60.8	50.8	Slug	Cooper	4.59E-05	0.13	2.7	NA

(a) Not included in analysis because depth information is missing
(b) Average of rising and falling tests or geometric mean of two interpretation methods
(c) Multiple zones screened
(d) Where multiple aquifer pumping test interpretations are available, the Theis method results are reported
(e) Depths are relative to top of casing
(f) Geologic unit and/or group estimated based on available geologic information

Notes:

NA = Not Available

Maryville Limestone has been re-designated Dismal Gap Formation and Rutledge Limestone has been re-designated Friendship Formation

Repeated Test Results (yellow)

Corrected Well Number or depth (green)

Sources:

A Reference 2.4.12-40, Table F.10
B Reference 2.4.12-37
C Reference 2.4.12-41, Table D.1
D Reference 2.4.12-39, Table 14
E Reference 2.4.12-38, Tables 25 and 26
F Reference 2.4.12-42, Table 2
G Reference 2.4.12-43, Tables 4.2, 4.3, 4.4, 4.5, 8.1, 9.1, and 9.2
H Reference 2.4.12-44, Tables A.1 and A.2
I Reference 2.4.12-45, Table 4.2
J Reference 2.4.12-46
K Reference 2.4.12-47, Appendix B
L Reference 2.4.12-3, Table 2

Table 2.4.12-2
Summary of Hydrogeologic Properties on the ORR

Residuum/Stormflow Zone		
Property	**Conditions**	**Value**
Stormflow zone thickness	Grassland	0.2 to 0.4 m
	Forest	0.6 to 2.0 m
Infiltration Capacity	Grassland	1.1 m/d
	Forest	8.8 m/d
Total porosity	General	0.4
Specific yield	General	0.035
Hydraulic conductivity	General	9.2 m/d
Hydraulic gradient	General	0.075
Discharge rate	General	0 to 110 L/s•km^2
Groundwater Zone		
Property	**Knox aquifer**	**ORR aquitards**
Thickness		
Permeable interval	–	1.5 m
Low-permeability interval	–	12 m
Water table fluctuation	5.3 m	1.5 m
Total porosity (matrix)	–	9.6 x 10^{-3}
Fracture porosity	–	5.0 x 10^{-4}
Specific yield	3.3 x 10^{-3}	2.3 x 10^{-3}
Fractures		
Spacing	–	35 cm
Aperture	0.25 mm	0.12 mm
Unfractured rock matrix hydraulic conductivity	–	8.7 x 10^{-8} m/d
Low-permeability intervals		
Transmissivity	–	1.1 x 10^{-3} m^2/d
Hydraulic conductivity	–	4.0 x 10^{-4} m/d
Permeable intervals		
Transmissivity	1.0 m^2/d	0.12 m^2/d
Hydraulic conductivity	–	0.068 m/d
Continuum		
Transmissivity	7.0 m^2/d	0.75 m^2/d
Hydraulic conductivity	–	0.18 m/d
Hydraulic gradient	0.02	0.05
Average recharge	65 mm	20 mm
Maximum discharge	1030 L/min•km^2	280 L/min•km^2
Average discharge	120 L/min•km^2	38 L/min•km^2

Adapted from Reference 2.4.12-12
ORR = Oak Ridge Reservation
Dash (–) = No information.

Table 2.4.12-3 (Sheet 1 of 6)
Clinch River Breeder Reactor Project Investigation Packer Test Results

Boring	Date	Test Section (ftbgs)	Test Length (ft)	C_p (ft^2/gpm-yr)	Flow Q (gpm)	Total Head H (ft)	Hydraulic Conductivity K[a] (ft/yr)	Hydraulic Conductivity K[b] (ft/d)	Hydraulic Conductivity K[b] (cm/s)	Geologic Horizon[c]	Geologic Strata[d]
B-26	10/2/1973	24–298	274	320	8.9	68.6	42	0.12	4.06E-05	U.A.S.S.	Chickamauga Group
	9/28/1973	30–298	268	325	10.1	64.7	51	0.14	4.93E-05	U.A.S.S.	Chickamauga Group
	9/28/1973	50–298	248	350	8.4	64.7	45	0.12	4.35E-05	U.A.S.S.	Chickamauga Group
	9/29/1973	70–298	228	380	8.6	99.4	33	0.09	3.19E-05	U.A.S.S.	Chickamauga Group
	1973[g]	90–298	208	420	4.9	61.7	33	0.09	3.19E-05	U.A.S.S.	Chickamauga Group
	10/2/1973	110–298	188	450	5.5	67.1	37	0.10	3.57E-05	U.A.S.S.	Chickamauga Group
	10/2/1973	150–298	148	540	7.2	67.1	58	0.16	5.60E-05	A.L.S.	Chickamauga Group
	10/2/1973	220–298	78	920	6.9	67.1	95	0.26	9.18E-05	L.A.S.S.	Chickamauga Group
B-27	11/8/1973	35–245	210	410	3.5	47.6	30	0.08	2.90E-05	A.L.S.	Chickamauga Group
	11/8/1973	60–245	185	460	2.8	47.6	27	0.07	2.61E-05	A.L.S.	Chickamauga Group
	11/8/1973	80–245	165	500	2.3	70.7	16	0.04	1.55E-05	A.L.S.	Chickamauga Group
	11/8/1973	100–245	145	550	1.1	70.7	9	0.02	8.69E-06	A.L.S.	Chickamauga Group
	11/8/1973	120–245	125	620	0.8	70.7	7	0.02	6.76E-06	L.A.S.S.	Chickamauga Group
B-28	11/13/1973	16–25	9	5300	8.7	44.6	1040[e]	2.85	1.00E-03	U.A.S.S.	Chickamauga Group
	11/13/1973	19–28	9	5300	8.8	41.6	980[e]	2.68	9.47E-04	U.A.S.S.	Chickamauga Group
	11/13/1973	27–36	9	5300	3.1	55.6	298[e]	0.82	2.88E-04	U.A.S.S.	Chickamauga Group
	11/13/1973	50–271	221	390	0.47	65.1	2.8	0.01	2.70E-06	U.A.S.S.	Chickamauga Group
	11/13/1973	90–271	181	470	0.96	65.1	6.9	0.02	6.66E-06	U.A.S.S.	Chickamauga Group
B-29	11/12/1973	30–335	305	290	2.5	61.1	11.9	0.03	1.15E-05	U.A.S.S.	Chickamauga Group
	11/12/1973	40–335	295	300	0.21	84.2	0.75	0.002	7.24E-07	U.A.S.S.	Chickamauga Group
	11/12/1973	50–335	285	305	0.76	107.3	2.2	0.01	2.12E-06	U.A.S.S.	Chickamauga Group
	11/12/1973	80–335	255	340	4.45	130.4	11.6	0.03	1.12E-05	U.A.S.S.	Chickamauga Group

Table 2.4.12-3 (Sheet 2 of 6)
Clinch River Breeder Reactor Project Investigation Packer Test Results

Boring	Date	Test Section (ftbgs)	Test Length (ft)	C_p (ft^2/gpm-yr)	Flow Q (gpm)	Total Head H (ft)	Hydraulic Conductivity K[a] (ft/yr)	Hydraulic Conductivity K[b] (ft/d)	Hydraulic Conductivity K[b] (cm/s)	Geologic Horizon[c]	Geologic Strata[d]
B-30	12/4/1973	11–20	9	5300	11.3	39.6	1510[e]	4.14	1.46E-03	U.A.S.S.	Chickamauga Group
	12/5/1973	20–253.5	233.5	370	14.8	68.1	80	0.22	7.73E-05	U.A.S.S.	Chickamauga Group
	12/5/1973	65–253.5	188.5	450	9.9	68.1	65	0.18	6.28E-05	U.A.S.S.	Chickamauga Group
	12/5/1973	88–253.5	165.5	500	2.2	91.2	12	0.03	1.16E-05	U.A.S.S.	Chickamauga Group
	12/5/1973	144–253.5	139.5	560	0.5	91.2	3.1	0.01	2.99E-06	A.L.S.	Chickamauga Group
B-31	11/1/1973	82–91	9	5300	12.5	89.5	740	2.03	7.15E-04	A.L.S.	Chickamauga Group
	11/1/1973	92–101	9	5300	12	89.5	711	1.95	6.87E-04	A.L.S.	Chickamauga Group
	11/1/1973	101–110	9	5300	12	89.5	711	1.95	6.87E-04	A.L.S.	Chickamauga Group
	10/21/1973	110–252	142	560	1.8	89.5	112[e]	0.31	1.08E-04	L.A.S.S.	Chickamauga Group
B-34	10/30/1973	45.5–54.5	9	5300	12.2	73.1	885	2.42	8.55E-04	A.L.S.	Chickamauga Group
	10/30/1973	54.5–63.5	9	5300	12.1	82.1	781	2.14	7.54E-04	A.L.S.	Chickamauga Group
	10/30/1973	56–65	9	5300	11.5	83.1	733	2.01	7.08E-04	A.L.S.	Chickamauga Group
	10/29/1973	92.5–248	155.5	520	6	84.1	37	0.10	3.57E-05	A.L.S./ L.A.S.S.	Chickamauga Group
	10/29/1973	105–248	143	550	2	84.1	13	0.04	1.26E-05	L.A.S.S.	Chickamauga Group
	10/29/1973	130–248	118	660	1.8	84.1	14	0.04	1.35E-05	L.A.S.S.	Chickamauga Group
	10/29/1973	165–248	83	880	1.6	84.1	17	0.05	1.64E-05	L.A.S.S.	Chickamauga Group
	10/29/1973	172–248	76	950	4.5	84.1	51	0.14	4.93E-05	L.A.S.S.	Chickamauga Group
B-35	10/27/1973	51.5–284	232.5	375	6.2	34.6	67	0.18	6.47E-05	A.L.S./ L.A.S.S.	Chickamauga Group
	10/27/1973	95–284	189	450	4.9	41.6	53	0.15	5.12E-05	L.A.S.S.	Chickamauga Group
	10/26/1973	130–284	154	525	4.8	51.6	49	0.13	4.73E-05	L.A.S.S.	Chickamauga Group
	10/27/1973	169–284	115	670	3.3	51.6	42[e]	0.12	4.06E-05	L.A.S.S.	Chickamauga Group
	10/27/1973	218–284	66	1080	2.7	51.6	57	0.16	5.51E-05	L.A.S.S.	Chickamauga Group
	10/27/1973	238–284	46	1450	2	74.7	39	0.11	3.77E-05	L.A.S.S./ Knox	Chickamauga Group/ Knox Group

Table 2.4.12-3 (Sheet 3 of 6)
Clinch River Breeder Reactor Project Investigation Packer Test Results

Boring	Date	Test Section (ftbgs)	Test Length (ft)	C_p (ft^2/gpm-yr)	Flow Q (gpm)	Total Head H (ft)	Hydraulic Conductivity K[a] (ft/yr)	Hydraulic Conductivity K[b] (ft/d)	Hydraulic Conductivity K[b] (cm/s)	Geologic Horizon[c]	Geologic Strata[d]
B-36	11/1/1973	36.5–274.5	238	365	3.9	123.2	12	0.03	1.16E-05	L.A.S.S.	Chickamauga Group
	11/1/1973	50–274.5	244.5	385	4.4	123.2	14	0.04	1.35E-05	L.A.S.S.	Chickamauga Group
	11/1/1973	70–274.5	204.5	420	3.1	123.2	11	0.03	1.06E-05	L.A.S.S.	Chickamauga Group
	11/1/1973	90–274.5	184.5	460	2.6	123.2	10	0.03	9.66E-06	L.A.S.S.	Chickamauga Group
	11/1/1973	110–274.5	164.5	500	3	123.2	12	0.03	1.16E-05	L.A.S.S.	Chickamauga Group
B-38	10/4/1973	41–47.5	–	–	0	–	0	0	0	B	Chickamauga Group
	10/4/1973	44.5–51	–	–	0	–	0	0	0	B	Chickamauga Group
	10/3/1973	70–380.9	–	–	0	–	0	0	0	B	Chickamauga Group
	10/3/1973	100–380.9	–	–	0	–	0	0	0	B	Chickamauga Group
	10/3/1973	140–380.9	–	–	0	–	0	0	0	U.A.S.S.	Chickamauga Group
	10/3/1973	170–380.9	–	–	0	–	0	0	0	U.A.S.S.	Chickamauga Group
	10/3/1973	190–380.9	–	–	0	–	0	0	0	U.A.S.S.	Chickamauga Group
B-39	11/9/1973	20–29	9	5300	4	87.8	242[e]	0.66	2.34E-04	U.A.S.S.	Chickamauga Group
	11/8/1973	28.5–329	300.5	290	7.5	64.7	33.5[e]	0.09	3.24E-05	U.A.S.S.	Chickamauga Group
	11/8/1973	50–329	279	310	5.5	64.7	26.4	0.07	2.55E-05	U.A.S.S.	Chickamauga Group
	11/8/1973	65–329	264	330	5.1	64.7	26.0	0.07	2.51E-05	U.A.S.S.	Chickamauga Group
	11/8/1973[f]	85–329	244	360	1.03	87.6	4.2	0.01	4.06E-06	U.A.S.S.	Chickamauga Group
	11/8/1973[f]	85–329	244	360	2.32	110.9	7.5	0.02	7.24E-06	U.A.S.S.	Chickamauga Group

Table 2.4.12-3 (Sheet 4 of 6)
Clinch River Breeder Reactor Project Investigation Packer Test Results

Boring	Date	Test Section (ftbgs)	Test Length (ft)	C_p (ft^2/gpm-yr)	Flow Q (gpm)	Total Head H (ft)	Hydraulic Conductivity K[a] (ft/yr)	Hydraulic Conductivity K[b] (ft/d)	Hydraulic Conductivity K[b] (cm/s)	Geologic Horizon[c]	Geologic Strata[d]
B-40	9/25/1973	30–39	9	5300	9.8	59.6	871	2.39	8.41E-04	A.L.S.	Chickamauga Group
	9/25/1973	36–45	9	5300	5.8	65.6	471[e]	1.29	4.55E-04	A.L.S.	Chickamauga Group
	9/25/1973	46–55	9	5300	9.1	75.6	637[e]	1.75	6.15E-04	A.L.S.	Chickamauga Group
	9/25/1973	57.5–66.5	9	5300	2.1	87.1	128	0.35	1.24E-04	A.L.S.	Chickamauga Group
	9/25/1973	68.5–77.5	9	5300	9.5	106.9	470[e]	1.29	4.54E-04	A.L.S.	Chickamauga Group
	9/24/1973	81–90	9	5300	2	125.2	85	0.23	8.21E-05	A.L.S.	Chickamauga Group
	9/24/1973	91–100	9	5300	0.5	102.1	26	0.07	2.51E-05	A.L.S.	Chickamauga Group
	9/24/1973	101–110	9	5300	2.1	105.1	108[e]	0.30	1.04E-04	A.L.S.	Chickamauga Group
	9/23/1973	110–314	204	420	5.5	124	19	0.05	1.84E-05	L.A.S.S.	Chickamauga Group
	9/23/1973	140–314	174	480	6.1	101.6	29	0.08	2.80E-05	L.A.S.S.	Chickamauga Group
	9/23/1973	184–314	130	600	6.1	101.1	36	0.10	3.48E-05	L.A.S.S.	Chickamauga Group
	9/23/1973	220–314	94	800	5.2	106.1	39	0.11	3.77E-05	L.A.S.S.	Chickamauga Group
	9/23/1973	259.5–314	54.5	1250	3.2	106.1	38	0.10	3.67E-05	Knox	Knox Group
B-42	11/5/1973	60–301.5	241.5	360	2.92	101.1	10	0.03	9.66E-06	B	Chickamauga Group
	11/5/1973	85–301.5	216.5	400	0	–	0	0	0	B	Chickamauga Group
	11/5/1973	140–301.5	161.5	500	1.22	101.1	6	0.02	5.80E-06	B/U.A.S.S.	Chickamauga Group
	11/5/1973	150–301.5	151.5	530	1.54	101.1	8	0.02	7.73E-06	U.A.S.S.	Chickamauga Group
B-46	11/6/1973	30–78.9	48.9	1380	6.24	77.9	111	0.30	1.07E-04	U.A.S.S.	Chickamauga Group
	11/6/1973	65–78.9	13.9	3900	0.15	101	6	0.02	5.80E-06	U.A.S.S.	Chickamauga Group
B-47	12/4/1973	83–92	9	5300	6	83.7	380	1.04	3.67E-04	A.L.S.	Chickamauga Group
	12/3/1973	89–98	9	5300	4.8	83.7	304	0.83	2.94E-04	A.L.S.	Chickamauga Group
	12/3/1973	98–107	9	5300	11.0	83.7	697	1.91	6.73E-04	A.L.S.	Chickamauga Group
	11/30/1973	108–370	262	340	3.7	83.7	15	0.04	1.45E-05	L.A.S.S.	Chickamauga Group
	11/30/1973	115–370	255	340	3.1	106.8	10	0.03	9.66E-06	L.A.S.S.	Chickamauga Group
	11/30/1973	140–370	230	380	1.1	106.8	4	0.01	3.86E-06	L.A.S.S.	Chickamauga Group
	11/30/1973	150–370	220	400	1.2	106.8	4	0.01	3.86E-06	L.A.S.S.	Chickamauga Group

Table 2.4.12-3 (Sheet 5 of 6)
Clinch River Breeder Reactor Project Investigation Packer Test Results

Boring	Date	Test Section (ftbgs)	Test Length (ft)	C_p (ft^2/gpm-yr)	Flow Q (gpm)	Total Head H (ft)	Hydraulic Conductivity K(a) (ft/yr)	Hydraulic Conductivity K(b) (ft/d)	Hydraulic Conductivity K(b) (cm/s)	Geologic Horizon(c)	Geologic Strata(d)
B-48	9/20/1973	33–114	81	900	2.5	52.4	43	0.12	4.15E-05	B	Chickamauga Group
	9/20/1973	43–114	71	1000	1.4	53.1	27(e)	0.07	2.61E-05	B	Chickamauga Group
	--	56–114	58	1200	0.7	60.9	14	0.04	1.35E-05	B	Chickamauga Group
	9/17/1973	85–114	29	2000	0.5	68.6	15	0.04	1.45E-05	U.A.S.S.	Chickamauga Group
B-49	11/7/1973	57.5–144	86.5	860	10.8	94.9	98	0.27	9.47E-05	B	Chickamauga Group
	11/7/1973	70–144	74	980	2.2	118	18	0.05	1.74E-05	B	Chickamauga Group
	11/7/1973	85–144	59	–	0	–	0	0	0	B	Chickamauga Group
	11/6/1973	110–144	34	–	0	–	0	0	0	U.A.S.S.	Chickamauga Group
B-50	11/2/1973	78–241	163	500	2.7	91.1	15	0.04	1.45E-05	B	Chickamauga Group
	11/2/1973	90–241	151	535	2.6	91.1	15	0.04	1.45E-05	B	Chickamauga Group
	11/2/1973	100–241	141	560	2.6	91.1	16	0.04	1.55E-05	B	Chickamauga Group
	11/2/1973	201–241	40	1650	1.4	91.1	25	0.07	2.41E-05	U.A.S.S.	Chickamauga Group
B-51	11/20/1973	31–40	9	5300	1	60.6	91(e)	0.25	8.79E-05	A.L.S.	Chickamauga Group
	11/20/1973	36.5–45.5	9	5300	0.46	66.1	37	0.10	3.57E-05	A.L.S.	Chickamauga Group
	11/20/1973	45.5–54.5	9	5300	0.11	75.1	8	0.02	7.73E-06	A.L.S.	Chickamauga Group
	11/20/1973	34.5–63.5	9	5300	17.2	82.1	1110	3.04	1.07E-03	A.L.S.	Chickamauga Group
	11/20/1973	83–338.5	255.5	340	2.67	105.2	9	0.02	8.69E-06	A.L.S.	Chickamauga Group
	11/20/1973	100–338.5	238.5	365	1.86	105.2	6	0.02	5.80E-06	A.L.S./ L.A.S.S.	Chickamauga Group
B-53	11/29/1973	53–200	147	540	0.15	131.7	0.6	0.002	5.80E-07	Knox	Knox Group
	11/29/1973	90–200	110	700	0.15	108.6	1	0.003	9.66E-07	Knox	Knox Group
B-66	11/29/1973	37–101	64	1100	0.12	92.9	1.4	0.004	1.35E-06	Knox	Knox Group
	11/29/1973	50–101	51	1350	0.08	92.9	1.2	0.003	1.16E-06	Knox	Knox Group
	11/29/1973	73–101	28	2200	0.12	92.9	2.8	0.01	2.70E-06	Knox	Knox Group

Table 2.4.12-3 (Sheet 6 of 6)
Clinch River Breeder Reactor Project Investigation Packer Test Results

Boring	Date	Test Section (ftbgs)	Test Length (ft)	C_p (ft^2/gpm-yr)	Flow Q (gpm)	Total Head H (ft)	Hydraulic Conductivity K[a] (ft/yr)	Hydraulic Conductivity K[b] (ft/d)	Hydraulic Conductivity K[b] (cm/s)	Geologic Horizon[c]	Geologic Strata[d]
B-67	11/17/1973	24–33	9	5300	0.08	76.3	5.6	0.02	5.41E-06	Knox	Knox Group
	11/17/1973	33–42	9	5300	0	–	0	0	0	Knox	Knox Group
	11/17/1973	42–51	9	5300	0	–	0	0	0	Knox	Knox Group
	11/17/1973	51–60	9	5300	9.1	59.7	807[e]	2.21	7.79E-04	Knox	Knox Group
	11/16/1973	40–100	60	1180	9.2	59.7	182	0.50	1.76E-04	Knox	Knox Group
	11/15/1973	61–100	39	–	0	–	0	0	0	Knox	Knox Group

Explanation:

(a) $K = C_p \dfrac{Q}{H}$

(b) Hydraulic conductivity in ft/yr (Table 24-17 of Reference 2.4.12-1) converted to ft/d by dividing by 365 and converted to cm/s by multiplying by 9.6590 x 10^{-7}

(c) Geologic Horizon from (Table 24-17 of Reference 2.4.12-1)
U.A.S.S. = Upper Unit A Siltstone
A.L.S. = Unit A Limestone
L.A.S.S. = Lower Unit A Siltston
B = Unit B Limestone
Knox = Knox Group

(d) Geologic Strata nomenclature used in current investigation

(e) Yellow highlighted values indicate discrepancy between values reported on (Table 24-17 of Reference 2.4.12-1) and values calculated using the formula shown above

(f) Orange highlighted values are duplicate tests—the maximum value is used in hydraulic conductivity analysis

(g) Exact date unknown

Notes:

Dash (–) = No information

Table 2.4.12-4 (Sheet 1 of 2)
Well Construction Summary

							Top of Bentonite Seal		Top of Filter Pack						Top of Screen		Bottom of Screen		Bottom of Well Cap		Bottom of Borehole	
Well	Northing (NAD 83)	Easting (NAD 83)	Geologic Unit[a]	Top of Casing Elevation (NAVD88)	Top of Concrete Elevation (NAVD88)	Ground Surface Elevation (NAVD88)	Depth below Ground (ft)	Elevation (NAVD88)	Depth below Ground (ft)	Elevation (NAVD88)	Well Casing Diameter (inches)	Well Casing Schedule	Well Material	Screen Slot Size (inches)	Depth below Ground (ft)	Elevation (NAVD88)	Depth below Ground (ft)	Elevation (NAVD88)	Depth below Ground (ft)	Elevation (NAVD88)	Depth below Ground (ft)	Elevation (NAVD88)
OW-101U	570235.5	2448339.3	Benbolt	803.72	800.73	800.58	15.0	785.6	21.4	779.2	2	40	PVC	0.020	26.0	774.6	46.0	754.6	46.5	754.1	50.0	750.6
OW-101L	570262.0	2448370.8	Rockdell	803.48	800.81	800.66	126.6	674.1	133.6	667.1	2	80	PVC	0.020	138.0	662.7	158.0	642.7	158.5	642.2	161.0	639.7
OW-101D	570274.9	2448386.4	Rockdell	803.57	800.82	800.65	219.2	581.5	225.8	574.9	2	80	PVC	0.020	230.5	570.2	250.5	550.2	251.0	549.7	261.5	539.2
OW-202U	570946.0	2448081.1	Fleanor	815.38	812.11	811.83	4.3	807.5	11.1	800.7	2	40	PVC	0.020	15.7	796.1	35.7	776.1	36.2	775.6	39.0	772.8
OW-202L	570934.2	2448064.9	Fleanor	815.05	812.23	811.97	141.1	670.9	147.0	665.0	2	80	PVC	0.020	150.5	661.5	170.5	641.5	171.0	641.0	173.0	639.0
OW-202D	570909.7	2448033.7	Eidson	815.00	812.21	812.10	260.0	552.1	273.0	539.1	2	80	PVC	0.020	276.4	535.7	296.4	515.7	296.9	515.2	303.0	509.1
OW-401U	571967.9	2447619.9	Newala	820.48	817.55	817.39	5.2	812.2	10.5	806.9	2	40	PVC	0.020	15.2	802.2	35.2	782.2	35.7	781.7	37.5	779.9
OW-401L	571973.8	2447628.0	Newala	820.57	817.47	817.22	126.7	690.5	130.8	686.4	2	80	PVC	0.020	135.2	682.0	155.2	662.0	155.7	661.5	159.3	657.9
OW-401D	571941.2	2447589.7	Newala	821.28	818.41	818.17	215.6	602.6	221.9	596.3	2	80	PVC	0.020	226.6	591.6	246.6	571.6	247.1	571.1	251.7	566.5
OW-409U	570557.1	2448130.3	Rockdell	809.70	807.12	806.91	44.4	762.5	52.4	754.5	2	40	PVC	0.020	54.9	752.0	74.9	732.0	75.4	731.5	78.0	728.9
OW-409L	570570.8	2448143.3	Rockdell	809.51	806.82	806.67	82.7	724.0	86.6	720.1	2	40	PVC	0.020	89.1	717.6	109.1	697.6	109.6	697.1	112.0	694.7
OW-415U	569590.2	2448180.2	Bowen/ Benbolt	787.22	784.41	784.13	19.5	764.6	24.1	760.0	2	40	PVC	0.020	28.1	756.0	48.1	736.0	48.6	735.5	51.1	733.0
OW-415L	569564.4	2448148.1	Benbolt	786.75	783.93	783.65	146.9	636.8	151.9	631.8	2	80	PVC	0.020	154.9	628.8	174.9	608.8	175.4	608.3	177.4	606.3
OW-416U	569990.0	2447535.9	Rockdell	812.82	809.82	809.54	67.6	741.9	71.8	737.7	2	40	PVC	0.020	75.4	734.1	95.4	714.1	95.9	713.6	97.5	712.0
OW-416L	569965.2	2447504.9	Rockdell	812.73	809.72	809.43	98.4	711.0	107.6	701.8	2	40	PVC	0.020	110.6	698.8	130.6	678.8	131.1	678.3	133.0	676.4
OW-417U	569927.1	2446646.9	Fleanor	775.03	772.36	772.20	40.4	731.8	46.7	725.5	2	40	PVC	0.020	50.0	722.2	70.0	702.2	70.5	701.7	73.1	699.1
OW-417L	569903.0	2446614.6	Fleanor	775.71	772.78	772.65	81.8	690.9	91.5	681.2	2	40	PVC	0.020	95.0	677.7	115.0	657.7	115.5	657.2	118.0	654.7
OW-418U	570526.8	2447065.0	Eidson	812.94	810.30	810.01	78.0	732.0	90.1	719.9	2	40	PVC	0.020	95.0	715.0	105.0	705.0	105.5	704.5	108.0	702.0
OW-418L	570506.0	2447038.8	Blackford	814.41	811.80	811.44	124.9	686.5	133.6	677.8	2	80	PVC	0.020	136.8	674.6	156.8	654.6	157.3	654.1	160.0	651.4
OW-419U	571283.4	2446716.1	Newala	803.13	800.21	799.98	48.8	751.2	54.4	745.6	2	40	PVC	0.020	57.2	742.8	77.2	722.8	77.7	722.3	79.6	720.4
OW-419L	571257.7	2446683.4	Newala	802.72	799.89	799.75	90.5	709.3	101.0	698.8	2	40	PVC	0.020	104.5	695.3	124.5	675.3	125.0	674.8	126.5	673.3
OW-420U	572009.6	2446886.0	Newala	805.70	803.10	802.85	15.0	787.9	21.2	781.7	2	40	PVC	0.020	26.0	776.9	46.0	756.9	46.5	756.4	48.5	754.4
OW-420L	572021.1	2446902.0	Newala	806.15	803.31	803.07	120.0	683.1	127.4	675.7	2	40	PVC	0.020	130.9	672.2	150.9	652.2	151.4	651.7	152.4	650.7
OW-421U	570557.7	2446471.7	Blackford	808.27	805.55	805.36	41.2	764.2	51.4	754.0	2	40	PVC	0.020	55.0	750.4	75.0	730.4	75.5	729.9	78.0	727.4
OW-421L	570544.2	2446455.6	Blackford/ Newala	807.81	805.05	804.78	92.4	712.4	101.0	703.8	2	40	PVC	0.020	104.8	700.0	124.8	680.0	125.3	679.5	128.0	676.8
OW-421D	570520.1	2446424.4	Newala	805.20	802.63	802.49	165.2	637.3	172.8	629.7	2	80	PVC	0.020	175.7	626.8	195.7	606.8	196.2	606.3	198.0	604.5
OW-422U	570450.2	2448763.8	Benbolt	804.90	–	802.40	9.7	792.7	17.9	784.5	2	40	PVC	0.020	21.0	781.4	41.0	761.4	41.5	760.9	44.0	758.4
OW-422L	570438.1	2448748.1	Benbolt	803.70	–	801.70	147.3	654.4	155.2	646.5	2	80	PVC	0.020	158.0	643.7	178.0	623.7	178.5	623.2	181.0	620.7
OW-422D	570444.3	2448756.2	Rockdell	805.40	–	802.10	281.2	520.9	286.2	515.9	2	80	PVC	0.020	290.0	512.1	310.0	492.1	310.5	491.6	313.0	489.1
OW-423U	571494.1	2448309.5	Eidson	800.21	797.53	797.41	31.5	765.9	39.1	758.3	2	40	PVC	0.020	42.2	755.2	62.2	735.2	62.7	734.7	65.0	732.4
OW-423L	571481.6	2448293.2	Blackford	801.13	798.33	798.02	127.9	670.1	136.6	661.4	2	80	PVC	0.020	139.6	658.4	159.6	638.4	160.1	637.9	163.0	635.0
OW-423D	571457.9	2448262.0	Blackford	802.86	800.13	799.89	236.9	563.0	244.2	555.7	2	80	PVC	0.020	248.1	551.8	268.1	531.8	268.6	531.3	273.0	526.9
OW-428U	570781.4	2448710.6	Rockdell	807.78	804.57	804.33	24.4	779.9	34.4	769.9	2	40	PVC	0.020	40.4	763.9	60.4	743.9	60.9	743.4	63.0	741.3
OW-428L	570767.9	2448696.6	Rockdell	807.06	804.18	803.86	100.5	703.4	110.2	693.7	2	40	PVC	0.020	115.2	688.7	135.2	668.7	135.7	668.2	138.0	665.9
OW-428D	570741.9	2448666.5	Rockdell	807.03	804.02	803.73	172.2	631.5	185.2	618.5	2	80	PVC	0.020	190.2	613.5	210.2	593.5	210.7	593.0	213.0	590.7
OW-429U	569989.1	2448606.2	Bowen/ Benbolt	799.17	796.41	796.21	27.8	768.4	31.8	764.4	2	40	PVC	0.020	36.8	759.4	56.8	739.4	57.3	738.9	60.0	736.2

Table 2.4.12-4 (Sheet 2 of 2)
Well Construction Summary

							Top of Bentonite Seal		Top of Filter Pack						Top of Screen		Bottom of Screen		Bottom of Well Cap		Bottom of Borehole	
Well	Northing (NAD 83)	Easting (NAD 83)	Geologic Unit[(a)]	Top of Casing Elevation (NAVD88)	Top of Concrete Elevation (NAVD88)	Ground Surface Elevation (NAVD88)	Depth below Ground (ft)	Elevation (NAVD88)	Depth below Ground (ft)	Elevation (NAVD88)	Well Casing Diameter (inches)	Well Casing Schedule	Well Material	Screen Slot Size (inches)	Depth below Ground (ft)	Elevation (NAVD88)	Depth below Ground (ft)	Elevation (NAVD88)	Depth below Ground (ft)	Elevation (NAVD88)	Depth below Ground (ft)	Elevation (NAVD88)
OW-429L	569965.3	2448576.5	Benbolt	799.49	796.52	796.26	136.1	660.2	140.1	656.2	2	80	PVC	0.020	145.1	651.2	165.1	631.2	165.6	630.7	168.0	628.3
PT-OW-U1	571512.5	2448235.3	Eidson	801.52	798.71	798.55	19.8	778.8	36.8	761.8	2	40	PVC	0.020	41.8	756.8	61.8	736.8	62.3	736.3	65.0	733.6
PT-OW-L1	571493.2	2448235.2	Blackford	803.13	800.09	799.77	129.7	670.1	134.9	664.9	2	40	PVC	0.020	139.7	660.1	159.7	640.1	160.2	639.6	163.0	636.8
PT-OW-U2	571489.5	2448182.4	Eidson	805.31	802.60	802.19	32.9	769.3	37.0	765.2	2	40	PVC	0.020	42.0	760.2	62.0	740.2	62.5	739.7	65.0	737.2
PT-OW-L2	571478.7	2448192.1	Blackford	804.32	801.22	800.89	124.8	676.1	135.0	665.9	2	40	PVC	0.020	139.8	661.1	159.8	641.1	160.3	640.6	163.0	637.9
PT-OW-U3	571418.4	2448310.6	Eidson	801.65	799.31	799.17	24.6	774.6	34.1	765.1	2	40	PVC	0.020	42.6	756.6	62.6	736.6	63.1	736.1	65.0	734.2
PT-OW-L3	571420.6	2448290.2	Blackford	803.12	800.41	800.07	127.5	672.6	135.5	664.6	2	40	PVC	0.020	140.5	659.6	160.5	639.6	161.0	639.1	163.0	637.1
PT-PW	571432.2	2448229.1	Eidson/ Blackford	804.03	802.41	802.06	29.4	772.7	34.6	767.5	6	40	PVC	0.020	39.3	762.8	169.3	632.8	171.8	630.3	173.0	629.1

(a) Geologic units from Table B.1.2 in the Clinch River Data Report (Reference 2.4.12-13)
Notes:
Dash (–) = Measurement not taken due to contamination of well

Table 2.4.12-5
Groundwater Withdrawals from Five Counties Surrounding the Clinch River Nuclear Site by Use Category

County	Year	Industrial (mgd)	Public Supply (mgd)	Irrigation (mgd)	Total Groundwater Withdrawal (mgd)
Anderson	2010	NR	0.22	0	0.22
	2005	0.12	0.28	0.12	0.52
	2000	NR	0.96	0.01	0.97
Knox	2010	1.13	NR	0.02	1.16
	2005	0.67	0.67	0.04	1.38
	2000	0.13	0.93	0.1	1.16
Loudon	2010	0.01	0.8	NR	0.81
	2005	0.02	0.35	NR	0.37
	2000	NR	1.2	NR	1.2
Morgan	2010	NR	NR	NR	NR
	2005	NR	NR	NR	NR
	2000	NR	NR	NR	NR
Roane	2010	NR	1.28	0	1.28
	2005	NR	1.03	0.01	1.03
	2000	NR	0.2	NR	0.2
Total	2010	1.14	2.3	0.02	3.5
	2005	0.79	2.33	0.18	3.3
	2000	0.13	3.29	0.11	3.5

Notes:

Data for each county for the years 2000, 2005 and 2010 come from Reference 2.4.12-16, Reference 2.4.12-17, and Reference 2.4.12-18, respectively; total values (shaded) are computed.

“NR” (None Recorded) indicates that no value was recorded. “NR” is treated as zero for the purposes of summation, as was done in the source documents listed above.

Figures for individual categories may not add up to totals because of independent rounding.

Table 2.4.12-6
Summary of Water Systems Using Groundwater for Supply

Water System	County	System Category
Norris Water Commission	Anderson	Community
Sequoyah Marina, LLC	Anderson	Transient non-community
Modine Manufacturing Company	Anderson	NA
Oak Ridge Country Club	Anderson	NA
Johnson University	Knox	Community
CEMEX Construction Materials Atlantic	Knox	Non-transient non-community
NYRSTAR TN Mines—Strawberry Plains, LLC	Knox	Non-transient non-community
Fort Loudoun Yacht Club	Knox	Transient non-community
Cornell Dubilier Foil, LLC	Knox	NA
Panasonic	Knox	NA
Rinker Materials South Central	Knox	NA
Tamko Building Products, Inc.	Knox	NA
Vinylex Corporation	Knox	NA
Creekside Mobile Home S/D	Loudon	Community
Sweetwater Valley KOA	Loudon	Transient non-community
Cross Eyed Cricket Campground	Roane	Transient non-community

Notes:
NA = Not available

Table 2.4.12-7
Nearby Public Water Systems Using Groundwater for Supply

Community Water System	County	Population	Groundwater Source
Norris Water Commission[a]	Anderson	1801	Spring
North Anderson County Utility District	Anderson	10,653	Spring
First Utility District Of Knox County	Knox	64,230	Spring
Hallsdale Powell Utility District	Knox	57,732	Springs
Creekside Mobile Home Subdivision[a]	Loudon	51	Wells
Lenoir City Utility Board	Loudon	16,686	Spring
Loudon Utilities Board	Loudon	10,297	Springs
Helton Estates Mobile Home Park[a]	Roane	82	Well
Kingston Water System	Roane	8384	Spring
Lewands Water System[a]	Roane	61	Wells
Oliver Springs Water Board	Roane	5323	Spring

(a) Reference 2.4.12-20 indicates that the system uses exclusively groundwater for its supply (i.e., no other source is listed)

Notes:

The listed county reflects the location of the water system users, which is not necessarily the county from which all of the system's water is sourced due to intersystem transfers.

Source: Reference 2.4.12-20

Table 2.4.12-8 (Sheet 1 of 3)
Horizontal Hydraulic Gradients

Direction	Length (ft)	Elevation at the Well or Contour (upgradient), (ft NAVD88)	Elevation at the Well or Contour (downgradient) (ft NAVD88)	Head Difference (ft)	Horizontal Hydraulic Gradient (ft/ft)
September 24, 2013 Potentiometric Surface Map					
Section 1	266	810.0	780.0	30.0	0.11
Section 2	582	810.0	760.0	50.0	0.09
Section 3	162	810.0	798.7	11.3	0.07
Section 4	830	770.0	740.0	30.0	0.04
Section 5	273	790.0	760.0	30.0	0.11
Section 6	700	800.0	750.0	50.0	0.07
Note: Based on Figure 2.4.12-19; Maximum Water Levels in Each Nested Well Cluster					
December 20, 2013 Potentiometric Surface Map					
Section 1	227	805.0	785.0	20.0	0.09
Section 2	423	795.0	765.0	30.0	0.07
Section 3	332	805.0	795.0	10.0	0.03
Section 4	650	775.0	745.0	30.0	0.05
Section 5	96	775.0	765.0	10.0	0.10
Section 6	351	795.0	765.0	30.0	0.09
Section 7	253	785.0	775.0	10.0	0.04
Note: Based on Figure 2.4.12-20; Maximum Water Levels in Each Nested Well Cluster					
January 13, 2014 Potentiometric Surface Map					
Section 1	266	810	790	20	0.08
Section 2	629	800	760	40	0.06
Section 3	389	810	800	10	0.03
Section 4	646	780	750	30	0.05
Section 5	189	790	770	20	0.11
Section 6	398	780	760	20	0.05
Note: Based on Figure 2.4.12-21; Maximum Water Levels in Each Nested Well Cluster					
March 16, 2014 Potentiometric Surface Map					
Section 1	401	810	780	30	0.07
Section 2	653	810	760	50	0.08
Section 3	339	810	800	10	0.03
Section 4	707	790	750	40	0.06
Section 5	128	780	770	10	0.08
Section 6	686	810	760	50	0.07
Section 7	306	780	770	10	0.03
Note: Based on Figure 2.4.12-22; Maximum Water Levels in Each Nested Well Cluster					

Table 2.4.12-8 (Sheet 2 of 3)
Horizontal Hydraulic Gradients

Direction	Length (ft)	Elevation at the Well or Contour (upgradient), (ft NAVD88)	Elevation at the Well or Contour (downgradient) (ft NAVD88)	Head Difference (ft)	Horizontal Hydraulic Gradient (ft/ft)
May 15, 2014 Potentiometric Surface Map					
Section 1	329	810	780	30	0.09
Section 2	564	810	760	50	0.09
Section 3	318	810	800	10	0.03
Section 4	588	780	750	30	0.05
Section 5	85	780	770	10	0.12
Section 6	539	810	760	50	0.09
Section 7	191	780	770	10	0.05
Note: Based on Figure 2.4.12-23; Maximum Water Levels in Each Nested Well Cluster					
August 18, 2014 Potentiometric Surface Map					
Section 1	394	810	780	30	0.08
Section 2	696	810	760	50	0.07
Section 3	356	810	800	10	0.03
Section 4	591	780	750	30	0.05
Section 5	97	780	770	10	0.10
Section 6	948	810	750	60	0.06
Section 7	255	780	770	10	0.04
Note: Based on Figure 2.4.12-24; Maximum Water Levels in Each Nested Well Cluster					
November 4, 2014 Potentiometric Surface Map					
Section 1	319	810	780	30	0.09
Section 2	736	810	750	60	0.08
Section 3	275	810	800	10	0.04
Section 4	430	780	750	30	0.07
Section 5	120	780	770	10	0.08
Section 6	841	810	750	60	0.07
Section 7	286	780	770	10	0.04
Note: Based on Figure 2.4.12-25; Maximum Water Levels in Each Nested Well Cluster					
February 12, 2015 Potentiometric Surface Map					
Section 1	399	810	780	30	0.08
Section 2	609	810	760	50	0.08
Section 3	335	810	800	10	0.03
Section 4	492	780	750	30	0.06
Section 5	107	780	770	10	0.09
Section 6	609	810	760	50	0.08
Section 7	259	780	770	10	0.04
Note: Based on Figure 2.4.12-26; Maximum Water Levels in Each Nested Well Cluster					

Table 2.4.12-8 (Sheet 3 of 3)
Horizontal Hydraulic Gradients

Direction	Length (ft)	Elevation at the Well or Contour (upgradient), (ft NAVD88)	Elevation at the Well or Contour (downgradient) (ft NAVD88)	Head Difference (ft)	Horizontal Hydraulic Gradient (ft/ft)
May 19, 2015 Potentiometric Surface Map					
Section 1	293	810	780	30	0.10
Section 2	693	810	750	60	0.09
Section 3	243	810	800	10	0.04
Section 4	349	780	750	30	0.09
Section 5	208	780	760	20	0.10
Section 6	929	810	750	60	0.06
Section 7	285	780	770	10	0.04
Note: Based on Figure 2.4.12-27; Maximum Water Levels in Each Nested Well Cluster					
August 10, 2015 Potentiometric Surface Map					
Section 1	296	810	780	30	0.10
Section 2	682	810	750	60	0.09
Section 3	230	810	800	10	0.04
Section 4	250	770	750	20	0.08
Section 5	111	780	770	10	0.09
Section 6	520	810	760	50	0.10
Section 7	260	780	770	10	0.04
Note: Based on Figure 2.4.12-28; Maximum Water Levels in Each Nested Well Cluster					

Notes:

Mean Horizontal Hydraulic Gradient = 0.07 ft/ft

Minimum Horizontal Hydraulic Gradient = 0.03 ft/ft

Maximum Horizontal Hydraulic Gradient = 0.12 ft/ft

Table 2.4.12-9 (Sheet 1 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-101U/L (Upper /Lower)	24-Sep-13	774.6	754.6	764.6	790.71	662.7	642.7	652.7	768.33	–	–	–	–	111.9	22.38	0.20
	1-Oct-13	774.6	754.6	764.6	784.18	662.7	642.7	652.7	766.37	–	–	–	–	111.9	17.81	0.16
	9-Oct-13	774.6	754.6	764.6	783.14	662.7	642.7	652.7	761.90	–	–	–	–	111.9	21.24	0.19
	26-Oct-13	774.6	754.6	764.6	782.73	662.7	642.7	652.7	756.89	–	–	–	–	111.9	25.84	0.23
	5-Nov-13	774.6	754.6	764.6	782.69	662.7	642.7	652.7	753.48	–	–	–	–	111.9	29.21	0.26
	12-Nov-13	774.6	754.6	764.6	782.84	662.7	642.7	652.7	749.60	–	–	–	–	111.9	33.24	0.30
	23-Nov-13	774.6	754.6	764.6	783.95	662.7	642.7	652.7	762.05	–	–	–	–	111.9	21.90	0.20
	9-Dec-13	774.6	754.6	764.6	798.42	662.7	642.7	652.7	773.47	–	–	–	–	111.9	24.95	0.22
	20-Dec-13	774.6	754.6	764.6	790.65	662.7	642.7	652.7	768.74	–	–	–	–	111.9	21.91	0.20
	13-Jan-14	774.6	754.6	764.6	795.74	662.7	642.7	652.7	771.52	–	–	–	–	111.9	24.22	0.22
	16-Jan-14	774.6	754.6	764.6	795.38	662.7	642.7	652.7	771.11	–	–	–	–	111.9	24.27	0.22
	18-Feb-14	774.6	754.6	764.6	791.86	662.7	642.7	652.7	768.70	–	–	–	–	111.9	23.16	0.21
	16-Mar-14	774.6	754.6	764.6	785.52	662.7	642.7	652.7	766.01	–	–	–	–	111.9	19.51	0.17
	15-Apr-14	774.6	754.6	764.6	788.72	662.7	642.7	652.7	767.45	–	–	–	–	111.9	21.27	0.19
	15-May-14	774.6	754.6	764.6	792.69	662.7	642.7	652.7	768.01	–	–	–	–	111.9	24.68	0.22
	16-Jun-14	774.6	754.6	764.6	791.90	662.7	642.7	652.7	768.62	–	–	–	–	111.9	23.28	0.21
	16-Jul-14	774.6	754.6	764.6	783.11	662.7	642.7	652.7	762.61	–	–	–	–	111.9	20.50	0.18
	18-Aug-14	774.6	754.6	764.6	789.18	662.7	642.7	652.7	767.59	–	–	–	–	111.9	21.59	0.19
	4-Nov-14	774.6	754.6	764.6	783.64	662.7	642.7	652.7	764.05	–	–	–	–	111.9	19.59	0.18
	12-Feb-15	774.6	754.6	764.6	786.53	662.7	642.7	652.7	766.59	–	–	–	–	111.9	19.94	0.18
	19-May-15	774.6	754.6	764.6	782.96	662.7	642.7	652.7	763.31	–	–	–	–	111.9	19.65	0.18
	10-Aug-15	774.6	754.6	764.6	783.54	662.7	642.7	652.7	764.88	–	–	–	–	111.9	18.66	0.17
																0.20

Table 2.4.12-9 (Sheet 2 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-101U/D (Upper/Deeper)	24-Sep-13	774.6	754.6	764.6	790.71	–	–	–	–	570.2	550.2	560.2	743.45	204.4	47.26	0.23
	1-Oct-13	774.6	754.6	764.6	784.18	–	–	–	–	570.2	550.2	560.2	743.03	204.4	41.15	0.20
	9-Oct-13	774.6	754.6	764.6	783.14	–	–	–	–	570.2	550.2	560.2	741.77	204.4	41.37	0.20
	26-Oct-13	774.6	754.6	764.6	782.73	–	–	–	–	570.2	550.2	560.2	741.33	204.4	41.40	0.20
	5-Nov-13	774.6	754.6	764.6	782.69	–	–	–	–	570.2	550.2	560.2	740.52	204.4	42.17	0.21
	12-Nov-13	774.6	754.6	764.6	782.84	–	–	–	–	570.2	550.2	560.2	739.89	204.4	42.95	0.21
	23-Nov-13	774.6	754.6	764.6	783.95	–	–	–	–	570.2	550.2	560.2	739.25	204.4	44.70	0.22
	9-Dec-13	774.6	754.6	764.6	798.42	–	–	–	–	570.2	550.2	560.2	749.39	204.4	49.03	0.24
	20-Dec-13	774.6	754.6	764.6	790.65	–	–	–	–	570.2	550.2	560.2	741.05	204.4	49.60	0.24
	13-Jan-14	774.6	754.6	764.6	795.74	–	–	–	–	570.2	550.2	560.2	745.15	204.4	50.59	0.25
	16-Jan-14	774.6	754.6	764.6	795.38	–	–	–	–	570.2	550.2	560.2	744.49	204.4	50.89	0.25
	18-Feb-14	774.6	754.6	764.6	791.86	–	–	–	–	570.2	550.2	560.2	741.50	204.4	50.36	0.25
	16-Mar-14	774.6	754.6	764.6	785.52	–	–	–	–	570.2	550.2	560.2	739.22	204.4	46.30	0.23
	15-Apr-14	774.6	754.6	764.6	788.72	–	–	–	–	570.2	550.2	560.2	740.92	204.4	47.80	0.23
	15-May-14	774.6	754.6	764.6	792.69	–	–	–	–	570.2	550.2	560.2	743.81	204.4	48.88	0.24
	16-Jun-14	774.6	754.6	764.6	791.90	–	–	–	–	570.2	550.2	560.2	743.33	204.4	48.57	0.24
	16-Jul-14	774.6	754.6	764.6	783.11	–	–	–	–	570.2	550.2	560.2	742.43	204.4	40.68	0.20
	18-Aug-14	774.6	754.6	764.6	789.18	–	–	–	–	570.2	550.2	560.2	743.45	204.4	45.73	0.22
	4-Nov-14	774.6	754.6	764.6	783.64	–	–	–	–	570.2	550.2	560.2	742.16	204.4	41.48	0.20
	12-Feb-15	774.6	754.6	764.6	786.53	–	–	–	–	570.2	550.2	560.2	739.98	204.4	46.55	0.23
	19-May-15	774.6	754.6	764.6	782.96	–	–	–	–	570.2	550.2	560.2	742.70	204.4	40.26	0.20
	10-Aug-15	774.6	754.6	764.6	783.54	–	–	–	–	570.2	550.2	560.2	743.18	204.4	40.36	0.20
																0.22

Table 2.4.12-9 (Sheet 3 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-101L/D (Lower/Deeper)	24-Sep-13	–	–	–	–	662.7	642.7	652.7	768.33	570.2	550.2	560.2	743.45	92.5	24.88	0.27
	1-Oct-13	–	–	–	–	662.7	642.7	652.7	766.37	570.2	550.2	560.2	743.03	92.5	23.34	0.25
	9-Oct-13	–	–	–	–	662.7	642.7	652.7	761.90	570.2	550.2	560.2	741.77	92.5	20.13	0.22
	26-Oct-13	–	–	–	–	662.7	642.7	652.7	756.89	570.2	550.2	560.2	741.33	92.5	15.56	0.17
	5-Nov-13	–	–	–	–	662.7	642.7	652.7	753.48	570.2	550.2	560.2	740.52	92.5	12.96	0.14
	12-Nov-13	–	–	–	–	662.7	642.7	652.7	749.60	570.2	550.2	560.2	739.89	92.5	9.71	0.11
	23-Nov-13	–	–	–	–	662.7	642.7	652.7	762.05	570.2	550.2	560.2	739.25	92.5	22.80	0.25
	9-Dec-13	–	–	–	–	662.7	642.7	652.7	773.47	570.2	550.2	560.2	749.39	92.5	24.08	0.26
	20-Dec-13	–	–	–	–	662.7	642.7	652.7	768.74	570.2	550.2	560.2	741.05	92.5	27.69	0.30
	13-Jan-14	–	–	–	–	662.7	642.7	652.7	771.52	570.2	550.2	560.2	745.15	92.5	26.37	0.29
	16-Jan-14	–	–	–	–	662.7	642.7	652.7	771.11	570.2	550.2	560.2	744.49	92.5	26.62	0.29
	18-Feb-14	–	–	–	–	662.7	642.7	652.7	768.70	570.2	550.2	560.2	741.50	92.5	27.20	0.29
	16-Mar-14	–	–	–	–	662.7	642.7	652.7	766.01	570.2	550.2	560.2	739.22	92.5	26.79	0.29
	15-Apr-14	–	–	–	–	662.7	642.7	652.7	767.45	570.2	550.2	560.2	740.92	92.5	26.53	0.29
	15-May-14	–	–	–	–	662.7	642.7	652.7	768.01	570.2	550.2	560.2	743.81	92.5	24.20	0.26
	16-Jun-14	–	–	–	–	662.7	642.7	652.7	768.62	570.2	550.2	560.2	743.33	92.5	25.29	0.27
	16-Jul-14	–	–	–	–	662.7	642.7	652.7	762.61	570.2	550.2	560.2	742.43	92.5	20.18	0.22
	18-Aug-14	–	–	–	–	662.7	642.7	652.7	767.59	570.2	550.2	560.2	743.45	92.5	24.14	0.26
	4-Nov-14	–	–	–	–	662.7	642.7	652.7	764.05	570.2	550.2	560.2	742.16	92.5	21.89	0.24
	12-Feb-15	–	–	–	–	662.7	642.7	652.7	766.59	570.2	550.2	560.2	739.98	92.5	26.61	0.29
	19-May-15	–	–	–	–	662.7	642.7	652.7	763.31	570.2	550.2	560.2	742.70	92.5	20.61	0.22
	10-Aug-15	–	–	–	–	662.7	642.7	652.7	764.88	570.2	550.2	560.2	743.18	92.5	21.70	0.23
																0.25

Table 2.4.12-9 (Sheet 4 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-202U/L (Upper /Lower)	24-Sep-13	796.1	776.1	786.1	798.65	661.5	641.5	651.5	766.92	–	–	–	–	134.6	31.73	0.24
	1-Oct-13	796.1	776.1	786.1	796.31	661.5	641.5	651.5	766.17	–	–	–	–	134.6	30.14	0.22
	9-Oct-13	796.1	776.1	786.1	792.89	661.5	641.5	651.5	765.36	–	–	–	–	134.6	27.53	0.20
	26-Oct-13	796.1	776.1	786.1	788.51	661.5	641.5	651.5	762.86	–	–	–	–	134.6	25.65	0.19
	5-Nov-13	796.1	776.1	786.1	787.32	661.5	641.5	651.5	761.76	–	–	–	–	134.6	25.56	0.19
	12-Nov-13	796.1	776.1	786.1	786.75	661.5	641.5	651.5	761.12	–	–	–	–	134.6	25.63	0.19
	23-Nov-13	796.1	776.1	786.1	797.43	661.5	641.5	651.5	705.78	–	–	–	–	134.6	91.65	0.68
	9-Dec-13	796.1	776.1	786.1	800.15	661.5	641.5	651.5	778.27	–	–	–	–	134.6	21.88	0.16
	20-Dec-13	796.1	776.1	786.1	798.10	661.5	641.5	651.5	773.58	–	–	–	–	134.6	24.52	0.18
	13-Jan-14	796.1	776.1	786.1	799.47	661.5	641.5	651.5	776.79	–	–	–	–	134.6	22.68	0.17
	16-Jan-14	796.1	776.1	786.1	798.96	661.5	641.5	651.5	776.08	–	–	–	–	134.6	22.88	0.17
	18-Feb-14	796.1	776.1	786.1	798.84	661.5	641.5	651.5	772.85	–	–	–	–	134.6	25.99	0.19
	16-Mar-14	796.1	776.1	786.1	795.76	661.5	641.5	651.5	771.33	–	–	–	–	134.6	24.43	0.18
	15-Apr-14	796.1	776.1	786.1	796.29	661.5	641.5	651.5	772.92	–	–	–	–	134.6	23.37	0.17
	15-May-14	796.1	776.1	786.1	799.44	661.5	641.5	651.5	768.85	–	–	–	–	134.6	30.59	0.23
	16-Jun-14	796.1	776.1	786.1	798.71	661.5	641.5	651.5	766.50	–	–	–	–	134.6	32.21	0.24
	16-Jul-14	796.1	776.1	786.1	795.66	661.5	641.5	651.5	764.40	–	–	–	–	134.6	31.26	0.23
	18-Aug-14	796.1	776.1	786.1	796.22	661.5	641.5	651.5	770.31	–	–	–	–	134.6	25.91	0.19
	4-Nov-14	796.1	776.1	786.1	795.68	661.5	641.5	651.5	766.10	–	–	–	–	134.6	29.58	0.22
	12-Feb-15	796.1	776.1	786.1	796.03	661.5	641.5	651.5	772.22	–	–	–	–	134.6	23.81	0.18
	19-May-15	796.1	776.1	786.1	795.47	661.5	641.5	651.5	767.00	–	–	–	–	134.6	28.47	0.21
	10-Aug-15	796.1	776.1	786.1	795.67	661.5	641.5	651.5	768.56	–	–	–	–	134.6	27.11	0.20
																0.20

Table 2.4.12-9 (Sheet 5 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-202U/D (Upper /Deeper)	24-Sep-13	796.1	776.1	786.1	798.65	–	–	–	–	535.7	515.7	525.7	759.34	260.4	39.31	0.15
	1-Oct-13	796.1	776.1	786.1	796.31	–	–	–	–	535.7	515.7	525.7	758.96	260.4	37.35	0.14
	9-Oct-13	796.1	776.1	786.1	792.89	–	–	–	–	535.7	515.7	525.7	757.50	260.4	35.39	0.14
	26-Oct-13	796.1	776.1	786.1	788.51	–	–	–	–	535.7	515.7	525.7	755.67	260.4	32.84	0.13
	5-Nov-13	796.1	776.1	786.1	787.32	–	–	–	–	535.7	515.7	525.7	754.85	260.4	32.47	0.12
	12-Nov-13	796.1	776.1	786.1	786.75	–	–	–	–	535.7	515.7	525.7	754.28	260.4	32.47	0.12
	23-Nov-13	796.1	776.1	786.1	797.43	–	–	–	–	535.7	515.7	525.7	755.05	260.4	42.38	0.16
	9-Dec-13	796.1	776.1	786.1	800.15	–	–	–	–	535.7	515.7	525.7	763.64	260.4	36.51	0.14
	20-Dec-13	796.1	776.1	786.1	798.10	–	–	–	–	535.7	515.7	525.7	762.41	260.4	35.69	0.14
	13-Jan-14	796.1	776.1	786.1	799.47	–	–	–	–	535.7	515.7	525.7	764.04	260.4	35.43	0.14
	16-Jan-14	796.1	776.1	786.1	798.96	–	–	–	–	535.7	515.7	525.7	764.76	260.4	34.20	0.13
	18-Feb-14	796.1	776.1	786.1	798.84	–	–	–	–	535.7	515.7	525.7	761.97	260.4	36.87	0.14
	16-Mar-14	796.1	776.1	786.1	795.76	–	–	–	–	535.7	515.7	525.7	760.31	260.4	35.45	0.14
	15-Apr-14	796.1	776.1	786.1	796.29	–	–	–	–	535.7	515.7	525.7	761.88	260.4	34.41	0.13
	15-May-14	796.1	776.1	786.1	799.44	–	–	–	–	535.7	515.7	525.7	759.74	260.4	39.70	0.15
	16-Jun-14	796.1	776.1	786.1	798.71	–	–	–	–	535.7	515.7	525.7	758.67	260.4	40.04	0.15
	16-Jul-14	796.1	776.1	786.1	795.66	–	–	–	–	535.7	515.7	525.7	757.06	260.4	38.60	0.15
	18-Aug-14	796.1	776.1	786.1	796.22	–	–	–	–	535.7	515.7	525.7	761.01	260.4	35.21	0.14
	4-Nov-14	796.1	776.1	786.1	795.68	–	–	–	–	535.7	515.7	525.7	757.89	260.4	37.79	0.15
	12-Feb-15	796.1	776.1	786.1	796.03	–	–	–	–	535.7	515.7	525.7	760.11	260.4	35.92	0.14
	19-May-15	796.1	776.1	786.1	795.47	–	–	–	–	535.7	515.7	525.7	758.58	260.4	36.89	0.14
	10-Aug-15	796.1	776.1	786.1	795.67	–	–	–	–	535.7	515.7	525.7	758.68	260.4	36.99	0.14
																0.14

Table 2.4.12-9 (Sheet 6 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-202L/D (Lower/Deeper)	24-Sep-13	–	–	–	–	661.5	641.5	651.5	766.92	535.7	515.7	525.7	759.34	125.8	7.58	0.06
	1-Oct-13	–	–	–	–	661.5	641.5	651.5	766.17	535.7	515.7	525.7	758.96	125.8	7.21	0.06
	9-Oct-13	–	–	–	–	661.5	641.5	651.5	765.36	535.7	515.7	525.7	757.50	125.8	7.86	0.06
	26-Oct-13	–	–	–	–	661.5	641.5	651.5	762.86	535.7	515.7	525.7	755.67	125.8	7.19	0.06
	5-Nov-13	–	–	–	–	661.5	641.5	651.5	761.76	535.7	515.7	525.7	754.85	125.8	6.91	0.05
	12-Nov-13	–	–	–	–	661.5	641.5	651.5	761.12	535.7	515.7	525.7	754.28	125.8	6.84	0.05
	23-Nov-13	–	–	–	–	661.5	641.5	651.5	705.78	535.7	515.7	525.7	755.05	125.8	-49.27	-0.39
	9-Dec-13	–	–	–	–	661.5	641.5	651.5	778.27	535.7	515.7	525.7	763.64	125.8	14.63	0.12
	20-Dec-13	–	–	–	–	661.5	641.5	651.5	773.58	535.7	515.7	525.7	762.41	125.8	11.17	0.09
	13-Jan-14	–	–	–	–	661.5	641.5	651.5	776.79	535.7	515.7	525.7	764.04	125.8	12.75	0.10
	16-Jan-14	–	–	–	–	661.5	641.5	651.5	776.08	535.7	515.7	525.7	764.76	125.8	11.32	0.09
	18-Feb-14	–	–	–	–	661.5	641.5	651.5	772.86	535.7	515.7	525.7	761.97	125.8	10.89	0.09
	16-Mar-14	–	–	–	–	661.5	641.5	651.5	771.33	535.7	515.7	525.7	760.31	125.8	11.02	0.09
	15-Apr-14	–	–	–	–	661.5	641.5	651.5	772.92	535.7	515.7	525.7	761.88	125.8	11.04	0.09
	15-May-14	–	–	–	–	661.5	641.5	651.5	768.85	535.7	515.7	525.7	759.74	125.8	9.11	0.07
	16-Jun-14	–	–	–	–	661.5	641.5	651.5	766.50	535.7	515.7	525.7	758.67	125.8	7.83	0.06
	16-Jul-14	–	–	–	–	661.5	641.5	651.5	764.40	535.7	515.7	525.7	757.06	125.8	7.34	0.06
	18-Aug-14	–	–	–	–	661.5	641.5	651.5	770.31	535.7	515.7	525.7	761.01	125.8	9.30	0.07
	4-Nov-14	–	–	–	–	661.5	641.5	651.5	766.10	535.7	515.7	525.7	757.89	125.8	8.21	0.07
	12-Feb-15	–	–	–	–	661.5	641.5	651.5	772.22	535.7	515.7	525.7	760.11	125.8	12.11	0.10
	19-May-15	–	–	–	–	661.5	641.5	651.5	767.00	535.7	515.7	525.7	758.58	125.8	8.42	0.07
	10-Aug-15	–	–	–	–	661.5	641.5	651.5	768.56	535.7	515.7	525.7	758.68	125.8	9.88	0.08
																0.08

Table 2.4.12-9 (Sheet 7 of 26) Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-401U/L (Upper/Lower)	24-Sep-13	802.2	782.2	792.2	810.96	682.0	662.0	672.0	783.49	–	–	–	–	120.2	27.47	0.23
	1-Oct-13	802.2	782.2	792.2	810.52	682.0	662.0	672.0	781.71	–	–	–	–	120.2	28.81	0.24
	9-Oct-13	802.2	782.2	792.2	810.19	682.0	662.0	672.0	780.43	–	–	–	–	120.2	29.76	0.25
	26-Oct-13	802.2	782.2	792.2	809.94	682.0	662.0	672.0	778.67	–	–	–	–	120.2	31.27	0.26
	5-Nov-13	802.2	782.2	792.2	809.82	682.0	662.0	672.0	778.16	–	–	–	–	120.2	31.66	0.26
	12-Nov-13	802.2	782.2	792.2	809.78	682.0	662.0	672.0	778.20	–	–	–	–	120.2	31.58	0.26
	23-Nov-13	802.2	782.2	792.2	809.63	682.0	662.0	672.0	780.61	–	–	–	–	120.2	29.02	0.24
	9-Dec-13	802.2	782.2	792.2	813.14	682.0	662.0	672.0	791.75	–	–	–	–	120.2	21.39	0.18
	20-Dec-13	802.2	782.2	792.2	810.63	682.0	662.0	672.0	787.29	–	–	–	–	120.2	23.34	0.19
	13-Jan-14	802.2	782.2	792.2	811.60	682.0	662.0	672.0	795.55	–	–	–	–	120.2	16.05	0.13
	18-Feb-14	802.2	782.2	792.2	810.86	682.0	662.0	672.0	788.69	–	–	–	–	120.2	22.17	0.18
	16-Mar-14	802.2	782.2	792.2	810.41	682.0	662.0	672.0	785.22	–	–	–	–	120.2	25.19	0.21
	15-Apr-14	802.2	782.2	792.2	810.56	682.0	662.0	672.0	788.03	–	–	–	–	120.2	22.53	0.19
	15-May-14	802.2	782.2	792.2	811.11	682.0	662.0	672.0	784.36	–	–	–	–	120.2	26.75	0.22
	16-Jun-14	802.2	782.2	792.2	810.66	682.0	662.0	672.0	784.03	–	–	–	–	120.2	26.63	0.22
	16-Jul-14	802.2	782.2	792.2	809.9	682.0	662.0	672.0	780.40	–	–	–	–	120.2	29.50	0.25
	18-Aug-14	802.2	782.2	792.2	810.33	682.0	662.0	672.0	784.45	–	–	–	–	120.2	25.88	0.22
	4-Nov-14	802.2	782.2	792.2	810.01	682.0	662.0	672.0	780.60	–	–	–	–	120.2	29.41	0.24
	12-Feb-15	802.2	782.2	792.2	810.25	682.0	662.0	672.0	784.05	–	–	–	–	120.2	26.20	0.22
	19-May-15	802.2	782.2	792.2	809.78	682.0	662.0	672.0	781.11	–	–	–	–	120.2	28.67	0.24
	10-Aug-15	802.2	782.2	792.2	809.76	682.0	662.0	672.0	780.44	–	–	–	–	120.2	29.32	0.24
																0.22

Table 2.4.12-9 (Sheet 8 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-401U/D (Upper/Deeper)	24-Sep-13	802.2	782.2	792.2	810.96	–	–	–	–	591.6	571.6	581.6	781.67	210.6	29.29	0.14
	1-Oct-13	802.2	782.2	792.2	810.52	–	–	–	–	591.6	571.6	581.6	782.70	210.6	27.82	0.13
	9-Oct-13	802.2	782.2	792.2	810.19	–	–	–	–	591.6	571.6	581.6	780.97	210.6	29.22	0.14
	26-Oct-13	802.2	782.2	792.2	809.94	–	–	–	–	591.6	571.6	581.6	777.33	210.6	32.61	0.15
	5-Nov-13	802.2	782.2	792.2	809.82	–	–	–	–	591.6	571.6	581.6	772.88	210.6	36.94	0.18
	12-Nov-13	802.2	782.2	792.2	809.78	–	–	–	–	591.6	571.6	581.6	777.09	210.6	32.69	0.16
	23-Nov-13	802.2	782.2	792.2	809.63	–	–	–	–	591.6	571.6	581.6	780.49	210.6	29.14	0.14
	9-Dec-13	802.2	782.2	792.2	813.14	–	–	–	–	591.6	571.6	581.6	786.87	210.6	26.27	0.12
	20-Dec-13	802.2	782.2	792.2	810.63	–	–	–	–	591.6	571.6	581.6	781.23	210.6	29.40	0.14
	13-Jan-14	802.2	782.2	792.2	811.60	–	–	–	–	591.6	571.6	581.6	794.33	210.6	17.27	0.08
	18-Feb-14	802.2	782.2	792.2	810.86	–	–	–	–	591.6	571.6	581.6	791.44	210.6	19.42	0.09
	16-Mar-14	802.2	782.2	792.2	810.41	–	–	–	–	591.6	571.6	581.6	787.87	210.6	22.54	0.11
	15-Apr-14	802.2	782.2	792.2	810.56	–	–	–	–	591.6	571.6	581.6	792.09	210.6	18.47	0.09
	15-May-14	802.2	782.2	792.2	811.11	–	–	–	–	591.6	571.6	581.6	783.04	210.6	28.07	0.13
	16-Jun-14	802.2	782.2	792.2	810.66	–	–	–	–	591.6	571.6	581.6	783.31	210.6	27.35	0.13
	16-Jul-14	802.2	782.2	792.2	809.9	–	–	–	–	591.6	571.6	581.6	780.86	210.6	29.04	0.14
	18-Aug-14	802.2	782.2	792.2	810.33	–	–	–	–	591.6	571.6	581.6	788.07	210.6	22.26	0.11
	4-Nov-14	802.2	782.2	792.2	810.01	–	–	–	–	591.6	571.6	581.6	781.55	210.6	28.46	0.14
	12-Feb-15	802.2	782.2	792.2	810.25	–	–	–	–	591.6	571.6	581.6	785.60	210.6	24.65	0.12
	19-May-15	802.2	782.2	792.2	809.78	–	–	–	–	591.6	571.6	581.6	780.82	210.6	28.96	0.14
	10-Aug-15	802.2	782.2	792.2	809.76	–	–	–	–	591.6	571.6	581.6	780.66	210.6	29.10	0.14
																0.13

Table 2.4.12-9 (Sheet 9 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-401L/D (Lower/Deeper)	24-Sep-13	–	–	–	–	682.0	662.0	672.0	783.49	591.6	571.6	581.6	781.67	90.4	1.82	0.02
	1-Oct-13	–	–	–	–	682.0	662.0	672.0	781.71	591.6	571.6	581.6	782.70	90.4	-0.99	-0.01
	9-Oct-13	–	–	–	–	682.0	662.0	672.0	780.43	591.6	571.6	581.6	780.97	90.4	-0.54	-0.01
	26-Oct-13	–	–	–	–	682.0	662.0	672.0	778.67	591.6	571.6	581.6	777.33	90.4	1.34	0.01
	5-Nov-13	–	–	–	–	682.0	662.0	672.0	778.16	591.6	571.6	581.6	772.88	90.4	5.28	0.06
	12-Nov-13	–	–	–	–	682.0	662.0	672.0	778.20	591.6	571.6	581.6	777.09	90.4	1.11	0.01
	23-Nov-13	–	–	–	–	682.0	662.0	672.0	780.61	591.6	571.6	581.6	780.49	90.4	0.12	0.00
	9-Dec-13	–	–	–	–	682.0	662.0	672.0	791.75	591.6	571.6	581.6	786.87	90.4	4.88	0.05
	20-Dec-13	–	–	–	–	682.0	662.0	672.0	787.29	591.6	571.6	581.6	781.23	90.4	6.06	0.07
	13-Jan-14	–	–	–	–	682.0	662.0	672.0	795.55	591.6	571.6	581.6	794.33	90.4	1.22	0.01
	18-Feb-14	–	–	–	–	682.0	662.0	672.0	788.69	591.6	571.6	581.6	791.44	90.4	-2.75	-0.03
	16-Mar-14	–	–	–	–	682.0	662.0	672.0	785.22	591.6	571.6	581.6	787.87	90.4	-2.65	-0.03
	15-Apr-14	–	–	–	–	682.0	662.0	672.0	788.03	591.6	571.6	581.6	792.09	90.4	-4.06	-0.04
	15-May-14	–	–	–	–	682.0	662.0	672.0	784.36	591.6	571.6	581.6	783.04	90.4	1.32	0.01
	16-Jun-14	–	–	–	–	682.0	662.0	672.0	784.03	591.6	571.6	581.6	783.31	90.4	0.72	0.01
	16-Jul-14	–	–	–	–	682.0	662.0	672.0	780.40	591.6	571.6	581.6	780.86	90.4	-0.46	-0.01
	18-Aug-14	–	–	–	–	682.0	662.0	672.0	784.45	591.6	571.6	581.6	788.07	90.4	-3.62	-0.04
	4-Nov-14	–	–	–	–	682.0	662.0	672.0	780.60	591.6	571.6	581.6	781.55	90.4	-0.95	-0.01
	12-Feb-15	–	–	–	–	682.0	662.0	672.0	784.05	591.6	571.6	581.6	785.60	90.4	-1.55	-0.02
	19-May-15	–	–	–	–	682.0	662.0	672.0	781.11	591.6	571.6	581.6	780.82	90.4	0.29	0.00
	10-Aug-15	–	–	–	–	682.0	662.0	672.0	780.44	591.6	571.6	581.6	780.66	90.4	-0.22	0.00
																0.00

Table 2.4.12-9 (Sheet 10 of 26) Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-409U/L (Upper/Lower)	24-Sep-13	752.0	732.0	742.0	744.72	717.6	697.6	707.6	771.91	–	–	–	–	34.4	-27.19	-0.79
	1-Oct-13	752.0	732.0	742.0	742.84	717.6	697.6	707.6	770.47	–	–	–	–	34.4	-27.63	-0.80
	9-Oct-13	752.0	732.0	742.0	741.31	717.6	697.6	707.6	764.45	–	–	–	–	34.4	-23.14	-0.67
	26-Oct-13	752.0	732.0	742.0	740.84	717.6	697.6	707.6	760.40	–	–	–	–	34.4	-19.56	-0.57
	5-Nov-13	752.0	732.0	742.0	740.79	717.6	697.6	707.6	759.02	–	–	–	–	34.4	-18.23	-0.53
	12-Nov-13	752.0	732.0	742.0	739.77	717.6	697.6	707.6	758.21	–	–	–	–	34.4	-18.44	-0.54
	23-Nov-13	752.0	732.0	742.0	739.10	717.6	697.6	707.6	768.26	–	–	–	–	34.4	-29.16	-0.85
	9-Dec-13	752.0	732.0	742.0	762.56	717.6	697.6	707.6	779.22	–	–	–	–	34.4	-16.66	-0.48
	20-Dec-13	752.0	732.0	742.0	741.99	717.6	697.6	707.6	773.06	–	–	–	–	34.4	-31.07	-0.90
	13-Jan-14	752.0	732.0	742.0	756.04	717.6	697.6	707.6	777.13	–	–	–	–	34.4	-21.09	-0.61
	16-Jan-14	752.0	732.0	742.0	753.35	717.6	697.6	707.6	776.43	–	–	–	–	34.4	-23.08	-0.67
	18-Feb-14	752.0	732.0	742.0	743.63	717.6	697.6	707.6	774.07	–	–	–	–	34.4	-30.44	-0.88
	16-Mar-14	752.0	732.0	742.0	738.31	717.6	697.6	707.6	769.68	–	–	–	–	34.4	-31.37	-0.91
	15-Apr-14	752.0	732.0	742.0	741.14	717.6	697.6	707.6	771.70	–	–	–	–	34.4	-30.56	-0.89
	15-May-14	752.0	732.0	742.0	746.09	717.6	697.6	707.6	769.67	–	–	–	–	34.4	-23.58	-0.69
	16-Jun-14	752.0	732.0	742.0	743.56	717.6	697.6	707.6	770.54	–	–	–	–	34.4	-26.98	-0.78
	16-Jul-14	752.0	732.0	742.0	741.15	717.6	697.6	707.6	761.63	–	–	–	–	34.4	-20.48	-0.60
	18-Aug-14	752.0	732.0	742.0	743.10	717.6	697.6	707.6	770.31	–	–	–	–	34.4	-27.21	-0.79
	4-Nov-14	752.0	732.0	742.0	740.91	717.6	697.6	707.6	760.74	–	–	–	–	34.4	-19.83	-0.58
	12-Feb-15	752.0	732.0	742.0	738.39	717.6	697.6	707.6	766.10	–	–	–	–	34.4	-27.71	-0.81
	19-May-15	752.0	732.0	742.0	741.10	717.6	697.6	707.6	756.67	–	–	–	–	34.4	-15.57	-0.45
	10-Aug-15	752.0	732.0	742.0	741.84	717.6	697.6	707.6	756.68	–	–	–	–	34.4	-14.84	-0.43
																-0.69

Table 2.4.12-9 (Sheet 11 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-415U/L (Upper/Lower)	24-Sep-13	756.0	736.0	746.0	758.80	628.8	608.8	618.8	763.83	–	–	–	–	127.2	-5.03	-0.04
	1-Oct-13	756.0	736.0	746.0	757.81	628.8	608.8	618.8	765.02	–	–	–	–	127.2	-7.21	-0.06
	9-Oct-13	756.0	736.0	746.0	756.09	628.8	608.8	618.8	765.46	–	–	–	–	127.2	-9.37	-0.07
	26-Oct-13	756.0	736.0	746.0	755.21	628.8	608.8	618.8	765.40	–	–	–	–	127.2	-10.19	-0.08
	5-Nov-13	756.0	736.0	746.0	754.89	628.8	608.8	618.8	765.26	–	–	–	–	127.2	-10.37	-0.08
	12-Nov-13	756.0	736.0	746.0	754.78	628.8	608.8	618.8	765.19	–	–	–	–	127.2	-10.41	-0.08
	23-Nov-13	756.0	736.0	746.0	756.38	628.8	608.8	618.8	766.13	–	–	–	–	127.2	-9.75	-0.08
	9-Dec-13	756.0	736.0	746.0	772.02	628.8	608.8	618.8	771.91	–	–	–	–	127.2	0.11	0.00
	20-Dec-13	756.0	736.0	746.0	764.40	628.8	608.8	618.8	770.87	–	–	–	–	127.2	-6.47	-0.05
	13-Jan-14	756.0	736.0	746.0	767.22	628.8	608.8	618.8	NM	–	–	–	–	127.2	NA	NA
	18-Feb-14	756.0	736.0	746.0	763.22	628.8	608.8	618.8	769.68	–	–	–	–	127.2	-6.46	-0.05
	16-Mar-14	756.0	736.0	746.0	760.06	628.8	608.8	618.8	767.15	–	–	–	–	127.2	-7.09	-0.06
	15-Apr-14	756.0	736.0	746.0	762.12	628.8	608.8	618.8	768.06	–	–	–	–	127.2	-5.94	-0.05
	15-May-14	756.0	736.0	746.0	762.46	628.8	608.8	618.8	767.42	–	–	–	–	127.2	-4.96	-0.04
	16-Jun-14	756.0	736.0	746.0	760.81	628.8	608.8	618.8	768.16	–	–	–	–	127.2	-7.35	-0.06
	16-Jul-14	756.0	736.0	746.0	756.13	628.8	608.8	618.8	766.02	–	–	–	–	127.2	-9.89	-0.08
	18-Aug-14	756.0	736.0	746.0	760.70	628.8	608.8	618.8	769.69	–	–	–	–	127.2	-8.99	-0.07
	4-Nov-14	756.0	736.0	746.0	756.24	628.8	608.8	618.8	766.51	–	–	–	–	127.2	-10.27	-0.08
	12-Feb-15	756.0	736.0	746.0	759.92	628.8	608.8	618.8	767.63	–	–	–	–	127.2	-7.71	-0.06
	19-May-15	756.0	736.0	746.0	756.84	628.8	608.8	618.8	766.55	–	–	–	–	127.2	-9.71	-0.08
	10-Aug-15	756.0	736.0	746.0	757.09	628.8	608.8	618.8	766.77	–	–	–	–	127.2	-9.68	-0.08
																-0.06

Table 2.4.12-9 (Sheet 12 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-416U/L (Upper/Lower)	24-Sep-13	734.1	714.1	724.1	741.44	698.8	678.8	688.8	741.48	–	–	–	–	35.3	-0.04	0.00
	1-Oct-13	734.1	714.1	724.1	741.04	698.8	678.8	688.8	741.08	–	–	–	–	35.3	-0.04	0.00
	9-Oct-13	734.1	714.1	724.1	740.06	698.8	678.8	688.8	740.13	–	–	–	–	35.3	-0.07	0.00
	26-Oct-13	734.1	714.1	724.1	739.89	698.8	678.8	688.8	739.92	–	–	–	–	35.3	-0.03	0.00
	5-Nov-13	734.1	714.1	724.1	739.74	698.8	678.8	688.8	739.79	–	–	–	–	35.3	-0.05	0.00
	12-Nov-13	734.1	714.1	724.1	738.85	698.8	678.8	688.8	738.90	–	–	–	–	35.3	-0.05	0.00
	23-Nov-13	734.1	714.1	724.1	737.22	698.8	678.8	688.8	737.29	–	–	–	–	35.3	-0.07	0.00
	9-Dec-13	734.1	714.1	724.1	745.93	698.8	678.8	688.8	745.56	–	–	–	–	35.3	0.37	0.01
	20-Dec-13	734.1	714.1	724.1	738.50	698.8	678.8	688.8	738.56	–	–	–	–	35.3	-0.06	0.00
	13-Jan-14	734.1	714.1	724.1	742.62	698.8	678.8	688.8	742.60	–	–	–	–	35.3	0.02	0.00
	18-Feb-14	734.1	714.1	724.1	739.24	698.8	678.8	688.8	739.30	–	–	–	–	35.3	-0.06	0.00
	16-Mar-14	734.1	714.1	724.1	736.64	698.8	678.8	688.8	736.75	–	–	–	–	35.3	-0.11	0.00
	15-Apr-14	734.1	714.1	724.1	739.02	698.8	678.8	688.8	739.08	–	–	–	–	35.3	-0.06	0.00
	15-May-14	734.1	714.1	724.1	741.99	698.8	678.8	688.8	742.00	–	–	–	–	35.3	-0.01	0.00
	16-Jun-14	734.1	714.1	724.1	741.19	698.8	678.8	688.8	741.24	–	–	–	–	35.3	-0.05	0.00
	16-Jul-14	734.1	714.1	724.1	740.70	698.8	678.8	688.8	740.72	–	–	–	–	35.3	-0.02	0.00
	18-Aug-14	734.1	714.1	724.1	740.92	698.8	678.8	688.8	740.98	–	–	–	–	35.3	-0.06	0.00
	4-Nov-14	734.1	714.1	724.1	739.92	698.8	678.8	688.8	739.97	–	–	–	–	35.3	-0.05	0.00
	12-Feb-15	734.1	714.1	724.1	736.89	698.8	678.8	688.8	736.94	–	–	–	–	35.3	-0.05	0.00
	19-May-15	734.1	714.1	724.1	740.44	698.8	678.8	688.8	740.49	–	–	–	–	35.3	-0.05	0.00
	10-Aug-15	734.1	714.1	724.1	741.15	698.8	678.8	688.8	741.18	–	–	–	–	35.3	-0.03	0.00
																0.00

Table 2.4.12-9 (Sheet 13 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-417U/L (Upper/Lower)	24-Sep-13	722.2	702.2	712.2	746.97	677.7	657.7	667.7	750.41	–	–	–	–	44.5	-3.44	-0.08
	1-Oct-13	722.2	702.2	712.2	746.77	677.7	657.7	667.7	750.17	–	–	–	–	44.5	-3.40	-0.08
	9-Oct-13	722.2	702.2	712.2	746.41	677.7	657.7	667.7	749.89	–	–	–	–	44.5	-3.48	-0.08
	26-Oct-13	722.2	702.2	712.2	745.93	677.7	657.7	667.7	749.15	–	–	–	–	44.5	-3.22	-0.07
	5-Nov-13	722.2	702.2	712.2	745.58	677.7	657.7	667.7	748.74	–	–	–	–	44.5	-3.16	-0.07
	12-Nov-13	722.2	702.2	712.2	745.09	677.7	657.7	667.7	748.44	–	–	–	–	44.5	-3.35	-0.08
	23-Nov-13	722.2	702.2	712.2	744.30	677.7	657.7	667.7	747.77	–	–	–	–	44.5	-3.47	-0.08
	9-Dec-13	722.2	702.2	712.2	748.15	677.7	657.7	667.7	748.61	–	–	–	–	44.5	-0.46	-0.01
	20-Dec-13	722.2	702.2	712.2	747.39	677.7	657.7	667.7	750.11	–	–	–	–	44.5	-2.72	-0.06
	13-Jan-14	722.2	702.2	712.2	749.18	677.7	657.7	667.7	752.28	–	–	–	–	44.5	-3.10	-0.07
	16-Jan-14	722.2	702.2	712.2	749.42	677.7	657.7	667.7	752.53	–	–	–	–	44.5	-3.11	-0.07
	18-Feb-14	722.2	702.2	712.2	747.71	677.7	657.7	667.7	751.87	–	–	–	–	44.5	-4.16	-0.09
	16-Mar-14	722.2	702.2	712.2	746.82	677.7	657.7	667.7	751.44	–	–	–	–	44.5	-4.62	-0.10
	15-Apr-14	722.2	702.2	712.2	746.63	677.7	657.7	667.7	751.29	–	–	–	–	44.5	-4.66	-0.10
	15-May-14	722.2	702.2	712.2	747.35	677.7	657.7	667.7	750.56	–	–	–	–	44.5	-3.21	-0.07
	16-Jun-14	722.2	702.2	712.2	745.42	677.7	657.7	667.7	749.38	–	–	–	–	44.5	-3.96	-0.09
	16-Jul-14	722.2	702.2	712.2	744.94	677.7	657.7	667.7	748.66	–	–	–	–	44.5	-3.72	-0.08
	18-Aug-14	722.2	702.2	712.2	745.17	677.7	657.7	667.7	748.55	–	–	–	–	44.5	-3.38	-0.08
	4-Nov-14	722.2	702.2	712.2	744.94	677.7	657.7	667.7	748.32	–	–	–	–	44.5	-3.38	-0.08
	12-Feb-15	722.2	702.2	712.2	745.80	677.7	657.7	667.7	750.96	–	–	–	–	44.5	-5.16	-0.12
	19-May-15	722.2	702.2	712.2	746.05	677.7	657.7	667.7	750.79	–	–	–	–	44.5	-4.74	-0.11
	10-Aug-15	722.2	702.2	712.2	745.92	677.7	657.7	667.7	750.16	–	–	–	–	44.5	-4.24	-0.10
																-0.08

Table 2.4.12-9 (Sheet 14 of 26) Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-418U/L (Upper/Lower)	24-Sep-13	715.0	705.0	710.0	750.96	674.6	654.6	664.6	748.21	–	–	–	–	45.4	2.75	0.06
	1-Oct-13	715.0	705.0	710.0	751.02	674.6	654.6	664.6	746.88	–	–	–	–	45.4	4.14	0.09
	9-Oct-13	715.0	705.0	710.0	750.61	674.6	654.6	664.6	745.77	–	–	–	–	45.4	4.84	0.11
	26-Oct-13	715.0	705.0	710.0	749.38	674.6	654.6	664.6	744.96	–	–	–	–	45.4	4.42	0.10
	5-Nov-13	715.0	705.0	710.0	748.53	674.6	654.6	664.6	744.31	–	–	–	–	45.4	4.22	0.09
	12-Nov-13	715.0	705.0	710.0	747.83	674.6	654.6	664.6	743.54	–	–	–	–	45.4	4.29	0.09
	23-Nov-13	715.0	705.0	710.0	747.17	674.6	654.6	664.6	742.98	–	–	–	–	45.4	4.19	0.09
	9-Dec-13	715.0	705.0	710.0	761.40	674.6	654.6	664.6	750.56	–	–	–	–	45.4	10.84	0.24
	20-Dec-13	715.0	705.0	710.0	754.59	674.6	654.6	664.6	752.07	–	–	–	–	45.4	2.52	0.06
	13-Jan-14	715.0	705.0	710.0	757.14	674.6	654.6	664.6	753.03	–	–	–	–	45.4	4.11	0.09
	18-Feb-14	715.0	705.0	710.0	755.36	674.6	654.6	664.6	751.43	–	–	–	–	45.4	3.93	0.09
	16-Mar-14	715.0	705.0	710.0	754.81	674.6	654.6	664.6	749.21	–	–	–	–	45.4	5.60	0.12
	15-Apr-14	715.0	705.0	710.0	755.25	674.6	654.6	664.6	749.83	–	–	–	–	45.4	5.42	0.12
	15-May-14	715.0	705.0	710.0	752.70	674.6	654.6	664.6	748.58	–	–	–	–	45.4	4.12	0.09
	16-Jun-14	715.0	705.0	710.0	750.61	674.6	654.6	664.6	747.88	–	–	–	–	45.4	2.73	0.06
	16-Jul-14	715.0	705.0	710.0	749.86	674.6	654.6	664.6	745.04	–	–	–	–	45.4	4.82	0.11
	18-Aug-14	715.0	705.0	710.0	750.95	674.6	654.6	664.6	750.26	–	–	–	–	45.4	0.69	0.02
	4-Nov-14	715.0	705.0	710.0	749.93	674.6	654.6	664.6	745.07	–	–	–	–	45.4	4.86	0.11
	12-Feb-15	715.0	705.0	710.0	753.45	674.6	654.6	664.6	747.99	–	–	–	–	45.4	5.46	0.12
	19-May-15	715.0	705.0	710.0	751.81	674.6	654.6	664.6	746.24	–	–	–	–	45.4	5.57	0.12
	10-Aug-15	715.0	705.0	710.0	752.26	674.6	654.6	664.6	746.41	–	–	–	–	45.4	5.85	0.13
																0.10

Table 2.4.12-9 (Sheet 15 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-419U/L (Upper/Lower)	24-Sep-13	742.8	722.8	732.8	757.40	695.3	675.3	685.3	756.40	–	–	–	–	47.5	1.00	0.02
	1-Oct-13	742.8	722.8	732.8	753.19	695.3	675.3	685.3	752.89	–	–	–	–	47.5	0.30	0.01
	9-Oct-13	742.8	722.8	732.8	749.58	695.3	675.3	685.3	749.68	–	–	–	–	47.5	-0.10	0.00
	26-Oct-13	742.8	722.8	732.8	748.62	695.3	675.3	685.3	748.72	–	–	–	–	47.5	-0.10	0.00
	5-Nov-13	742.8	722.8	732.8	748.41	695.3	675.3	685.3	748.52	–	–	–	–	47.5	-0.11	0.00
	12-Nov-13	742.8	722.8	732.8	748.31	695.3	675.3	685.3	748.45	–	–	–	–	47.5	-0.14	0.00
	23-Nov-13	742.8	722.8	732.8	751.16	695.3	675.3	685.3	751.07	–	–	–	–	47.5	0.09	0.00
	9-Dec-13	742.8	722.8	732.8	767.70	695.3	675.3	685.3	763.57	–	–	–	–	47.5	4.13	0.09
	20-Dec-13	742.8	722.8	732.8	759.76	695.3	675.3	685.3	758.77	–	–	–	–	47.5	0.99	0.02
	13-Jan-14	742.8	722.8	732.8	763.71	695.3	675.3	685.3	761.86	–	–	–	–	47.5	1.85	0.04
	18-Feb-14	742.8	722.8	732.8	758.78	695.3	675.3	685.3	758.00	–	–	–	–	47.5	0.78	0.02
	16-Mar-14	742.8	722.8	732.8	755.60	695.3	675.3	685.3	755.12	–	–	–	–	47.5	0.48	0.01
	15-Apr-14	742.8	722.8	732.8	757.75	695.3	675.3	685.3	757.09	–	–	–	–	47.5	0.66	0.01
	15-May-14	742.8	722.8	732.8	753.90	695.3	675.3	685.3	752.49	–	–	–	–	47.5	1.41	0.03
	16-Jun-14	742.8	722.8	732.8	757.11	695.3	675.3	685.3	755.99	–	–	–	–	47.5	1.12	0.02
	16-Jul-14	742.8	722.8	732.8	748.44	695.3	675.3	685.3	748.59	–	–	–	–	47.5	-0.15	0.00
	18-Aug-14	742.8	722.8	732.8	759.19	695.3	675.3	685.3	757.84	–	–	–	–	47.5	1.35	0.03
	4-Nov-14	742.8	722.8	732.8	748.77	695.3	675.3	685.3	748.84	–	–	–	–	47.5	-0.07	0.00
	12-Feb-15	742.8	722.8	732.8	753.79	695.3	675.3	685.3	753.23	–	–	–	–	47.5	0.56	0.01
	19-May-15	742.8	722.8	732.8	748.18	695.3	675.3	685.3	748.34	–	–	–	–	47.5	-0.16	0.00
	10-Aug-15	742.8	722.8	732.8	748.46	695.3	675.3	685.3	748.53	–	–	–	–	47.5	-0.07	0.00
																0.01

Table 2.4.12-9 (Sheet 16 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-420U/L (Upper/Lower)	24-Sep-13	776.9	756.9	766.9	758.87	672.2	652.2	662.2	742.13	–	–	–	–	104.7	16.74	0.16
	1-Oct-13	776.9	756.9	766.9	757.99	672.2	652.2	662.2	741.38	–	–	–	–	104.7	16.61	0.16
	9-Oct-13	776.9	756.9	766.9	757.04	672.2	652.2	662.2	740.97	–	–	–	–	104.7	16.07	0.15
	26-Oct-13	776.9	756.9	766.9	Dry	672.2	652.2	662.2	741.01	–	–	–	–	104.7	NA	NA
	5-Nov-13	776.9	756.9	766.9	Dry	672.2	652.2	662.2	740.66	–	–	–	–	104.7	NA	NA
	12-Nov-13	776.9	756.9	766.9	Dry	672.2	652.2	662.2	740.05	–	–	–	–	104.7	NA	NA
	23-Nov-13	776.9	756.9	766.9	758.61	672.2	652.2	662.2	736.59	–	–	–	–	104.7	22.02	0.21
	9-Dec-13	776.9	756.9	766.9	760.58	672.2	652.2	662.2	744.97	–	–	–	–	104.7	15.61	0.15
	20-Dec-13	776.9	756.9	766.9	758.88	672.2	652.2	662.2	739.99	–	–	–	–	104.7	18.89	0.18
	13-Jan-14	776.9	756.9	766.9	759.04	672.2	652.2	662.2	745.43	–	–	–	–	104.7	13.61	0.13
	18-Feb-14	776.9	756.9	766.9	759.13	672.2	652.2	662.2	741.77	–	–	–	–	104.7	17.36	0.17
	16-Mar-14	776.9	756.9	766.9	758.33	672.2	652.2	662.2	739.83	–	–	–	–	104.7	18.50	0.18
	15-Apr-14	776.9	756.9	766.9	758.69	672.2	652.2	662.2	741.64	–	–	–	–	104.7	17.05	0.16
	15-May-14	776.9	756.9	766.9	759.28	672.2	652.2	662.2	743.53	–	–	–	–	104.7	15.75	0.15
	16-Jun-14	776.9	756.9	766.9	759.23	672.2	652.2	662.2	741.98	–	–	–	–	104.7	17.25	0.16
	16-Jul-14	776.9	756.9	766.9	758.02	672.2	652.2	662.2	741.21	–	–	–	–	104.7	16.81	0.16
	18-Aug-14	776.9	756.9	766.9	758.72	672.2	652.2	662.2	741.75	–	–	–	–	104.7	16.97	0.16
	4-Nov-14	776.9	756.9	766.9	758.06	672.2	652.2	662.2	740.67	–	–	–	–	104.7	17.39	0.17
	12-Feb-15	776.9	756.9	766.9	758.67	672.2	652.2	662.2	739.28	–	–	–	–	104.7	19.39	0.19
	19-May-15	776.9	756.9	766.9	756.92	672.2	652.2	662.2	741.72	–	–	–	–	104.7	15.20	0.15
	10-Aug-15	776.9	756.9	766.9	757.12	672.2	652.2	662.2	741.62	–	–	–	–	104.7	15.50	0.15
																0.16

Table 2.4.12-9 (Sheet 17 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone						
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Δz	Δh	i_v
OW-421U/L (Upper/Lower)	24-Sep-13	750.4	730.4	740.4	753.23	700.0	680.0	690.0	709.27	–	–	–	–	50.4	43.96	0.87
	1-Oct-13	750.4	730.4	740.4	754.36	700.0	680.0	690.0	737.20	–	–	–	–	50.4	17.16	0.34
	8-9 Oct-13	750.4	730.4	740.4	754.48	700.0	680.0	690.0	746.66	–	–	–	–	50.4	7.82	0.16
	26-Oct-13	750.4	730.4	740.4	754.12	700.0	680.0	690.0	747.92	–	–	–	–	50.4	6.20	0.12
	5-Nov-13	750.4	730.4	740.4	754.14	700.0	680.0	690.0	748.04	–	–	–	–	50.4	6.10	0.12
	12-Nov-13	750.4	730.4	740.4	754.18	700.0	680.0	690.0	747.90	–	–	–	–	50.4	6.28	0.12
	23-Nov-13	750.4	730.4	740.4	754.15	700.0	680.0	690.0	688.34	–	–	–	–	50.4	65.81	1.31
	9-Dec-13	750.4	730.4	740.4	754.23	700.0	680.0	690.0	744.68	–	–	–	–	50.4	9.55	0.19
	20-Dec-13	750.4	730.4	740.4	754.45	700.0	680.0	690.0	749.45	–	–	–	–	50.4	5.00	0.10
	13-Jan-14	750.4	730.4	740.4	754.55	700.0	680.0	690.0	750.43	–	–	–	–	50.4	4.12	0.08
	18-Feb-14	750.4	730.4	740.4	754.45	700.0	680.0	690.0	750.26	–	–	–	–	50.4	4.19	0.08
	16-Mar-14	750.4	730.4	740.4	754.51	700.0	680.0	690.0	750.11	–	–	–	–	50.4	4.40	0.09
	15-Apr-14	750.4	730.4	740.4	754.70	700.0	680.0	690.0	750.39	–	–	–	–	50.4	4.31	0.09
	15-May-14	750.4	730.4	740.4	754.51	700.0	680.0	690.0	750.30	–	–	–	–	50.4	4.21	0.08
	16-Jun-14	750.4	730.4	740.4	754.30	700.0	680.0	690.0	750.11	–	–	–	–	50.4	4.19	0.08
	16-Jul-14	750.4	730.4	740.4	754.31	700.0	680.0	690.0	749.88	–	–	–	–	50.4	4.43	0.09
	18-Aug-14	750.4	730.4	740.4	754.31	700.0	680.0	690.0	749.93	–	–	–	–	50.4	4.38	0.09
	4-Nov-14	750.4	730.4	740.4	754.06	700.0	680.0	690.0	749.98	–	–	–	–	50.4	4.08	0.08
	12-Feb-15	750.4	730.4	740.4	754.57	700.0	680.0	690.0	749.86	–	–	–	–	50.4	4.71	0.09
	19-May-15	750.4	730.4	740.4	754.12	700.0	680.0	690.0	750.06	–	–	–	–	50.4	4.06	0.08
	10-Aug-15	750.4	730.4	740.4	754.10	700.0	680.0	690.0	750.10	–	–	–	–	50.4	4.00	0.08
																0.11

Table 2.4.12-9 (Sheet 18 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-421U/D (Upper/Deeper)	24-Sep-13	750.4	730.4	740.4	753.23	–	–	–	–	626.8	606.8	616.8	629.04	123.6	124.19	1.00
	1-Oct-13	750.4	730.4	740.4	754.36	–	–	–	–	626.8	606.8	616.8	669.54	123.6	84.82	0.69
	8-9 Oct-13	750.4	730.4	740.4	754.48	–	–	–	–	626.8	606.8	616.8	703.13	123.6	51.35	0.42
	26-Oct-13	750.4	730.4	740.4	754.12	–	–	–	–	626.8	606.8	616.8	733.19	123.6	20.93	0.17
	5-Nov-13	750.4	730.4	740.4	754.14	–	–	–	–	626.8	606.8	616.8	739.70	123.6	14.44	0.12
	12-Nov-13	750.4	730.4	740.4	754.18	–	–	–	–	626.8	606.8	616.8	741.91	123.6	12.27	0.10
	23-Nov-13	750.4	730.4	740.4	754.15	–	–	–	–	626.8	606.8	616.8	743.40	123.6	10.75	0.09
	9-Dec-13	750.4	730.4	740.4	754.23	–	–	–	–	626.8	606.8	616.8	744.02	123.6	10.21	0.08
	20-Dec-13	750.4	730.4	740.4	754.45	–	–	–	–	626.8	606.8	616.8	745.20	123.6	9.25	0.07
	13-Jan-14	750.4	730.4	740.4	754.55	–	–	–	–	626.8	606.8	616.8	719.16	123.6	35.39	0.29
	18-Feb-14	750.4	730.4	740.4	754.45	–	–	–	–	626.8	606.8	616.8	744.70	123.6	9.75	0.08
	16-Mar-14	750.4	730.4	740.4	754.51	–	–	–	–	626.8	606.8	616.8	745.90	123.6	8.61	0.07
	15-Apr-14	750.4	730.4	740.4	754.70	–	–	–	–	626.8	606.8	616.8	745.78	123.6	8.92	0.07
	15-May-14	750.4	730.4	740.4	754.51	–	–	–	–	626.8	606.8	616.8	742.91	123.6	11.60	0.09
	16-Jun-14	750.4	730.4	740.4	754.30	–	–	–	–	626.8	606.8	616.8	746.18	123.6	8.12	0.07
	16-Jul-14	750.4	730.4	740.4	754.31	–	–	–	–	626.8	606.8	616.8	746.47	123.6	7.84	0.06
	18-Aug-14	750.4	730.4	740.4	754.31	–	–	–	–	626.8	606.8	616.8	746.53	123.6	7.78	0.06
	4-Nov-14	750.4	730.4	740.4	754.06	–	–	–	–	626.8	606.8	616.8	746.59	123.6	7.47	0.06
	12-Feb-15	750.4	730.4	740.4	754.57	–	–	–	–	626.8	606.8	616.8	745.48	123.6	9.09	0.07
	19-May-15	750.4	730.4	740.4	754.12	–	–	–	–	626.8	606.8	616.8	746.55	123.6	7.57	0.06
	10-Aug-15	750.4	730.4	740.4	754.10	–	–	–	–	626.8	606.8	616.8	747.10	123.6	7.00	0.06
																0.08

Table 2.4.12-9 (Sheet 19 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-421L/D (Lower/Deeper)	24-Sep-13	–	–	–	–	700.0	680.0	690.0	709.27	626.8	606.8	616.8	629.04	73.2	80.23	1.10
	1-Oct-13	–	–	–	–	700.0	680.0	690.0	737.20	626.8	606.8	616.8	669.54	73.2	67.66	0.92
	8-9 Oct-13	–	–	–	–	700.0	680.0	690.0	746.66	626.8	606.8	616.8	703.13	73.2	43.53	0.59
	26-Oct-13	–	–	–	–	700.0	680.0	690.0	747.92	626.8	606.8	616.8	733.19	73.2	14.73	0.20
	5-Nov-13	–	–	–	–	700.0	680.0	690.0	748.04	626.8	606.8	616.8	739.70	73.2	8.34	0.11
	12-Nov-13	–	–	–	–	700.0	680.0	690.0	747.90	626.8	606.8	616.8	741.91	73.2	5.99	0.08
	23-Nov-13	–	–	–	–	700.0	680.0	690.0	688.34	626.8	606.8	616.8	743.40	73.2	-55.06	-0.75
	9-Dec-13	–	–	–	–	700.0	680.0	690.0	744.68	626.8	606.8	616.8	744.02	73.2	0.66	0.01
	20-Dec-13	–	–	–	–	700.0	680.0	690.0	749.45	626.8	606.8	616.8	745.20	73.2	4.25	0.06
	13-Jan-14	–	–	–	–	700.0	680.0	690.0	750.43	626.8	606.8	616.8	719.16	73.2	31.27	0.43
	18-Feb-14	–	–	–	–	700.0	680.0	690.0	750.26	626.8	606.8	616.8	744.70	73.2	5.56	0.08
	16-Mar-14	–	–	–	–	700.0	680.0	690.0	750.11	626.8	606.8	616.8	745.90	73.2	4.21	0.06
	15-Apr-14	–	–	–	–	700.0	680.0	690.0	750.39	626.8	606.8	616.8	745.78	73.2	4.61	0.06
	15-May-14	–	–	–	–	700.0	680.0	690.0	750.30	626.8	606.8	616.8	742.91	73.2	7.39	0.10
	16-Jun-14	–	–	–	–	700.0	680.0	690.0	750.11	626.8	606.8	616.8	746.18	73.2	3.93	0.05
	16-Jul-14	–	–	–	–	700.0	680.0	690.0	749.88	626.8	606.8	616.8	746.47	73.2	3.41	0.05
	18-Aug-14	–	–	–	–	700.0	680.0	690.0	749.93	626.8	606.8	616.8	746.53	73.2	3.40	0.05
	4-Nov-14	–	–	–	–	700.0	680.0	690.0	749.98	626.8	606.8	616.8	746.59	73.2	3.39	0.05
	12-Feb-15	–	–	–	–	700.0	680.0	690.0	749.86	626.8	606.8	616.8	745.48	73.2	4.38	0.06
	19-May-15	–	–	–	–	700.0	680.0	690.0	750.06	626.8	606.8	616.8	746.55	73.2	3.51	0.05
	10-Aug-15	–	–	–	–	700.0	680.0	690.0	750.10	626.8	606.8	616.8	747.10	73.2	3.00	0.04
																0.07

Table 2.4.12-9 (Sheet 20 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-423U/L (Upper/Lower)	24-Sep-13	755.2	735.2	745.2	761.43	658.4	638.4	648.4	771.60	–	–	–	–	96.8	-10.17	-0.11
	1-Oct-13	755.2	735.2	745.2	760.46	658.4	638.4	648.4	769.65	–	–	–	–	96.8	-9.19	-0.09
	9-Oct-13	755.2	735.2	745.2	760.36	658.4	638.4	648.4	765.89	–	–	–	–	96.8	-5.53	-0.06
	26-Oct-13	755.2	735.2	745.2	758.49	658.4	638.4	648.4	763.72	–	–	–	–	96.8	-5.23	-0.05
	5-Nov-13	755.2	735.2	745.2	757.93	658.4	638.4	648.4	762.85	–	–	–	–	96.8	-4.92	-0.05
	12-Nov-13	755.2	735.2	745.2	757.29	658.4	638.4	648.4	762.13	–	–	–	–	96.8	-4.84	-0.05
	23-Nov-13	755.2	735.2	745.2	758.68	658.4	638.4	648.4	763.36	–	–	–	–	96.8	-4.68	-0.05
	9-Dec-13	755.2	735.2	745.2	765.60	658.4	638.4	648.4	780.29	–	–	–	–	96.8	-14.69	-0.15
	20-Dec-13	755.2	735.2	745.2	760.92	658.4	638.4	648.4	774.24	–	–	–	–	96.8	-13.32	-0.14
	13-Jan-14	755.2	735.2	745.2	762.28	658.4	638.4	648.4	776.65	–	–	–	–	96.8	-14.37	-0.15
	16-Jan-14	755.2	735.2	745.2	762.00	658.4	638.4	648.4	777.16	–	–	–	–	96.8	-15.16	-0.16
	18-Feb-14	755.2	735.2	745.2	761.51	658.4	638.4	648.4	775.23	–	–	–	–	96.8	-13.72	-0.14
	16-Mar-14	755.2	735.2	745.2	761.17	658.4	638.4	648.4	774.00	–	–	–	–	96.8	-12.83	-0.13
	15-Apr-14	755.2	735.2	745.2	761.26	658.4	638.4	648.4	774.83	–	–	–	–	96.8	-13.57	-0.14
	15-May-14	755.2	735.2	745.2	762.04	658.4	638.4	648.4	772.85	–	–	–	–	96.8	-10.81	-0.11
	16-Jun-14	755.2	735.2	745.2	760.81	658.4	638.4	648.4	771.24	–	–	–	–	96.8	-10.43	-0.11
	16-Jul-14	755.2	735.2	745.2	759.71	658.4	638.4	648.4	768.64	–	–	–	–	96.8	-8.93	-0.09
	18-Aug-14	755.2	735.2	745.2	760.62	658.4	638.4	648.4	773.19	–	–	–	–	96.8	-12.57	-0.13
	4-Nov-14	755.2	735.2	745.2	759.97	658.4	638.4	648.4	770.46	–	–	–	–	96.8	-10.49	-0.11
	12-Feb-15	755.2	735.2	745.2	760.89	658.4	638.4	648.4	774.03	–	–	–	–	96.8	-13.14	-0.14
	19-May-15	755.2	735.2	745.2	760.34	658.4	638.4	648.4	771.95	–	–	–	–	96.8	-11.61	-0.12
	10-Aug-15	755.2	735.2	745.2	760.49	658.4	638.4	648.4	771.38	–	–	–	–	96.8	-10.89	-0.11
																-0.11

Table 2.4.12-9 (Sheet 21 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-423U/D (Upper/Deeper)	24-Sep-13	755.2	735.2	745.2	761.43	–	–	–	–	551.8	531.8	541.80	775.52	203.4	-14.09	-0.07
	1-Oct-13	755.2	735.2	745.2	760.46	–	–	–	–	551.8	531.8	541.80	775.77	203.4	-15.31	-0.08
	9-Oct-13	755.2	735.2	745.2	760.36	–	–	–	–	551.8	531.8	541.80	774.88	203.4	-14.52	-0.07
	26-Oct-13	755.2	735.2	745.2	758.49	–	–	–	–	551.8	531.8	541.80	772.06	203.4	-13.57	-0.07
	5-Nov-13	755.2	735.2	745.2	757.93	–	–	–	–	551.8	531.8	541.80	771.19	203.4	-13.26	-0.07
	12-Nov-13	755.2	735.2	745.2	757.29	–	–	–	–	551.8	531.8	541.80	770.81	203.4	-13.52	-0.07
	23-Nov-13	755.2	735.2	745.2	758.68	–	–	–	–	551.8	531.8	541.80	772.70	203.4	-14.02	-0.07
	9-Dec-13	755.2	735.2	745.2	765.60	–	–	–	–	551.8	531.8	541.80	782.28	203.4	-16.68	-0.08
	20-Dec-13	755.2	735.2	745.2	760.92	–	–	–	–	551.8	531.8	541.80	782.42	203.4	-21.50	-0.11
	13-Jan-14	755.2	735.2	745.2	762.28	–	–	–	–	551.8	531.8	541.80	784.91	203.4	-22.63	-0.11
	16-Jan-14	755.2	735.2	745.2	762.00	–	–	–	–	551.8	531.8	541.80	786.36	203.4	-24.36	-0.12
	18-Feb-14	755.2	735.2	745.2	761.51	–	–	–	–	551.8	531.8	541.80	782.40	203.4	-20.89	-0.10
	16-Mar-14	755.2	735.2	745.2	761.17	–	–	–	–	551.8	531.8	541.80	780.98	203.4	-19.81	-0.10
	15-Apr-14	755.2	735.2	745.2	761.26	–	–	–	–	551.8	531.8	541.80	783.21	203.4	-21.95	-0.11
	15-May-14	755.2	735.2	745.2	762.04	–	–	–	–	551.8	531.8	541.80	778.91	203.4	-16.87	-0.08
	16-Jun-14	755.2	735.2	745.2	760.81	–	–	–	–	551.8	531.8	541.80	776.92	203.4	-16.11	-0.08
	16-Jul-14	755.2	735.2	745.2	759.71	–	–	–	–	551.8	531.8	541.80	774.48	203.4	-14.77	-0.07
	18-Aug-14	755.2	735.2	745.2	760.62	–	–	–	–	551.8	531.8	541.80	778.31	203.4	-17.69	-0.09
	4-Nov-14	755.2	735.2	745.2	759.97	–	–	–	–	551.8	531.8	541.80	775.30	203.4	-15.33	-0.08
	12-Feb-15	755.2	735.2	745.2	760.89	–	–	–	–	551.8	531.8	541.80	781.84	203.4	-20.95	-0.10
	19-May-15	755.2	735.2	745.2	760.34	–	–	–	–	551.8	531.8	541.80	777.84	203.4	-17.50	-0.09
	10-Aug-15	755.2	735.2	745.2	760.49	–	–	–	–	551.8	531.8	541.80	776.72	203.4	-16.23	-0.08
																-0.09

Table 2.4.12-9 (Sheet 22 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-423L/D (Lower/Deeper)	24-Sep-13	–	–	–	–	658.4	638.4	648.4	771.60	551.8	531.8	541.8	775.52	106.6	-3.92	-0.04
	1-Oct-13	–	–	–	–	658.4	638.4	648.4	769.65	551.8	531.8	541.8	775.77	106.6	-6.12	-0.06
	9-Oct-13	–	–	–	–	658.4	638.4	648.4	765.89	551.8	531.8	541.8	774.88	106.6	-8.99	-0.08
	26-Oct-13	–	–	–	–	658.4	638.4	648.4	763.72	551.8	531.8	541.8	772.06	106.6	-8.34	-0.08
	5-Nov-13	–	–	–	–	658.4	638.4	648.4	762.85	551.8	531.8	541.8	771.19	106.6	-8.34	-0.08
	12-Nov-13	–	–	–	–	658.4	638.4	648.4	762.13	551.8	531.8	541.8	770.81	106.6	-8.68	-0.08
	23-Nov-13	–	–	–	–	658.4	638.4	648.4	763.36	551.8	531.8	541.8	772.70	106.6	-9.34	-0.09
	9-Dec-13	–	–	–	–	658.4	638.4	648.4	780.29	551.8	531.8	541.8	782.28	106.6	-1.99	-0.02
	20-Dec-13	–	–	–	–	658.4	638.4	648.4	774.24	551.8	531.8	541.8	782.42	106.6	-8.18	-0.08
	13-Jan-14	–	–	–	–	658.4	638.4	648.4	776.65	551.8	531.8	541.8	784.91	106.6	-8.26	-0.08
	16-Jan-14	–	–	–	–	658.4	638.4	648.4	777.16	551.8	531.8	541.8	786.36	106.6	-9.20	-0.09
	18-Feb-14	–	–	–	–	658.4	638.4	648.4	775.23	551.8	531.8	541.8	782.40	106.6	-7.17	-0.07
	16-Mar-14	–	–	–	–	658.4	638.4	648.4	774.00	551.8	531.8	541.8	780.98	106.6	-6.98	-0.07
	15-Apr-14	–	–	–	–	658.4	638.4	648.4	774.83	551.8	531.8	541.8	783.21	106.6	-8.38	-0.08
	15-May-14	–	–	–	–	658.4	638.4	648.4	772.85	551.8	531.8	541.8	778.91	106.6	-6.06	-0.06
	16-Jun-14	–	–	–	–	658.4	638.4	648.4	771.24	551.8	531.8	541.8	776.92	106.6	-5.68	-0.05
	16-Jul-14	–	–	–	–	658.4	638.4	648.4	768.64	551.8	531.8	541.8	774.48	106.6	-5.84	-0.05
	18-Aug-14	–	–	–	–	658.4	638.4	648.4	773.19	551.8	531.8	541.8	778.31	106.6	-5.12	-0.05
	4-Nov-14	–	–	–	–	658.4	638.4	648.4	770.46	551.8	531.8	541.8	775.30	106.6	-4.84	-0.05
	12-Feb-15	–	–	–	–	658.4	638.4	648.4	774.03	551.8	531.8	541.8	781.84	106.6	-7.81	-0.07
	19-May-15	–	–	–	–	658.4	638.4	648.4	771.95	551.8	531.8	541.8	777.84	106.6	-5.89	-0.06
	10-Aug-15	–	–	–	–	658.4	638.4	648.4	771.38	551.8	531.8	541.8	776.72	106.6	-5.34	-0.05
																-0.06

Table 2.4.12-9 (Sheet 23 of 26) Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-428U/L (Upper/Lower)	5-Nov-13	763.9	743.9	753.9	765.27	688.7	668.7	678.7	NM	–	–	–	–	75.20	NA	NA
	12-Nov-13	763.9	743.9	753.9	764.94	688.7	668.7	678.7	758.83	–	–	–	–	75.20	6.11	0.08
	23-Nov-13	763.9	743.9	753.9	773.13	688.7	668.7	678.7	782.21	–	–	–	–	75.20	-9.08	-0.12
	9-Dec-13	763.9	743.9	753.9	790.27	688.7	668.7	678.7	787.21	–	–	–	–	75.20	3.06	0.04
	20-Dec-13	763.9	743.9	753.9	785.43	688.7	668.7	678.7	778.42	–	–	–	–	75.20	7.01	0.09
	9-Jan-14	763.9	743.9	753.9	NM	688.7	668.7	678.7	NM	–	–	–	–	75.20	NA	NA
	13-Jan-14	763.9	743.9	753.9	791.44	688.7	668.7	678.7	789.46	–	–	–	–	75.20	1.98	0.03
	16-Jan-14	763.9	743.9	753.9	NM	688.7	668.7	678.7	NM	–	–	–	–	75.20	NA	NA
	18-Feb-14	763.9	743.9	753.9	788.43	688.7	668.7	678.7	790.14	–	–	–	–	75.20	-1.71	-0.02
	16-Mar-14	763.9	743.9	753.9	785.08	688.7	668.7	678.7	790.74	–	–	–	–	75.20	-5.66	-0.08
	15-Apr-14	763.9	743.9	753.9	787.62	688.7	668.7	678.7	791.00	–	–	–	–	75.20	-3.38	-0.04
	15-May-14	763.9	743.9	753.9	786.42	688.7	668.7	678.7	790.97	–	–	–	–	75.20	-4.55	-0.06
	16-Jun-14	763.9	743.9	753.9	782.39	688.7	668.7	678.7	790.89	–	–	–	–	75.20	-8.50	-0.11
	16-Jul-14	763.9	743.9	753.9	776.93	688.7	668.7	678.7	790.84	–	–	–	–	75.20	-13.91	-0.18
	18-Aug-14	763.9	743.9	753.9	782.16	688.7	668.7	678.7	790.88	–	–	–	–	75.20	-8.72	-0.12
	4-Nov-14	763.9	743.9	753.9	777.56	688.7	668.7	678.7	791.00	–	–	–	–	75.20	-13.44	-0.18
	12-Feb-15	763.9	743.9	753.9	785.41	688.7	668.7	678.7	791.37	–	–	–	–	75.20	-5.96	-0.08
	19-May-15	763.9	743.9	753.9	779.93	688.7	668.7	678.7	791.33	–	–	–	–	75.20	-11.40	-0.15
	10-Aug-15	763.9	743.9	753.9	779.84	688.7	668.7	678.7	791.15	–	–	–	–	75.20	-11.31	-0.15
																-0.07

Table 2.4.12-9 (Sheet 24 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone						
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Δz	Δh	i_v
OW-428U/D (Upper/Deeper)	5-Nov-13	763.9	743.9	753.9	765.27	–	–	–	–	613.5	593.5	603.5	NM	150.4	NA	NA
	12-Nov-13	763.9	743.9	753.9	764.94	–	–	–	–	613.5	593.5	603.5	629.81	150.4	135.13	0.90
	23-Nov-13	763.9	743.9	753.9	773.13	–	–	–	–	613.5	593.5	603.5	761.53	150.4	11.60	0.08
	9-Dec-13	763.9	743.9	753.9	790.27	–	–	–	–	613.5	593.5	603.5	795.98	150.4	-5.71	-0.04
	20-Dec-13	763.9	743.9	753.9	785.43	–	–	–	–	613.5	593.5	603.5	779.64	150.4	5.79	0.04
	9-Jan-14	763.9	743.9	753.9	NM	–	–	–	–	613.5	593.5	603.5	788.66	150.4	NA	NA
	13-Jan-14	763.9	743.9	753.9	791.44	–	–	–	–	613.5	593.5	603.5	NM	150.4	NA	NA
	16-Jan-14	763.9	743.9	753.9	NM	–	–	–	–	613.5	593.5	603.5	795.60	150.4	NA	NA
	18-Feb-14	763.9	743.9	753.9	788.43	–	–	–	–	613.5	593.5	603.5	797.23	150.4	-8.80	-0.06
	16-Mar-14	763.9	743.9	753.9	785.08	–	–	–	–	613.5	593.5	603.5	795.07	150.4	-9.99	-0.07
	15-Apr-14	763.9	743.9	753.9	787.62	–	–	–	–	613.5	593.5	603.5	795.60	150.4	-7.98	-0.05
	15-May-14	763.9	743.9	753.9	786.42	–	–	–	–	613.5	593.5	603.5	793.60	150.4	-7.18	-0.05
	16-Jun-14	763.9	743.9	753.9	782.39	–	–	–	–	613.5	593.5	603.5	793.43	150.4	-11.04	-0.07
	16-Jul-14	763.9	743.9	753.9	776.93	–	–	–	–	613.5	593.5	603.5	790.55	150.4	-13.62	-0.09
	18-Aug-14	763.9	743.9	753.9	782.16	–	–	–	–	613.5	593.5	603.5	795.44	150.4	-13.28	-0.09
	4-Nov-14	763.9	743.9	753.9	777.56	–	–	–	–	613.5	593.5	603.5	788.77	150.4	-11.21	-0.07
	12-Feb-15	763.9	743.9	753.9	785.41	–	–	–	–	613.5	593.5	603.5	794.07	150.4	-8.66	-0.06
	19-May-15	763.9	743.9	753.9	779.93	–	–	–	–	613.5	593.5	603.5	790.81	150.4	-10.88	-0.07
	10-Aug-15	763.9	743.9	753.9	779.84	–	–	–	–	613.5	593.5	603.5	791.22	150.4	-11.38	-0.08
																-0.07

Table 2.4.12-9 (Sheet 25 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-428L/D (Lower/Deeper)	5-Nov-13	–	–	–	–	688.7	668.7	678.7	NM	613.5	593.5	603.5	NM	75.2	NA	NA
	12-Nov-13	–	–	–	–	688.7	668.7	678.7	758.83	613.5	593.5	603.5	629.81	75.2	129.02	1.72
	23-Nov-13	–	–	–	–	688.7	668.7	678.7	782.21	613.5	593.5	603.5	761.53	75.2	20.68	0.27
	9-Dec-13	–	–	–	–	688.7	668.7	678.7	787.21	613.5	593.5	603.5	795.98	75.2	-8.77	-0.12
	20-Dec-13	–	–	–	–	688.7	668.7	678.7	778.42	613.5	593.5	603.5	779.64	75.2	-1.22	-0.02
	9-Jan-14	–	–	–	–	688.7	668.7	678.7	NM	613.5	593.5	603.5	788.66	75.2	NA	NA
	13-Jan-14	–	–	–	–	688.7	668.7	678.7	789.46	613.5	593.5	603.5	NM	75.2	NA	NA
	16-Jan-14	–	–	–	–	688.7	668.7	678.7	NM	613.5	593.5	603.5	795.60	75.2	NA	NA
	18-Feb-14	–	–	–	–	688.7	668.7	678.7	790.14	613.5	593.5	603.5	797.23	75.2	-7.09	-0.09
	16-Mar-14	–	–	–	–	688.7	668.7	678.7	790.74	613.5	593.5	603.5	795.07	75.2	-4.33	-0.06
	15-Apr-14	–	–	–	–	688.7	668.7	678.7	791.00	613.5	593.5	603.5	795.60	75.2	-4.60	-0.06
	15-May-14	–	–	–	–	688.7	668.7	678.7	790.97	613.5	593.5	603.5	793.60	75.2	-2.63	-0.03
	16-Jun-14	–	–	–	–	688.7	668.7	678.7	790.89	613.5	593.5	603.5	793.43	75.2	-2.54	-0.03
	16-Jul-14	–	–	–	–	688.7	668.7	678.7	790.84	613.5	593.5	603.5	790.55	75.2	0.29	0.00
	18-Aug-14	–	–	–	–	688.7	668.7	678.7	790.88	613.5	593.5	603.5	795.44	75.2	-4.56	-0.06
	4-Nov-14	–	–	–	–	688.7	668.7	678.7	791.00	613.5	593.5	603.5	788.77	75.2	2.23	0.03
	12-Feb-15	–	–	–	–	688.7	668.7	678.7	791.37	613.5	593.5	603.5	794.07	75.2	-2.70	-0.04
	19-May-15	–	–	–	–	688.7	668.7	678.7	791.33	613.5	593.5	603.5	790.81	75.2	0.52	0.01
	10-Aug-15	–	–	–	–	688.7	668.7	678.7	791.15	613.5	593.5	603.5	791.22	75.2	-0.07	0.00
																-0.04

Table 2.4.12-9 (Sheet 26 of 26)
Vertical Hydraulic Gradients

Well Pair	Date	Upper Zone				Lower Zone				Deeper Zone				Δz	Δh	i_v
		Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)	Top of screen (NAVD88)	Bottom of screen (NAVD88)	Midpoint (NAVD88)	Elevation of Water (NAVD88)			
OW-429U/L (Upper/Lower)	12-Nov-13	759.4	739.4	749.4	758.70	651.2	631.2	641.2	636.85	–	–	–	–	108.2	121.85	1.13
	23-Nov-13	759.4	739.4	749.4	762.10	651.2	631.2	641.2	638.49	–	–	–	–	108.2	123.61	1.14
	9-Dec-13	759.4	739.4	749.4	766.89	651.2	631.2	641.2	640.19	–	–	–	–	108.2	126.70	1.17
	20-Dec-13	759.4	739.4	749.4	768.22	651.2	631.2	641.2	641.29	–	–	–	–	108.2	126.93	1.17
	13-Jan-14	759.4	739.4	749.4	768.20	651.2	631.2	641.2	639.49	–	–	–	–	108.2	128.71	1.19
	18-Feb-14	759.4	739.4	749.4	766.89	651.2	631.2	641.2	642.72	–	–	–	–	108.2	124.17	1.15
	16-Mar-14	759.4	739.4	749.4	766.17	651.2	631.2	641.2	644.89	–	–	–	–	108.2	121.28	1.12
	15-Apr-14	759.4	739.4	749.4	766.46	651.2	631.2	641.2	647.32	–	–	–	–	108.2	119.14	1.10
	15-May-14	759.4	739.4	749.4	764.73	651.2	631.2	641.2	644.54	–	–	–	–	108.2	120.19	1.11
	16-Jun-14	759.4	739.4	749.4	763.42	651.2	631.2	641.2	646.99	–	–	–	–	108.2	116.43	1.08
	16-Jul-14	759.4	739.4	749.4	762.42	651.2	631.2	641.2	649.17	–	–	–	–	108.2	113.25	1.05
	18-Aug-14	759.4	739.4	749.4	764.16	651.2	631.2	641.2	651.84	–	–	–	–	108.2	112.32	1.04
	4-Nov-14	759.4	739.4	749.4	762.46	651.2	631.2	641.2	662.02	–	–	–	–	108.2	100.44	0.93
	12-Feb-15	759.4	739.4	749.4	765.26	651.2	631.2	641.2	674.70	–	–	–	–	108.2	90.56	0.84
	19-May-15	759.4	739.4	749.4	764.20	651.2	631.2	641.2	686.34	–	–	–	–	108.2	77.86	0.72
	10-Aug-15	759.4	739.4	749.4	764.28	651.2	631.2	641.2	695.56	–	–	–	–	108.2	68.72	0.64
																1.03

Notes:

Indicates averages of the vertical hydraulic gradient for the nested well pair. This does not include the anomalies in yellow.

Indicates an anomaly or suspect measurement.

NM = Not Measured
NA = Not Applicable
Dry = Water level was below the bottom of the well.
Δz =Difference between mid-point elevations of zones
Δh = Groundwater elevation differences between zones
i_v = Vertical hydraulic gradient (Δh/Δz)

Table 2.4.12-10 (Sheet 1 of 3)
Borehole Packer Test Results Summary

Boring	Zone	Geologic Unit Formation	Depth (ft below ground)	Estimated Transmissivity (ft^2/day)	Estimated Hydraulic Conductivity (ft/day)	Analysis Notes
MP-101	Z1	Chickamauga Benbolt	27.5 to 35.0	7	0.9	None
MP-101	Z2	Chickamauga Rockdell	145.0 to 152.5	20	3	None
MP-202	Z1	Chickamauga Fleanor member	41.7 to 49.2	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-202	Z2	Chickamauga Fleanor member	153.0 to 160.5	2	0.3	None
MP-202	Z3	Chickamauga Fleanor member	182.0 to 189.5	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-401	Z2	Knox Newala	28.0 to 35.5	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-401	Z3	Knox Newala	77.0 to 84.5	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-401	Z4	Knox Newala	237.0 to 244.5	3	0.4	Test results indicate higher transmissivity value for higher pressures. Possible explanations for the test behavior include fracture dilation or fracture washout.
MP-415	Z1	Chickamauga Bowen	27.5 to 35.0	High	High	High flow rates (exceeding 80 gpm) with pressure increase in the transducer above the test interval. The target test pressure in the interval was not achieved and the test was aborted. The high flow rates suggest high hydraulic conductivity.
MP-415	Z2	Chickamauga Benbolt	162.5 to 170.0	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-415	Z3	Chickamauga Benbolt	252.5 to 260.0	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-416	Z2	Chickamauga Rockdell	89.0 to 96.5	1	0.2	Flow for this test was low, behavior suggests nonlinear flow.
MP-416	Z3	Chickamauga Rockdell	109.0 to 116.5	8	1	None

Table 2.4.12-10 (Sheet 2 of 3)
Borehole Packer Test Results Summary

Boring	Zone	Geologic Unit Formation	Depth (ft below ground)	Estimated Transmissivity (ft^2/day)	Estimated Hydraulic Conductivity (ft/day)	Analysis Notes
MP-416	Z4	Chickamauga Rockdell	205.0 to 212.5	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-417	Z1	Chickamauga Fleanor member	61.5 to 69.0	10	2	Some response was observed in the transducers above and below the test interval. Flow did not increase in highly nonlinear fashion, suggesting an indirect connection to the borehole outside the test interval.
MP-417	Z2	Chickamauga Fleanor member	84.0 to 91.5	3	0.5	None
MP-417	Z3	Chickamauga Eidson member	210.5 to 218.0	3	0.4	None
MP-418A	Z1	Chickamauga Eidson member	86.0 to 93.5	40	5	None
MP-418A	Z2	Chickamauga Blackford	139.0 to 146.5	1	0.2	None
MP-418A	Z3	Chickamauga Blackford	240.0 to 247.5	0.3	0.04	None
MP-419	Z1	Knox Newala	210.0 to 217.5	1	0.2	None
MP-419	Z2	Knox Newala	135.0 to 142.5	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-419	Z3	Knox Newala	120.0 to 127.5	2	0.3	None
MP-419	Z4	Knox Newala	109.0 to 116.5	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-420	Z2	Knox Newala	79.0 to 86.5	2	0.2	None
MP-420	Z3	Knox Newala	100.0 to 107.5	10	2	None
MP-420	Z4	Knox Newala	132.5 to 140.0	8	1	None

Table 2.4.12-10 (Sheet 3 of 3)
Borehole Packer Test Results Summary

Boring	Zone	Geologic Unit Formation	Depth (ft below ground)	Estimated Transmissivity (ft^2/day)	Estimated Hydraulic Conductivity (ft/day)	Analysis Notes
MP-420	Z5	Knox Newala	166.0 to 173.5	5	0.7	None
MP-420	Z6	Knox Newala	186.0 to 193.5	10	1	None
MP-421	Z1	Chickamauga Blackford	57.0 to 64.5	1	0.2	None
MP-421	Z2	Chickamauga Blackford	99.0 to 106.5	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-421	Z3	Knox Newala	121.0 to 128.5	0.8	0.1	None
MP-421	Z4	Knox Newala	228.0 to 235.5	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-422	Z1	Chickamauga Benbolt	31.5 to 39.0	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-422	Z2	Chickamauga Benbolt	50.0 to 57.5	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-422	Z3	Chickamauga Benbolt	170.0 to 177.5	Low	Low	Low/negligible flow suggests low hydraulic conductivity.
MP-423	Z2	Chickamauga Eidson member	68.5 to 76.0	5	0.7	Much higher flows in later portion of test, which achieved the highest test pressure. There was no response in the transducers above or below the test interval, indicating that there was no hydraulic connection outside the test interval. Possible explanations for the test behavior include fracture dilation or fracture washout.

Notes:

Hydraulic conductivity values were computed based on unrounded transmissivity values; both values were then rounded to one significant figure.

Low – Qualitative indication of low transmissivity and hydraulic conductivity—below the test method’s ability to determine transmissivity and hydraulic conductivity.

High – Qualitative indication of high transmissivity and hydraulic conductivity—above the test method’s ability to determine to determine transmissivity and hydraulic conductivity.

Table 2.4.12-11 (Sheet 1 of 3)
Well Slug Test Results Summary

Well Name	Test Type	Falling Head Hydraulic Conductivity Estimate (ft/day)	Rising Head Hydraulic Conductivity Estimate (ft/day)	Test Average Hydraulic Conductivity (ft/day)	Geologic Unit Formation	Analysis Notes
OW-101D	Pneumatic	0.13	0.063	0.097	Chickamauga Group Rockdell	None
OW-101L	Pneumatic	7.6	7.5	7.6	Chickamauga Group Rockdell	None
OW-101U	Pneumatic	0.049	0.053	0.051	Chickamauga Group Benbolt	None
OW-202D	Solid	0.068	0.024	0.046	Chickamauga Group Eidson Member	None
OW-202L	Solid	–	–	–	Chickamauga Group Fleanor	Both tests discarded—Static water level discrepancy and normalized head never reaches 0.3 to 0.2[a]
OW-401D	Solid	–	–	–	Knox Group Newala	Not analyzed—Head does not change after initiation
OW-401L	Pneumatic	0.059	0.092	0.076	Knox Group Newala	None
OW-401U	Pneumatic	0.089	0.065	0.077	Knox Group Newala	None
OW-409L	Pneumatic	0.069	0.061	0.065	Chickamauga Group Rockdell	None
OW-409U	Solid	–	0.14	0.14	Chickamauga Group Rockdell	Falling head not analyzed—Irregular response
OW-415L	Pneumatic	–	0.29	0.29	Chickamauga Group Benbolt	Falling head discarded—Normalized head never reaches 0.3 to 0.2[a]
OW-415U	Solid	–	–	–	Chickamauga Group Bowen/Benbolt	Not analyzed—Irregular response
OW-416L	Pneumatic	0.61	0.48	0.54	Chickamauga Group Rockdell	None
OW-416U	Pneumatic	1.2	1.1	1.2	Chickamauga Group Rockdell	None

Table 2.4.12-11 (Sheet 2 of 3)
Well Slug Test Results Summary

Well Name	Test Type	Falling Head Hydraulic Conductivity Estimate (ft/day)	Rising Head Hydraulic Conductivity Estimate (ft/day)	Test Average Hydraulic Conductivity (ft/day)	Geologic Unit Formation	Analysis Notes
OW-417L	Pneumatic	0.31	0.44	0.38	Chickamauga Group Fleanor Member	None
OW-417U	Pneumatic	2.2	1.6	1.9	Chickamauga Group Fleanor Member	None
OW-418L	Pneumatic	0.16	0.14	0.15	Chickamauga Group Blackford	None
OW-418U	Pneumatic	0.21	0.21	0.21	Chickamauga Group Eidson Member	None
OW-419L	Pneumatic	2.7	3.6	3.2	Knox Group Newala	None
OW-419U	Pneumatic	11	13	12	Knox Group Newala	None
OW-420L	Solid	0.062	0.048	0.055	Knox Group Newala	None
OW-421D	Solid	–	–	–	Knox Group Newala	Not analyzed—Irregular early-time response
OW-421L	Solid	–	0.00055	0.00055	Knox/Chickamauga Newala/Blackford	Falling head not analyzed—Head does not decrease after initiation
OW-421U	Solid	0.066	0.036	0.051	Chickamauga Group Blackford	None
OW-423D	Pneumatic	0.039	–	0.039	Chickamauga Group Blackford	Rising head discarded—Normalized head never reaches 0.3 to 0.2[a]
OW-423L	Solid	0.10	0.095	0.098	Chickamauga Group Blackford	None
OW-423U	Pneumatic	2.3	0.66	1.5	Chickamauga Group Eidson Member	None
OW-428L	Solid	0.012	0.0022	0.0071	Chickamauga Group Rockdell	None

Table 2.4.12-11 (Sheet 3 of 3)
Well Slug Test Results Summary

Well Name	Test Type	Falling Head Hydraulic Conductivity Estimate (ft/day)	Rising Head Hydraulic Conductivity Estimate (ft/day)	Test Average Hydraulic Conductivity (ft/day)	Geologic Unit Formation	Analysis Notes
OW-428U	Solid	0.0016	0.012	0.0068	Chickamauga Group Rockdell	None
OW-429U	Solid	0.0035	–	0.0035	Chickamauga Group Bowen/Benbolt	Rising head discarded—Normalized head never reaches 0.3 to 0.2[(a)]

(a) Normalized head between 0.3 and 0.2 represents the optimal area on the response curve to analyze the test.

Notes:

Dash (–) = See “Analysis Notes” column.

Table 2.4.12-12
Clinch River Nuclear Site Constant Rate Aquifer Pumping Test Results

Well Name	Orientation Relative to Pumping Well	Transmissivity Pumping Period T_p (ft^2/d)	Transmissivity Recovery Period T_r (ft^2/d)	Storage Coefficient Pumping Period (dimensionless)	Hydraulic Conductivity $(T_p+T_r)/2/155$ ft (ft/d)
PT-OW-U1	N7°E	10.6	7	5.37×10^{-4}	0.06
PT-OW-L1	N7°E	129.3	128.7	3.10×10^{-3}	0.8
PT-OW-U2	N38°W	28.4	22.2	4.83×10^{-2}	0.2
PT-OW-L2	N38°W	28.1	30.3	2.28×10^{-3}	0.2
PT-OW-L3	S7°E	11.8	8.0	2.73×10^{-4}	0.06
OW-423L	N52°E	410.1	391.1	8.1×10^{-3}[a]	2.6

(a) A storage coefficient of 8.9×10^{-10} was reported for the pumping period of observation well OW-423L and is considered a nonrealistic value; however, for the same well in the recovery period, a value of 8.1×10^{-3} was reported—the recovery period derivative data exhibited less noise.

Table 2.4.12-13 (Sheet 1 of 5)
Rock Effective Porosity Measurements on the Oak Ridge Reservation

Borehole	Group	Unit[(a)]	Depth (m)	Depth (ft)	Effective Porosity (%)				Grain Density		Bulk Density		Data Source[(c)]
					Helium	Mercury	Immersion[(b)]	Other	(g/cm^3)	(pcf)	(g/cm^3)	(pcf)	
Joy-1	Conasauga	Pumpkin Valley Shale	201.2	660	–	–	0.46	–	–	–	–	–	A
Joy-1	Conasauga	Pumpkin Valley Shale	219.2	719	–	–	1.1	–	–	–	–	–	A
Joy-1	Conasauga	Pumpkin Valley Shale	244.2	801	–	–	1.9	–	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	52.1	171	–	–	–	0.4	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	52.7	173	–	–	–	0.1	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	57.9	190	–	–	–	1.1	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	58.5	192	–	–	–	0.4	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	65.1	214	–	–	–	0.3	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	66.1	217	–	–	–	1.5	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	71.8	236	–	–	–	0.7	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	73	240	–	–	–	0.1	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	77	253	–	–	–	2.0	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	80.2	263	–	–	–	0.8	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	81.7	268	–	–	–	1.9	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	83.5	274	–	–	–	2.7	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	93.9	308	–	–	–	1.5	–	–	–	–	A
05MW013A	Conasauga	Dismal Gap	94.6	310	–	–	–	1.9	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	105.8	347	–	–	–	3.4	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	107.3	352	–	–	–	1.8	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	115.9	380	–	–	–	1.3	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	116.3	382	–	–	–	0.9	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	122.7	403	–	–	–	1.0	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	130.8	429	–	–	–	2.3	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	132.6	435	–	–	–	1.3	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	135.3	444	–	–	–	1.4	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	138.1	453	–	–	–	2.1	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	141.4	464	–	–	–	1.7	–	–	–	–	A

Table 2.4.12-13 (Sheet 2 of 5)
Rock Effective Porosity Measurements on the Oak Ridge Reservation

Borehole	Group	Unit[(a)]	Depth (m)	Depth (ft)	Effective Porosity (%)				Grain Density		Bulk Density		Data Source[(c)]
					Helium	Mercury	Immersion[(b)]	Other	(g/cm^3)	(pcf)	(g/cm^3)	(pcf)	
05MW013A	Conasauga	Rogersville Shale	141.7	465	–	–	–	1.6	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	147.2	483	–	–	–	0.8	–	–	–	–	A
05MW013A	Conasauga	Rogersville Shale	151.5	497	–	–	–	0.6	–	–	–	–	A
GW-133	Conasauga	Dismal Gap	41.07	135	11.4	3.8	7.67	–	2.73	170	2.64	165	A
GW-133	Conasauga	Dismal Gap	67.18	220	12.7	4.9	11.47	–	2.78	174	2.71	169	A
GW-133	Conasauga	Dismal Gap	80.52	264	10.2	3.1	11.83	–	2.74	171	2.73	170	A
GW-133	Conasauga	Dismal Gap	114.53	376	7.6	3.4	11.51	–	2.74	171	2.70	169	A
GW-133	Conasauga	Rogersville Shale	138.73	455	11.5	3	10.9	–	2.72	170	2.67	167	A
GW-133	Conasauga	Rogersville Shale	163.12	535	12.7	3.5	11.03	–	2.75	172	2.71	169	A
GW-133	Conasauga	Rogersville Shale	165.56	543	19.2	4.4	9.75	–	2.81	175	2.74	171	A
GW-132	Conasauga	Friendship	45.95	151	–	–	9.16	–	–	–	–	–	A
GW-132	Conasauga	Friendship	65.33	214	5.1	2.9	9.39	–	2.73	170	2.72	170	A
GW-132	Conasauga	Pumpkin Valley Shale	90.73	298	9.3	3.8	9.24	–	2.77	173	2.70	169	A
GW-132	Conasauga	Pumpkin Valley Shale	102.97	338	10.7	3.0	10.35	–	2.76	172	2.72	170	A
GW-132	Conasauga	Pumpkin Valley Shale	130.71	429	–	–	11.41	–	–	–	–	–	A
GW-132	Conasauga	Pumpkin Valley Shale	130.76	429	6.3	4.5	9.43	–	2.82	176	2.72	170	A
GW-132	Conasauga	Pumpkin Valley Shale	187.83	616	3.8	3.1	11.44	–	2.78	174	2.77	173	A
GW-134	Conasauga	Nolichucky Shale	44.45	146	9.9	2.7	9.46	–	2.73	170	2.69	168	A
GW-134	Conasauga	Nolichucky Shale	58.27	191	12.2	3.4	11.52	–	2.78	174	2.70	169	A
GW-134	Conasauga	Nolichucky Shale	80.29	263	3.2	3.8	12.04	–	2.79	174	2.71	169	A
GW-134	Conasauga	Nolichucky Shale	99.80	327	2.9	4.3	13.29	–	2.79	174	2.69	168	A
GW-134	Conasauga	Nolichucky Shale	109.53	359	4.9	4.3	15.87	–	2.76	172	2.77	173	A
GW-134	Conasauga	Nolichucky Shale	151.59	497	3.9	4.0	9.16	–	2.79	174	2.70	169	A
GW-134	Conasauga	Nolichucky Shale	158.27	519	4.7	5.1	11.60	–	2.70	169	2.68	167	A
GW-134	Conasauga	Nolichucky Shale	171.86	564	14.7	4.2	11.95	–	2.79	174	2.67	167	A
GW-134	Conasauga	Nolichucky Shale	181.14	594	4.1	3.7	11.74	–	2.77	173	2.69	168	A
GW-134	Conasauga	Nolichucky Shale	201.19	660	10.4	3.2	10.57	–	2.80	175	2.67	167	A

Table 2.4.12-13 (Sheet 3 of 5)
Rock Effective Porosity Measurements on the Oak Ridge Reservation

Borehole	Group	Unit[(a)]	Depth (m)	Depth (ft)	Effective Porosity (%)				Grain Density		Bulk Density		Data Source[(c)]
					Helium	Mercury	Immersion[(b)]	Other	(g/cm^3)	(pcf)	(g/cm^3)	(pcf)	
WOL-1	Conasauga	Nolichucky Shale	12.04	40	–	–	13.00	–	–	–	–	–	A
WOL-1	Conasauga	Nolichucky Shale	26.67	88	4.4	4.2	3.67	–	2.83	177	2.74	171	A
WOL-1	Conasauga	Nolichucky Shale	38.41	126	5.3	4.1	–	–	2.79	174	2.71	169	A
WOL-1	Conasauga	Nolichucky Shale	57.38	188	6.0	5.2	10.81	–	2.82	176	2.72	170	A
WOL-1	Conasauga	Nolichucky Shale	99.90	328	10.9	3.2	11.80	–	2.77	173	2.71	169	A
WOL-1	Conasauga	Dismal Gap	243.84	800	15.4	3.4	7.43	–	2.79	174	2.67	167	A
WOL-1	Conasauga	Friendship	320.09	1050	7.8	3.5	6.84	–	2.79	174	2.74	171	A
WOL-1	Conasauga	Pumpkin Valley Shale	352.60	1157	3.5	3.2	5.35	–	2.79	174	2.76	172	A
0.5MW012A	Conasauga	Dismal Gap	38.34	126	–	–	5.41	–	–	–	–	–	A
0.5MW012A	Conasauga	Dismal Gap	51.44	169	3.9	3.1	12.84	–	2.77	173	2.72	170	A
0.5MW012A	Conasauga	Rogersville Shale	83.10	273	11.8	4.2	4.58	–	2.81	175	2.73	170	A
0.5MW012A	Conasauga	Rogersville Shale	118.10	387	–	–	9.59	–	–	–	–	–	A
0.5MW012A	Conasauga	Rogersville Shale	135.13	443	3.7	4.5	7.97	–	2.78	174	2.70	169	A
0.5MW012A	Conasauga	Friendship	148.10	486	3.6	4.5	6.44	–	2.78	174	2.68	167	A
GW-131	Knox	Copper Ridge Dolomite	127.76	419	0.59	–	1.02	–	2.83	177	2.82	176	B
GW-131	Knox	Copper Ridge Dolomite	134.80	442	0.22	–	0.56	–	2.82	176	2.81	175	B
GW-131	Knox	Copper Ridge Dolomite	136.96	449	1.13	–	1.30	–	2.82	176	2.79	174	B
GW-131	Knox	Copper Ridge Dolomite	148.69	488	2.77	–	1.82	–	2.83	177	2.75	172	B
GW-131	Knox	Copper Ridge Dolomite	149.23	490	1.25	–	1.03	–	2.84	177	2.80	175	B
GW-131	Knox	Copper Ridge Dolomite	151.56	497	2.40	–	2.43	–	2.86	179	2.79	174	B
GW-131	Knox	Copper Ridge Dolomite	154.28	506	2.17	–	3.62	–	2.79	174	2.73	170	B
GW-131	Knox	Copper Ridge Dolomite	159.56	523	1.19	–	2.04	–	2.80	175	2.77	173	B
GW-131	Knox	Copper Ridge Dolomite	175.16	575	1.62	–	1.65	–	2.84	177	2.79	174	B
GW-131	Knox	Copper Ridge Dolomite	179.05	587	0.81	–	0.54	–	2.81	175	2.79	174	B
GW-131	Conasauga	Maynardville Limestone	183.72	603	0.45	–	0.45	–	2.82	176	2.81	175	B
GW-131	Conasauga	Maynardville Limestone	188.93	620	0.61	–	0.54	–	2.70	169	2.69	168	B
GW-131	Conasauga	Maynardville Limestone	195.45	641	1.12	–	0.88	–	2.78	174	2.75	172	B

Table 2.4.12-13 (Sheet 4 of 5)
Rock Effective Porosity Measurements on the Oak Ridge Reservation

Borehole	Group	Unit[(a)]	Depth (m)	Depth (ft)	Effective Porosity (%)				Grain Density		Bulk Density		Data Source[(c)]
					Helium	Mercury	Immersion[(b)]	Other	(g/cm^3)	(pcf)	(g/cm^3)	(pcf)	
GW-131	Conasauga	Maynardville Limestone	205.92	676	1.06	–	0.67	–	2.78	174	2.75	172	B
GW-131	Conasauga	Maynardville Limestone	206.35	677	8.13	–	4.52	–	2.85	178	2.62	164	B
GW-131	Conasauga	Maynardville Limestone	217.02	712	0.37	–	0.24	–	2.71	169	2.70	169	B
GW-131	Conasauga	Maynardville Limestone	231.27	759	0.37	–	0.22	–	2.73	170	2.72	170	B
GW-131	Conasauga	Maynardville Limestone	236.88	777	0.22	–	0.21	–	2.71	169	2.71	169	B
GW-131	Conasauga	Maynardville Limestone	248.26	815	0.22	–	1.45	–	2.72	170	2.72	170	B
GW-131	Conasauga	Maynardville Limestone	258.62	848	0.37	–	0.22	–	2.71	169	2.70	169	B
GW-131	Conasauga	Maynardville Limestone	266.27	874	0.37	–	0.31	–	2.71	169	2.70	169	B
GW-131	Conasauga	Maynardville Limestone	268.28	880	0.45	–	0.31	–	2.76	172	2.75	172	B
GW-131	Conasauga	Maynardville Limestone	290.04	952	0.22	–	0.17	–	2.73	170	2.73	170	B
GW-131	Conasauga	Maynardville Limestone	294.44	966	0.22	–	0.29	–	2.72	170	2.72	170	B
GW-131	Conasauga	Maynardville Limestone	301.60	990	0.30	–	0.30	–	2.72	170	2.72	170	B
GW-131	Conasauga	Maynardville Limestone	311.56	1022	0.52	–	0.62	–	2.72	170	2.71	169	B
GW-131	Conasauga	Maynardville Limestone	326.49	1071	0.22	–	0.44	–	2.71	169	2.70	169	B
GW-131	Conasauga	Maynardville Limestone	333.60	1094	0.22	–	0.51	–	2.71	169	2.71	169	B
GW-135	Knox	Copper Ridge Dolomite	155.85	511	0.21	–	0.34	–	2.84	177	2.83	177	B
GW-135	Knox	Copper Ridge Dolomite	177.78	583	0.48	–	0.81	–	2.83	177	2.81	175	B
GW-135	Knox	Copper Ridge Dolomite	184.53	605	0.55	–	1.72	0.3[(d)]	2.79	174	2.78	174	B
GW-135	Knox	Copper Ridge Dolomite	186.23	611	1.47	–	2.91	0.5[(d)]	2.80	175	2.76	172	B
GW-135	Knox	Copper Ridge Dolomite	189.74	623	0.92	–	1.39	–	2.83	177	2.80	175	B
GW-135	Knox	Copper Ridge Dolomite	193.09	633	1.53	–	1.81	1.0[(d)]	2.82	176	2.78	174	B
GW-135	Knox	Copper Ridge Dolomite	202.49	664	4.99	–	3.41	1.3[(d)]	2.87	179	2.72	170	B
GW-135	Conasauga	Maynardville Limestone	212.24	696	0.10	–	0.24	0.3[(d)]	2.74	171	2.73	170	B
GW-135	Conasauga	Maynardville Limestone	223.11	732	3.34	–	2.18	1.4[(d)]	2.84	177	2.75	172	B
GW-135	Conasauga	Maynardville Limestone	227.25	746	4.10	–	1.31	2.3[(d)]	2.84	177	2.72	170	B
GW-135	Conasauga	Maynardville Limestone	234.44	769	1.79	–	1.84	1.7[(d)]	2.84	177	2.79	174	B
GW-135	Conasauga	Maynardville Limestone	243.46	799	0.10	–	0.14	1.2[(d)]	2.70	169	2.70	169	B

Table 2.4.12-13 (Sheet 5 of 5)
Rock Effective Porosity Measurements on the Oak Ridge Reservation

Borehole	Group	Unit[a]	Depth (m)	Depth (ft)	Effective Porosity (%)				Grain Density		Bulk Density		Data Source[c]
					Helium	Mercury	Immersion[b]	Other	(g/cm^3)	(pcf)	(g/cm^3)	(pcf)	
GW-135	Conasauga	Maynardville Limestone	249.53	819	0.46	–	0.24	0.4[d]	2.76	172	2.75	172	B
GW-135	Conasauga	Maynardville Limestone	255.40	838	0.34	–	0.29	2.3[d]	2.70	169	2.69	168	B
GW-135	Conasauga	Maynardville Limestone	268.91	882	0.28	–	0.26	0.2[d]	2.75	172	2.75	172	B
GW-135	Conasauga	Maynardville Limestone	290.53	953	0.36	–	0.29	0.8[d]	2.75	172	2.74	171	B
GW-135	Conasauga	Maynardville Limestone	306.58	1006	0.24	–	0.26	0.4[d]	2.74	171	2.73	170	B
GW-135	Conasauga	Maynardville Limestone	314.96	1033	0.14	–	0.24	0.3[d]	2.70	169	2.70	169	B
GW-135	Conasauga	Maynardville Limestone	318.01	1043	0.56	–	0.29	0.2[d]	2.74	171	2.72	170	B
GW-135	Conasauga	Maynardville Limestone	324.08	1063	0.17	–	0.60	0.4[d]	2.71	169	2.70	169	B
GW-135	Conasauga	Maynardville Limestone	345.49	1133	0.15	–	0.46	0.2[d]	2.71	169	2.70	169	B
GW-135	Conasauga	Maynardville Limestone	365.02	1198	0.06	–	0.34	0.3[d]	2.73	170	2.73	170	B

(a) Unit names for Maryville Limestone and Rutledge Limestone changed to current usage of Dismal Gap and Friendship respectively.
(b) Some values represent the average of several tests.
(c) Data Sources:
A—Reference 2.4.12-31
B—Reference 2.4.12-32
(d) Results from a sample approximately collocated with the other results.

Notes:

Dash (–) = No information is provided in data source.

Summary of Results

	Effective Porosity (%)				Grain Density		Bulk Density	
	Helium	Mercury	Immersion	Other	(g/cm^3)	(pcf)	(g/cm^3)	(pcf)
Number of tests	83	33	90	46	83	83	83	83
Average	3.85	3.79	4.67	1.11	2.77	173	2.73	170
Minimum	0.06	2.7	0.14	0.1	2.70	169	2.62	164
Maximum	19.2	5.2	15.87	3.4	2.87	179	2.83	177

Table 2.4.12-14
Representative Soil and Rock Properties

Group	Unit	Material	Total Unit Weight		Specific Gravity	
			Best Estimate (pcf)	Range (pcf)	Best Estimate	Range
Unconsolidated	Existing Fill/Residual Soil	Silt and Clay	120	NA[b]	2.75	NA[b]
	New Granular Backfill[a]	Well Graded Sand	135	NA[b]	2.70	NA[b]
	Weathered Rock	Limestone/Siltstone	140	NA[b]	NA[b]	NA[b]
Chickamauga	Benbolt formation	Limestone/Siltstone	168	163–170	2.70	2.62–2.72
	Rockdell formation	Limestone	168	160–169	2.69	2.57–2.71
	Fleanor member	Siltstone	168	166–176	2.70	2.67–2.83
	Eidson member	Limestone	168	164–169	2.69	2.64–2.71
	Blackford formation	Limestone/Siltstone	168	164–169	2.68	2.64–2.71
Knox	Newala formation	Dolomite	175	161–177	2.80	2.59–2.84

(a) Based on Tennessee Department of Transportation Type A specification
(b) NA – information not available

Table 2.4.12-15
Field Geochemical Results

Well Number	Date	Geologic Unit Formation	pH (standard units)	Specific Conductance (µS/cm)[(a)]	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (°C)[(b)]	REDOX (±mv)	Purge Water Appearance
OW-101L	11/19/2013	Chickamauga Rockdell	7.17	620	3.86	0.05	16.5	-152.5	Clear, faint sulfur odor
OW-202L[(c)]	11/19/2013	Chickamauga Fleanor Member	9.58	978	193.00	5.16	17.0	-116.9	Red, purged dry
OW-401L	11/21/2013	Knox Newala	7.78	340	14.30	4.21	19.5	9.7	Clear
OW-409U	11/19/2013	Chickamauga Rockdell	7.10	672	49.70	45.30[(d)]	17.2	186.2	Clear
OW-409L	11/18/2013	Chickamauga Rockdell	7.80	849	25.20	3.31	16.0	30.5	Clear
OW-415U	11/20/12013	Chickamauga Bowen/Benbolt	7.24	598	122.00	3.61	17.3	75.7	Clear to slightly cloudy
OW-416L	11/21/2013	Chickamauga Rockdell	7.04	694	1.07	0.25	17.4	-188.1	Clear, sulfur odor
OW-417L	11/21/2013	Chickamauga Fleanor Member	7.21	609	2.55	1.51	16.3	53.4	Clear
OW-418U	11/19/2013	Chickamauga Eidson Member	7.47	517	2.84	1.18	18.8	119.8	Clear
OW-419U	11/20/2013	Knox Newala	6.97	532	1.27	1.15	16.3	63.0	Clear
OW-420L	11/22/2013	Knox Newala	7.56	472	69.90	9.21	17.7	57.5	Clear
OW-421L	11/22/2013	Chickamauga/Knox Blackford/Newala	8.00	400	17.50	8.53	17.0	44.3	Clear
OW-423U	11/19/2013	Chickamauga Eidson Member	6.99	599	5.82	4.70	16.7	90.6	Clear

Notes:
(a) Specific conductance in mS/cm converted to specific conductance in µS/cm by multiplying by 1000 (S = Siemens).
(b) Values rounded to the nearest 0.1°C.
(c) Well purged dry; insufficient water for field parameter testing at time of sampling. Values are last before purged dry.
(d) Suspect results—concentration in excess of maximum oxygen saturation value.

Adapted from Reference 2.4.12-13 Table 3.2.

Table 2.4.12-16
Laboratory Geochemical Results

Well Number	Date	Geologic Unit Formation	Water Type	Analytical Error[a] (%)	Nitrate as N (mg/L)	Qualifier[b]	Nitrite as N (mg/L)	Qualifier[b]	Fluoride (mg/L)	Qualifier[b]	Chloride (mg/L)	Qualifier[b]	Bromide (mg/L)	Qualifier[b]	Sulfate (mg/L)	Bicarbonate (mg/L)[c]	Total Alkalinity (mg/L as $CaCO_3$)	Bicarbonate Alkalinity (mg/L as $CaCO_3$)	Carbonate Alkalinity (mg/L as $CaCO_3$)	Qualifier[b]	Ammonia (mg/L)	Qualifier[b]	Total Dissolved Solids (mg/L)	Calcium (mg/L)	Qualifier[b]	Iron (mg/L)	Qualifier[b]	Potassium (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Sodium (mg/L)	Silicon (mg/L)	Silica (mg/L)
OW-101L	11/19/13	Chickamauga Rockdell	Calcium- Bicarbonate	12	0.0054	JQ	<0.020	U	0.22		2.1		0.038	JQ	42	366	300	300	<5.0	U	0.31	J	370	130	J	0.33		2.1	23	0.05	7.8	3.9	8.3
OW-101L Dup	11/19/13	Chickamauga Rockdell	Calcium- Bicarbonate	3.0	0.0099	JQ	<0.020	U	0.19		2.1		0.04	JQ	43	354	290	290	<5.0	U	0.35	J	370	99	J	0.31		2.1	22	0.048	7.6	4.2	9
OW-202L	11/22/13	Chickamauga Fleanor Member	Sodium- Bicarbonate	-3.2	0.028		<0.020	UL	7.4		24		0.17	JQ	93	732[d]	680	600	78		0.58	J	1100	23		19		14	9.9	0.16	280	82	170
OW-401L	11/21/13	Knox Newala	Calcium- Bicarbonate	1.4	0.15		<0.020	UL	0.20	JH	1.4		<0.25	U	6.9	219	180	180	<5.0	U	0.140	J	190	40		0.14		1.8	22	0.008	0.91	4.7	10
OW-409U	11/19/13	Chickamauga Rockdell	Calcium- Bicarbonate	12	0.88		<0.020	UL	0.25		1.8		<0.25	U	83	329	270	270	<5.0	U	0.099	J	410	140		0.22		1.2	23	0.011	4.8	7.6	16
OW-409L	11/19/13	Chickamauga Rockdell	Sodium- Bicarbonate	1.1	0.12		0.0052	JQ	0.37		2.2		<0.25	U	150	366	300	300	<5.0	U	0.710	J	520	46		0.068		8.1	31	0.017	99	4.6	9.9
OW-415U	11/20/13	Chickamauga Bowen/ Benbolt	Calcium- Bicarbonate	16	0.90		<0.020	UL	0.13		8.8		0.053	JQ	36	329	270	270	<5.0	U	0.140	J	370	150		0.39		2.4	13	0.046	5.2	7.6	16
OW-416L	11/21/13	Chickamauga Rockdell	Calcium- Bicarbonate	-1.7	0.20		<0.020	U	0.39		7.6		0.071	JQ	63	366	300	300	<5.0	U	0.120	J	420	99		0.072		0.77	13	0.020	29	5	11
OW-417L	11/21/13	Chickamauga Fleanor Member	Calcium- Bicarbonate	-0.76	<0.020	U	<0.020	U	0.18		2.8		0.048	JQ	13	390	320	320	<5.0	U	0.140	J	340	61		0.041	JQ	3.4	31	0.021	22	6.1	13
OW-418U	11/20/13	Chickamauga Eidson Member	Calcium- Bicarbonate	0.019	0.68		<0.020	U	0.3		2.7		<0.25	U	20	329	270	270	<5.0	U	0.059	J	300	52		0.055		2.7	19	0.0037	40	8.7	19
OW-419U	11/20/13	Knox Newala	Calcium- Bicarbonate	2.0	0.43		<0.020	U	0.16		1.3		<0.25	U	17	329	270	270	<5.0	U	0.140	J	290	72		0.023	JQ	1.5	29	0.0023	0.91	3.2	6.8
OW-420L	11/22/13	Knox Newala	Calcium- Bicarbonate	2.1	0.36	J	<0.020	UL	0.31	JH	2.1	J	<0.25	U	14	280	230	230	<5.0	U	0.110	J	270	59		0.25		1.8	26	0.033	1.2	4.2	9
OW-420L Dup	11/22/13	Knox Newala	Calcium- Bicarbonate	-0.019	0.25	J	<0.020	UL	0.35		2.6	J	<0.25	U	15	293	240	240	<5.0	U	0.140	J	280	59		0.29		1.9	26	0.032	1.3	4.4	9.4
OW-421L	11/22/13	Chickamauga/ Knox Blackford/ Newala	Magnesium- Bicarbonate	3.9	1.6		<0.020	UL	0.58		2.6		<0.25	U	8.3	256	210	210	<5.0	U	<0.050	UL	230	38		0.23		12	27	0.01	12	6	13
OW-423U	11/19/13	Chickamauga Eidson Member	Calcium- Bicarbonate	4.1	0.14		<0.020	U	0.090	JQ	2.7		<0.25	U	24	354	290	290	<5.0	U	0.083	J	340	99		0.076		1.3	19	0.051	8.7	7.2	15

Notes:
(a) Analytical error is the difference between the sum of the cations and the sum of the anions divided by the sum of the cations and anion and multiplied by 100% (the anion and cation concentrations are in milliequivalents per liter). The analytical error represents the charge balance error of the analysis.
(b) Data Qualifier Definitions.
J = Estimated quantitation based on associated QC data.
JQ = Estimated quantitation; value is between the reporting limit and the detection limit.
JH = Estimated quantitation; possibly biased high based on QC data.
U = Undetected.
UL = Undetected; data biased low: the reporting detection limit is higher than indicated.
(c) Bicarbonate concentration determined by dividing the Bicarbonate Alkalinity by 0.8202 (Reference 2.4.12-48).
(d) Bicarbonate concentration is suspect due to high sample pH (pH = 9.58).
Dup = Duplicate sample.
Data adapted from Reference 2.4.12-13 Table 5.13.

Table 2.4.12-17
Groundwater Linear Velocity and Travel Time

Property	Representative Value	Source
Hydraulic Conductivity (ft/d)	2.6	Maximum calculated value as documented in Table 2.4.12-12 (observation well OW-423L)
Horizontal Hydraulic Gradient (ft/ft)	0.07	Mean value as presented in Table 2.4.12-8
Effective Porosity	0.0467	Mean value determined in Table 2.4.12-13, using the Immersion test method results which the referenced author identified as the test method that yields results that most accurately approaches the true effective porosity value.
Distance to Receptor (ft)	1400	Shortest distance from edge of power block area to Clinch River arm of the Watts Bar Reservoir (Figure 2.4.12-5)

Calculated Values	
Linear Velocity (ft/d)	3.90
Travel Time (days)	359
Travel Time (years)	0.98

Table 2.4.12-18
Characteristics of Individual Wells Located Within a 1.5-mile Radius of the CRN Site

Well Number	Well Use	Estimated Yield (gpm)	Total Depth (feet)	Casing Depth (feet)	Geologic Unit	Finish Type
14500062	Residential	10	100	25	Nolichucky Shale	NR
14500100	Residential	10	92	45	Copper Ridge Dolomite	NR
14500274	Residential	10	195	75	Maynardville Limestone	NR
14501409	Residential	5	160	42	Nolichucky Shale	NR
14501415	Commercial	2	400	25	Nolichucky Shale	NR
14501867	Residential	NR	180	21	Dismal Group Formation (Maryville Limestone)	Open Hole
14501990	Residential	20	145	28	Dismal Group Formation (Maryville Limestone)	Open Hole
14502043	Residential	7	85	31	Dismal Group Formation (Maryville Limestone)	Open Hole
14502044	Residential	7	85	31	Dismal Group Formation (Maryville Limestone)	Open Hole
14502059	Residential	15	102	34	Dismal Group Formation (Maryville Limestone)	Open Hole
14502075	Residential	5	390	20	Dismal Group Formation (Maryville Limestone)	Open Hole
14502085	Farm	2	340	41	Dismal Group Formation (Maryville Limestone)	Open Hole
14502157	Commercial	2	500	62	Dismal Group Formation (Maryville Limestone)	Open Hole
14502179	Residential	20	275	105	Witten Formation	Open Hole
14502230	Residential	7	275	89	Dismal Group Formation (Maryville Limestone)	Open Hole
14509007	Residential	NR	NR	NR	Rockdell Formation	NR
14509008	Residential	NR	42	42	Maynardville Limestone	NR
20005513	Residential	3	526	126	Chepultepec Dolomite	Open Hole
20021254	Residential	9	300	62	Nolichucky Shale	NR
20022808	Residential	3	575	104	Chepultepec Dolomite	Open Hole
20053044	Residential	30	240	126	Maynardville Limestone	Open Hole
20061323	Residential	30	160	105	Copper Ridge Dolomite	Open Hole
20064090	Residential	1	320	105	Fleanor Shale	Open Hole
20074093	Residential	4	900	42	Pumpkin Valley Shale	Open Hole
20082006	Residential	0.5	610	126	Moccasin Formation	Open Hole
20083553	Residential	7	200	63	Moccasin Formation	Open Hole
20091942	Residential	50	220	190	Kingsport Formation.	Open Hole
90001001	Residential	2	470	38	Nolichucky Shale	Open Hole
90002790	Residential	7	373	41	Nolichucky Shale	Open Hole
91002142	Residential	75	547	41	Nolichucky Shale	Open Hole
92003314	Residential	4	360	41	Copper Ridge Dolomite	Open Hole
92003730	Residential	3	503	104	Copper Ridge Dolomite	Open Hole
93000627	Residential	1	300	62	Nolichucky Shale	Open Hole
93003943	Residential	30	118	36	Copper Ridge Dolomite	Open Hole
96000454	Residential	3	465	126	Copper Ridge Dolomite	Open Hole
96002158	Commercial	3	305	75	Witten Formation	Open Hole

Note: NR denotes “Not Reported” and gpm is gallons per minute; the geologic units in which wells are completed was inferred from regional geological mapping; total depth and casing depth are measured from grade.

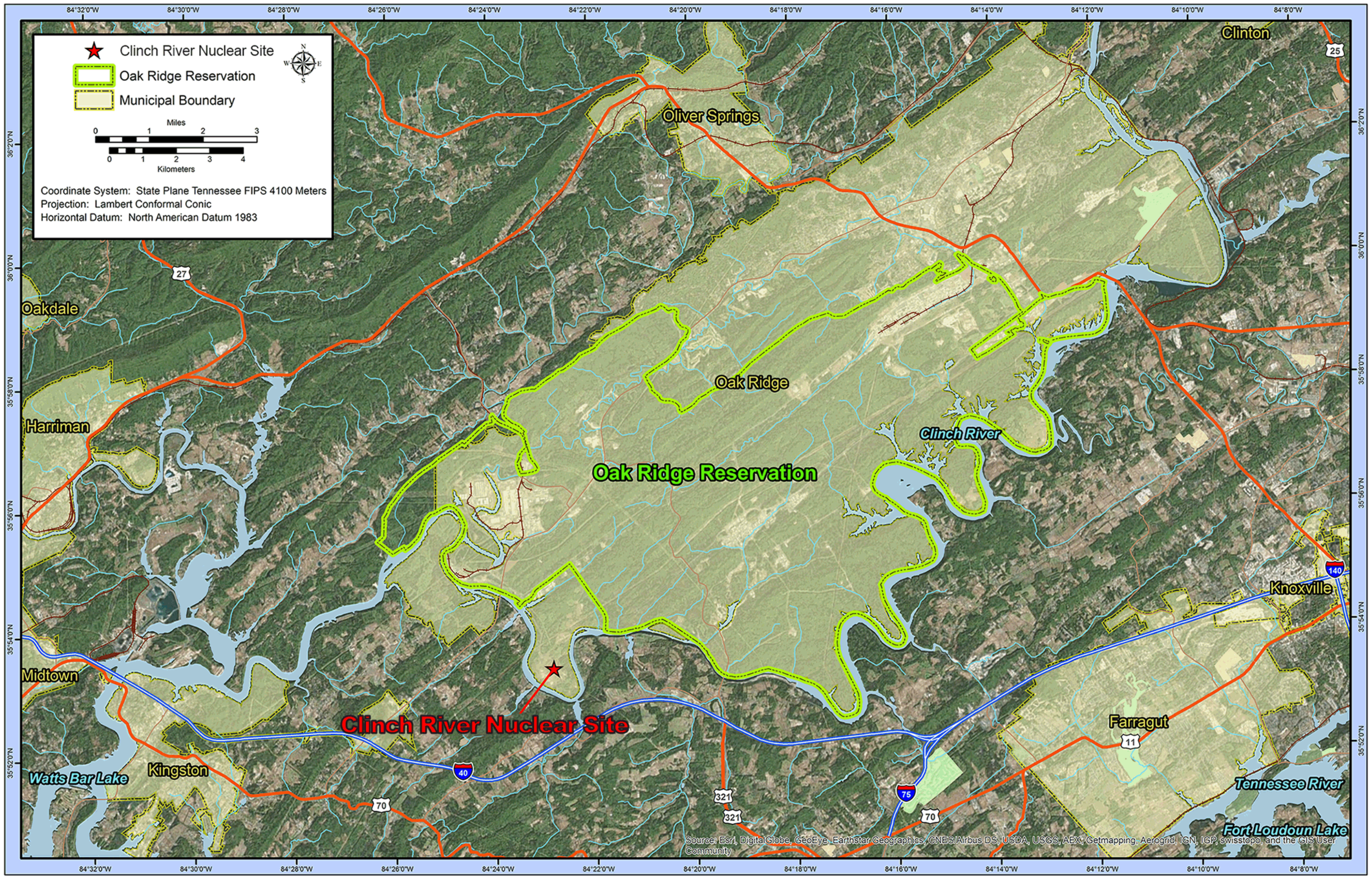


Figure 2.4.12-1. (Sheet 1 of 2) Location Map—Oak Ridge Reservation and the Clinch River Nuclear Site

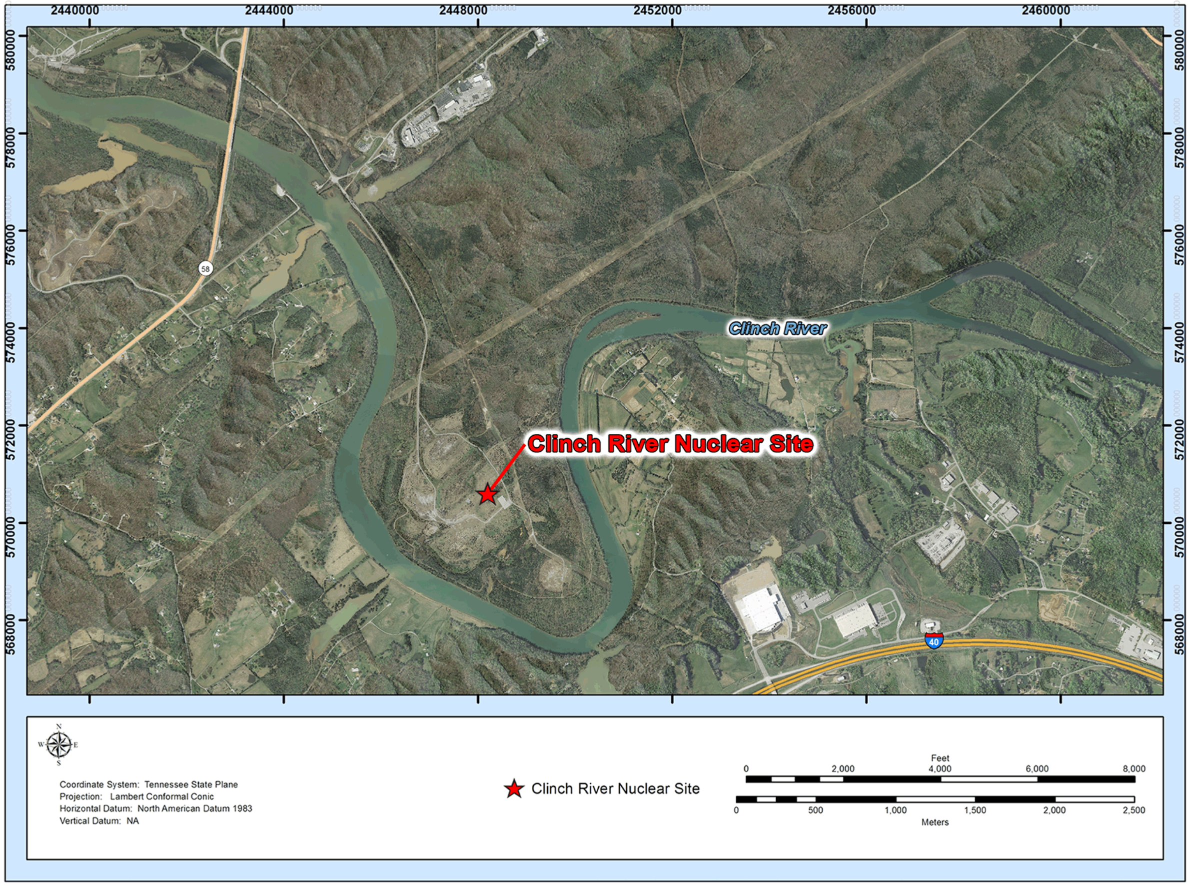
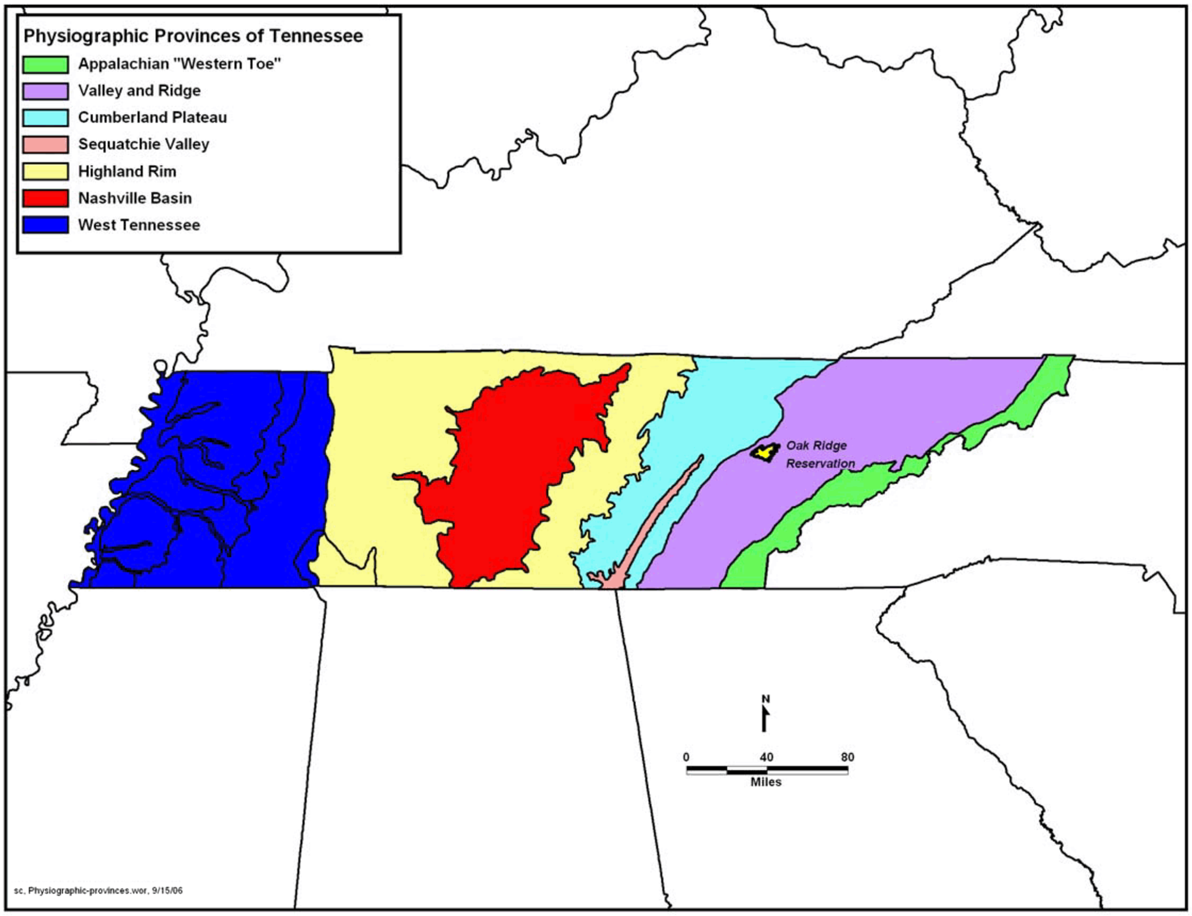
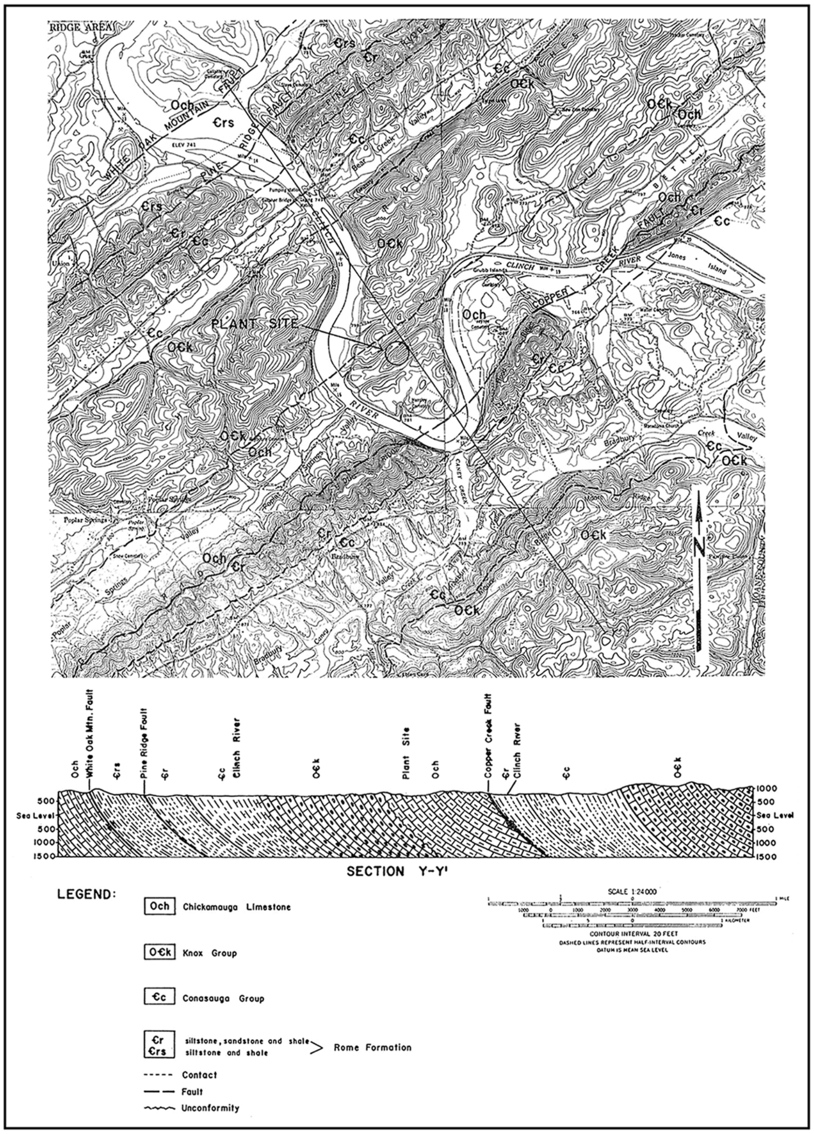


Figure 2.4.12-1. (Sheet 2 of 2) Location Map—Oak Ridge Reservation and the Clinch River Nuclear Site



Adapted from Reference 2.4.12-7

Figure 2.4.12-2. Physiographic Provinces in Tennessee



Adapted from Reference 2.4.12-49
1 inch = 4000 ft
Contour Interval = 20 ft

Figure 2.4.12-3. Preconstruction Topographic and Geologic Map and Cross-Section

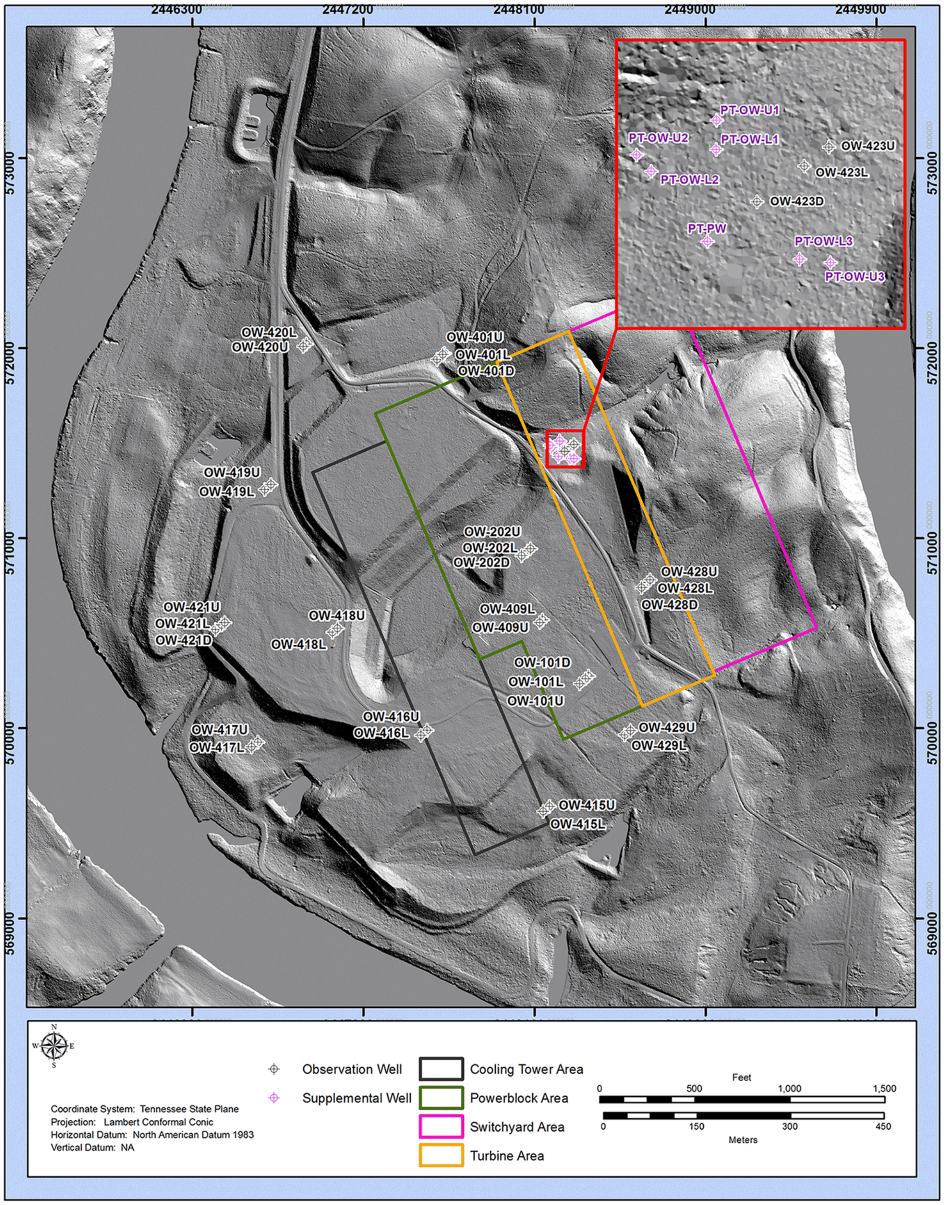


Figure 2.4.12-4. Current Site Topography and Observation Well Locations

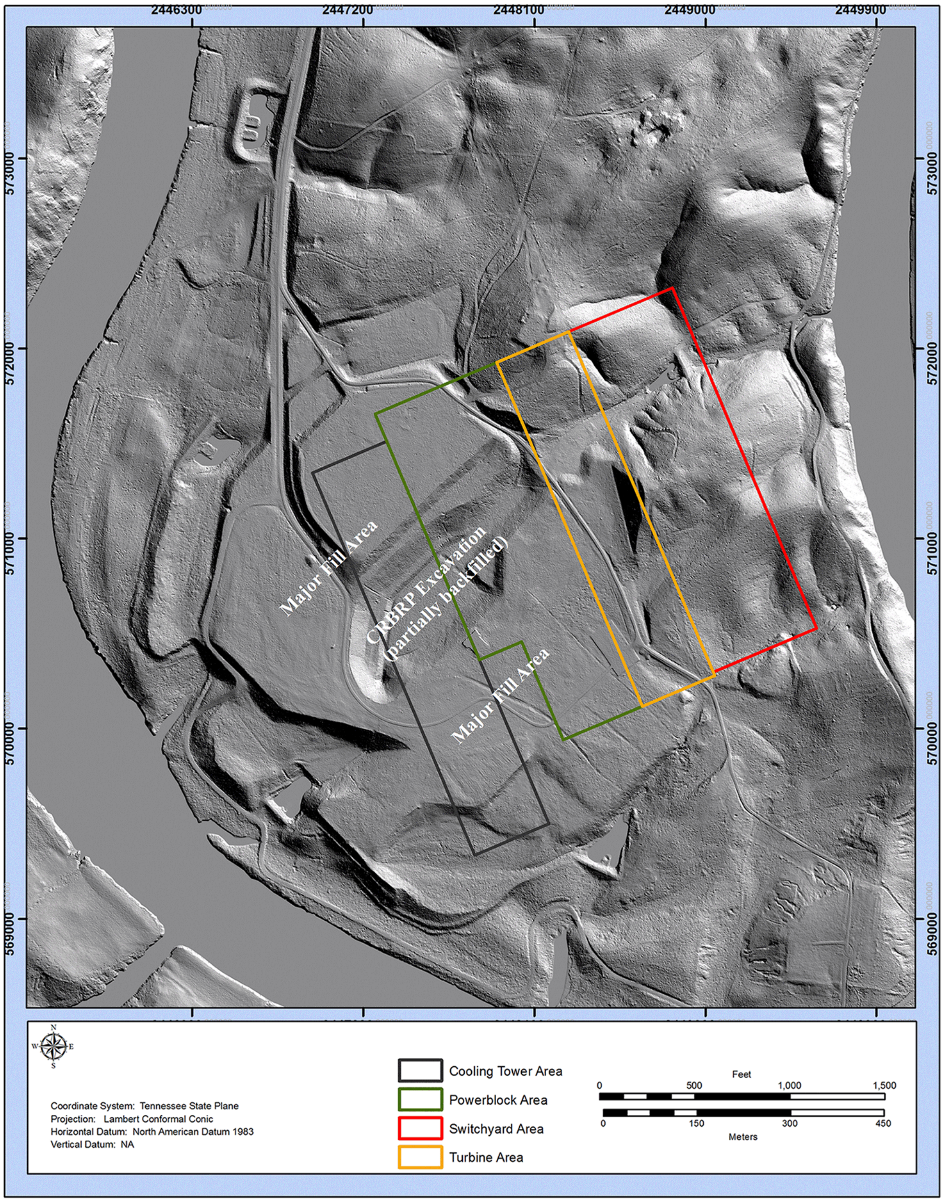
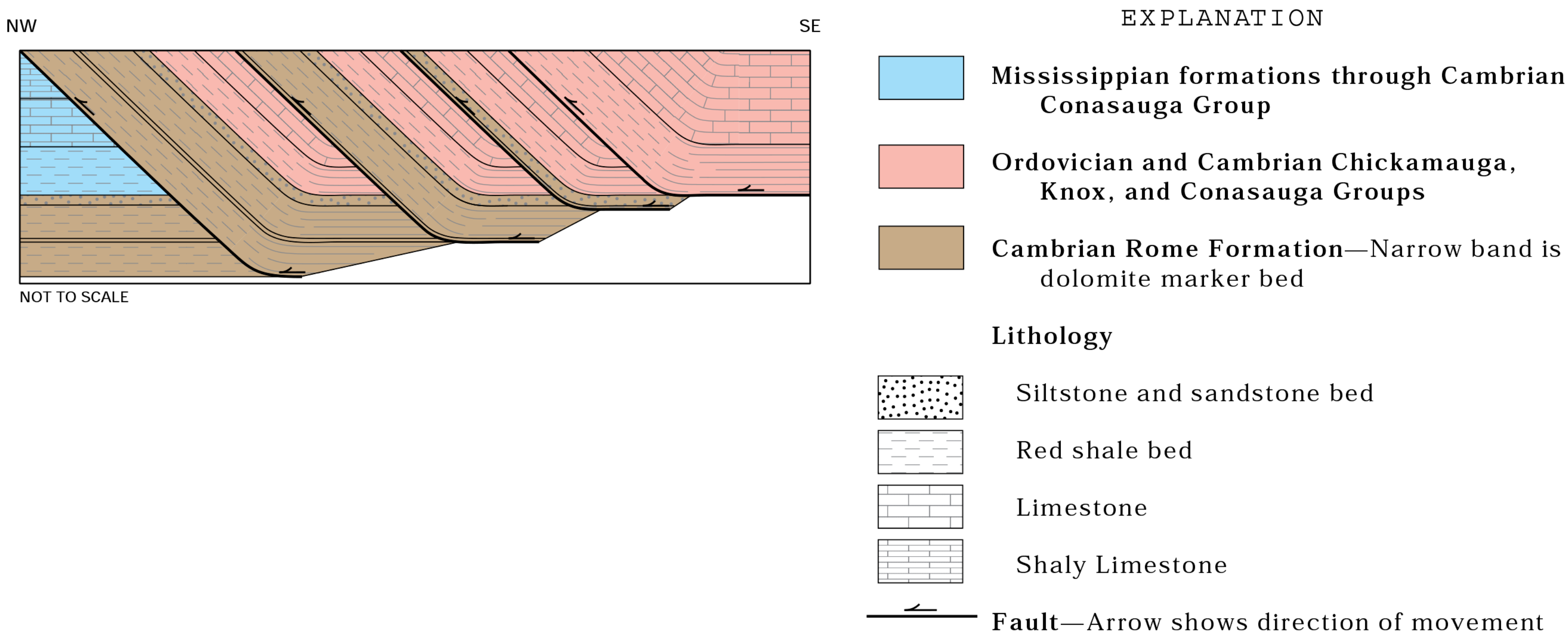
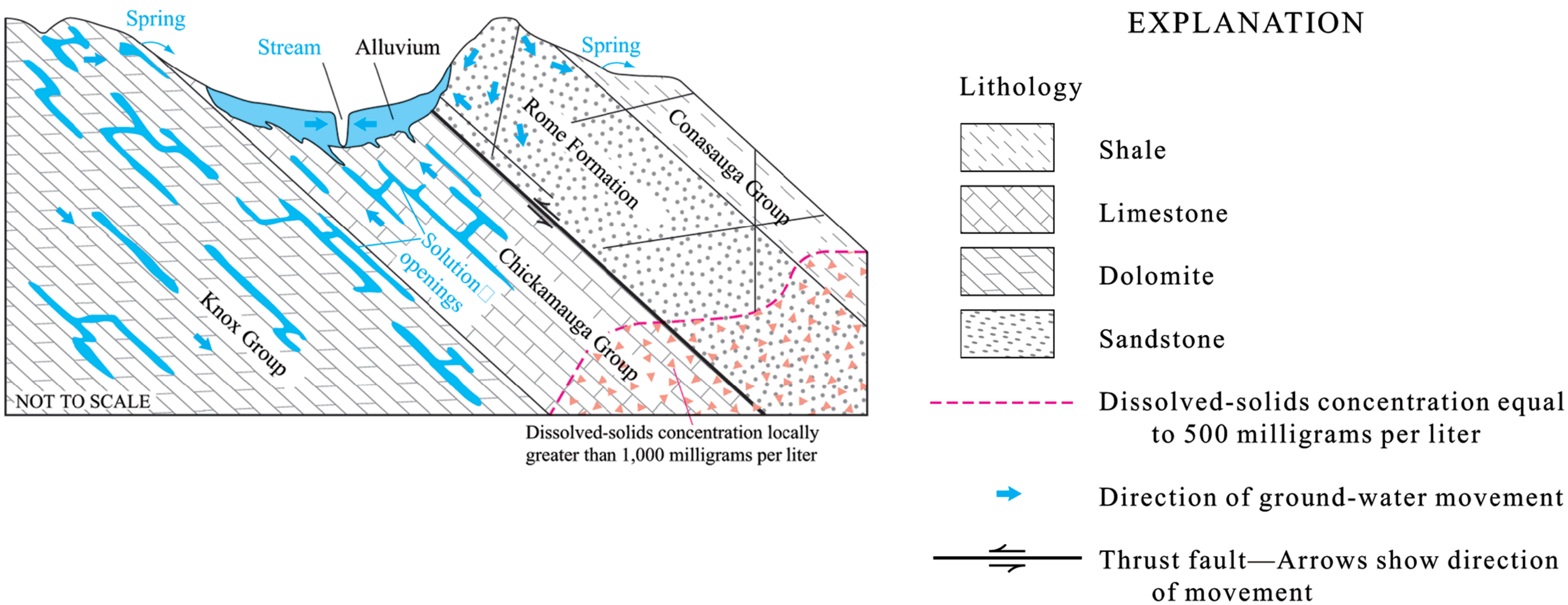


Figure 2.4.12-5. Clinch River Breeder Reactor Project Fill and Excavation Areas



Adapted from Reference 2.4.12-2

Figure 2.4.12-6. Cambrian and Ordovician Aquifers

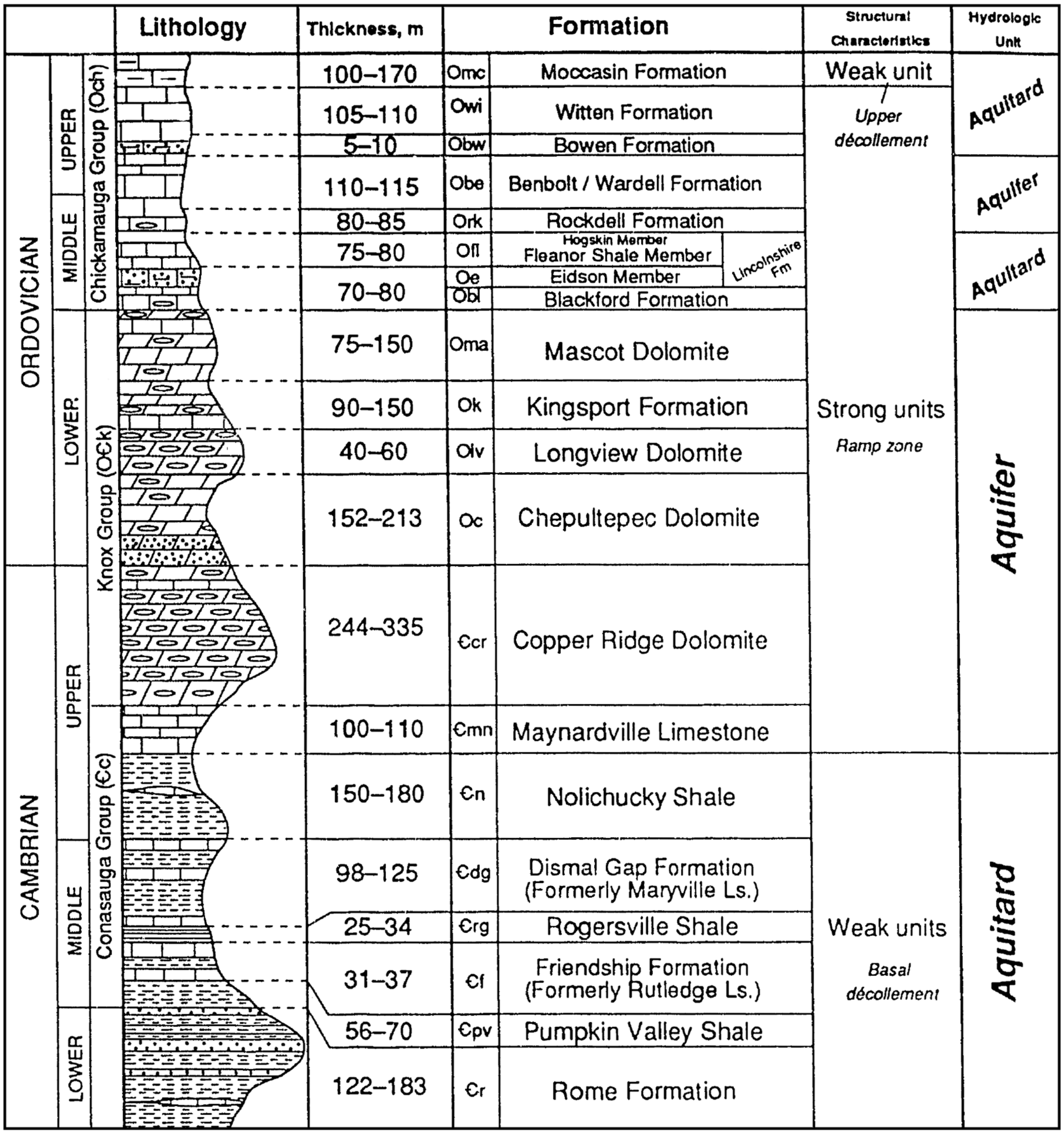


Adapted from Reference 2.4.12-2

Figure 2.4.12-7. Typical Cross-Section of the East Tennessee Aquifer System

Note: Adapted from Reference 2.4.12-18. Green shading shows the five counties included in the water use study area.

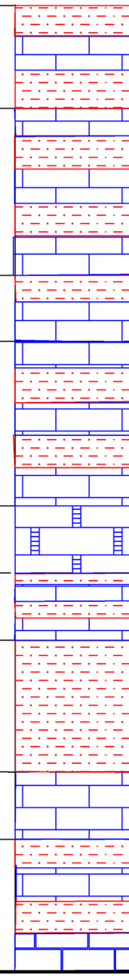
Figure 2.4.12-8. Water Use Study Area



After Reference 2.4.12-8

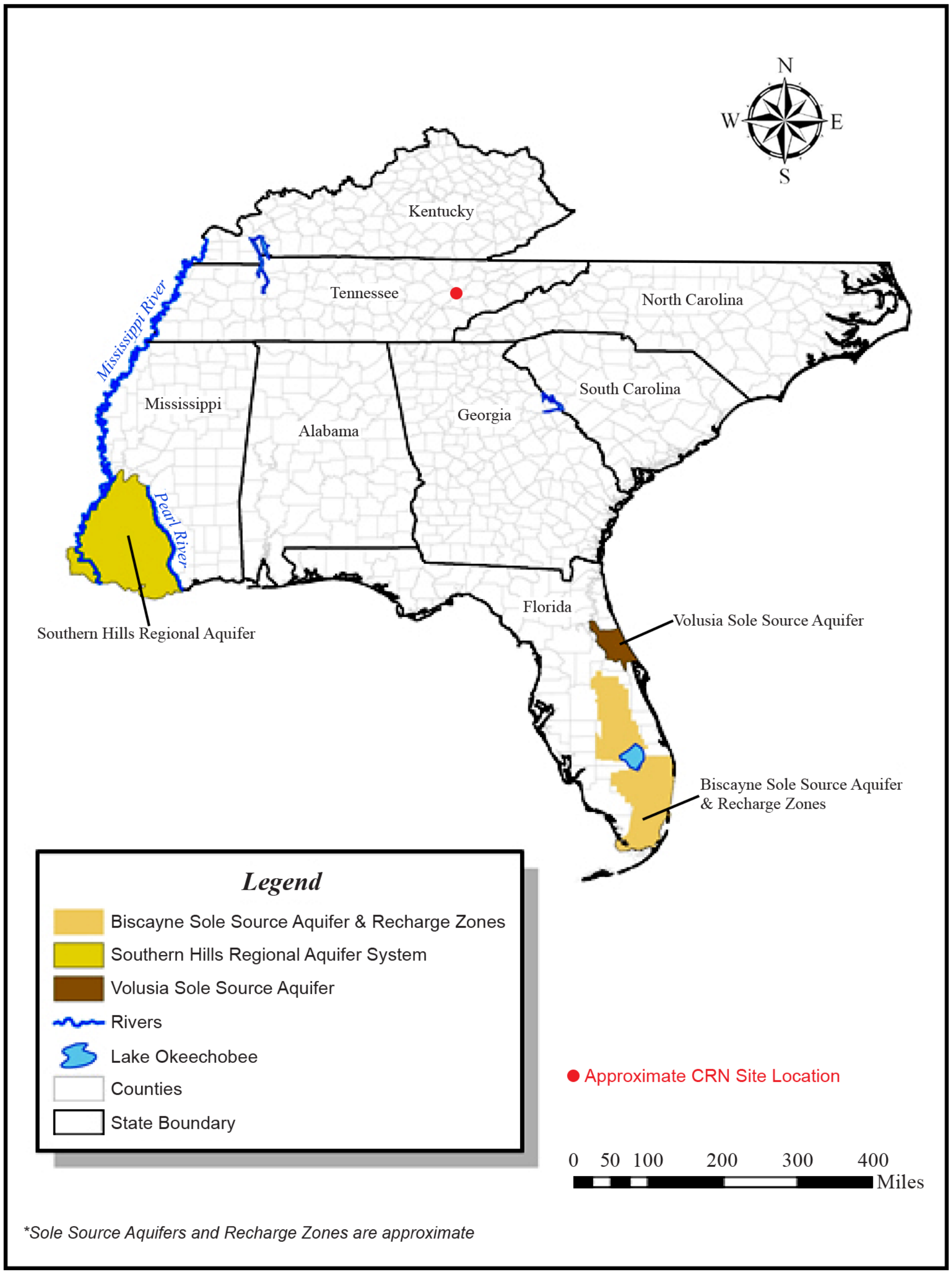
Figure 2.4.12-9. Site Area Hydrogeostratigraphy

Group	Formation Name	Thickness	Lithology	Unit Designation
Chickamauga Group	Mocassin Formation	330 - 560 ft (100 - 170 m)	siltstone and limestone	H
Chickamauga Group	Witten Formation	345 - 360 ft (105 - 110 m)	limestone and siltstone	G
Chickamauga Group	Bowen Formation	15 - 30 ft (5 - 10 m)	calcareous and shaly siltstone and limestone	F
Chickamauga Group	Benbolt Formation	360 - 380 ft (110 - 115 m)	limestone and siltstone	E
Chickamauga Group	Rockdell Formation	260 - 280 ft (80 - 85 m)	limestone with bedded and nodular chert	D
Chickamauga Group	Rockdell Formation		limestone and calcareous siltstone	C
Chickamauga Group	Lincolnshire Formation: Fleanor Member	245 - 260 ft (75 - 80 m)	calcareous siltstone	B
Chickamauga Group	Lincolnshire Formation: Eidson Member	65 ft (20 m)	limestone	A
Chickamauga Group	Blackford Formation	230 - 260 ft (70 - 80 m)	siltstone, limestone, and dolomitic limestone	A



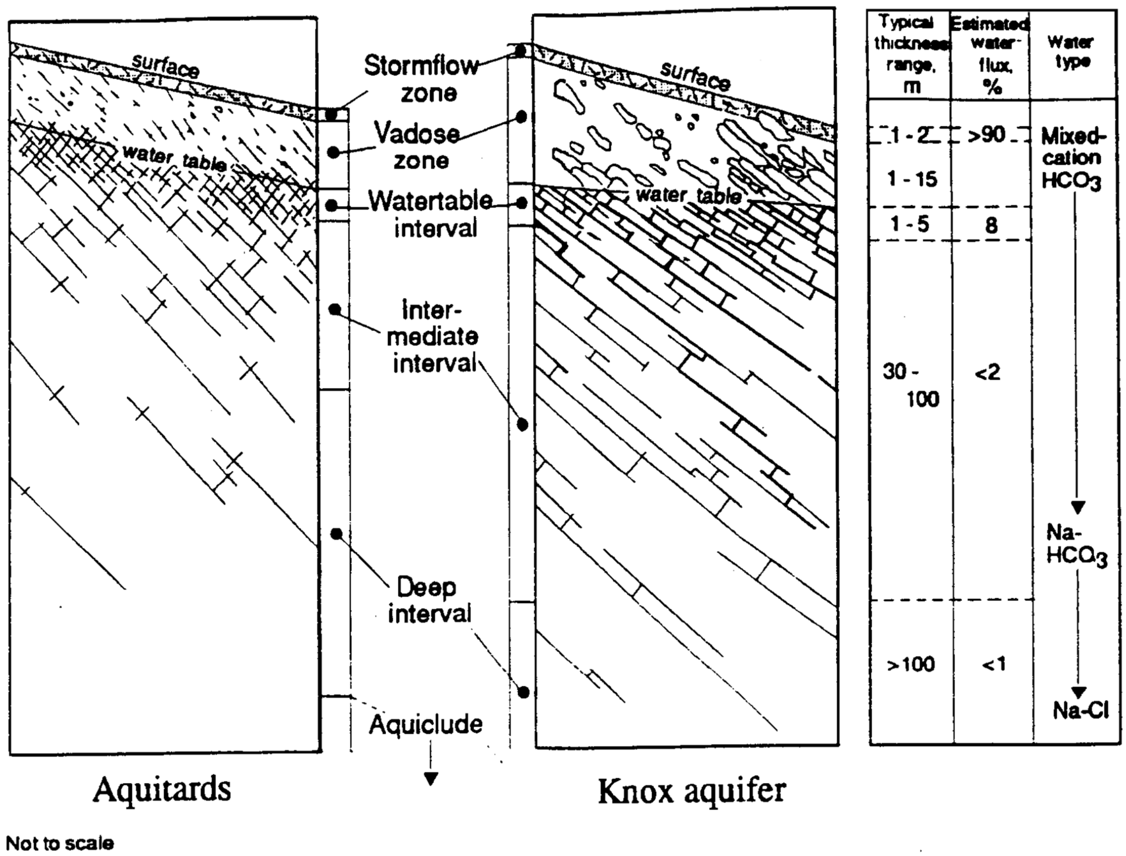
Adapted from Reference 2.4.12-8
Unit Designations from Reference 2.4.12-9

Figure 2.4.12-10. Bethel Valley Chickamauga Group Stratigraphy



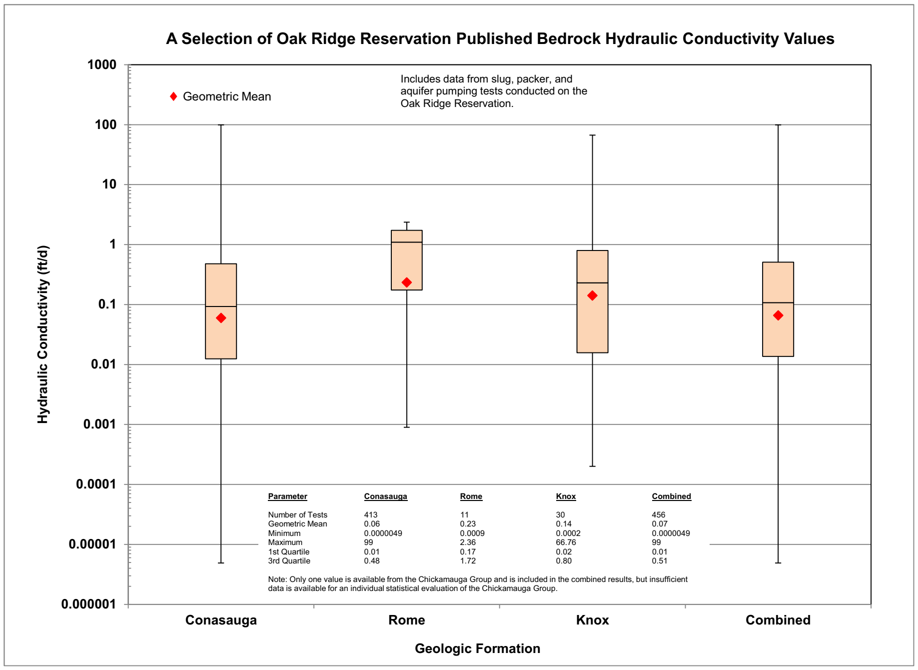
Adapted from Reference 2.4.12-10

Figure 2.4.12-11. Sole Source Aquifers in EPA Region IV

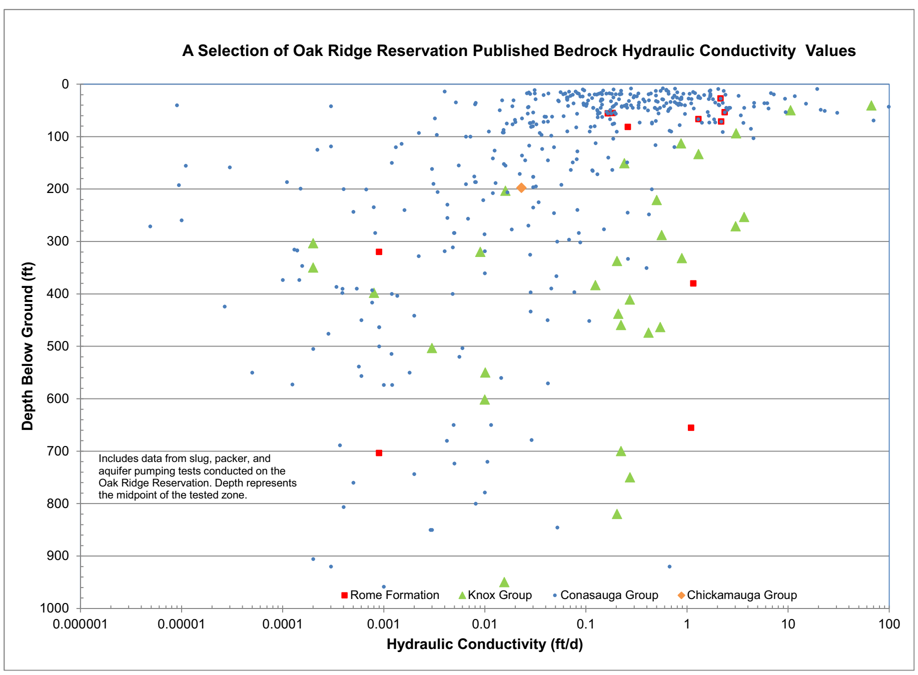


Reference 2.4.12-11

Figure 2.4.12-12. Oak Ridge Reservation Vertical Flow



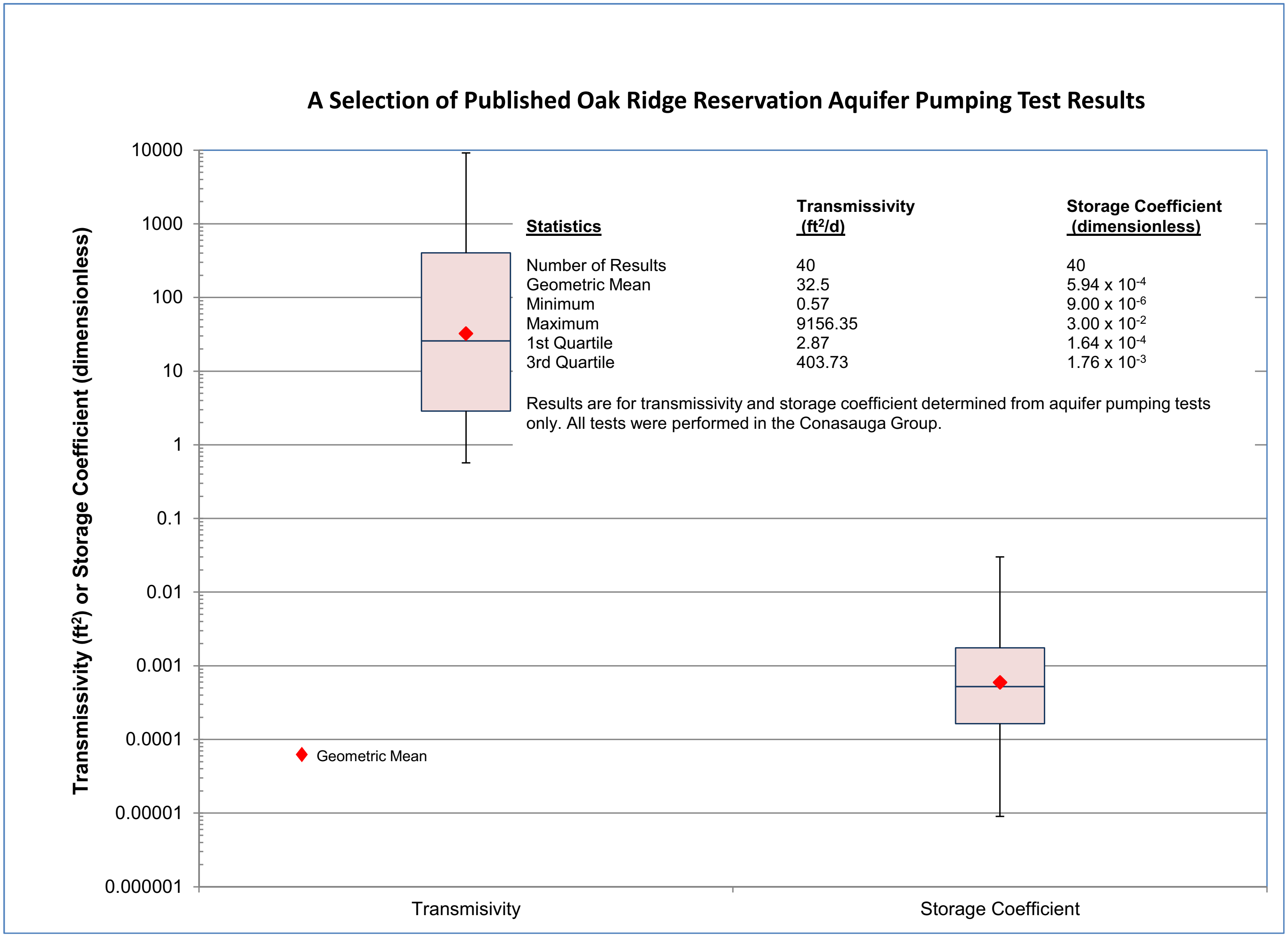
a) Box and whisker plot of hydraulic conductivity tests by geologic formation



b) Scatter plot of hydraulic conductivity versus depth

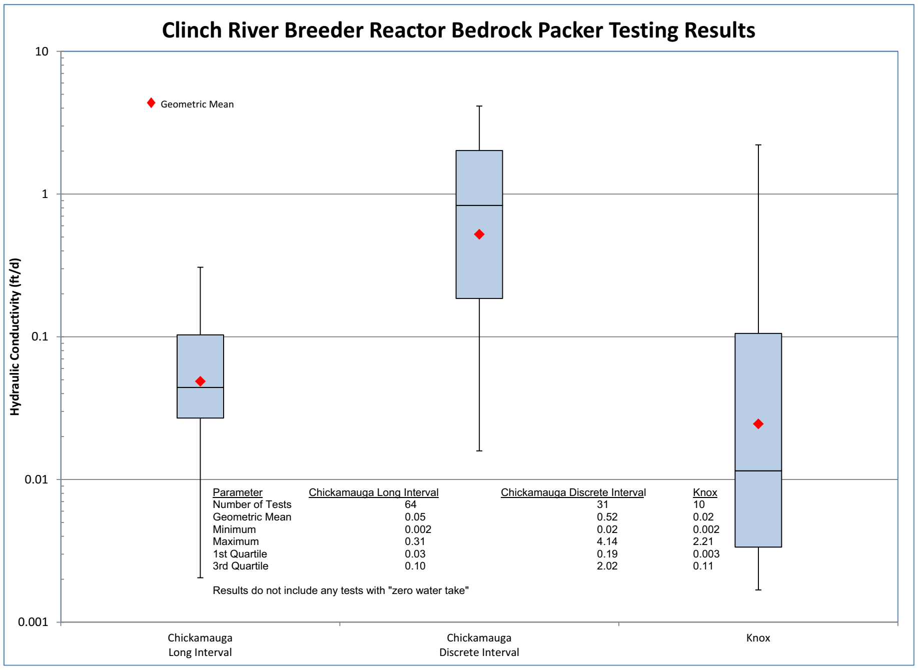
Data Source: Table 2.4.12-1

Figure 2.4.12-13. Oak Ridge Reservation Historic Bedrock Hydraulic Conductivity Test Data

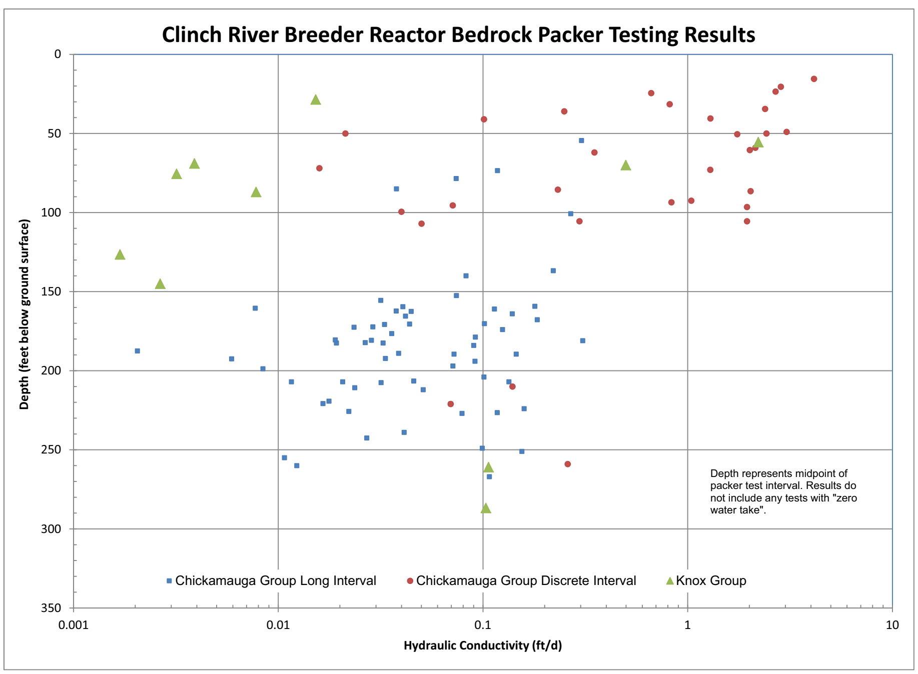


Data Source: Table 2.4.12-1

Figure 2.4.12-14. Oak Ridge Reservation Aquifer Pumping Test Results



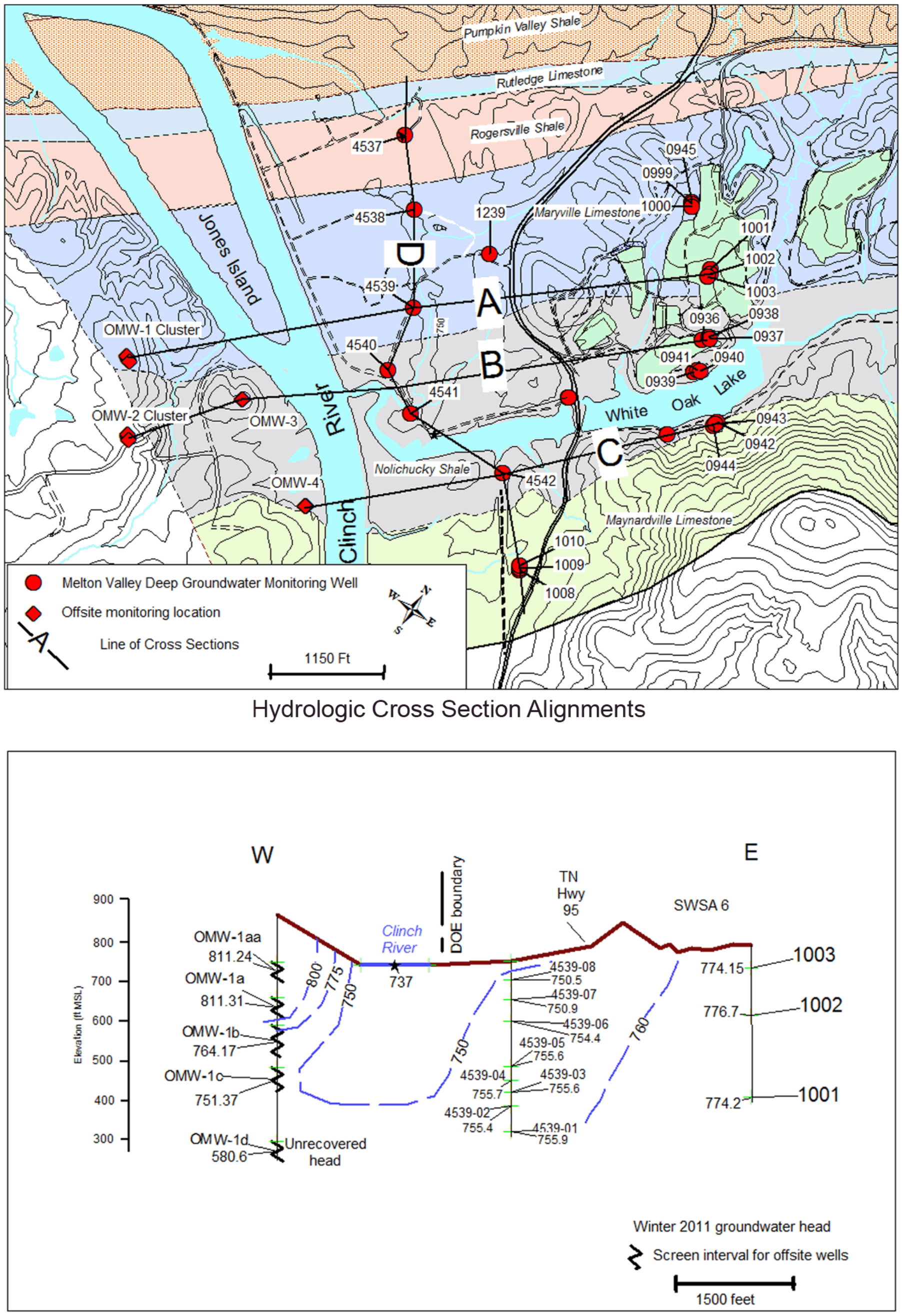
a) Box and whisker plot of CRBRP bedrock packer test results



b) Hydraulic conductivity versus depth plot of CRBRP bedrock packer test results

Data Source: Table 2.4.12-3

Figure 2.4.12-15. Clinch River Breeder Reactor Project Bedrock Packer Hydraulic Conductivity Tests

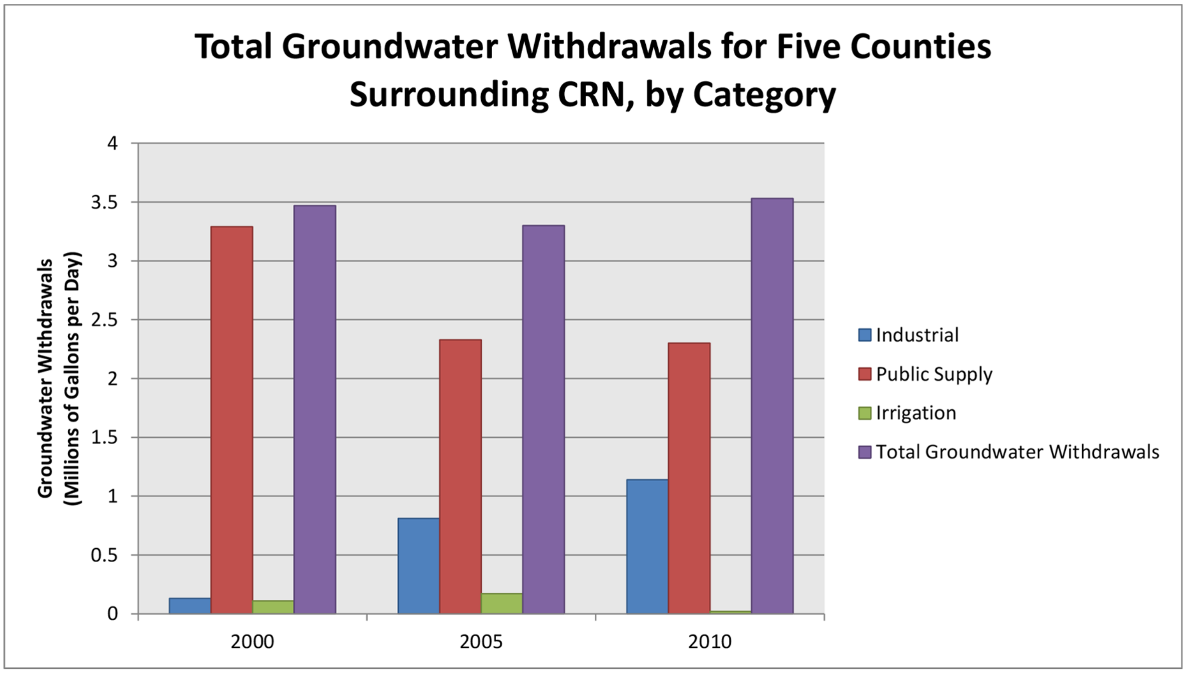


Hydrologic Cross Section Alignments

Hydrologic Cross Section A

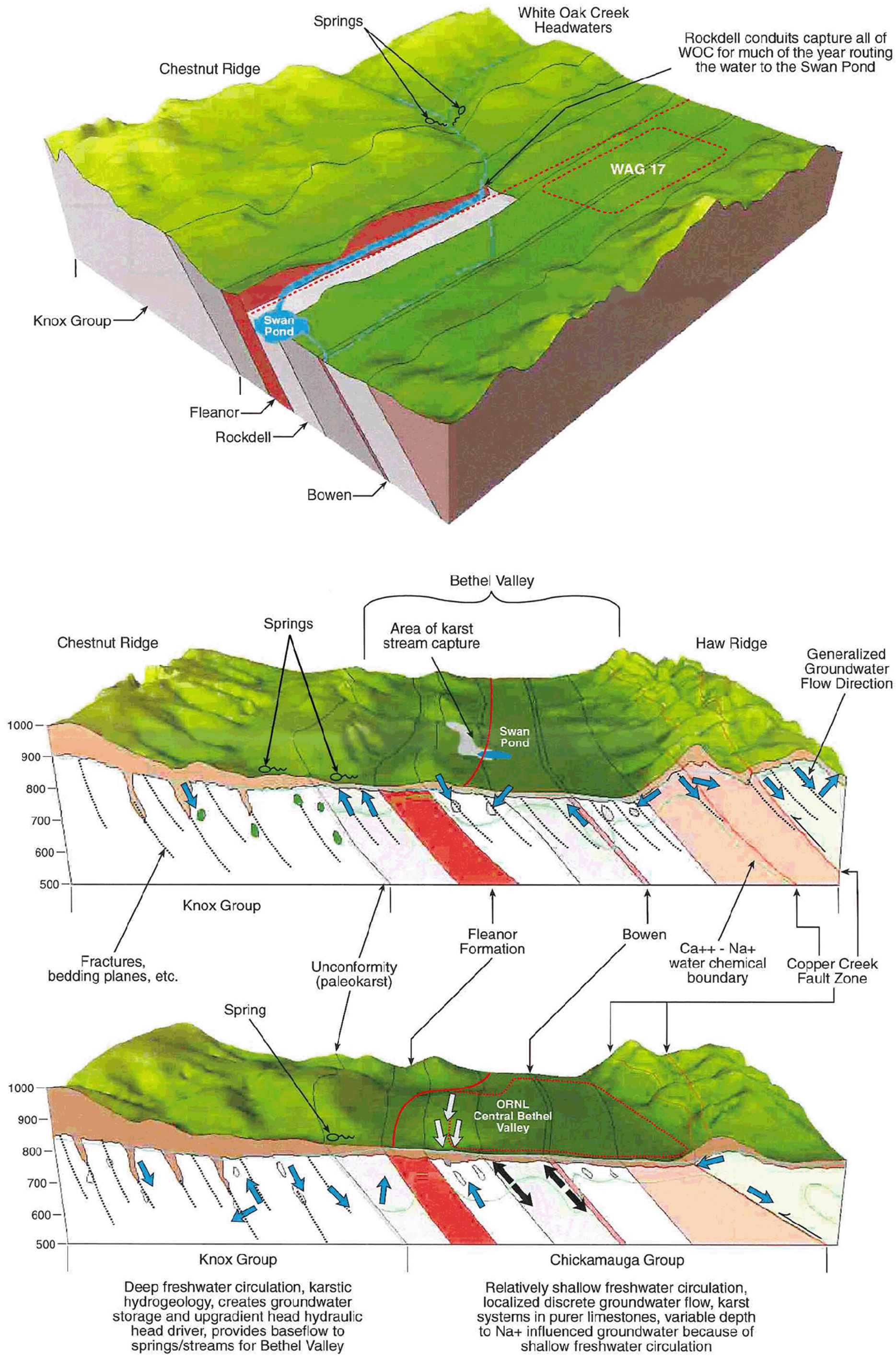
Adapted from Reference 2.4.12-14

Figure 2.4.12-16. Groundwater Levels Adjacent to the Clinch River



Note: Data for the years 2000, 2005 and 2010 from Reference 2.4.12-16, Reference 2.4.12-17, and Reference 2.4.12-18, respectively.

Figure 2.4.12-17. Groundwater Use by Category in the Study Area for 2000, 2005, and 2010



After Reference 2.4.12-22

Figure 2.4.12-18. Bethel Valley Flow Conceptualization

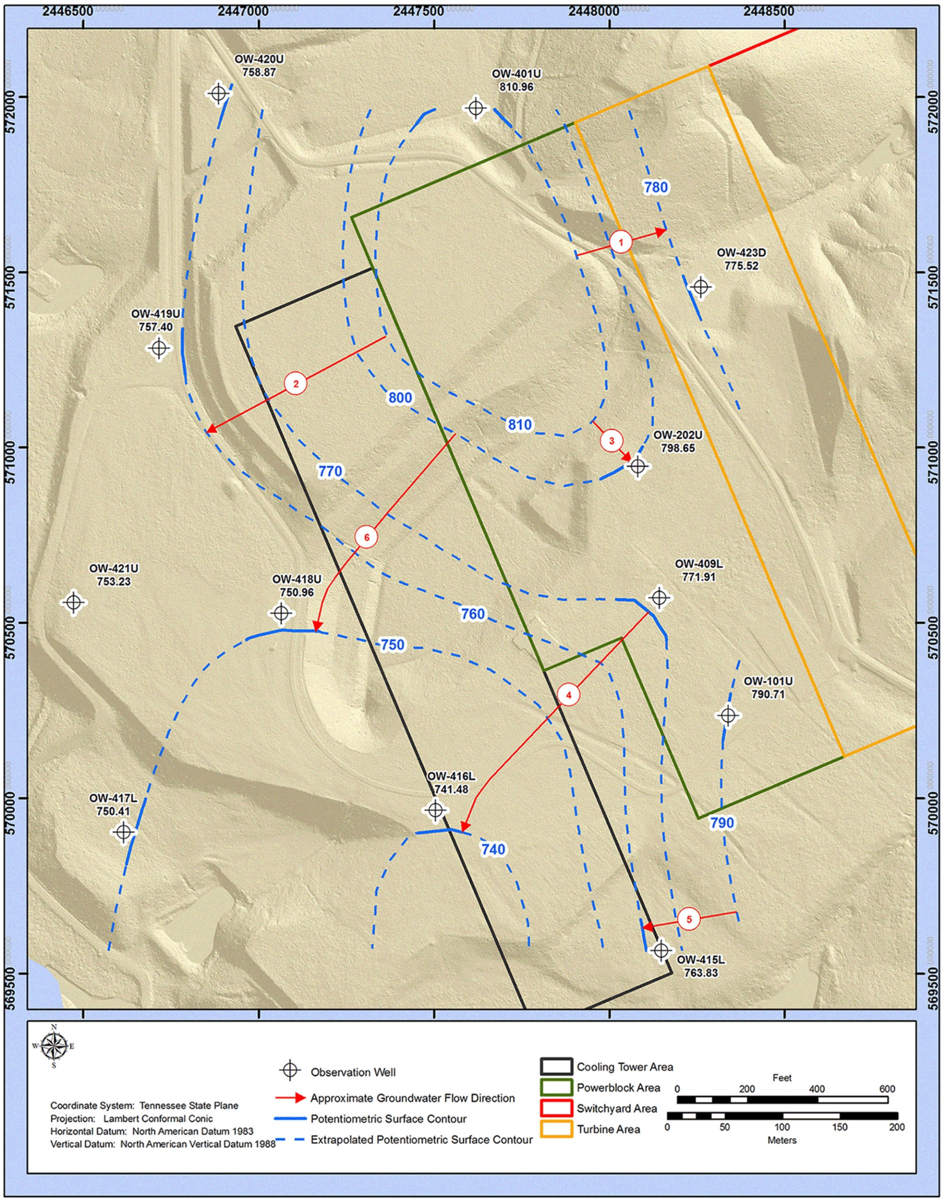


Figure 2.4.12-19. Potentiometric Surface Map for September 24, 2013

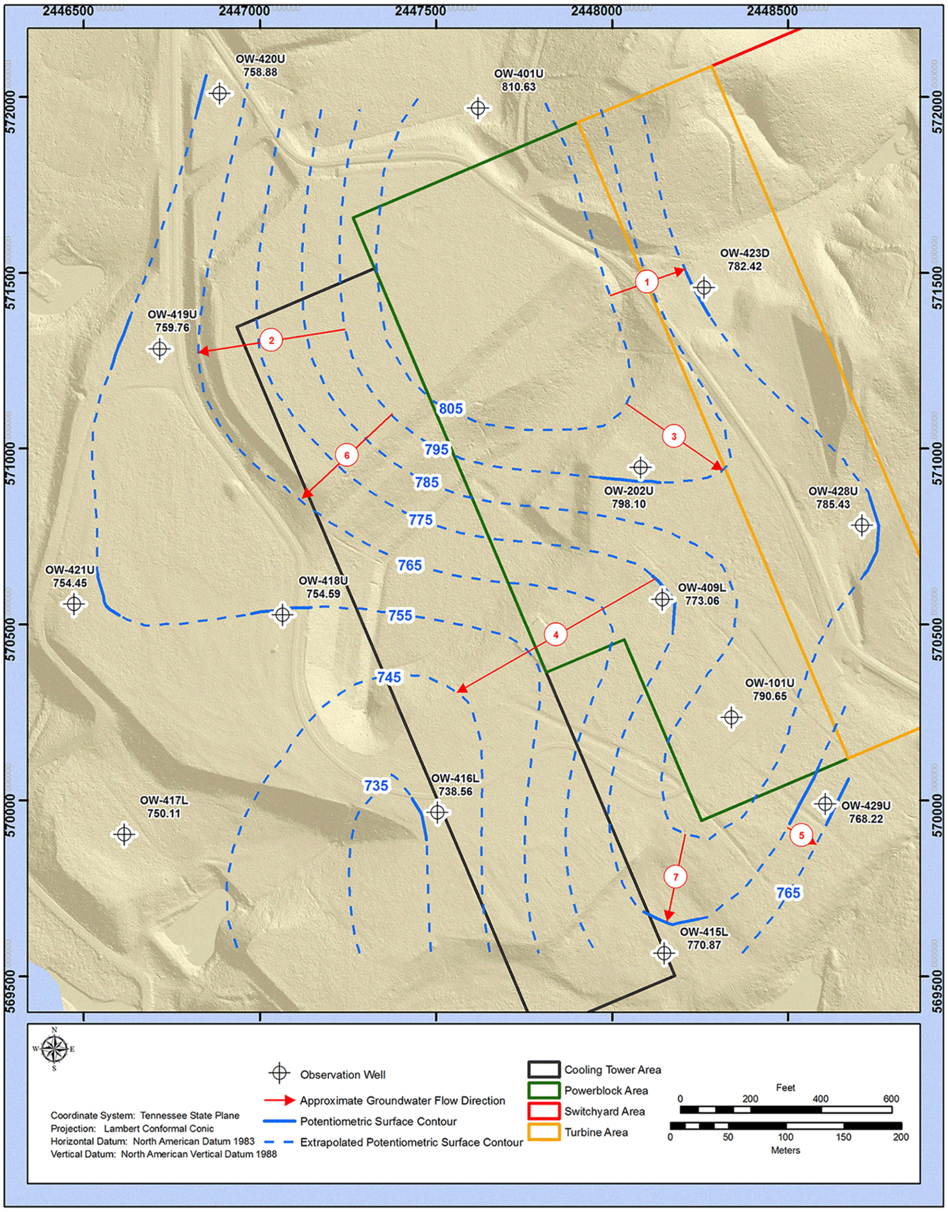


Figure 2.4.12-20. Potentiometric Surface Map for December 20, 2013

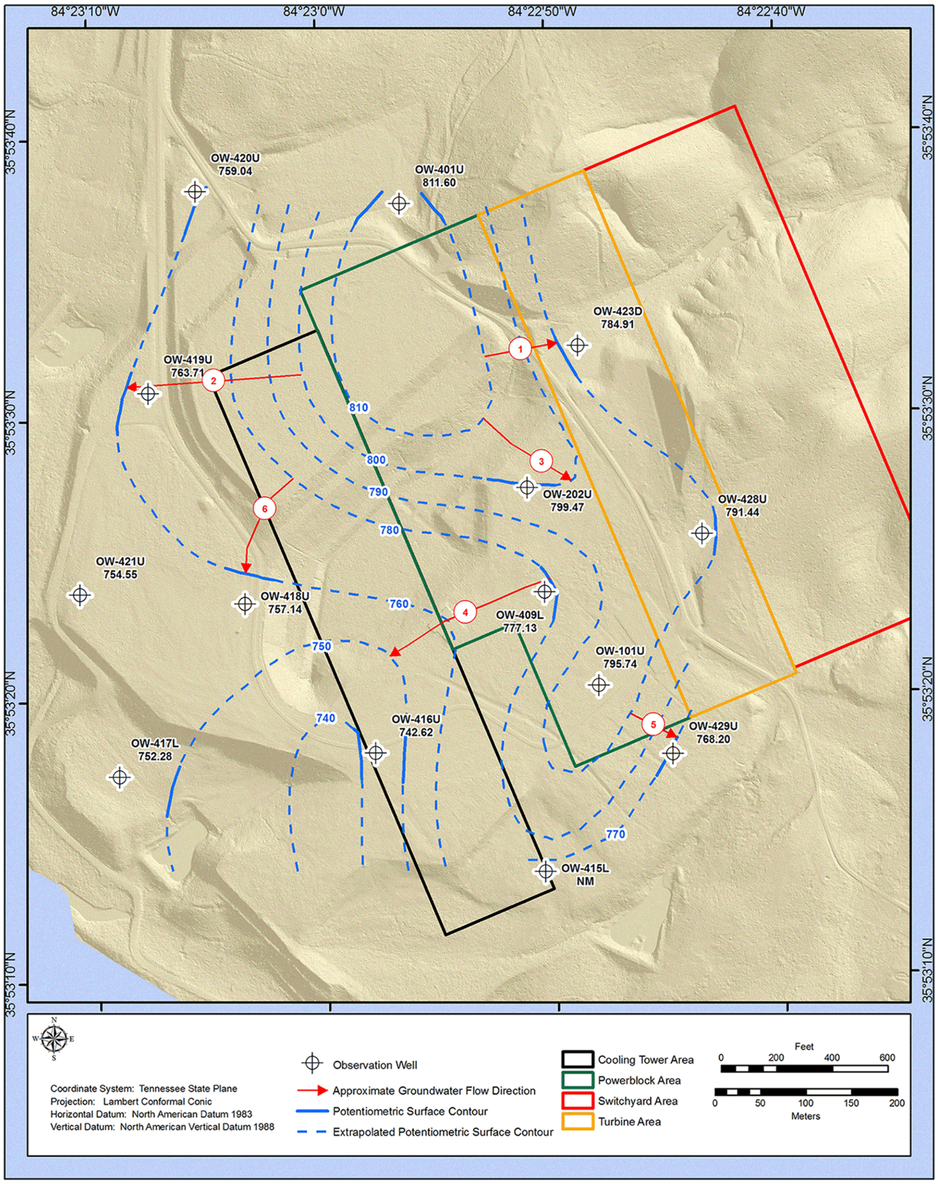


Figure 2.4.12-21. Potentiometric Surface Map for January 13, 2014

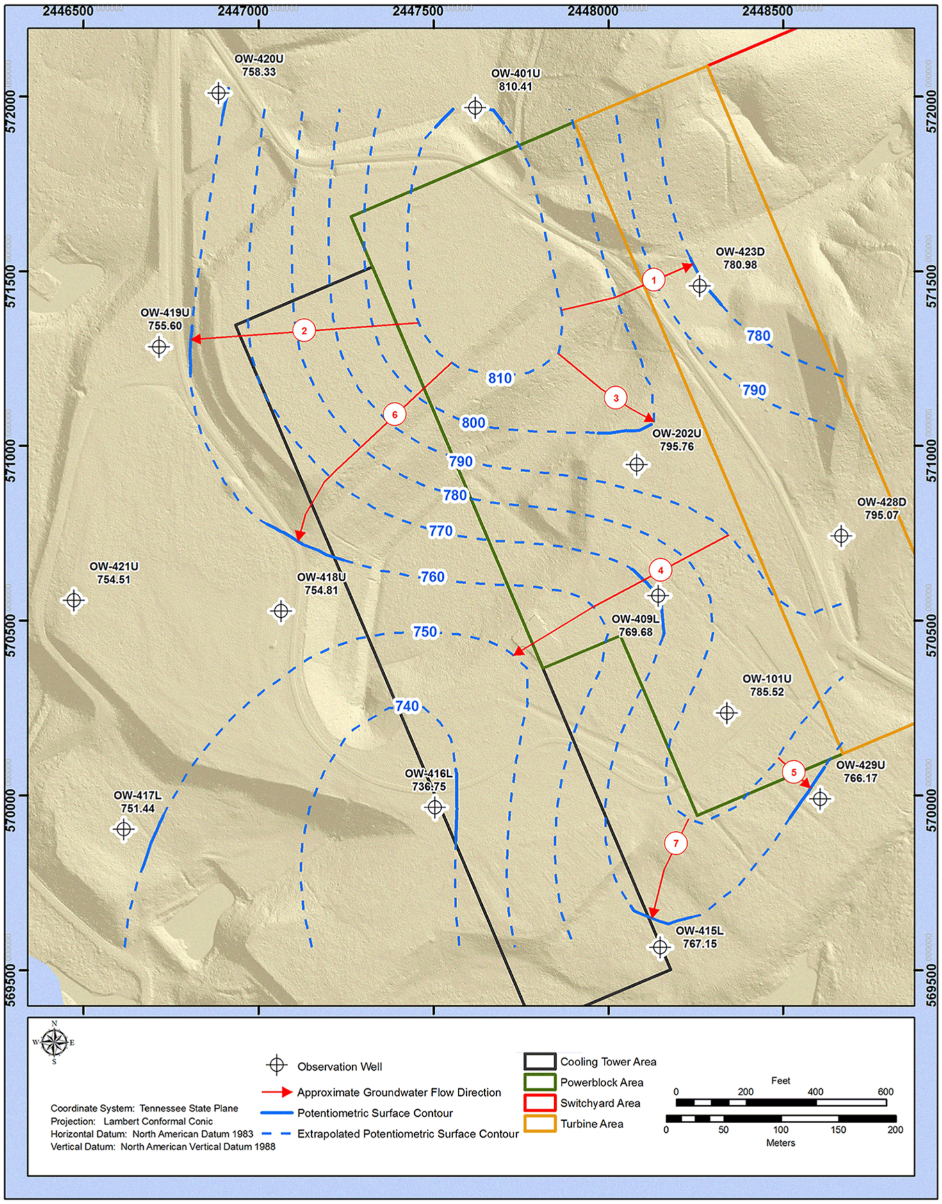


Figure 2.4.12-22. Potentiometric Surface Map for March 16, 2014

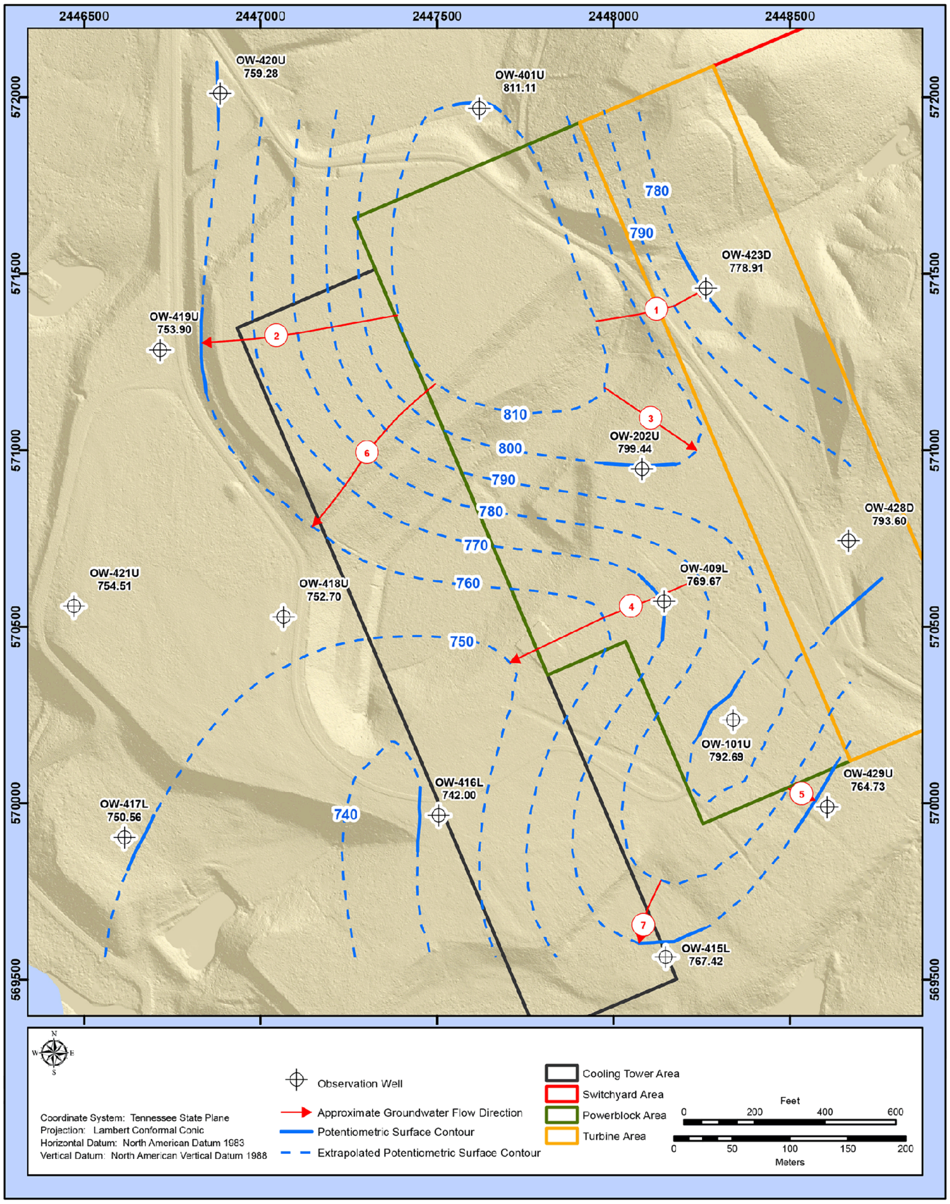


Figure 2.4.12-23. Potentiometric Surface Map for May 15, 2014

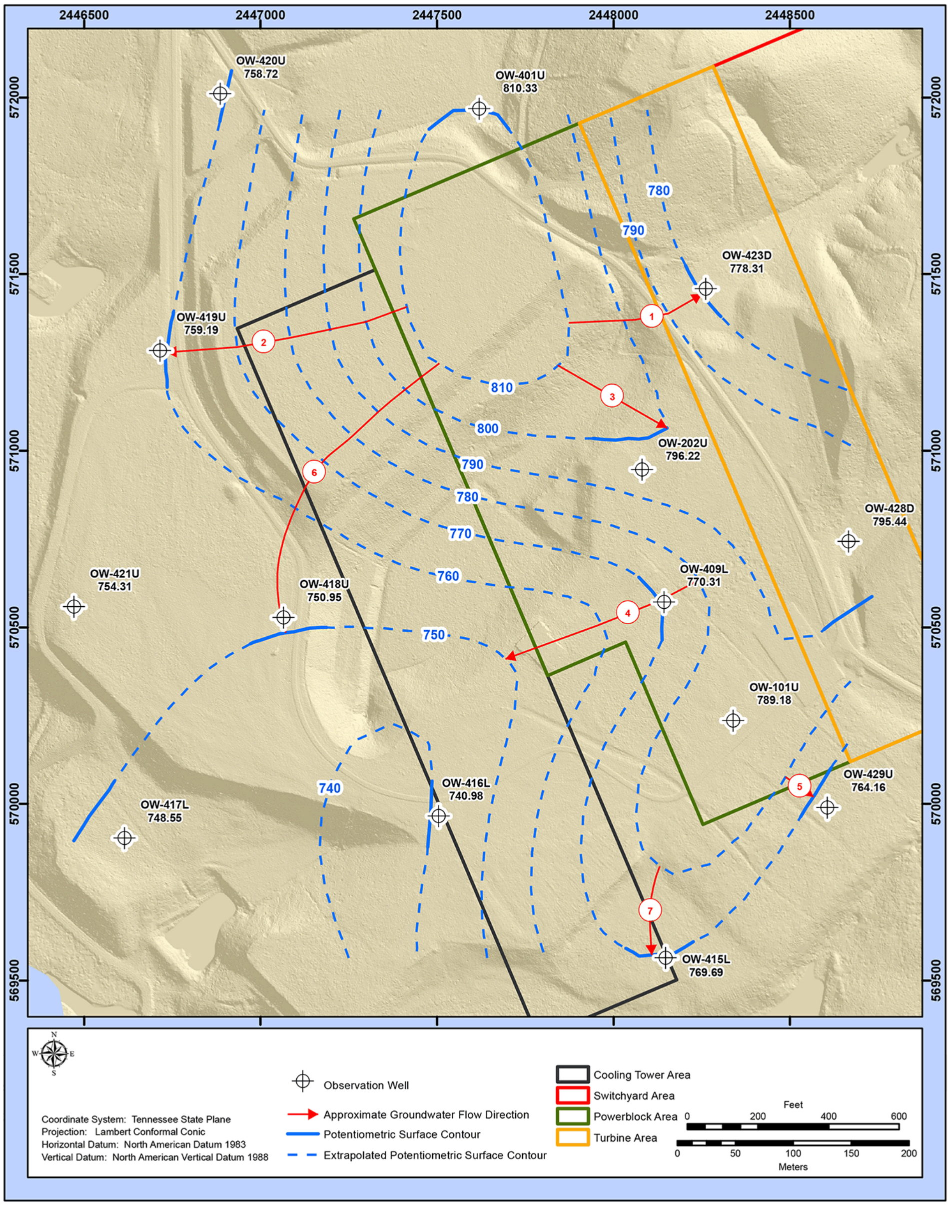


Figure 2.4.12-24. Potentiometric Surface Map for August 18, 2014

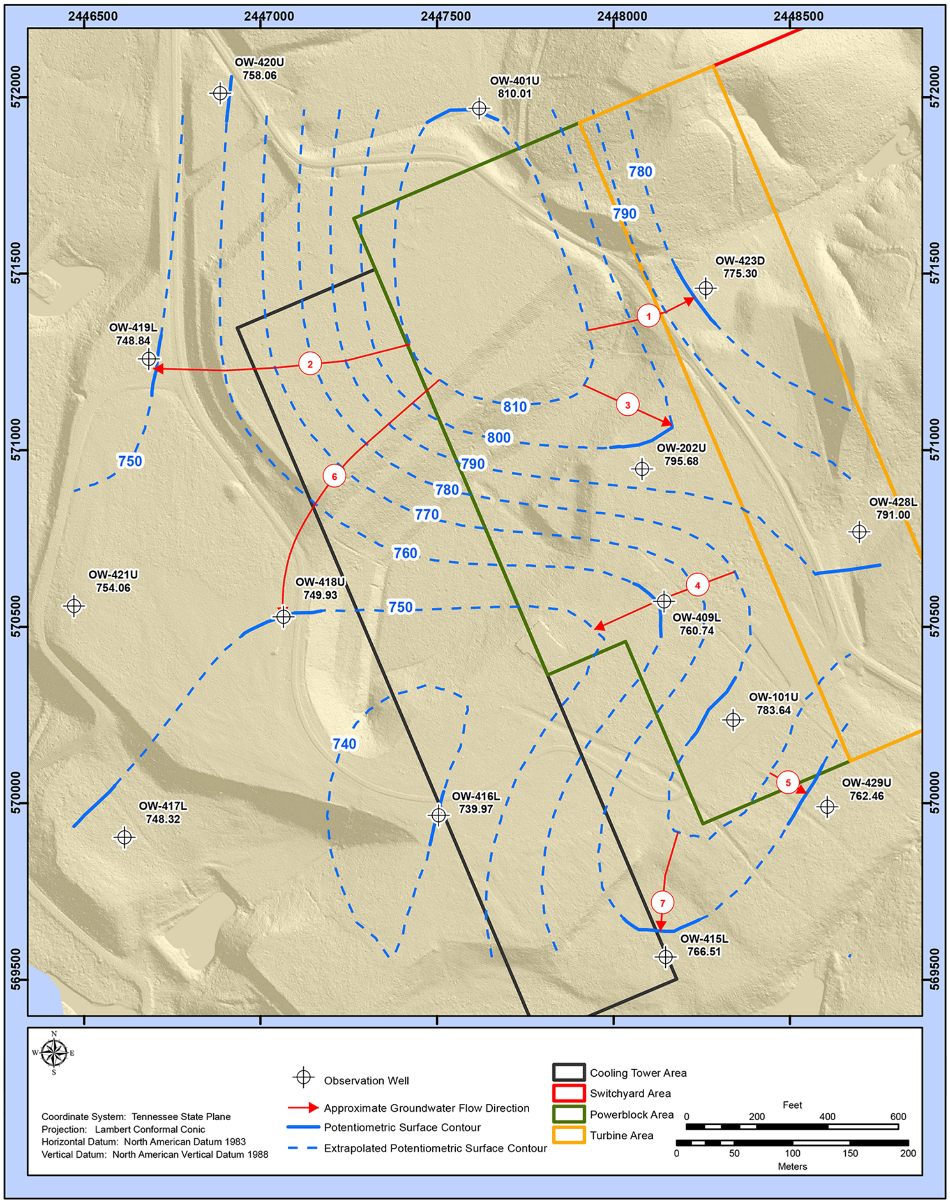


Figure 2.4.12-25. Potentiometric Surface Map for November 4, 2014

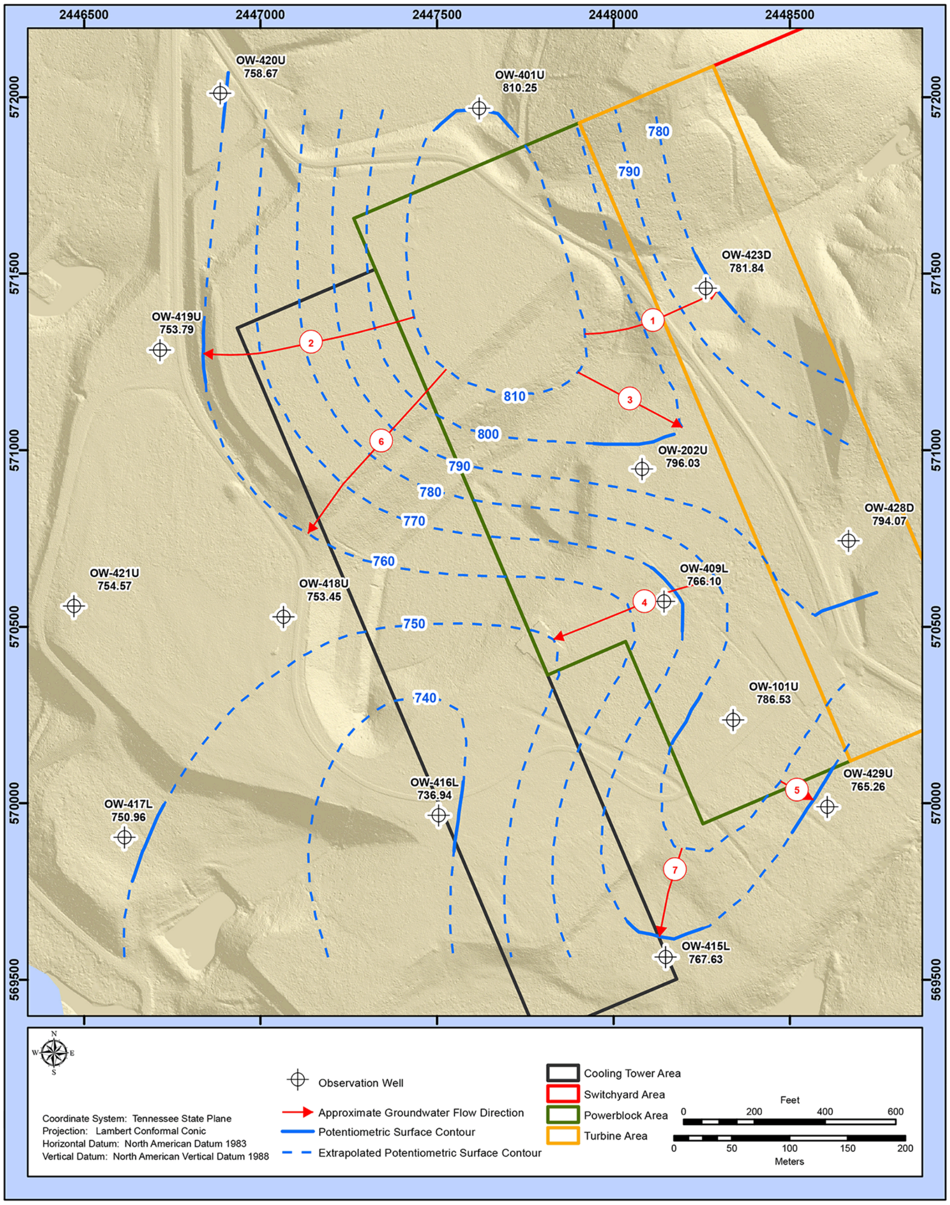


Figure 2.4.12-26. Potentiometric Surface Map for February 12, 2015

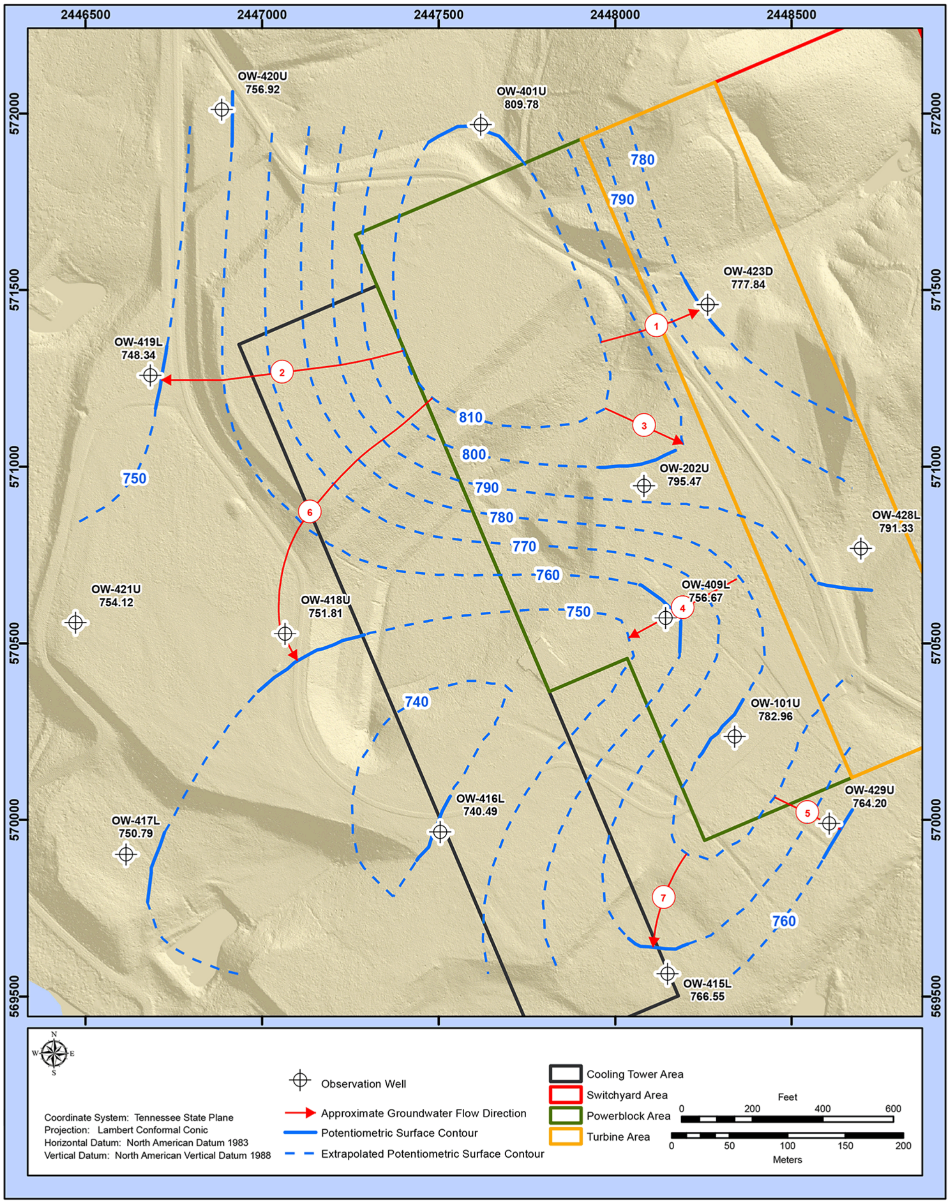


Figure 2.4.12-27. Potentiometric Surface Map for May 19, 2015

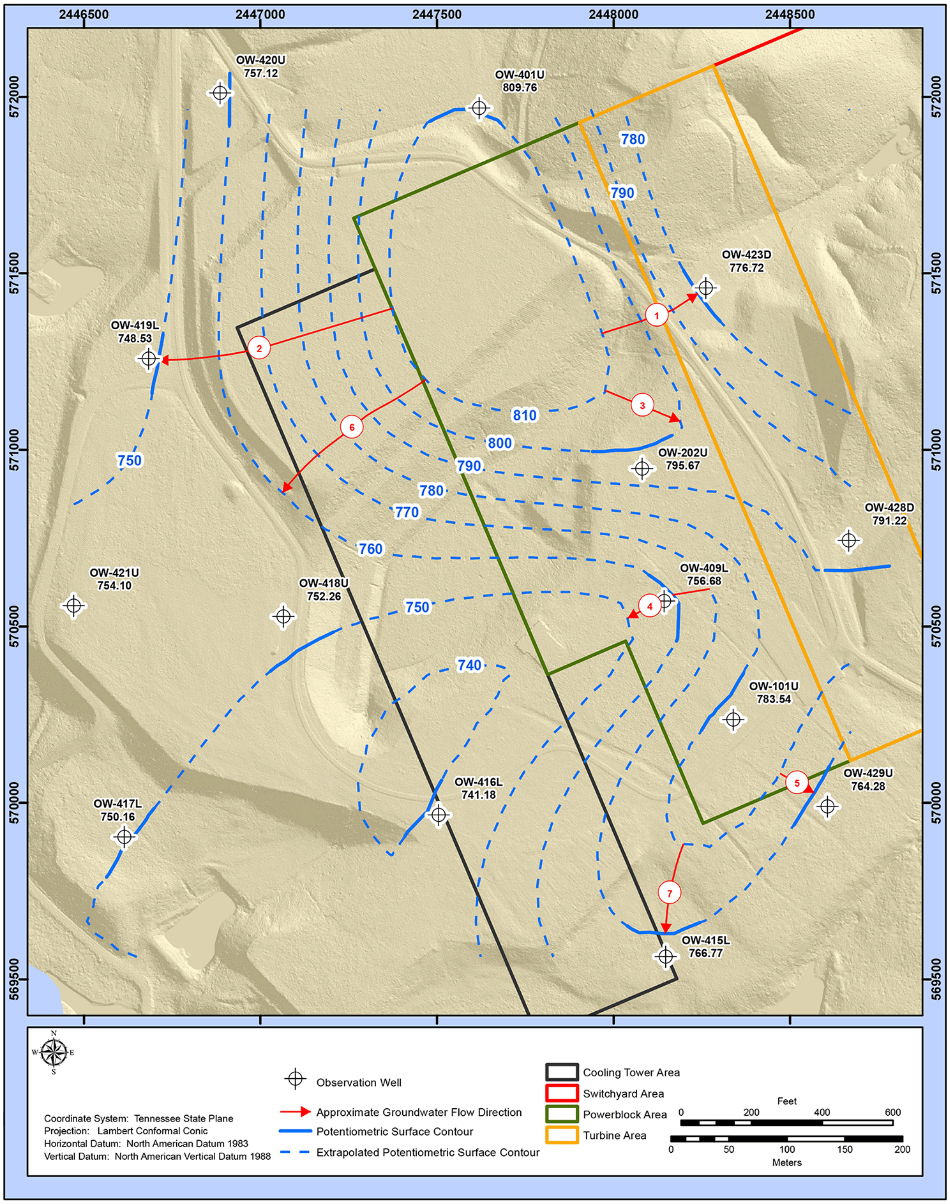


Figure 2.4.12-28. Potentiometric Surface Map for August 10, 2015

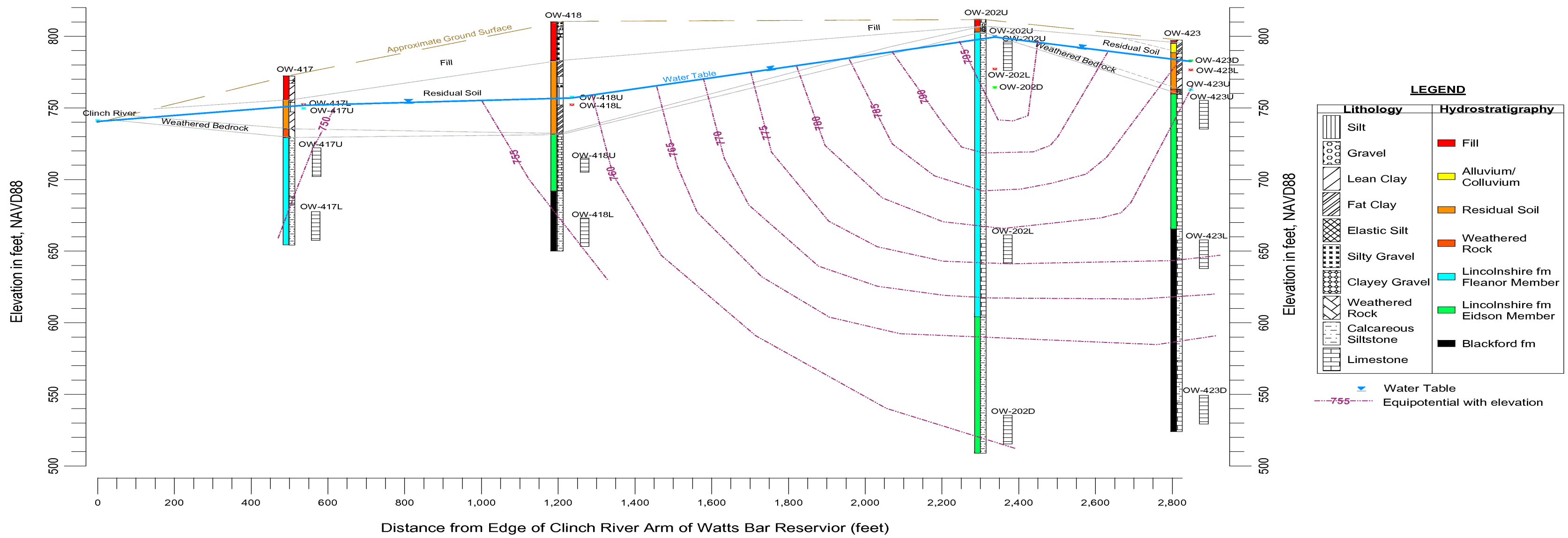
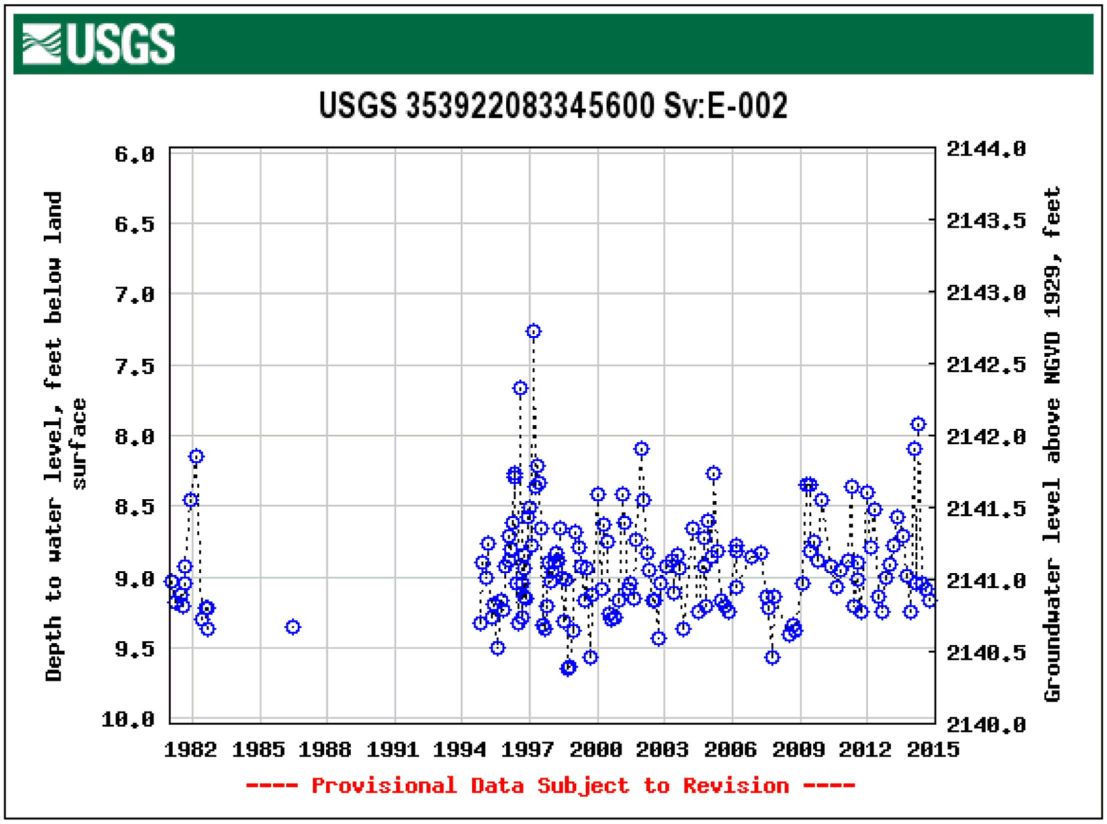


Figure 2.4.12-29. Snapshot in Time Showing Equipotential Lines in the Vertical Plane Along the Strike of the Bedding Plane on June 13, 2014

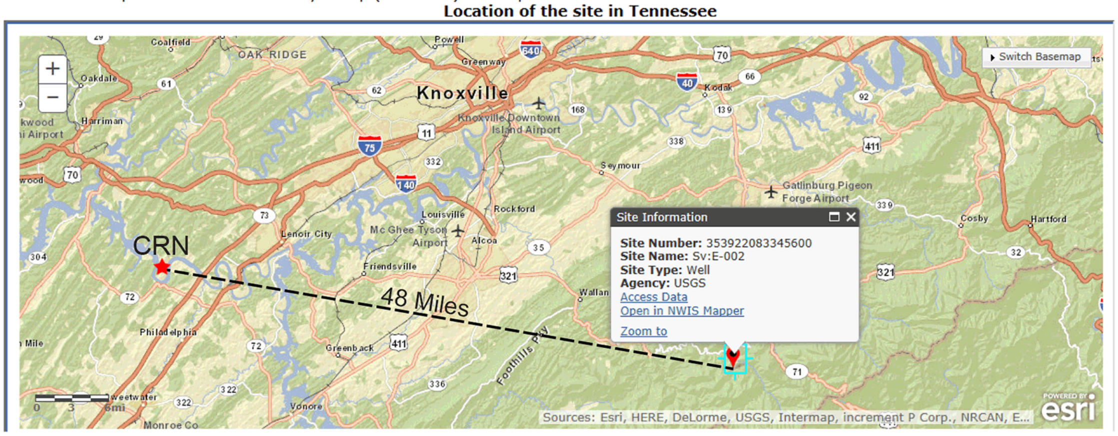


USGS 353922083345600 Sv:E-002

Available data for this site | Location map | GO

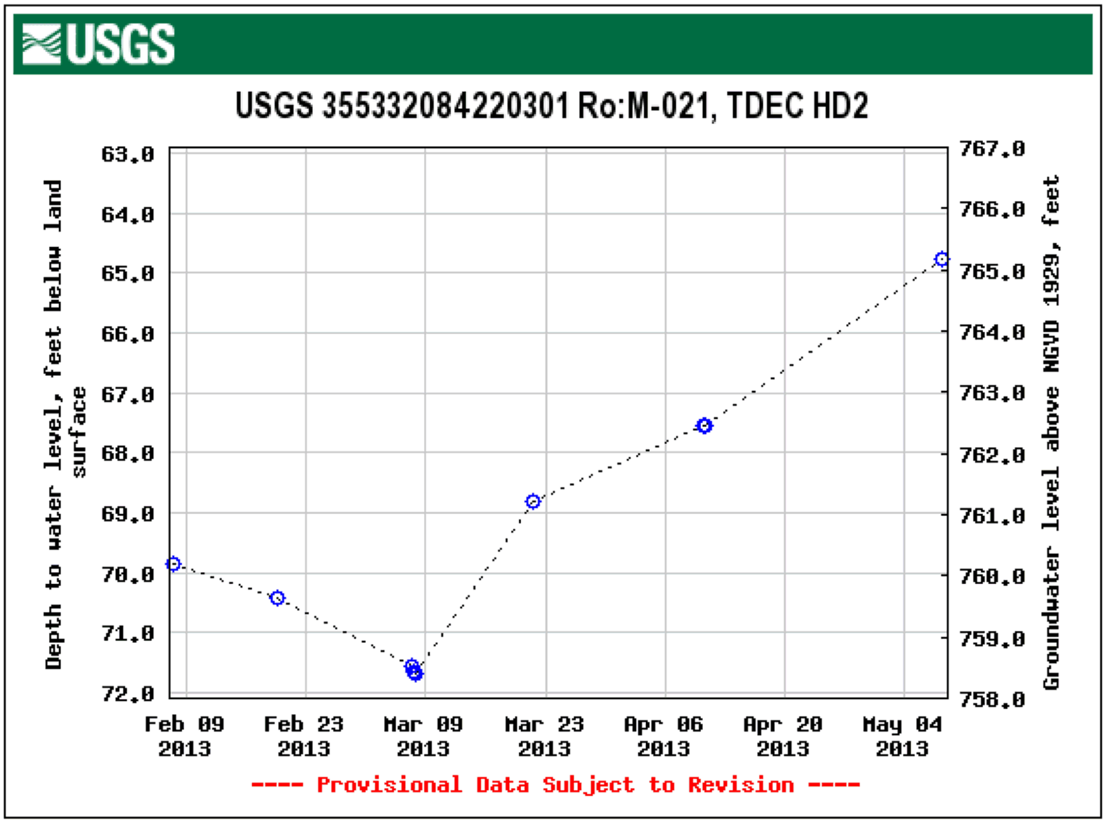
Sevier County, Tennessee
Hydrologic Unit Code 06010201
Latitude 35°39'22", Longitude 83°34'56" NAD27
Land-surface elevation 2,150 feet above NGVD29
The depth of the well is 220 feet below land surface.
The depth of the hole is 220 feet below land surface.
This well is completed in the Piedmont and Blue Ridge crystalline-rock aquifers (N400PDMBRX) national aquifer.
This well is completed in the Great Smoky Group (400GSMK) local aquifer.

Location of the site in Tennessee



Reference 2.4.12-23

Figure 2.4.12-30. U.S. Geological Survey Regional Hydrograph

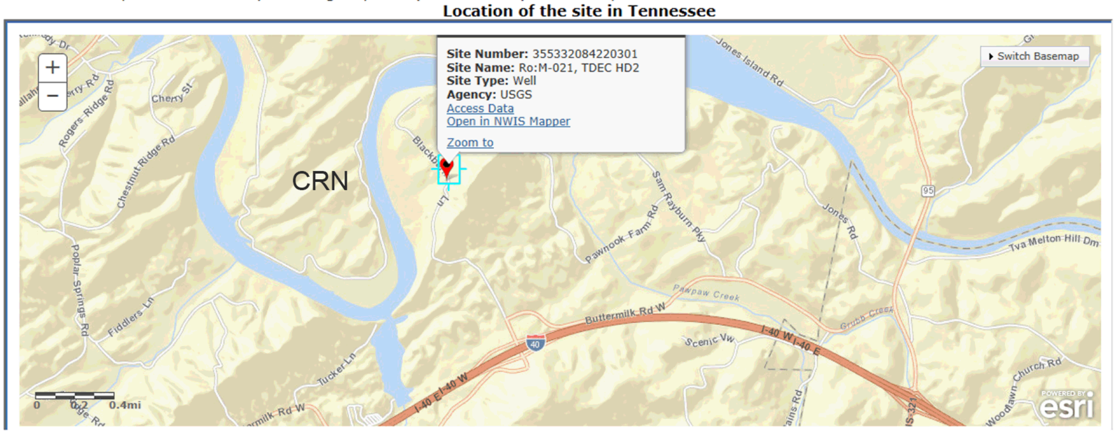


USGS 355332084220301 Ro:M-021, TDEC HD2

Available data for this site Location map GO

Roane County, Tennessee
Hydrologic Unit Code --
Latitude 35°53'32.15", Longitude 84°22'03.04" NAD83
Land-surface elevation 830 feet above NGVD29
The depth of the well is 610 feet below land surface.
The depth of the hole is 610 feet below land surface.
This well is completed in the Valley and Ridge aquifers (N500VLYRDG) national aquifer.

Location of the site in Tennessee



Reference 2.4.12-24

Figure 2.4.12-31. U.S. Geological Survey Hydrograph Near the Clinch River Nuclear Site

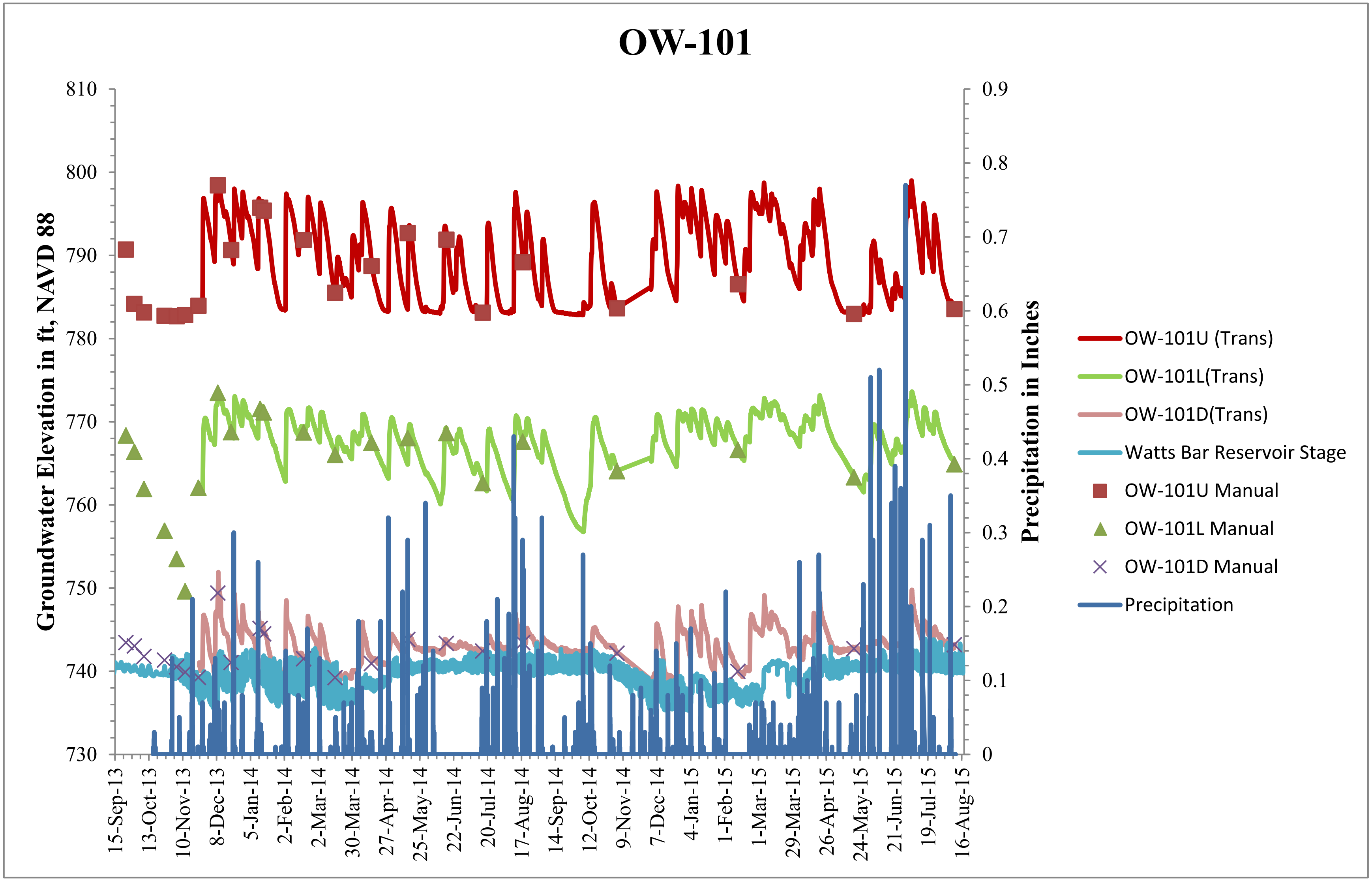


Figure 2.4.12-32. (Sheet 1 of 14) Hydrograph of OW-101 Well Cluster

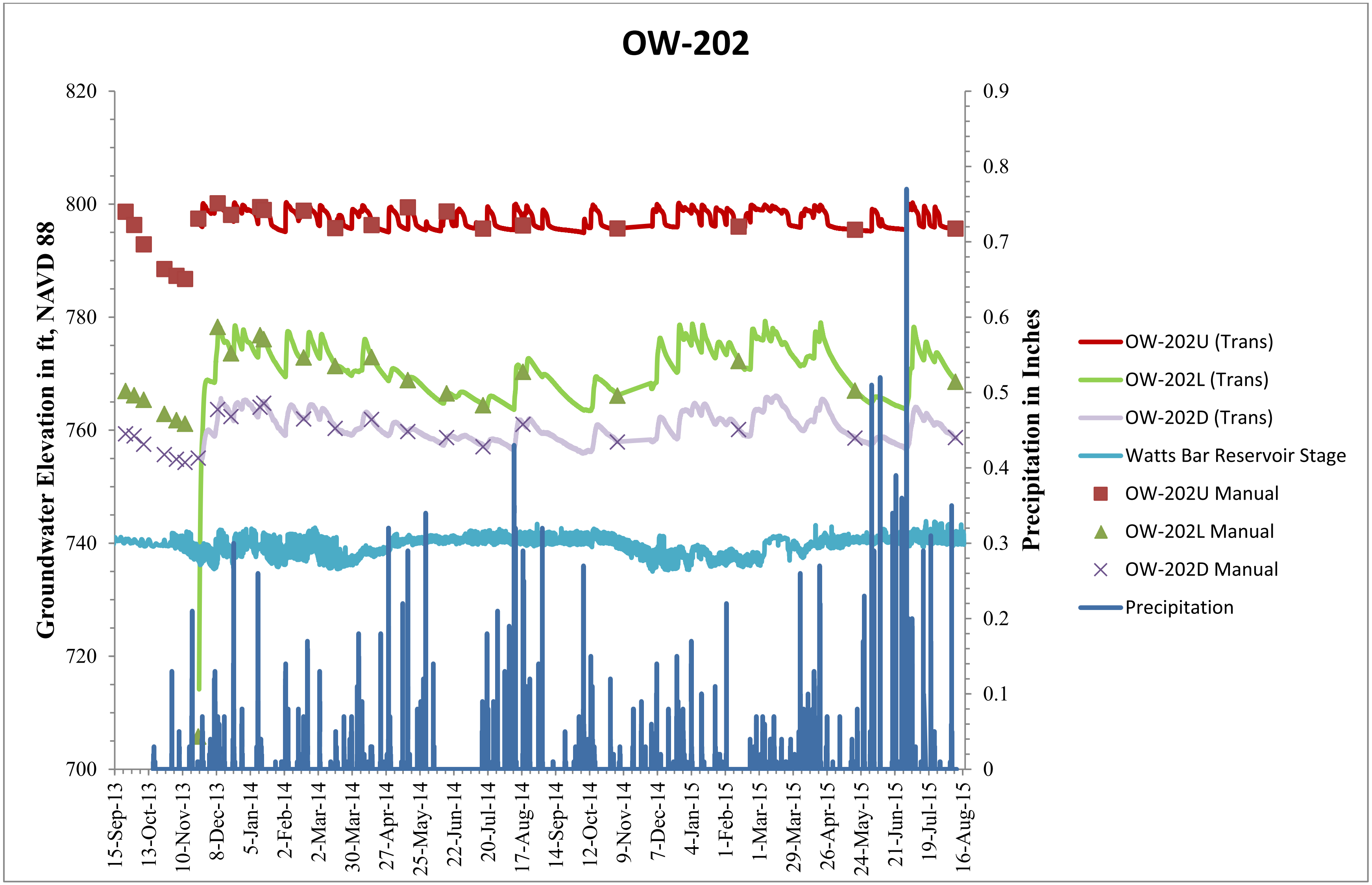


Figure 2.4.12-32. (Sheet 2 of 14) Hydrograph of OW-202 Well Cluster

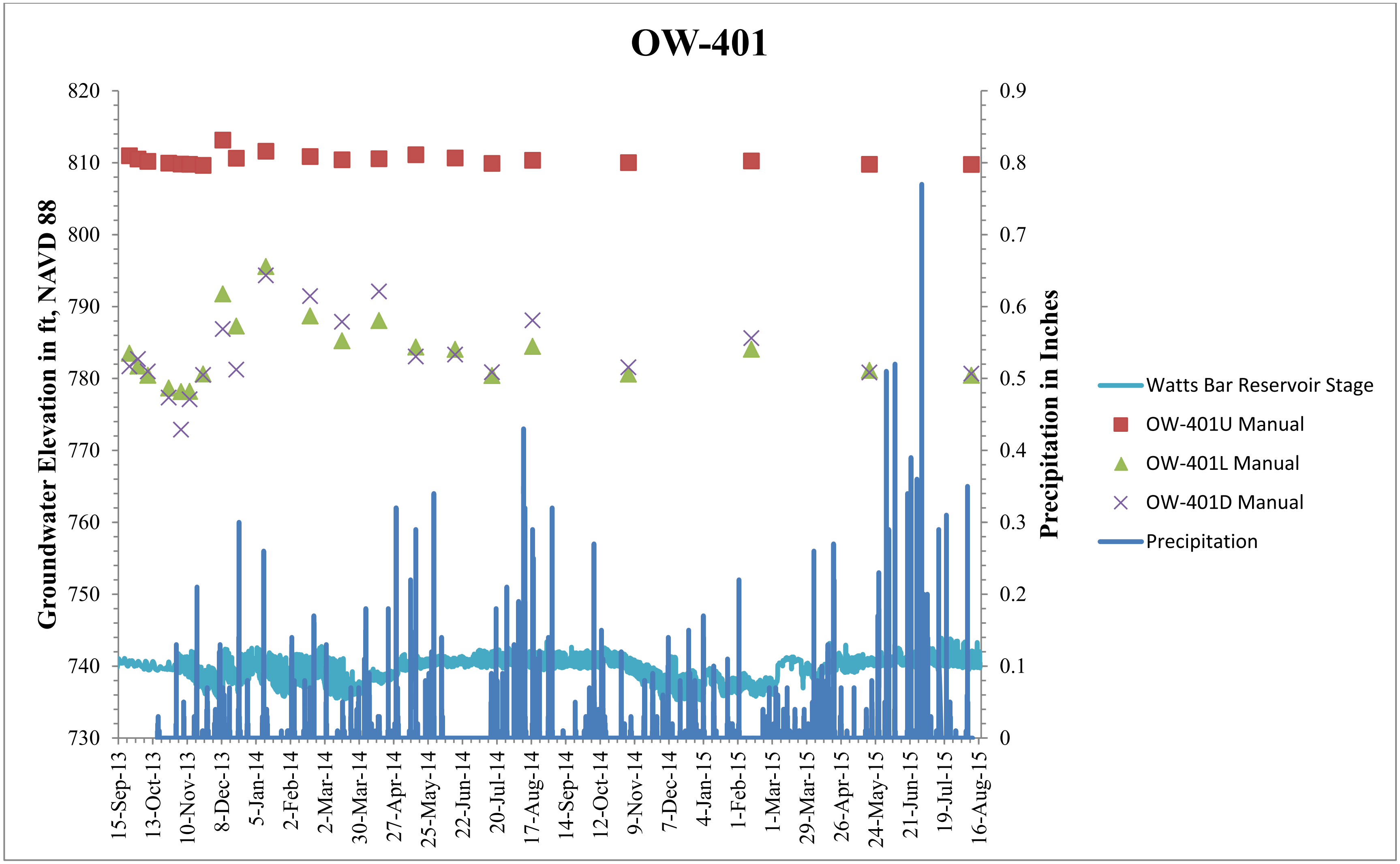


Figure 2.4.12-32. (Sheet 3 of 14) Hydrograph of OW-401 Well Cluster

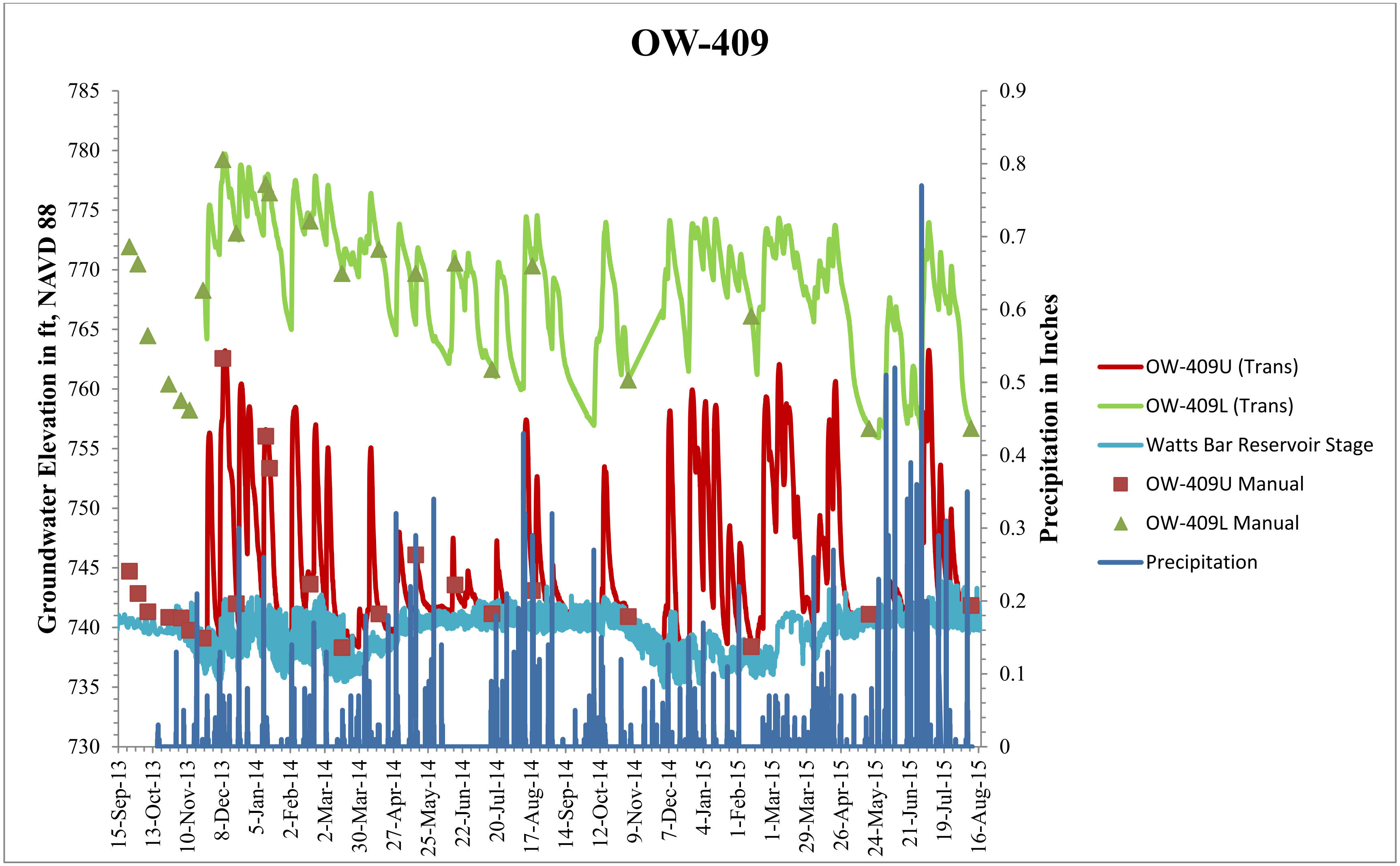


Figure 2.4.12-32. (Sheet 4 of 14) Hydrograph of OW-409 Well Cluster

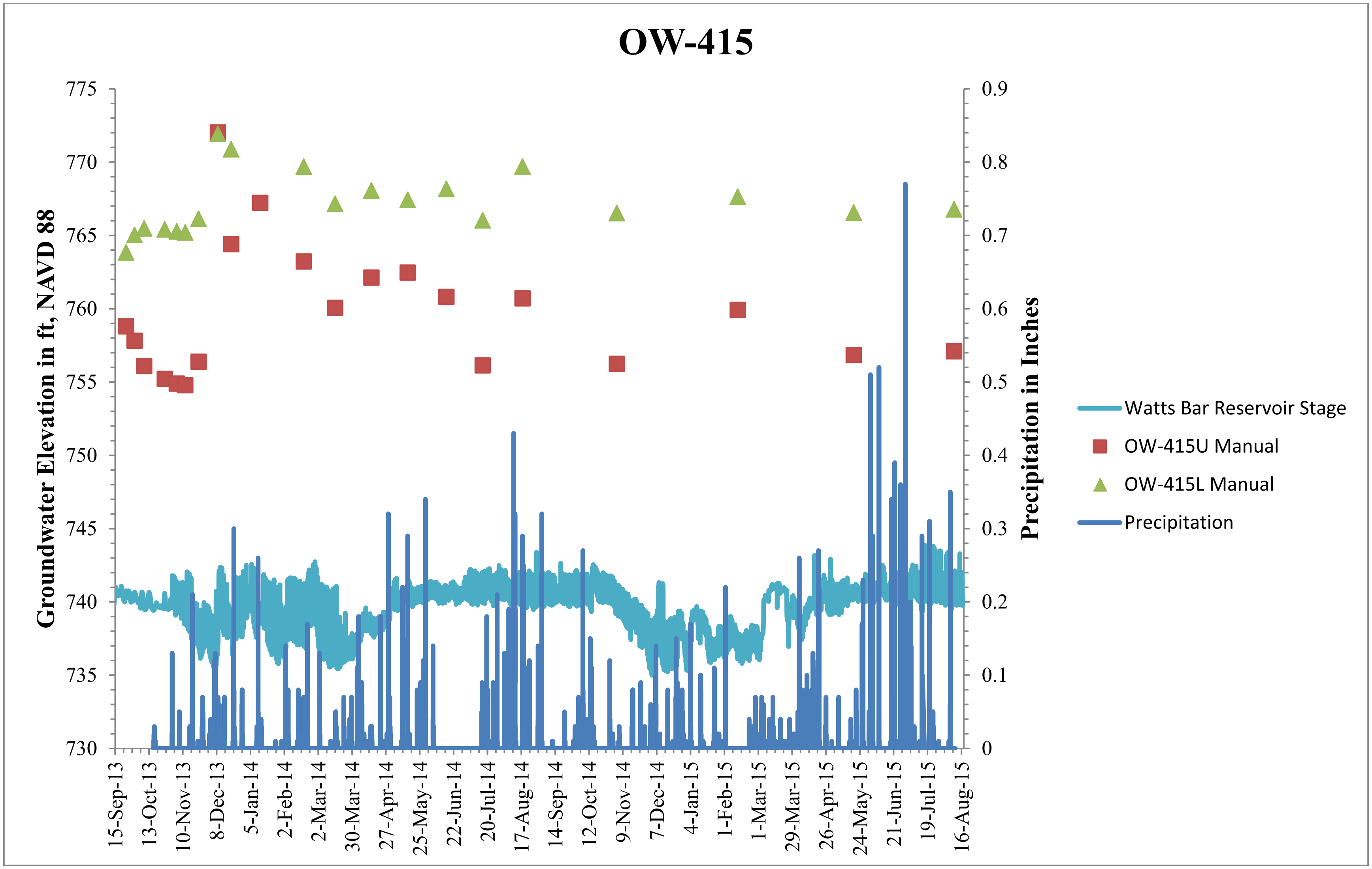


Figure 2.4.12-32. (Sheet 5 of 14) Hydrograph of OW-415 Well Cluster

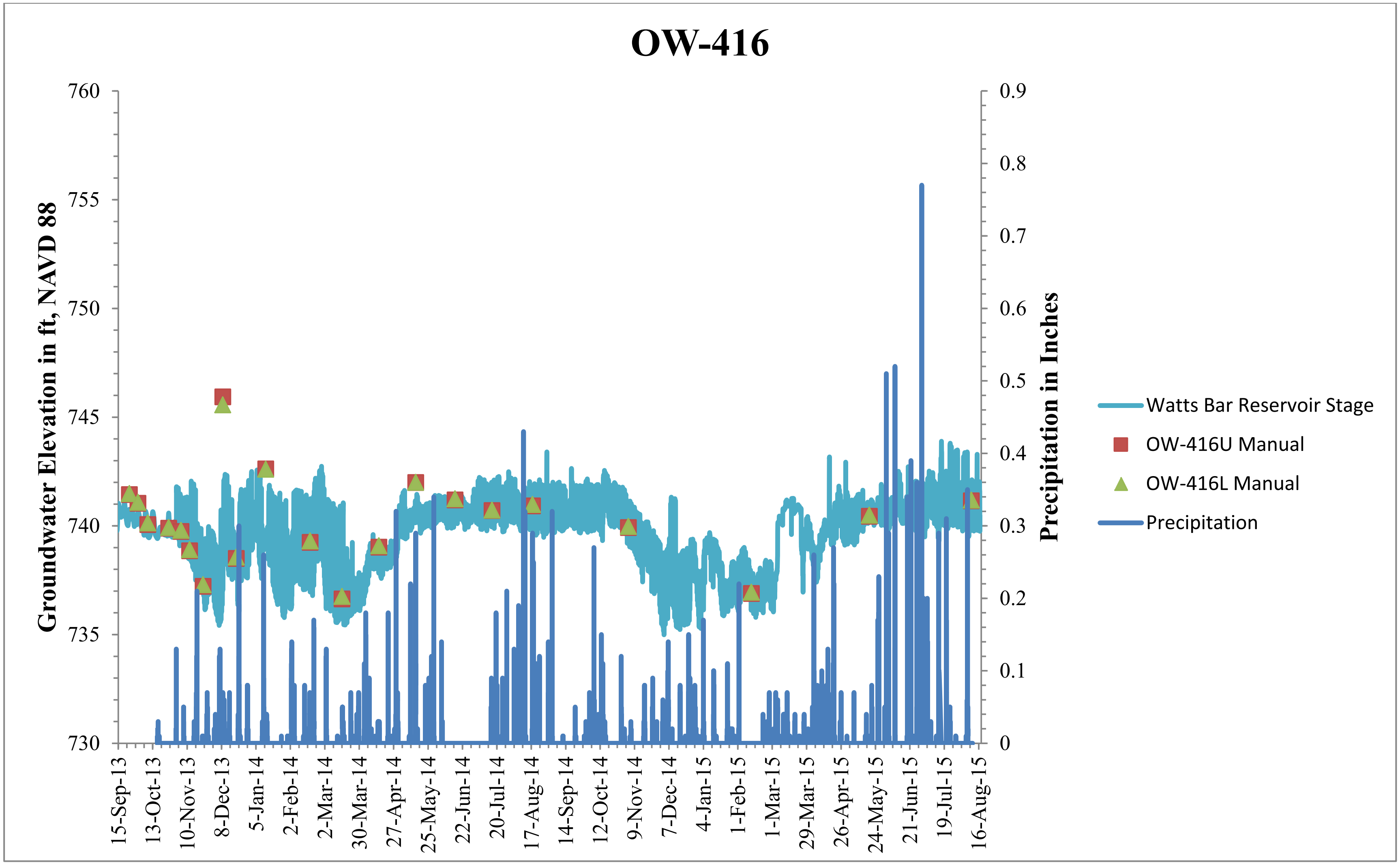


Figure 2.4.12-32. (Sheet 6 of 14) Hydrograph of OW-416 Well Cluster

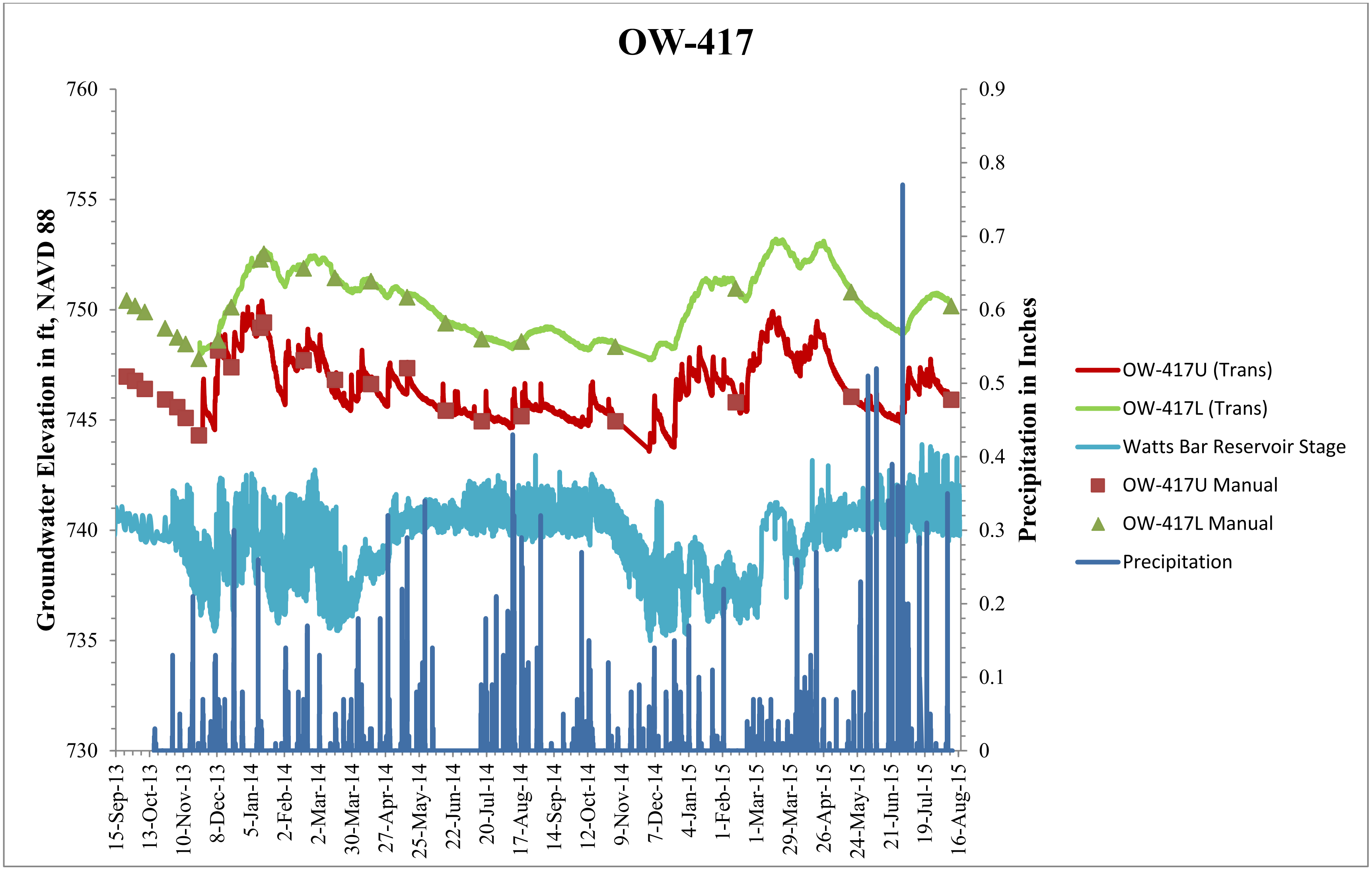


Figure 2.4.12-32. (Sheet 7 of 14) Hydrograph of OW-417 Well Cluster

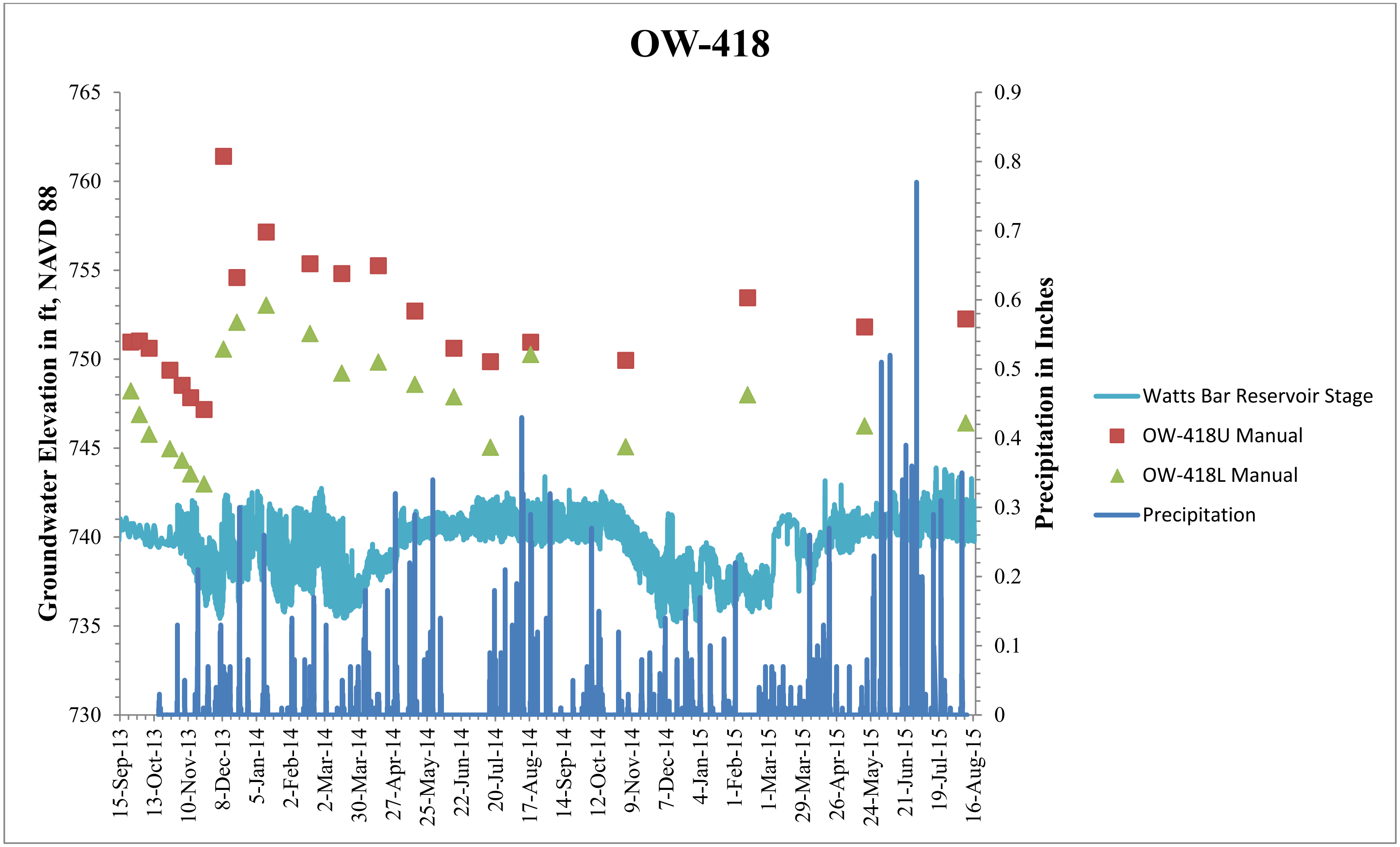


Figure 2.4.12-32. (Sheet 8 of 14) Hydrograph of OW-418 Well Cluster

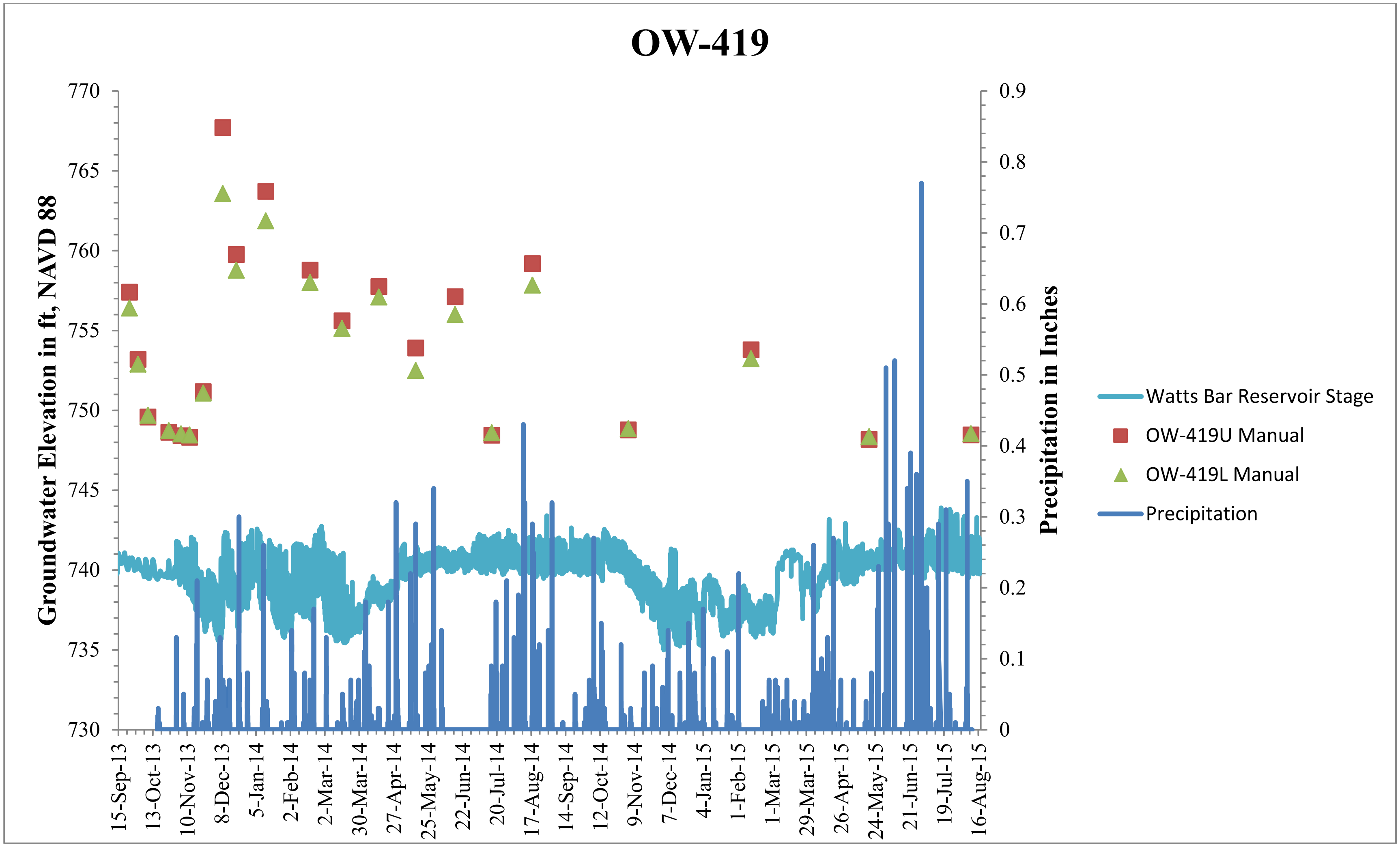


Figure 2.4.12-32. (Sheet 9 of 14) Hydrograph of OW-419 Well Cluster

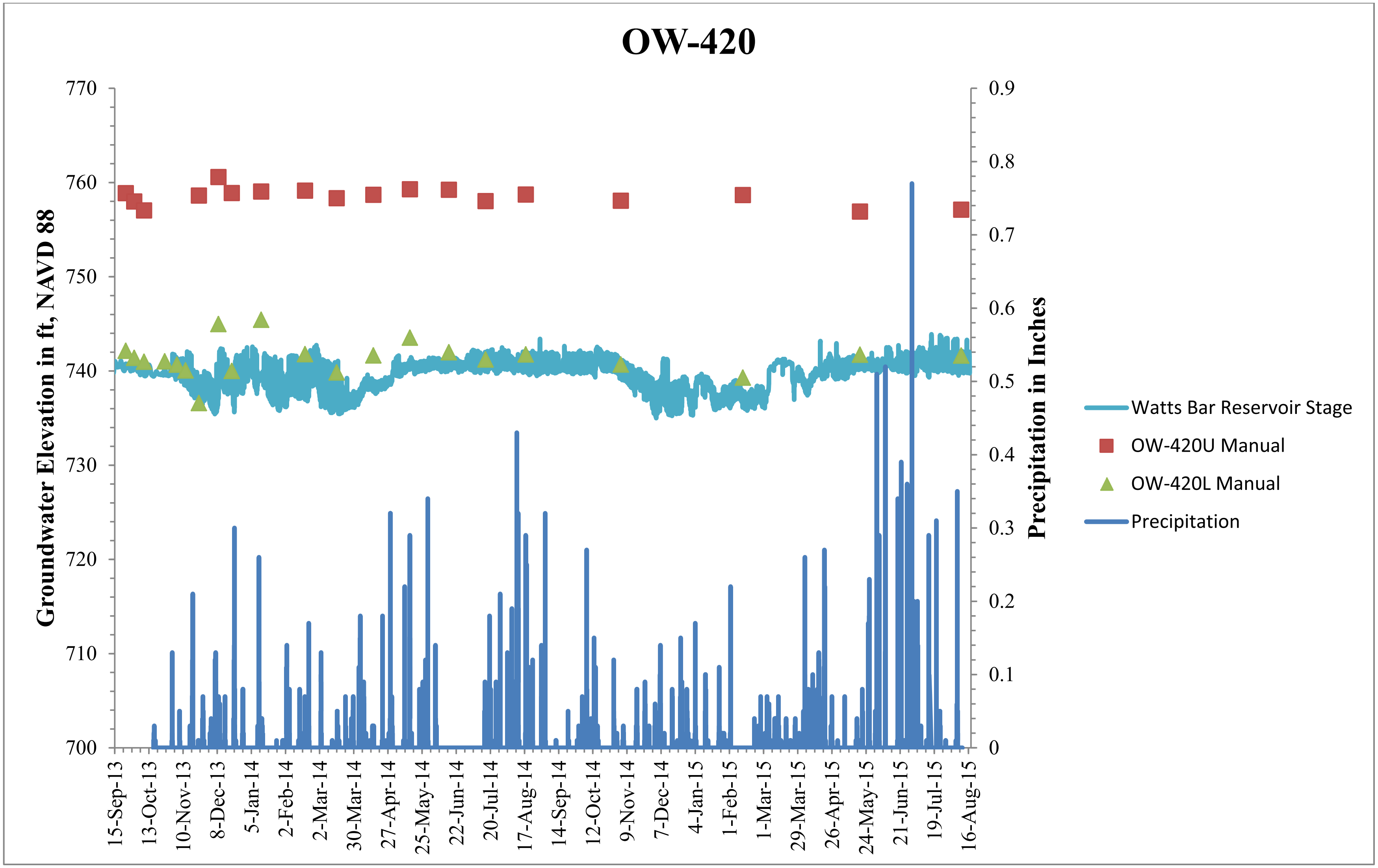


Figure 2.4.12-32. (Sheet 10 of 14) Hydrograph of OW-420 Well Cluster

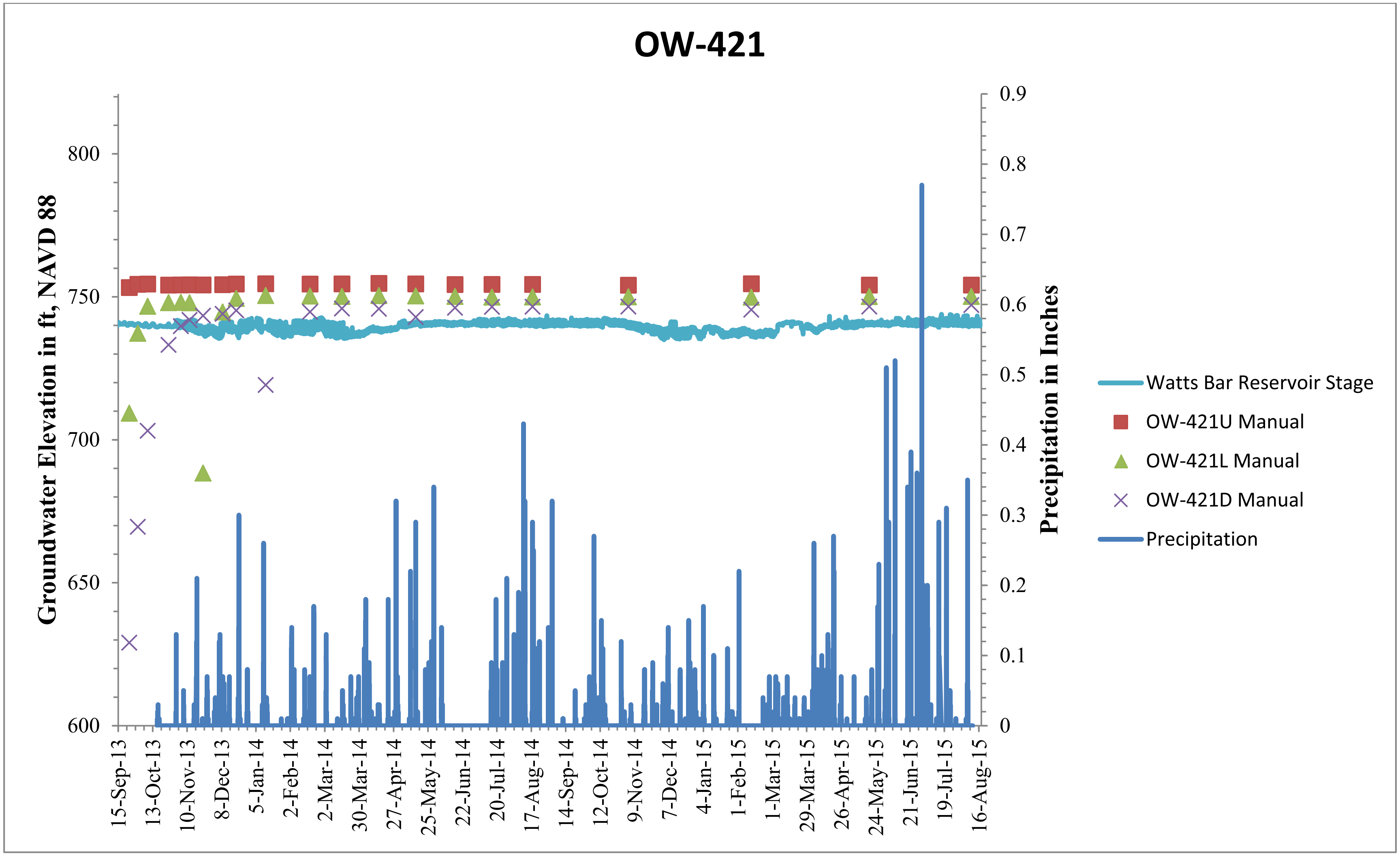


Figure 2.4.12-32. (Sheet 11 of 14) Hydrograph of OW-421 Well Cluster

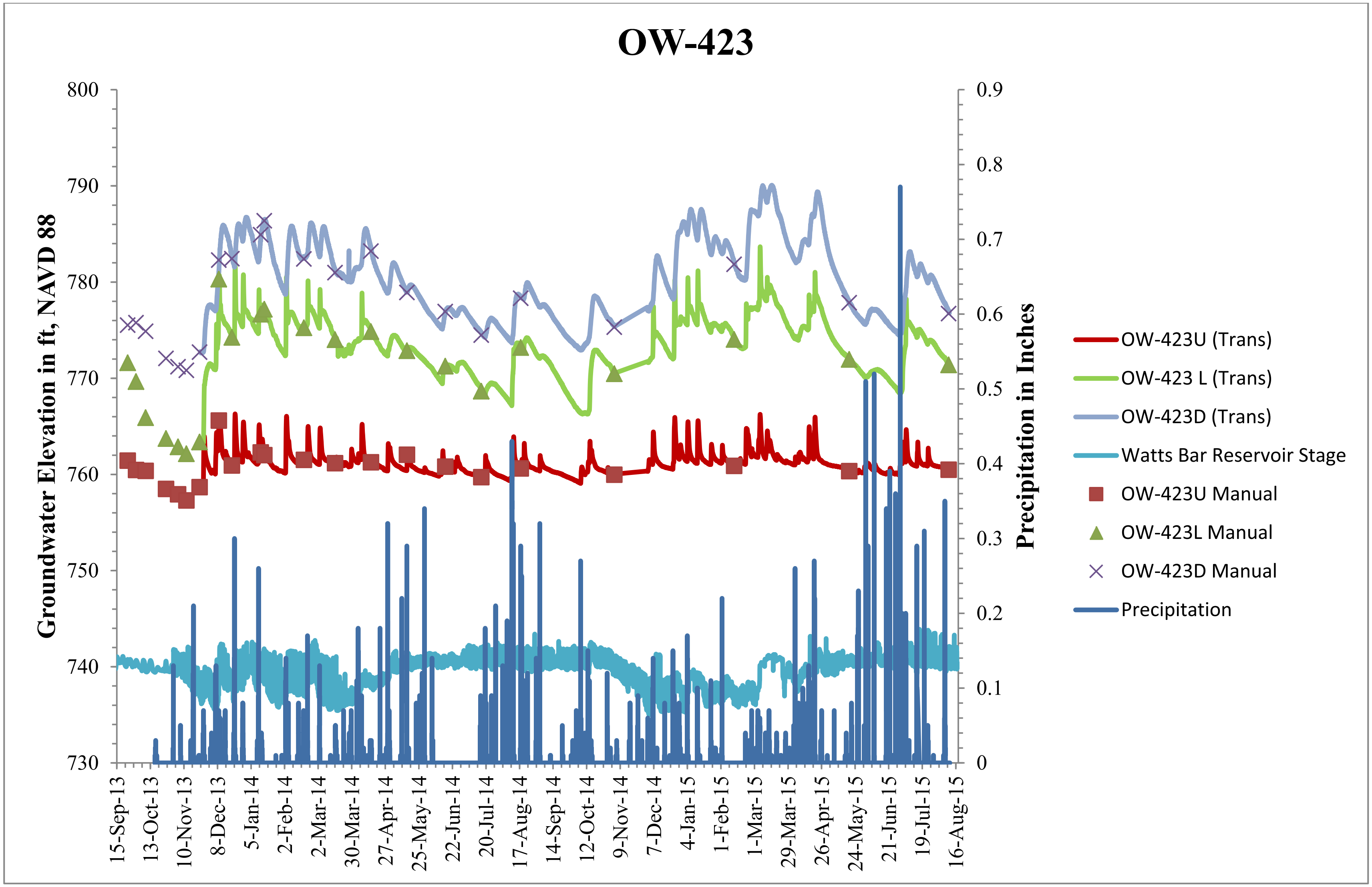


Figure 2.4.12-32. (Sheet 12 of 14) Hydrograph of OW-423 Well Cluster

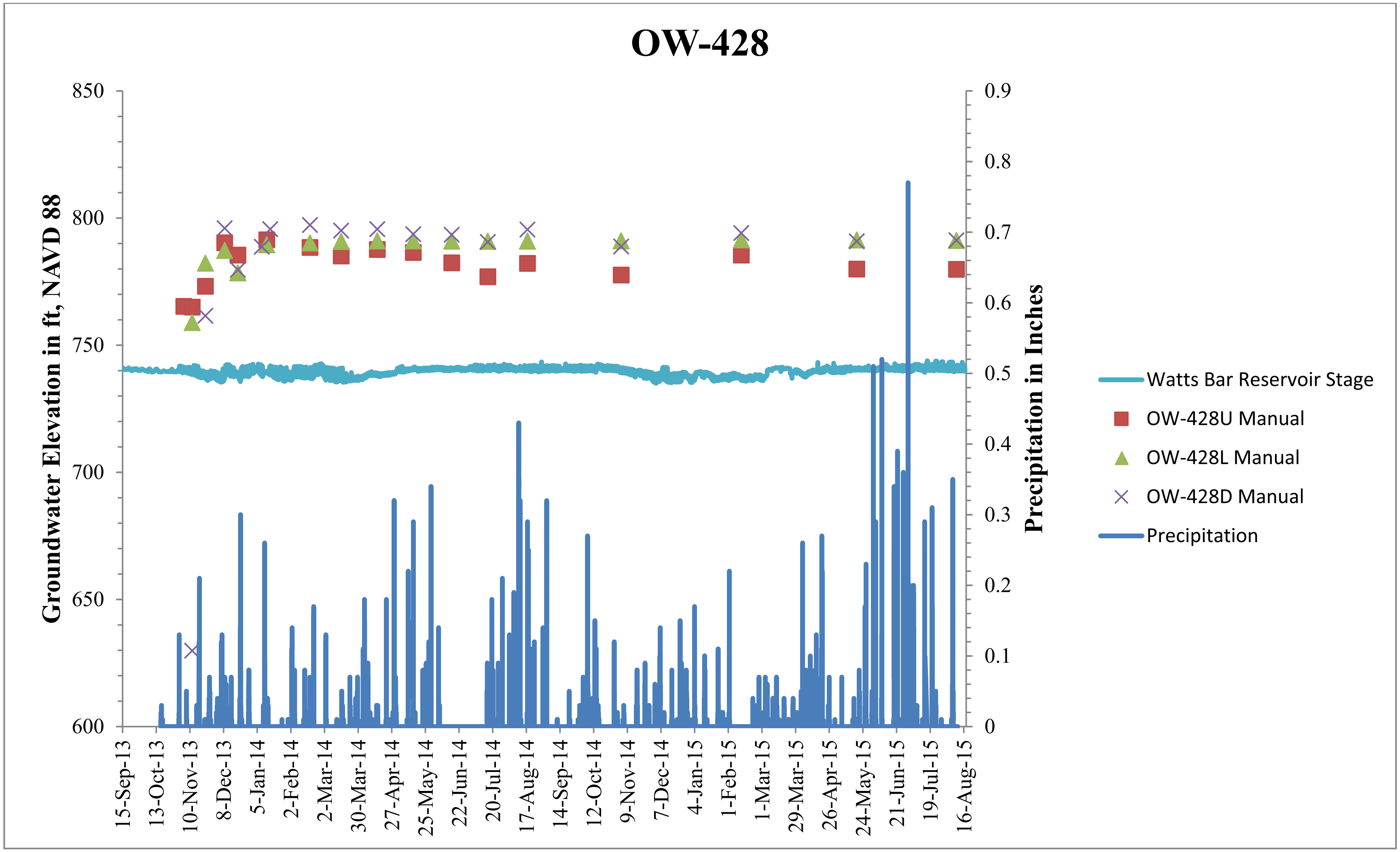


Figure 2.4.12-32. (Sheet 13 of 14) Hydrograph of OW-428 Well Cluster

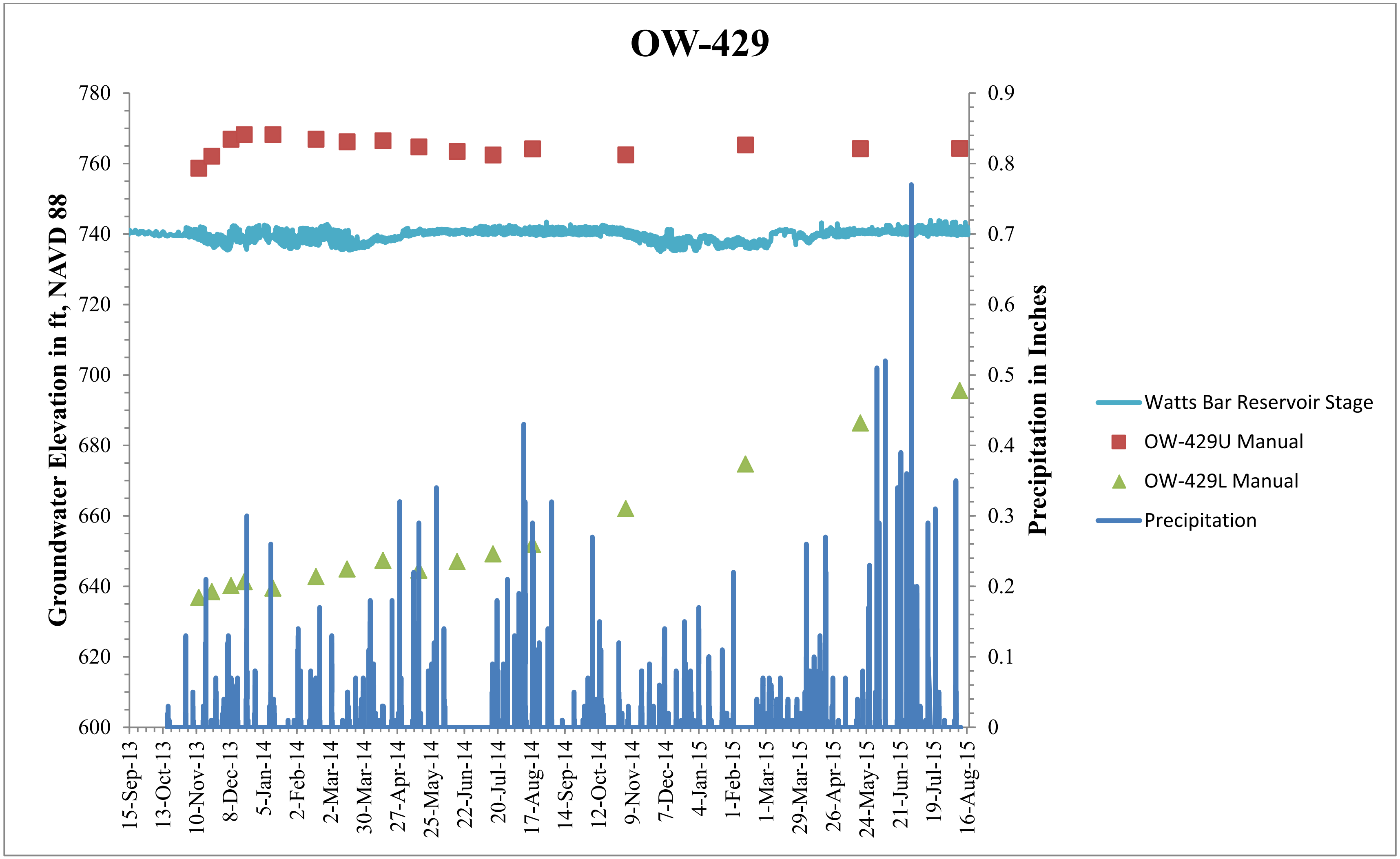


Figure 2.4.12-32. (Sheet 14 of 14) Hydrograph of OW-429 Well Cluster

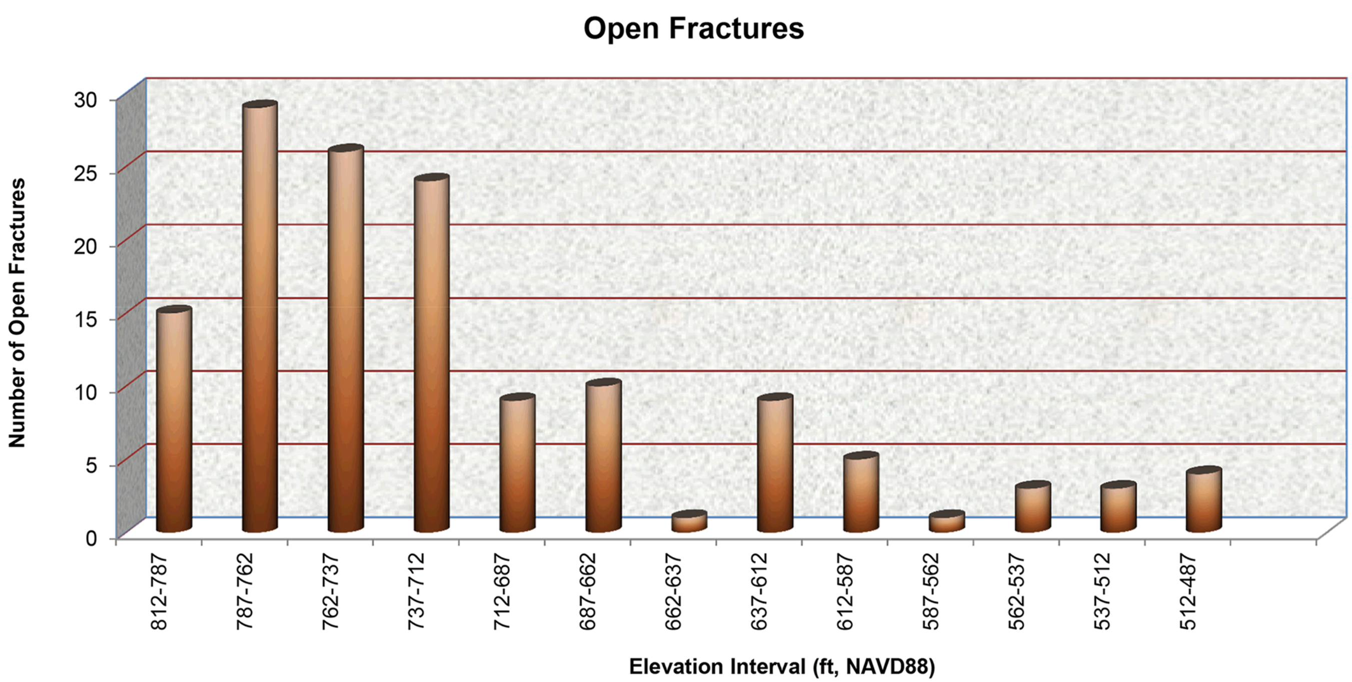
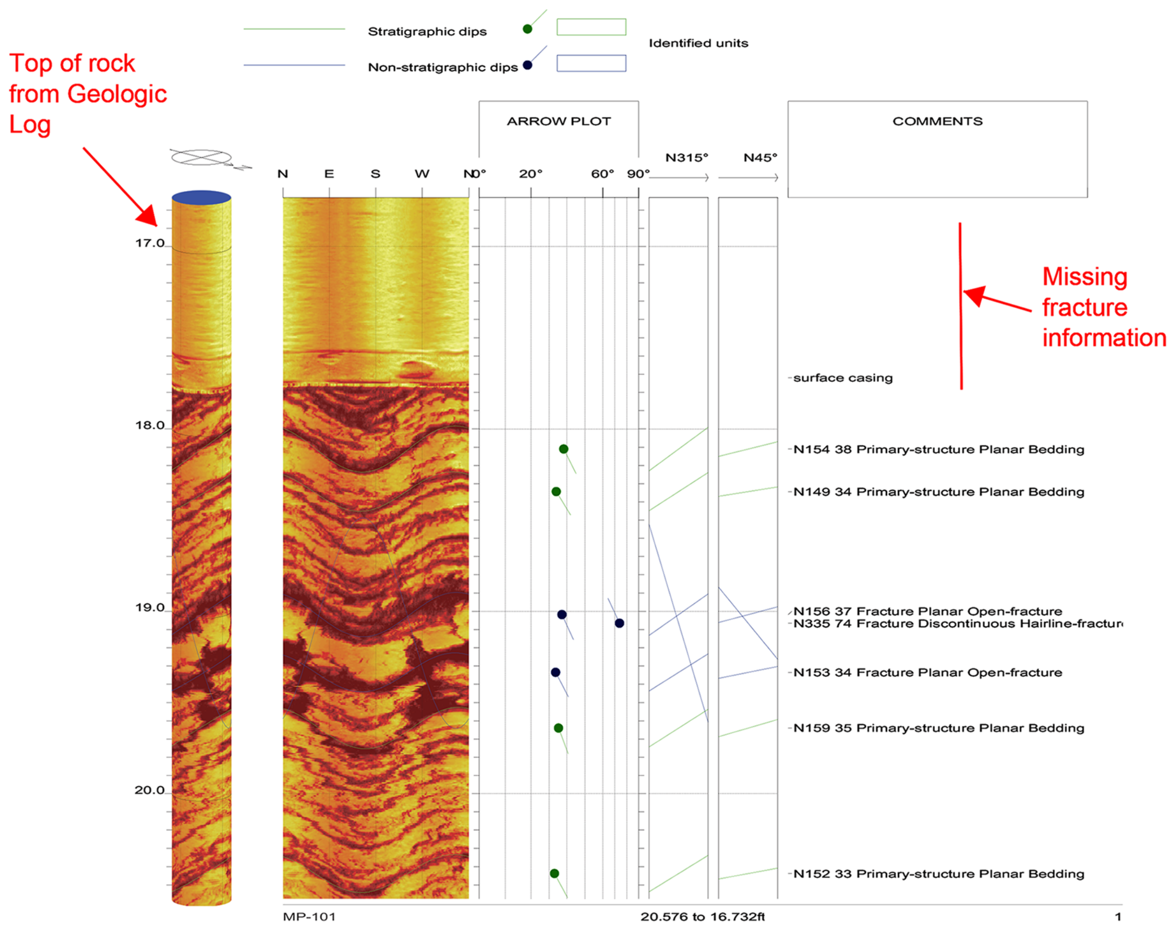
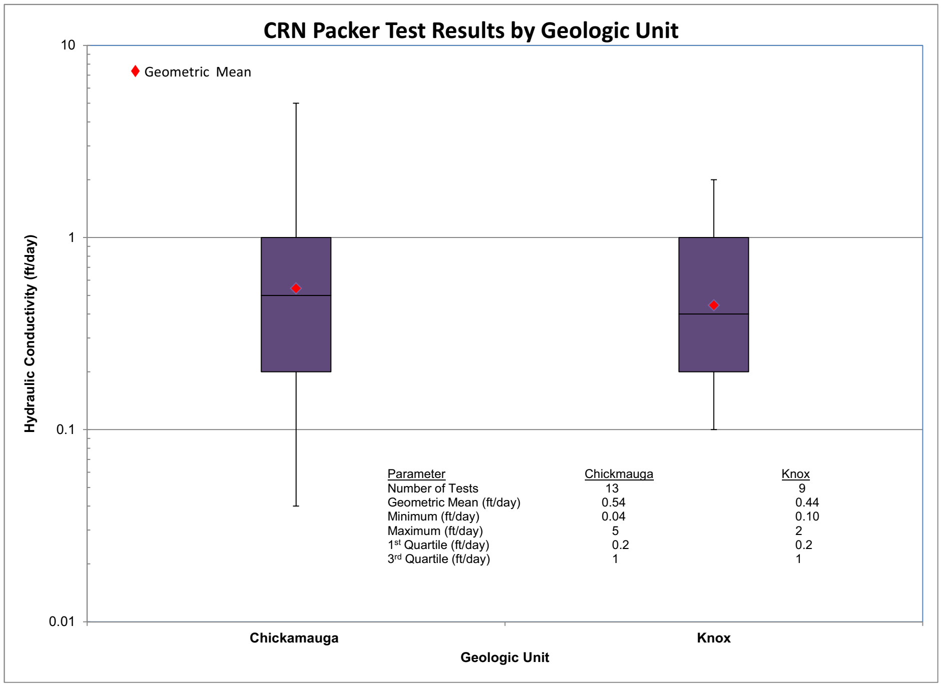


Figure 2.4.12-33. Fracture Frequency Histogram

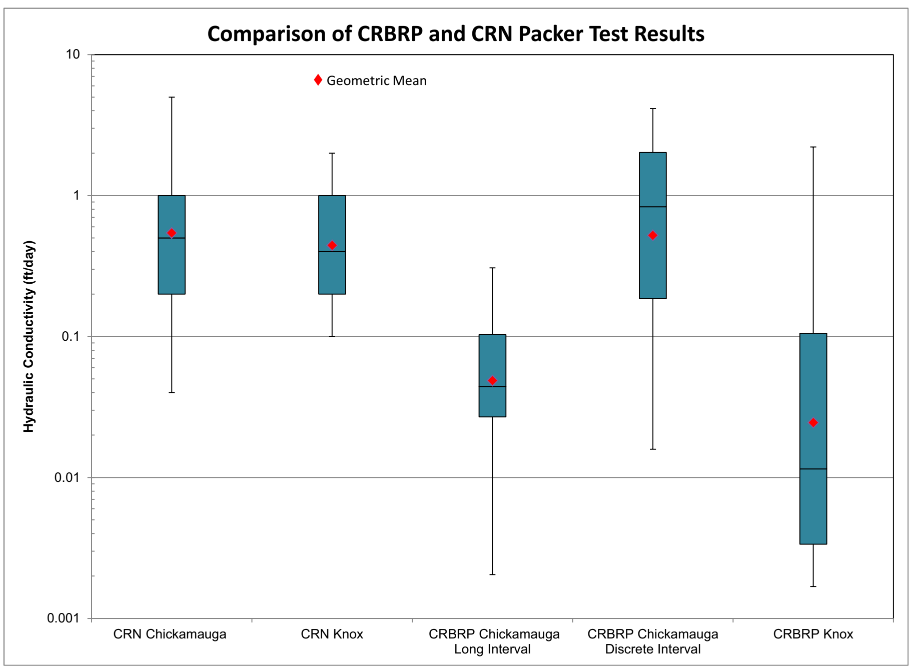


Adapted from Reference 2.4.12-13

Figure 2.4.12-34. Example Acoustic Televiewer Geophysical Log



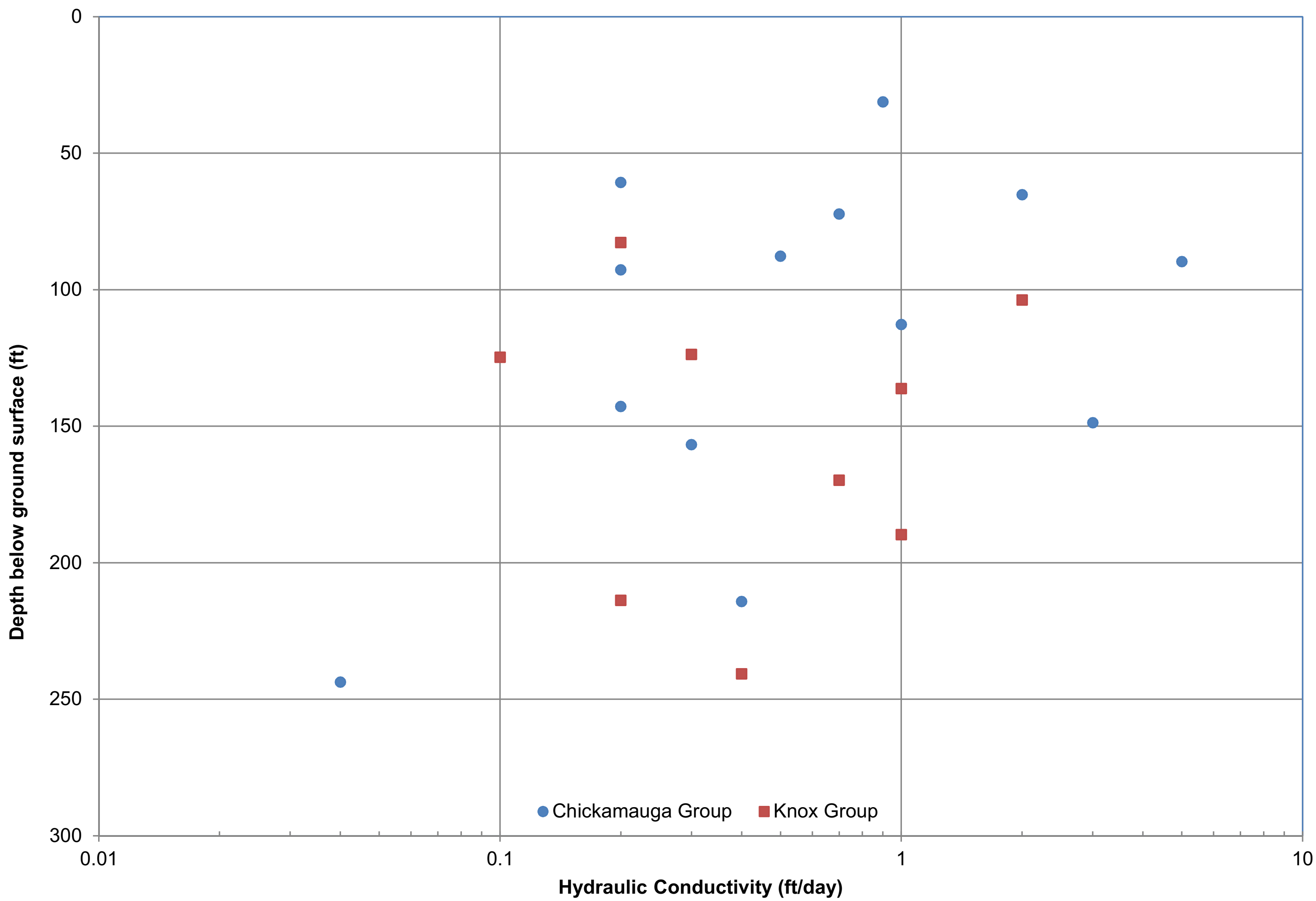
a) Box and whisker plot of CRN site packer test results by geologic unit



b) Box and whisker plot comparing CRN site packer test results with CRBRP packer test results

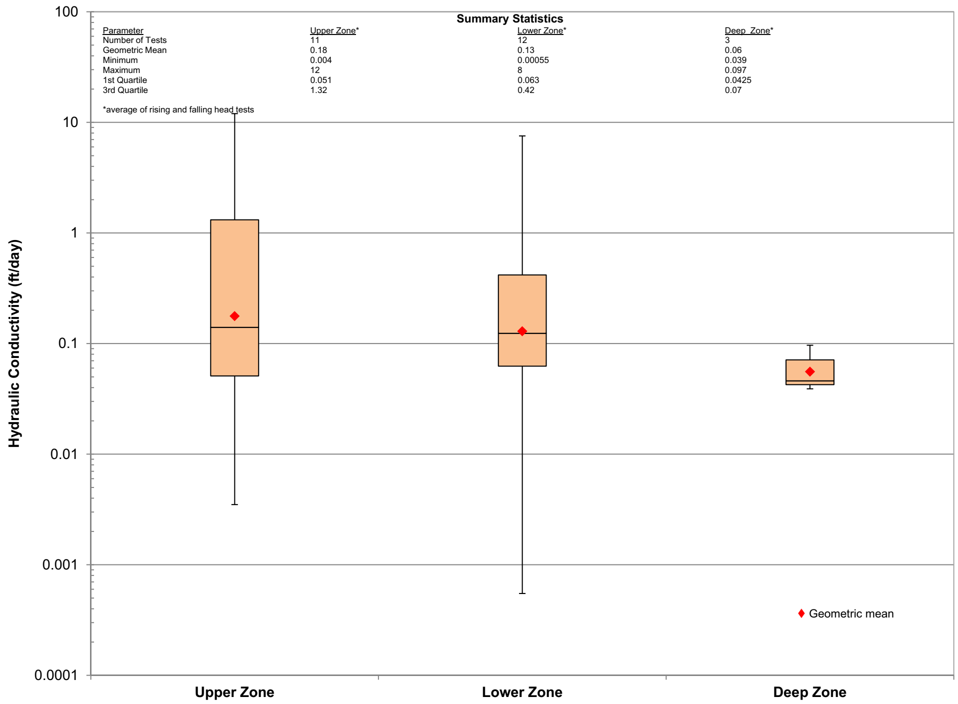
Data sources: Table 2.4.12-10 and Table 2.4.12-3

Figure 2.4.12-35. Clinch River Nuclear Site Borehole Packer Test Results Box and Whisker Plots

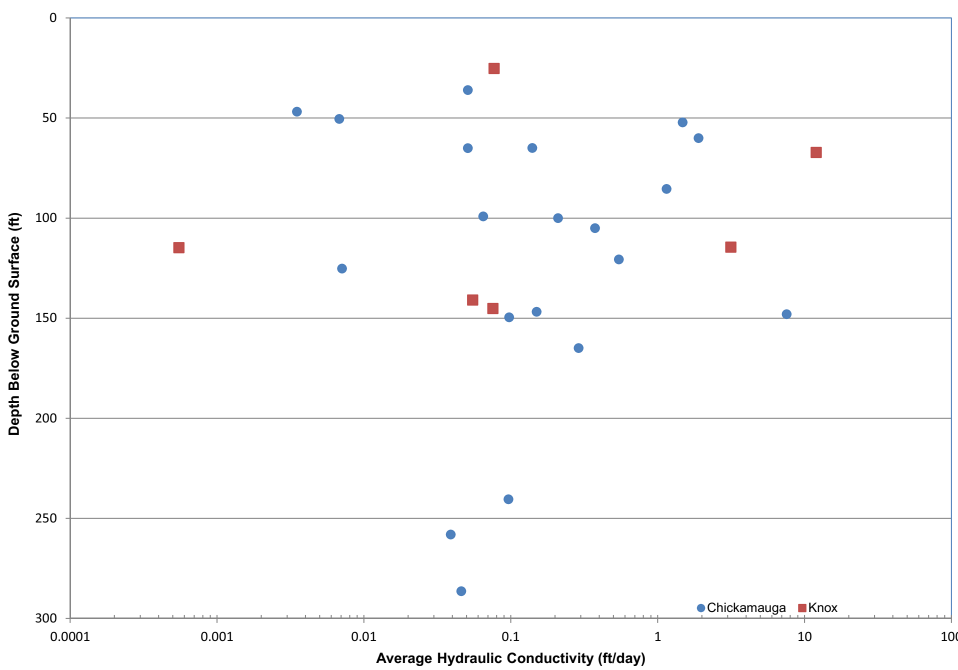


Data Source: Table 2.4.12-10

Figure 2.4.12-36. Scatter Plot of Clinch River Nuclear Site Packer Test Hydraulic Conductivity Results with Depth



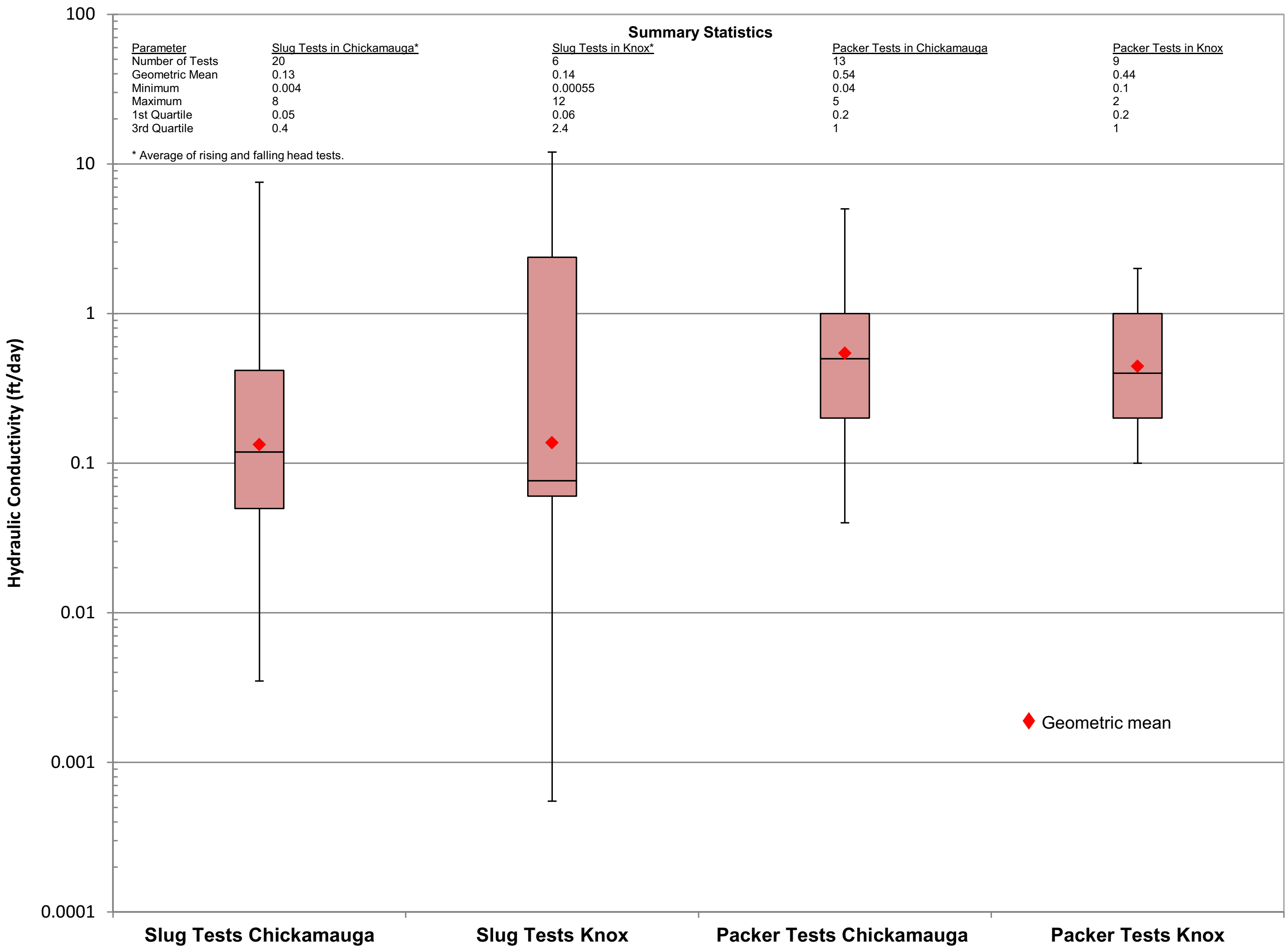
a) Box and whisker plot of slug test hydraulic conductivity by observation well monitoring zone



b) Scatter plot of slug test hydraulic conductivity with depth below ground surface

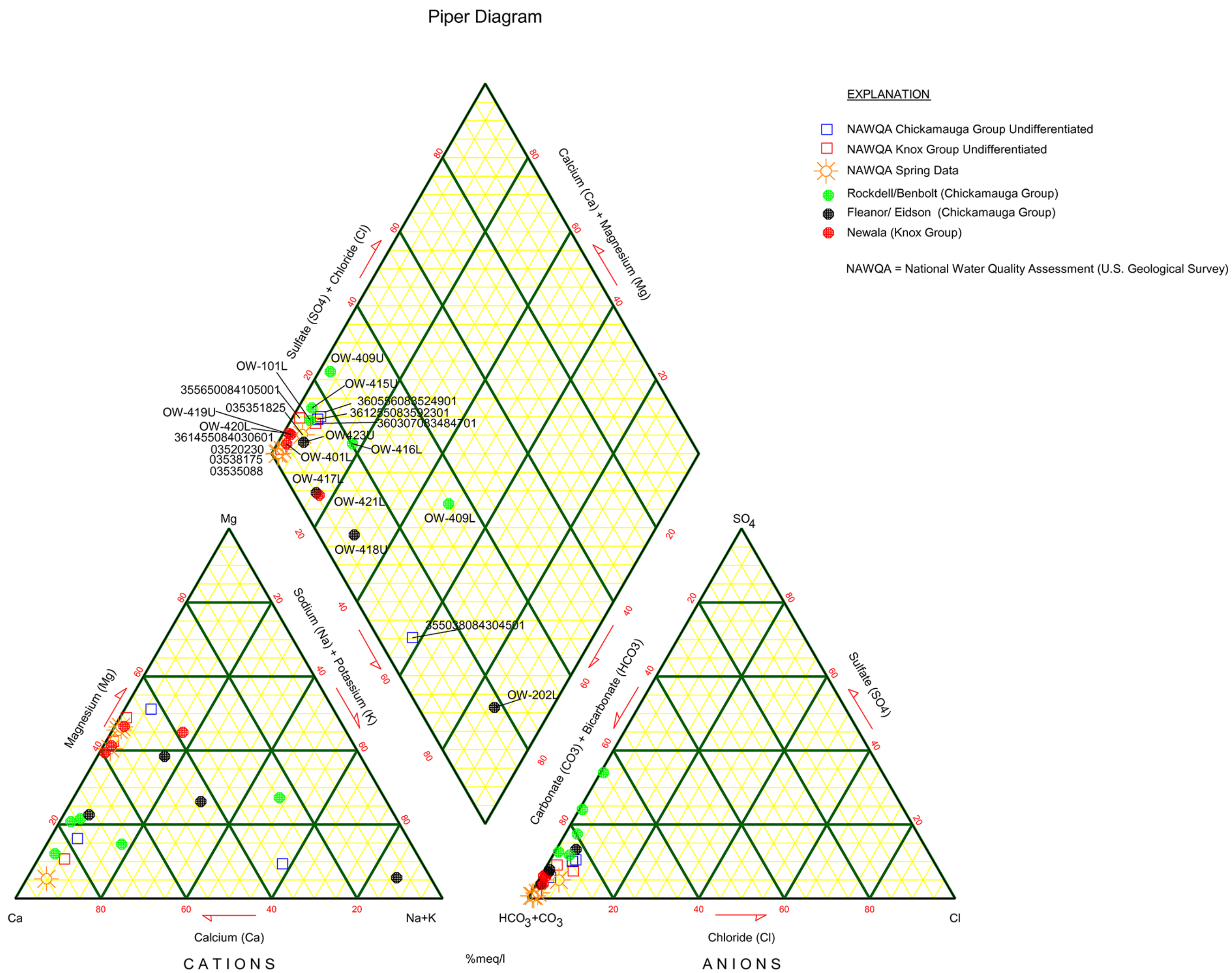
Data Source: Table 2.4.12-11

Figure 2.4.12-37. Slug Test Results for the Clinch River Nuclear Site



Data Sources: Table 2.4.12-10 and Table 2.4.12-11

Figure 2.4.12-38. Comparison of Slug and Packer Test Results



Data Sources: Reference 2.4.12-13 and Reference 2.4.12-35

Figure 2.4.12-39. Piper Trilinear Diagram

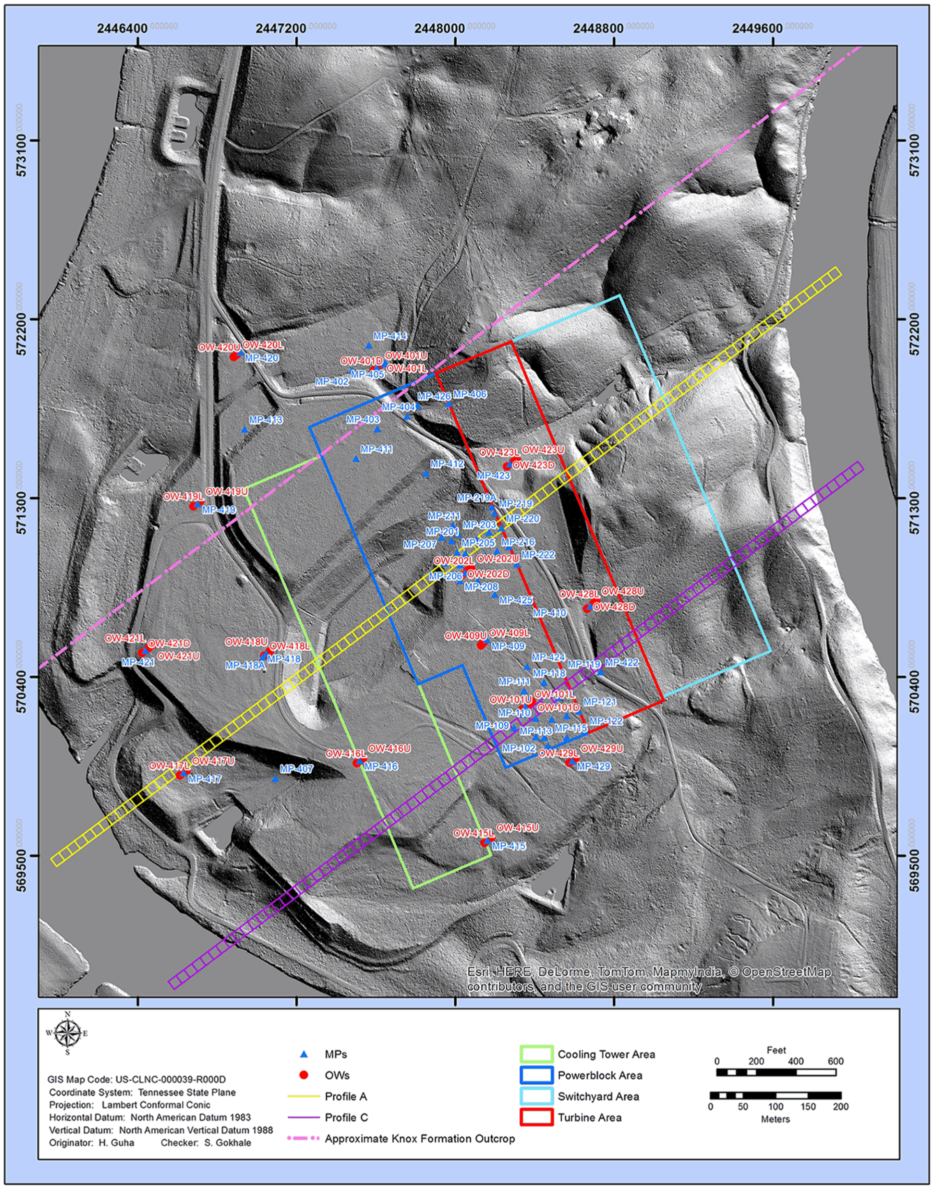


Figure 2.4.12-40. Plan View of the Profile Model with Grids

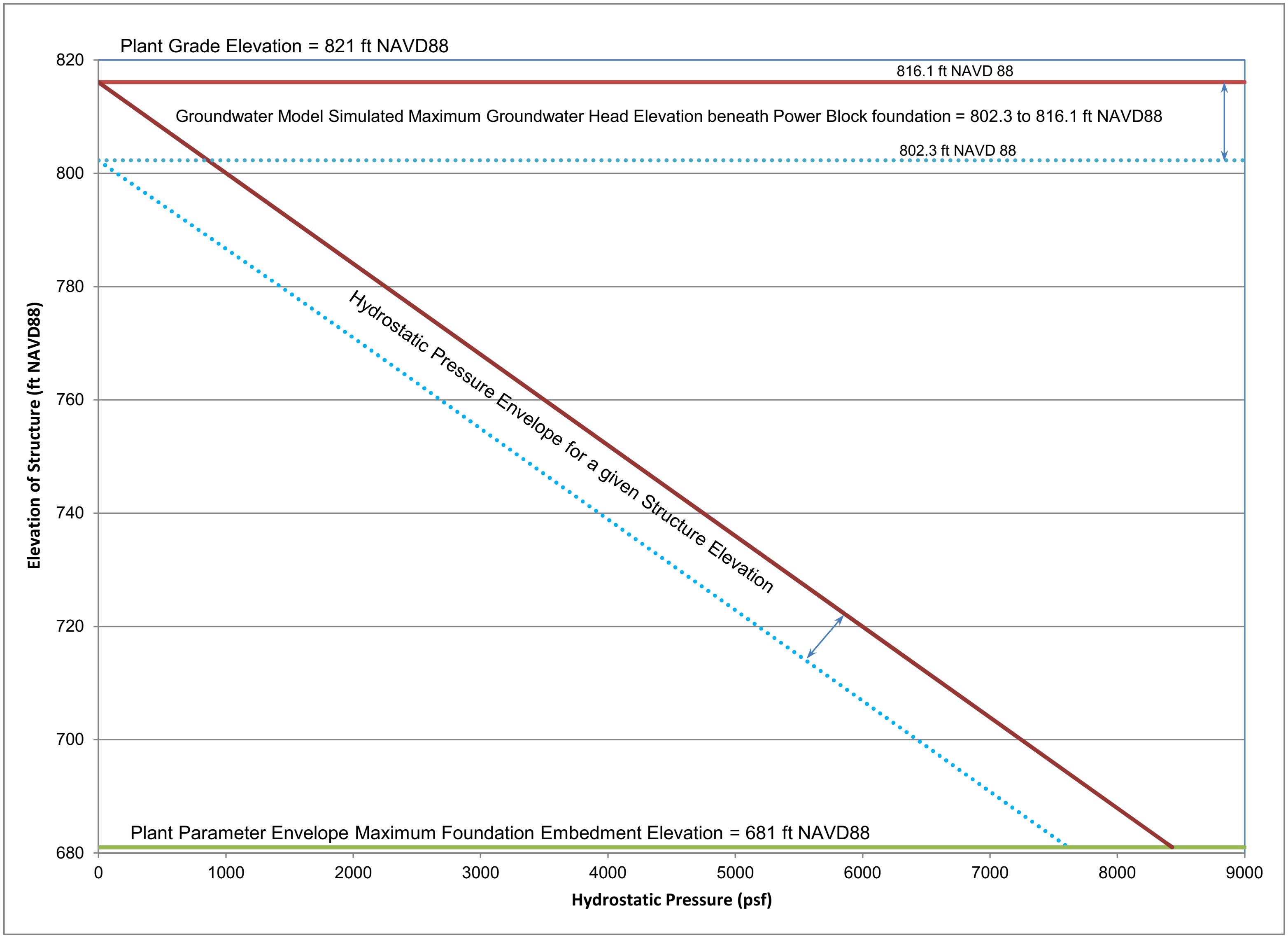
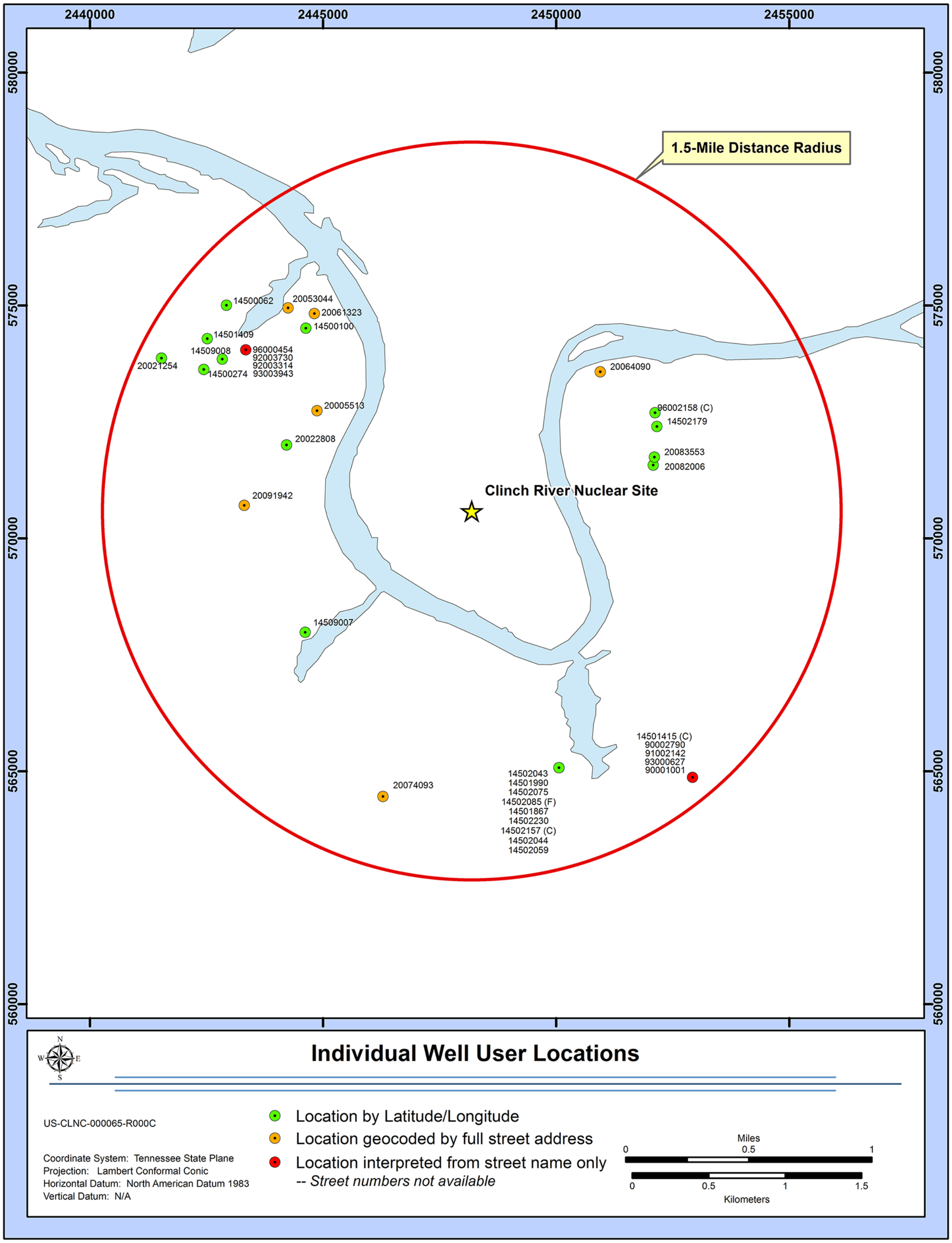


Figure 2.4.12-41. Maximum Hydrostatic Pressure



Note: (F) indicates farm well, (C) indicates commercial well.

Figure 2.4.12-42. Individual Well Locations Within a 1.5-mile Radius of the CRN Site