4.2 Water-Related Impacts

Water-related impacts from construction of a nuclear power plant are similar to those from any large construction project. Large construction projects can, if not properly planned, result in adverse impacts to groundwater, physical alteration of local streams and wetlands, and impacts to downstream water quality as a result of erosion and sedimentation or as a result of spills of fuel and lubricants used in construction equipment. Because of this potential for harming surface and groundwater resources, applicants are required to obtain a number of permits before initiating construction.

Tables in Section 1.2 provide a complete list of construction-related consultations and permits STPNOC would have to obtain before initiating construction activities. No new transmission rights-of-way would be required and there are no plans to widen existing transmission rights-of-way (Subsection 2.2.2). However, some of the existing transmission towers from the STP site to the Hillje Substation would require modification or replacement to accommodate reconductored transmission lines. These modifications and new towers may result in water-related impacts associated with development of this segment of the transmission facilities.

4.2.1 Hydrological Alterations

This section identifies proposed construction activities that could result in impacts to the hydrology at the STP site and offsite transmission locations, including:

- Land clearing and disturbance for constructing infrastructure such as roads and storm water drainage systems.
- Construction of STP site facilities in floodplains.
- Clearing, excavating, filling, and grading for new buildings/facilities (reactor containment structure, turbine building, ultimate heat sink [mechanical cooling towers]), support structures (e.g., switchyard), road/rails, and parking lots.
- Placement of excavated materials from construction activities that cannot be used as fill soils.
- Temporary disturbance of currently vegetated areas for construction laydown areas, concrete batch plants, sand/soil/gravel stockpiles, and construction-phase parking areas.
- Modification or replacement of selected transmission towers along the STP to Hillje right-of-way.
- Dewatering of foundation excavations during construction to the extent its effects are not mitigated by installation of a slurry wall around the excavation zone.
- Maintenance/dredging in the area of the Reservoir Makeup Pumping Facility (RMPF) and the barge loading facility on the Colorado River.

4.2.1.1 Surface Water

The STP 3 & 4 project will require replacing some of the existing transmission towers along the 20 miles of transmission right-of-way from the STP site to the Hillje substation (Section 3.7). The modification or replacement of the towers along the existing right-of-way would result in construction activities occurring that would likely result in the disturbance of surface soils within the footprint of the existing towers or access roads. The right-of-way itself as well as adjacent lands is used for crop production. Based on the current use of the land within the right-of-way, disturbance to surface soils would not appreciably alter surface water flow during the modification of the towers or construction of new towers. STPNOC has determined that impacts from the potential changes to surface water flow would be similar to the impacts from the original construction activities along the transmission right-of-way. The impacts would be temporary and would impact relatively small areas. Access to the existing rights-of-way would occur where existing access points are located and would not result in additional land disturbances. STPNOC, therefore, estimates impacts to surface water alterations would be SMALL and would not warrant additional mitigation other than those required by the appropriate permits. If construction activities occur close to surface water features, it is anticipated that the transmission line constructor would use erosion controls to limit the potential impacts to nearby water bodies or drainage features.

The only STP 3 & 4 facilities to be located in the Colorado River floodplain are those facilities that will be shared and have already been constructed for use by STP 1 & 2. These facilities are the RMPF, the Main Cooling Reservoir (MCR) blowdown discharge pipes, the MCR spillway discharge structure, and the barge facility. The remainder of the STP 3 & 4 facilities would be constructed in areas located above the elevation of the floodplain. Impacts to the floodplain from STP 3 & 4 would be less than the impact of constructing STP 1 & 2. The area occupied by these structures in the floodplain is insignificant when compared to the total area of the floodplain. There would be no additional reduction in channel conveyance and the elevation of the 100-year floodplain upstream and downstream of the STP site would not be affected by construction of STP 3 & 4. STPNOC has determined that impacts to the floodplain would be SMALL and would not warrant mitigation.

The local relief of the STP site varies from approximately 30 feet above mean sea level (MSL) in the northern portion of the site to 15 feet MSL in the southern portion, (Subsection 2.3.1.2). Within the site boundary (Figure 2.3.2-3) flows the West Branch of the Colorado River, the Colorado River, as well as surface water drainage features, one of which feeds 34-acre Kelly Lake, which is located in the northeast corner of the site (Reference 4.2-1). The largest surface water feature in the vicinity of the site is the above-grade MCR that covers approximately 7000 acres (2800 hectare). Another STP site surface water feature associated with STP 1 & 2 operations is the 47-acre Essential Cooling Pond (Reference 4.2-2).

As discussed in Subsection 2.3.1, Little Robbins Slough, an intermittent stream, flows south of the MCR to a coastal marsh area north of Matagorda Bay. A portion of Little Robbins Slough that would have been inundated by the construction of the MCR was relocated during the construction of STP 1 & 2 to an area outside of the MCR. The relocated channel rejoins the natural drainage course approximately 1 mile east of the southwest corner of the MCR (Reference 4.2-2). The West Branch of the Colorado River is an old river channel associated with the Colorado River adjacent to the MCR that flows south toward the Gulf Intracoastal Waterway and Matagorda Bay. Surface water drainage features near the southeastern portion of the MCR feed the West Branch of the Colorado River, which flows only intermittently.

The construction of STP 3 & 4 and its support facilities, especially the proposed 2-mile long heavy-haul road (Figure 3.9-1) from the barge facility to STP 3 & 4 (Section 4.1) could alter the current surface water flow patterns. Drainage ditches, storm water culverts, and other drainage devices will be used to maintain flow patterns across the construction areas. The refurbishment of an existing rail line that enters the northern portion of the STP site would result in less impact to the area crossed than when originally constructed. Actual impacts would be similar to those associated with normal maintenance of the rail line, including rail and ballast replacement where appropriate.

Surface water features that could be affected by the STP 3 & 4 construction activities include the unnamed onsite drainage associated with site sloughs, drainage ditches currently located in the STP 3 & 4 project area, an area currently designated as the Texas Prairie Wetland Project (Subsection 2.4.1), several onsite areas of standing water and their associated drainages, and other site drainage features that flow to the Colorado River or to the West Branch of the Colorado River (Subsection 2.3.1). Refer to Section 2.4 for additional information on the STP site surface water features.

There have been no studies performed by STPNOC to determine water storage or flow characteristics for surface water features within the STP site boundary other than the Essential Cooling Pond for STP 1 & 2 and the MCR because none have been required by state regulatory agencies. Monitoring of STP site surface water features is performed in accordance with STPNOC's storm water management program. As discussed in Subsection 2.3.3, surface water quality is analyzed for radionuclides as part of the existing radiological monitoring program for the West Branch of the Colorado River, Little Robbins Slough, the East Branch of Little Robbins Slough, a surface water drainage ditch located northeast of the MCR, and the MCR, as indicated in Subsection 2.3.3.

Part of a surface water ditch system is currently located in the area proposed for the STP 3 & 4 facilities. The ditch drains surface water away from the northern portion of the STP 1 & 2 operations area when surface water is present as the result of precipitation events. STPNOC plans to relocate this section of ditch north of the STP 3 & 4 site to capture surface water runoff from STP 1 & 2 and STP 3 & 4. As discussed in Subsection 2.4.1, STPNOC performed a bio-assessment survey of the ditch that passes through the STP 3 & 4 site that could be affected by construction activities (Reference 4.2-3).

STPNOC also surveyed the proposed construction site to determine if jurisdictional wetlands were present (Reference 4.2-4). Subsequent to the completion of this survey, STPNOC performed additional surveys in concert with its request for a Preliminary Jurisdictional Determination of wetlands within the areas potentially affected by construction of Units 3 & 4. In May of 2009 the USACE confirmed the presence of 29 separate wetlands which would fall under the jurisdiction of the Clean Water Act. These wetlands ranged in size from 0.07 acres to 3.78 acres. Each of these wetlands would be avoided during construction activities (Reference 4.2-4). STPNOC would use silt fences and other erosion control devices, as needed, to help mitigate the possibility of surface water runoff from proposed construction activities impacting the STP site's surface water drainage features.

The RMPF intake structure on the Colorado River for STP 1 & 2 was built with the capability to provide enough makeup water to the MCR for four nuclear units. At present, it is operating at half its capacity, with only four makeup pumps in service. STPNOC has determined that the RMPF intake structure itself would not have to be modified to accommodate the new units. New pumps would be installed in the existing structure. This would limit potential direct impacts to the Colorado River.

The circulating water intake structure for STP 3 & 4 would be located on the modified existing MCR dike south of the STP 1 & 2 circulating water intake. The circulating water discharge outfall for STP 3 & 4 is located approximately 1000 feet west of the STP 1 & 2 discharge structure. Because of the configuration of circulating water pipes passing over the embankment, an overflow weir would be installed inside the discharge outfall to maintain proper siphon when the water level drops toward the low-water level datum. Downstream of the discharge outfall, riprap placement would be provided to prevent erosion. For more information, refer to Subsection 3.4.2.3. The MCR discharge is the existing blowdown facility to the Colorado River downstream of the RMPF. The MCR blowdown structure to the Colorado River is adequate in size to support the proposed project.

Any maintenance dredging of the Colorado River in the vicinity of the RMPF and the barge landing facility would be performed under existing or future STPNOC permits as required by the U.S.Army Corps of Engineers and in accordance with any applicable state permits or other requirements (Section 1.2 Tables 1.2-1 through 1.2-4). Dredged material from the dredged locations would be disposed in accordance with the STP site's dredging permits. Surface water impacts from dredging would be limited to the Colorado River in the direct vicinity of dredging operations and to the vicinity of the dredged material disposal area. Dredging would disturb sediments and increase turbidity downstream of the RMPF; however, impacts would be of short duration essentially limited to the period of actual dredging operations.

The State of Texas Construction Storm Water Program requires industrial facilities that discharge to waters of the United States and plan construction that would disturb more than 5 acres of land to:

- Obtain coverage under the Texas Pollutant Discharge Elimination System (TPDES).
- Implement best management practices including structural (i.e., erosion-control devices and retention ponds) and operational measures to prevent the movement of pollutants (including sediments) offsite via storm water runoff.

- Develop a Storm Water Pollution Prevention Plan (SWPPP) through the TCEQ.

New retention ponds and connecting drainage ditches would be constructed to accommodate surface water runoff from areas where surface soils would be disturbed by construction activities. The proposed ditches and retention ponds may also be used to allow potential sediment-laden water generated from dewatering activities to settle in them to reduce the amount of sediment potentially discharged to surface water bodies at the site. The water could then, if necessary, be discharged at a TPDES permitted outfall. The locations of these ditches and retention ponds have yet to be determined.

Therefore, STPNOC concludes that impacts to surface water hydrology would be SMALL and would not warrant additional mitigation in addition to those included in required permits.

4.2.1.2 Groundwater Dewatering

As discussed in Subsection 2.3.1, groundwater use in the vicinity of the STP site is primarily from the confined Chicot Aquifer (Beaumont Formation) within the Gulf Coast Aquifer system. The Chicot Aquifer is separated into shallow and deep aquifers by at least 150 feet of confining clay. Groundwater wells in Matagorda County are located within the Chicot Aquifer (Subsection 2.3.1). The Beaumont Formation comprises the shallower aquifer material below the alluvial deposits directly along the Colorado River channel and deeper portions of the Chicot Aquifer. The Beaumont Formation is comprised of deltaic sediments consisting of discontinuous interfingering beds of clay, silt, sand, and gravel that grade laterally over short distances (Reference 4.2-2). The upper 10 to 30 feet of the Beaumont Formation acts as an upper confining unit for the shallow portion of the Chicot Aquifer. As discussed in Subsection 2.3.1, the base of the shallow portion of the Chicot Aquifer is 90 to 150 feet deep at the STP site. This shallow portion of the Chicot Aquifer is the portion of the aquifer in which dewatering would occur.

Recharge to the shallow portion of the Chicot Aquifer is within a few miles north of the STP site. Discharge from the shallow portion of the aquifer is to local wells, to Colorado River alluvial material east of the site, and to Matagorda Bay and the Colorado River estuary, approximately 5 miles southeast of the site (Subsection 2.3.1).

The excavations for STP 3 & 4 would be approximatly one year apart. Each excavation would reach a depth of approximately 95 feet below grade. Perimeter dewatering would be required to a depth of at least 35 feet with dewatering wells for the deeper portion of the excavations located in the lower unit of the shallow portion of the Chicot aquifer to a depth of approximately 95 feet below grade. A slurry wall will be installed around the entire excavation (both Units 3 and 4) to a depth of approximately 125 feet below grade. The extent of each excavation would be approximately 1000 feet wide (east-west) by 1200 feet long (north-south) and would cover an area of approximately 27 acres for each unit.

It is currently anticipated that dewatering and excavation activities for STP 3 & 4 and their ancillary facilities would be similar to those performed during construction of STP

1 & 2. Dewatering and excavation activities for the existing STP 1 & 2 are described in STP 1 & 2 FSAR Subsection 2.5.4 (Reference 4.2-1). As discussed in Subsection 2.3.1, the proposed cut and fill excavation dewatering activities for STP 3 & 4 would consist of a combination of a perimeter slurry wall, deepwells, recharge wells, jet eductors, sand drains, wellpoints, pumps, standby pumps, sumps, sump pumps, trenches, and necessary appurtenances capable of achieving the design requirements to dewater or to depressurize the major water-bearing strata. The perimeter dewatering wells would control lateral inflow and assist in removing water stored within the excavation. The open pumping system would control precipitation runoff, assist in water storage removal, and any inflow to the excavation.

The initial dewatering rate is estimated to be 6700 gpm and is expected to decline to approximately 1000 gpm due to the surrounding slurry wall. The hydraulic conductivity in the upper unit of the shallow portion of the Chicot Aquifer is between 65 and 420 gallons per day/square foot (gpd/ft^2). Transmissivity values range from 1100 and 10,500 gallons per day per ft (gpd/ft). The storage coefficient varies between 0.0017 and 0.0007. The lower unit of the shallow portion of the Chicot Aquifer has a hydraulic conductivity that ranges between 410 and 600 gpd/ft^2, a transmissivity range between 13,000 and 33,000 gpd/ft, and storage coefficients between 0.00045 and 0.00071.

Based on the range of estimated flow, drawdown and subsidence estimates at key facility structures are included in Table 4.2-1. The excavation dewatering rates measured during STP 1 & 2 construction (1300 gpm to 2900 gpm) indicate the estimated STP 3 & 4 rates would be less than the upper bounded steady-state flow of 6700 gpm at the initial dewatering with a steady state of approximately 1000 gpm, which suggests that the estimates based on the lower hydraulic conductivity value may be more realistic. Therefore, the amount of projected drawdown and subsidence at the MCR and STP 1 & 2 would likely be on the lower end of the estimate range as shown in Table 4.2-1. Table 4.2-2 includes groundwater hydrologic parameters based on pump tests performed in the upper portion of the Chicot Aquifer.

As discussed in Subsection 2.3.1, the soils to a depth of approximately 10 to 30 feet in the vicinity of STP 3 & 4 consist primarily of silty clays that create a confined groundwater system in the shallow portion of the Chicot Aquifer at the site. The presence of the surficial clays would also isolate wetlands and shallow surface water (natural and man-made drainage) features in the vicinity of STP 3 & 4 from the underlying subsurface soil units being dewatered during construction. Therefore, the impact to wetlands or to surface water drainage features in the vicinity of the proposed excavation from the proposed dewatering activities would be SMALL and would not warrant additional mitigation.

Due to the presence of the confining clays above and below the shallow portion of the Chicot Aquifer, dewatering activities would be limited to the shallow portion of the Chicot Aquifer. As discussed in Subsections 2.3.1 and 2.3.2, the closest offsite well to the STP 3 & 4 site location (Figure 2.3.1-43) installed in the shallow artesian portion of the Chicot Aquifer is Well 2004120846, which is located approximately 9000 feet east of the STP 3 & 4 site. This well is approximately 80 feet deep and is used to supply water to livestock.

Dewatering activities in the upper shallow aquifer would not impact most local water well users because most water wells close to the site are located in the deeper portion of the Chicot Aquifer (Subsection 2.3.2). Dewatering wells would be installed above the confining layer separating the shallow portion of the Chicot Aquifer from the deeper portion. Therefore, dewatering would occur within the direct vicinity of the excavation for a reasonably short period of time (period of construction), affecting only the shallow portion of the Chicot Aquifer. The potential for subsidence associated with dewatering would be SMALL and limited to onsite areas, primarily to the areas of STP 1 & 2 and the MCR. Subsidence impacts could be mitigated through the installation of cutoff walls that would limit the amount of groundwater required to be pumped during the dewatering of the excavation. The use of injection wells or infiltration trenches could also help to limit the amount or possibility of subsidence near the existing STP site facilities by creating an area of recharge between the excavation and those facilities.

As discussed in Subsection 2.3.1, the use of the slurry wall could reduce the amount of water it would be necessary to remove from the excavation during dewatering. The steady state dewatering during the construction phase is significantly reduced with an estimated dewatering rate of 1000 gpm.

As discussed in Subsection 2.3.1, the MCR is connected to the shallow portion to the Chicot Aquifer where the surficial clays were excavated during the construction of the STP 1 & 2. This connectivity of the MCR to the shallow portion of the Chicot Aquifer and the fact that the proposed excavation sites are only 2200 feet from the MCR, dewatering over time could result in the movement of water from the MCR (higher head potential) to the excavation (lower head potential) if there are subsurface flow paths that directly connect the two areas. The loss of surface water from the MCR as a result of dewatering activities could result in the need to increase surface water use from the Colorado River or an increase in groundwater use. The use of the slurry wall between the excavation for STP 3 & 4 and the MCR could block potential flow from the MCR to the STP 3 & 4 excavation and prevent the additional loss of surface water from the reservoir.

Due to the nature of the clay and sand materials, sumping may be required to handle any seepage, trapped water, perched water, or surface water on top of these formations. A system of shallow drains and/or ditches is utilized inside and outside the excavation to collect and direct minor seepage to sumps. This system would also be utilized to handle storm water that enters the excavation. Sand drains may also be installed to allow the trapped and/or perched water to migrate to the lower permeable formations that are pumped by the active dewatering systems. The effluent from the dewatering well system would be controlled, and discharged into drop structures with discharge points located in the existing MCR.

A surficial clay extends across the STP site with the exception of beneath some sections of the MCR where the clay was penetrated during construction activities for STP 1 & 2. Because the shallow portion of the Chicot Aquifer is generally isolated from surface waters outside of the footprint of the MCR by the surficial clay and from underlying aquifer units by a confining unit, STPNOC concludes that impacts to groundwater due to pumping during dewatering activities in this aquifer would be limited to the shallow portion of the Chicot Aquifer. Impacts on surface water hydrology from dewatering activities with the possible exception of the MCR would be SMALL and would not warrant additional mitigation.

Compacted materials added to the excavation as part of the backfill process and the presence of the new units would alter the groundwater flow paths in the vicinity of STP 3 & 4 foundations. However, these impacts would be localized to the STP site in the area of construction. When the slurry wall is installed prior to construction, flow patterns within the shallow portion of the Chicot Aquifer on the STP site would also be altered. These impacts would be limited to areas of construction within the STP site boundary and would have no impact on surface water hydrology. STPNOC has developed a Dewatering Plan to be used by the construction contractor that contains detailed information on dewatering and water disposal activities and possible mitigation measures for the STP 3 & 4 site. Once dewatering operations cease, the affected potentiometric surface at the site is expected to return to pre-construction levels. Therefore, STPNOC concludes impacts to the shallow groundwater aquifer from dewatering activities would primarily be localized to the STP site and would be SMALL, and would not warrant mitigation other than as mentioned above or required by existing or required permits.

4.2.2 Water Use Impacts

The existing five (5) site groundwater production wells are indicated in Figure 2.3-2. A description of the groundwater underlying the STP site is provided in Subsection 2.3.1.2.2. A description of current groundwater use at STP 1 & 2 is provided in Subsection 2.3.2.2 and Table 3.2-18.

Based on the results of an operating plant (Units 3 and 4) water balance calculation (Reference 4.2-8) and a site groundwater use calculation (Reference 4.2-9), STPNOC has determined that the STP site groundwater operating permit (Reference 4.2-5) limit provides adequate groundwater supply for water uses required for the operation of STP Units 1 and 2 and the construction, initial testing, and operation of STP Units 3 and 4. The permit allows groundwater withdrawals from the five site production wells up to a limit of 9000 acre-feet over the permit term of approximately 3 years. For discussion purposes, this permit limit may be described herein as “approximately 3000 acre-feet/year,” recognizing that groundwater withdrawal in a single year may exceed 3000 acre-feet provided that total withdrawals over the permit term do not exceed 9000 acre-feet. As a point of reference, if the permit limit were exactly 3000 acre-feet/year (which is not necessarily the case due to slight variances in the permit term with each permit renewal), the equivalent “normalized” withdrawal rate assuming continuous pumping every minute of every day of each year would be approximately 1860 gpm.

As discussed in Subsection 2.3.2, annual groundwater use for operation of STP Units 1 & 2 from 2001 through 2006 averaged approximately 798 gpm (approximately 1288 acre-feet/year). A small but not insignificant portion of this amount has been diverted to the Main Cooling Reservoir (MCR) as a result of manual operation of the groundwater well pump and header system. With the installation of appropriate automated groundwater well pump and header system controls, this diverted groundwater would be available for construction, initial testing, and operation of Units

3 and 4. However, as documented in the site groundwater use calculation (Reference 4.2-9), it has been determined that even if this water were not available to Units 3 and 4, the existing STP site groundwater operating permit limit provides adequate groundwater supply for water uses required for the operation of STP Units 1 and 2 and the construction, initial testing, and operation of STP Units 3 and 4.

Groundwater would be used during construction and initial testing of STP Units 3 and 4 for personal consumption and use, concrete batch plant operation, concrete curing, cleanup activities, dust suppression, placement of engineered backfill, and piping flushing and hydrostatic tests. Water uses for the construction and initial testing of STP Units 3 and 4 were estimated for each month during the construction period through the commencement of unit operation (Reference 4.2-9). As documented in the site groundwater use calculation (Reference 4.2-9), monthly construction water uses are projected to range from a normalized rate of approximately 10 gpm to approximately 228 gpm. Similarly, monthly water uses associated with initial testing of STP Units 3 and 4 are projected to range from a normalized rate of approximately 47 gpm to approximately 491 gpm.

When evaluating whether the total site groundwater demand can be satisfied by the available groundwater supply, the site groundwater use calculation (Reference 4.2-9) considers the schedule projected for each use, and evaluates the total site groundwater usage at each point in time from the commencement of STP Units 3 and 4 construction until both Units 3 and 4 are in operation (i.e., Units 1, 2, 3 and 4 are operating simultaneously). With consideration for the need to maintain water storage capacity to provide for peak site water demands, this evaluation confirms that total site groundwater demand remains below the existing site groundwater permit limit during construction, initial testing, and operation of STP Units 3 and 4.

As discussed in Section 2.3.2, the design groundwater withdrawal capacity associated with the five site production wells covered by the existing site groundwater operational permit is 1950 gpm. Of the total 1950 gpm design capacity, not more than approximately 1650 gpm is considered to be available based on operating experience and the fact that use of the Nuclear Training Facility (NTF) pump is limited to providing fire protection water for the NTF. Therefore, STPNOC intends to install at least one additional site groundwater well with a design capacity of 500 gpm. As with the existing five site production wells, any new well(s) would be installed to depths within the deep portion of the Chicot Aquifer. As documented in the site groundwater use calculation (Reference 4.2-9), this additional capacity will allow for sufficient groundwater withdrawal to meet water uses required for: (1) operation of STP Units 1 and 2 and the construction, initial testing, and operation of STP Units 3 and 4; and (2) potential temporary capacity reduction as a result of equipment failure/unavailability. Any additional wells would be properly permitted under applicable Coastal Plains Groundwater Conservation District (CPGCD) and TECQ requirements, and would not involve a request for an increase in the existing permit limit.

As discussed in Subsection 2.3.2, the site's five (5) production wells provide water from the deep portion of the Chicot Aquifer (well depths between 600 and 700 feet) for STP Units 1 & 2 operations, the NTF, and for the STP Visitor Center (located within the

NTF). STP Units 1 & 2 currently use this water for cooling, condensing, and refrigeration; process and washdown; boiler feed; air-conditioning; sanitary and drinking; and other plant activities. A sixth well located at the east entrance to the STP Unit 1 and 2 site off FM 521 has been plugged and abandoned. An onsite pump test on Well 5 installed to a depth of 700 feet in the deep aquifer portion of the Chicot Aquifer yielded 50,000 gpd/ft (6680 ft^3/day). However, as indicated in Table 2.3.1-16, lower transmissivity values were calculated for Well 6 and Well 7. Therefore, an average transmissivity value of 33,245 gpd/ft (4444 ft^3/day) was used in the calculations. No values for the coefficient of storage were determined for these wells, so the values used are those for Well 5. The specific capacity of Well 5 was 10 gallons per minute per foot (gpm/ft) of drawdown. The average permeability of the deep aquifer beneath the site was calculated to be 35 ft/day (Reference 4.2-2). The hydrologic parameters for the modeling of potential groundwater use impacts using a confined aquifer scenario for the deeper portion of the Chicot Aquifer are included in Table 4.2-3. Subsection 2.3.1 describes the confining unit separating the shallow portion of the Chicot Aquifer from the deeper portion of the Chicot as being confined. Therefore, the results of using a confined scenario would represent STPNOC's current knowledge of the site conditions.

The upper shallow aquifer is primarily used for livestock watering and other low-yield requirements. The upper shallow aquifer is isolated from the surface waters by surficial clays and from the lower aquifer units by several confining units. As discussed in Subsection 2.3.2, most well water users near STP do not use the upper shallow aquifer as a source for drinking water because of its low yield. The deep confined aquifer is used as the primary source of water for the region due to higher aquifer yield. Therefore, STPNOC concludes that impacts due to pumping from the STP site's production wells during construction activities to the shallow portion of the Chicot Aquifer would be SMALL and would not warrant mitigation.

As indicated above, construction and initial testing of STP Units 3 & 4 will result in an increase in the average groundwater pumping rate (not to exceed the existing permit limit) as compared to that currently required to supply the needs of STP Units 1 & 2. The wells located in the deeper portion of the Chicot Aquifer were evaluated to determine any potential impact to wells located in the vicinity of the STP site within the same portion of the aquifer. The closest offsite well (Figure 2.3.2-5) in the same aquifer unit from an STP site well is Texas Water Development Board Well 8109702, which is located approximately 1.25 miles (6600 feet) southeast of STP Well 7. However, the CPGCD requires a distance of 2,500 feet to be between wells permitted by the District (Reference 4.2-6). Therefore a distance between the potential wells of 2,500 feet would result in the more conservative model results than 6600 feet. As discussed above, the hydrologic parameters used for the modeling are listed in Table 4.2-3.

4.2.2.1 Confined Nonleaky Scenario

A confined nonleaky scenario would most likely represent actual site conditions. The hydrologic parameters used in support of a confined nonleaky aquifer scenario are included in Table 4.2-3. The Theis non-equilibrium well equations (Reference 4.2-7) for a confined non-leaky scenario are as follows:

$s = [Q/4(3.14)T](W(u))$ $\qquad$ $u = r^2S/4Tt$

where:

s = drawdown (ft)

T = transmissivity, ft^2/day

Q = pumping rate, ft^3/day

t = time since pumping started, days

S = coefficient of storage

W(u) = Theis well function

r = distance to pumping well, ft

The assumptions made were that the aquifer is homogeneous, isotropic, of uniform thickness, and of infinite aerial extent. The assumptions also include that the potentiometric surface prior to pumping is horizontal; the well is pumped at a constant discharge rate; the well is fully penetrating and flow is horizontal; the well diameter is infinitesimal so that storage within the well can be neglected; and water from storage is discharged instantaneously with decline of head. The results of the confined non-leaky scenario model indicated that drawdown of the deeper portion of the Chicot Aquifer potentiometric surface at a distance of 2500 feet from any STP site well based on an average pumping rate of 798 gpm after a period of 27 years (9855 days), which is the operational period of STP 1 & 2 to beginning of construction, would result in a drawdown of 27 to 30 feet. During the construction period [7 years (2555 days)] for STP 3 & 4, the drawdown associated only with the construction activities and a pumping rate of 1062 gpm is 32 to 36 feet. During the period of overlap of the current operational water use and the amount of water projected to be used during construction of STP 3 & 4 over the length of construction activities, the drawdown of the potentiometric surface of the Chicot Aquifer was determined to be 55 to 63 feet (pumping rate of 1860 gpm, which, as detailed in Subsection 4.2.2, is a conservative normalized approximation of the current permitted limit) at 2,500 feet from the pumping well.

In reality, as with the confined non-leaky scenario, the actual withdrawal resulting from the pumping of any STP site well a distance of 2,500 feet away would be similar to the drawdown that could be generated under current operating conditions based on design yields and assuming that the wells pumped are pumped in a manner such that no two adjacent wells are ever pumped at the same time to prevent coalescing drawdowns. The drawdown at a distance 2,500 feet from any STP site well for the 500 gpm design yield during the projected 40-year operating period of STP 1 & 2 is 18 to 20 feet.

STPNOC concludes that impacts due to increased pumping during construction activities to the deeper portion of the Chicot Aquifer would be SMALL and would not warrant mitigation. A reduction in drawdown potential could be obtained by the permitting of additional production wells within the same aquifer sequence. This would allow STP to decrease the actual pumping rate at each well location, thereby spreading out the potential drawdown impacts across the STP site and reducing the effect each of the individual wells would have on offsite well locations while pumping within the current permitted rate.

4.2.3 Water Quality Impacts

4.2.3.1 Surface Water

Impacts to surface water quality can occur as the result of chemical spills and soil erosion due to ground disturbance during construction. Potential impacts from the modification or construction of new replacement transmission towers along the STP to Hillje right-of-way would result in soil disturbance which would increase the potential impacts to surface water from sedimentation. Based on observation of aerial photographs, buffers of vegetated land that lie between the transmission towers to be modified or constructed and nearby surface water features would reduce the likelihood of any impacts due to sedimentation resulting from construction activities. STPNOC anticipates that modifications/construction along the transmission right-of-way would occur in accordance with all applicable regulations (Section 1.2, Tables 1.2-1 through 1.2-4) and best management practices to further reduce the potential impact, including erosion control measures that may include the use of silt fences and sediment retention basins to prevent storm water from carrying soil into down-gradient water bodies.

Any contaminants (e.g., diesel fuel, hydraulic fluid, antifreeze, or lubricants) spilled during construction activities and not controlled by spill control measures could also affect surface water quality. Any minor spills of potential contaminants, including diesel fuel, hydraulic fluid, or lubricants during construction of the project, would be remediated quickly in accordance with the STP Construction SWPPP. Therefore, impacts to water quality would be considered SMALL and would not warrant additional mitigation.

Due to the relatively flat topography of the STP site, erosional impact to onsite land surfaces would be SMALL. Little Robbins Slough and Kelly Lake receive surface water from the northern portion of the STP site via surface flow from STP site drainage features and could therefore be impacted by site disturbance activities in the vicinity of STP 3 & 4 and the heavy-haul road. Direct impacts to the Colorado River from the construction activities at STP 3 & 4 are less likely because of the distance (approximately 3 miles) between the construction site and the waterway. Based on observation of aerial photographs, buffers of vegetated land that lie between the construction site and nearby surface water features would reduce the likelihood of any impacts due to sedimentation resulting from construction activities. STPNOC would plan and carry out road building and other project construction activities in accordance with all applicable regulations (Section 1.2, Tables 1.2-1 through 1.2-4) and best management practices including erosion-control measures that may include silt fences and sediment retention basins to prevent storm water from carrying soil into down-gradient water bodies.

Because the STP 3 & 4 site slated to be disturbed for facilities and supporting infrastructure is more than 5 acres, STPNOC would, in compliance with the TCEQ TPDES Construction Storm Water Program, do the following:

- Submit a Notice of Intent to obtain coverage under the TCEQ General Permit Number TX150000 Relating to Discharges from Construction Activities.
- Develop a SWPPP.
- Implement best management practices, including structural and operation controls to prevent the movement of pollutants (including sediments) into wetlands and water bodies via storm water runoff.

Based on the fact that any ground-disturbing activities would be permitted and overseen by state regulators, and guided by an approved SWPPP, STPNOC believes any impacts to surface water during the construction phase would be SMALL and would not warrant mitigation beyond those best practices mentioned above and any additional requirements required by permitting agencies.

4.2.3.2 Groundwater

The shallow aquifer beneath the plant and the STP to Hillje transmission right-of-way is under confined conditions resulting from the overlying surficial clay material and the underlying confining unit that separates the shallow confined aquifer from the deep aquifer located within the Beaumont Formation. The groundwater at the STP site and in the vicinity of the STP site is replenished by natural precipitation that percolates to the water table and then moves laterally to the closest interceptor stream, the Colorado River. As a consequence, any contaminants (e.g., diesel fuel, hydraulic fluid, antifreeze, or lubricants) spilled during construction and not controlled by spill control measures may affect only the shallow aquifer and would ultimately move to surface water bodies where they could be intercepted.

Any minor spills of diesel fuel, hydraulic fluid, or lubricants during construction of the project would be remediated quickly in accordance with the construction SWPP.

None of the planned construction activities has the potential to affect the deep, confined aquifers. In the unlikely event small amounts of contaminants escape into the environment, they would have only a small, localized, temporary impact on the shallow confined aquifer. STPNOC believes that any impacts to groundwater quality would be SMALL and would not warrant mitigation beyond those described in this section or required by permit.

4.2.4 References

4.2-1 STPEGS Updated Final Safety Analysis Report for Units 1 & 2, Revision 13, May 2006.

4.2-2 "Final Environmental Statement related to the Operation of STP 1 & 2," NRC (Nuclear Regulatory Commission) August 1986.

4.2-3 "Rapid Bioassessment Initial Report," ENSR (ENSR Corporation), South Texas Project Electric Generating Station, Prepared for STP Nuclear Operating Company, Wadsworth, Texas, May 2007.

4.2-4 "Ecological Survey Report Unit 3 and 4 Licensing Project," ENSR, South Texas Project Electric Generating Station, Prepared for STP Nuclear Operating Company, Wadsworth, Texas, March 2007.

4.2-5 Operating Permit, STP Nuclear Operating Company, Historical User Permit No. OP-04122805, Coastal Plains Groundwater Conservation District, March 2005.

4.2-6 CPGCD (Coastal Plains Groundwater Conservation District) 2004, Rules of the Coastal Plains Groundwater Conservation District, adopted May 25.

4.2-7 "Groundwater and Wells," Fletcher G. Driscoll, 2nd Edition, Johnson Filtration Systems Inc., St. Paul, Minnesota, 1989.

4.2-8 "Plant Water Balance," Fluor Nuclear Power Calculation No. U7-SITE-G-CALC-DESN-2001.

4.2-9 "Site Groundwater Use for Construction, Initial Testing, Startup, and Operations," Fluor Nuclear Power Calculation No. U7-SITE-G-CALC-DESN-2002.

Table 4.2-1 Estimated Dewatering Drawdown and Subsidence

Location	Distance from STP Proposed Excavation	Drawdown at Location Facility	Subsidence at Location Facility
MCR Dike	2200 ft from STP 3 & 4	<0.1 to 10 ft	<0.01 to 0.08 ft
STP Unit 1	1800 ft from STP 3 & 4	<0.1 to 19 ft	<0.01 to 0.15 ft
STP Unit 2	2250 ft from STP 3 & 4	<0.1 to 9 ft	<0.01 to 0.07 ft

Table 4.2-2 Pump Test Data STP 1 & 2 Shallow Aquifer Portion of the Chicot Aquifer

Pump Test	Test Depth (ft)	Transmissivity (gpd/ft)	Permeability		Storage Coefficient
			gpd/ft	cm/sec	
1	60-140	33,000	410	0.0200	0.00071
2	59-83	13,000	600	0.0280	0.00045
3	20-43	1,100	65	0.0030	0.00170
4	30-45	10,500	420	0.0200	0.00070

Source: Reference 4.2-2, Table 2.4.13-3

Table 4.2-3 Drawdown Inputs for Confined Non-leaky Aquifer Scenario/Construction

Case	1	2	3	4	5	6	7	8
Distance (Feet) [1]	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Storage Coefficient [2]	0.00076 to 0.00022	0.00076 to 0.00022	0.00076 to 0.00022	0.00076 to 0.00022	0.00076 to 0.00022	0.00076 to 0.00022	0.00076 to 0.00022	0.00076 to 0.00022
Transmissivity [2] (Feet^2/day)	4,444	4,444	4,444	4,444	4,444	4,444	4,444	4,444
Time (Days)	3,650	9,855	365	2555	365	2555	2555	14600
Flow, Q (gpm)/(Feet^3/day)	798/(153,615)	798/(153,615)	1062/(204,435)	1062/(204,435)	1860/(358,050)	1860/(358,050)	500/(92,250)	500/(92,250)
Confining Unit [2] b' (FT)	100	100	100	100	100	100	100	100
K' Feet/Day [2]	0.00053	0.00053	0.00053	0.00053	0.00053	0.00053	0.00053	0.00053
Drawdown at closest offsite well from Well 7 (Feet)	25–28	27–30	24–29	32–36	43–51	55–63	15–17	18–20

Case 1 to 2 – STP 1 & 2 operations - pumping current average rate (798 gpm) over different time spans

Case 3 to 4 – STP 3 & 4 construction - pumping well at 1062 gpm, which is 1860 gpm (i.e., as detailed in Section 4.2.2, the conservative normalized approximation of the current permit limit) less the Units 1 and 2 average annual withdrawal rate (798 gpm)

Case 5 to 6 – STP 1 & 2 operation and STP 3 & 4 construction - pumping at 1860 gpm

Case 7 – STP site well pumping at current well maximum design yield of 500 gpm over 7-year construction period

Case 8 – STP site well pumping at current well maximum design yield of 500 gpm over 40-year operational period

[1] ER Section 2.3.2

[2] ER Section 2.3.1