Section 6 | **Statement of Need**

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Statement of Need

This section evaluates the Region's future CWS and domestic use demands in comparison to future water supplies. A discussion of the water needs of self-supplied users throughout the region is also included. To support the development of a statement of need for publicly-owned CWSs, the projected water demands were compared to projected water supplies. The Region's projected water supply is adequate to meet the projected future water demands through the year 2050. However, the statement of need for the York-James Peninsula sub-region includes the possibility of the projected water demand exceeding the available water supply near the year 2040. The current water supply and future water demands are evaluated at +/-10% to address uncertainties within the projections. Section 1 of this plan describes existing sources and Section 4 provides future demand projections.

Uncertainties Associated with Statement of Need

There are inherent uncertainties associated with the estimation of future water demands. Demand projections utilize population growth estimates that are subject to accuracy limitations. Other socio-economic factors also contribute to uncertainty. For example, Table 4-8 (see Section 4, Projected Water Demands) describes the potential additional demands on publicly-owned CWSs that may develop if private CWSs and self-supplied commercial and industrial water users choose to be serviced by publicly-owned CWS water systems by the end of the planning period. To address the uncertainties in water demand projections, future publicly-owned CWS demands were also evaluated at +/-10% of the projected demands.

Uncertainty exists in predicting the yield and availability of source waters. Two significant issues may impact the region's available water supply over the planning period:

1) Regulatory climate (e.g., the availability of groundwater), and
2) Natural physical constraints (e.g., climate change).

Both issues are discussed here to explain the potential impacts on the future water supplies for CWSs and self-supplied users. Evaluations of +/-10% of the current water supply are included to address uncertainties.

Availability of Groundwater

Groundwater provides 23% of the raw source water for publicly-owned CWSs in the Hampton Roads region. Most of the region relies on conjunctive use systems, as found in Chesapeake, Isle of Wight, Newport News (and localities it serves), Norfolk, Portsmouth, Suffolk, and Williamsburg. However, some localities rely exclusively on groundwater (e.g., the James City Service Authority on the York-James Peninsula and most systems in the Western Tidewater sub-region). Also, all private CWSs and all self-supplied commercial and industrial users rely on groundwater, with the exception of the self-supplied users in the energy industry.

Under the authority of the 1992 Groundwater Management Act, the State has established Ground Water Management Areas (GWMA) where groundwater resources have been determined to be stressed and interference is likely to occur between nearby wells. The HRPDC localities, with the exception of Gloucester County, fall within the Eastern Virginia GWMA. Groundwater users in a GWMA must apply for a permit from DEQ to withdraw more than 300,000 gallons per month. Permits are effective for a period of 10 years and permit holders must re-apply prior to the expiration of a current permit.

Permitted withdrawals are based on the justification of need over the 10-year permit period. Most self-supplied users in the region withdraw groundwater and must project demands for the ten-year permit period. Active permits can be re-opened during this period, and permitted amounts can be reduced if actual use is significantly less than the permitted use. This has not occurred as of the time of this report (communication with DEQ).

The Coastal Plain aquifer system is wedge-shaped with a thin edge to the west near Richmond and a thick edge to the east in the Atlantic Ocean (see Figure 6-1). Increased pumping throughout the Coastal Plain generally has greater impacts on existing wells near the thin edge of the system. DEQ has identified areas along the western edge of the Eastern GWMA where groundwater levels have dropped below the top of the aquifer. Through the permit renewal process, DEQ has required many permit holders to reduce their withdrawal limits due to low water level measurements in these areas, and simulated decreasing groundwater levels in the future.

There are indicators of a relationship between groundwater withdrawals and land subsidence in the Hampton Roads region. Land subsidence rates in the Chesapeake Bay range from 1.3 millimeters per year (mm/yr) to 4.0 mm/yr (Boon, Brubaker and Forrest 2010). It is hypothesized that groundwater withdrawals are responsible for some portion of local land subsidence.

The USGS Virginia Coastal Plain groundwater model indicates that a significant amount of the 100 mgd of groundwater withdrawn from the aquifer system is released from soft clay layers that form the confining units between the aquifers. The release of water from these clay layers causes the clay material to shrink and compress under the weight of overlying stone and sediment formations. As clay layers compress, the cumulative result is the "sinking" of the ground surface, which is referred to as land subsidence. It is possible that groundwater withdrawals may be further limited in the future to mitigate subsidence. It is also important to understand that compression causes clay layers to lose inelastic storage, which means that the material becomes unable to expand again to hold the same amount of water, even if groundwater withdrawals stop. Therefore, land subsidence results in decreased aquifer storage capacity, effectively reducing the availability of groundwater.

Several public water systems in the Region have been encouraged by DEQ to reduce the amount requested in their permit renewal applications. If HRPDC Locality permitted withdrawals are reduced, the available water supply for the region is also reduced. Virginia's groundwater management policy has been to issue permits on a first-come, first-served basis, and there is no guarantee that the same amount (or greater amount) of groundwater will be available to publicly-owned CWSs in 20 to 30 years. Each submittal for permit renewal must undergo the same administrative process and technical evaluation of need and aquifer sustainability. Reductions of permitted withdrawals for publicly-owned CWSs and/or commercial and industrial users will effectively reduce the available water supply in the Hampton Roads region.

As of August 2010, the major groundwater user International Paper ceased groundwater withdrawals to support operations at its former Franklin, Virginia mill. While in operation, withdrawals for the Franklin mill comprised approximately one third of all groundwater withdrawals in the Virginia Coastal Plain. Water levels are rebounding, but have not yet stabilized. The DEQ Ground Water Withdrawal Permit for International Paper remains active. If the property associated with the permit is purchased by another industrial user, the State Water Control Board could allow the permit to be transferred to the new property owner. Therefore, this report cannot conclude whether more or less groundwater will be available for other users in Hampton Roads as a consequence of the plant's closure.

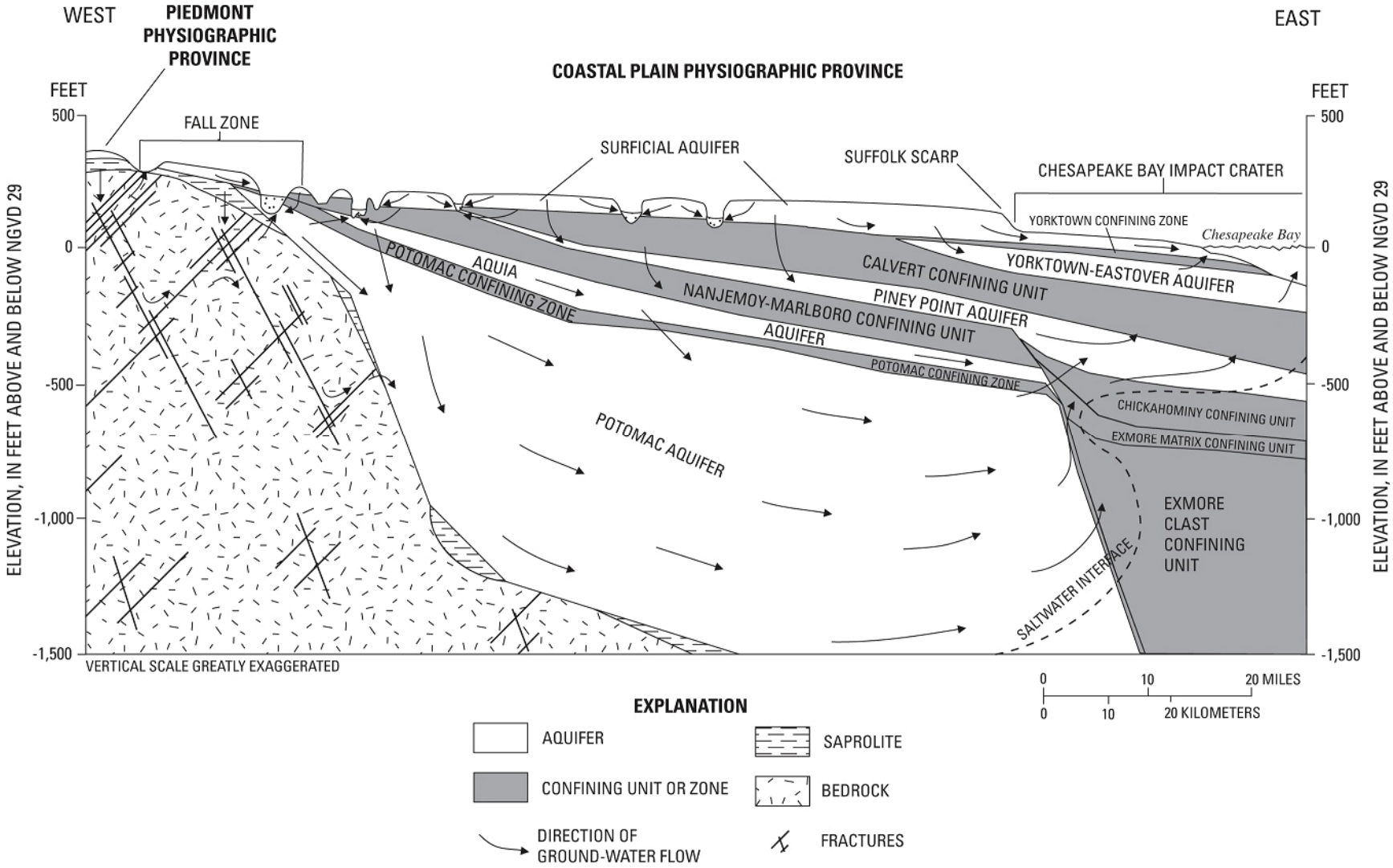

Figure 6-1: Cross section of Coastal Plain aquifer system (McFarland and Bruce 2006).
This generalized cross section shows the hydrogeologic units and the groundwater flow direction from the Fall Zone near Richmond in the west to the Chesapeake Bay in the east.

Climate Change Impacts

As of August 2010, models of climate change do not provide specific predictions for changes in temperature, precipitation, and sea level rise in the Hampton Roads region. Climate changes could result in increases or decreases in regional water supplies. The following section discusses the possible impacts on the region.

Temperature

Studies indicate that the average temperature is likely to rise. With higher average temperatures, increased reservoir water losses can be anticipated due to higher evaporation rates. Evapotranspiration, the sum of evaporation from the ground surface and transpiration loss through vegetation, would also increase. Less runoff would be available to recharge shallow groundwater aquifers, which provide base flows to streams and rivers.

Precipitation

Climate change projections regarding changes in precipitation are very sensitive location; in addition, many of the climate models used for these projections are too coarse to predict changes at anything smaller than the state or regional scale. Researchers for the Virginia Governor's Commission on Climate Change found that Virginia and its neighbors could expect to see an 11% increase in precipitation by 2099 (Governor's Commission on Climate Change 2008). However, recent observations have shown a shift in rainfall, with summer and fall precipitation increasing and winter and spring precipitation decreasing (Karl, Melillo and Peterson 2009). By 2099, Virginia is expected to see increases in the winter, with slightly more or less precipitation occurring throughout the rest of the year (Karl, Melillo and Peterson 2009). In addition, more precipitation is expected to occur during the heaviest events. Changes in the distribution of rainfall throughout the year could result in longer periods of dry weather. Additional efforts should be made to prepare the region for droughts and increase the resiliency of water supply systems. The region could take advantage of additional rainfall during wet seasons by developing additional storage capacity (e.g., new or expanded reservoir capacity or Aquifer Storage Recovery systems).

Changes in the average precipitation patterns to more intense, shorter duration storms could reduce the amount of water currently recharging the shallow aquifers that feed streams and rivers. This could also lead to periodic water losses over reservoir dams, as the reservoirs may fill faster than the water can be withdrawn.

Sea Level Rise

Sea level rise is predicted to continue, potentially pushing the saltwater transition zone in tidal rivers farther inland. The water supply intake on the Northwest River already withdraws brackish water during a portion of the year. Chesapeake's Northwest River water treatment plant is designed to treat brackish water, but water of higher salinity would increase treatment costs. Newport News Waterworks withdraws approximately 70% of its water supply from the Chickahominy River. Withdrawals from the Chickahominy River may be suspended when tidal influences occur and downstream chlorides are elevated, as may occur during drought conditions. During those periods, pumping ceases so as to avoid drawing high chloride water into the intake. Sea level rise may impact Waterworks' available water supply or require changes to operations and infrastructure.

Sea level rise will also slowly move the saltwater transition zone in the groundwater system farther inland (see Figure 6-2). Because saltwater is denser than the freshwater contained in the aquifer, a wedge of saltwater forms under the freshwater. If the wedge moves farther inland with sea level rise, deep wells in the eastern portion of the Hampton Roads region may begin to yield brackish water. The USGS monitors chloride levels in wells near the saltwater transition zone as part of a cooperative agreement with the HRPDC. Thus far, the USGS monitoring results have not indicated the inland migration of the saltwater transition zone.

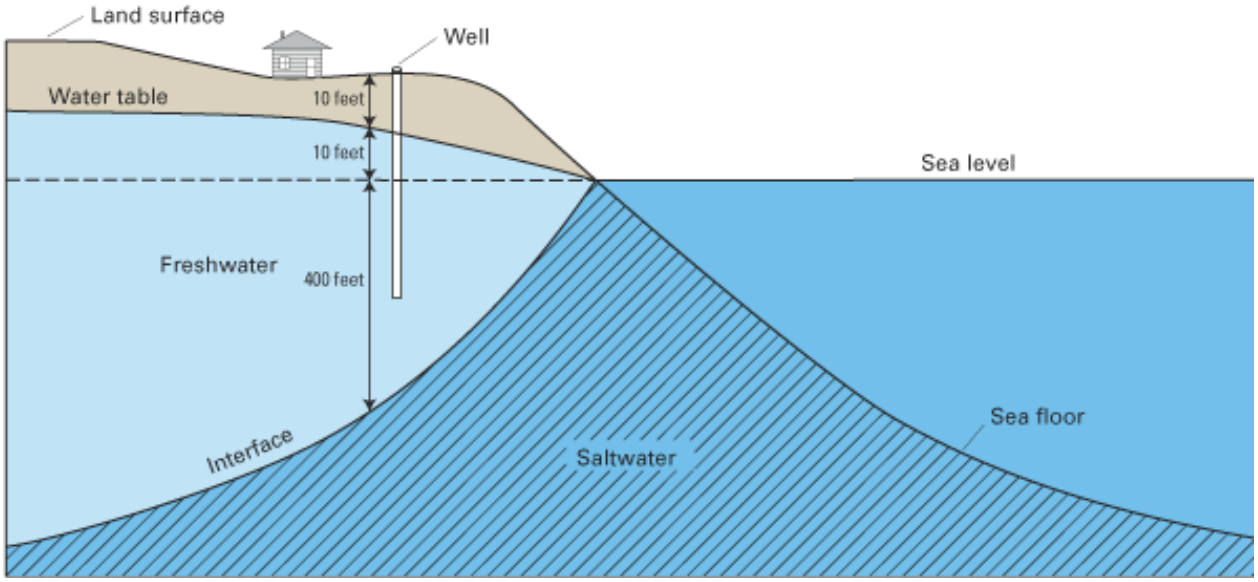

Figure 6-2: Saltwater may migrate farther inland if sea level rises (Barlow 2003).

The impacts of climate change are not well defined at the regional scale. However, they should be considered because they may undermine the assumption that the current water supply will be available 40 years from now. The potential changes in temperature, precipitation, and sea level rise require additional study to support long-term water supply planning. Future investigation efforts should focus on developing better models of climate trends in Hampton Roads and estimating how those trends impact the quantity and quality of water available in the future.

Southside Sub-Region Statement of Need: CWS and Domestic Users

The Southside sub-region includes the Cities of Chesapeake, Norfolk, Portsmouth, Suffolk, and Virginia Beach. The available water supply for these cities exceeds their projected demands. The water systems are interconnected to some degree, increasing the resiliency of the entire sub-region.

The majority of the population in the Southside sub-region is currently served by publicly-owned CWSs and will continue to be served by publicly-owned CWSs through 2050. There are plans to expand the Chesapeake and Suffolk publicly-owned CWS service areas. However, it is anticipated that the number of domestic users located outside of these CWS service areas will also increase through 2050.

The water sources serving the CWSs in the Southside sub-region are diversified and include river intakes, reservoirs, and groundwater. The existing water sources available to the Southside sub-region are adequate to meet the current and projected water demands through the end of the planning period in 2050.

Western Tidewater Sub-Region Statement of Need: CWS and Domestic Users

Many residences and businesses in the Western Tidewater sub-region rely on groundwater. Under current conditions, wells drilled anywhere in the Western Tidewater sub-region will produce enough water to support an individual home or small business. It is estimated that water supplies are adequate to meet sub-regional demands over the next 40 years. Most of the CWSs in the sub-region have projected little growth in demands. If a new commercial or manufacturing facility wanted to locate in the sub-region, the CWSs would probably not have enough water to support the associated additional demand. There may not be enough groundwater available to support new commercial facilities.

There are some issues of concern associated with groundwater in the Western Tidewater sub-region. Future planning efforts should address water quality, well interference, and system resiliency issues described below.

Water quality is a concern in some areas of the sub-region, where groundwater sources have been found to contain naturally elevated concentrations of fluoride (above regulatory limits). Therefore, in the future, water quality requirements may necessitate deeper wells in these areas or some degree of treatment for groundwater withdrawn from area sources.

There is the potential for well interference to occur in the sub-region. Groundwater users may impact each other, as withdrawals from wells influence local water levels. If a large groundwater withdrawal is permitted in the sub-region, local water levels may fall, forcing residents and businesses served by groundwater wells to lower the elevation of their pumps and/or deepen their wells. This scenario has implications for the groundwater permitting process and regulatory context.

The low population densities across large portions of the Western Tidewater sub-region are not easily served by centralized water system infrastructure. Therefore, a smaller percentage of the population is served by CWSs compared to other sub-regions. As noted earlier, the CWSs in the Western Tidewater sub-region have adequate future water supplies to meet projected demands. The sub-region's water supplies include permitted withdrawals from groundwater sources and water supplied per the purchase contract between the Western Tidewater Water Authority and the City of Norfolk. The CWSs in the Western Tidewater sub-region are spread out over a large geographic area; only a few systems are interconnected or have the potential for future connection. Such connections increase water system resiliency by allowing source water to be shared and water to be delivered to areas of need.

The population density in the eastern portion of Isle of Wight County is greater than the rest of the sub-region. Eastern Isle of Wight

County is the only portion of the sub-region that has a viable option to use water sources other than groundwater. Higher population density makes expanding water distribution systems more economical. Isle of Wight County's Newport Development Service District is already connected to the publicly-owned CWSs in the Southside sub-region, and plans also exist to connect the County's Windsor Development Service District.

In view of the growing interconnectivity between publicly-owned CWSs in the Southside and Western Tidewater sub-regions it is prudent to compare the combined projected available water supply and projected demands for the Southside and Western Tidewater sub-regions (see See Figure 6-3). Norfolk currently sells water to Western Tidewater Water Authority (WTWA) which provides part of the water supply for Suffolk and Isle of Wight County. Evaluation of the adequacy of water supplies is better accomplished by looking at these two sub-regions together.

If trends continue under average conditions as projected, by the year 2050 upper estimates of demand will be equal to the readily available water supply. Under extreme conditions, the upper range of demand will exceed the lower range of supply by 2050, creating a shortage of approximately 15 mgd.

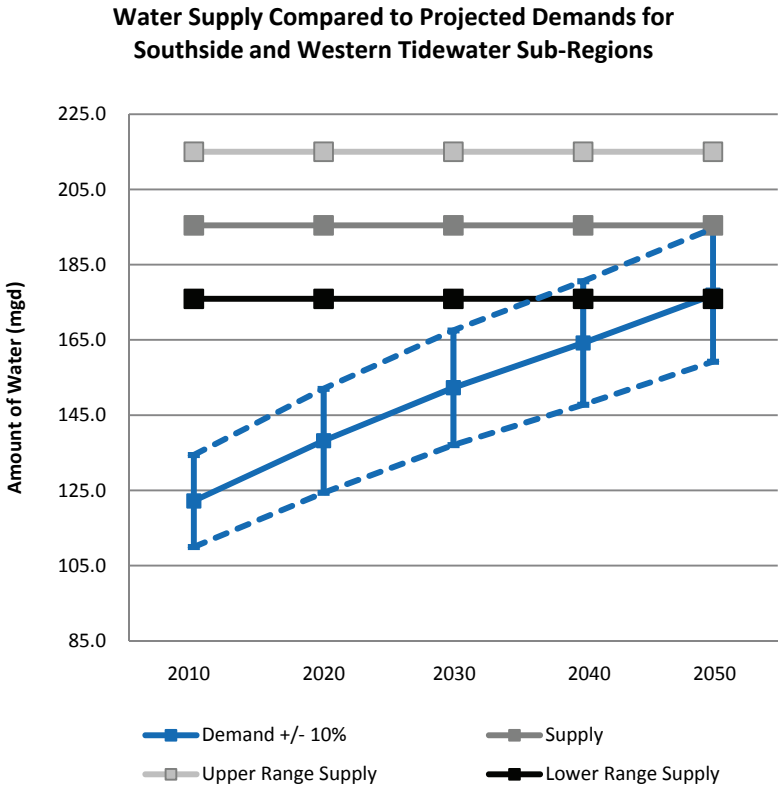

Figure 6-3: Comparison of the combined water supplies and projected demands for the Southside and Western Tidewater sub-regions.

York-James Peninsula Statement of Need: CWS and Domestic Users

The York-James Peninsula includes James City County, York County, and the Cities of Hampton, Newport News, Poquoson, and Williamsburg. The majority of the population for the York-James Peninsula resides within publicly-owned CWS service areas and will continue to be served by publicly-owned CWSs through 2050. The privately-owned CWSs purchase water from the publicly-owned systems. James City County predicts some continued growth outside of the CWS service areas. Those homes will require individual wells. In the next 40 years, wells may need to be drilled in different aquifers but there should be enough water to meet these small demands. The CWSs for the York-James Peninsula are currently supported by a variety of sources including river intakes, reservoirs, and groundwater. However, current estimates indicate that the projected water demand for the York-James Peninsula will exceed the available water supply near the year 2040 (see Figure 6-4).

If trends continue as projected, under average conditions, the projected water demand will exceed the available water supply for the York-James Peninsula in the year 2041. By 2050, a shortage of approximately 6 mgd is predicted (see Figure 6-4). Under extreme conditions, the upper range of projected demand will exceed the lower range of supply by approximately 21 mgd in 2050.

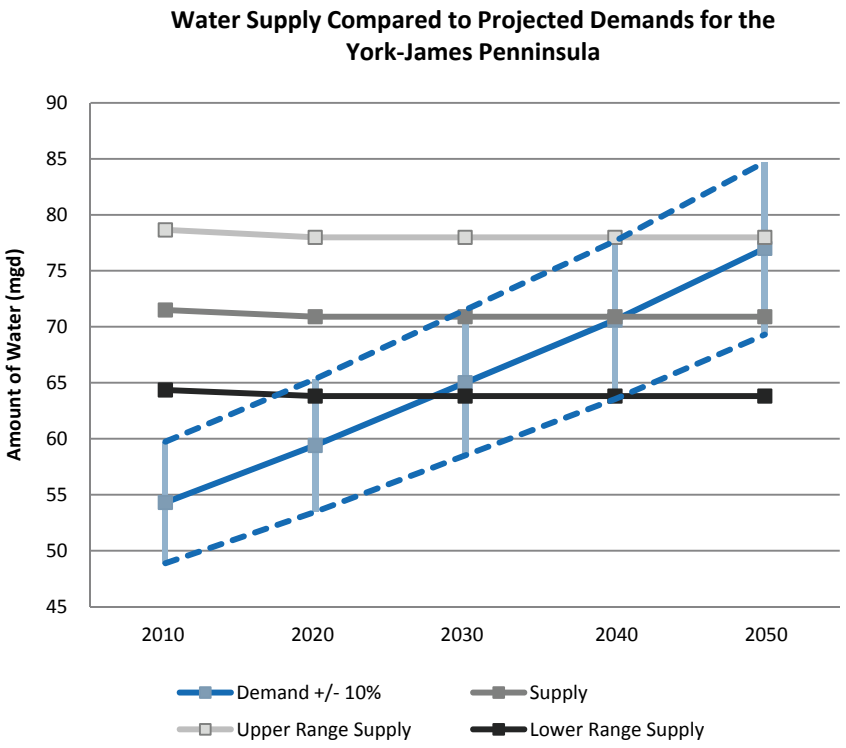

Figure 6-4: Comparison of the water supply and projected demands for the York-James Peninsula.

Middle Peninsula Statement of Need: CWS and Domestic Users

The Middle Peninsula includes only Gloucester County; it is separated from the rest of the Hampton Roads region by the York River. As a result, its water supply is completely independent from that of other sub-regions.

The Middle Peninsula supports a relatively small population compared to that of other sub-regions. Most of the population is served by residential wells or privately-owned CWSs.

Wells in Gloucester County may be impacted by sea level rise and the associated migration of the saltwater transition zone in the groundwater system (see Figure 6-2). Water quality in Gloucester wells may deteriorate toward more brackish quality water if the saltwater wedge moves inland. Additional research is required to estimate the area in Gloucester that would be impacted by saltwater intrusion over the next 40 years. As shown in Section 4, Table 4-3 approximately 52% of the population of the Middle Peninsula will be served by a publicly-owned CWS in 2050. Currently, the available water supply for Gloucester County exceeds demands. The existing sources that serve the Middle Peninsula publicly-owned CWS include wells and the Beaverdam Reservoir located in Gloucester County.

If trends continue as projected, the available water supply for the Middle Peninsula in 2050 will be in excess of projected demand. Under extreme conditions, the upper range of 2050 demand is projected to slightly exceed the lower range of supply, resulting in a shortage of approximately 0.15 mgd (see Figure 6-5).

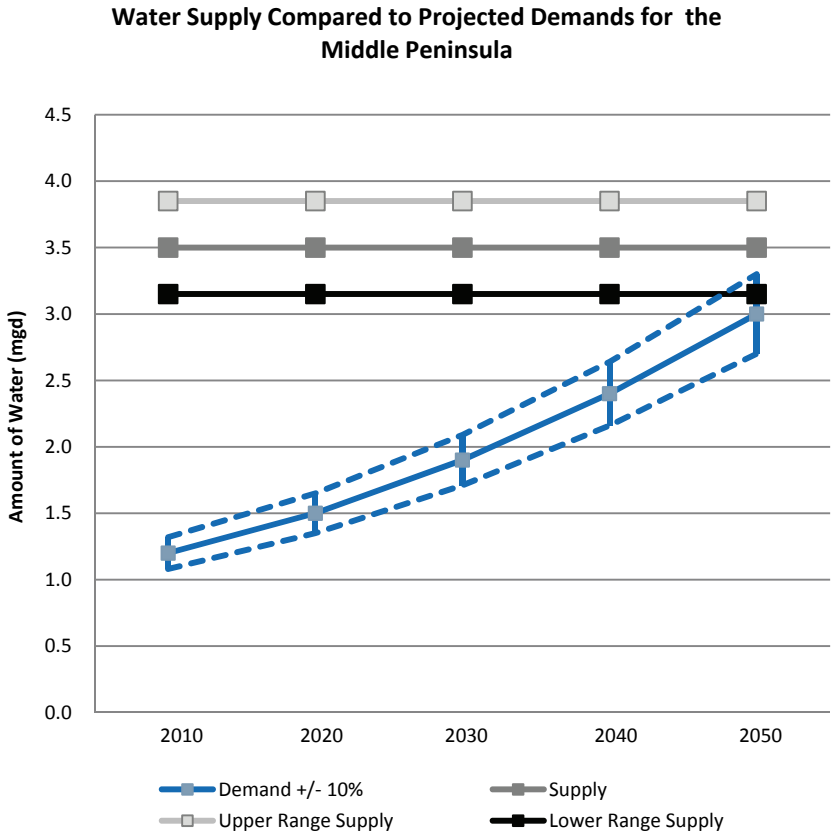

Figure 6-5: Comparison of the water supply and projected demands of the Middle Peninsula.

Statement of Need: Self-Supplied Users

Groundwater supports many agricultural, commercial, and industrial users throughout the Hampton Roads region. It is unclear if existing groundwater demands for these users can be met for the next 40 years. Existing users have permits that support their current use and may support user projected demands for the next 10 years. Future water supply planning efforts should include more robust water projections for self-supplied users; better projections of future water use for the energy and agriculture industries are of particular interest. Also, additional research is required to understand how much groundwater will be available in 40 years. Future studies should focus on the data and tools required to estimate the sustainable yield of the aquifer system and consider the prioritization of groundwater uses.

The energy industry is responsible for the largest volume of self-supplied surface water use in the Hampton Roads region; 2007 surface water use exceeded 3,100 mgd. The three primary users are Dominion Power Nuclear Power Plant (2007 average annual use of 1,774 mgd from the James River), Yorktown Fossil Power Plant (2007 average annual use of 817 mgd from the York River), and Chesapeake Energy Center (2007 average annual use of 521 mgd from the Elizabeth River). Nearly all of the surface water withdrawn by these users is returned to source rivers. Currently, the James, York, and Elizabeth Rivers are not used as drinking water sources, and there are no known conflicts between water users of these rivers. Therefore, the available surface water sources for energy production are considered adequate to meet future industry demands.

Agricultural users also utilize surface water, but sources are typically isolated farm ponds that do not significantly influence water supply planning. The demands of agricultural users are estimated to be small, and their water use decreases or increases based on the abundance or scarcity of rainfall. Therefore, the existing surface water sources for agriculture in Hampton Roads are adequate to meet the existing demands, assuming no significant variation in precipitation patterns and frequency.

Statement of Need: Summary

All of the sub-regions and the majority of self-supplied users in the Region have adequate water supplies to meet their projected demands through 2040. Water supplies in the Southside and Western Tidewater sub-regions and the Middle Peninsula are expected to exceed water demands until at least 2050. The York-James Peninsula may have a small deficit in 2040-2050. If water demands continue to increase over the next two decades, the York-James Peninsula may consider alternatives to satisfy the projected deficit. Potential alternatives are discussed in Section 7.