2.3.2 Water Use

This subsection describes surface water and groundwater uses in the vicinity of the Clinch River Nuclear (CRN) Site which can affect or be affected by the construction and operation of two or more small modular reactors (SMRs). Information provided in this subsection includes descriptions of the types of consumptive and non-consumptive water uses, identification of water use withdrawal and discharge locations, and qualification of water withdrawals and returns. In addition, a detailed assessment of local area facility water use is discussed in this subsection.

2.3.2.1 Surface Water

To evaluate surface water availability for the Clinch River (CR) SMR Project, Tennessee Valley Authority (TVA) conducted a Regional Surface Water Use Study (Reference 2.3.2-1).

2.3.2.1.1 Basin-wide Surface Water Use

Total surface water withdrawals for the Tennessee River watershed during 2010 were estimated to average 11,747 million gallons per day (mgd). The return flow was estimated to be 11,480 mgd, which represents 96.1 percent of the water withdrawn. The net water demand, which is the difference between the withdrawals and the returns, is a measure of consumptive use. Consumptive use is water that evaporates, transpires, or is consumed by humans, livestock, or crops. The net water demand in 2010 was 471 mgd, or 3.9 percent of the total withdrawals. (Reference 2.3.2-1)

Of the 11,747 mgd of surface water withdrawn from the Tennessee River system in 2010, thermoelectric power withdrawals were an estimated 10,046 mgd; industrial withdrawals were 1116 mgd; public supply withdrawals were 558 mgd; and irrigation withdrawals were 27 mgd. (Reference 2.3.2-1)

In 2010, net water demand was 52 mgd for thermoelectric, 75 mgd for industrial, 310 mgd for public supply, and 34 mgd for irrigation. By 2035, overall total water withdrawals are projected to decline approximately 21 percent to 9449 mgd. By category, water withdrawals are projected to increase as follows: industrial withdrawals increase 31 percent to 1502 mgd, public supply withdrawals increase 30 percent to 938 mgd, and irrigation withdrawals increase 35 percent to 46 mgd. Thermoelectric water withdrawal is expected to decline 31 percent to 6963 mgd, reflecting a change in both generating and cooling technologies for power plants. (Reference 2.3.2-1)

Table 2.3.2-1 shows historical off-stream water use in the Tennessee River watershed from 1995 to 2010 and projected water use to 2035. Total water use peaked in 2005 and has decreased since then, mostly due to decline in thermoelectric water use. Industrial and irrigation use has changed little from 1995 to 2010, but public supply has increased steadily, closely following population growth.

2.3.2.1.2 Water Use Regulation

The U.S. Environmental Protection Agency (EPA) has promulgated regulations that implement Section 316(b) of the Clean Water Act (CWA) for new and existing electric power producing facilities. Subpart I of Title 40 of the Code of Federal Regulations (40 CFR) Part 125 describes requirements applicable to cooling water intake structures for new facilities. Under the definitions in 40 CFR 125.83, the Watts Bar Reservoir would be considered a lake or reservoir, because it has a residence time greater than 7 days.

The impacts of the cooling water intake structures at the facility are regulated by the Tennessee Department of Environment and Conservation (TDEC), under Section 316(b) of the Federal Water Pollution Control Act (also known as the CWA), through limitations specified in the National Pollutant Discharge Elimination System (NPDES) permit for the facility. These CWA 316(b) requirements seek to protect water quality from the potential adverse impacts of water withdrawals through intake structures. Separately, TDEC implements state water registration requirements to gather information that helps the management of water resources.

2.3.2.1.3 Surface Water Use in the CRN Site Vicinity

For the Regional Surface Water Use Study, TVA's 2010 Water Use database was queried for the seven-county area surrounding the CRN Site (Reference 2.3.2-1).. The results for water withdrawal are summarized in Table 2.3.2-2. Table 2.3.2-3 contains the individual data records from the query for withdrawals and Figure 2.3.2-1 shows the locations of the withdrawals.

As shown in Table 2.3.2-2, total 2010 withdrawal was 1478.91 mgd. Thermoelectric water use (1366.17 mgd) was by far the highest usage due to withdrawals for Bull Run, Kingston, and Watts Bar power plants. Public supply was the second highest water use (102.62 mgd).

Of the water intakes listed in Table 2.3.2-3, only the Oak Ridge Bear Creek Road facility has a Surface Water Protection Area which includes the CRN Site. Presently, Oak Ridge has plans to close down the Bear Creek Road facility.

TVA's reservoir operating policy was designed to meet the off-stream water needs of the Tennessee Valley until the year 2030. The forecast of 2030 water needs was based on a water use estimate prepared using year 2000 data. The estimates used to develop the reservoir operating policy were a total withdrawal of 13,990 mgd with a return of 13,010 mgd with a net water demand of 980 mgd. The current watershed projection of water demand for 2035 indicates a total withdrawal of 9449 mgd with a return of 8737 mgd for a net water demand of 712 mgd. (Reference 2.3.2-1)

There is no hydroelectric power generation in the immediate vicinity of the CRN Site; however, the Melton Hill, Watts Bar, and Norris dams include hydroelectric generation plants. Both dams are multipurpose dams with operations that also include maintaining navigation channels, flood

control, recreational opportunities, fisheries and aquatic habitat, and water quality. (Reference 2.3.2-2; Reference 2.3.2-3; Reference 2.3.2-4)

The Clinch River arm of Watts Bar Reservoir is host to various recreational activities, including canoeing, kayaking, boating, and fishing (Reference 2.3.2-5). Both commercial and recreational boating are available in the vicinity of the CRN Site. Recreational boat access and fishing opportunities are provided at the area boat ramps and public parks (Reference 2.3.2-6). These recreational activities are discussed in further detail in Subsection 2.5.2.5.

2.3.2.1.4 Surface Water Use for the Proposed SMR

The use of water for the proposed SMR is described in Section 3.3.

2.3.2.2 Groundwater Use

This section contains a description of the historical, current, and projected groundwater use at and in the vicinity of the CRN Site. Sole source aquifers within the region are also identified and discussed.

As discussed in Subsection 2.3.1.2.1.2, the principal aquifers in the Valley and Ridge Province consist of the carbonate rocks. Other types of rocks in the province can yield large quantities of water to wells where they are fractured, contain solution openings, or are directly hydraulically connected to sources of recharge (Reference 2.3.2-7).

Well yields in the Valley and Ridge Province vary from 1 to 2500 gallons per minute (gpm). The largest yields are from wells completed in Ordovician and Cambrian carbonate rocks (e.g., the Knox Group). The median yield of wells completed in the principal aquifers range from about 11 to 350 gpm (Reference 2.3.2-7).

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. 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 2.3.2-7). Wet-weather perched water tables and intermittent springs have been noted to occur.

Because surface water is abundant in the region, the EPA's Sole Source Aquifer Program has not identified any sole source aquifers in Tennessee (Subsection 2.3.1.2)**.** 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. 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 will not impact any identified sole-source aquifer.

2.3.2.2.1 Historical Groundwater Use

In support of the CRBRP licensing activities at the CRN Site, TVA conducted a survey (completed in June 1973) to locate wells and springs within a two-mile radius of the site (Reference 2.3.2-8). The TVA survey reported that 110 wells and springs were located within two miles of the CRN Site. All of the wells were located across the Clinch River from the site, and nearly all of the wells inspected were small domestic wells of limited capacity (Reference 2.3.2-8). Reported well flow rates were generally less than 10 gpm, and reported well depths ranged from approximately 20 to 700 feet (ft) below ground. The study concluded that due to the abundance of surface water supplies and the relatively low yield of bedrock aquifers in the area, future groundwater use is unlikely to be significantly different than the present groundwater use. Publicly available data regarding current and projected future residential well/spring use were not found at this time.

Water use in the Tennessee River Valley, which includes the Clinch River watershed, has been estimated for the years 2000, 2005, and 2010 (Reference 2.3.2-9; Reference 2.3.2-10; Reference 2.3.2-11). 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 “groundwater study area”). The CRN Site is located in northeast Roane County, while nearby population centers, including the cities of Oak Ridge and Knoxville, lie in the surrounding counties. Figure 2.3.2-2 shows the location of the site and the five counties that comprise the groundwater study area for water use characterization.

Surface water is the predominant source of water for all uses in the Tennessee Valley, accounting for 98.3 percent of total withdrawals in 2010 (Reference 2.3.2-11). Groundwater provided the remaining 1.7 percent, or about 205 mgd of withdrawals in the Tennessee Valley. In the groundwater study area, surface water accounted for 99.7 percent of total withdrawals in 2010.

In the Tennessee Valley, thermoelectric power generation uses water exclusively from surface water withdrawals and is the dominant use category in the Tennessee Valley, as well as in the groundwater study area. Water withdrawals in 2010 for use categories (i.e., industrial, public supply and irrigation) other than thermoelectric power generation, were 97 percent from surface water and 3 percent from groundwater in the study area (Reference 2.3.2-11).

In the groundwater study area, total groundwater withdrawals for 2010 were 3.5 mgd, up from 3.3 mgd in 2005 (Reference 2.3.2-11; Reference 2.3.2-10). This also reflects a decrease in groundwater withdrawals relative to the estimates of withdrawals for 1985, which indicated withdrawals of at least 5 mgd (Reference 2.3.2-7). Table 2.3.2-4 presents groundwater withdrawals for the five counties in the groundwater study area for 2000, 2005, and 2010 by category (industrial, public supply, and irrigation); total withdrawals by category are shown in

Figure 2.3.2-3. The largest category of use for groundwater withdrawals for the groundwater study area in 2010 was public water supply (66 percent), followed by industrial use (33 percent) and irrigation (less than 1 percent) (Reference 2.3.2-11).

As shown in Figure 2.3.2-3, there has been an increase in industrial use of groundwater and a decrease in groundwater 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 2.3.2-4). Only Roane County has seen an increase in reported groundwater withdrawals since 2000, almost exclusively for public supply. No groundwater withdrawals were reported for Morgan County.

2.3.2.2.2 Current Groundwater Use

The EPA's Safe Drinking Water Information System (SDWIS) database was queried for the five counties in the groundwater study area to identify public drinking water systems that utilize groundwater for supply. The database query was performed in July of 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) (Reference 2.3.2-12)

The SDWIS query includes the water system name, county, population served, and system category and the results are summarized in Table 2.3.2-5.

Three community water systems in the groundwater study area were identified that use groundwater as the primary source of supply (Table 2.3.2-5). The town of Norris, Tennessee, located about 40 mi northeast of the CRN 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 2.3.2-5.

TDEC produced a source water assessment report in 2003, which was submitted to the 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 2.3.2-13) 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, TDEC does not indicate in what proportion the water sources are used (Reference 2.3.2-13). 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 2.3.2-6. Groundwater intakes near the CRN Site are shown in Figure 2.3.2-4.

A later report by TDEC published in 2009 assesses Tennessee drinking water sources and potential threats to drinking water quality and quantity (Reference 2.3.2-14). 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 2.3.2-14).

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.

Information pertaining to individual wells in the vicinity of the CRN Site was obtained from the Tennessee Department of Environment and Conservation (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 2.3.2-5 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 2.3.2-7 lists for each well the proposed use, estimated yield, total depth, casing depth, expected geologic unit in which the wells are located, 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 geologic 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 2.3.2-7, depending on the exact well location and the well and casing depths.

2.3.2.2.3 Projected Groundwater Use

Bohac and Bowen provide general future water use projections through 2035 for the Tennessee Valley. Predictions include 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 Bohac and Bowen. (Reference 2.3.2-11)

The current surrogate CRN 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 is sourced from the Clinch River arm of Watts Bar Reservoir, while potable and other water comes from the Oak Ridge Department of Public Works. In addition, surface disturbance at the site is not expected to affect the recharge zones for those users shown on Table 2.3.2-6 or for intakes shown on Figure 2.3.2-4.

2.3.2.2.4 CRN 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. This abundant surface water coupled with relatively low productivity groundwater wells within a two-mile radius of the CRN Site, make it unlikely that significant differences from current usage will occur in the future.

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.

Present and known future offsite groundwater users are sufficiently distant from the CRN Site such that withdrawals would not affect or be adversely affected by the plant.

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

Temporary dewatering is required to maintain a dry excavation for the construction of the foundations for the CRN plant structures. Dewatering is to be accomplished using similar techniques as were used during the CRBRP excavations. These techniques 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 the excavation. Grouting of localized areas was performed when higher water inflow was encountered (Reference 2.3.2-8). These dewatering methods are localized to the power block area excavation and to the areas immediately in the vicinity of the power block excavations.

2.3.2.3 References

Reference 2.3.2-1. Tennessee Valley Authority, "Clinch River Small Modular Reactor Site Regional Surface Water Use Study - Revision 2," April 24, 2015.

Reference 2.3.2-2. Tennessee Valley Authority, Watts Bar Reservoir Website, Website: http://www.tva.com/sites/wattsbarres.htm, 2015.

Reference 2.3.2-3. Tennessee Valley Authority, Melton Hill Reservoir, Website: http://www.tva.gov/sites/meltonhill.htm, 2013.

Reference 2.3.2-4. Tennessee Valley Authority, Norris Reservoir, Website: http://www.tva.gov/sites/norris.htm, 2015.

Reference 2.3.2-5. AECOM, "Final Clinch River Site Land Use and Recreation Technical Report - Revision 2," Greenville, SC, Tennessee Valley Authority, October, 2014.

Reference 2.3.2-6. Tennessee Valley Authority, Office of Environment and Research, Recreation Area Matrix - Watts Bar Reservoir, Website: http://www.tva.com/river/recreation/pdf/watts_bar_rec_matrix.pdf, 2011.

Reference 2.3.2-7. Lloyd, O. B. and Lyke, W. L., Ground Water Atlas of the United States: Segment 10, Illinois, Indiana, Kentucky, Ohio, Tennessee, USGS Hydrological Atlas 730-K, 1995.

Reference 2.3.2-8. Project Management Corporation, "Clinch River Breeder Reactor Project, Preliminary Safety Analysis Report," Volume 2, Amendment 68, May, 1982.

Reference 2.3.2-9. Hutson, S., Koroa, M. C., and Murphree, C. M., "Estimated Water Use in the Tennessee River Watershed in 2000 and Projections of Water Use to 2030," U.S. Geological Survey Water-Resources Investigation Report 03-4302, 89pp, 2004.

Reference 2.3.2-10. Bohac, C. E. and McCall, M. J., "Water Use in the Tennessee Valley for 2005 and Projected Use in 2030," Tennessee Valley Authority, River Operations and Renewables, 2008.

Reference 2.3.2-11. Bohac, C. E. and Bowen, A. K., "Water Use in the Tennessee Valley for 2010 and Projected Use in 2035," Tennessee Valley Authority, River Operations and Renewables, 2012.

Reference 2.3.2-12. U.S. Environmental Protection Agency, Safe Drinking Water Search for the State of Tennessee, Safe Drinking Water Database, Website: http://oaspub.epa.gov/enviro/sdw_form_v3.create_page?state_abbr=TN, 2013.

Reference 2.3.2-13. Tennessee Department of Environment and Conservation, Tennessee Source Water Assessment Report, August 2003, Website: http://www.tn.gov/environment/water/water-supply_source-assessment.shtml, August, 2003.

Reference 2.3.2-14. Tennessee Department of Environment and Conservation, TDEC Division of Water Pollution Control and Division of Water Supply, Protection of Potable Water Supplies in Tennessee Watersheds, Website: http://www.tn.gov/environment/water/water-supply_source-assessment.shtml, 2009.

Table 2.3.2-1
Trends of Estimated Water Use in the Tennessee River Watershed 1995 to 2035

Off-stream Use (mgd)	1995	2000	2005	2010	2035	Percent change 2010-2035
Total withdrawals	10,008	12,211	12,437	11,951	9449	-21
Thermoelectric	8010	10,276	10,531	10,046	6963	-31
Industrial	1030	1205	1179	1148	1502	31
Public supply	574	662	684	723	938	30
Irrigation	48	69	43	34	46	35
Source of water						
Surface	9750	11,996	12,237	11,747	NA	NA
Ground	258	215	200	204	NA	NA
Net water demand (consumptive use)	NA	649	432	471	712	51

Note:
NA = not available

Source: (Reference 2.3.2-1)

Table 2.3.2-2
2010 Surface Water Use in the Surface Water Review Area (mgd)

County	Thermoelectric	Industrial	Public Supply	Irrigation[1]	Total
Withdrawal					
Anderson	430.18	0.52	13.20	0.45	444.35
Knox	0	2.08	66.99	0.29	69.35
Loudon	0	5.65	11.23	0.57	17.45
Meigs	0	0	0	0	0
Morgan	0	0	1.13	0	1.13
Rhea	207.91	0	3.42	0.22	211.55
Roane	728.08	0.30	6.65	0.04	735.07
Total	1366.17	8.54	102.62	1.57	1478.91
Return					
Anderson	429.57	4.46	6.85	NA	440.88
Knox	0	3.14	57.78	NA	60.92
Loudon	0	4.00	8.85	NA	12.85
Meigs	0	0	0.33	NA	0.33
Morgan	0	0	0.65	NA	0.65
Rhea	191.40	0	3.01	NA	194.41
Roane	727.41	0.96	3.00	NA	731.37
Total	1348.38	12.56	80.47	NA	1441.41

[1] Includes known intakes and estimated irrigation from agricultural surveys.

Note:
NA = Not available

Source: (Reference 2.3.2-1)

Table 2.3.2-3 (Sheet 1 of 2)
Surface Water Withdrawals in Anderson, Knox, Loudon, Meigs, Morgan, Rhea, and Roane Counties

Name	County	User Type	Water Source	Average Annual Withdrawal 2010 (mgd)	Record #
Oak Ridge Dept. Of Public Works	Anderson	PS	Melton Hill Reservoir	8.07	6520
Centennial Golf Course	Anderson	IR	Melton Hill Reservoir	0.42	4427
Bull Run Fossil Plant	Anderson	TH	Melton Hill Reservoir	430.18	5833
Anderson County Utility Board	Anderson	PS	Melton Hill Reservoir	1.41	6775
Rexnord Corporation Link-Belt Bearing	Anderson	IN	Melton Hill Reservoir	0.52	4423
Clinton Utilities Board	Anderson	PS	Melton Hill Reservoir	2.26	5992
North Anderson County U D	Anderson	PS	Clinch River	1.46	6507
First UD Of Knox County	Knox	PS	Fort Loudoun Reservoir	12.70	6305
West Knox Utility District	Knox	PS	Melton Hill Reservoir	4.81	6307
Knox-Chapman Utility District	Knox	PS	Fort Loudoun Reservoir	4.00	6302
Knoxville Ub#1 Whitaker Plant	Knox	PS	Fort Loudoun Reservoir	35.96	6299
West Knox Utility District	Knox[1]	PS	Melton Hill Reservoir	0.76	6308
Hallsdale Powell U D	Knox[1]	PS	Melton Hill Reservoir	6.77	6203
Cemex, Inc.	Knox	IN	Holston River	1.95	4557
Northeast Knox U D	Knox	PS	Holston River	1.98	6510
Valley Proteins	Knox	IN	Lyons Creek	0.01	8892
Rinker Materials South Central - Midway Quarry	Knox	MI	Quarry Pit	0.07	4563
Rinker Materials South Central - I-75 Quarry	Knox	MI	Quarry Pit	0.04	4560
Rinker Materials South Central - I-75 Quarry	Knox	MI	Williams Branch	0.00	4561
Tellico Village Public Works	Loudon	PS	Tellico Reservoir	0.22	9622
Loudon Utilities Board	Loudon	PS	Watts Bar Reservoir	9.28	6352
Viskase Corp.	Loudon	IN	Watts Bar Reservoir	1.58	4569
Kimberly Clark Corporation	Loudon	IN	Watts Bar Reservoir	4.07	4568

Table 2.3.2-3 (Sheet 2 of 2)
Surface Water Withdrawals in Anderson, Knox, Loudon, Meigs, Morgan, Rhea, and Roane Counties

Name	County	User Type	Water Source	Average Annual Withdrawal 2010 (mgd)	Record #
Tennessee National, Llc	Loudon	IR	Watts Bar Reservoir	0.46	8830
Lenoir City Utility Board	Loudon	PS	Watts Bar Reservoir	1.72	6331
Plateau Utility District	Morgan	PS	Crooked Fork Creek	1.13	6717
Dayton Water Dept	Rhea	PS	Chickamauga Reservoir	2.94	6039
Watts Bar Nuclear Plant	Rhea	TH	Chickamauga Reservoir	52.81	7223
Watts Bar Nuclear Plant	Rhea	TH	Chickamauga Reservoir	155.10	7222
Spring City Water System	Rhea	PS	Watts Bar Reservoir	0.48	6463
Rockwood Water System	Roane	PS	Watts Bar Reservoir	2.48	6612
Lakeside Golf Course	Roane	IR	Watts Bar Reservoir	0.00	4614
Kingston Water System	Roane	PS	Watts Bar Reservoir	0.77	6295
Kingston Fossil Plant	Roane	TH	Watts Bar Reservoir	728.08	5835
Harriman Utility Board	Roane	PS	Watts Bar Reservoir	2.01	6217
Cumberland Utility District	Roane	PS	Watts Bar Reservoir	1.39	6540
Oak Ridge Country Club	Roane	IR	East Fork Poplar Creek	0.03	8955
Oak Ridge Bear Creek Plant	Roane	IN	Watts Bar Reservoir	0.30	9723

Notes:
Intake is in Anderson County
IN = Industrial
IR = Irrigation
PS = Public Supply
TH = Thermoelectric
MI = Mining

Source: (Reference 2.3.2-1)

Table 2.3.2-4
Groundwater Withdrawals from Five Counties Surrounding the CRN 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:
1. Data for each county for the years 2000, 2005 and 2010 come from (Reference 2.3.2-9; Reference 2.3.2-10; Reference 2.3.2-11), respectively; total values (shaded) are computed.
2. “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.
3. Figures for individual categories may not add up to totals because of independent rounding.

Table 2.3.2-5
Summary of Nearby 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	Know	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 2.3.2-6
Nearby Public Water Systems Using Groundwater for Supply

Community Water System	County	Population	Groundwater Source
Norris Water Commission[1]	Anderson	1801	Spring
North Anderson County Utility District	Anderson	10653	Spring
First Utility District Of Knox County	Knox	64230	Spring
Hallsdale Powell Utility District	Knox	57732	Springs
Creekside Mobile Home Subdivision[1]	Loudon	51	Wells
Lenoir City Utility Board	Loudon	16686	Spring
Loudon Utilities Board	Loudon	10297	Springs
Helton Estates Mobile Home Park[1]	Roane	82	Well
Kingston Water System	Roane	8384	Spring
Lewands Water System[1]	Roane	61	Wells
Oliver Springs Water Board	Roane	5323	Spring

[1] The system uses exclusively groundwater for its supply (i.e., no other source is listed) (Reference 2.3.2-13)

Note: 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 2.3.2-13)

Table 2.3.2-7 (Sheet 1 of 2)
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

Table 2.3.2-7 (Sheet 2 of 2)
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
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

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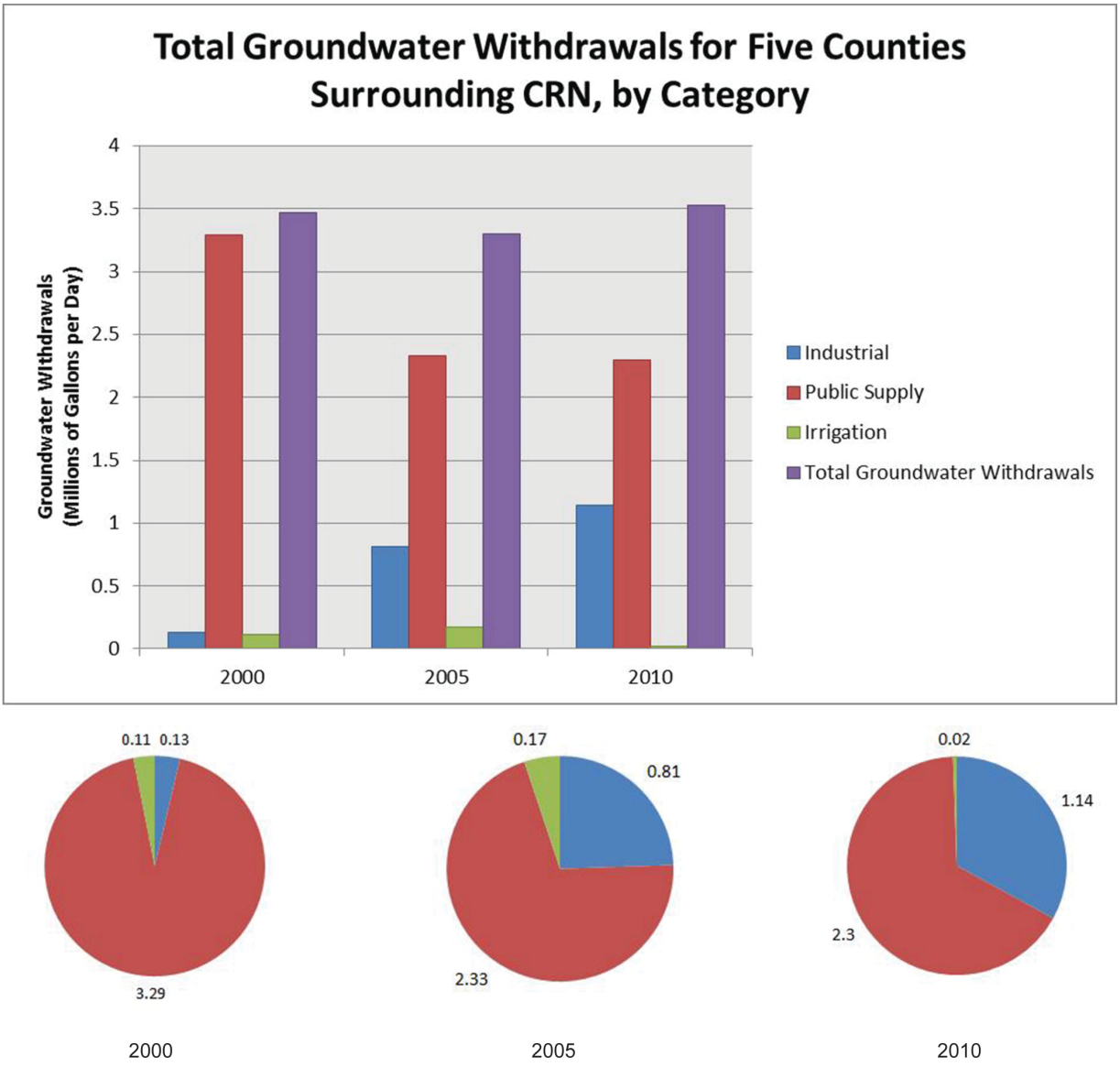
(See Part 7 of this Early Site Permit Application)

Figure 2.3.2-1. Surface Water Intakes Near the CRN Site in Anderson, Knox, Loudon, Meigs, Morgan, Rhea, and Roane Counties

Note: Adapted from (Reference 2.3.2-11). Green shading shows the five counties included in the groundwater use study area.

Figure 2.3.2-2. Groundwater Use Study Areas



Note: Data for the years 2000, 2005 and 2010 from (Reference 2.3.2-9; Reference 2.3.2-10; Reference 2.3.2-11), respectively.

Figure 2.3.2-3. Groundwater Use by Category in the Groundwater Study Area for 2000, 2005, and 2010

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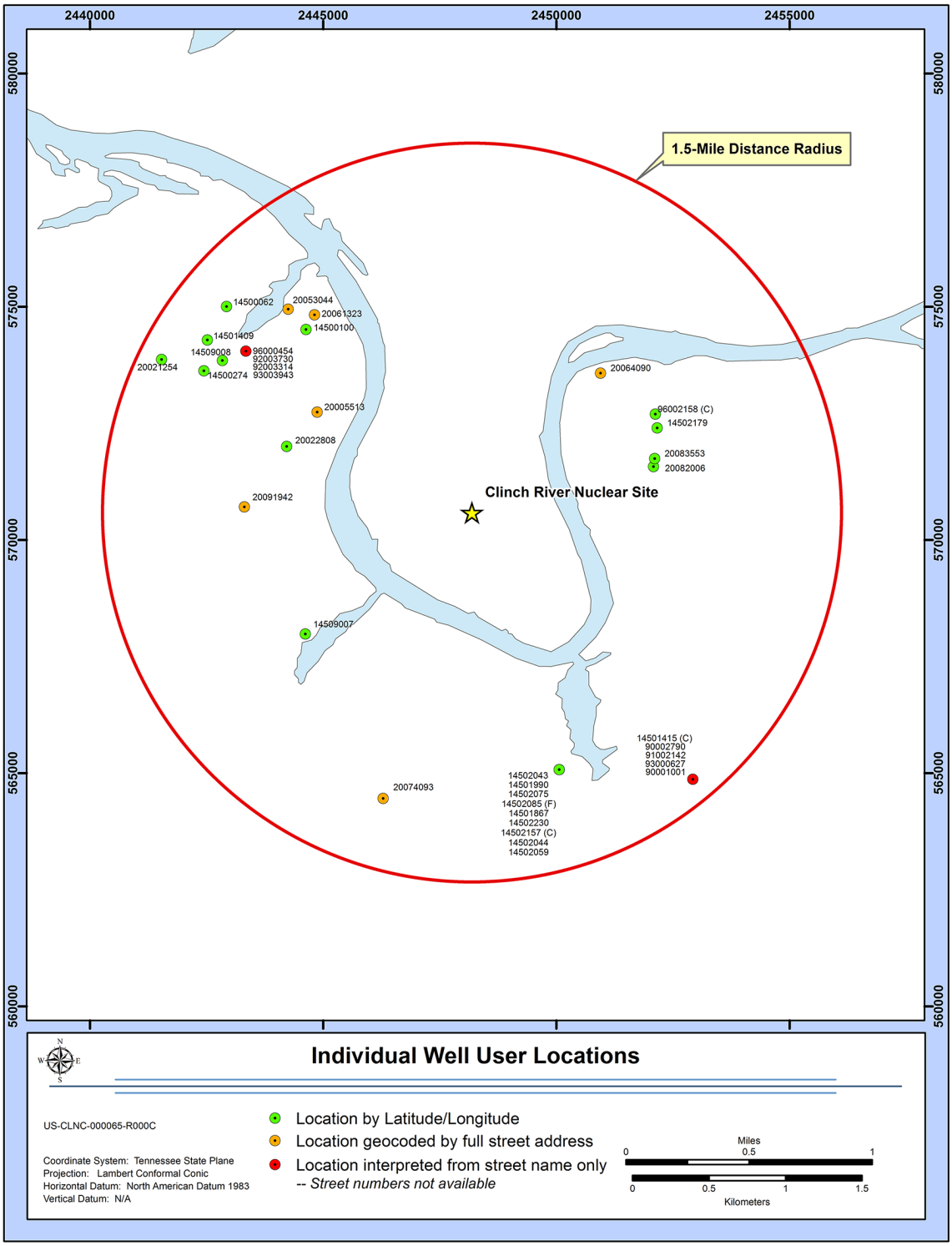
(See Part 7 of this Early Site Permit Application)

Figure 2.3.2-4. Groundwater Intakes Near the CRN Site in Anderson, Knox, Loudon, and Roane Counties



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

Figure 2.3.2-5. Individual Well Locations Within a 1.5-mile Radius of the CRN Site