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2.3 WATER

This section provides site-specific and regional descriptions of the hydrology, water use, and water quality conditions that could affect or be affected by the construction and operation of Units 6 & 7. The potential impacts of plant construction and operation on surface water and groundwater are described in Chapters 4 and 5, respectively.

Units 6 & 7 would be collocated with two natural gas/oil steam electric generating units (Units 1 & 2), two pressurized water reactor nuclear units (Units 3 & 4), and one natural gas combined-cycle steam electric generating unit (Unit 5) on the approximately 11,000-acre Turkey Point property. The Turkey Point plant property is located in southeast Florida on the west bank of Biscayne Bay in Miami-Dade County, approximately 25 miles south of Miami, Florida, as shown on Figure 2.3-1. Major hydrologic features near the plant property are also identified in the figure. Areas surrounding the plant property are shown on Figure 2.3-2.

The 218-acre Units 6 & 7 plant area would be built up to higher elevations above the adjacent grade with finished grade elevations varying from 19 feet to 25.5 feet in North American Vertical Datum of 1988 (NAVD 88). The plant area would be surrounded by a retaining wall structure with the top of wall elevation varying from 20 feet to 21.5 feet NAVD 88. The Units 6 & 7 plant area is south of Units 3 & 4 and completely encircled by the cooling canals of the industrial wastewater facility (Figure 2.3-3, Figure 2.3-4) that are used by Units 1 through 4. Unit 5 uses mechanical draft cooling towers where the cooling tower makeup water is supplied from the Upper Floridan aquifer and the blowdown is routed to the industrial wastewater facility. The Units 6 & 7 plant area is sparsely vegetated consisting of mudflats, open water, dwarf mangroves, man-made remnant canals, wetland spoil areas, and mangrove heads and is isolated by the surrounding industrial wastewater facility. The existing grade elevation within the Units 6 & 7 plant area varies from approximately –2.4 feet to 0.8 feet NAVD 88.

2.3.1 HYDROLOGY

This subsection describes surface water and groundwater hydrology that could affect or be affected by the construction and operation of Units 6 & 7. The site-specific and regional data on the physical and hydrologic characteristics are also summarized to provide the basis for an evaluation of impacts on water bodies, aquifers, aquatic ecosystems, and social and economic structures of the area.

2.3.1.1 Surface Water Resources

The Units 6 & 7 plant area is located on the shore of Biscayne Bay within the Everglades drainage basin of the south Florida watershed subregion, as shown on Figure 2.3-5 (Marella 1999). As described in Section 2.6, the Turkey Point plant property is located in the Southern Slope subprovince of the Southern Zone subregion of the Florida Platform within the Atlantic

Coastal Plain physiographic province (Figure 2.6-1). The physiographic features in the Southern Zone subregion that govern surface water flows southward from Lake Okeechobee include the Immokalee Rise, Big Cypress Spur, Atlantic Coastal Ridge, and the Everglades physiographic sub-provinces (Figure 2.6-1). Higher topographic relief of the Immokalee Rise and Big Cypress Spur in the west and the Atlantic Coastal Ridge in the east of the Everglades historically guided the stormwater runoff and freshwater flows from Lake Okeechobee to drain south and southeast into the Everglades. However, flood control structures and an elaborate drainage canal system constructed in the past century has since modified the natural drainage basin, its freshwater discharge, and its interaction with the coastal bays of the Atlantic Ocean and Gulf of Mexico. The interaction of surface water and groundwater within the area further complicates the hydrology of the area (McPherson and Halley 1997, Godfrey 2006, Wolfert-Lohmann et al. 2007).

The Units 6 & 7 plant area is located in the low-lying areas of the Southern Slope physiographic subprovince on the western shore of Biscayne Bay (Figure 2.6-1). There are no lakes, major rivers, or dams located near the plant area, as shown on Figures 2.3-1 through 2.3-3. However, a network of drainage canals, which includes canals from the Everglades National Park-South Dade Conveyance System (ENP-SDCS) and local project (drainage) canals, provides freshwater supply to the Everglades National Park and controlled drainage from southeast Florida to the Biscayne Bay. Consequently, the hydrology near the Units 6 & 7 plant area is mainly governed by the dynamics of Biscayne Bay. In addition to Biscayne Bay, other major hydrologic features near the Units 6 & 7 plant area include the Everglades and the drainage canal system of southeast Florida, and the cooling canals of the industrial wastewater facility (see Figure 2.3-1 and Figure 2.3-3). Each of these hydrologic features is described below.

The Westinghouse AP1000 certified plant design has been selected for Units 6 & 7. The AP1000 design employs a passive containment that does not require offsite water sources to perform its safety-related functions. Units 6 & 7 would use mechanical draft towers for nonsafety-related circulating water system cooling. Makeup water for the circulating water system cooling towers would be from two independent water sources, each capable of supplying the required makeup water demand, as described in Section 3.4. The makeup water sources for the circulating water system would be reclaimed water from Miami-Dade Water and Sewer Department (MDWASD) water treatment facilities and saltwater from radial collector wells with horizontal laterals installed beneath the floor of Biscayne Bay. Therefore, there would be no direct withdrawals or discharges to surface waters associated with the operation of Units 6 & 7. It is noted however, that the majority of water recharging the radial collector wells would originate from Biscayne Bay. Cooling tower blowdown discharge and other applicable plant discharge effluents from Units 6 & 7 would be collected in a common blowdown sump and discharged into deep injection wells, as described in Section 3.4. None of the surface water bodies would be used as an effluent discharge point or heat sink for Units 6 & 7.

Units 6 & 7 transmission lines would use existing and new corridors. New corridors would be established to supplement existing corridors where necessary. The transmission corridors are described in Section 3.7.

2.3.1.1.1 The Everglades

The Everglades is the largest wetland in the continental United States and was part of the larger, natural Kissimmee-Okeechobee-Everglades watershed that once extended south from Lake Okeechobee to the southernmost extremity of peninsular Florida (McPherson and Halley 1997). Elevations within the Everglades, which was formed on limestone bedrock, are lower than the elevations in the Immokalee Rise or Atlantic Coastal Ridge physiographic subprovinces and slope towards the south with an average gradient less than 2 inches per mile (McPherson and Halley 1997, Galloway et al. 1999). The freshwater flow from Lake Okeechobee and the flat terrain of the basin supported the accumulation of layers of peat and mud that formed the historical Everglades wetlands over an area of approximately 4500 square miles (McPherson and Halley 1997, Galloway et al. 1999). Historically, overflows from Lake Okeechobee slowly moved through the Everglades as sheet flows. The overflow also provided the freshwater supply that sustained the ecosystem functions within the wetlands that were dominated by sawgrass and tree islands, the small, forested islands that are a prominent feature of the Everglades (McPherson and Halley 1997, Godfrey 2006). From the Everglades, water drained south to the Gulf of Mexico through a series of open-water sloughs. Hydrological features and direction of historical surface water flows are shown on Figure 2.3-6.

The Atlantic Coastal Ridge that separates the Everglades from the Atlantic coastline has a maximum elevation of approximately 20 feet above MSL datum (Galloway et al. 1999), which is equivalent to the National Geodetic Vertical Datum of 1929 (NGVD 29). At the National Oceanic and Atmospheric Administration (NOAA) tide gage station at Virginia Key, Florida, the NGVD 29 is located approximately 1.6 feet below the NAVD 88. This datum relationship is also considered applicable to the Units 6 & 7 plant area. Applying the datum conversion, the maximum elevation of the Atlantic Coastal Ridge is approximately 18.4 feet NAVD 88. The NAVD 88 is used as the reference vertical datum in this subsection. A conversion to NAVD 88 is provided when a reference to other vertical datums are made. Historically, nearly all of southeast Florida, except for the Atlantic Coastal Ridge, was flooded annually (Galloway et al. 1999). The floodwater discharged to Biscayne Bay through the undeveloped Miami, New, and Hillsborough Rivers and other sloughs that formed the transverse glades in the Atlantic Coastal Ridge.

Since the late nineteenth century, the south Florida watershed subregion has been affected by anthropogenic alterations (Ishman 1997, Godfrey 2006). Land reclamation for agriculture, construction of flood control levees and drainage canals, and urbanization has irreversibly modified the hydrology of the region. One of the major impacts of the hydrologic modification is the reduction of freshwater flow to the Everglades, which resulted in a degradation of the south

Florida ecosystem. Canals were first dug through the Everglades to drain water from the area south of Lake Okeechobee, thus enabling agriculture to develop during the late nineteenth century (McPherson and Halley 1997, Renken et al. 2005, Godfrey 2006). By the late 1920s, major canals were constructed and rivers in the transverse glades were modified to connect Lake Okeechobee with the Gulf of Mexico and Atlantic Ocean (Figure 2.3-7). In the west, the Caloosahatchee Canal connected Lake Okeechobee with the Gulf of Mexico. St. Lucie Canal in the east connected Lake Okeechobee with the St. Lucie River and estuary. In the southeast, the West Palm Beach, Hillsborough, North New River, South New River, and Miami (River) Canals connected Lake Okeechobee with the Biscayne Bay and the Atlantic Ocean (McPherson and Halley 1997, Renken et al. 2005, Godfrey 2006). Government-initiated flood control measures including levee construction and drainage channel modification began in the 1930s (Godfrey 2006).

The consequences of the Everglades watershed alterations were the destruction of plants and wildlife, soil subsidence, saltwater intrusion, and fires in the peat layers during periods of drought (Godfrey 2006). To counter the deteriorating environmental conditions, the U.S. Congress authorized the Central and Southern Florida Flood Control Project (C&SF project) in 1948 with a mandate to provide flood protection, water supply, prevention of saltwater intrusion, and protection of fish and wildlife resources (McPherson and Halley 1997, Godfrey 2006). The state of Florida formed the Central and Southern Florida Flood Control District in 1949, which later became the South Florida Water Management District (SFWMD), to work with the C&SF project. The C&SF project adopted a water-management plan for Lake Okeechobee and three water conservation areas (WCAs) to provide flood protection and water supply through a complex series of canals, levees, pumps, and control structures (McPherson and Halley 1997, Renken et al. 2005, Godfrey 2006). An area of approximately 800,000 acres was identified in the northern Everglades, on the basis of soil thickness and geologic formations, as potential agricultural land and referred to as the Everglades Agricultural Area (EAA), which was subsequently drained and farmed. The WCAs, which are approximately 900,000 acres of land enclosed by levees and canals, were constructed in the central Everglades (McPherson and Halley 1997). The locations of the EAA and the WCAs are shown on Figure 2.3-7.

The construction of the flood control canals, levees, and structures by the C&SF project causes a large portion of runoff that originally flowed from the Kissimmee River and Lake Okeechobee into the Everglades to be diverted directly to the Gulf of Mexico by the Caloosahatchee Canal and to the Atlantic Ocean by the St. Lucie Canal. The remaining outflow from the lake discharges to the canals that pass through the EAA (McPherson and Halley 1997). Before flood control, agriculture, and urbanization development, which began in the late nineteenth century, the natural water level in the lake overflowed its southern bank at elevations 20 to 21 feet NGVD 29 (18.4 to 19.4 feet NAVD 88). Currently, the lake water level is artificially maintained at approximately 13 to 16 feet NGVD 29 (11.4 to 14.4 feet NAVD 88) (Galloway et al. 1999). Surface water flows from the EAA into the WCAs are maintained by pumping, resulting in alterations in the timing and spatial distribution of flows, as well as a reduction in the volume of water discharged. As a result, water levels in the Everglades at present are generally shallower and have shorter hydroperiods than water levels prior to late nineteenth century development (McPherson and Halley 1997, Galloway et al. 1999). By 1930, the network of mostly uncontrolled canals drained large quantities of freshwater from the Everglades into the Atlantic Ocean, lowering the water levels in the Everglades as much as 6 feet compared to the predevelopment period (Renken et al. 2005). In the southern part of the Everglades, levees impede water flows and cause ponding, which became evident during the mid-1960s in WCA-3 with extensive flooding of tree islands. During periods of drought, water is released from Lake Okeechobee to the EAA and the WCAs. Most of the flows, however, never reach the interior marshes as the flows are confined to canals and nearby marshes (Wolfert-Lohmann et al. 2007). Post-development drainage patterns in the Everglades are shown on Figure 2.3-7.

By 2000, approximately 50 percent of the historic Everglades basin in Florida remained undeveloped (Renken et al. 2005). The rest of the area has been altered for agriculture or urban growth (Godfrey 2006). Most of the remaining portions of the Everglades at present are protected by public parks including Everglades National Park, Big Cypress National Preserve, Loxahatchee National Wildlife Refuge, the WCAs, the Fakahatchee Strand State Preserve, and other state lands (McPherson and Halley 1997). Everglades National Park was established in 1947 on marshland south of the WCAs and now covers approximately 1.4 million acres (McPherson and Halley 1997). Everglades National Park is approximately 15 miles west of the Units 6 & 7 plant area and is adjacent to the southeast Florida drainage canal system.

In 2000, the Federal Water Resources Development Act authorized a Comprehensive Everglades Restoration Plan (CERP) to guide the restoration, protection, and preservation of the water resources of central and southern Florida, including the Everglades (CERP 2008a). The plan covers 16 counties over an area of 18,000 square-miles and focuses on updating the C&SF project. The CERP includes more than 60 elements that would require more than 30 years to construct (CERP 2008a). The CERP projects would improve south Florida's ecosystem by restoring water flows that have changed over the past century. CERP projects would capture and store freshwater flows in surface and subsurface reservoirs, which are currently released to the Atlantic Ocean and Gulf of Mexico. The freshwater would be directed to the wetlands, lakes, rivers, and estuaries of south Florida while also ensuring future urban and agricultural water supplies (CERP 2008a). The reservoir storage areas would mainly be located within the EAA and WCAs.

2.3.1.1.2 Everglades National Park-South Dade Conveyance System

The development of reclaimed land from the Everglades for agriculture, urbanization, and flood control needs resulted in a gradual construction of canals and levees in the south Florida region before the implementation of the C&SF project. The systematic and elaborate construction of drainage canals in southern Dade County was initiated in the 1960s. The federal Flood Control Act of 1962 authorized the C&SF project for southern Dade County. The C&SF project implemented a system of canals and structures to provide drainage for urban development, prevent over-drainage of agricultural lands, and prevent contamination of groundwater by saltwater intrusion (USACE 2007). The conveyance system relies on gravity drainage through a primary network of 12 canals with outlets to serve a system of secondary canals (USACE 2007). The stages of development of the canals during the 1950s and 1960s are shown on Figure 2.3-8.

The canal system was modified in the 1970s to meet the hydrologic needs of the Everglades National Park, as authorized by the updated Flood Control Act of 1968, by implementing the ENP-SDCS (USACE 2007). ENP-SDCS interconnected several drainage basins of the C&SF drainage project (Cooper and Lane 1987). Gated control structures were first installed at the eastern (coastal) end of the primary canals to release excess stormwater runoff to the coastal water bodies during the wet season and to manage saltwater intrusion during the dry seasons. Secondary controls on the inland reaches of canals were then installed to regulate flow eastward, control inland and agricultural flooding, and maintain higher water levels in the surficial aquifer system where appropriate (Renken et al. 2005). The surface water canal system was fully developed in the 1980s when the ENP-SDCS was completed. The progression of canal development during the 1970s through 1990 is shown on Figure 2.3-9. The conveyance system met its objectives by providing agricultural water supply, controlling inland flooding, and mitigating saltwater intrusion (Renken et al. 2005).

The ENP-SDCS was mandated to supply 55,000 acre-feet of water per year to the Everglades National Park. It made use of the existing canals from the C&SF project (Cooper and Lane 1987). The existing north-south directed borrow canals, L-30 and L-31N/L-31W, were enlarged to convey water from the Miami Canal (C-6) to the Everglades. The west-east running canals provide drainage from the South Dade development corridor to Biscayne Bay by control structures at the mouth of the canals (Renken et al. 2005). The locations of present day ENP-SDCS and C&SF project drainage canals are shown on Figure 2.3-10. The western borrow canal of the Levee L31-E (L-31E Canal) runs parallel to the Biscayne Bay coastline in southern Miami-Dade County, separating the coastal wetlands along the bay from the mainland. Starting north of Black Creek Canal (C-1) and extending to Card Sound Road in the south, the L-31E Canal has a levee crest elevation of approximately 7 feet NAVD 88 (SFWMD 2006a). Near the Turkey Point plant property, the levee and canal are located immediately west of the Turkey Point interceptor ditch and the industrial wastewater facility.

Based on the hydrology of the area, the U.S. Army Corps of Engineers (USACE) delineated water management subbasins in southern Dade County (Cooper and Lane 1987). At present, the water management area includes 17 subbasins that contribute flow to Biscayne Bay and the Everglades, as shown on Figure 2.3-11. Surface water flows from the drainage subbasins to

Biscayne Bay or the Everglades are controlled by numerous flow control structures. Flow control structures also control flow between the subbasin areas. The names of subbasins are based on the major canal in the subbasin. A summary of the subbasins (with names corresponding to the primary canal servicing each of the areas), drainage areas, and the control structures at basin outlets that regulate flow to Biscayne Bay is provided in Table 2.3-1 (Cooper and Lane 1987). The locations of the major control structures are shown on Figure 2.3-10.

Detailed flow and water level monitoring and measurements are performed as part of the operation of the structures in the ENP-SDCS. A search in the SFWMD database (DBHYDRO) for flow and water level monitoring data within the subbasins listed in Table 2.3-1 returned approximately 700 records (SFWMD 2009). The DBHYDRO database includes data from stations maintained by various agencies including USGS, SFWMD, and Everglades National Park. Monthly mean flow rates and water levels at four stations near the Units 6 & 7 plant area, S-197, S-20, S-21A, and S-21, were obtained from the SFWMD database. Details of the station locations and available data records are presented in Table 2.3-2. Monthly mean flow rates and water levels at the selected locations are presented in Tables 2.3-3 through 2.3-10. The location of these structures is shown on Figure 2.3-10.

2.3.1.1.3 Biscayne Bay

Biscayne Bay is a shallow coastal lagoon located on the lower southeast coast of Florida (Langevin 2001). The bay is approximately 38 miles long, approximately 11 miles wide on average, and has an area of approximately 428 square miles (USGS 2004 and Wingard 2004). Biscayne Bay began forming between 5000 and 3000 years ago as sea level rose and filled a limestone depression (Wolfert-Lohmann et al. 2007). The eastern boundary of Biscayne Bay is composed of barrier islands that also form part of the Florida Keys and separates the bay from the Atlantic Ocean (NOAA 2000). Coral reefs east of the barrier islands make up the northern extent of the Florida reef tract (USGS 2004). Several canals on the western shore discharge surface water into the bay, as described in Subsection 2.3.1.1.2. The Biscayne Bay subbasin is hydrologically connected with the Everglades, as shown in Figure 2.3-5. Biscayne Bay is connected to the Atlantic Ocean by a wide and shallow opening of coral shoal near the middle of the bay that is known as the safety valve, and by several channels and cuts (Cantillo et al. 2000). Because Biscayne Bay, unlike most estuaries, is not a drowned river valley, sediment inflow to the bay from rivers/canals is insignificant.

Part of Biscayne Bay is within the designated boundary of Biscayne National Park. With an area of 172,000 acres, Biscayne National Park is the largest marine park in the U.S. National Park system. More than 95 percent of Biscayne National Park is located in the marine environment (USGS 2006). The park contains a narrow fringe of mangrove forest along the mainland. Similar mangrove zones are present along the southern expanse of Biscayne Bay and in the northernmost islands of the Florida Keys including Elliott Key (BNP 2008b).

For basin-wide planning purposes, Biscayne Bay is divided into three subregions: North Bay, Central Bay, and South Bay (Cantillo et al. 2000). North Bay extends from approximately 5 miles north of the Miami-Dade/Broward County boundary to the highly urbanized shoreline near Miami, Florida; Central Bay extends from the shoreline near Miami, Florida to the Featherbed Banks east of Black Creek Canal; and South Bay extends from the Featherbed Banks east of Black Creek Canal to Barnes Sound (Figure 2.3-10). The Turkey Point plant property is located on South Bay, which is generally undeveloped and fringed by mangrove wetlands. The South Bay (also identified as the Lower Biscayne Bay) is approximately 100 square miles in area.

The average depth of Biscayne Bay is approximately 6 feet with a maximum depth of approximately 13 feet (Caccia and Boyer 2005). The volume of the bay at mean low water is approximately 1.5E10 cubic feet. The mean low water datum is located at approximately elevation -1.9 feet NAVD 88 at the NOAA Virginia Key, Florida station (NOAA 2008a).

Tides in Biscayne Bay are semidiurnal. NOAA maintains tidal stations in Biscayne Bay and surrounding areas (NOAA 2008b). A list of selected stations near Units 6 & 7 and their estimated tidal ranges are presented in Table 2.3-11. The stations with more than 10 years of record that remain in operation include Virginia Key, Florida (NOAA station 8723214), Vaca Key, Florida (8723970), and Key West, Florida (8724580) (NOAA 2008c, NOAA 2008d, and NOAA 2008e). The Virginia Key, Florida station is located approximately 25 miles north-northeast of the Units 6 & 7 plant area. The Vaca Key, Florida and Key West, Florida stations are located approximately 70 miles and 110 miles southwest of the plant area, respectively. Historical high and low water levels at these stations are presented in Table 2.3-12. Other stations, as listed in Table 2.3-11, are located within Biscayne Bay and Card Sound with only short periods of tidal data and are no longer active. The locations of the tidal stations are shown on Figure 2.3-12.

In Biscayne Bay, the great diurnal tide range, which is the difference between the mean higher high and mean lower low tide levels, is higher near the entrance of the bay, as shown in Table 2.3-11 and Figure 2.3-12. At the Cutler, Biscayne Bay, Florida station, the great diurnal range is 2.13 feet. Near the Units 6 & 7 plant area, the range is 1.78 feet, and in southern Biscayne Bay at Card Sound Bridge station, the range is reduced to 0.63 feet. The 100-year return period low water level in Biscayne Bay near the Units 6 & 7 plant area is estimated to be approximately –3.8 feet NAVD 88.

Monthly mean salinities vary widely over Biscayne Bay, ranging from a low of approximately 6 parts per thousand (ppt) to a high of 42 ppt, depending on the amount of rainfall and surface drainage reaching the coastal zone (Caccia and Boyer 2005). The bay is shallow and well mixed with only a weak salinity-based density gradient generated by the freshwater discharge from the canals on the western side. Salinity in the bay is affected by the pronounced wet-dry seasonal dynamics and is highest in June when rainfall is low and evaporation is high (BNP 2008b, Caccia and Boyer 2005). Natural water temperatures range from 59°F to 92°F at the surface, with little or no thermal stratification.

Studies of Biscayne Bay show the principal circulation forces to be tidal. Hurricane storm events with persistent wind for long periods may also cause relatively large water movements. Measurements of tidal flow past discrete points such as Cutter Bank (east of the industrial wastewater facility) average approximately 50,000 acre-feet per day, or a continuous flow of 60,000 acre-feet per half tidal cycle. Tidal exchange between Biscayne Bay and the Atlantic Ocean is estimated to be less than 10,000 acre-feet per day. Apart from the wide and shallow opening of coral shoal near the middle of the bay, the major creeks and sloughs that control the tidal circulation within Biscayne Bay and interact with the Atlantic Ocean flows include Angelfish Creek, Broad Creek, and Caesar Creek in the South Bay and Virginia Key Channel in the North Bay. Measured data indicate a net southward tidal current magnitude of approximately 0.018 meter per second (0.06 foot per second) (Wang et al. 2003). The 10-year annual mean and seasonal freshwater inflow to the bay from major canals over a period from 1994 to 2003 are presented in Table 2.3-13 (Caccia and Boyer 2005).

Bathymetry variation within Biscayne Bay is shown on Figure 2.3-13. Long- and short-term shoreline change rates for the bay are not available. The average long-term rate of shoreline change for east Florida along the Atlantic coast shoreline is 0.2 ± 0.6 meter per year (0.66 ± 2.0 feet per year) (Morton and Miller 2005). This long-term shoreline rate of change is relatively small compared to shoreline changes for the other parts of the southeast Atlantic coast (Morton and Miller 2005). Shoreline changes within Biscayne Bay would be smaller than the rates for the Atlantic coast shoreline because the bay is protected from tide and wave actions by the barrier islands. The long-term trends in sea level rise at Miami Beach, Vaca Key, and Key West, Florida are approximately 2.39 ± 0.43 millimeters/year (0.09 ± 0.017 inch per year), 2.78 ± 0.6 millimeters/year (0.11 ± 0.024 inch per year), and 2.24 ± 0.16 millimeters per year (0.09 ± 0.006 inch per year), respectively (NOAA 2008f). Because Units 6 & 7 would not use surface water from or discharge process water into Biscayne Bay, detailed sediment transport properties for the bay are not provided.

The South Bay also includes Card Sound and Barnes Sound south of Biscayne Bay. Card Sound is part of the Biscayne Bay Aquatic Preserve of the Upper Florida Keys. Freshwater input to Card Sound is primarily surficial sheet flow with additional flow from groundwater upwelling (Ishman 1997). Circulation within Card Sound and Barnes Sound is restricted because of the enclosed configuration of the sounds by barrier islands that increases residence times of its waters (Ishman 1997).

The waters of Biscayne Bay support a rich and diverse ecosystem of marine fauna and flora, and the bay serves the coral reef and marine ecosystems of Biscayne National Park. As Biscayne Bay evolved and formed, a natural cyclical change occurred as a result of the large-scale physical variation, such as sea level and climate change. Analysis of sediment core data from Biscayne Bay and Card Sound indicates that the Biscayne Bay ecosystem underwent many substantial changes between the last 100 and 500 years (Ishman 1997). Southern Biscayne Bay, including Card Sound and Barnes Sound, has been relatively isolated from direct marine influence for at least the last two centuries, and this area is less affected by the urbanization that has occurred to the north. Despite its relative isolation, however, the area has changed substantially during the last century (Ishman 1997). At Card Bank, salinity has varied substantially on multidecadal and centennial time scales relative to the variation observed at central Biscayne Bay sites. Marine influence at Card Bank has increased over the last century. The mud banks of central Biscayne Bay have become increasingly marine and increasingly stable (showing less fluctuation in salinity) during the last 100 years (Ishman 1997). The statutory and legal restrictions of surface water use and the list of impaired waters near the Units 6 & 7 plant area are described in Subsections 2.3.2.1.3 and 2.3.3.1.3, respectively.

2.3.1.1.4 Industrial Wastewater Facility

Units 1 through 4 use the cooling canals of the industrial wastewater facility for condenser and auxiliary system cooling (Figure 2.3-3). The industrial wastewater facility also receives cooling tower blowdown from Unit 5 and existing facilities drainage. The industrial wastewater facility is a closed-loop system of canals for cooling water recirculation with no surface water discharge or surface water interaction with surrounding hydrology. The unlined cooling canals act as a cooling basin that covers an area of approximately 5900 acres spread over a length of approximately 5 miles and a width of approximately 2 miles. Plant cooling water discharged to the canals on the northwestern side is distributed into 32 feeder canals flowing south. The feeder canals flow to a single collector canal in the south, which then distributes water to seven return canals flowing north to the intakes, as shown on Figure 2.3-14. The canals are approximately 200 feet wide with a centerline distance of approximately 290 feet (see Figure 2.3-14). The top elevation of the berms is approximately 7.8 feet above mean low water (5.9 feet NAVD 88). The feeder and return canals are shallow, generally 1 to 3 feet deep, with the exception of the westernmost return canal (formerly Card Sound Canal), which extends to a depth of –18 feet NGVD 29 (–19.6 feet NAVD 88). Routine maintenance of the canals is performed for the removal of aquatic vegetation to minimize flow restriction.

Plant circulating water for Units 1 through 4, and cooling tower blowdown from Unit 5 pumped at the northern end of the feeder canals provide the maximum hydraulic head at the northern end of the canals. The total circulating water flow in the industrial wastewater facility for Units 1 through 4 is 4250 cubic-feet per second. The cooling tower blowdown from Unit 5 is approximately 737 acre-feet per month (12.4 cubic feet per second). The hydraulic head is lowest at the north end of the return canals providing required water flow to the intake pumps. The difference in hydraulic head between the westernmost feeder canals and the easternmost return canals is approximately 3 feet that drives the circulating flow in the industrial wastewater facility.

Measurements taken in the industrial wastewater facility indicate that the water level within the system rise and fall with the tide in Biscayne Bay. Because the canals are not lined, groundwater flow interacts with water in the cooling canals. The cooling canals also experience losses as a result of evaporation and seepage. Makeup water for the industrial wastewater facility comes from treated process wastewater, rainfall, stormwater runoff, and groundwater infiltration. The water in the industrial wastewater facility is hypersaline with salinity concentrations approximately twice that of Biscayne Bay.

The initial design of the collector canal considered a connection of the canal with Card Sound (extending the westernmost return canal). However, the wastewater permit conditions required the canal to be cut off from Card Sound at the southern end of the industrial wastewater facility. At present, the remnant canal (south of the westernmost return canal) does not receive any surface water flow from the industrial wastewater facility and is only connected to Card Sound.

Along the northwest and west sides of the industrial wastewater facility, an interceptor ditch was constructed that has no surface water connection to the industrial wastewater facility or other surface waters. The interceptor ditch with a bottom elevation of –18 feet mean low water (or –19.9 feet NAVD 88) is located just west of and adjacent to the industrial wastewater facility, and east of the L-31E levee. The purpose of the ditch is to restrict inland movement of water from the industrial wastewater facility by pumping water from the interceptor ditch back into the industrial wastewater facility, thereby maintaining the water level in the ditch lower than the water level in L-31E Canal. Pumping from the interceptor ditch to the industrial wastewater facility is performed based on water level monitoring in the interceptor ditch and L-31E Canal at locations and frequencies agreed upon by FPL and SFWMD. This pumping prevents seepage from the industrial wastewater facility from moving landward toward the L-31E Canal and maintains freshwater west of the interceptor ditch.

2.3.1.1.5 Local Site Drainage

The Units 6 & 7 plant area is separated from the low-lying mangrove flatlands of the Biscayne Bay Coastal Wetlands. The Turkey Point units including the industrial wastewater facility is bordered by Biscayne Bay and the L-31E Canal to the east and west, respectively, by the Florida City Canal to the north, and by Card Sound Road and Card Sound to the south. Because the L-31E levee intercepted freshwater flows that historically discharged as sheet flow to the coastal wetlands and the bay east of the canal, the salinity of the wetlands has increased over time. Outflows from the canals near Units 6 & 7 are controlled by two flow control structures, S-20 and S-20F. Public works projects in the early 1900s in this area for mosquito control and land reclamation included shallow ditches approximately 6 to 10 feet wide. The shallow mosquito ditches run north-south, and the drainage ditches run east-west that provided quick drainage of the wetlands. Remnants of the ditches can still be identified in the area (Ruiz and Ross 2004).

The SFWMD has undertaken a plan (Biscayne Bay Coastal Wetlands Project) to restore the Biscayne Bay ecosystem that would include areas surrounding the Turkey Point units. At present, FPL maintains wetland areas north and west of Unit 5 (TP 5 Mitigation Area). FPL is also implementing a wetland mitigation project west and southwest of the Units 6 & 7 plant area (Everglades Mitigation Bank). These wetland areas are shown on Figure 2.3-2 and Figure 2.3-3. Locations of wetlands near the Units 6 & 7 plant area, as designated by the U.S. Fish and Wildlife Services, are shown on Figure 2.3-15.

The Biscayne Bay Coastal Wetlands Project would provide overland sheet flow in a 13,600-acre area through the construction of spreader canals and other structures (CERP 2008b). The increased natural water flow is designed to improve the ecology of Biscayne Bay including its freshwater and tidal wetlands, nearshore bay habitat, marine nursery habitat, oysters, and the oyster reef community. Any future hydrologic changes brought about by the project would not have any adverse flooding and water use impacts on Units 6 & 7.

The design basis flood elevation for Units 6 & 7 was predicted from a probable maximum surge event combined with the effects of wind-driven wave activity. The design basis flood elevation thus obtained is at 24.8 feet NAVD 88. The corresponding hurricane surge stillwater level is 21.1 feet NAVD 88. The Federal Emergency Management Agency (FEMA) Flood Insurance Study for Dade County indicates that the most severe flooding of the county would be as a result of hurricane storm surge events (FEMA 1994). The Flood Insurance Study estimated the surge elevations (stillwater level) at selected transect locations along the Biscayne Bay shoreline. The Units 6 & 7 plant area lies between Transect 30 in the north to Transect 31 in the south. The maximum stillwater levels in the transects vary between 12.0 feet and 12.4 feet NGVD 29 for a 500-year return period, which are approximately 10.4 feet and 10.8 feet NAVD 88.

2.3.1.2 Groundwater

The regional, local, and site-specific data on the physical and hydrologic characteristics of the groundwater resources are summarized in this subsection to provide the basic data for an evaluation of impacts on the aquifers in the area.

2.3.1.2.1 Description and Onsite Use

This subsection contains a description of the regional and local physiography and geomorphology, groundwater aquifers, geologic formations, and groundwater sources and sinks. Regional and onsite uses of groundwater are presented in Subsection 2.3.2, including groundwater production and groundwater flow requirements of Units 6 & 7.

2.3.1.2.1.1 Site and Regional Physiography and Geomorphology

Units 6 & 7 are located in Miami-Dade County, Florida, approximately 25 miles south of Miami, 8 miles east of Florida City, and 9 miles southeast of Homestead. The Turkey Point plant property is located within the Southern Slopes subprovince of the Southern Zone of the Florida Platform (a partly submerged peninsula of the Continental Shelf) within the Atlantic Coastal Plain physiographic province (Figure 2.3-16). It is bordered on the east by Biscayne Bay, on the west by the Everglades Mitigation Bank, and on the northeast by Biscayne National Park. The Florida Platform is underlain by approximately 4000 to 15,000 feet of clastic deposits (quartz sands, silt, marl, and clay) and nonclastic deposits of carbonate rocks (shell beds, calcareous sandstone, limestone, dolostone, dolomite, and anhydrite). The sediments range in age from Paleozoic to Recent and overlay the basement complex of Jurassic and Paleozoic age. A description of the regional and site-specific geology, physiography, and geomorphology is provided in Section 2.6.

The physiographic features surrounding Units 6 & 7 are the Atlantic Coastal ridge, the Everglades, and the Florida Keys. The geomorphology of Florida has been described in the literature (White 1970 and Randazzo and Jones 1997) as having three zones: Northern, Central, and Southern. The plant property is in the Southern Zone (Figure 2.3-16). The property spans former coastal mangrove swamps and tidal flats along the west margin of Biscayne Bay that were altered to create the existing and industrial wastewater facility/cooling canals.

The existing ground surface in the Units 6 & 7 plant area is generally flat, with elevations ranging from –2.4 to 0.8 feet NAVD 88. Vegetated depressions resulting from surficial erosion or solutioning are observed on the plant area. Two remnant canals cross the Units 6 & 7 plant area and are connected to the industrial wastewater facility on the eastern side. The 5900-acre industrial wastewater facility, of which 4370 acres is water surface, is the predominant surface water feature on the plant property. A detailed description is provided in Subsection 2.3.1.2.2.5.

The surficial geology within the Units 6 & 7 plant area consists primarily of organic muck. The organic muck is described as either light gray–dark gray to pale brown with trace amounts of shell fragments and little to no reaction to hydrochloric acid, or black to brown with organic fibers and strong reaction to hydrochloric acid. The thickness of the muck across the Units 6 & 7 plant area typically varies from 2 to 7 feet with an average thickness of 3.4 feet (MACTEC 2008). The Miami Limestone underlies the muck and is a marine carbonate consisting predominately of white to gray oolitic limestone with varying abundances of fossils such as mollusks, bryozoans, and corals.

2.3.1.2.1.2 Regional Groundwater Aquifers

The regional hydrostratigraphic framework of Florida consists of a thick sequence of Cenozoic sediments which comprise three major aquifers: (1) the surficial aquifer system, (2) intermediate aquifer system/confining unit, and (3) the Floridan aquifer system (SEGS 1986). The hydrologic parameters and lithologies of each aquifer system vary widely across the state. A generalized hydrostratigraphic column is presented in Figure 2.3-17.

Surficial Aquifer System

The surficial aquifer system is defined by the Southeastern Geological Society (SEGS) Ad Hoc Committee (SEGS 1986) as "the permeable hydrologic unit contiguous with the land surface that is comprised principally of unconsolidated to poorly indurated, siliciclastic deposits." Rocks making up the surficial aquifer system belong to all or part of the Upper Miocene to Holocene Series, consisting primarily of quartz sands, shell beds, and carbonates. In southern Florida, the surficial aquifer system consists of the Tamiami, Caloosahatchee, Fort Thompson, and Anastasia Formations; the Key Largo and Miami Limestones; and undifferentiated sediments (SEGS 1986).

The surficial aquifer system is under mainly unconfined conditions; however, beds of low permeability may cause semi-confined or locally confined conditions in its deeper parts. The base of the surficial aquifer system coincides with the top of laterally extensive and vertically persistent beds of low permeability belonging to the intermediate aquifer system/confining unit. Regionally, the thickness of the surficial aquifer system ranges from approximately 20 to 400 feet.

The main aquifer in the surficial aquifer system in southeastern Florida is the Biscayne aquifer, which is used for primary water supply. The Biscayne aquifer has been declared a sole-source aquifer (SSA) by the U.S. Environmental Protection Agency (EPA). An SSA is defined as "an underground water source that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water" (U.S. EPA 2008a). Figure 2.3-18 (U.S. EPA 2008a) shows the locations of SSAs in EPA Region 4. The figure also contains a description of the limits of the Biscayne SSA. Although the Biscayne aquifer underlies the Units 6 & 7 plant area, it contains saline to saltwater in this area and is not usable as a potable water supply.

Intermediate Aquifer System/Confining Unit

Regionally, a sequence of relatively low-permeability, largely clayey deposits approximately 900 feet thick forms a confining unit that separates the Biscayne aquifer from the underlying, fresh-to-saltwater Floridan aquifer system. The confining unit also contains transmissive units that can locally act as an aquifer system.

The SEGS (1986) defines the intermediate aquifer system/confining unit as "all rocks that lie between and collectively retard the exchange of water between the overlying surficial aquifer system and the underlying Floridan aquifer system." In general, the rocks of this system consist of fine-grained siliciclastic deposits interlayered with carbonate strata of Miocene or younger age.

In areas where poorly yielding to nonwater-yielding units occur, the term "intermediate confining unit" is used. In areas where low- to moderate-yielding units are interlayered with relatively impermeable confining beds, the term "intermediate aquifer system" applies. The aquifer's units within this system contain water under confined conditions. The top of the intermediate aquifer system/confining unit coincides with the base of the surficial aquifer system. The base of the intermediate aquifer, or confining unit, is at the top of the vertically persistent, permeable, carbonate section that comprises the Floridan aquifer system. The sediments comprising the intermediate aquifer system/confining unit are widely variable across the state. In the southern part of the state, the Hawthorn Group, consisting of the Peace River Formation and the Arcadia Formation, forms both an intermediate confining unit and an intermediate aquifer system. The Hawthorn Group sediments are up to approximately 900 feet thick in southern Florida (Figure 2.3-17). In many areas of the state, permeable carbonates occurring at the base of the Hawthorn Group may be hydraulically connected to the Floridan aquifer system and locally form the top of the Upper Floridan aquifer. The intermediate confining unit provides an effective aquiclude for the Floridan aquifer system throughout the state.

Floridan Aquifer System

The Floridan aquifer system underlies approximately 100,000 square miles in southern Alabama, southeastern Georgia, southern South Carolina, and all of Florida. Potable water is present in some parts of the aquifer. As defined by Miller (1986), the Floridan aquifer system is a vertically continuous sequence of interbedded carbonate rocks of Tertiary age that are hydraulically interconnected by varying degrees and with permeabilities several orders of magnitude greater than the hydrogeologic systems above and below. The system may occur as a continuous series of vertically connected carbonate sediments or may be separated by sub-regional to regional confining beds (Miller 1986). The Floridan aquifer formally consists of three main hydrogeologic units: the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer (Figure 2.3-17). Porosity and permeability in the aquifer units vary widely depending on location and formation.

In southern Florida, the Floridan aquifer system is composed of all or parts of the Cedar Keys Formation, Oldsmar Formation, Avon Park Formation, Ocala Limestone, Suwannee Limestone, and, possibly, the basal carbonates of the Hawthorn Group in limited areas.

In southern Florida, the top of the Floridan aquifer system ranges in elevation from approximately –1000 feet National Geodetic Vertical Datum of 1929 (NGVD 29) to more than –1100 feet NGVD 29 with thicknesses ranging from approximately 2300 feet to more than 3400 feet (Miller 1986). Throughout most of southern Florida, the Floridan aquifer system occurs under confined conditions.

2.3.1.2.1.3 Local Hydrogeology

Two major aquifers underlie the local area including all of Miami-Dade County and the Units 6 & 7 plant area:

- The surficial aquifer system, comprised of the Biscayne aquifer
- The Floridan aquifer system consisting of the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer

A site-specific hydrostratigraphic column developed from borings drilled up to maximum depths of approximately 615 feet below ground surface (bgs) is presented in Figure 2.3-19.

The Biscayne aquifer extends from near surface to a depth of approximately 240 feet near Fort Lauderdale and approximately 80 to 115 feet locally.

The Upper Floridan aquifer extends from approximately 1000 to 1200 feet bgs. The middle confining unit extends from approximately 1200 to 2400 feet bgs. The Lower Floridan aquifer extends from approximately 2400 feet bgs to an undetermined depth thought to be greater than 4000 feet bgs in the Miami-Dade County area. The Boulder Zone in the Lower Floridan aquifer extends from approximately 2800 to at least 3000 feet bgs at the MDWASD South District Wastewater Treatment Plant (SDWTP)(Starr et al. 2001), which is located approximately 9 miles north of the Units 6 & 7 plant area.

Surficial (Biscayne) Aquifer

The surficial aquifer system comprises all the rocks and sediments from the land surface downward to the top of the intermediate confining unit. These lithologic materials consist primarily of limestones and sandstones with sands, shells, and clayey sand with minor clays and silts. The base of the system is defined by a significant change in hydraulic conductivity. Sedimentary bedrock and unconsolidated sediments in the surficial aquifer system have a wide range of hydraulic properties and locally may be divided into one or more aquifers separated by less-permeable or semi-confining units. Within the surficial aquifer system, the major water-producing unit is the unconfined Biscayne aquifer, which underlies the Units 6 & 7 plant area and all of Miami-Dade County and parts of Broward, Monroe, and Palm Beach counties, as shown in Figure 2.3-21. The aquifer contains carbonate rocks, sandstones, and sand extending from land surface to an elevation of approximately –10 feet NGVD 29 in southern Miami-Dade County and deepening northward to more than elevation –240 feet NGVD 29 in southeastern Palm Beach County and eastern Broward County (Figure 2.3-22). These formations include, from oldest to youngest (bottom to top): the upper portion of the Tamiami Formation, Caloosahatchee Formation, Fort Thompson Formation, Anastasia Formation, Key Largo Limestone, Miami Limestone, and Pamlico Sand (Fish and Stewart 1991). However, the entire sequence of units is not present in any one place. At the Units 6 & 7 plant area, the formations within the Biscayne aquifer include the Miami Limestone, Key Largo Limestone, and the Fort Thompson Formation (Figure 2.3-19). The Fort Thompson Formation and Key Largo Limestone are the major water producing formations within the aquifer (Miller 1990). Site-specific boring data indicates that the maximum thickness of the Biscayne aquifer is approximately 115 feet at the Units 6 & 7 plant area.

The water table occurs primarily within the organic soils (muck) or the Miami Limestone and fluctuates in response to variations in tide levels, recharge, natural discharge, water levels in adjacent canals, and well withdrawal/injection. The aquifer extends beneath Biscayne Bay and the Atlantic Ocean. Because of the aquifer's high permeability, and in response to the lowering of inland groundwater levels due to pumpage, saltwater has migrated inland along the base of the aquifer and affects the entire coastal zone. Saltwater moves inland and upward in response to low inland groundwater levels and moves seaward and downward in response to high inland groundwater levels (Klein and Hull 1978).

Biscayne aquifer groundwater use in the immediate vicinity of the plant area has been limited due to saline to saltwater composition. Figure 2.3-23 (Langevin 2001) shows the approximate location of the freshwater-saltwater interface in the area. The figure indicates that the saltwater interface at the base of the aquifer is approximately 6 to 8 miles inland of the Units 6 & 7 plant area.

Intermediate Confining Unit

The intermediate confining unit (upper confining unit for the Upper Floridan aquifer) extends from the base of the surficial aquifer system to the top of the Floridan aquifer system and is characterized by complex interbedded lithologies of the Hawthorn Group. These lithologies consist primarily of silty clay, calcareous sands, silts, calcareous wackestones, limestones, sandstones and sands, and obtain a thickness of approximately 600 to 1050 feet at Turkey Point (Reese 1994). Site information suggests a thickness of approximately 700 feet just to the north of Units 6 & 7 site (Unit 5 Upper Floridan aquifer production wells PW-3 [JLA Geosciences 2006]) to approximately 1000 feet southwest of the site (Dames & Moore 1975).

The top of the Hawthorn Group occurs at approximately –100 feet MSL southwest of the site (Dames & Moore 1975) to approximately –215 feet MSL at Units 6 & 7 and production well PW-3 (JLA Geosciences 2006) in the vicinity of the site. The unit is not exposed at the land surface. Sand beds and limestone lenses comprise the permeable parts of the system, however, the overall hydraulic conductivity of the group is very low and provides good confinement for the underlying Floridan aquifer system.

Floridan Aquifer System

The Floridan aquifer system underlies the Units 6 & 7 plant area and all of Florida. The system formally consists of three main hydrogeologic units: the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer (Figure 2.3-17). In the Miami-Dade County area, the top of the Floridan aquifer system is found at a depth of approximately 1000 feet bgs, is approximately 3000 feet thick, and is directly overlain by the intermediate confining unit. The Floridan aquifer system forms the deepest part of the active groundwater flow system in southeastern Florida (Reese 1994 and SEGS 1986).

Floridan Aquifer System: Upper Floridan Aquifer

The top most hydrogeologic unit of the Floridan aquifer system is the Upper Floridan aquifer. This unit is overlain by the intermediate confining layer that acts as a confining unit to the Upper Floridan aquifer (Stewart 1980). The Upper Floridan aquifer consists of several thin water-bearing zones of high permeability interlayered with thick zones of low permeability. The hydrogeology of the Upper Floridan aquifer varies throughout Florida. In southeastern Florida, the aquifer has been interpreted to include a thinner Suwannee Limestone and extends down into the Avon Park Formation (Figure 2.3-17). Confinement is typically better between flow zones in southwestern Florida than in southeastern Florida (Reese and Richardson 2008). In southeastern Florida, the Upper Floridan aquifer ranges from 100 feet to greater than 400 feet in thickness as shown on Figure 2.3-24. In the vicinity of the Turkey Point plant property, the Upper Floridan aquifer is approximately 200 feet thick.

Although the Upper Floridan aquifer is a major source of potable groundwater in much of Florida, water withdrawn from the unit in southeastern Florida, including Miami-Dade County, is brackish and variable in quality (Reese and Richardson 2008).

Floridan Aquifer System: Middle Confining Unit

The middle confining unit of the Floridan aquifer system underlies the Upper Floridan aquifer, separating it from the Lower Floridan aquifer. In many places, the middle confining unit is divided into upper and lower units separated by the Avon Park permeable zone (Figure 2.3-17). The middle confining unit contains beds of micritic limestone (wackestone to mudstone), dolomitic limestone, and dolomite (dolostone) that are distinctly less permeable that the strata of the Upper Floridan aquifer and Lower Floridan aquifer. The elevation of the top of the middle confining unit is approximately –1200 feet NGVD 29 and the thickness is approximately 1000 feet in the vicinity of the Turkey Point plant property (Reese and Richardson 2008).

Floridan Aquifer System: Lower Floridan Aquifer

The Lower Floridan aquifer in southern Florida consists of a thick sequence of low permeability rocks separated by relatively thin permeable zones (Miller 1986). The aquifer underlies the middle confining unit and extends from a depth of approximately 2400 feet bgs to a depth that is undetermined, but thought to be greater than 4000 feet bgs in the Miami-Dade County area. The Lower Floridan aquifer includes the lower part of the Avon Park Formation, the Oldsmar Limestone, and the upper part of the Cedar Keys Formation (Figure 2.3-17). The base of the Lower Floridan aquifer (or the base of the Floridan aquifer system) is marked by impermeable, massive anhydrite beds of the Cedar Keys Formation (Miller 1986).

A highly permeable zone in the Lower Floridan aquifer known as the Boulder Zone occurs in southern Florida. The Boulder Zone contains saltwater and has been permitted by the Florida Department of Environmental Protection as a zone to discharge treated sewage and other wastes disposed of through injection wells operated in South Florida.

In southern Florida, the Lower Floridan aquifer contains thick confining units above the Boulder Zone. These confining units are similar in lithology to the middle confining unit of the Floridan aquifer system (Reese 1994). The base of the Lower Floridan aquifer is below the base of the Boulder Zone, with the lower section consisting of permeable dolomites or dolomitic limestones of the Cedar Keys Formation (Meyer 1989 and Reese 1994).

2.3.1.2.1.4 Site-Specific Hydrogeology

A subsurface investigation was conducted for Units 6 & 7 between February and June 2008 to evaluate soil, bedrock, and groundwater conditions at depths of up to a maximum of approximately 615 feet bgs. Subsurface information was collected from 94 geotechnical borings, 4 cone penetrometer tests (CPTs), 2 test pits, 22 groundwater observation wells, and 2 surface water stations. Data on the borings, test pits, and cone penetrometer tests in the form of boring logs, laboratory test results, etc., are provided in MACTEC 2008.

Twenty groundwater observation wells, two deep geotechnical piezometers, and the two surface water monitoring stations were installed in the Units 6 & 7 plant area as follows:

- Ten observation well pairs used for measuring groundwater levels (or 20 individual observation wells) were installed across the plant area. These wells were completed to depths ranging from 24 to 110 feet bgs and were installed in the Miami Limestone/Key Largo Limestone and the Fort Thompson Formation.

- Two deep geotechnical piezometers, one at each reactor site, were installed to a depth of approximately 135 feet bgs. These two piezometers were installed to measure pore pressure in the Tamiami Formation and are not part of the groundwater level monitoring network.

- Two surface water monitoring stations (SW-1 and SW-2) were installed in the canals surrounding the Units 6 & 7 plant area. The pressure transducers were set several feet below the water level in the canals to allow monitoring of the surface water level variations.

Groundwater level and surface water level measurements commenced in the 20 observation wells and 2 surface water stations in June 2008. Observation wells OW-606D and OW-706D, installed as piezometers for geotechnical purposes, are not part of the groundwater level monitoring network. Groundwater level measurements are made using electronic recording pressure transducers.

Figure 2.3-25 shows the locations of the 20 observation wells, 2 piezometers, and 2 surface water stations in the plant area. Table 2.3-14 presents the construction information for the wells. The observation wells are named in three series that represent the location and screened intervals of the wells:

- OW-600 series wells and geotechnical piezometer are located in the Unit 6 power block area and include "U," "L," and "D" suffix wells monitoring the Key Largo Limestone, the Fort Thompson Formation, and the upper Tamiami Formation, respectively.

- OW-700 series wells and geotechnical piezometer are located in the Unit 7 power block area and include "U," "L," and "D" suffix wells monitoring the Key Largo Limestone, the Fort Thompson Formation, and the upper Tamiami Formation, respectively.

- OW-800 series wells are located outside of the power block areas and include "U" and "L" suffix wells that monitor the Key Largo Limestone and the Fort Thompson Formation, respectively.

A supplemental groundwater investigation was conducted between January and March 2009 at the Units 6 & 7 plant area. The results of this investigation are provided in Subsection 2.3.1.2.2.3. Four test wells and fifty temporary observation wells were installed and pumping tests performed for this supplemental investigation as follows:

Four temporary test wells and fifty temporary observation wells were installed for the purpose of conducting aquifer pumping tests. Two pumping wells were located at each unit, with one well completed as an open-hole to test the upper Biscayne aquifer (Key Largo Limestone) and one well completed as an open-hole to test the lower Biscayne aquifer (Fort Thompson Formation). The observation wells at each unit consisted of five well clusters containing five temporary wells each, installed in the following test zones:

- Upper aquitard (Miami Limestone)

- Upper Biscayne aquifer test zone (Key Largo Limestone)

- Middle aquitard (freshwater limestone unit)
- Lower Biscayne aquifer test zone (Fort Thompson Formation)
- Lower aquitard (Upper Tamiami Formation)

Descriptions and locations of the aquifer pumping test wells and temporary observation wells are presented in Subsection 2.3.1.2.2.3.

2.3.1.2.2 Groundwater Sources and Sinks

This subsection contains a description of the historic groundwater levels, groundwater flow direction(s) and gradients, seasonal and long-term variations of groundwater levels, horizontal and vertical permeability and total and effective porosity of the geologic formations beneath the plant area, reversibility of groundwater flow, the effects of water use on hydraulic gradients and groundwater levels beneath the plant area, and groundwater recharge areas. This information has been organized into five subcategories as follows: (1) groundwater horizontal and vertical flow directions, (2) temporal groundwater trends, (3) aquifer properties, (4) hydrogeochemical characteristics, and (5) groundwater recharge and discharge.

2.3.1.2.2.1 Groundwater Flow Directions

Groundwater flow directions are provided in the following sections by aquifer.

Biscayne Aquifer

Regional groundwater flow in the Biscayne aquifer is generally toward the east-southeast. Figures 2.3-26 and 2.3-27 (Langevin 2001) show potentiometric surface maps of the Biscayne aquifer for May and November of 1993. The potentiometric maps show localized effects from surface water canals and cones of depression associated with groundwater well fields. Based on the regional data, the hydraulic gradient in the vicinity of the Turkey Point plant property is approximately 0.00002 foot per foot. The elevations in NGVD 29 used by the U.S. Geological Survey (USGS) are approximately 1.53 feet higher than the NAVD 88 elevations used for the plant area data (NOAA 2008g).

Potentiometric surface maps for the upper and lower monitoring zones of the Biscayne aquifer in the immediate vicinity of the Units 6 & 7 plant area are shown on Figures 2.3-28 through 2.3-35 and Figures 2.3-69 through 2.3-72). A separate map was prepared for each high and low tide time sequence for the upper (Miami and Key Largo Limestones) and lower (Fort Thompson Formation) monitoring zones. For the purposes of this analysis, high and low tides refer to the approximate local highs and lows obtained from the observation well hydrographs. The water levels were corrected to equivalent reference heads. FSAR Subsection 2.4.12, Appendix 2AA describes the data evaluation process for the transducer generated water level data and the calculation of reference heads from observed head data.

These maps indicate that the highest portion of the potentiometric surface in the lower monitoring zone generally runs from the southwestern portion of the island near OW-735L to the central portion of the island near OW-706L. Flow patterns extend radially in multiple directions from this high spot, but flow patterns are not symmetrically arrayed. The lower monitoring zone potentiometric surfaces and resulting flow patterns are similar for all high and low tide conditions examined.

In the upper monitoring zone, a relative high spot in the potentiometric surface runs from the northwest near OW-812U to the center of the island near OW-706U. A second high spot in the potentiometric surface is evident in the southeast corner of the island near OW-636U. A relatively low region in the potentiometric surface extends from the southwest near OW-735U to the east-central portion of the island near OW-805U and OW-606U.

Flow patterns in both monitoring zones are complex. In both zones, the center of the island near OW-706 provides a relative high spot in the potentiometric surface and flow lines extend in multiple directions away from this high spot.

Because of the complexity of the observed flow patterns in the upper and lower monitoring zones, one to three flow path lines were used to calculate horizontal gradients for each potentiometric surface shown in Figures 2.3-28 through 2.3-35 and Figures 2.3-69 through 2.3-72. The average horizontal gradient in the upper monitoring zone across all examined tidal conditions is 0.0003 ft/ft, and the average horizontal gradient in the lower monitoring zone is 0.001 ft/ft.

Vertical hydraulic gradients were computed for selected observation well pairs on the site. Table 2.3-15 presents the vertical hydraulic gradients determined from these well pairs. The overall vertical hydraulic gradient is generally upward across the plant area. The vertical hydraulic gradients do not vary significantly between high and low tidal cycles.

In general the groundwater flow conditions in the Biscayne aquifer at the Units 6 & 7 plant area can be summarized as follows:

- Flow conditions in the upper monitoring zone indicate a consistent flow direction from the high spots in the potentiometric surface in the northwest and southeast towards the relative low region in the potentiometric surface that runs from the southwest to the east-central of the island. Flow in the low region is generally towards the southwest.

- Flow conditions in the lower monitoring zone indicate a high spot in the potentiometric surface that extends from the southwestern portion of the island to the center of the island. Flow patterns extend in multiple directions from this high spot but the patterns are not symmetrical.
- Vertical hydraulic gradients indicate upward flow potential.
- The vertical (upward) gradient is approximately an order of magnitude larger than the horizontal gradient in the lower monitoring zone. The average horizontal gradient in the lower monitoring zone is, in turn, approximately a factor of four larger than the average horizontal gradient in the upper monitoring zone.

Floridan Aquifer

Regional groundwater flow in the Upper Floridan aquifer is generally toward the east. Figure 2.3-36 shows a potentiometric surface map of the Upper Floridan aquifer for May 1980 (Meyer 1989). The apparent hydraulic gradient in the vicinity of the Turkey Point plant property is approximately 0.00006 foot per foot. South Florida is in the brackish to saline portion of the aquifer, and groundwater development has generally been restricted to industrial water supplies.

Determination of groundwater flow directions and hydraulic heads in the Boulder Zone have been unreliable due to the lack of head data and the transitory effects of ocean tides, earth tides, and atmospheric tides (Meyer 1989). Regional groundwater movement in the Lower Floridan aquifer in southern Florida is estimated to follow the circulation pattern described as follows: 1) cold seawater moves inland through the Lower Floridan aquifer, 2) heating of the seawater in the Lower Floridan aquifer during inland movement results in lower fluid density, 3) upwelling of this seawater from the Lower Floridan aquifer occurs through the middle confining unit, and 4) dilution of the seawater (further reducing fluid density) results in its transport back to the ocean by seaward flowing groundwater in the Upper Floridan aquifer. Figure 2.3-48 illustrates this circulation pattern (Meyer 1989). This circulation is generally very slow due to the low permeability of the middle confining unit.

There are no Floridan aquifer monitoring wells installed at the Units 6 & 7 plant area. Dual-zone monitoring wells would be installed as part of the deep injection wells.

2.3.1.2.2.2 Temporal Groundwater Trends

Regional temporal trends in the Biscayne aquifer groundwater levels are monitored by the USGS (USGS 2009a) and the SFWMD (SFWMD 2009). Figure 2.3-37 presents a map of wells and surface water control structures in the vicinity of the Turkey Point plant property used for long-term monitoring of groundwater and surface water levels. Figures 2.3-38 and 2.3-39 show the hydrographs for these locations. The locations show varying degrees of short-term tidal influence and fluctuations associated with precipitation events. The long-term trends in the wells and surface water indicate a generally steady water level over the period examined. Well G-1183 shows the largest magnitude of fluctuation with water level elevations ranging from 6.38 to –0.59 feet NGVD 29. The remaining wells show a range of fluctuation of less than 3.5 feet.

Figure 2.3-40 shows hydrographs of the Biscayne aquifer monitoring wells for Units 6 & 7. The hydrographs contain data gaps, which were a result of loss of transducer data due to storm preparation activities or equipment failure. A partial listing of water level data from the transducers is presented in FSAR Subsection 2.4.12, Appendix 2AA. Appendix 2AA also describes the data evaluation process for the transducer generated level data. The results of this evaluation indicate that the present data is sufficient for use.

Regional temporal trends in the Floridan aquifer have been monitored by the USGS (2008). A hydrograph of a well completed in the Upper Floridan aquifer is shown on Figure 2.3-41. The wellhead elevation is 4.50 feet NGVD 29 and the hydraulic head inside the well ranges from 30 to 42.6 feet NGVD 29, indicating that the potentiometric surface in this area is above ground surface.

2.3.1.2.2.3 Aquifer Properties

This subsection provides a summary of the regional, local, and site-specific hydrogeologic parameters of the different aquifer units. These parameters include transmissivity, storativity (storage coefficient), specific yield, hydraulic conductivity (permeability), and leakage coefficient (leakance). The following are definitions of these properties:

- Transmissivity — The rate at which a fluid of a specified density and viscosity is transmitted through a unit width of an aquifer or confining bed under a unit hydraulic gradient and is a function of the properties of the fluid, the porous medium, and the thickness of the porous medium (Fetter 1988).
- Storativity (Storage Coefficient) — The volume of water released from or taken into storage per unit surface area of the aquifer per unit change in head (Fetter 1988).
- Specific Yield — The ratio of the volume of water a rock or soil will yield by gravity drainage to the volume of the rock or soil (Fetter 1988).
- Hydraulic Conductivity (Permeability) — A coefficient of proportionality describing flow per unit time under a unit hydraulic gradient through a unit area of a porous medium and is a function of the properties of the fluid and the porous medium (Fetter 1988).
- Leakage Coefficient (Leakance) — The quantity of water that flows across a unit area of the boundary between the main aquifer and its semi-confining bed, typically expressed as

seconds^{-1}or days^{-1} derived from the relationship K'/b' where K' is the hydraulic conductivity of the semi-confining unit and b' is its thickness (Davis and DeWeist 1966).

Typical values of hydraulic conductivity, porosity, and thickness for different formations in Miami-Dade County are shown on Table 2.3-16 (U.S. EPA 2003). The values are based on weighted averages for management of treated wastewater. The weighted average values presented in Table 2.3-16 were developed by the EPA to support a risk assessment of wastewater disposal. The data were based on a literature review of published values of the hydrogeologic parameters used to characterize the hydrologic units in Miami-Dade County. The weighted means of the data were calculated to determine representative values to be used in the risk assessment. The weighted mean method essentially reduces the effect of extreme data outliers and may not be representative of actual conditions. These values were not used in the hydrogeologic analysis of site conditions.

Table 2.3-17 presents aquifer test results for tests performed within 15 miles of Units 6 & 7. Figure 2.3-42 shows the locations of these tests. The data were obtained from the SFWMD DBHYDRO database and the Dames & Moore site investigation report (SFWMD 2009 and Dames & Moore 1971). The tests were performed in the Biscayne aquifer, the Floridan aquifer, and confining layers. The tests include standard aquifer performance tests and packer tests used for assessment of the injection and confining layers for deep injection well permitting. The Boulder Zone packer tests listed in Table 2.3-17 show transmissivities lower than those reported for other regional testing of the Boulder Zone. The depths given on the table suggest that the tests were performed in the interval between the top of the Lower Floridan aquifer and the top of the Boulder Zone as determined from cross section Y-Y in Reese and Richardson (2008).

Surficial/Biscayne Aquifer

Hydrogeologic properties of the Biscayne aquifer vary based on lithology. Along the coast, where the Biscayne aquifer is the thickest, transmissivities are lower due to the amounts of sandy material. In central and south Miami-Dade County, the aquifer is thinner with higher hydraulic conductivity due to the occurrence of cavernous limestone (Klein and Hull 1978). The permeable limestone content in the aquifer decreases northward and the overall transmissivity of the aquifer decreases with increased sand content. Transmissivities for the highly permeable limestones and less permeable sandstones and sands of the aquifer in the vicinity of Units 6 & 7 have been estimated to range from less than 1.0E06 gallons per day per foot to 3.0E06 gallons per day per foot (Dames & Moore 1971).

According to Parker et al. (1955), the Biscayne aquifer is the most productive of the shallow non-artesian aquifers in the area. The Biscayne aquifer is one of the most permeable in the world with transmissivity values (hydraulic conductivity x saturated thickness) for the highly permeable limestones ranging from 4.0E06 to 15.0E06 gallons per day per foot (5.4E05 to 2.0E06 square feet per day) with a median value of 5.0E06 gallons per day per foot (6.7E05 square feet per day) and storage coefficients ranging from 0.047 to 0.247. In Broward County, transmissivities are reported to range from about 4.0E05 gallons per day per foot (5.4E04 square feet per day) to 4.0E06 gallons per day per foot (5.4E05 square feet per day) with storage coefficients as high as 0.34 (Sherwood et al. 1973). A generalized distribution of the transmissivities in the Biscayne aquifer is presented in Figure 2.3-43 (Merritt 1996).

Large-capacity municipal wells are commonly completed as open holes and yield from approximately 500 to more than 7000 gallons per minute with only small drawdowns. Specific capacities obtained from pumping tests are on the order of 1000 gallons per minute per foot of drawdown in Miami-Dade County (Klein and Hull 1978).

Two studies performed to the northwest of the plant property by the USGS (Cunningham et al. 2004 and Cunningham et al. 2006) examined the vertical variations in aquifer properties of the Biscayne aquifer. Table 2.3-18 presents the results of testing core samples. The locations of the core samples are shown on Figure 2.3-42. Figure 2.3-44 is a plot of core properties versus elevation.The core samples were tested for horizontal air permeability, vertical air permeability, porosity, and grain density. The horizontal air permeability test included a maximum permeability at 90 degrees to the maximum permeability direction to assess horizontal anisotropy. The studies included a detailed examination of the core samples to determine lithology and fossil assemblages. As a result of this examination, the authors were able to subdivide the Biscayne aquifer into a series of high-frequency depositional cycles that ranged from a freshwater to a marine depositional environment. These depositional cycles control the permeability and porosity of the aquifer. The freshwater and transitional portions of the depositional cycles are characterized by lower permeability (<1000 milliDarcies) and porosity (<20 percent), while the marine portions of depositional cycles exhibit higher permeability (>1000 milliDarcies) and porosity (20–40 percent). This general observation appears to support the site-specific findings regarding the fresh water limestone layer and the other marine and transitional units identified at the Units 6 & 7 plant area. The vertical changes in properties as a result of these depositional cycles can be seen on the figure. Figure 2.3-45 presents a plot of the vertical anisotropy ratio ($K_{vertical:}K_{horizontal}$) versus elevation using the vertical permeability and maximum horizontal permeability determined from the USGS laboratory core testing. The graph indicates that the central tendency of the anisotrophy measurements is approximately one. This value was used as a starting point for groundwater model calibration.

As part of the Units 6 & 7 investigation, a total of 10 observation wells were installed in the upper part of the Biscayne aquifer in the Miami Limestone/Key Largo Limestone ("U" suffix wells) and 10 observation wells were installed in the Fort Thompson Formation ("L" suffix wells). The screen depths for the upper ("U") wells range from 15 to 28 feet bgs and for the lower ("L") wells they range from 98 to 110 feet bgs. The locations and installation details of the wells are provided in Figure 2.3-25 and Table 2.3-14, respectively.

Thirty-one in situ hydraulic conductivity tests (slug tests) were conducted in these wells. These data were imported into AQTESOLV™ for Windows version 4.5 (Duffield 2007) and evaluated using either the Butler, KGS (Kansas Geological Survey), McElwee-Zenner, or Springer-Gelhar solution methods (MACTEC 2008). Hydraulic conductivity values obtained for wells screened in the upper part ("U" wells) of the Biscayne aquifer range from 3 to 319 feet per day with a geometric mean of 61.3 feet per day. For the wells screened in the lower part ("L" wells) of the aquifer, values range from 1.0 to 120 feet per day with a geometric mean of 20.1 feet per day. The results of the tests are summarized in Table 2.3-19. The results suggest that the rate-limiting recharge of the well filter pack may be influencing the results of the tests. The rate-limiting recharge effects are caused by the formation having a higher hydraulic conductivity than the filter pack material; this results in the filter pack controlling the slug test response rather than the formation. This interpretation is supported by site vicinity aquifer tests (Dames & Moore 1971) and other regional studies (Table 2.3-17) that suggest much higher hydraulic conductivity values for the aquifer. In addition, aquifer pumping tests are, in general, found to yield higher hydraulic conductivity values than slug tests.

Four aquifer pumping tests were conducted in the Units 6 & 7 power block area, in order to determine hydrogeologic properties of the Biscayne aquifer. These tests were performed to measure the hydrogeologic properties of the aquifer units and the overlying or underlying aquitards for use in the design and implementation of the construction dewatering system, development of the site groundwater flow model, and simulation of the radial collector wells in the groundwater model. Two test zones were identified within the Biscayne aquifer: the upper zone, which is located in the Key Largo Limestone, and the lower zone, which is located in the Fort Thompson Formation. The muck and Miami Limestone units are interpreted to have a lower hydraulic conductivity than the underlying Key Largo Limestone. The freshwater limestone layer is interpreted to have a lower hydraulic conductivity than either the overlying Key Largo Limestone or the underlying Fort Thompson Formation. The Tamiami Formation is also interpreted to have a lower hydraulic conductivity than the overlying Fort Thompson Formation. Thus, the Miami Limestone, the freshwater limestone unit, and the Tamiami Formation were treated as aquitards in the subsurface profile. For the conditions at the plant area, the term aquitard is amended from its usual definition as a low permeability unit to a unit that has a much lower permeability than the aquifer units.

A total of four pumping wells and fifty temporary observation wells were installed for aquifer characterization. Two pumping wells and twenty-five observation wells were installed at each unit location. The pumping wells at Unit 6 were designated PW-6U and PW-6L and at Unit 7 were designated PW-7U and PW-7L, with the U/L suffix indicating completion in either the upper (U) or lower (L) Biscayne aquifer test zone. The pumping wells were nominally 30-inches in diameter and were completed as open holes in the test intervals. The upper test zone wells (PW-6U and PW-7U) were both completed at a total depth of 45 feet bgs. The lower test zone wells (PW-6L and PW-7L) were completed at a total depth of 105 feet and 87 feet bgs, respectively. Each aquifer test location had two observation well clusters of five wells each installed at right angles to and approximately 10 feet from the pumping well. Additionally, a shared well cluster of five wells was installed between the two pumping wells at each unit location at a distance of approximately 25 feet. The observation well clusters at Unit 6 (C6-1 through C6-5) and Unit 7 (C7-1 through C7-5) each included wells designated as A through E completed in the following zones:

- Miami Limestone/Upper Aquitard (A)
- Key Largo Limestone/Upper Test Zone (D)
- Freshwater Limestone/Middle Aquitard (B)
- Fort Thompson Formation/Lower Test Zone (E)
- Tamiami Formation/Lower Aquitard (C)

Figure 2.3-46 presents the configuration of the pumping and observation wells for Units 6 & 7.

Each pumping test was conducted at a constant discharge rate and drawdown data was collected for a period of 8 hours, followed immediately by the recovery period during which water level data were collected for an additional 8 hours. The discharge rate for each test was selected based on data collected during a step-drawdown test conducted on each pumping well prior to initiation of the 8 hour drawdown test. Discharge rates for the tests ranged from approximately 3300 gpm to 5100 gpm.

The pumping test results were interpreted using the AQTESOLV™ (Duffield 2007) computer program. This program contains solution options for different hydrogeologic conditions such as unconfined, confined, and leaky conditions. Two interpretation methods were used: the Theis method and the Hantush leaky aquifer with aquitard storage method. The Theis method was applied to the time-drawdown data, to provide an upper bound on transmissivity, because the Theis method assumes no leakage. The Hantush leaky method with aquitard storage was used to evaluate the distance-drawdown and time-drawdown relationships in the pumping zone observation wells ("D" or "E" series wells). Table 2.3-20 presents a summary of the averages of the aquifer testing results. Based on these analyses, the average transmissivity for the upper Biscayne aquifer is approximately 2.3E06 gallons per day per foot and for the lower Biscayne aquifer it is approximately 1.3E05 gallons per day per foot. Details of the pumping tests and the analytical methods are provided in FSAR Subsection 2.4.12, Appendix 2BB.

Intermediate Aquifer System/Confining Unit

The overall hydraulic conductivity of the intermediate aquifer system/confining unit is very low and provides good confinement for the underlying Floridan aquifer system (Bush and Johnston 1988). The leakage coefficient of this confining unit is highly variable, especially in the semi-confined areas where the confining beds may be either sandy or clayey. Leakage coefficient values of the upper confining unit, derived from computer model simulations, range from less than 0.01 inches per year per foot in tightly confined areas to more than 1.00 inches per year per foot in semi-confined areas (Bush and Johnston 1988). According to Bush and Johnston (1988), leakage coefficients calculated from aquifer test data, in general, are much larger than those obtained from simulation, ranging from 0.44 to 88 inches per year per foot. Their analyses indicate that in the majority of locations, leakage coefficients from aquifer test data are too large to realistically represent the exchange of water between the surficial aquifer and the Upper Floridan aquifer. The values obtained from aquifer test data can reflect not only downward leakage from the surficial aquifer, but upward leakage from permeable rocks beneath the pumped interval, as well as leakage from beds of relatively low permeability that might exist within the pumped interval. Upper confining unit leakage coefficients derived from Floridan aquifer test data are composite or lumped properties that include leakage from all available sources.

Floridan Aquifer System

The Floridan aquifer system is a confined series of aquifer zones, separated by aquicludes, that is approximately 3000 feet thick in southeastern Florida. Porosity and permeability in the aquifer vary widely depending on location and formation. High permeability values are the result of both fractured limestone and extensive secondary porosity derived from dissolution of carbonates. In the central part of the Lower Floridan aquifer within the Floridan aquifer system is the Boulder Zone. The Boulder Zone consists mainly of fractured dolostones, in which large cavities develop during drilling as the result of borehole collapse (Safko and Hickey 1992, Duerr 1995, and Maliva and Walker 1998). The Boulder Zone is used for underground injection of industrial and domestic wastes in South Florida.

Floridan Aquifer System: Upper Floridan Aquifer

Hydraulic parameters of the Upper Floridan aquifer vary considerably as a result of the wide variation in hydrogeologic conditions encountered at different locations. According to Johnston and Bush (1988), conditions that most affect transmissivity are the degree of solution development in the aquifer and, to a lesser extent, aquifer thickness. High transmissivities are usually found in the areas having less confinement because circulation of flow helps to develop solution openings in the aquifer. Transmissivities are lowest (less than 50,000 square feet per day) in the Florida panhandle and southernmost Florida (where the aquifer is confined by thick clay sections and contains thick sections of low-permeability limestone) and are highest (greater than 1,000,000 square feet per day) in the karst areas of central and northern Florida where the aquifer is generally unconfined or semi-confined (Johnston and Bush 1988).

Regionally, storage coefficients calculated from aquifer tests conducted in the Upper Floridan aquifer range from a low of 1.0E-05 to a high of 2.0E-2 with most values in the 1.0E-03 to 1.0E-04 range (Johnston and Bush 1988).

Dames & Moore (1975) installed a test production well, designated W-12295 as shown on Figure 2.3-42, and four observation wells southwest of the Units 6 & 7 plant area. They conducted a 90-day continuous pumping test of the principal artesian water-bearing zone (Upper Floridan aquifer). The test production well was completed as an open hole between approximately 1130 feet and 1400 feet bgs. Calculated average values for transmissivity, storage coefficient, and leakance obtained from graphical solutions of the test data were 400,000 gallons per day per foot (53,600 square feet per day), 6.0E-04, and 0.002 gallons per day per cubic foot, respectively. Bush and Johnston (1988) report a transmissivity of approximately 232,000 gallons per day per foot (31,000 square feet per day) for the Upper Floridan aquifer.

The most transmissive zone is generally found at the top of the unit and is estimated to range between 10,000 to 60,000 square feet per day. According to Bush and Johnston (1988), at wells S-1532 and S-1533 on the Turkey Point plant property the transmissivity is 31,000 square feet per day (Reese 1994). Transmissivity of the Upper Floridan aquifer is highest in west central Florida (greater than 100,000 square feet per day) with lower transmissivities (less than 10,000 square feet per day) in central Florida (Reese and Richardson 2008).

The Upper Floridan aquifer water supply wells used for Unit 5 cooling water and Units 1 & 2 process water included the performance of an aquifer pumping test as part of the well installation process. The results of this test indicate a transmissivity of 244,000 gallons per day per foot, a storage coefficient of 2.0E-04, and a leakance of 5.0E-03 gallons per day per cubic foot (6.7E-04 day^{-1}). These values are consistent with the values reported from other nearby tests in the Upper Floridan aquifer.

Floridan Aquifer System: Middle Confining Unit

The middle confining unit of the Floridan aquifer system includes most of the Avon Park Formation (Reese and Richardson 2008) (Figure 2.3-17). The zones that contain highly transmissive dolomite with cavernous porosity are found in the upper to middle part of the Oldsmar Formation in southeastern Florida. Reese (1994) places the base of the middle confining unit at the top of the first such zone. The base of the middle confining unit is encountered at a depth of about 2460 feet in a well (MDS-I12) drilled in southeastern Miami-Dade County, 230 feet below the top of the Oldsmar Formation (Reese 1994). Based on core sample analysis, packer tests, and aquifer tests conducted at the MDWASD South District Wastewater Treatment Plant site, the hydraulic conductivity of the middle to lower part of the confining unit ranges from 3.0E-03 to 3.0 feet per day (Reese 1994). Vertical hydraulic conductivity measured in eight core samples from a well drilled in eastern Broward County, reported by Reese (1994), ranged from 1.3E-04 to 0.24 feet per day. Core analyses of the low porosity (<15%) dolostones from the Floridan aquifer middle confining unit in Palm Beach County gave vertical hydraulic conductivities of less than or equal to 1.7E-08 centimeters per second. The lowest recorded value was 2.7E-09 centimeters per second (Maliva et al. 2007).

Floridan Aquifer System: Lower Floridan Aquifer

The Lower Floridan aquifer underlies the middle confining unit and extends from a depth of approximately 2400 feet bgs to a depth that is undetermined, but thought to be greater than 4000 feet bgs in the Miami-Dade County area. This thick sequence of carbonate rocks contains several permeable zones separated by thick confining units (Miller 1986). These confining units are similar in lithology to the middle confining unit of the Floridan aquifer system (Reese 1994). Underlying the confining beds in the lower part of the Lower Floridan aquifer is the highly transmissive Boulder Zone, which is of varying thickness. The base of the Lower Floridan aquifer extends below the base of the Boulder Zone with the lower section consisting of permeable dolomites or dolomitic limestones of the Cedar Keys Formation (Miller 1986, Meyer 1989, and Reese 1994). Because the Lower Floridan aquifer is deeply buried in southern Florida and contains saltwater, the unit has not been intensively drilled or tested; therefore, the hydraulic characteristics are not well known (Miller 1986).

Boulder Zone

The Boulder Zone is a highly transmissive zone of cavernous limestones and dolomites found in the lower Oldsmar Limestone in the Lower Floridan aquifer in southeastern Florida. However, locally the Boulder Zone may range upward to the middle of the Oldsmar Limestone or downward to the top of the Cedar Keys Formation (Miller 1986). It consists mostly of massively bedded dolostones within which secondary permeability has been extensively developed. The term "Boulder Zone" is a misnomer because no boulders are present other than large chunks occasionally broken off during drilling. The difficult slow drilling and rough bit behavior, similar to that observed drilling in boulders, encountered while drilling dolostone, gave rise to the term "Boulder Zone" (Miller 1986). The Boulder Zone can be up to 700 feet in thickness (Reese and Richardson 2008). Based on previous studies in the region (Reese and Richardson 2008, Starr et al. 2001, Dames & Moore, 1975, and Miller 1986), the Boulder Zone underlies a 13-county area in southern Florida with the elevation of the top of the zone ranging from about –2000 feet NGVD 29 to about –3400 feet NGVD 29, Figure 2.3-47 (Miller 1986). The Boulder Zone is found at a depth of approximately 2800 feet at the Turkey Point plant property.

Transmissivities ranging from 3.2E06 to 24.6E06 square feet per day have been reported for the Boulder Zone (Meyer 1989). A measured hydraulic conductivity value of approximately 4250 feet per day was obtained from an injection well at the SDWTP, operated by the MDWASD in Miami-Dade County. This value is approximately two orders of magnitude larger than measured values in the overlying portion of the Lower Floridan aquifer and the middle confining unit (Fish and Stewart 1991).

2.3.1.2.2.4 Hydrogeochemical Characteristics

The state of Florida has conducted an extensive characterization of the background water quality in the major aquifer systems (FGS 1992). The data have been subdivided into properties for each of the water management districts. Tables 2.3-21 and 2.3-22 present typical site-specific geochemical parameters for the Biscayne aquifer, the Floridan aquifer, and precipitation at Everglades National Park.

The state of Florida has classified the groundwater in the vicinity of Turkey Point as Class G-III waters to identify groundwater that has no reasonable potential as a future source of drinking water due to high total dissolved solids content (Merritt 1996). Field-measured groundwater quality indicator parameters (temperature, pH, dissolved oxygen, specific conductivity, turbidity, and oxidation-reduction potential) obtained during the collection of samples from observation wells (installed in the Biscayne aquifer as part of the Units 6 & 7 characterization investigation) are summarized in Table 2.3-21. The results of the laboratory analyses of the water samples are presented in Table 2.3-22.

Although the Upper Floridan aquifer is a major source of potable groundwater in much of Florida, water withdrawn from the unit in southeastern Florida, including Miami-Dade County, is brackish and variable with chloride and dissolved solid concentrations greater than 1000 mg/L. Groundwater samples from the Upper Floridan aquifer production wells at Unit 5 (Table 2.3-22) show an average chloride concentration of 2900 mg/L.

Average dissolved solids concentration of Boulder Zone groundwater is approximately 37,000 mg/L total dissolved solids (Meyer 1989). There is also a pronounced temperature anomaly present in the Boulder Zone with the lowest observed temperatures (approximately 50°F) occurring along the southeastern coast. The temperature increases from the Straits of Florida toward the center of the Florida Plateau, suggesting recharge from cold seawater through the lower part of the Floridan aquifer system. The groundwater circulation pattern is shown on Figure 2.3-48 (Meyer 1989).

Figure 2.3-49 presents a Piper trilinear diagram of the plant property and regional geochemical data. Examination of the diamond field on the diagram indicates that the plant property groundwater, Biscayne Bay, and the industrial wastewater facility data all plot together on the diagram, indicating similar geochemical compositions. These waters are classified as a sodium-chloride water type.

2.3.1.2.2.5 Aquifer Recharge and Discharge

Groundwater Discharge

Natural discharge of groundwater in the Biscayne aquifer is by seepage into streams, canals, or the ocean; by evaporation; and by transpiration by plants. Induced discharge is through wells pumped for municipal, industrial, domestic, and agricultural supplies. Evapotranspiration, transpiration, and groundwater discharge are greatest during the wet season when water levels, temperature, and plant growth rates are high. Pumpage of groundwater constitutes a part of the total discharge from the aquifer. The effect of pumpage is amplified because it is greatest during the dry season when recharge and aquifer storage are least. Most of the water that circulates in the surficial aquifer system is discharged by canals (Fish and Stewart 1991). There is very little direct runoff of precipitation; however, regional discharge of the surficial aquifer into drainage canals and directly into Biscayne Bay is estimated to be approximately 15 to 25 inches per year (Parker et al. 1955). It is estimated that 20 inches of the approximately 60 inches of annual rainfall in Miami-Dade County is lost directly by evaporation, approximately 20 inches is lost by evapotranspiration after infiltration, 16 to 18 inches is discharged by canals and by coastal seepage, and the remainder is used by man (Meyer 1989 and Parker et al. 1955). Nearly 50 percent of the rainfall that infiltrates the Biscayne aquifer is discharged to the ocean (Klein and Hull 1978).

Groundwater Recharge

There are several mechanisms affecting recharge of the surficial/Biscayne aquifer in Miami-Dade County including (Fish and Stewart 1991):

- Infiltration of rainfall or irrigation water through surface materials to the water table
- Infiltration of surface water imported by runoff from the north in the water-conservation areas or by canals
- Infiltration of urban runoff by way of drains, wells, or ponds
- Groundwater inflow from southwestern Broward County

Recharge by rainfall is greatest during the wet season, from June to November, and recharge by canal seepage is greatest during the dry season, from December to May. The average annual rainfall in Miami-Dade County is approximately 60 inches, of which approximately 38 inches is recharge to the aquifer (Parker et al. 1955). Recharge occurs over most of Miami-Dade County during rainstorms. The low coastal groundwater levels and the low, but continuous, seaward gradient indicate the very high transmissivity of the aquifer, the high degree of interconnection between the aquifer and the canals, and the effectiveness of the canals in rapidly draining floodwaters (Fish and Stewart 1991).

Recharge to the Floridan aquifer system is directly related to the confinement of the system. The highest recharge rates occur where the Floridan aquifer is unconfined or poorly confined as in those areas where the system is at or near land surface or where the confining layers are breached by karst or other structural features. The Floridan aquifer system is confined, with upward vertical gradients, and is approximately 1000 feet bgs in the vicinity of the Turkey Point plant property.

Groundwater–Industrial Wastewater Facility Interaction

Units 1–4 use the 5900-acre closed-loop industrial wastewater facility for condenser cooling (Figure 2.3-61). The canals comprising this facility are shallow, approximately 3 feet deep with the exception of the grand canal (main return canal), north discharge canal, south collector canal, and the east return canal, all of which are approximately 18 feet deep. The canals convey warm water south from the existing units and return cooled water for use by Units 1 through 4. The industrial wastewater facility does not directly discharge to fresh or marine surface waters; however, because the canals are not lined, water in the canals interacts with groundwater in the unconfined Biscayne aquifer, which immediately underlies the bottom of the industrial wastewater facility. Makeup water for the industrial wastewater facility comes from treated process water, rainfall, stormwater runoff, and groundwater infiltration. There is a net inflow to the industrial wastewater facility from the Biscayne aquifer beneath the canals. The water in the canals has a salinity greater than that of seawater due to the effects of evaporation, with salinity concentrations approximately twice that of Biscayne Bay.

An interceptor ditch adjacent to the west side of the industrial wastewater facility and east of the L-31E Canal and levee was constructed at the same time as the industrial wastewater facility (Figure 2.3-61). The purpose of the interceptor ditch is to keep water from the industrial wastewater facility from influencing groundwater quality to the west in the upper portion of the aquifer. This is accomplished by the existence of a natural freshwater hydraulic gradient during the wet season and by pumping water as necessary from the interceptor ditch into the westernmost canal (Canal 32) of the industrial wastewater facility during the dry season when natural freshwater hydraulic gradients are low. Operation of the interceptor ditch prevents seepage from the industrial wastewater facility from moving landward toward the L-31E Canal in the upper portion of the aquifer and thereby helps to maintain existing groundwater quality in the Biscayne aquifer west of the interceptor ditch. Table 2.3-23 presents the manual staff gage readings along various transects between the L-31E Canal and the westernmost canal in the industrial wastewater facility for the year 2008. The table also indicates pumping activities to maintain seaward flow. Figure 2.3-50 presents hydrographs of canal, interceptor ditch, and industrial wastewater facility Canal 32 water elevations for the year 2008.

2.3.1.2.3 Groundwater Flow Model

In order to better characterize the groundwater flow system, a three-dimensional numerical groundwater flow model was used. The model code used was MODFLOW-2000 (Harbaugh et al. 2000) as implemented in the Visual MODFLOW software. The MODFLOW model is a constant-density, three-dimensional finite-difference model, with modular capability to add various equation solvers and boundary conditions to the basic model. The model developed for Units 6 & 7 used a geometric multigrid (GMG) solver.

The Biscayne aquifer is represented in the model by six layers: 1) muck, 2) Miami Limestone, 3) Key Largo Limestone, 4) freshwater limestone, 5) Fort Thompson Formation, and 6) Tamiami Formation. The horizontal discretization for most simulations in the model is represented by a telescopic grid that ranges from a coarse grid (200 by 450 feet) at the model perimeter to a fine grid (20 by 20 feet) in the immediate area of Units 6 & 7.

Hydrological features are represented in the model as boundary conditions. The river boundary condition is used to represent the industrial wastewater facility and the regional water management canals. Recharge and evapotranspiration boundaries are assigned to the top layer of the model, with properties varying depending on the surface conditions. These conditions include open water (canals), wetlands, and impervious surfaces (Units 1 through 5). The perimeter of the model is represented by a general head boundary, except in portions of the top layer at Biscayne Bay. The general head boundary represents the influence of conditions beyond the model area, primarily recharge from the Everglades. The top layer in Biscayne Bay is represented in the model as a constant head boundary condition using an average head based on tidal monitoring at Virginia Key. The remaining layers beneath Biscayne Bay are represented as general head boundaries at the perimeter of the model. The bottom layer of the model (Tamiami Formation) is represented as a no flow boundary condition. The vertical seepage upwards or downwards through the Tamiami Formation and the Hawthorn Group is assumed to be negligible relative to the horizontal flow in the Biscayne aquifer.

Calibration of the model was performed by adjusting the river boundary condition conductance and riverbed thickness values in the industrial wastewater facility and regional water management canals and by adjusting hydraulic conductivities. The calibration targets for the model were the average measured groundwater levels in the upper and lower monitoring zones at Units 6 & 7 and two SFWMD wells adjacent to the plant area. The average inflow/outflow between the industrial wastewater facility and Biscayne Bay was also used as a calibration target.

The calibrated model was used to simulate the impacts of construction dewatering, construction of Units 6 & 7 (site grade increase and use of diaphragm walls for groundwater control), and operation of the radial collector wells. The results of these model simulations are presented in FSAR Subsection 2.4.12, Appendix 2CC.

2.3.2 WATER USE

This section describes surface water and groundwater uses that could affect or be affected by the construction or operation of Units 6 & 7 and associated transmission corridor and offsite facilities. Consumptive and nonconsumptive water uses are identified, and water diversions, withdrawals, consumption, and returns are quantified. In addition, this section describes statutory and legal restrictions on water use and provides the projected water use for Units 6 & 7.

2.3.2.1 Surface Water Use

Surface water bodies around the Turkey Point plant property include Biscayne Bay, Card Sound, the industrial wastewater facility, numerous named and unnamed canals, and various wetlands. Figures 2.3-1 through 2.3-3 show the relationship of the Turkey Point plant property to these major hydrologic features. The locations of designated wetlands near the Turkey Point plant property are shown on Figure 2.3-15.

The natural drainage of the area is to the east and south towards Biscayne Bay. The shallow tidal creeks and swales in the area are submerged, and therefore any flow they may have is sluggish. This, together with the permeable limestone bedrock of the area, results in approximately two-thirds of the rainfall percolating directly to the water table aquifer. In the absence of well-defined stream channels, heavy precipitation runs off in a slow, sheet flow towards the Biscayne Bay.

A complex network of levees, canals, and control structures was constructed to manage the water resources in the lower east coast region of Florida. The major canals, operated and maintained by the SFWMD, are used to prevent low-lying coastal areas from flooding and to prevent saltwater intrusion into coastal aquifers (Wolfert-Lohmann et al. 2007).

The surface water body that is within the hydrologic system where the Units 6 & 7 plant area is located and that could potentially affect or be affected by the construction and operation of the new units is Biscayne Bay. For construction or operation of Units 6 & 7, there would be no surface water withdrawal directly from or discharging to Biscayne Bay. It is noted, however, that one of the two primary sources of makeup water would be saltwater obtained from radial collector wells located on the Turkey Point peninsula, east of the existing units. As described in Subsection 2.3.2.2.2.2, each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with horizontal laterals projecting up to a distance of

900 feet from the caisson in the subsurface beneath the floor of Biscayne Bay. The water recharging the radial collector wells would originate from Biscayne Bay.

2.3.2.1.1 Consumptive Surface Water Use

2.3.2.1.1.1 Present Consumptive Surface Water Use

In South Florida, most (approximately 90 percent) of the water used in homes and businesses comes from groundwater sources, with the remainder coming from surface water sources (SFWMD 2008b).

The consumptive use of water in the state of Florida is regulated by the water management districts, as prescribed in Part II of Chapter 373 of Florida Statute (F.S.). According to the consumptive water-use permit files of SFWMD (2008c), 139 projects in Miami-Dade County were permitted for surface water withdrawals as of October 2008 and are summarized in Table 2.3-24. Eighty-three percent of the permitted projects are for landscape irrigation, and the remaining are for irrigation of golf courses and agriculture, industrial and dewatering uses, and other minor uses. All consumptive surface water uses are self-supplied, and there are no surface water withdrawals for potable water. A total of 9410 million gallons per year are allocated annually for six industrial uses, most of which are used for quarry sites and rock washing facilities. Seven golf course irrigation projects are permitted to withdraw 1360 million gallons per year, and 115 landscape irrigation projects are permitted to withdraw approximately 1123 million gallons of surface water per year.

Figure 2.3-51 shows the location of permitted users within 10 miles of Units 6 & 7, and Table 2.3-25 presents the details of their permits. Onsite ponds/lakes and canals are the major sources of surface water for these users. There are no permitted surface water users in the immediate vicinity of Units 6 & 7. The nearest surface water user is located approximately 6 miles west-northwest of Units 6 & 7.

Because all the surface water uses are self-supplied and have limited metered data, it is difficult to estimate the actual monthly withdrawal rates of surface water. In cases of agricultural and landscape irrigation, however, monthly withdrawal rates can be estimated from the monthly supplemental crop requirement data shown in the water use permit applications (SFWMD 2008c). The monthly supplemental crop requirements are calculated according to the SFWMD's Supplemental Crop Requirement and Withdrawal Calculation (SFWMD 2008d), which varies by crop, soil type, and local climatology. Figure 2.3-52 shows monthly supplemental crop requirement applied for some typical crops in the Homestead area in 2008. As seen in this figure, the monthly supplemental crop requirement has a large seasonal variation—it is high in the spring and summer seasons, and low in the fall and winter seasons.

Most of the freshwater withdrawn from surface water sources is not returned to its surface source. Irrigation water applied for agricultural and landscape uses is consumed by the processes of evapotranspiration and infiltration into the subsurface. As indicated in the SFWMD permit files (SFWMD 2008c), most of the surface water withdrawn for industrial and dewatering uses is drained to sedimentation basins where the water percolates back into an aquifer or is returned to onsite borrow pits/lakes and recycled.

Surface waters of Miami-Dade County serve as receiving water bodies for both domestic and industrial discharges. Table 2.3-26 lists the major facilities that discharge treated wastewater or cooling water into canals, bays, or the open ocean. As seen in this table, the sources of the surface discharge water originate primarily as groundwater. Two MDWASD Wastewater Treatment Plants discharge treated wastewater into the ocean.

According to Ecology & Environment, Inc. (2007), approximately 16.2 million gallons per day of wastewater, which represents approximately 5 percent of the total volume of public water supplied by the MDWASD, is currently reused in the MDWASD system. Most of the reuse is for process water and irrigation at the regional wastewater treatment plants.

2.3.2.1.1.2 Future Consumptive Surface Water Use

The SFWMD prepares water supply plans for each of its four planning areas to support planning initiatives and address local issues. The regional water supply plans encompass a minimum 20-year future planning horizon and are updated every 5 years. Each regional water supply plan update provides revised water demand estimates and projections.

According to the SFWMD's *Water Supply Plan Update 2005–2006* (SFWMD 2006b), the total water demand of the lower east coast region which includes Miami-Dade, Monroe, Broward, and Palm Beach counties will increase by 27 percent between 2005 and 2025, as shown in Table 2.3-27.

Agricultural water withdrawal demands are projected to decline by 9 percent by 2025 due to a decrease in agricultural acreage. However, withdrawal demands for public supply, domestic self-supply, and recreational (landscape and golf course) irrigation are projected to increase by more than 30 percent by 2025.

Power generation water use and withdrawal demand are both expected to increase significantly during the planning period, reflecting the development of new power generation facilities in the lower east coast planning area. Industrial demands, which include construction and mining dewatering, are relatively small and historical data do not indicate any trends in use. Therefore, the industrial water use levels are expected to remain constant through the projection period.

In Miami-Dade County, surface water is rarely used as a source for public or domestic water supply, as already indicated in Table 2.3-24. Moreover, there is no surface water use and withdrawal permit for Units 6 & 7 anticipated in the future. Although the withdrawal demand for recreational water use could be increased in the future, the total consumptive surface water use is not expected to significantly increase in Miami-Dade County.

2.3.2.1.2 Nonconsumptive Surface Water Use

The Turkey Point plant property is adjacent to a large area of protected marine environments: Biscayne National Park is located to the east, and Biscayne Bay Aquatic Preserve (Card Sound portion) and John Pennekamp Coral Reef State Park are located to the southeast as shown in Figure 2.3-53.

As described in NPCA (2006), Biscayne National Park encompasses much of Biscayne Bay, making it one of the largest marine parks in the National Park system. The park protects part of the third-largest coral reef system in the world and the longest stretch of mangrove forest remaining on Florida's east coast, providing habitat and nursery grounds for most of the region's important commercial and recreational fish, shellfish, and crustaceans. It is also a source of environmental education and recreation.

According to Biscayne National Park (BNP 2008a), the park encompasses approximately 181,500 acres, 95 percent of which is under water. Therefore, most of the activities in this national park are water-related activities such as boating, canoeing, diving, fishing, sailing, snorkeling, swimming, and waterskiing.

Commercial fishing has been allowed within the boundaries of Biscayne National Park since the park became a National Monument in 1968. According to the landings data presented by the Fish and Wildlife Research Institute (FWRI 2008), the average annual landing amounts and trips in the entire Miami-Dade County region was 1.7 million pounds and 8186 trips for the period of 2003 through 2007. Four major species represented more than 60 percent of the total amounts: pink shrimp (20 percent), spiny lobster (15.6 percent), bait shrimp (14.1 percent), and ballyhoo (10.8 percent). Major species that commercial harvesters target include pink shrimp, spiny lobster, blue crab, stone crab, and finfish.

Recreational fishing is among the most popular activities undertaken in Biscayne National Park. According to the park's internal annual fisheries report (NPS 2006), the park hosts thousands of recreational fishing vessels annually; the 1997 total was estimated to be approximately 33,000 fishing vessels. Most fishermen tend to be recreational anglers, with approximately 20 percent engaging spearfishing and 30 percent fishing further offshore (east of the park's islands). The areas that most fishermen use are along the reef tract (hard bottom substrate) and the area inside the bay near Adams Key (mixed substrate). The composition of the catch covers common reef species, such as snappers, grunts, and lobster (NPS 2006).

Pleasure boating, or cruising, remains a popular water-based activity in South Florida and in Biscayne National Park. The number of registered vessels has increased steadily, reaching a total of 62,324 registered vessels in Miami-Dade County in 2007. Of this total, 59,651 are pleasure craft, and approximately half of these are between 16 to 26 feet long (Florida Department of Highway Safety and Motor Vehicles 2007).

Diving is also an important recreational activity in and around Biscayne National Park. Survey results estimate that there were 3.25 million person-days spent snorkeling and diving in natural and artificial reefs in Miami-Dade County from June 2000 to May 2001 (Johns et al. 2001). During that period, the estimated total use was 9.17 million person-days, including activities such as fishing and glass-bottom boating.

Biscayne National Park hosts over 500,000 visitors annually (NPS 2009). Biscayne National Park is open year-round, but the majority of park visits occur from April to July and in October. Table 2.3-28 presents the monthly variation of number of visitors for the period of 2005 through 2007. Visitors spent approximately 152,000 person-days per year in the park during the period.

There are several public beaches in Miami-Dade County. Homestead Bayfront Park, which accommodates a natural atoll pool and beach (Miami-Dade County 2008a), is located within 6 miles of the plant area, as shown in Figure 2.3-53. Homestead Bayfront Park also accommodates fishing in designated areas and along the canal and bay for barracuda, snapper, mullet and sea bass (Miami-Dade County 2008b). Five boat ramps and a yachting marina known as Herbert Hoover Marina are located in the park (Miami-Dade County 2008c).

The Atlantic Intracoastal Waterway runs through Biscayne Bay, and Hawk Channel is a shipping lane that transverses Biscayne National Park on the outside of the Keys (NPS 2006). Commercial and noncommercial vessels pass through the waterway along the eastern side of the bay. Traffic includes cargo vessels, transportation vessels, and cruise ships. The navigational usage of the Atlantic Intracoastal Waterway in the Miami-Dade county district is difficult to quantify, but it is expected to be significant based on the large number of registered vessels within the county.

Barges delivering fossil fuel to Units 1 & 2 use Biscayne Bay. The fossil fuels are delivered from the port of Miami through Biscayne Bay to the units typically hauling between 11,500 and 14,000 barrels of bunker “C” fuel oil per trip. The number of barge trips from 2004 to 2008 varied between 95 and 277 per year.

Other than the navigational use of Biscayne Bay for shipping fossil fuel for Units 1 & 2, there are no nonconsumptive surface water uses by the existing units.

As described in Section 3.9, barges delivering components and modules for the construction of Units 6 & 7 would also use Biscayne Bay. There would be approximately 80 round-trip barge deliveries for modules and components for each unit over an approximately six-year duration.

2.3.2.1.3 Statutory and Legal Restrictions on Surface Water Use

The consumptive use of water in the state of Florida is regulated by the water management districts, as prescribed in Part II of Chapter 373 of Florida Statute (F.S.). This regulation applies to public water supplies, agricultural and landscape irrigation, contamination cleanup, commercial/industrial uses, and dewatering/mining activities. Water uses that are exempt from the permitting process include domestic uses for single-family homes, water used for fire fighting, saltwater and reclaimed water uses (SFWMD 2008f).

Specific water body restrictions on water use imposed by federal, state, or local regulations that are relevant to Units 6 & 7 are summarized below:

- Biscayne National Park is designated as an Outstanding Florida Water and an Outstanding National Resource Water pursuant to Rule 62-302.700 of Florida Administrative Code (F.A.C.). Any discharges or activities that may cause degradation of water quality and natural resources, other than that allowed in Rule 62-4.242(2) and (3) of F.A.C., are prohibited.
- The Biscayne Bay Aquatic Preserve is managed by the FDEP in accordance with F.S. 258.397 and F.A.C. 18-18. Activities such as dredging, filling, drilling of wells, and erection of structures are regulated to preserve the water quality and aquatic resources.
- Pursuant to the Resolution (No. Z-56-07, conditions 4 & 5) of the Board of County Commissioners of Miami-Dade County, FPL shall not apply for any water withdrawals from the Biscayne aquifer as a source of cooling water for the proposed facilities, and shall use reclaimed or reuse water to the maximum extent possible.

2.3.2.1.4 Plant Water Use

2.3.2.1.4.1 Existing Units Water Use

Units 1-4 use the 5900-acre closed-loop industrial wastewater facility for condenser and auxiliary system cooling. Condenser cooling water is pumped from the intake portion of the industrial wastewater facility and through the plant's condensers where it gains heat. The heated water is discharged to the discharge portion of the industrial wastewater facility. The head difference between the discharge and intake in this closed-loop system causes the heated water to flow through the industrial wastewater facility, dissipating heat along the way, and eventually returning the cooled water to the plant intake. The required condenser cooling water is 574,300 gallons per minute (gpm) for Units 1 & 2, and 1.25 million gpm for Units 3 & 4. Incidental rainfall, some stormwater runoff, treated process wastewater, and groundwater inflows, compensate for evaporative cooling losses from this system.

Unit 5 uses a closed-cycle cooling system with mechanical draft cooling towers. The required cooling tower makeup water is supplied by groundwater from the upper production zone of the Floridan aquifer. A 90-day average withdrawal of 14.06 million gallons per day and an average annual withdrawal of 4599 million gallons per year are permitted to be used for cooling water for Unit 5 and process water for Units 1, 2, and 5 (FDEP 2007). The cooling tower makeup water for Unit 5, which is currently withdrawn from the Floridan aquifer, may switch to reclaimed water if a reliable source of reclaimed water becomes available (FDEP 2007).

Units 3 & 4 use approximately 690 gpm of water from the Miami-Dade public water supply system. Plant water use includes process (primary demineralizer water makeup), potable, and fire protection water. The Newton water treatment plant, which is part of Miami-Dade’s public water supply system, supplies the existing units.

The process wastewater from the existing units is released into the industrial wastewater facility, and the sanitary wastewater is sent to an onsite treatment plant and disposed of through an underground injection well.

The State Industrial Wastewater Facility Permit No. FL0001562, issued by the FDEP, authorizes releases of industrial wastewater to the closed-loop cooling system and subsequently to groundwater. The permit does not authorize the existing units to discharge to surface waters of the state. The industrial wastewater facility is an integral part of the existing units design and is not waters of the state.

2.3.2.1.4.2 Units 6 & 7 Water Use

Units 6 & 7 would use closed-cycle, mechanical draft cooling towers for both circulating water system cooling and service water system cooling.

The primary source of makeup water for the circulating water cooling towers would be reclaimed water supplied by the MDWASD South District Wastewater Treatment Plant, which is located approximately 9 miles north of the Turkey Point plant property (Figure 2.3-51). When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, radial collector wells supplying saltwater would be used to supplement the supply. The raw water system would be designed to supply 100 percent of the makeup water from either reclaimed water or saltwater, or any combination of both. The ratio of water supplied by the two makeup water sources would vary depending on the availability of reclaimed water from the MDWASD South District Wastewater Treatment Plant. The circulating water system would be designed to accommodate the differing water quality of the two sources.

Municipal water from the Miami-Dade County public water supply system would serve as the source for potable water, makeup water to the service water system, demineralized water, fire protection, and miscellaneous water uses.

The cooling tower blowdown and wastewater from Units 6 & 7 would be discharged to the Boulder Zone of the Lower Floridan aquifer via deep injection wells, as described in Subsection 3.3.1.2.

The water use quantities and diagrams for the plant during operation are presented in Section 3.3, and water use during construction is discussed in Section 4.2.

Details on the transmission lines are provided in Section 3.7. As presented in Subsection 4.2.1.1.10, the impacts of the transmission line on the surface water use are expected to be small.

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 Turkey Point plant property. SSAs within the region are also identified and described.

The hydrostratigraphic framework of Florida, including Miami-Dade County and the vicinity of the Turkey Point plant property, consists of a thick sequence of Cenozoic sediments that comprise two major aquifers. The two major aquifers are (SEGS 1986):

- The surficial aquifer system, including the Biscayne aquifer.
- The Floridan aquifer system consisting of the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer. The Floridan aquifer is separated from the Biscayne aquifer by the intermediate confining unit.

The Biscayne aquifer is the most productive of the shallow aquifers in southeastern Florida, and it is the prime source of drinking water for the municipal water systems south of Palm Beach County, including Miami-Dade County. However, saltwater intrusion affects the entire coastal zone of the aquifer, thereby limiting use of the aquifer for drinking water in the vicinity of the Turkey Point plant property as a result of the saline to saltwater composition of the groundwater. Figure 2.3-23 shows the approximate location of the freshwater-saltwater interface in the area. The figure indicates that the saltwater interface at the base of the aquifer is approximately 6 to 8 miles inland of the Turkey Point plant property. Provisional data from the USGS (2009b) showing the 2008 freshwater-saltwater interface in Southeast Florida indicates a similar pattern to that shown on Figure 2.3-23.

The Floridan aquifer system consists of three units in southeastern Florida: the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer. In southeastern Florida, groundwater in the Upper Floridan aquifer is brackish and variable in quality. The aquifer typically contains saline water, which is defined as greater than 250 mg/L of chloride, or saltwater, which is greater than 19,000 mg/L of chloride as defined (by the SFWMD) (SFWMD 2008g). The Upper Floridan aquifer, however, is the primary aquifer used for seasonal storage of both raw and treated freshwater within the aquifer storage and recovery (ASR) systems in southern Florida. Approximately 30 aquifer storage and recovery sites in southern Florida have their storage zone completed within or planned for the Upper Floridan aquifer (Reese and Richardson 2008).

The Boulder Zone of the Lower Floridan aquifer contains saltwater which is used for deep well injection of treated municipal wastewater and reverse osmosis concentrate in Miami-Dade County. Injection occurs below the middle confining layer at depths of approximately 2800 feet or greater, approximately 900 feet below the base of the lowest underground source of drinking water (USDW) (defined as an aquifer that contains water with a total dissolved solids concentration of less than 10,000 mg/L (U.S. EPA 2003 and Reese and Richardson 2008).

2.3.2.2.1 Regional Groundwater Use

Historical, current, and projected groundwater use in the vicinity of the Turkey Point plant property was evaluated using information from the U. S. Geological Survey (USGS) and the SFWMD.

2.3.2.2.1.1 Historical Groundwater Use

Freshwater withdrawal of groundwater has been monitored for Miami-Dade County by the USGS (Marella 2005 and Marella 2008). In the Miami-Dade County area, freshwater is restricted to the Biscayne aquifer. However, the Turkey Point plant property is in an area of the Biscayne aquifer with Class G-III groundwater (non-potable water use). Groundwater use has shown a steady increase between the 1960s and the present as shown on Figure 2.3-55. The primary groundwater use in Miami-Dade County is for public water supply, followed by agricultural irrigation. Beginning in approximately 1985, a new category of use was introduced—recreational irrigation. This category includes golf course irrigation and other types of turf grass irrigation. Table 2.3-29 presents the groundwater use for each category.

The underlying Upper Floridan aquifer typically contains saline water to saltwater. In 1990 and 1995, no groundwater use was reported from the Floridan aquifer for Miami-Dade County (Marella 1992 and Marella 1999). In 2000, water use of 3.68 million gallons per day from the Upper Floridan aquifer was reported for the county with a use category of industrial (Marella and Berndt 2005).

2.3.2.2.1.2 Current Use

Figure 2.3-56 shows the current groundwater users in Miami-Dade County based on water use permits filed with the SFWMD (SFWMD 2008a). The figure does not show wells that do not require a water use permit, such as domestic wells, wells used exclusively for fire fighting, or those wells withdrawing saline or saltwater. Table 2.3-30 lists the public water supply systems in Miami-Dade County along with the population served (FDEP 2008a). Figure 2.3-57 (FDEP 2008d) presents the major well fields in Miami-Dade County and their associated groundwater protection zones.

In addition to the traditional uses of the groundwater aquifer, other uses of the groundwater aquifer are present in south Florida. These include disposal of municipal and industrial wastewater in Class I injection wells and the use of ASR wells. The ASR wells are used to inject raw or partially treated water into the aquifer for later extraction and use. Figure 2.3-58 shows the typical configuration of Class I injection wells and ASR wells in south Florida. ASR wells are typically completed as open-hole wells in the Upper Floridan aquifer. Class I injection wells are typically completed as open-hole wells in the Boulder Zone portion of the Lower Floridan aquifer which is below the lowermost USDW. Figures 2.3-59 and 2.3-60 show the locations of these wells in Florida (FDEP 2008b).

2.3.2.2.1.3 Projected Use

Projected groundwater use in Miami-Dade County was obtained from the *Lower East Coast Water Supply Plan*, 2005–2006 update (SFWMD 2006b). Figure 2.3-55 includes projections of groundwater use through 2025. The projections combine domestic and public water supply categories into one total value.

2.3.2.2.2 Local Groundwater Use

This section provides a description of the current and projected groundwater use in the vicinity of the Turkey Point plant property.

2.3.2.2.2.1 Current Use

Units 1 through 4 use the cooling canals of the industrial wastewater facility for condenser and auxiliary system cooling (Figure 2.3-3). The canals also receive cooling tower blowdown from Unit 5 and existing facilities drainage. The industrial wastewater facility is a closed-loop system (Figure 2.3-61) that includes the canal network adjacent to Units 6 & 7. There are no discharges to surface water from the industrial wastewater facility. Cooling water for Unit 5 and process water for Units 1, 2, and 5 are obtained from Upper Floridan aquifer saline production wells (PW-1, PW-3, and PW-4). The locations of these production wells, which were commissioned in February 2007, are shown in Figure 2.3-62. Monthly production from each of the wells is shown in Figure 2.3-63. The average combined production from the three wells is approximately 180 million gallons per month. Water supply for other water uses at Turkey Point comes from the potable water system of the MDWASD.

A single Class V, Group 3 gravity injection well is used to dispose of up to 35,000 gallons per day of domestic reclaimed water at the Units 3 & 4 wastewater treatment plant. The well, designated IW-1, is open from 42 to 62 feet below ground surface and is 8 inches in diameter.

2.3.2.2.2.2 Projected Use

Reclaimed water from the MDWASD or saltwater from radial collector wells would be the two sources of cooling water for Units 6 & 7. The total makeup flow required from the radial collector wells is estimated to be 86,400 gpm; however, the actual amount of saltwater used would depend on the quality and quantity of reclaimed water available from the MDWASD. Water supply for potable water, service water system makeup, fire protection, and miscellaneous raw water use would be from the MDWASD.

Radial collector wells would consist of a central concrete caisson excavated to an optimal target depth. The caisson diameter is based on the size of pumps and number of laterals required. The optimal target depth of the caisson will be based on the available drawdown and the desired elevation of the laterals. Screened sections will be incorporated along the lateral based on site conditions. Once the caisson and laterals are installed, groundwater will infiltrate into the laterals and flow back to the caisson. The water then will be pumped from the caisson.

Four radial collector wells, each capable of producing approximately 45 million gallons per day, would be installed. Figure 2.3-64 shows the location of the radial collector wells. At any time, one collector well will operate in standby mode as a reserve well in the event of an unplanned well outage or scheduled maintenance event. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground surface with laterals projecting horizontally from the caisson. The laterals would be advanced horizontally a distance of up to 900 feet from the caisson beneath Biscayne Bay and installed at a depth of approximately 40 feet. The wells would be designed and located to induce infiltration from Biscayne Bay.

Disposal of wastewater from Units 6 & 7 is planned to occur in Class I deep injection wells drilled at the site. The wells would inject the wastewater into the Boulder Zone of the Lower Floridan aquifer at depths of approximately 2900 to 3500 feet below ground surface. This injection zone has been used for the underground disposal of liquid wastes since 1943 (Maliva et al. 2007). The Boulder Zone is located beneath groundwater supplies that are currently or may be used in the future as a source of drinking water. Drinking water supply sources are typically not more than a few hundred feet deep and, therefore, far above the Boulder Zone (U.S. EPA 2000).

The Boulder Zone is permitted by the FDEP as a zone for the discharge of treated sewage and other wastes disposed of through injection wells. The Boulder Zone meets the Florida Department of Environmental Regulations criteria for Class I injection. The Boulder Zone has the following characteristics throughout its extent:

- Deep. The top of the Boulder Zone is 2000 to 3400 feet in depth.
- Confined. There is approximately 800 to 1000 feet of confining limestone and dolomite beds between the Boulder Zone and the base of the Underground Source of Drinking Water.
- Thick. The Boulder Zone is up to 700 feet in thickness.
- Porous. The Boulder Zone has well developed secondary permeability.
- Highly Transmissive. The transmissivity of the Boulder Zone is up to 24.6E06 square feet per day.
- Contains groundwater with total dissolved solids concentration >10,000 mg/L. The average dissolved solids concentration of Boulder Zone groundwater is approximately 37,000 mg/L.

Currently over 90 Class I injection wells are used to dispose of over 200 million gallons per day of secondary treated wastewater in southeast Florida (Bloetscher et al. 2006).

Deep injection wells would be used for the disposal of non-hazardous industrial wastewater consisting of cooling tower blowdown, sanitary wastewater, and miscellaneous plant wastewater from Units 6 & 7. The wastewater disposal requirements for Units 6 & 7 are estimated to be a combined total of approximately 20 million gallons per day when using only reclaimed water from the MDWASD as a cooling water source, and as high as 90 million gallons per day when using only saltwater as a cooling water source. Therefore, the combined disposal volumes are estimated to be between 20 million and 90 million gallons per day when using a combination of reclaimed water and saltwater for cooling. The wells would be Class I industrial injection wells with a total capacity of 90 million gallons per day. The deep injection wells would consist of 10 primary wells and 2 backup wells. The injection zone would be in the Boulder Zone of the Lower Floridan aquifer, which is at a depth of approximately 2900 feet bgs in the plant area. Approximately 800 to 1000 feet of confining limestone and dolomite beds would be present between the injection zone and the base of the USDW.

Injection well design includes determining the allowable injection rate and the area of review. Section 62-528.415 (1)(f)2 FAC (FDEP 2008b) states that the hourly peak injection rate should not exceed a velocity of 10 feet per second. Based on a review of data from other deep injection wells in southeast Florida, it is estimated that each injection well would have a maximum allowed injection capacity of 18.6 million gallons per day at a peak hourly flow. However, it is estimated that each well would be operated at an injection rate of approximately 10 million gallons per day.

The casing in the injection wells for Units 6 & 7 would be seated at a depth of approximately 2800 feet bgs to maximize the thickness of the confining strata between the injection zone and base of the USDW. Grouting the pilot holes drilled for core and data collection, prior to reaming the holes for casing placement, would be employed to prevent the possible development of double borehole conditions. Additionally, all Class I injection wells are required to have a dual-zone monitoring system that consists of a zone open below the deepest USDW and a zone located in the USDW for geochemical and pressure monitoring.

The temperature and total dissolved solids concentration of the injected effluent will be variable. The injected effluent temperature would vary seasonally. The maximum and minimum expected temperatures would be 91°F and 65°F, respectively. The expected wastewater TDS when using reclaimed water would be 2721 mg/L; when using saltwater from the radial collector wells, the expected wastewater TDS would be 57,030 mg/L. Based on the temperature and TDS values, the density of the injected fluid is estimated to range from 996.8 kilograms per cubic meter (100-percent reclaimed water in the summer) to 1042.2 kilograms per cubic meter (100-percent saltwater in the winter).

2.3.2.2.3 Sole Source Aquifers

EPA has designated two SSAs that are located entirely within the state of Florida, the Volusia-Floridan aquifer and the Biscayne Aquifer, as shown on Figure 2.3-18 (U.S. EPA 2008a). The Volusia-Floridan aquifer is located in east-central Florida, well beyond the boundaries of the local hydrogeologic system underlying the plant area; however, the Biscayne aquifer underlies the site and Miami-Dade County. An SSA is defined as “an underground water source that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water” (U.S. EPA 2008a). Saltwater intrusion affects the entire coastal zone of the Biscayne aquifer including the Turkey Point plant property. As a result, groundwater beneath the Turkey Point plant property is not used as a drinking water source because of its salinity.

2.3.3 WATER QUALITY

This subsection describes the water quality characteristics of surface water bodies and groundwater aquifers that could affect plant water use, wastewater injection, and stormwater runoff or be impacted by preconstruction/construction and operation of Units 6 & 7.

2.3.3.1 Surface Water

Surface water bodies of primary interest near the Units 6 & 7 plant area include Biscayne Bay, Card Sound/Card Sound Canal, and the cooling canals of the industrial wastewater facility. These water bodies have the potential to be affected as a result of the construction (e.g., surface water runoff), and operation (e.g., radial collector well operation) of Units 6 & 7. They are addressed in the following paragraphs.

2.3.3.1.1 Biscayne Bay and Card Sound/Card Sound Canal

The Units 6 & 7 plant area is located adjacent to Lower Biscayne Bay. Card Sound is south of Biscayne Bay. Card Sound Canal starts at the southern end of the industrial wastewater facility and terminates at Card Sound. Card Sound Canal is not hydraulically connected to the industrial wastewater facility; however, it is connected to Card Sound. Therefore, Card Sound Canal would be expected to have similar water quality to Card Sound. The locations of Biscayne Bay, Card Sound, and the Card Sound Canal relative to Units 6 & 7 are shown in Figures 2.3-1 and 2.3-3.

Biscayne Bay's beauty and utility invites a diversity of recreational and commercial water activities, including powerboating, sailboating, catamaraning, canoeing, sculling, waterskiing, other motorized watercraft, parasailing, swimming, windsurfing, snorkeling, diving, and fishing.

Biscayne Bay is also important navigationally as part of the Intracoastal Waterway and home to the Port of Miami, one of the busiest cargo and passenger ports in the world. Biscayne Bay provides for a variety of educational and research activities. Several marine science and education facilities use Biscayne Bay and include the University of Miami School of Rosenstiel School of Marine and Atmospheric Sciences, Florida International University, Barry University, the National Oceanic & Atmospheric Administration, the Southeast Fisheries Laboratory, and the Miami Seaquarium. The MAST (Maritime and Science Technology) Academy is a local magnet school located on Virginia Key and is dedicated to students interested in marine science. In addition to these institutions, several governmental agencies as well as scientists from remote locations conduct research and education programs pertaining to Biscayne Bay (FDEP 2008f).

To meet the requirements of Section 303(d) of the federal Clean Water Act, the 1999 Florida Watershed Restoration Act was created directing the Florida Department of Environmental Protection (FDEP) to implement a comprehensive, integrated watershed approach to evaluating and managing impacts to Florida's waters (FDEP 2006b). Units 6 & 7 would be located in the Everglades (HUC 090202)/Florida Bay (HUC 090203) watersheds as shown in Figure 2.3-5. This watershed is currently managed by the SFWMD, a regional Florida state-run agency responsible for water quality, flood control, water supply, and environmental restoration in 16 counties from Orlando to the Florida Keys (SFWMD 2008i). South Florida's coastal systems support spiny lobster, penaeid shrimp, blue crab, oyster, spotted sea trout, stone crab, and many other marine and freshwater species of commercial and recreational interest. Coastal ecosystems are especially vulnerable because they attract intense human development, making these areas especially prone to habitat loss and alteration. (SFWMD 2008h) One of the SFWMD's goals is to manage freshwater discharge to south Florida's estuaries in a way that preserves, protects, and, where possible, restores essential estuarine resources. The SFWMD seeks to ensure that estuaries receive not only the right amount of water at the right time but also clean, high-quality water. (SFWMD 2008h)

Biscayne Bay water quality is monitored by the SFWMD through a project with the four-letter code name BISC. Project BISC is monitored by two entities: the Dade County Department of Environmental Resources Management and the Florida International University. The entities monitor different parts of Biscayne Bay with the same goals which are to determine water quality and provide data to SFWMD staff and outside agencies. (SFWMD 2008e)

Dade County Department of Environmental Resources Management's monitoring program consists of monthly surface water monitoring in Biscayne Bay and its tributaries. Routine monitoring was initiated to detect spatial and seasonal water quality trends, determine impacts on the health of the bay ecosystem, and identify areas of degradation. (SFWMD 2008e)

The program with Florida International University is part of an integrated monitoring network known as the South Florida Coastal Water Quality Monitoring Network. The network monitors water quality on the coastal regions of south Florida. The data generated from the South Florida Coastal Water Quality Monitoring Network is used to examine water quality trends along the Florida coast as well as address issues concerning freshwater inflow, water clarity, salinity, and nutrient availability patterns. (SFWMD 2008e)

Project BISC monitors the following parameters: temperature, dissolved oxygen, pH, turbidity, nitrogen oxides, nitrate, ammonia, total Kjeldahl nitrogen, orthophosphate, total phosphate, silica, chlorophyll A, nitrite, total nitrogen, salinity, total organic carbon, and alkaline phosphate. Figure 2.3-66 depicts the BISC monitoring points Key Biscayne to Miami. Table 2.3-31 presents the monthly average water qualities for Project BISC samples collected between 1993 and 2008 at varied depths of sampling local to the Turkey Point plant property. To analyze horizontal variations in Biscayne Bay, the data is presented at two depth ranges: less than 1 meter and 1 meter to 3.5 meters. To analyze temporal variations, the data is presented monthly.

Analysis of the data from Project BISC for horizontal spatial variation reveals that alkaline phosphate, silica, and nitrogen oxides are slightly elevated in samples closest to the shore (BISC101, 110, and 122). Total Kjeldahl nitrogen and nitrate are slightly elevated at sampling location BISC 101. Silica, nitrate, total phosphate, orthophosphate, and total nitrogen are elevated at the southernmost sampling location in Card Sound (BISC 135), with nitrate being particularly elevated during the summer months of 2007. Water quality data from samples taken in Card Sound (locations BISC 121 and 135) shows no meaningful water quality differences when compared to data from Biscayne Bay, other than elevated levels at BISC135 as stated above. In summary, Biscayne Bay, including Card Sound, is relatively consistent in regard to horizontal spatial variations.

As shown in Table 2.3-31, temperature, dissolved oxygen, and salinity were sampled at two depths and there was no meaningful variation in the data. The water quality data shown in Table 2.3-31 is consistent with the data analyzed for other sample locations in Biscayne Bay at varying depths and, as a result, it can be concluded that Biscayne Bay is relatively consistent in regard to vertical spatial variations in water quality.

Seasonal analysis of the data collected through Project BISC shows higher concentrations of total nitrogen during the summer months for all sampling locations. In addition, the temperature of Biscayne Bay varies from an average monthly maximum of 31.3°C in July at BISC 101 to an average monthly minimum of 18.9°C in January at BISC 135 (average of samples taken at greater than 1 foot deep). Otherwise, most likely because of the limited atmospheric temperature variation seasonally (Florida's proximity to the equator), there is minimal seasonal variation in Biscayne Bay.

2.3.3.1.2 Industrial Wastewater Facility

Stormwater runoff from the construction and operation of Units 6 & 7 would be routed to the industrial wastewater facility which is described in Subsection 2.3.1.1.4. Water quality sampling and analyses were performed in the industrial wastewater facility in 2003. The results are summarized in Table 2.3-32.

The industrial wastewater facility receives tidal inflow and outflow from the saline aquifer beneath Biscayne Bay because of the exceptional porosity of the underlying rock. The industrial wastewater facility does not directly discharge to fresh or marine surface waters; however, because the canals are not lined, groundwater does interact with water in the industrial wastewater facility. Makeup water for the industrial wastewater facility comes from treated process water, rainfall, stormwater runoff, and groundwater infiltration to replace evaporative and seepage losses. Consequently, the water in the canals is hypersaline because of the effects of evaporation, with salinity concentrations approximately twice that of Biscayne Bay.

Analysis of the industrial wastewater facility temperatures has been performed using a steady-state energy balance model developed for Unit 5 in 2003. This analysis used 5 years of data to predict temperatures in the industrial wastewater facility. Depending on the time of year and plant capacity factors, the temperature of heated water from Units 1 through 4 entering the industrial wastewater facility ranges from approximately 85ºF to 105°F, while cooled water returning to the units ranges from approximately 70ºF to 90°F. The predicted average monthly temperatures in the industrial wastewater facility range from 95.9°F for water entering to 82.6°F for water leaving (i.e., cooling water intakes). The associated predicted annual average temperature difference (ΔT) across the industrial wastewater facility is 13.4°F over the 5-year period analyzed. To predict the maximum temperatures in the industrial wastewater facility, data from June 1998 was used. The highest monthly temperatures were predicted for this period, with the highest temperature reported at 106.1°F, that had cooled down to approximately 94.8°F at the south end of the industrial wastewater facility, and then further cooled to approximately 91.9°F when returning to the units. Because continuous flow through the canals occurs, spatial variations in water quality and seasonal variation, other than temperature, are not expected.

Liquid radioactive waste effluent from Units 3 & 4 is also discharged to the industrial wastewater facility. The tritium level in the cooling canals is monitored and averaged 5250 picocuries per liter during 2000-2007.

2.3.3.1.3 Section 303(d) List of Impaired Waters

Section 303(d) of the Clean Water Act requires states to develop a list of waters not meeting water quality standards or waters not supporting their designated uses. Chapter 99-223, *Laws of Florida*, sets forth the process by which the list is refined through more detailed water quality assessments. Total maximum daily loads are required for the waters determined to be impaired based on these detailed assessments because technology-based effluent limitations, current effluent limitations required by state or local authority, or other pollution-control requirements are not stringent enough to meet current water quality standards. (FDEP 2008e)

To protect present and future most beneficial uses of the waters, water quality criteria have been established for each designated use classification. While some criteria are intended to protect aquatic life, others are designed to protect human health (FDEP 2008f). The Southeast Coast/Biscayne Bay is given surface water Class III-recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife classification.

Biscayne Bay, Card Sound, and Card Sound Canal do not appear on the 2006 Florida 305(b) Report of impaired waters, and are not listed in Section 303(d) impaired waters. Biscayne Bay is described as having "fairly good water quality" (FDEP 2006b).

As shown in Figure 2.3-67, there are only three Section 303(d)-listed waters in the Southeast Florida Coast Water Basin and located within 15 miles of Units 6 & 7. These waters are FL-3303 or C-111 Canal (Aerojet Canal), FL-3033A (a stream in South Dade County), and FL-3304 Canal (Military Canal located at Homestead Air Reserve Base). The closest Section 303(d)-listed water to Units 3 & 4 is the Military Canal at Homestead Air Reserve Base, which is approximately 5 miles from the Units 6 & 7 plant area. The Florida Keys, located just south of Biscayne Bay, are Section 303(d)-listed waters impaired for nutrients. The Homestead Air Reserve Base is impaired for cadmium, copper, and lead. The Aerojet Canal is impaired for dissolved oxygen and mercury and the FL-3033A stream is impaired for dissolved oxygen and nutrients. Because the Units 6 & 7 plant area is not located close to surface waters on the Section 303(d) list and does not have an intake from or discharge to these water bodies, there would be no interaction between Units 6 & 7 and these Section 303(d)-listed water bodies.

2.3.3.1.4 Surface Water Pollutant Sources

Figure 2.3-68 shows the National Pollutant Discharge Elimination System (NPDES) discharges within 15 miles of Units 6 & 7. The closest industrial NPDES discharger to Units 6 & 7, located adjacent to the plant area, but not permitted to discharge to waters of the state of Florida or waters of the United States, is Units 1 through 5 (Permit Number: FL0001562). All the other permitted NPDES discharges shown on Figure 2.3-68 are remotely located in relation to the plant and, therefore, would not interact with Units 6 & 7.

2.3.3.2 Groundwater

Groundwater in the vicinity of the Turkey Point plant property is not used as a water source because of its salinity. The state of Florida has classified these as Class G-III waters to identify groundwater that has no reasonable potential as a future source of drinking water due to high total dissolved solids content (Merritt 1996). Field-measured groundwater quality indicator parameters (temperature, pH, dissolved oxygen, specific conductivity, turbidity, and oxidation-reduction potential) obtained during the collection of samples from 12 observation wells (installed in the Biscayne aquifer as part of the site characterization investigation) for field-measured parameters are summarized in Table 2.3-22. The results of the laboratory analyses are presented in Table 2.3-23. The state of Florida has conducted an extensive characterization of the background water quality in the major aquifer systems (FGS 1992). Table 2.3-22 and 2.3-23 also present typical geochemical parameters for the Biscayne aquifer, the Floridan aquifer, and precipitation at Everglades National Park.

This data was taken from the surficial aquifer at depths of approximately 20 or 100 feet below local ground surface. The location of these wells is shown in Figure 2.3-25.

Chemically, the water in the middle confining unit is similar to seawater, but salinity varies greatly at the top of the unit as the upward moving saline water from the Lower Floridan is blended with the seaward flowing freshwater in the Upper Floridan aquifer (Meyer 1989).

Although the Upper Floridan aquifer is a major source of potable groundwater in much of Florida, water withdrawn from the unit in southeastern Florida, including Miami-Dade County, is brackish and variable with chloride and dissolved solid concentrations greater than 1000 mg/L. Groundwater samples from the Upper Floridan aquifer production wells at Unit 5 show an average chloride concentration of 2900 mg/L.

Treated wastewater, sanitary waste, blowdown, and treated liquid radioactive waste effluent would be injected into the Boulder Zone of the Lower Floridan aquifer via injection wells that would terminate approximately 2900-3000 feet below grade. Subsurface injection, the practice of emplacing fluids in a permeable underground aquifer by gravity flow or under pressure through an injection well, is one of a variety of wastewater disposal or reuse methods applied in Florida. Permits for underground injection wells are issued by the FDEP Underground Injection Control Program. The injection wells permitted by the FDEP Underground Injection Control Program are divided into the EPA's five classes (Class I through Class V) based on the similarity in the fluids injected, activities, construction, injection depth, design, and operating techniques (FDEP 2008b, U.S. EPA 2008b). Class I wells are used for discharging wastewater to the Boulder Zone of the Lower Floridan aquifer, where the wastewater from Units 6 & 7 would be injected. The closest facility to Units 6 & 7 currently permitted for subsurface injection is the MDWASD, approximately 9 miles north, which injects secondary treated municipal wastewater. This facility has 13 active Florida Class I wells (wells used to inject nonhazardous waste or municipal waste below the lowermost underground sources of drinking water). The next closest facility to Units 6 & 7 that is permitted for Class I deep well injection is more than 30 miles north with two active wells. Miami-Dade County injects 91.31 million gpd (average annual) to injection wells. Florida has more than 125 active Class I wells, with the majority of these wells being used to dispose nonhazardous, secondary treated effluent from domestic wastewater treatment plants, like the MDWASD (FDEP 2008c).

Additionally, the EPA's *Relative Risk Assessment of Management Options for Treated Wastewater in South Florida* evaluated the potential stressors to human health or ecology (U.S. EPA Apr 2003). These potential stressors include any dissolved or entrained wastewater constituents that may reach receptors in sufficient concentrations to cause adverse human health or ecological effects. In this evaluation, water quality data was obtained from the MDWASD South District Wastewater Treatment Plant, which receives secondary treatment (secondary treatment is the standard practice for municipal wastewater treatment facilities in South Florida). This data was compared to the EPA's maximum contaminant levels for drinking water. Drinking water standards are a good indicator of the health of the groundwater in the Boulder Zone because aquifers above the Boulder Zone are used for drinking water in Florida. It was concluded that South Florida's municipal wastewater (Dade County, Miami-Dade North District) that has received secondary treatment does not exceed the EPA's primary drinking water standard maximum contaminant levels for any constituents at the point of injection to the Boulder Zone. Although FDEP §62-520-410 does not require non-potable water use groundwater aquifers Class G-IV to meet primary drinking water standards, the fact that the Boulder Zone does meet the EPA's primary drinking water standard maximum contaminant levels is indicative of the health of the groundwater.

Section 2.3 References

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Table 2.3-1
East Miami-Dade County Drainage Subbasin Areas and Outfall Structures

Subbasin Name	Major Canal	Drainage Area	Outfall Structure	Structure Type	Design Headwater Stage	Structure Design Discharge
		Square mile			Feet NGVD 29	Cubic feet per second
C-9[(a)]	Snake Creek Canal (C-9)	98	S-29	Spillway, 4 gates	3.0	4780
C-8	Biscayne Bay Canal (C-8)	31.5	S-28	Spillway, 2 gates	2.3	3220
C-7	Little River Canal (C-7)	35	S-27	Spillway, 2 gates	3.2	2800
C-6	Miami Canal (C-6)	69	S-26 S-25B	Spillway, 2 gates Spillway, 2 gates	4.4 4.4	3400 2000
C-5	Comfort Canal (C-5)	2.3	S-25	Culvert	2.5	260
C-4	Tamiami Canal (C-4)[(b)]	60.9	S-25A	Gated Culvert	N/A[(c)]	N/A
C-3	Coral Gables Canal (C-3)	18	G-97	Weir	4.5	640
C-2	Snapper Creek Canal (C-2)	53	S-22	Spillway, 2 gates	3.5	1950
C-100	C-100 Canal	40.6	S-123	Spillway, 2 gates	2.0	2300
C-1	Black Creek Canal (C-1)	56.9	S-21	Spillway, 3 gates	1.9	2560
C-102	C-102 Canal	25.4	S-21A	Spillway, 2 gates	1.9	1330
C-103	Mowry Canal (C-103)	40.6	S-20F	Spillway, 3 gates	1.9	2900
Homestead	Military Canal	4.7	S-20G	Spillway, 1 gate	2.0	900
North Canal	North Canal[(d)]	7.8	S-20F	Spillway, 3 gates	1.9	2900
Florida City	Florida City Canal[(e)]	12.5	—	—	—	—
Model Land	Model Land Canal	28.1	S-20	Spillway, 1 gate	1.5	450
C-111	C-111 Canal	100	S-197	Gated Culvert	1.4	550

(a) Subbasin C-9 combines areas C-9 West and C-9 East, as shown in Figure 2.3-12
(b) Joins with Subbasins C-5 and C-6 and outflows through S-25 and S-25B
(c) N/A indicates data not available
(d) Outflows through S-20F
(e) No outflow structure joins with the L-31E Canal
Source: Cooper and Lane 1987

Table 2.3-2
Summary of Data Records for Gage Stations at S-197, S-20, S-21A and S-21 Flow Control Structures

Structure	Database Key[(a)]	Station[(b)]	Latitude[(c)]	Longitude[(c)]	Subbasin[(d)]	Data Type[(e)]	Frequency	Statistics	Agency	Start Date[(f)]	End Date[(f)]
S-197	04994	S197_C	251713.4	802629.2	MODEL	FLOW	Daily	Mean	SFWMD	19690623	20000330
	HA458	S197_C	251713.4	802629.2	MODEL	FLOW	Daily	Mean	SFWMD	19971231	Ongoing
	15763	S197_C	251713.4	802629.2	MODEL	FLOW	Daily	Mean	SFWMD	19700101	Ongoing
	04990	S197_H	251713.4	802629.2	MODEL	STG	Daily	Mean	SFWMD	19690623	19930428
	13093	S197_H	251713.4	802629.2	MODEL	STG	Daily	Mean	SFWMD	19900921	19990629
	HA459	S197_H	251713.4	802629.2	MODEL	STG	Daily	Mean	SFWMD	19980129	Ongoing
S-20	13037	S20_H	252201.4	802235.2	FLA CITY	STG	Daily	Mean	SFWMD	19900530	Ongoing
	03846	S20_H	252201.4	802235.2	FLA CITY	STG	Daily	Mean	SFWMD	19671228	19920526
	13036	S20_S	252201.4	802235.2	FLA CITY	FLOW	Daily	Mean	SFWMD	19900530	Ongoing
	03850	S20_S	252201.4	802235.2	FLA CITY	FLOW	Daily	Mean	SFWMD	19680229	19910826
S-21A	04708	S21A_H	253109.4	802046.2	C1	STG	Daily	Mean	SFWMD	19720817	19900130
	06601	S21A_H	253109.4	802046.2	C1	STG	Daily	Mean	SFWMD	19850831	Ongoing
	04712	S21A_S	253109.4	802046.2	C1	FLOW	Daily	Mean	SFWMD	19740116	19900130
	06777	S21A_S	253109.4	802046.2	C1	FLOW	Daily	Mean	SFWMD	19850831	Ongoing
S-21	06597	S21_H	253235.5	801951.4	DA-4	STG	Daily	Mean	SFWMD	19840117	Ongoing
	00677	S21_H	253235.5	801951.4	DA-4	STG	Daily	Mean	USGS	19671001	20041020
	06776	S21_S	253235.5	801951.4	DA-4	FLOW	Daily	Mean	SFWMD	19840117	Ongoing
	00679	S21_S	253235.5	801951.4	DA-4	FLOW	Daily	Mean	USGS	19691101	20040930

(a) Record identification number for SFWMD DBHYDRO database
(b) Suffix designation: C – Culvert, H – Headwaters, S – Spillway
(c) Latitude/longitude format: ddmmss.s, dd – Degrees, mm – Minutes, ss.s – Seconds, latitudes in degrees North, longitudes in degrees West
(d) MODEL - Model Land subbasin, FLA CITY – Florida City subbasin, C1 – C1 subbasin, DA-4 – Dade subbasin 4
(e) Flow – flow discharge, STG – stage
(f) Date Format: yyyymmdd, where yyyy – Year, mm – Month, dd – Day
Source: SFWMD 2009

Table 2.3-3 (Sheet 1 of 2)
Mean Monthly Flows at the Canal C-111 Structure S-197

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	19.278	96.74	45	15.411	8.538	4.083	0	0
1973	0	0	0	0	0	0	3.64	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	4.905	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	79.304	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	26.519	17.269	0	0
1979	0	0	0	0	65.356	0	0	0	47.398	49.93	0	0
1980	0	0	0	0	0	0	76.507	78.337	240.179	29.640	112.646	0
1981	0	52.891	0	0	0	0	0	239.978	536.729	105.378	0	0
1982	0	0	0	0	0	170.247	28.94	0	63.522	129.102	144.590	0
1983	96.527	373.798	452.039	79.333	0	334.074	100.896	157.914	328.885	12.586	0	0
1984	0	0	51.403	0	82.276	0	116.553	43.698	14.174	0	0	0
1985	0	0	0	0	0	0	60.308	0	134.999	0	0	0
1986	0	0	0	0	0	60.811	0	290.441	110.000	0	8.963	6.990
1987	58.032	0	0	0	0	0	0	0	41.852	250.42	92.859	0
1988	0	0	0	0	0	342.095	0	916.717	39.972	92.99	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	46.051	0	0
1992	0	0	0	0	0	459.429	94.048	115.695	82.059	0	0	0
1993	0	0	0	0	0	0	0	0	0	41.968	0	0
1994	0	0	0	0	0	0	0	0	74.269	95.552	332.916	0
1995	0	0	0	0	0	341.752	125.366	269.349	122.944	690.039	8.278	0

Table 2.3-3 (Sheet 2 of 2)
Mean Monthly Flows at the Canal C-111 Structure S-197

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996	0	0	0	0	0	257.087	8.231	0	0	178.448	0	0
1997	0	0	0	0	0	505.727	0	0	82.344	0	0	16.801
1998	0	0	0	0	0	0	0	0	472.435	0	27.967	0
1999	0	0	0	0	0	0	0	0	74.81	608.412	0	0
2000	0	0	0	0	0	0	0	0	21.391	393.893	0	0
2001	0	0	0	0	0	0	0	80.273	40.494	219.259	0	0
2002	0	0	0	0	0	134.37	132.425	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	30.410	26.294	0	0
2004	0	0	0	0	0	0	0	0	0	38.366	0	0
2005	0	0	0	0	0	113.481	0	444.112	349.756	167.782	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	24.685	0	0	0	113.736	0	0
2008	0	0	0	0	0	0	0	70.182	—	—	—	—
Mean	3.963	10.941	12.909	2.034	4.280	74.867	20.303	69.923	77.465	87.137	19.164	0.626

Source: SFWMD 2009

Table 2.3-4 (Sheet 1 of 2)
Mean Monthly Water Level at the Canal C-111 Structure S-197 (Headwater)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	1.518	1.506	1.290	0.732	0.232	1.346	1.513	1.316	1.350	1.519	1.464	1.207
1971	0.851	0.619	0.136	-0.467	-0.535	0.461	1.224	1.278	1.451	1.519	1.529	1.407
1972	1.348	1.315	1.148	1.284	1.364	1.717	1.660	1.490	1.675	1.667	1.654	1.512
1973	1.465	1.407	1.188	0.790	0.376	0.760	1.477	1.676	1.721	1.690	1.538	1.375
1974	1.389	1.027	0.348	-0.239	-0.072	1.076	1.347	1.444	1.477	1.580	1.387	1.395
1975	1.197	0.856	0.231	-0.468	0.375	1.179	1.628	1.574	1.497	1.516	1.513	1.289
1976	1.011	0.905	0.733	0.594	1.041	1.697	1.485	1.706	1.778	1.617	1.499	1.389
1977	1.414	1.328	1.114	0.521	1.267	1.593	1.388	1.483	1.866	1.679	1.565	1.608
1978	1.556	1.611	1.590	1.334	1.505	1.629	1.749	1.728	1.999	1.995	1.832	1.608
1979	1.579	1.415	1.009	0.503	1.697	1.625	1.581	1.603	1.820	1.934	1.682	1.723
1980	1.594	1.620	1.476	1.359	1.328	1.736	1.749	1.778	1.865	1.893	1.838	1.797
1981	1.617	1.592	1.565	0.976	0.536	1.133	1.317	1.536	1.929	1.791	1.774	1.558
1982	1.366	1.168	0.940	1.038	1.477	1.741	1.593	1.686	1.796	2.079	2.014	1.805
1983	1.848	2.122	2.107	2.161	1.549	1.955	1.807	2.030	2.272	2.161	2.004	1.698
1984	1.576	1.372	1.289	1.248	0.922	1.773	1.912	2.099	2.150	2.094	1.759	1.612
1985	1.472	1.354	1.226	1.336	1.257	1.346	2.023	2.215	2.358	2.522	2.310	1.900
1986	1.862	1.548	1.552	1.664	1.245	1.847	2.315	2.353	2.405	1.914	1.818	1.854
1987	1.952	1.607	1.782	1.466	1.482	1.414	1.713	1.841	2.091	2.633	2.621	2.381
1988	1.953	1.623	1.357	0.927	1.564	2.350	2.629	2.309	2.627	2.455	1.883	1.664
1989	1.488	1.205	1.028	1.279	1.155	1.025	1.792	1.983	2.032	1.801	1.661	1.560
1990	1.334	1.014	0.972	1.034	0.859	1.492	1.548	2.160	2.095	2.147	1.707	1.614
1991	1.529	1.345	1.350	1.172	1.335	2.170	1.965	2.021	2.493	2.594	2.114	1.715
1992	1.617	1.583	1.396	1.305	0.857	1.848	2.145	1.982	2.428	2.068	2.120	1.830

Table 2.3-4 (Sheet 2 of 2)
Mean Monthly Water Level at the Canal C-111 Structure S-197 (Headwater)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993	2.138	1.821	1.667	1.555	1.290	2.121	2.018	2.014	2.316	2.472	2.224	1.722
1994	1.721	1.937	1.852	1.537	1.785	1.992	1.595	2.078	2.569	2.531	2.414	2.500
1995	2.445	2.122	1.899	1.685	1.962	2.194	2.427	2.549	2.656	2.603	2.392	1.931
1996	1.894	1.602	1.421	1.093	1.339	2.271	2.043	1.811	2.167	2.400	1.929	1.687
1997	1.684	1.654	1.382	1.144	1.354	2.385	2.258	2.356	2.574	2.275	1.760	2.185
1998	1.928	2.180	2.268	2.016	1.962	1.743	1.719	2.103	2.195	2.373	2.281	1.937
1999	1.926	1.718	1.441	0.877	1.035	1.957	2.152	2.217	2.521	2.549	2.379	2.172
2000	2.190	2.125	1.878	1.796	1.319	1.801	2.117	2.431	2.519	2.514	1.996	1.949
2001	1.648	1.314	1.116	0.832	1.212	1.253	1.994	2.368	2.433	2.560	2.446	2.229
2002	2.078	1.777	1.586	1.110	0.709	2.231	2.507	2.369	2.368	2.023	1.710	1.905
2003	1.605	1.326	1.423	1.763	1.953	2.376	2.073	2.396	2.583	2.411	2.419	2.266
2004	1.856	1.941	1.560	1.140	0.976	0.827	1.239	2.257	2.349	2.269	2.253	1.939
2005	1.640	1.503	1.439	1.450	1.399	2.321	2.422	2.445	2.732	2.645	2.354	2.230
2007	1.666	1.595	1.531	1.596	1.715	2.311	2.547	2.291	2.169	2.519	2.189	1.765
2008	1.600	1.528	1.343	1.597	1.255	1.593	2.152	2.345	2.456	—	—	—
Mean	1.650	1.509	1.333	1.130	1.161	1.688	1.876	1.990	2.162	2.138	1.946	1.780

Source: SFWMD 2009

Table 2.3-5 (Sheet 1 of 2)
Mean Monthly Flows in the Canal L-31E at Structure S-20

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	—	—	—	3.2	0
1969	1.507	0	25.242	4.747	0	42.24	32.724	0	106.301	80.99	284.187	
1970	0	0	0	0	0	4.567	-0.173	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0.289	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0.777	0.052	1.165	0.085
1975	0	0	0	0	0	0	0.078	0	0.17	0	0	0
1976	0	0	0	0	0	0	0	3.701	75.683	0.243	0	0
1977	0	0	0	0	30.657	59.678	0	0	116.304	9.482	0	0
1978	0	0	0	0	0	4.948	1.159	16.284	21.56	45.93	24.549	0
1979	0	0	0	0	0	0	0	8.022	57.789	80.121	0	0
1980	23.595	0	0	0	0	59.211	35.737	26.648	45.653	40.799	26.491	0
1981	0	0	0	0	0	0	0	105.314	128.263	83.247	0	0
1982	0	0	0	0	0	40.808	0	0	0	11.921	0	0
1983	40.372	0	0	0	2.832	0	0	0	106.754	0	0.219	0
1984	0	0	0	0	0	0	0	0	0.582	38.388	0	0
1985	0	0	0	0	0	0	57.109	58.302	22.063	38.642	0	0
1986	0	0	0	0	0	15.749	41.475	0.087	0	15.926	1.833	0
1987	43.152	0	23.583	0.016	0	0	0	0	22.114	106.246	46.753	0
1988	0	0	0	0	0	161.759	149.41	179.534	38.577	0	0	0
1989	0	0	0	0	0	0	0	38.758	0.219	0	0	0
1990	0	0	0	0	0	0	0	106.017	45.836	10.81	0	0

Table 2.3-5 (Sheet 2 of 2)
Mean Monthly Flows in the Canal L-31E at Structure S-20

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	0	0.095	0.159	2.227	0.251	0	0	0	0	149.682	49.295	
1992	N/A[(a)]	0	2.307	0	0	81.074	149.633	62.117	86.822	0	0	0
1993	0	0	0	0	0	0	0	25.621	57.057	N/A	N/A	N/A
1994	N/A	N/A	0	0	0	0	0	0.115	63.734	108.26	103.73	70.832
1995	0	0	0.868	0	0	95.945	57.231	90.961	109.186	201.169	28.057	0
1996	0	0	0	0	0	187.071	114.843	0.298	0	49.303	0	0.033
1997	0	0.078	0	0	0	603.788	0	143.963	399.966	7.812	0	63.708
1998	0	17.561	0	0	0	N/A	N/A	N/A	N/A	0	0.027	0.038
1999	N/A	N/A	N/A	0	0	59.886	22.741	52.061	52.330	119.456	42.276	0.188
2000	1.274		0	0	0	0	0	0	51.708	76.003	-4.708	0
2001	0	0	0	0	0	20.359	21.717	51.343	76.752	31.414	19.377	0
2002	-4.001	0	0	0	0	102.642	129.294	0.003	0	0	0.000	0.042
2003	0.003	0.010	0	0	0	0	0.001	0	39.591	60.012	51.666	0.023
2004	0.066	0	0.052	0	0	0	0.001	0	0	0	N/A	N/A
2005	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2006	0	0	0	0	0	0	108.994	0.008	0.000	0.035	0.001	0
2007	0	0	0	0	0	88.319	76.108	0	35.958	-19.527	N/A	N/A
2008	0	0	0	0	0	0	0	102.019	0	—	—	—
Mean	3.117	0.522	1.450	0.189	0.912	45.230	27.733	29.755	48.937	38.469	19.945	4.217

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-6 (Sheet 1 of 2)
Mean Monthly Water Levels in the L-31E Canal at Structure S-20 (Headwaters)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	0.924	0.785	0.574	0.216	1.697	2.092	2.096	1.763	1.877	2.454	1.469	1.016
1969	1.272	1.089	1.232	1.121	1.277	2.006	1.744	1.557	1.846	2.004	1.873	1.404
1970	1.228	1.210	0.867	0.496	0.435	1.566	1.622	1.205	1.485	1.783	1.473	1.067
1971	0.790	0.761	0.401	-0.040	-0.102	0.793	1.295	1.465	1.617	1.755	1.901	1.550
1972	1.379	1.320	1.003	1.333	1.480	1.832	1.678	1.532	1.958	1.894	1.855	1.473
1973	1.496	1.496	1.356	1.258	0.826	1.004	1.853	1.788	2.091	2.175	1.875	1.600
1974	1.382	1.014	0.706	0.594	0.902	1.428	1.811	1.869	1.800	2.299	1.823	1.702
1975	1.364	1.234	0.968	0.551	1.082	1.601	2.265	1.977	1.827	1.801	1.800	1.451
1976	1.132	0.984	0.956	0.982	1.230	2.230	1.964	1.948	2.087	1.954	1.655	1.424
1977	1.318	1.230	1.209	0.982	1.754	1.844	1.506	1.762	2.071	1.994	1.806	1.732
1978	1.491	1.566	1.535	1.344	1.592	1.949	1.846	1.889	2.110	2.259	2.179	1.731
1979	1.645	1.234	1.015	0.803	1.762	1.883	1.592	1.642	2.054	2.153	1.947	1.807
1980	1.523	1.617	1.312	1.412	1.285	1.925	2.036	2.018	2.132	2.045	2.067	1.830
1981	1.432	1.505	1.342	0.956	1.030	1.318	1.367	2.010	2.354	2.408	2.348	1.683
1982	1.140	1.194	1.092	1.459	1.854	2.192	2.039	2.079	1.894	2.336	2.350	1.927
1983	1.814	2.101	1.809	1.422	0.902	1.729	1.870	2.041	2.170	2.278	2.064	1.592
1984	1.587	1.321	1.318	1.186	1.066	2.177	2.191	2.125	2.202	2.273	1.980	1.639
1985	1.429	1.378	1.390	1.300	1.488	1.685	2.212	2.184	2.378	2.334	2.058	1.895
1986	1.731	1.390	1.356	1.486	1.432	1.967	1.944	1.978	2.137	2.029	1.830	1.944
1987	1.901	1.539	1.831	1.441	1.618	1.632	1.886	2.063	2.108	2.384	2.301	1.946
1988	1.748	1.564	1.362	1.228	1.825	2.289	2.256	2.335	2.123	2.237	1.933	1.590
1989	1.406	1.339	1.355	1.504	1.548	1.548	2.073	2.198	2.224	2.154	1.886	1.722
1990	1.513	1.338	1.433	1.508	1.414	1.900	2.035	2.149	2.023	2.083	1.918	1.564

Table 2.3-6 (Sheet 2 of 2)
Mean Monthly Water Levels in the L-31E Canal at Structure S-20 (Headwaters)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	1.355	1.242	1.358	1.233	1.380	2.260	2.004	1.730	2.260	2.529	2.207	1.636
1992	1.507	1.495	1.303	1.436	1.104	2.018	2.228	1.847	1.808	2.090	1.872	1.592
1993	1.951	1.789	1.450	1.459	1.253	2.179	1.892	2.072	2.057	2.197	1.728	1.624
1994	1.688	1.784	1.782	1.351	1.674	2.031	1.670	1.961	2.201	2.295	2.391	2.083
1995	1.814	1.467	1.495	1.399	1.708	2.150	2.140	2.141	2.267	2.332	1.985	1.598
1996	1.640	1.378	1.242	1.137	1.428	2.039	1.901	1.730	2.156	2.235	1.985	1.655
1997	1.760	1.782	1.342	1.364	1.720	2.291	2.159	2.082	2.158	2.124	1.775	1.963
1998	1.739	2.067	1.955	1.412	1.359	1.658	1.684	1.952	2.069	1.966	2.063	1.724
1999	1.716	1.443	1.213	0.969	1.433	2.181	2.010	2.159	2.282	2.679	2.085	1.758
2000	1.380	1.230	1.347	1.211	1.782	2.063	2.022	2.096	2.435	1.771	1.964	0.000
2001	1.615	1.158	1.233	1.099	1.599	1.631	2.125	1.997	2.073	2.216	2.179	1.737
2002	1.411	1.417	1.475	1.162	1.167	2.172	2.055	2.047	2.101	1.802	1.787	1.724
2003	1.356	1.232	1.365	1.653	1.789	1.948	1.698	1.924	2.118	1.937	2.050	1.729
2004	1.458	1.626	1.305	1.188	1.170	0.980	1.296	1.846	1.958	2.034	1.932	1.446
2005	1.275	1.303	1.211	1.240	1.302	2.127	2.025	2.180	2.300	2.035	1.533	1.371
2006	1.227	1.321	1.086	1.355	1.413	1.980	1.880	1.914	1.989	2.051	1.804	1.659
2007	1.553	1.491	1.266	1.682	1.914	2.205	2.066	2.049	2.083	2.375	N/A[(a)]	N/A
2008	1.437	1.409	1.378	1.437	1.263	1.658	1.921	1.988	2.108	—	—	—
Mean	1.476	1.386	1.274	1.179	1.362	1.858	1.901	1.934	2.073	2.144	1.942	1.605

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-7 (Sheet 1 of 2)
Mean Monthly Flows in the Princeton Canal at Structure S-21A

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1974	9.435	0	0	0	0	0	32.84	55.339	54.278	49.674	75.27	82.035
1975	4.747	0	0	0	0	3.025	95.608	35.223	30.335	33.959	20.947	1.215
1976	0	7.712	0	0	18.548	117.709	44.113	73.103	83.76	38.139	35.222	32.355
1977	2.655	4.198	0	0	64.372	112.828	64.626	83.935	176.795	65.827	45.415	19.826
1978	20.417	38.995	37.522	43.604	38.447	102.558	84.474	59.364	N/A[(a)]	N/A	N/A	N/A
1979	N/A	N/A	13.417	68.191	1051.47	307.851	375.055	372.993	98.64	376.168	320.883	294.474
1980	67.74	21.967	56.912	57.65	13.838	210.051	179.707	187.95	114.565	153.029	195.734	102.176
1981	44.347	51.843	37.898	10.1	0	0	0	383.346	285.008	73.878	119.334	23.698
1982	0.007	11.398	0.647	125.831	83.497	313.143	153.097	154.617	100.653	215.819	250.798	102.82
1983	189.691	469.708	1333.76	334.007	57.05	99.966	60.42	160.741	274.665	139.755	111.76	93.85
1984	70.448	74.615	81.103	63.543	27.797	94.174	142.746	41.639	69.896	73.726	79.649	66.527
1985	27.484	3.726	21.169	4.88	6.728	8.845	62.25	22.043	31.973	25.926	14.955	45.541
1986	78.845	27.175	61.792	31.395	1.78	57.659	33.898	58.089	107.032	52.864	69.996	60.653
1987	50.722	24	59.869	8.248	8.674	15.223	92.143	57.107	126.581	189.892	164.684	94.396
1988	47.966	33.688	31.374	0.239	40.66	258.467	68.005	212.75	34.153	55.578	32.958	11.474
1989	21.769	12.651	9.38	33.061	17.165	2.189	33.193	84.996	39.75	47.731	28.744	9.885
1990	0	0	8.298	29.27	34.061	36.054	88.441	137.671	87.143	123.553	53.003	4.9
1991	0	0.76	7.084	1.446	86.171	172.545	100.563	63.064	121.688	253.953	107.368	75.455
1992	64.85	52.447	54.478	54.825	1.999	382.2	96.134	243.132	127.167	122.511	221.32	86.207
1993	171.185	68.823	78.011	69.455	55.609	143.798	73.026	43.203	105.048	182.708	135.688	91.928
1994	85.937	152.05	83.005	99.623	56.702	73.905	46.621	122.298	196.47	137.074	381.629	128.094
1995	117.867	44.154	39.982	51.118	79.55	238.251	124.943	179.08	151.179	346.364	120.264	52.75
1996	66.487	35.889	30.943	18.43	63.053	269.232	83.949	99.303	115.444	185.69	66.505	30.116

Table 2.3-7 (Sheet 2 of 2)
Mean Monthly Flows in the Princeton Canal at Structure S-21A

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	107.126	33.513	23.898	28.421	10.995	350.415	61.169	118.172	232.901	92.902	68.711	132.915
1998	67.46	118.244	130.06	43.857	7.093	9.721	31.652	138.74	275.595	98.768	186.898	49.636
1999	96.239	55.918	28.174	0.003	6.797	183.58	105.567	152.807	247.516	507.426	136.659	128.483
2000	97.294	80.866	56.941	63.135	17.474	67.439	108.355	131.344	138.044	474.344	79.037	223.266
2001	55.809	16.575	34.604	25.216	38.249	82.513	157.76	169.212	321.322	382.933	201.383	110.312
2002	75.508	74.604	102.733	30.66	5.745	280.486	364.62	80.11	369.277	123.284	147.597	107.289
2003	34.029	7.663	65.534	90.772	164.064	226.718	70.154	240.216	237.285	162.985	231.379	112.74
2004	114.212	121.945	54.576	14.329	1.654	0.009	44.222	183.182	225.799	285.275	147.807	103.87
2005	55.799	33.831	52.935	17.276	19.514	365.851	145.679	423.939	408.996	253.485	161.395	56.957
2006	67.375	94.428	66.376	42.824	44.279	46.991	180.394	117.288	185.094	102.259	108.915	93.871
2007	68.548	67.974	17.493	40.3	45.059	186.579	176.821	78.382	141.404	203.069	135.269	26.473
2008	8.28	5.932	19.43	72.587	11.467	110.57	103.732	217.908	122.309	—	—	—
Mean	58.538	54.332	77.126	44.980	62.273	140.873	105.314	142.351	159.934	170.623	129.005	80.491

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-8 (Sheet 1 of 2)
Mean Monthly Water Levels in the Princeton Canal at Structure S-21A (Headwaters)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1974	1.332	1.129	1.138	0.815	0.959	1.213	1.383	1.555	1.725	1.901	2.253	0.76
1975	1.475	1.187	0.842	0.42	0.528	N/A[(a)]	N/A	N/A	N/A	N/A	N/A	N/A
1976	N/A	1.731	1.827	1.914	2.001	2.088	2.168	2.158	2.137	2.116	2.096	2.022
1977	1.579	1.6	1.174	1.016	1.433	1.496	1.628	1.763	2.147	2.218	2.095	1.846
1978	1.694	1.558	1.754	1.783	1.895	1.975	1.989	1.992	1.968	1.947	1.742	1.721
1979	1.683	1.463	1.345	0.744	1.157	1.369	1.689	2.014	2.245	2.086	1.609	2.028
1980	1.761	1.765	1.683	1.666	1.922	1.801	1.819	1.97	1.945	1.819	1.665	1.566
1981	1.4	1.453	1.454	1.538	1.262	1.44	2.134	2.087	1.684	1.665	2.071	1.903
1982	2.068	1.969	1.73	1.786	1.762	1.576	1.732	1.953	2.169	2.073	1.928	1.579
1983	1.659	1.106	1.466	1.458	1.512	1.603	1.504	1.695	1.498	1.878	N/A	N/A
1984	N/A	N/A	N/A	1.369	1.314	1.208	1.398	2.145	2.113	1.998	1.931	1.73
1985	1.553	1.556	1.501	1.722	1.623	1.738	1.69	1.501	1.832	1.931	1.815	1.803
1986	1.584	1.391	1.591	1.543	1.84	1.912	1.985	2.058	2.13	2.151	1.909	1.629
1987	1.535	1.941	1.629	1.724	1.839	1.905	1.97	2.037	2.103	2.023	1.727	1.522
1988	1.611	1.66	1.709	1.834	2.025	1.798	1.714	1.692	2.036	2.098	1.443	1.598
1989	1.759	1.689	1.598	1.557	1.736	1.759	1.793	1.828	1.863	1.868	1.818	1.536
1990	1.746	1.595	1.773	1.694	1.636	2.098	2.051	1.999	2.056	1.847	1.891	1.89
1991	1.722	1.719	1.866	1.714	1.616	2.056	2.07	2.09	2.061	1.864	1.613	1.373
1992	1.534	1.619	1.668	1.684	1.609	1.682	2.038	1.885	1.913	1.782	1.449	1.284
1993	1.318	1.57	1.493	1.655	1.818	1.941	2.077	2.106	2.046	1.753	1.376	1.356
1994	1.284	1.444	1.497	1.55	2.039	2.078	2.089	2.046	1.682	1.484	1.528	1.433
1995	1.254	1.437	1.685	1.675	1.77	1.787	1.864	1.582	1.659	1.571	1.206	1.619
1996	1.677	1.705	1.608	1.705	2.041	1.736	1.818	2.047	1.94	1.548	1.459	1.64

Table 2.3-8 (Sheet 2 of 2)
Mean Monthly Water Levels in the Princeton Canal at Structure S-21A (Headwaters)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	1.416	1.719	1.728	1.723	2.086	1.801	2.037	2.03	1.843	1.701	1.433	1.439
1998	1.66	1.373	1.486	1.537	2.002	2.045	2.113	1.668	1.802	1.7	1.35	1.726
1999	1.615	1.663	1.717	1.734	1.969	1.727	1.957	1.955	1.934	1.869	1.409	1.303
2000	1.434	1.654	1.68	1.728	1.923	1.968	2.043	1.997	2.017	1.711	1.45	1.597
2001	1.681	1.733	1.71	1.717	2.064	2.062	1.999	1.555	1.608	1.693	1.515	1.309
2002	1.457	1.634	1.616	1.698	1.614	1.599	1.646	2.074	1.624	1.393	1.303	1.277
2003	1.622	1.949	1.834	1.666	1.63	1.514	1.663	1.526	1.621	1.524	1.495	1.311
2004	1.275	1.348	1.682	1.733	1.941	1.463	1.73	1.476	1.394	1.523	1.384	1.261
2005	1.502	1.724	1.695	1.726	1.997	1.518	1.885	1.908	1.607	1.646	1.46	1.967
2006	1.66	1.654	1.665	1.815	1.875	2.094	1.732	1.862	2.018	1.731	1.364	1.425
2007	1.668	1.67	1.812	2.039	2.114	1.998	2.002	2.068	2.003	1.78	1.451	1.846
2008	1.816	1.721	1.911	1.894	2.003	1.998	2.04	1.791	1.867	—	—	—
Mean	1.577	1.592	1.605	1.588	1.730	1.766	1.866	1.886	1.891	1.815	1.632	1.572

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-9 (Sheet 1 of 2)
Mean Monthly Flows in the Black Creek Canal at Structure S-21

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1969	—	—	—	—	—	—	—	—	—	—	363.533	203.935
1970	113.071	86.357	87.516	3.667	32.742	223.973	405.839	136.645	144.733	199.161	113.723	5.71
1971	0	0	0	0	0	11.4	38.977	206.452	433.767	141.00	161.8	56.194
1972	23.742	17.586	31.645	26.88	152.213	392.303	206.742	170.774	249.433	173.613	150.133	71.348
1973	49.839	54.571	9.935	3.523	0	10.5	94.742	299.419	334.667	159.29	43.053	10.806
1974	64.00	0	0	0	0	0	152.871	123.103	135.767	189.419	76.113	71.452
1975	1.677	0	0	0	4.323	62.08	195.323	132.29	126.833	212.452	184.2	45.71
1976	0	19.041	3.774	0	72.548	403.567	146.774	322.29	373.1	133.355	156.533	81.00
1977	82.871	39.336	3.548	0	337.871	256.533	212.935	208.806	714.2	227.71	169.133	149.706
1978	N/A[(a)]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	286.452	266.867	53.077
1979	39.742	2.118	0.742	147.133	376.935	121.4	168.226	126.129	342.033	348.968	87.667	115.574
1980	83.00	81.807	55.581	70.833	102.323	263.8	206.968	268.516	320.7	165.226	193.333	60.00
1981	28.419	80.036	26.903	0	0	0	0	551.645	791.133	303.129	142.473	66.839
1982	81.161	146.786	81.174	236.367	187.329	417.567	153.903	231.968	496.067	318.935	367.033	144.194
1983	109.871	325.332	387.806	190.7	42.774	1151.23	184.968	433.868	459.6	316.29	126.667	86.29
1984	46.903	31.966	127.577	31.583	136.739	355.8	463.613	516.097	558.567	595.677	26.067	0
1985	0	0.304	0.003	0	0	11.647	245.968	135.132	195.9	143.968	139.593	135.384
1986	89.077	9.621	89.677	20.667	25.842	146.213	95.161	130.929	108.333	73.032	50.967	77.935
1987	85.839	44.893	47.226	28.467	53.29	7.467	42.161	10.226	83.133	219.226	69.138	46.903
1988	25.774	14.759	8.871	4.333	59.8	531.967	153.323	422.467	46.367	70.867	24.207	3.567
1989	4.1	4.607	3.733	2.933	57.259	15.133	63.00	52.129	33.2	38.097	30.233	13.355
1990	34.52	149.292	256.088	160.496	33.442	317.631	131.319	198.869	94.819	146.608	35.793	7.291
1991	0.484	0.357	0.286	14.881	48.113	207.505	179.625	284.815	375.555	528.618	116.626	4.474

Table 2.3-9 (Sheet 2 of 2)
Mean Monthly Flows in the Black Creek Canal at Structure S-21

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1992	0.381	1.42	15.937	13.568	7.465	347.896	171.25	192.409	474.359	89.909	226.841	29.021
1993	222.444	47.409	44.073	110.976	85.589	354.5	119.3	90.136	152.886	342.589	109.203	9.018
1994	43.762	174.738	71.703	60.836	110.167	167.21	89.916	271.454	594.523	575.636	662.847	268.017
1995	367.651	226.985	80.073	65.508	106.159	450.776	403.799	619.149	566.021	832.155	396.028	81.116
1996	94.213	56.224	32.052	0	84.74	588.074	207.946	126.247	266.319	176.66	169.56	10.228
1997	28.792	11.903	0	16.576	73.356	24.883	186.66	252.386	464.535	166.624	24.263	239.284
1998	208.252	351.905	334.38	133.637	129.326	31.362	128.917	109.435	152.856	408.19	451.057	94.114
1999	228.022	91.506	23.212	6.516	51.438	306.899	273.907	341.364	249.443	-199.16	184.773	36.565
2000	22.748	37.451	24.186	71.223	18.967	60.176	195.201	283.803	194.159	323.833	49.375	190.364
2001	21.085	0	2.363	12.046	85.385	80.084	290.448	528.428	312.307	332.213	118.061	116.599
2002	157.957	69.728	212.451	13.274	6.501	321.608	655.617	475.612	429.076	150.229	349.113	285.442
2003	118.357	50.457	89.819	80.03	421.771	648.237	298.798	488.602	586.424	384.12	430.864	51.456
2004	15.993	234.295	20.356	4.065	33.779	0.119	15.127	551.962	468.00	461.935	424.301	229.754
2005	3.429	0	6.63	1.704	33.513	576.389	566.696	248.34	430.815	343.049	65.844	157.406
2006	72.209	53.517	26.728	15.268	24.845	25.007	473.775	339.882	546.94	263.886	149.359	65.278
2007	15.796	12.107	0.003	54.565	18.664	398.945	192.742	83.746	172.323	470.974	287.835	9.794
2008	6.197	21.613	6.103	62.842	16.64	231.963	372.791	593.504	367.183	—	—	—
Mean	68.194	67.106	58.215	43.818	79.785	250.575	215.403	277.869	338.055	266.156	184.467	86.774

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-10 (Sheet 1 of 2)
Mean Monthly Water Levels in the Black Creek Canal at Structure S-21

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1969	1.784	1.799	1.747	1.867	1.792	1.798	1.972	2.015	2.062	2.064	2.043	1.796
1970	2.043	2.052	2.064	2.182	1.794	1.995	2.026	2.144	2.154	2.153	2.196	2.192
1971	1.905	1.659	1.279	0.768	0.564	1.41	2.192	2.162	2.042	2.082	2.111	2.177
1972	2.198	2.157	2.042	1.887	1.961	1.942	1.909	1.973	2.013	2.002	1.971	2.033
1973	2.06	2.041	2.107	1.611	1.075	1.176	1.99	1.931	1.946	1.995	2.046	2.024
1974	2.012	2.042	1.42	0.858	0.793	1.643	2.006	2.025	2.028	2.073	2.11	2.072
1975	2.257	1.944	1.467	0.752	1.193	2.092	1.928	2.059	2.008	2.015	2.029	2.133
1976	2.144	2.017	2.059	1.565	1.93	1.933	2.088	1.959	1.927	2.008	2.076	2.162
1977	2.197	2.26	2.207	1.669	1.795	1.901	1.994	1.948	1.928	1.949	1.969	1.909
1978	N/A[(a)]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.157	2.13	2.197
1979	2.244	2.203	1.934	1.476	2.066	2.175	2.105	2.148	2.079	2.135	2.274	2.213
1980	2.26	2.276	2.282	2.304	2.319	2.194	2.135	2.136	2.118	2.175	2.159	2.238
1981	2.349	2.239	2.32	1.932	1.695	1.965	2.197	2.005	1.95	2.202	2.459	2.116
1982	1.903	1.925	1.946	1.916	2.079	2.109	2.12	1.94	2.221	2.07	2.089	2.237
1983	2.07	1.886	1.843	1.668	1.863	1.842	2.221	2.166	1.876	2.029	1.833	1.818
1984	1.891	1.917	1.905	1.986	1.736	2.119	2.021	2.103	2.145	2.152	2.253	2.23
1985	2.03	2.071	2.05	2.079	1.898	2.122	2.142	2.235	2.211	2.208	2.274	2.256
1986	2.04	2.356	1.982	2.207	2.247	2.178	2.223	2.214	1.973	2.248	2.328	2.105
1987	1.838	1.888	2.172	2.048	2.128	2.281	2.263	2.356	2.268	2.133	2.225	2.245
1988	2.273	2.332	2.304	2.154	2.287	2.032	2.197	1.647	2.353	2.207	2.317	2.206
1989	2.196	2.142	1.983	2.021	1.974	1.924	2.225	2.264	2.298	2.293	2.269	2.229
1990	2.072	1.891	1.999	2.298	2.084	2.32	2.243	2.223	2.232	2.21	2.303	2.233
1991	1.959	1.904	2.034	1.952	1.925	2.229	2.181	2.097	2.098	2.095	2.256	2.251

Table 2.3-10 (Sheet 2 of 2)
Mean Monthly Water Levels in the Black Creek Canal at Structure S-21

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1992	2.276	2.351	2.126	2.346	1.955	1.814	2.104	2.08	N/A	2.115	1.795	2.214
1993	2.044	2.185	2.116	2.138	2.234	1.653	1.926	2.123	2.059	2.07	2.132	2.28
1994	2.209	1.969	2.164	2.18	2.13	2.037	2.156	2.054	1.657	1.838	1.853	1.655
1995	1.536	1.497	1.681	1.938	2.106	1.854	1.978	1.636	1.656	1.561	1.507	1.743
1996	1.713	1.764	1.831	2.137	2.195	1.781	1.866	2.182	2.001	1.884	1.808	2.113
1997	2.165	2.264	2.243	2.223	2.098	1.863	2.065	2.03	1.817	2.078	2.255	1.939
1998	2.008	1.695	1.846	2.08	2.132	2.21	2.078	1.97	1.838	1.64	1.581	2.035
1999	1.985	2.173	2.265	2.241	2.211	1.951	1.98	1.964	1.997	1.72	1.947	2.214
2000	2.259	2.227	2.251	2.117	2.206	2.146	2.074	1.957	2.059	1.849	1.863	2.039
2001	2.259	2.138	2.074	2.193	2.174	2.162	1.971	1.968	1.81	1.924	1.794	1.692
2002	1.563	1.958	1.977	2.199	1.9	1.841	1.818	2.201	1.859	1.782	1.679	1.54
2003	1.691	1.774	1.685	1.729	1.969	2.023	1.919	1.929	2.017	2.096	2.076	2.206
2004	2.221	1.948	2.249	2.216	2.188	1.873	1.958	1.859	1.74	1.838	1.751	1.771
2005	2.037	2.179	2.227	2.147	2.188	1.701	2.014	1.86	1.798	1.814	1.829	2.036
2006	2.209	2.203	2.238	2.244	2.121	2.262	2.054	1.961	2.032	2.122	1.713	1.814
2007	2.29	2.263	2.224	2.152	2.246	1.887	2.048	2.128	2.106	2.102	2.093	2.302
2008	2.269	2.196	2.154	2.135	2.237	2.171	1.881	1.673	1.876	—	—-	—
Mean	2.057	2.039	2.006	1.931	1.928	1.957	2.050	2.023	1.996	2.022	2.030	2.062

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-11
NOAA Tide Gages Surrounding the Turkey Point Plant Property and Corresponding Tidal Range

Site Number	Site Name	Latitude	Longitude	Start Date	End Date	Great Diurnal Tide Range[(a)] Feet
8723289	Cutler, Biscayne Bay, FL	25° 36.9'	80° 18.3'	5/1/1970	3/31/1972	2.13
8723355	Ragged Key No. 5, Biscayne Bay, FL	25° 31.4'	80° 10.5'	8/1/1987	9/30/1987	1.68
8723393	Elliott Key (Outside), FL	25° 28.6'	80° 10.8'	7/1/1974	7/31/1974	2.53
8723409	Elliott Key Harbor, Elliott Key, FL	25° 27.2'	80° 11.8'	7/1/1974	8/31/1987	1.66
8723423	Turkey Point, Biscayne Bay, FL	25° 26.2'	80° 19.8'	5/1/1970	8/31/1993	1.78
8723465	East Arsenicker, Card Sound, FL	25° 22.4'	80° 17.4'	12/1/1971	2/29/1972	1.02
8723439	Billys Point, Elliott Key, FL	25° 24.9'	80° 12.6'	7/1/1974	7/31/1974	1.64
8723506	Pumpkin Key, Card Sound, FL	25° 19.5'	80° 17.6'	8/1/1987	9/30/1987	0.75
8723534	Card Sound Bridge, FL	25° 17.3'	80° 22.2'	5/1/1970	7/31/1971	0.63
8723214[(b)]	Virginia Key, FL	25° 43.9'	80° 9.7'	1/1/1996	9/30/2008	2.24
8723970[(b)]	Vaca Key, FL	24° 42.7'	81° 6.3'	12/1/1995	9/30/2008	0.97
8724580[(b)]	Key West, FL	24° 33.2'	81° 48.5'	11/27/1973	9/30/2008	1.81

(a) Great diurnal tide range is the difference between the mean higher high and mean lower low tide levels
(b) Active stations

Source: NOAA 2008b, NOAA 2008c, NOAA 2008d, and NOAA 2008e

Table 2.3-12
Highest and Lowest (Top 10) Tidal Levels at NOAA Virginia Key, Florida; Vaca Key, Florida; and Key West, Florida Gages for the Data Period Given in Table 2.3-10

	Virginia Key[(a)]				Vaca Key[(b)]				Key West[(c)]			
	Highest		Lowest		Highest		Lowest		Highest		Lowest	
Rank	feet NAVD 88	Date[(d)]	feet NAVD 88	Date[(d)]	feet NAVD 88	Date[(d)]	feet NAVD 88	Date[(d)]	feet NAVD 88	Date[(d)]	feet NAVD 88	Date[(d)]
1	2.79	20051024	–3.28	19940329	5.43	20051024	–2.39	19710204	3.18	20051024	–3.42	19140412
2	2.17	20050920	–3.06	19960217	1.19	20050826	–2.26	19890409	1.98	19650908	–3.42	19280219
3	2.15	19941115	–2.91	19980101	1.06	19741007	–2.24	19760112	1.69	20050921	–3.32	19260212
4	2.12	19991015	–2.88	20010110	1.03	20080926	–2.23	19860815	1.57	19980925	–3.32	19131227
5	1.92	20080926	–2.88	20030119	1.01	19991016	–2.23	19911220	1.42	20011105	–3.32	19160106
6	1.81	20080926	–2.87	20041215	1.01	20080905	–2.22	19710510	1.37	20080926	–3.32	19201225
7	1.78	20080927	–2.86	19960308	0.98	20011106	–2.22	19740103	1.31	20080910	–3.32	19240518
8	1.74	20080925	–2.86	20030120	0.93	19790119	–2.21	19731223	1.30	19951026	–3.16	19891214
9	1.74	20080928	–2.84	20041213	0.89	20011105	–2.21	19770407	1.27	19951025	–3.12	19880320
10	1.72	20051016	–2.82	20010206	0.87	20080930	–2.21	19790131	1.25	20080925	–3.11	19940329

(a) Tidal elevations converted from station datum to NAVD 88, which is located 12.13 feet above the station datum (NOAA 2008c)
(b) Tidal elevations converted from station datum to NAVD 88, which is located 3.88 feet above the station datum (NOAA 2008d)
(c) Tidal elevations converted from station datum to NAVD 88, which is located 6.32 feet above the station datum (NOAA 2008e)
(d) Date format: yyyymmdd, where, yyyy – Year, mm – Month, and dd - Day

Source: NOAA 2008c, NOAA 2008d, NOAA 2008e

Table 2.3-13
Freshwater Inflow to Biscayne Bay from Drainage Canals over the Period from 1994 to 2003

	Canal Input (Cubic Feet per Second)		
	Annual Mean	Wet Season	Dry Season
North Bay			
Snake Creek	335.8	537.3	191.9
Arch Creek	1.4	1.4	1.5
Biscayne Canal	132.5	224.2	66.9
Little River	220.0	306.6	158.2
Miami River Canal	530.0	535.0	526.0
Total	1219.7	1604.5	944.5
Central Bay			
Coral Gables Waterway	15.9	30.6	5.4
Snapper Creek	186.7	316.8	93.8
Cutler Drain	46.1	86.6	19.0
Total	248.7	434.0	118.2
South Bay			
Military Canal	21.9	36.0	11.8
Mowry Canal	231.5	354.9	143.3
Black Creek	223.4	357.1	127.9
Princeton Canal	126.3	187.8	82.4
Total	603.1	935.8	365.4
Grand mean	2071.5	2974.3	1428.1

Source: Cacci and Boyer 2005

Table 2.3-14
Summary of Observation Well Construction Data

Well Number	Borehole Depth (feet bgs)	Well Depth (feet bgs)	Coordinates (Florida East State Plane) in feet		Screened Interval (feet bgs)	Top of Casing Elevation (feet NAVD 88)	Height of Casing (feet above ground service)	Pad Elevation (feet NAVD 88)
			Northing	Easting				
OW-606D	137.0	136.0	396962.8	876712.9	125–135	1.70	3.2	–1.6
OW-606L	110.0	108.0	396979.9	876732.6	97–107	1.31	2.8	–1.5
OW-606U	30.2	29.0	396938.0	876734.8	18–28	1.37	3.2	–1.8
OW-621L	110.0	109.6	397364.5	876970.0	98.6–108.6	3.07	3.0	0.1
OW-621U	30.0	28.4	397375.8	876930.0	17.4–27.4	3.88	3.3	0.6
OW-636L	111.0	108.1	395290.8	877257.2	97.1–107.1	2.89	3.4	–0.4
OW-636U	29.8	28.0	396960.1	875864.4	17–27	2.82	3.4	–0.6
OW-706D	138.4	135.1	396960.1	875864.4	123.8–133.8	2.22	3.3	–1.1
OW-706L	112.0	111.0	396978.2	875904.6	100–110	2.26	3.2	–1.0
OW-706U	29.0	28.0	396940.1	875895.7	17–27	1.70	3.2	–1.5
OW-721L	109.0	107.0	397321.5	876120.3	96–106	2.06	3.2	–1.2
OW-721U	26.0	25.0	397361.2	876121.4	14–24	2.07	3.1	–1.1
OW-735L	110.0	107.9	395824.3	875669.5	96.9–106.9	2.70	3.4	–0.7
OW-735U	28.0	27.0	395823.3	875709.2	16–26	2.82	3.3	–0.5
OW-802L	110.0	109.0	398817.1	876255.7	98–108	2.16	3.3	–1.2
OW-802U	27.0	26.0	398820.2	876243.7	15–25	2.23	3.4	–1.2
OW-805L	97.0	96.0	396883.0	877239.5	85–95	2.25	3.7	–1.5
OW-805U	30.0	29.0	396842.8	877240.9	18–28	1.28	2.8	–1.6
OW-809L	110.0	106.5	397007.9	875152.3	95.5–105.5	2.38	3.3	–0.9
OW-809U	27.0	26.0	397045.8	875152.4	15–25	2.55	3.2	–0.7
OW-812L	109.0	108.0	368892.8	875045.5	97–107	2.15	3.3	–1.2
OW-812U	27.0	26.0	398933.9	875043.5	15–25	2.22	3.0	–0.8

Table 2.3-15 (Sheet 1 of 4)
Vertical Hydraulic Gradients

Well Pair	Date/Time	Tide Condition	Upper Screened Interval Midpoint (feet NAVD 88)	Lower Screened Interval Midpoint (feet NAVD 88)	ΔL (feet)	Upper Reference Head (feet NAVD 88)	Lower Reference Head (feet NAVD 88)	Δh (feet)	Vertical Hydraulic Gradient i (feet/feet)
OW-606U/L	6/29/2008 7:00	High	–24.8	–103.5	78.7	–0.55	0.12	0.67	0.008
OW-606U/L	6/29/2008 14:00	Low	–24.8	–103.5	78.7	–0.84	–0.17	0.67	0.008
OW-606U/L	8/15/2008 10:00	High	–24.8	–103.5	78.7	–0.22	0.34	0.56	0.007
OW-606U/L	8/15/2008 17:00	Low	–24.8	–103.5	78.7	–0.64	–0.09	0.54	0.007
OW-606U/L	1/20/2009 19:00	High	–24.8	–103.5	78.7	—1.74	–1.27	0.47	0.006
OW-606U/L	1/21/2009 2:00	Low	–24.8	–103.5	78.7	–2.36	–1.89	0.47	0.006
OW-606U/L	7/15/2009 7:00	High	–24.8	–103.5	78.7	–0.22	0.32	0.54	0.007
OW-606U/L	7/15/2009 14:00	Low	–24.8	–103.5	78.7	–0.38	0.16	0.54	0.007
OW-621U/L	6/29/2008 7:00	High	–21.8	–103.5	81.7	–0.39	0.81	1.19	0.015
OW-621U/L	6/29/2008 14:00	Low	–21.8	–103.5	81.7	–0.69	0.49	1.19	0.015
OW-621U/L	8/15/2008 10:00	High	–21.8	–103.5	81.7	–0.70	1.12	1.16	0.014
OW-621U/L	8/15/2008 17:00	Low	–21.8	–103.5	81.7	–0.04	0.68	1.17	0.014
OW-621U/L	10/5/2008 1:00	High	–21.8	–103.5	81.7	–0.49	2.34	1.11	0.014
OW-621U/L	10/5/2008 8:00	Low	–21.8	–103.5	81.7	1.22	1.86	1.10	0.013
OW-621U/L	1/20/09 19:00	High	–21.8	–103.5	81.7	–1.58	–0.31	1.28	0.016
OW-621U/L	1/21/09 2:00	Low	–21.8	–103.5	81.7	–2.22	–0.93	1.29	0.016
OW-621U/L	7/15/09 7:00	High	–21.8	–103.5	81.7	0.07	0.49	0.42	0.005
OW-621U/L	7/15/09 14:00	Low	–21.8	–103.5	81.7	–0.10	0.32	0.42	0.005
OW-621U/L	1/15/10 11:00	High	–21.8	–103.5	81.7	0.64	1.07	0.43	0.005
OW-621U/L	1/15/10 18:00	Low	–21.8	–103.5	81.7	0.24	0.66	0.42	0.005
OW-636U/L	6/29/2008 7:00	High	–22.6	–102.5	79.9	–0.32	0.02	0.34	0.004
OW-636U/L	6/29/2008 14:00	Low	–22.6	–102.5	79.9	–0.65	–0.28	0.37	0.005

Table 2.3-15 (Sheet 2 of 4)
Vertical Hydraulic Gradients

Well Pair	Date/Time	Tide Condition	Upper Screened Interval Midpoint (feet NAVD 88)	Lower Screened Interval Midpoint (feet NAVD 88)	∆L (feet)	Upper Reference Head (feet NAVD 88)	Lower Reference Head (feet NAVD 88)	∆h (feet)	Vertical Hydraulic Gradient i (feet/feet)
OW-636U/L	8/15/2008 10:00	High	–22.6	–102.5	79.9	0.01	0.35	0.34	0.004
OW-636U/L	8/15/2008 17:00	Low	–22.6	–102.5	79.9	–0.43	–0.05	0.38	0.005
OW-636U/L	10/5/2008 1:00	High	–22.6	–102.5	79.9	1.20	1.01	0.29	0.004
OW-636U/L	10/5/2008 8:00	Low	–22.6	–102.5	79.9	0.72	0.46	0.30	0.004
OW-636U/L	7/15/2009 7:00	High	–22.6	–102.5	79.9	0.18	0.29	0.28	0.004
OW-636U/L	7/15/2009 14:00	Low	–22.6	–102.5	79.9	0.01	0.44	0.28	0.004
OW-636U/L	1/15/2010 11:00	High	–22.6	–102.5	79.9	0.49	1.00	0.51	0.006
OW-636U/L	1/15/2010 18:00	Low	–22.6	–102.5	79.9	0.12	0.66	0.54	0.007
OW-706U/L	1/15/2010 11:00	High	–23.5	–106	82.5	0.46	0.95	0.48	0.006
OW-706U/L	1/15/2010 18:00	Low	–23.5	–106	82.5	0.23	0.72	0.49	0.006
OW-735U/L	6/29/2008 7:00	High	–21.5	–102.6	81.1	–0.12	2.18	2.30	0.028
OW-735U/L	6/29/2008 14:00	Low	–21.5	–102.6	81.1	–0.24	2.07	2.31	0.028
OW-735U/L	8/5/2008 10:00	High	–21.5	–102.6	81.1	0.15	2.44	2.28	0.028
OW-735U/L	8/15/2008 17:00	Low	–21.5	–102.6	81.1	–0.12	2.18	2.30	0.028
OW-735U/L	10/5/2008 1:00	High	–21.5	–102.6	81.1	1.48	3.54	2.06	0.025
OW-735U/L	10/5/2008 8:00	Low	–21.5	–102.6	81.1	1.26	3.33	2.07	0.025
OW-735U/L	7/15/2009 7:00	High	–21.5	–102.6	81.1	0.93	1.21	0.28	0.003
OW-735U/L	7/15/2009 14:00	Low	–21.5	–102.6	81.1	0.82	1.10	0.28	0.003
OW-735U/L	1/15/2010 11:00	High	–21.5	–102.6	81.1	1.67	2.05	0.38	0.005
OW-735U/L	1/15/2010 18:00	Low	–21.5	–102.6	81.1	1.47	1.86	0.39	0.005
OW-805U/L	6/29/2008 7:00	High	–24.6	–91.5	66.9	–0.51	0.45	0.96	0.014
OW-805U/L	6/29/2008 14:00	Low	–24.6	–91.5	66.9	–0.86	0.09	0.95	0.014
OW-805U/L	8/15/200810:00	High	–24.6	–91.5	66.9	–0.18	0.71	0.89	0.013

Table 2.3-15 (Sheet 3 of 4)
Vertical Hydraulic Gradients

Well Pair	Date/Time	Tide Condition	Upper Screened Interval Midpoint (feet NAVD 88)	Lower Screened Interval Midpoint (feet NAVD 88)	∆L (feet)	Upper Reference Head (feet NAVD 88)	Lower Reference Head (feet NAVD 88)	∆h (feet)	Vertical Hydraulic Gradient i (feet/feet)
OW-805U/L	8/15/2008 17:00	Low	–24.6	–91.5	66.9	–0.66	0.29	0.95	0.014
OW-805U/L	10/5/2008 1:00	High	–24.6	–91.5	66.9	1.03	1.95	0.92	0.014
OW-805U/L	10/5/2008 8:00	Low	–24.6	–91.5	66.9	0.52	1.44	0.93	0.014
OW-805U/L	1/20/2009 19:00	High	–24.6	–91.5	66.9	–1.69	–0.79	0.90	0.013
OW-805U/L	1/21/2009 2:00	Low	–24.6	–91.5	66.9	–2.32	–1.41	0.90	0.013
OW-805U/L	7/15/2009 7:00	High	–24.6	–91.5	66.9	–0.08	0.45	0.54	0.008
OW-805U/L	7/15/2009 14:00	Low	–24.6	–91.5	66.9	–0.25	0.28	0.54	0.008
OW-805U/L	1/15/2010 11:00	High	–24.6	–91.5	66.9	0.59	1.13	0.54	0.008
OW-805U/L	1/15/2010 18:00	Low	–24.6	–91.5	66.9	0.15	0.70	0.55	0.008
OW-809U/L	6/29/2008 7:00	High	–20.7	–101.4	80.7	–0.42	0.57	0.99	0.012
OW-809U/L	6/29/2008 14:00	Low	–20.7	–101.4	80.7	–0.50	0.49	0.99	0.012
OW-809U/L	8/15/2008 10:00	High	–20.7	–101.4	80.7	–0.17	0.71	0.88	0.011
OW-809U/L	8/15/2008 17:00	Low	–20.7	–101.4	80.7	–0.39	0.49	0.88	0.011
OW-809U/L	10/5/2008 1:00	High	–20.7	–101.4	80.7	1.26	2.06	0.80	0.010
OW-809U/L	10/5/2008 8:00	Low	–20.7	–101.4	80.7	1.11	1.90	0.79	0.010
OW-809U/L	1/20/2009 19:00	High	–20.7	–101.4	80.7	–1.67	–0.89	0.78	0.010
OW-809U/L	1/21/2009 2:00	Low	–20.7	–101.4	80.7	–2.28	–1.51	0.77	0.010
OW-809U/L	7/15/2009 7:00	High	–20.7	–101.4	80.7	–0.06	0.85	0.91	0.011
OW-809U/L	7/15/2009 14:00	Low	–20.7	–101.4	80.7	–0.15	0.75	0.90	0.011
OW-812U/L	6/29/2008 7:00	High	–20.8	–103.2	82.4	–0.19	0.70	0.89	0.011
OW-812U/L	6/29/2008 14:00	Low	–20.8	–103.2	82.4	–0.29	0.58	0.87	0.011
OW-812U/L	8/15/2008 10:00	High	–20.8	–103.2	82.4	0.05	0.95	0.89	0.011
OW-812U/L	8/15/2008 17:00	Low	–20.8	–103.2	82.4	–0.18	0.71	0.89	0.011

Table 2.3-15 (Sheet 4 of 4)
Vertical Hydraulic Gradients

Well Pair	Date/Time	Tide Condition	Upper Screened Interval Midpoint (feet NAVD 88)	Lower Screened Interval Midpoint (feet NAVD 88)	ΔL (feet)	Upper Reference Head (feet NAVD 88)	Lower Reference Head (feet NAVD 88)	Δh (feet)	Vertical Hydraulic Gradient i (feet/feet)
OW-812U/L	7/15/2009 7:00	High	–20.8	–103.2	82.4	0.47	0.71	0.24	0.003
OW-812U/L	7/15/2009 14:00	Low	–20.8	–103.2	82.4	0.38	0.61	0.24	0.003
OW-812U/L	1/15/2010 11:00	High	–20.8	–103.2	82.4	1.27	1.27	0.00	0.000
OW-812U/L	1/15/2010 18:00	Low	–20.8	–103.2	82.4	1.12	1.10	–0.01	0.000

Δh = Lower Reference Head — Upper Reference Head
ΔL = Lower Screened Interval Midpoint — Upper Screened Interval Midpoint
i = Δh/ΔL (negative value indicates downward flow potential and positive value indicates upward flow potential)
Reference Head values are estimated using the density of water in the well and correcting the water level to the average density of seawater in Biscayne Bay.

Table 2.3-16
Representative Hydrogeologic Properties in Miami-Dade County[a]

Hydrogeologic Unit or Subunit	Hydraulic Conductivity (feet per day)		Porosity	Approximate Depth (feet bgs)	Unit Thickness (feet)
	Horizontal	Vertical			
Biscayne aquifer	1524	15	0.31	0–230	230
Intermediate confining unit	90	0.1–2.38	0.1–0.31	230–840	610
Upper Floridan aquifer	42	0.42–2.38	0.1–0.32	840–2060	1220
Middle confining unit	4.7	0.04–1.50[b]	0.1–0.43	2060–2550	490
Lower Floridan aquifer	0.01	0.1	0.1–0.4	2550–2750	200[c]
Boulder Zone	6540	65	0.2	2750–3250	500

(a) Values in this table represent weight and averages for risk assessment for measurement of treated wastewater and thus may not be representative of actual conditions.
(b) The vertical hydraulic conductivity included here may be two to three orders of magnitude higher than other measurements in South Florida. Maliva et. al. 2007 indicates a vertical hydraulic conductivity range of 3E-04 to 3E-05 feet per day based on core measurements.
(c) The Lower Floridan aquifer extends below the Boulder Zone; the thickness presented is only for the portion above the Boulder Zone.

Adapted from U.S. EPA 2003

Table 2.3-17 (Sheet 1 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
Florida Keys Aqueduct Auth Jr Dean WTP-Florida City[a]	APT	08-OCT-2003 0000	FKAAFCEW1	818,318	403,673	280	10,790	72		880	1,353				Upper Floridan Aquifer	Specific capacity: 15 gpm/ft **Water was blended with raw water from Biscayne aquifer well field and apt initiated as step test to accommodate discharge to sewer system. Initial pump rate of 280 gpm; increased to 500 gpm and 750 gpm for first 24 hours. Rate decreased to 600 gpm for remainder of test as TDS concentration rose at 750 gpm.
Florida Keys Aqueduct Auth Jr Dean WTP-Florida City[a]	Packer	02-JUL-2003 0000	FKAAFCEW1	818,318	403,673	25	29			1,050	1,150				Upper Floridan Aquifer	Packer test #1 Specific capacity: 0.3 gpm/ft Salt plug in well was not completely purged prior to start of test- the initial static water level assumed to be the level to which the water level in the drill stem recovered at conclusion of test.
Florida Keys Aqueduct Auth Jr Dean WTP-Florida City[a]	Packer	09-JUL-2003 0000	FKAAFCEW1	818,318	403,673	85				1,220	1,283				Upper Floridan Aquifer	Packer test #2 Specific capacity: 12 gpm/ft Parameters not analyzed-no typical pump or recovery curves-water level responded so quickly to the start and stop of test.

Table 2.3-17 (Sheet 2 of 7)
Regional Aquifer Properties

Site	Test Type(c)	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
Florida Keys Aqueduct Auth Jr Dean WTP-Florida City(a)	Packer	10-JUL-2003 0000	FKAAFCEW1	818,318	403,673	82	2,200			1,150	1,213				Upper Floridan Aquifer	Packer test #3 Specific capacity: 3 gpm/ft.
Florida Keys Aqueduct Auth Jr Dean WTP-Florida City(a)	Packer	22-JUL-2003 0000	FKAAFCEW1	818,318	403,673	60	492			880	1,040				Upper Floridan Aquifer	Packer test #4 Specific capacity: 2 gpm/ft.
Homestead Air Force Base(a)	Step-Draw down	25-DEC-1991 0000	G-3314	801,450	426,168		1,000,000			21	48	37,000			Surficial Aquifer System	Step drawdown test. Limits of the aquifer testing resulted in the transmissivity and conductivity values being greater than the values listed. For example the transmissivity may say 1,000,000 but it was actually 1,000,000+.
Camp Owaissa-Bauer(a)	Step-Draw down	25-DEC-1991 0000	G-3315	833,217	432,443		1,000,000			32	69	27,000			Surficial Aquifer System	Step drawdown test. Limits of the aquifer testing resulted in the transmissivity and conductivity values being greater than the values listed. For example the transmissivity may say 1,000,000 but it was actually 1,000,000+.

Table 2.3-17 (Sheet 3 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
Camp Owaissa-Bauer[a]	Other	25-DEC-1991 0000	G-3315	833,217	432,443		65			94	111.5	3.7			Surficial Aquifer System	Specific capacity test.
Levee 31w (At Structure 175)[a]	Other	25-DEC-1991 0000	G-3319	796,786	394,757		1,000,000			21	39.3	55,000			Surficial Aquifer System	Step drawdown test. Limits of the aquifer testing resulted in the transmissivity and conductivity values being greater than the values listed. For example the transmissivity may say 1,000,000 but it was actually 1,000,000+.
Naval Station[a]	Other	25-DEC-1991 0000	G-3320	831,332	399,726		1,000,000			32	80	21,000			Surficial Aquifer System	Step drawdown test. Limits of the aquifer testing resulted in the transmissivity and conductivity values being greater than the values listed. For example the transmissivity may say 1,000,000 but it was actually 1,000,000+.
Homestead Air Force Base Well Field 2[a]	Specific Capacity	01-JAN-2000 0000	HAFB-1	852,589	423,035	900	60,000				30				Surficial Aquifer System	Transmissivity value was estimated from specific capacity value. Prepared in cooperation with the SFWMD, this data was compiled from Metro-Dade Water and Sewer Authority or from SFWMD files.

Table 2.3-17 (Sheet 4 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
MDWASD SDWTP[a]	Packer	25-AUG-1977 0812	MDWSA_I5	876,304	442,461	50	8.54	0.7		2,737	2,759		1		Boulder Zone	Packer test 1 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	25-AUG-1977 1225	MDWSA_I5	876,304	442,461	4	12.47	3.2		2,697	2,727				Boulder Zone	Packer test 2 of 10 Pump adjusted to 7.9 gpm at time 1310 and to 23 gpm at time 1424 leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	25-AUG-1977 2317	MDWSA_I5	876,304	442,461	24.5	18.97	3.31		2,367	2,397				Boulder Zone	Packer test 3 of 10 (parts 1 & 2) Pump was stopped at 42 min into pumping at rate of 12.8 gpm (part 1); began pumping again at rate of 24.5 gpm for 2.6 hours--transmissivity is average of the two tests. Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	26-AUG-1977 0747	MDWSA_I5	876,304	442,461	61	47.43	1.55		2,407	2,759				Boulder Zone	Packer test 4 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.

Table 2.3-17 (Sheet 5 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
MDWASD SDWTP[a]	Packer	26-AUG-1977 1558	MDWSA_I5	876,304	442,461	42.5	23.98	1.28		1,968	1,998				Boulder Zone	Packer test 5 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	26-AUG-1977 1814	MDWSA_I5	876,304	442,461	61	88.48	0.5		2,008	2,759				Boulder Zone	Packer test 6 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	27-AUG-1977 1150	MDWSA_I5	876,304	442,461	55	19.38	1.88		2,543	2,573				Boulder Zone	Packer test 7 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	27-AUG-1977 1628	MDWSA_I5	876,304	442,461	33	44.17	1.78		2,583	2,759				Boulder Zone	Packer test 8 of 10 pumping rate was increased to 60 gpm at time 1733 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	28-AUG-1977 0130	MDWSA_I5	876,304	442,461	12	35.77	2.8		2,692	2,759				Boulder Zone	Packer test 9 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	28-AUG-1977 0554	MDWSA_I5	876,304	442,461	20	13.01	2.4		2,652	2,682				Boulder Zone	Packer test 10 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.

Table 2.3-17 (Sheet 6 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
Florida City[a]	Specific Capacity	01-JAN-2000 0000	S-3051	826,078	407,075	900	220,000				47.5				Surficial Aquifer System	Transmissivity value was estimated from specific capacity value. Prepared in cooperation with the SFWMD, this data was compiled from Metro-Dade Water and Sewer Authority or from SFWMD files.
Florida City[a]	Specific Capacity	01-JAN-2000 0000	S-3052	825,987	406,974	590	160,000			40	60				Surficial Aquifer System	Trasmissivity value was estimated from specific capacity value. Prepared in cooperation with the SFWMD, this data was compiled from Metro-Dade Water and Sewer Authority or from SFWMD files.
Harris Park Power Plant[a]	Specific Capacity	01-JAN-2000 0000	S-3060	833,747	414,778	3,000	240,000	4		40	60				Surficial Aquifer System	Trasmissivity value was estimated from specific capacity value. Prepared in cooperation with the SFWMD, this data was compiled from Metro-Dade Water and Sewer Authority or from SFWMD files.
Harris Park Power Plant[a]	Specific Capacity	01-JAN-2000 0000	S-3061	833,105	414,775	3,000	110,000	9		40	60				Surficial Aquifer System	Trasmissivity value was estimated from specific capacity value. Prepared in cooperation with the SFWMD, this data was compiled from Metro-Dade Water and Sewer Authority or from SFWMD files.

Table 2.3-17 (Sheet 7 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
Turkey Point Area – Floridan Aquifier System[a]	APT	24-APR-2006 0000	TKPT-PW1	874,572	402,532	4,500	33,062	72	0.0002	1,003	1,242		3	0.005	Upper Floridan Aquifer	Average of results from Hantush-Jacob, leaky confined aquifer solution. Tidal effects negligible.
Turkey Point Area – Floridan Aquifier System[a]	APT	16-OCT-1974 1000	W-12295	851,079	370,735	5,000	67,750.68	2,160	0.005	1,126	1,400		5	6.68E-06	Floridan Aquifer System	Very long-term (90 day) test. Barometric eff. Est. = 100%. Graphical plots of drawdown vs time indicated that despite the very long duration of the test full equilibrium had not been reached. Recommended values based on drawdowns from the furthest observation wells (r=2000' & r=45000'). Leakance values are based on drawdown in lower monitor zone (so leakance for middle confining unit). Estimated effective porosity = 0.30.
Turkey Point Area[b]	APT	Jun-71	GH-11B	864,806	384,465	1,380	401,070	4	0.35	15	50		5		Biscayne Aquifer	No apparent tidal influence during the test.
Turkey Point Area [b]	APT	Jun-71	GH-14A	873,673	400,465	1,380	133,690	4	0.35	15	40		6		Biscayne Aquifer	Tidal fluctuations observed during the test.
Turkey Point Area[b]	APT	Jun-71	GH-14B	873,673	400,465	1,380	200,535	2	0.2	15	50		6		Biscayne Aquifer	Tidal fluctuations observed during the test.

(a) SFWMD 2009
(b) Dames & Moore 1971
(c) APT = Aquifer Pumping Test

Table 2.3-18 (Sheet 1 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3672	16	20	4	HFC5	0.69	NM	NM	NM	27.4	2.68	core plug	1
G-3672	17	20	3	HFC5	96.3	NM	NM	NM	33.9	2.68	core plug	1
G-3672	18.25–18.75	20	1.5	HFC5	175	NM	NM	NM	37.0	2.66	core plug	1
G-3673	17–17.5	20	2.75	HFC5	654	NM	NM	NM	37.1	2.66	core plug	1
G-3674	4.25–5	10	5.63	HFC5	515	NM	NM	NM	37.5	2.67	core plug	1
G-3675	4.25–4.5	8	3.62	HFC5	98.1	NM	NM	NM	22.0	2.69	core plug	1
G-3675	4.5-5	8	3.25	HFC5	599	NM	NM	NM	29.5	2.67	core plug	1
G-3711	4	10	6	HFC5	NM	25,764	12,875	13,372	46.7	2.69	whole core	1
G-3712	6.21	10	3.79	HFC5	NM	NM	NM	14,159	47.8	2.70	whole core	1
G-3714	9.46	13	3.54	HFC5	NM	NM	NM	9,494	49.3	2.67	whole core	1
G-3770	4.05–4.22	6.7	2.61	HFC5	NM	4,564	1,531	7,099	41.6	2.66	whole core	2
G-3778	8.46–8.73	16.4	7.76	HFC5	NM	1,684	79	220	40.4	2.70	whole core	2
G-3778	9.4–9.67	16.4	6.82	HFC5	NM	11,659	10,201	1,990	45.4	2.70	whole core	2
G-3778	9.92–10.11	16.4	6.39	HFC5	NM	1,116	966	14,750	46.1	2.70	whole core	2
G-3778	11.03–11.24	16.4	5.27	HFC5	NM	19,355	19,355	2,291	41.6	2.67	whole core	2
G-3778	13.08–13.48	16.4	3.12	HFC5	NM	10,178	9,159	3,605	43.2	2.69	whole core	2
G-3778	13.48–13.90	16.4	2.71	HFC5	NM	8,638	5,757	6,157	43.2	2.69	whole core	2
G-3778	13.90–14.28	16.4	2.31	HFC5	NM	10,356	10,356	3,727	44.7	2.69	whole core	2
G-3778	14.28-14.70	16.4	1.91	HFC5	NM	8,357	7,312	2,687	44.7	2.68	whole core	2
G-3778	15.03-15.36	16.4	1.21	HFC5	NM	10,155	8,884	6,520	45.9	2.71	whole core	2
G-3779	14.93-15.26	16.2	1.07	HFC5	NM	2,703	2,101	2,121	47.0	2.72	whole core	2
G-3779	15.26–15.55	16.2	0.8	HFC5	NM	4,178	4,178	2,107	46.7	2.72	whole core	2
G-3779	15.75–15.96	16.2	0.35	HFC5	NM	17,818	9,646	1,347	44.2	2.70	whole core	2
G-3779	16.25–16.63	16.2	–0.23	HFC5	NM	7,566	3,360	3,195	45.5	2.72	whole core	2
G-3779	16.63–17.09	16.2	–0.66	HFC5	NM	7,805	6,829	2,973	47.6	2.72	whole core	2

Table 2.3-18 (Sheet 2 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3779	17.51–17.93	16.2	–1.52	HFC5	NM	6,717	4,797	3,023	44.3	2.71	whole core	2
G-3779	17.93–18.39	16.2	–1.96	HFC5	NM	7,101	4,436	2,239	44.4	2.71	whole core	2
G-3779	18.39–18.77	16.2	–2.38	HFC5	NM	8,022	5,728	2,168	44.5	2.70	whole core	2
G-3791	6.42–6.8	8	1.39	HFC5	NM	10,733	10,733	4,357	44.5	2.71	whole core	2
G-3791	7.05–7.38	8	0.78	HFC5	NM	12,695	12,695	4,423	49.4	2.69	whole core	2
G-3794	6.68–7.10	9	2.11	HFC5	NM	2,257	1,544	2,044	42.6	2.70	whole core	2
G-3675	6.0	8	2.00	HFC4	NM	9,080	2,054	NM	34.7	2.70	whole core	1
G-3683	12.5	12	–0.5	HFC4	NM	13.8	2.56	11.3	16.7	2.72	whole core	1
G-3689	15.3	9	–6.3	HFC4	NM	950	337	0.03	18.6	2.72	whole core	1
G-3692	10.8	9	–1.8	HFC4	221.32	NM	NM	NM	23.3	2.71	core plug	1
G-3694	16	10	–6	HFC4	NM	83.2	42.5	11.8	17.3	2.71	whole core	1
G-3696	19	10	–9	HFC4	NM	1,035	680	5,624	12.5	2.71	whole core	1
G-3697	12.9	9	–3.9	HFC4	NM	0.67	0.5	0.18	18.9	2.72	whole core	1
G-3697	13	9	–4	HFC4	NM	18.2	0.05	0.02	8.3	2.72	whole core	1
G-3713	9.28	10	0.72	HFC4	NM	2,204	1,835	922	27.3	2.70	whole core	1
G-3717	11.75	9	–2.75	HFC4	NM	7,017	4,302	248	11.0	2.69	whole core	1
G-3721	9.75	10	0.25	HFC4	NM	82.5	21.1	10.6	16.4	2.70	whole core	1
G-3725	9.92	6	–3.92	HFC4	NM	6,964	3,731	758	14.8	2.69	whole core	1
G-3730	9	6	–3	HFC4	NM	1,319	47.3	262	13.7	2.68	whole core	1
G-3731	9.67	6.7	–2.97	HFC4	NM	144	0.03	201	5.9	2.69	whole core	1
G-3770	4.38–4.59	6.7	2.22	HFC4	NM	2	0.3	0.02	10.1	2.70	whole core	2
G-3770	4.76–5.01	6.7	1.82	HFC4	NM	1,067	949	1,090	27.3	2.69	whole core	2
G-3771	6.85–7.1	6	–0.98	HFC4	NM	0.04	0.04	13,108	15.0	2.68	whole core	2
G-3771	7.1–7.4	6	–1.25	HFC4	NM	831	215	2,463	10.1	2.68	whole core	2
G-3771	7.4–7.7	6	–1.55	HFC4	NM	0.02	0.02	0.01	7.8	2.68	whole core	2
G-3771	7.8–8.1	6	–1.95	HFC4	NM	694	600	1	16.9	2.68	whole core	2

Table 2.3-18 (Sheet 3 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3789	10.29–10.46	8	–2.38	HFC4	NM	10,040	7,529	2,118	37.2	2.73	whole core	2
G-3790	11.6–11.85	8	–3.72	HFC4	NM	11,017	9,442	1,727	16.8	2.70	whole core	2
G-3790	17.43–17.72	8	–9.58	HFC4	NM	43	28	31	11.2	2.69	whole core	2
G-3790	18.17–18.42	8	–10.3	HFC4	NM	708	567	359	15.0	2.70	whole core	2
G-3790	18.55–18.71	8	–10.63	HFC4	NM	3,813	1,670	997	26.0	2.72	whole core	2
G-3791	14.11–14.36	8	–6.24	HFC4	NM	734	291	1,750	21.6	2.68	whole core	2
G-3791	15.45–15.68	8	–7.56	HFC4	NM	560	453	255	24.6	2.69	whole core	2
G-3792	13.15–13.35	8	–5.25	HFC4	NM	1	0.05	0.01	6.9	2.69	whole core	2
G-3794	6.82–7.09	9	2.04	HFC4	NM	31	19	16	16.1	2.71	whole core	2
G-3794	7.42–7.67	9	1.46	HFC4	NM	799	671	348	21.4	2.71	whole core	2
G-3794	8.65–8.92	9	0.22	HFC4/3	NM	366	40	19	13.1	2.70	whole core	2
G-3794	9.38–9.63	9	–0.5	HFC4	NM	869	810	391	16.2	2.72	whole core	2
G-3672	20.5	20	–0.5	HFC3	NM	750	280	0.2	13.5	2.75	whole core	1
G-3672	24	20	–4	HFC3	3,098	NM	NM	NM	32.1	2.71	core plug	1
G-3673	20–20.75	20	–0.38	HFC3	1,699	NM	NM	NM	19.1	2.70	core plug	1
G-3673	23.5–24	20	–3.75	HFC3	3,704	NM	NM	NM	30.9	2.68	core plug	1
G-3673	24.5–25	20	–4.75	HFC3	80.6	NM	NM	NM	14.6	2.71	core plug	1
G-3673	27.25–27.75	20	–7.5	HFC3	4,657	NM	NM	NM	28.8	2.70	core plug	1
G-3673	30.75–31.25	20	–11	HFC3	9,443	NM	NM	NM	20.6	2.69	core plug	1
G-3673	32–32.3	20	–12.15	HFC3	10.1	NM	NM	NM	19.3	2.68	core plug	1
G-3674	15.5–16	10	–5.75	HFC3	5,222	NM	NM	NM	27.4	2.69	core plug	1
G-3674	18	10	–8	HFC3	NM	2,428	1,582	0.05	21.0	2.70	whole core	1
G-3674	18.5–19	10	–8.75	HFC3	0.01	NM	NM	NM	20.8	2.70	core plug	1
G-3675	8	8	0	HFC3	NM	856	847	0.52	21.3	2.70	whole core	1
G-3675	9–9.5	8	–1.25	HFC3	112	NM	NM	NM	21.4	2.70	core plug	1
G-3678	23.3	9	–14.3	HFC3	NM	3,758	1,754	8,662	19.7	2.71	whole core	1

Table 2.3-18 (Sheet 4 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3679	14.6	9	–5.6	HFC3	8,818	NM	NM	NM	46.6	2.71	core plug	1
G-3679	15.6	9	–6.6	HFC3	NM	3,410	1,101	14,000	20.9	2.71	whole core	1
G-3681	15.6	9	–6.6	HFC3	NM	20.1	2.56	0.72	12.8	2.72	whole core	1
G-3688	13.3	9.5	–3.8	HFC3	NM	0.15	0.07	<0.01	6.5	2.71	whole core	1
G-3689	28.5	9	–19.5	HFC3	NM	19,323	19,323	15,112	25.8	2.72	whole core	1
G-3690	11.7	9	–2.7	HFC3	NM	202	20.8	235	10.2	2.73	whole core	1
G-3691	22.3	8	–14.3	HFC3	NM	6,501	4,332	7,474	32.4	2.71	whole core	1
G-3695	15.5	9.5	–6	HFC3	NM	0.14	0.11	0.02	10.6	2.70	whole core	1
G-3695	20	9.5	–10.5	HFC3	NM	58.5	13.7	532	16.7	2.72	whole core	1
G-3696	19.5	10	–9.5	HFC3	NM	355	291	0.12	13.9	2.71	whole core	1
G-3710	19.25	10	–9.25	HFC3	NM	11,227	11,227	12,900	22.6	2.72	whole core	1
G-3710	24.33	10	–14.33	HFC3	NM	1,315	998	9,754	14.7	2.71	whole core	1
G-3710	26.3	10	–16.3	HFC3	34,400	NM	NM	NM	35.2	2.72	core plug	1
G-3711	27.33	10	–17.33	HFC3	NM	1,031	1,007	6.18	25.9	2.71	whole core	1
G-3713	22.5	10	–9.83	HFC3	NM	27.5	0.18	840	16.0	2.71	whole core	1
G-3713	23.75	10	–13.75	HFC3	NM	31,148	29,419	8,171	32.3	2.72	whole core	1
G-3714	18.83	9	–9.83	HFC3	NM	13,356	11,685	11,642	36.6	2.71	whole core	1
G-3715	16.88	9	–7.88	HFC3	NM	2,606	1,968	2,226	31.1	2.71	whole core	1
G-3717	20.29	9	–11.29	HFC3	NM	20,592	18,303	13,217	23.4	2.71	whole core	1
G-3717	21.25	9	–12.25	HFC3	NM	16.3	10.5	92.3	20.3	2.70	whole core	1
G-3717	23.58	9	–14.58	HFC3	NM	8,458	4,229	12,213	21.8	2.70	whole core	1
G-3719	8.75	9	0.25	HFC3	NM	4.1	0.12	4.13	10.4	2.71	whole core	1
G-3719	14.57	9	–5.57	HFC3	NM	8,067	6,054	8,532	34.8	2.72	whole core	1
G-3720	18.71	9	–9.71	HFC3	NM	16,478	16,478	11,878	38.0	2.73	whole core	1
G-3722	15.62	10	–5.62	HFC3	NM	1,867	1,787	2,273	37.1	2.65	whole core	1
G-3722	17.33	10	–7.33	HFC3	NM	5,263	4,426	7,190	41.7	2.72	whole core	1

Table 2.3-18 (Sheet 5 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3724	9.67	9	–0.67	HFC3	NM	673	597	404	12.6	2.69	whole core	1
G-3724	14.08	9	–5.08	HFC3	NM	18,308	7,891	5,100	44.6	2.72	whole core	1
G-3725	18.83	6	–12.83	HFC3	NM	12,191	8,125	6,354	41.1	2.72	whole core	1
G-3728	9	7	–2	HFC3	NM	1,200	1,200	607	20.5	2.70	whole core	1
G-3730	21.58	6	–15.58	HFC3	NM	8,452	6,500	15,894	15.5	2.70	whole core	1
G-3731	11.75	10	–1.75	HFC3	NM	2,595	1,842	1,839	31.0	2.71	whole core	1
G-3734	9.13	8	–1.13	HFC3	NM	15.5	10.9	20.2	13.1	2.70	whole core	1
G-3770	9–9.29	6.7	–2.45	HFC3	NM	0.2	0.03	0.02	12.5	2.70	whole core	2
G-3770	9.46–9.67	6.7	–2.86	HFC3	NM	20	11	167	14.9	2.69	whole core	2
G-3770	9.94–10.23	6.7	–3.39	HFC3	NM	1,345	1,125	1,142	22.7	2.69	whole core	2
G-3770	10.86–11.19	6.7	–4.32	HFC3	NM	1,637	1,059	648	26.4	2.70	whole core	2
G-3770	13.9–14.34	6.7	–7.42	HFC3	NM	2,389	2,296	20,140	46.8	2.70	whole core	2
G-3770	14.34–14.74	6.7	–7.84	HFC3	NM	3,471	2,726	18,802	45.8	2.70	whole core	2
G-3770	14.74–15.07	6.7	–8.2	HFC3	NM	3,389	3,389	17,827	48.3	2.70	whole core	2
G-3770	18.49–18.78	6.7	–11.94	HFC3	NM	3,278	3,278	13,992	26.6	2.69	whole core	2
G-3771	8.60–8.85	6	–2.72	HFC3	NM	5	0.2	258	12.2	2.69	whole core	2
G-3771	8.85–9.1	6	–2.98	HFC3	NM	1,511	1,151	3,152	15.7	2.68	whole core	2
G-3771	9.5–9.77	6	–3.64	HFC3	NM	263	188	194	14.5	2.69	whole core	2
G-3771	9.89–10.1	6	–4	HFC3	NM	1,717	1,552	1,277	19.7	2.69	whole core	2
G-3771	10.23–10.56	6	–4.4	HFC3	NM	667	601	370	19.7	2.69	whole core	2
G-3771	10.56–10.85	6	–4.7	HFC3	NM	2,350	2,268	13,272	29.7	2.68	whole core	2
G-3771	11.15–11.4	6	–5.28	HFC3	NM	329	270	317	24.1	2.70	whole core	2
G-3771	11.65–11.94	6	–5.8	HFC3	NM	1,427	1,366	363	25.9	2.70	whole core	2
G-3771	12.52–12.71	6	–6.62	HFC3	NM	2,459	2,346	8,483	25.2	2.70	whole core	2
G-3771	12.98–13.19	6	–7.08	HFC3	NM	1,528	1,251	4,877	26.9	2.71	whole core	2
G-3771	13.60–13.89	6	–7.74	HFC3	NM	3,391	3,391	14,564	40.3	2.73	whole core	2

Table 2.3-18 (Sheet 6 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[a]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3771	14.06–14.4	6	–8.23	HFC3	NM	2,731	1,306	16,468	42.1	2.72	whole core	2
G-3771	16.5–16.85	6	–10.68	HFC3	NM	2,783	2,783	15,965	17.6	2.69	whole core	2
G-3771	16.88–17.09	6	–10.98	HFC3	NM	3,427	3,182	9,885	17.6	2.69	whole core	2
G-3778	15.86–16.15	16.4	0.4	HFC3	NM	0.02	0.001	0.001	7.2	2.70	whole core	2
G-3778	16.15–16.44	16.4	0.1	HFC3	NM	0.02	0.02	0.3	6.1	2.71	whole core	2
G-3778	16.69–16.82	16.4	–0.36	HFC3	NM	19	0.3	8	7.2	2.73	whole core	2
G-3778	17.24–17.59	16.4	–1.02	HFC3	NM	2,713	2,469	301	19.3	2.70	whole core	2
G-3778	26.01–26.18	16.4	–9.7	HFC3	NM	NM	NM	1,569	48.4	2.75	whole core	2
G-3778	31.06–31.16	16.4	–14.71	HFC3	NM	11,797	5,363	951	39.7	2.75	whole core	2
G-3778	31.75–31.65	16.4	–15.3	HFC3	NM	22,704	22,704	2,213	40.8	2.73	whole core	2
G-3778	35–35.17	16.4	–18.68	HFC3	NM	3,993	2,966	2,253	41.5	2.71	whole core	2
G-3778	35.54–35.87	16.4	–19.3	HFC3	NM	217	4	602	24.3	2.70	whole core	2
G-3779	21.6–21.85	16.2	–5.52	HFC3	NM	0.001	0.001	0.001	5.5	2.71	whole core	2
G-3779	21.95–22.25	16.2	–5.9	HFC3	NM	0.2	0.02	0.3	7.1	2.71	whole core	2
G-3779	24.38–24.57	16.2	–8.28	HFC3	NM	5,268	4,811	1,652	46.9	2.79	whole core	2
G-3779	25.53–26.03	16.2	–9.58	HFC3	NM	7,228	6,424	4,169	50.2	2.81	whole core	2
G-3779	26.95–27.18	16.2	–10.86	HFC3	NM	14,754	NM	2,103	45.5	2.76	whole core	2
G-3779	35.06–35.37	16.2	–19.02	HFC3	NM	9,319	6,211	3,806	28.1	2.72	whole core	2
G-3789	13.68–13.93	8	–5.8	HFC3	NM	2,470	1,082	159	8.6	2.70	whole core	2
G-3789	14.59–14.76	8	–6.68	HFC3	NM	7,529	6,694	1,333	31.4	2.72	whole core	2
G-3789	15.85–16.08	8	–7.96	HFC3	NM	1,249	1,067	512	26.0	2.71	whole core	2
G-3789	19.63–19.94	8	–11.78	HFC3	NM	12,974	12,974	3,645	31.1	2.74	whole core	2
G-3789	20.15–20.44	8	–12.3	HFC3	NM	12,213	10,855	2,566	21.5	2.72	whole core	2
G-3789	20.86–21.24	8	–13.05	HFC3	NM	5,315	4,961	3,274	32.6	2.74	whole core	2
G-3789	21.49–21.93	8	–13.71	HFC3	NM	4,336	3,716	4,770	29.3	2.74	whole core	2
G-3789	22.06–22.56	8	–14.31	HFC3	NM	7,484	6,235	4,189	33.5	2.75	whole core	2

Table 2.3-18 (Sheet 7 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[a]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3789	25.32–25.47	8	–17.4	HFC3	NM	54	1	1,578	17.9	2.71	whole core	2
G-3790	22.79–23	8	–14.9	HFC3	NM	4,478	4,277	507	27.0	2.73	whole core	2
G-3790	24–24.33	8	–16.16	HFC3	NM	10,076	7,195	2,084	27.7	2.73	whole core	2
G-3790	31.5–31.88	8	–23.69	HFC3	NM	2,566	1,970	2,765	30.2	2.72	whole core	2
G-3790	31.88–32.25	8	–24.19	HFC3/2	NM	3,335	3,160	3,661	32.6	2.72	whole core	2
G-3791	16.06–16.28	8	–8.17	HFC3	NM	0.02	0.02	0.02	12.7	2.69	whole core	2
G-3791	16.47–16.80	8	–8.64	HFC3	NM	476	0.2	7	14.7	2.70	whole core	2
G-3791	19.3–19.59	8	–11.74	HFC3	NM	5,258	4,343	2,439	29.7	2.71	whole core	2
G-3791	23.28–23.74	8	–15.51	HFC3	NM	4,338	4,049	3,037	30.0	2.72	whole core	2
G-3791	24.41–24.66	8	–16.54	HFC3	NM	15,535	13,980	2,858	30.0	2.72	whole core	2
G-3791	24.91–25.24	8	–17.08	HFC3	NM	8,994	8,994	3,097	32.7	2.72	whole core	2
G-3791	27.93–28.30	8	–20.1	HFC3	NM	10,831	10,831	4,639	29.6	2.72	whole core	2
G-3791	29.25–29.67	8	–21.46	HFC3	NM	6,663	3,805	4,054	19.7	2.70	whole core	2
G-3792	14.41–14.58	8	–6.5	HFC3	NM	4,247	4,106	769	17.4	2.70	whole core	2
G-3793	6.98–7.27	10	2.88	HFC3	NM	283	271	463	13.6	2.71	whole core	2
G-3794	12.7–12.89	9	–3.8	HFC3	NM	5,268	2,401	533	20.2	2.71	whole core	2
G-3794	17.63–18.01	9	–8.82	HFC3	NM	10,356	692	1,032	12.8	2.71	whole core	2
G-3794	20.18–20.60	9	–11.39	HFC3	NM	4,333	3,999	1,930	23.2	2.70	whole core	2
G-3673	46.5–47.25	20	–26.88	HFC2	<0.01	NM	NM	NM	12.8	2.69	core plug	1
G-3674	26.5–27	10	–16.75	HFC2	5011	NM	NM	NM	19.6	2.70	core plug	1
G-3675	20.4	20	–0.4	HFC2	<0.01	NM	NM	NM	6.6	2.68	core plug	1
G-3675	23.5	8	–15.5	HFC2	NM	0.12	0.06	<0.01	11.3	2.69	whole core	1
G-3675	24.5–25	8	–16.75	HFC2	5,027	NM	NM	NM	22.9	2.68	core plug	1
G-3675	31.75–32	8	–23.88	HFC2	<0.01	NM	NM	NM	12.5	2.70	core plug	1
G-3675	50.75–51	8	–42.88	HFC2	1,688	NM	NM	NM	27.8	2.68	core plug	1
G-3679	28.3	9	–19.3	HFC2	0.3	NM	NM	NM	25.7	2.72	core plug	1

**Table 2.3-18 (Sheet 8 of 15)
Regional Hydrogeologic Properties from Rock Core Samples**

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3681	43.3	9	–34.3	HFC2	NM	0.08	0.05	0.02	11.6	2.72	whole core	1
G-3685	28.5	9	–19.5	HFC2	NM	10.6	0.71	1,949	13.9	2.71	whole core	1
G-3690	22	9	–13	HFC2	NM	670	638	711	13.8	2.71	whole core	1
G-3697	27.5	9	–18.5	HFC2	NM	0.45	0.4	0.16	23.2	2.72	whole core	1
G-3710	30.33	10	–20.33	HFC2	NM	4,754	1,357	92.5	33.7	2.72	whole core	1
G-3718	24.4	9	–15.4	HFC2	9.49	NM	NM	NM	24.1	2.72	core plug	1
G-3718	24.38	9	–15.38	HFC2	NM	47	11.3	179	24.3	2.70	whole core	1
G-3720	22	9	–13	HFC2	NM	7.33	0.61	10,875	17.0	2.71	whole core	1
G-3721	20.5	10	–10.5	HFC2	NM	0.14	0.04	0.62	20.5	2.81	whole core	1
G-3722	29.42	10	–19.42	HFC2	NM	9,580	6,385	9,704	25.2	2.70	whole core	1
G-3727	23.29	8	–14.29	HFC2	NM	0.19	0.14	0.01	15.2	2.71	whole core	1
G-3729	24.12	6	–18.12	HFC2	NM	4.51	1.03	570	21.8	2.71	whole core	1
G-3731	30.71	10	–20.71	HFC2	NM	7.23	0.53	10,038	18.2	2.72	whole core	1
G-3732	25.5	6	–19.5	HFC2	NM	28.7	22.9	206	11.5	2.71	whole core	1
G-3734	24	8	–16	HFC2	NM	667	332	17,567	23.4	2.72	whole core	1
G-3733	46.25–46.44	6	–40.34	HFC2	NM	138	94	66	17.4	2.70	whole core	2
G-3733	48.63–48.79	6	–42.71	HFC2	NM	101	18	202	23.6	2.71	whole core	2
G-3733	49.04–49.42	6	–43.23	HFC2	NM	3,932	2,449	59	26.1	2.70	whole core	2
G-3733	49.67–49.92	6	–43.8	HFC2	NM	1,432	249	112	21.7	2.70	whole core	2
G-3770	20.5–20.79	6.7	–13.94	HFC2	NM	3,830	3,458	13,701	34.2	2.70	whole core	2
G-3770	24.26–24.47	6.7	–17.66	HFC2	NM	11,232	11,232	10,294	47.7	2.70	whole core	2
G-3770	25.03–25.34	6.7	–18.48	HFC2	NM	5,616	5,616	14,886	32.6	2.70	whole core	2
G-3770	25.63–25.92	6.7	–19.08	HFC2	NM	1,742	1,421	12,891	24.9	2.71	whole core	2
G-3770	29.47–29.87	6.7	–22.97	HFC2	NM	361	2	18,551	22.2	2.71	whole core	2
G-3770	30.04–30.27	6.7	–23.46	HFC2	NM	3,073	1,634	10,694	28.9	2.70	whole core	2
G-3770	37.69–38.02	6.7	–31.16	HFC2	NM	4,917	4,917	7,419	35.1	2.70	whole core	2

Table 2.3-18 (Sheet 9 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3770	40.93–41.28	6.7	–34.4	HFC2	NM	4,470	2,037	5,524	30.8	2.68	whole core	2
G-3770	44.88–45.21	6.7	–38.34	HFC2	NM	NM	0.6	NM	30.7	2.69	whole core	2
G-3770	45.4–45.63	6.7	–38.82	HFC2	NM	7,375	3,361	2,481	27.8	2.70	whole core	2
G-3770	50.9–51.13	6.7	–44.32	HFC2	NM	0.2	0.2	3	17.0	2.70	whole core	2
G-3770	51.3–51.72	6.7	–44.81	HFC2	NM	14	0.2	0.1	17.7	2.71	whole core	2
G-3770	51.72–52.14	6.7	–45.23	HFC2	NM	0.2	0.1	0.1	16.6	2.69	whole core	2
G-3770	52.29–52.62	6.7	–45.76	HFC2	NM	20	0.3	0.1	21.1	2.70	whole core	2
G-3771	18.0–18.38	6	–12.19	HFC2	NM	983	248	5	19.2	2.71	whole core	2
G-3771	18.38–18.67	6	–12.52	HFC2	NM	18	0.07	1	18.6	2.71	whole core	2
G-3771	18.67–19.02	6	–12.84	HFC2	NM	10	0.5	1,925	23.3	2.71	whole core	2
G-3771	19.29–19.64	6	–13.46	HFC2	NM	2,135	813	16,070	24.6	2.70	whole core	2
G-3771	19.64–20.02	6	–13.83	HFC2	NM	11,534	11,534	15,745	24.9	2.70	whole core	2
G-3771	20.15–20.48	6	–14.32	HFC2	NM	11,316	11,316	16,068	31.7	2.71	whole core	2
G-3771	20.61–20.98	6	–14.8	HFC2	NM	10,615	10,615	17,158	30.3	2.71	whole core	2
G-3771	25.77–26.14	6	–19.96	HFC2	NM	10,341	5,168	17,428	15.9	2.70	whole core	2
G-3771	27.94–28.27	6	–22.1	HFC2	NM	11,646	11,646	15,674	25.9	2.70	whole core	2
G-3771	29.57–29.84	6	–23.7	HFC2	NM	1	0.04	1	13.1	2.71	whole core	2
G-3771	29.84–30.07	6	–23.96	HFC2	NM	0.04	0.04	0.5	13.2	2.71	whole core	2
G-3771	30.42–30.57	6	–24.5	HFC2	NM	0.2	0.1	634	13.8	2.69	whole core	2
G-3771	30.61–30.76	6	–24.68	HFC2	NM	7	0.3	2,057	17.5	2.70	whole core	2
G-3771	31.58–31.91	6	–25.74	HFC2	NM	527	41	787	20.1	2.69	whole core	2
G-3771	32.16–32.41	6	–26.28	HFC2	NM	7,887	7,887	5,732	22.7	2.70	whole core	2
G-3771	32.7–32.95	6	–26.82	HFC2	NM	215	37	456	17.3	2.70	whole core	2
G-3771	32.95–33.24	6	–27.1	HFC2	NM	314	70	492	18.5	2.71	whole core	2
G-3771	33.24–33.53	6	–27.38	HFC2	NM	6,446	6,446	7,001	17.7	2.71	whole core	2
G-3771	34.18–34.47	6	–28.32	HFC2	NM	14,112	14,112	6,410	34.9	2.71	whole core	2

Table 2.3-18 (Sheet 10 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3771	40.49–40.72	6	–34.6	HFC2	NM	922	665	749	25.1	2.71	whole core	2
G-3771	40.91–41.12	6	–35.02	HFC2	NM	NM	76	NM	30.2	2.72	whole core	2
G-3771	47.93–48.03	6	–41.98	HFC2	NM	4	1	81	22.2	2.70	whole core	2
G-3771	48.23–48.52	6	–42.38	HFC2	NM	315	70	394	27.6	2.72	whole core	2
G-3771	49.06–49.27	6	–43.16	HFC2	NM	109	49	38	29.2	2.71	whole core	2
G-3771	49.27–49.5	6	–43.38	HFC2	NM	4,106	2,878	803	31.0	2.71	whole core	2
G-3771	49.65–49.88	6	–43.76	HFC2	NM	5,789	5,789	5,235	34.3	2.71	whole core	2
G-3771	50.09–50.15	6	–44.12	HFC2	NM	4,550	3,327	136	25.7	2.71	whole core	2
G-3778	38.6–38.88	16.4	–22.34	HFC2	NM	109	80	100	38.5	2.71	whole core	2
G-3778	39.2–39.37	16.4	–22.88	HFC2	NM	87	81	273	35.6	2.72	whole core	2
G-3778	40.96–41.25	16.4	–24.7	HFC2	NM	5,985	5,129	4,145	42.6	2.73	whole core	2
G-3778	52.27–52.52	16.4	–36	HFC2	NM	2,726	1,890	2,321	21.3	2.71	whole core	2
G-3778	54.16–54.43	16.4	–37.9	HFC2	NM	28	4	588	22.2	2.71	whole core	2
G-3778	55.13–55.23	16.4	–38.78	HFC2	NM	77	42	310	20.0	2.72	whole core	2
G-3778	59.2–59.47	16.4	–42.94	HFC2	NM	20,467	20,467	2,452	23.5	2.70	whole core	2
G-3778	59.8–60.05	16.4	–43.52	HFC2	NM	18,720	18,720	3,490	21.5	2.70	whole core	2
G-3779	46.8–46.97	16.2	–30.68	HFC2	NM	114	91	574	37.1	2.73	whole core	2
G-3779	47.39–47.6	16.2	–31.3	HFC2	NM	358	26	801	35.4	2.75	whole core	2
G-3779	47.6–47.81	16.2	–31.5	HFC2	NM	873	680	57	36.0	2.73	whole core	2
G-3779	49.18–49.31	16.2	–33.04	HFC2	NM	4,595	3,201	1,682	29.6	2.72	whole core	2
G-3779	49.5–49.63	16.2	–33.36	HFC2	NM	10,813	7,053	893	25.6	2.73	whole core	2
G-3779	49.88–50.07	16.2	–33.78	HFC2	NM	2,137	2,137	1,647	32.2	2.73	whole core	2
G-3779	52.19–52.57	16.2	–36.18	HFC2	NM	2,165	1,866	4,821	16.8	2.71	whole core	2
G-3779	54.3–54.68	16.2	–38.26	HFC2	NM	49	33	365	24.1	2.72	whole core	2
G-3779	54.94–55.06	16.2	–38.8	HFC2	NM	16	16	926	18.4	2.69	whole core	2
G-3779	58.21–58.42	16.2	–42.12	HFC2	NM	17,621	17,621	4,697	26.7	2.71	whole core	2

Table 2.3-18 (Sheet 11 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3779	58.75–58.92	16.2	–42.64	HFC2	NM	26,236	26,236	2,252	23.5	2.70	whole core	2
G-3779	59.09–59.26	16.2	–42.98	HFC2	NM	25,120	268	2,588	12.0	2.69	whole core	2
G-3779	59.59–60.01	16.2	–43.6	HFC2	NM	9,599	8,638	5,542	29.4	2.72	whole core	2
G-3789	27.67–28	8	–19.84	HFC2	NM	1,529	782	2,465	23.1	2.72	whole core	2
G-3789	28–28.27	8	–20.14	HFC2	NM	2,784	2,784	1,966	23.1	2.71	whole core	2
G-3789	28.27–28.58	8	–20.42	HFC2	NM	5,618	5,185	2,975	22.8	2.72	whole core	2
G-3789	28.88–29.07	8	–20.98	HFC2	NM	5,784	3,439	2,170	20.8	2.72	whole core	2
G-3789	29.24–29.39	8	–21.32	HFC2	NM	9,142	8,230	1,615	22.9	2.72	whole core	2
G-3789	29.68–30.03	8	–21.86	HFC2	NM	506	250	495	22.6	2.73	whole core	2
G-3789	31.61–32.15	8	–23.88	HFC2	NM	77	46	4	29.4	2.73	whole core	2
G-3789	32.23–32.56	8	–24.4	HFC2	NM	214	184	255	32.0	2.73	whole core	2
G-3789	33.86–34.19	8	–26.08	HFC2	NM	41	0.4	0.1	22.1	2.73	whole core	2
G-3789	34.4–34.73	8	–26.56	HFC2	NM	696	365	184	25.1	2.72	whole core	2
G-3789	34.9–35.15	8	–27.02	HFC2	NM	1,096	888	1,232	30.0	2.73	whole core	2
G-3789	37.33–37.54	8	–29.44	HFC2	NM	0.4	0.2	0.05	18.4	2.71	whole core	2
G-3789	40.66–40.87	8	–32.76	HFC2	NM	38	0.4	61	18.1	2.73	whole core	2
G-3789	42.57–42.92	8	–34.74	HFC2	NM	0.02	0.001	2,840	13.5	2.71	whole core	2
G-3789	52–52.17	8	–44.08	HFC2	NM	28	23	89	17.9	2.69	whole core	2
G-3789	53.10–53.56	8	–45.33	HFC2	NM	1,874	1,055	238	25.8	2.69	whole core	2
G-3790	32.25–32.54	8	–24.4	HFC2	NM	2,016	1,328	3,268	28.2	2.72	whole core	2
G-3790	34.2–34.45	8	–26.32	HFC2	NM	952	713	299	37.4	2.72	whole core	2
G-3790	39.31–39.69	8	–31.5	HFC2	NM	0.2	0.2	0.2	26.7	2.72	whole core	2
G-3790	40.54–40.96	8	–32.75	HFC2	NM	0.08	0.08	4,391	19.4	2.71	whole core	2
G-3790	41.21–41.5	8	–33.36	HFC2	NM	0.02	0.02	4	13.0	2.72	whole core	2
G-3790	41.68–41.95	8	–33.82	HFC2	NM	9	9	12	19.3	2.72	whole core	2
G-3790	42.38–42.71	8	–34.54	HFC2	NM	3,539	0.05	1,796	22.5	2.72	whole core	2

Table 2.3-18 (Sheet 12 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3790	44.63–44.8	8	–36.72	HFC2	NM	24	7	273	14.5	2.71	whole core	2
G-3790	49.76–50.01	8	–41.88	HFC2	NM	9,569	7,973	2,300	21.1	2.71	whole core	2
G-3790	50.18–50.42	8	–42.3	HFC2	NM	9,077	7,260	8	21.5	2.69	whole core	2
G-3790	52.98–53.23	8	–45.1	HFC2	NM	297	282	75	26.8	2.70	whole core	2
G-3790	56.17–56.5	8	–48.25	HFC2	NM	309	2	2	19.2	2.70	whole core	2
G-3790	57.83–57.71	8	–50.27	HFC2	NM	380	6	0.5	22.1	2.70	whole core	2
G-3791	30.63–30.88	8	–22.76	HFC2	NM	2,101	1,641	1,047	37.8	2.70	whole core	2
G-3791	32–32.29	8	–24.14	HFC2	NM	1,084	658	1,016	29.5	2.71	whole core	2
G-3791	32.83–33.25	8	–25.04	HFC2	NM	8,854	6,885	4,117	45.4	2.73	whole core	2
G-3791	33.75–34.21	8	–25.98	HFC2	NM	8,555	8,555	4,957	30.4	2.72	whole core	2
G-3791	34.38–34.8	8	–26.59	HFC2	NM	8,854	6,885	3,050	22.2	2.71	whole core	2
G-3791	38.13–38.42	8	–30.3	HFC2	NM	6,413	5,557	1,936	31.6	2.72	whole core	2
G-3791	38.63–38.96	8	–30.8	HFC2	NM	8,100	6,942	3,334	31.0	2.71	whole core	2
G-3791	41.21–41.59	8	–33.4	HFC2	NM	1,762	1,560	2,110	32.0	2.70	whole core	2
G-3791	41.96–42.38	8	–34.17	HFC2	NM	2,634	2,406	3,304	36.0	2.71	whole core	2
G-3791	42.38–42.59	8	–34.48	HFC2	NM	4,338	3,407	2,223	32.0	2.70	whole core	2
G-3791	43.42–43.65	8	–35.54	HFC2	NM	16,346	14,529	2,125	25.5	2.71	whole core	2
G-3791	51.35–51.68	8	–43.52	HFC2	NM	2,612	1,729	1,589	15.4	2.70	whole core	2
G-3791	51.68–52.06	8	–43.87	HFC2	NM	2,472	1,831	6	17.7	2.70	whole core	2
G-3792	26.06–26.39	8	–18.22	HFC2	NM	10,954	0.2	764	24.2	2.70	whole core	2
G-3792	26.39–26.72	8	–18.56	HFC2	NM	2,082	2,005	1,405	30.1	2.71	whole core	2
G-3792	27.14–27.45	8	–19.3	HFC2	NM	812	462	1,337	18.3	2.71	whole core	2
G-3792	27.83–28.25	8	–20.04	HFC2	NM	4,123	4,123	3,265	16.9	2.71	whole core	2
G-3792	28.25–28.58	8	–20.42	HFC2	NM	7,454	6,211	2,502	20.1	2.72	whole core	2
G-3792	32.82–33.24	8	–25.03	HFC2	NM	3,836	564	296	18.4	2.71	whole core	2
G-3792	34.17–34.50	8	–26.34	HFC2	NM	40	39	1	13.4	2.68	whole core	2

Table 2.3-18 (Sheet 13 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3792	34.50–34.88	8	–26.69	HFC2	NM	589	346	0.02	15.5	2.69	whole core	2
G-3792	34.88–35.09	8	–26.98	HFC2	NM	0.1	0.1	0.2	10.8	2.69	whole core	2
G-3792	38.63–38.96	8	–30.8	HFC2	NM	404	265	6	19.9	2.70	whole core	2
G-3792	43.15–43.53	8	–35.34	HFC2	NM	2	0.04	0.02	13.3	2.70	whole core	2
G-3792	45.27–45.5	8	–37.38	HFC2	NM	1,736	53	1,517	9.9	2.70	whole core	2
G-3792	45.6–45.98	8	–37.79	HFC2	NM	699	470	3,333	8.3	2.69	whole core	2
G-3792	50.05–50.3	8	–42.18	HFC2	NM	15	0.4	591	19.7	2.70	whole core	2
G-3792	51.69–51.98	8	–43.84	HFC2	NM	13,265	11,938	4,010	23.4	2.71	whole core	2
G-3792	62.71–63.04	8	–54.88	HFC2	NM	533	495	155	21.5	2.72	whole core	2
G-3792	66.81–67.06	8	–58.94	HFC2	NM	0.3	0.02	0.2	13.8	2.71	whole core	2
G-3792	67.39–67.72	8	–59.56	HFC2	NM	7,869	5,619	0.02	18.3	2.71	whole core	2
G-3792	67.72—68.05	8	–59.88	HFC2	NM	8,022	4,199	1	17.5	2.71	whole core	2
G-3792	69.47–69.89	8	–61.68	HFC2	NM	273	12	0.03	13.8	2.71	whole core	2
G-3792	76–76.25	8	–68.12	HFC2	NM	23,984	4,012	1,387	30.8	2.72	whole core	2
G-3793	13.88–14.21	10	–4.04	HFC2	NM	9,081	3,403	3,906	22.8	2.70	whole core	2
G-3793	17.21–17.63	10	–7.42	HFC2	NM	4,268	3,047	3,067	17.9	2.71	whole core	2
G-3793	27–27.21	10	–17.1	HFC2	NM	962	3	5	22.8	2.71	whole core	2
G-3793	28.68–29.01	10	–18.84	HFC2	NM	12,480	9,599	3,023	31.2	2.72	whole core	2
G-3793	29.18–29.6	10	–19.39	HFC2	NM	19,318	15,000	1,502	23.4	2.73	whole core	2
G-3793	31.75–31.94	10	–21.84	HFC2	NM	27,411	21,083	1,290	27.0	2.72	whole core	2
G-3793	32.11–32.36	10	–22.24	HFC2	NM	15,136	13,622	1,742	29.3	2.71	whole core	2
G-3793	39.52–39.9	10	–29.71	HFC2	NM	929	678	940	22.0	2.71	whole core	2
G-3793	39.9–40.28	10	–30.09	HFC2	NM	1,865	1,678	1,626	22.8	2.71	whole core	2
G-3793	40.44—40.73	10	–30.58	HFC2	NM	571	28	1,657	20.1	2.72	whole core	2
G-3793	41.15–41.42	10	–31.34	HFC2	NM	52	41	1,853	17.9	2.71	whole core	2
G-3793	52.98–53.25	10	–43.12	HFC2	NM	3,616	2,218	357	27.1	2.70	whole core	2

Table 2.3-18 (Sheet 14 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3793	53.79–53.98	10	–43.88	HFC2	NM	327	13	189	22.7	2.70	whole core	2
G-3794	19.4–19.73	9	–10.56	HFC2	NM	439	316	2,251	15.0	2.77	whole core	2
G-3794	24.18–24.51	9	–15.34	HFC2	NM	2,317	1,958	3,592	22.0	2.71	whole core	2
G-3794	30.72–30.97	9	–21.84	HFC2	NM	5,055	226	233	29.6	2.72	whole core	2
G-3673	51–51.5	20	–31.25	HFC1	34.3	NM	NM	NM	37.3	2.68	core plug	1
G-3674	39.25–40	10	–29.62	HFC1	77.6	NM	NM	NM	12.3	2.70	core plug	1
G-3674	49–49.75	10	–39.38	HFC1	<0.01	NM	NM	NM	21.2	2.68	core plug	1
G-3674	52.1	10	–42.1	HFC1	2.19	NM	NM	NM	18.1	2.69	core plug	1
G-3675	64.5–65	8	–56.75	HFC1	<0.01	NM	NM	NM	17.7	2.69	core plug	1
G-3678	33.3	9	–24.3	HFC1	NM	2,244	997	18,223	16.1	2.71	whole core	1
G-3679	36.7	9	–27.7	HFC1	NM	1,870	0.54	13,498	20.7	2.71	whole core	1
G-3731	39.08	10	–29.08	HFC1	NM	3,530	1,463	13,050	20.4	2.71	whole core	1
G-3732	39.5	6	–33.5	HFC1	194.3	NM	NM	NM	10.8	2.71	core plug	1
G-3732	42.4–42.7	6	–36.55	HFC1	NM	NM	NM	13,362	34.8	2.68	whole core	1
G-3732	44	6	–38	HFC1	165.3	NM	NM	NM	16.2	2.71	core plug	1
G-3674	83.5–84	10	–73.75	Tamiami	16,584	NM	NM	NM	42.6	2.68	core plug	1
G-3770	64.59–64.8	6.7	–58	Tamiami	NM	1,956	1,831	1,236	28.2	2.74	whole core	2
G-3770	64.92–65.38	6.7	–58.45	Tamiami	NM	1,996	1,996	2,862	29.0	2.72	whole core	2
G-3770	69.88–70.17	6.7	–63.35	Tamiami	NM	1,983	63	296	19.7	2.72	whole core	2
G-3770	70.17–70.42	6.7	–63.6	Tamiami	NM	1,402	1,329	343	22.6	2.72	whole core	2
G-3770	70.42–70.67	6.7	–63.85	Tamiami	NM	2,186	1,994	1,878	26.1	2.72	whole core	2
G-3771	54.21–54.46	6	–48.35	Tamiami	NM	13	13	32	23.3	2.74	whole core	2
G-3771	55.47–55.7	6	–49.58	Tamiami	NM	36	12	116	19.0	2.74	whole core	2
G-3771	55.89–56.08	6	–49.98	Tamiami	NM	39	2	37	18.4	2.74	whole core	2
G-3771	58.93–59.18	6	–53.06	Tamiami	NM	2,650	2,467	2,490	26.3	2.77	whole core	2
G-3771	59.93–60.1	6	–54.02	Tamiami	NM	4,825	4,669	2,077	38.2	2.79	whole core	2

Table 2.3-18 (Sheet 15 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3771	74.27–74.44	6	–68.36	Tamiami	NM	4,302	3,625	4,127	40.6	2.74	whole core	2
G-3771	74.57–74.78	6	–68.68	Tamiami	NM	7,091	7,091	5,116	40.3	2.72	whole core	2
G-3793	63.95–64.12	10	–54.04	Tamiami	NM	20,433	15,889	735	11.5	2.69	whole core	2
G-3793	64.29–64.62	10	–54.46	Tamiami	NM	12,171	10,954	2,042	14.5	2.69	whole core	2
G-3793	64.92–64.96	10	–54.94	Tamiami	NM	4,964	4,964	465	11.2	2.69	whole core	2
G-3794	59.23–59.65	9	–49.44	Tamiami	NM	4,690	3,607	2,006	15.7	2.72	whole core	2
G-3794	61.02–61.52	9	–52.27	Tamiami	NM	100	17	11	15.8	2.69	whole core	2
G-3794	61.94–62.27	9	–53.1	Tamiami	NM	2,807	2,010	638	26.4	2.74	whole core	2
G-3794	63.13–63.38	9	–54.26	Tamiami	NM	61	0.1	204	10.0	2.72	whole core	2
G-3794	64.07–64.57	9	–55.32	Tamiami	NM	1,952	837	0.03	21.0	2.76	whole core	2

(a) Reported as grams per centimeter in the references
Sources: 1 – Cunningham et al. 2004
2 – Cunningham et al. 2006
NM = Not measured

Table 2.3-19 (Sheet 1 of 4)
Slug Test Hydraulic Conductivity Summary

Observation Well	Test Date	Surface Elevation (NAVD 88)	Screened Interval (feet bgs)	Geologic Unit	Saturated Thickness (feet)	Solution	Hydraulic Conductivity in feet per day		
							Falling	Rising	Arithmetic Mean
OW-606U Test #1	5/20/2008	–1.4	18–28	Miami Limestone	29.9	KGS	NC	97.98	97.98
OW-606U Test #1						Springer-Gelhar	NC	134.80	134.80
OW-606U Test #2						KGS	NC	92.02	92.02
OW-606U Test #2						Springer-Gelhar	NC	123.10	123.10
OW-606U Average							**N/A**	**111.98**	**111.98**
OW-606L Test #1	5/18/2008	–1.4	97–107	Lower Fort Thompson Formation	92.0	Butler	119.90	30.16	75.03
OW-606L Test #1						McElwee-Zenner	117.80	NC	117.80
OW-606L Test #1						KGS	NC	35.04	35.04
OW-606L Test #2						Butler	NC	67.40	67.40
OW-606L Test #2						McElwee-Zenner	NC	66.13	66.13
OW-606L Average							**118.85**	**49.68**	**72.74**
OW-621U	5/20/2008	0.2	17.4–27.4	Miami Limestone	27.6	KGS	NC	94.35	94.35
OW-621U						Springer-Gelhar	NC	68.89	68.89
OW-621U Average							**N/A**	**81.62**	**81.62**
OW-621L Test #1	5/17/2008	0.2	98.6–108.6	Lower Fort Thompson Formation	88.5	Butler	91.59	31.07	61.33
OW-621L Test #1						KGS	71.28	33.31	52.30
OW-621L Test #2						Butler	NC	35.72	35.72
OW-621L Test #2						KGS	NC	30.40	30.40
OW-621L Test #3						Butler	NC	16.65	16.65
OW-621L Test #3						KGS	NC	16.66	16.66
OW-621L Average							**81.44**	**27.30**	**40.84**
OW-636U Test #1	5/21/2008	–1.1	17–27	Miami Limestone	28.9	KGS	NC	57.27	57.27
OW-636U Test #1						Springer-Gelhar	NC	50.64	50.64
OW-636U Test #2						KGS	NC	79.27	79.27
OW-636U Test #2						Springer-Gelhar	NC	64.33	64.33

Table 2.3-19 (Sheet 2 of 4)
Slug Test Hydraulic Conductivity Summary

Observation Well	Test Date	Surface Elevation (NAVD 88)	Screened Interval (feet bgs)	Geologic Unit	Saturated Thickness (feet)	Solution	Hydraulic Conductivity in feet per day		
							Falling	Rising	Arithmetic Mean
OW-636U Average							**N/A**	**62.88**	**62.88**
OW-636L	5/21/2008	–1.1	97.1–107.1	Lower Fort Thompson Formation	88.0	Butler	NC	10.08	10.08
OW-636L						KGS	NC	10.58	10.58
OW-636L						Butler	NC	9.425	9.43
OW-636L						KGS	NC	10.01	10.01
OW-636L Average							**N/A**	**10.02**	**10.02**
OW-706U Test #1	5/16/2008	–1.2	17–27	Miami Limestone	30.7	KGS	6.423	31.19	18.81
OW-706U Test #1						Springer-Gelhar	83.78	30.27	57.03
OW-706U Test #1						Hvorslev	0.7146	NC	0.71
OW-706U Test #1						Bouwer-Rice	0.5455	NC	0.55
OW-706U Test #2						Springer-Gelhar	NC	70.18	70.18
OW-706U Test #2						KGS	NC	76.09	76.09
OW-706U Average							**22.87**	**51.93**	**37.40**
OW-706L	5/16/2008	–1.2	100–110	Lower Fort Thompson Fm	82.8	Butler	21.20	25.09	23.15
OW-706L						KGS	21.97	26.07	24.02
OW-706L Average							**21.59**	**25.58**	**23.58**
OW-721U Test #1	5/15/2008	–1.5	14–24	Miami Limestone	24.8	Springer-Gelhar	45.50	27.03	36.27
OW-721U Test #1						KGS	45.50	32.46	38.98
OW-721U Test #2						Springer-Gelhar	NC	24.39	24.39
OW-721U Test #2						KGS	NC	32.47	32.47
OW-721U Average							**45.50**	**29.09**	**37.29**
OW-721L Test #1	5/15/2008	–1.5	96–106	Lower Fort Thompson Formation	90.0	Butler	2.726	11.59	7.16
OW-721L Test #1						KGS	1.13	2.91	1.13
OW-721L Test #2						Butler	NC	2.839	2.84
OW-721L Test #2						KGS	NC	1.325	1.33
OW-721L Average							**1.93**	**4.67**	**3.30**
OW-735 U Test #1	5/15/2008	–0.8	16–26	Miami Limestone	26.5	Springer-Gelhar	319.20	58.21	188.70
OW-735 U Test #1						KGS	109.50	84.68	97.09
OW-735 U Test #2						Springer-Gelhar	NC	80.18	80.18
OW-735 U Test #2						KGS	NC	70.70	70.70

Table 2.3-19 (Sheet 3 of 4)
Slug Test Hydraulic Conductivity Summary

Observation Well	Test Date	Surface Elevation (NAVD 88)	Screened Interval (feet bgs)	Geologic Unit	Saturated Thickness (feet)	Solution	Hydraulic Conductivity in feet per day		
							Falling	Rising	Arithmetic Mean
OW-735U Average							**214.35**	**73.44**	**143.90**
OW-735L Test #1	5/13/2008	–0.8	96.9–106.9	Lower Fort Thompson Fm	87.0	Butler	49.09	42.01	45.55
OW-735L Test #1						KGS	20.57	32.05	26.31
OW-735L Average							**34.83**	**37.03**	**35.93**
OW-802U	5/20/2008	–1.5	15–27	Miami Limestone	25.8	KGS	NC	41.06	41.06
OW-802U						Springer-Gelhar	NC	31.90	31.90
OW-802U Average							**N/A**	**36.48**	**36.48**
OW-802L	5/20/2008	–1.5	98–108	Lower Fort Thompson Fm	88.0	Butler	NC	23.28	23.28
OW-802L						KGS	NC	30.99	30.99
OW-802L Average							**N/A**	**27.14**	**27.14**
OW-805U	6/6/2008	–1.6	18–28	Miami Limestone	32.3	KGS	NC	101.7	101.70
OW-805U						Butler	NC	136.4	136.40
OW-805U						Springer-Gelhar	NC	107.1	107.10
OW-805U Average							**N/A**	**115.07**	**115.07**
OW-805L	6/6/2008	–1.6	85–95	Lower Fort Thompson Fm	67.5	Butler	NC	5.269	5.27
OW-805L						KGS	NC	5.936	5.94
OW-805L Average							**N/A**	**5.60**	**5.60**
OW-809U Test #1	5/15/2008	–1.3	15–25	Miami Limestone	25.5	Springer-Gelhar	91.20	60.67	75.90
OW-809U Test #1						KGS	102.90	82.32	92.60
OW-809U Test #2						Springer-Gelhar	NC	26.86	26.86
OW-809U Test #2						KGS	NC	35.94	35.94
OW-809U Average							**97.05**	**51.45**	**74.25**
OW-809L	5/15/2008	–1.3	95.5–105.5	Lower Fort Thompson Fm	88.0	KGS	108.60	36.57	72.60
OW-809L						Butler	103.70	33.43	68.57
OW-809L Average							**106.15**	**35.00**	**70.58**
OW-812U	5/20/2008	–1.4	15–25	Miami Limestone	25.5	KGS	NC	31.24	31.24
OW-812U						Springer-Gelhar	NC	24.49	24.49

Table 2.3-19 (Sheet 4 of 4) Slug Test Hydraulic Conductivity Summary

Observation Well	Test Date	Surface Elevation (NAVD 88)	Screened Interval (feet bgs)	Geologic Unit	Saturated Thickness (feet)	Solution	Hydraulic Conductivity in feet per day		
							Falling	Rising	Arithmetic Mean
OW-812U Average							**N/A**	**27.87**	**27.87**
OW-812L	5/20/2008	–1.4	97–107	Lower Fort Thompson Fm	86.0	Butler	NC	21.01	21.01
OW-812L						KGS	NC	21.20	21.20
OW-812L Average							**N/A**	**21.11**	**21.11**

Geometric Mean: Upper: 61.3 feet per day
Lower: 20.1 feet per day

Source: Appendix G Groundwater Data, MACTEC 2008
N/A = Not Applicable
NC = Not Conducted
KGS = Kansas Geological Survey
For wells with multiple tests, test results were averaged and used to calculate the geometric mean.
Data from these tests are considered not valid due to rate-limiting recharge effects from the filter pack.

Table 2.3-20
Summary of Aquifer Pumping Test Results

Geologic Unit	Thickness (ft)	Test Well	Aquifer Transmissivity (gpd/ft)[(a)]	Aquifer Storativity (dimensionless)[(a)]	Hydraulic Conductivity (K_h or K_v)		
					gpd/ft^2[(a)]	ft/d[(a)]	cm/s[(a)]
Miami Limestone (K_v)	8	PW-6U	—	—	103	14	0.005
	13	PW-7U	—	—	173	23	0.008
Key Largo Limestone (K_h)	33	PW-6U	2,331,000	0.00015	71,000	9,400	3.3
	24	PW-7U	2,200,000	0.0022	92,000	12,000	4.3
freshwater limestone (K_v)	11	PW-6U	—	—	46	6	0.002
	19	PW-7U	—	—	54	7	0.003
	11	PW-6L	—	—	2	0.2	7×10^{-5}
	19	PW-7L	—	—	3	0.4	1×10^{-4}
Fort Thompson Formation (K_h)	57	PW-6L	122,000	0.00016	2,140	286	0.1
	36	PW-7L	131,200	0.0003	3,600	490	0.2
Tamiami Formation (K_v)	18	PW-6L	—	—	7,940	1,061	0.4
	18	PW-7L	—	—	649	87	0.03

(a) All values are averages.

Table 2.3-21
Summary of Groundwater Field Measurements

Well ID	Sample Date	Temperature (°Celsius)	pH (standard units)	Dissolved Oxygen (milligrams per liter)	Specific Conductance (milliSiemens per centimeter)	Turbidity (Nephelometric Turbidity Units)	Oxidation-Reduction Potential (millivolts)
OW-606L[(a)]	5/28/2008	28.29	7.08	9.92	52.8, 72.4[(c)]	0.77	–370
OW-606U[(a)]	5/28/2008	28.71	6.84	1.66	66.9, 62.8[(c)]	0.34	–344
OW-621L[(a)]	6/4/2008	27.80	7.06	1.66	>99.9, 73.9[(c)]	0.21	–349
OW-621U[(a)]	5/29/2008	27.82	7.08	0.05	91.0, 58.3[(c)]	2.91	–351
OW-706L[(a)]	5/29/2008	29.61	6.83	1.49	46.4, 48.6[(c)]	0.20	–351
OW-706U[(a)]	5/29/2008	30.85	6.65	1.13	76.6, 77.3[(c)]	0.83	–392
OW-721L[(a)]	5/28/2008	28.56	6.76	1.18	74.3, 73.7[(c)]	7.55	–370
OW-721U[(a)]	5/28/2008	28.92	7.10	10.6	53.1, 63.8[(c)]	0.36	–364
OW-735U[(a)]	5/27/2008	29.47	7.00	0.02	86.6, 77.5[(c)]	0.92	–360
OW-802U[(a)]	6/5/2008	28.27	6.80	1.90	82.8, 70.8[(c)]	0.48	–322
OW-805U[(a)]	6/5/2008	28.26	7.10	1.19	60.9, 59.8[(c)]	0.32	–346
OW-809U[(a)]	5/27/2008	30.82	6.98	0.01	83.9, 79.0[(c)]	0.97	–371
OW-606L[(d)]	11/12/2009	26.90	7.04	0.16	88.40	NM	–199.7
OW-606U[(d)]	11/12/2009	26.61	7.07	0.33	72.20	NM	–197.6
OW-621L[(d)]	11/13/2009	27.93	7.29	0.11	90.45	NM	–185.3
OW-621U[(d)]	11/16/2009	27.96	7.27	0.16	81.41	NM	–183.4
OW-706L[(d)]	11/12/2009	28.67	7.16	0.23	55.63	NM	–101.6
OW-706U[(d)]	11/12/2009	28.20	7.05	0.19	98.91	NM	–241.2
OW-721L[(d)]	11/16/2009	28.58	7.12	0.15	103.2	NM	–188.4
OW-721U[(d)]	11/16/2009	28.58	7.17	0.12	95.07	NM	–179.3
OW-735U[(d)]	11/12/2009	29.46	7.03	0.19	108.0	NM	–206.9
OW-802U[(d)]	11/13/2009	26.60	7.08	0.16	76.47	NM	–178.0
OW-805U[(d)]	11/16/2009	27.17	7.16	0.25	82.62	NM	–121.4
OW-809U[(d)]	11/13/2009	29.24	7.02	0.13	94.76	NM	–197.4
ENP Precipitation[(b)]	mean	NM	4.98	NM	0.016	NM	NM
Surficial Aquifer SFWMD[(b)]	median	24.8	6.9	NM	0.619	NM	NM
Floridan Aquifer SFWMD[(b)]	median	26.3	7.4	NM	1.787	NM	NM
Cooling Canal	average	30.05	8.02	8.70	NM	1.92	NM
L-31N	average	NM	NM	NM	NM	NM	NM
Biscayne Bay	average	NM	NM	NM	NM	NM	NM
Upper Floridan Production well	mean	NM	7.70	NM	NM	1.1	NM

ENP = Everglades National Park NM = Not Measured
(a) Appendix G Groundwater, MACTEC 2008
(b) FGS 1992
(c) Samples collected February 3-5, 2009
(d) Samples collected and analyzed during routine groundwater level monitoring

Table 2.3-22 (Sheet 1 of 4)
Hydrogeochemical Data

Constituent		TDS	Calcium	Iron	Magnesium	Manganese	Potassium	Silica	Silicon	Sodium
Location ID	Date Collected	milligrams/Liter								
OW-606L[a]	5/28/2008	34,320[i], 47,047[i][j]	632(b)	<0.050U[c]	1,880[b]	0.0391	549[b]	3	<250[b][c]	15,100[b]
OW-606U[a]	5/28/2008	43,485[i], 40,804[i][j]	535[b]	0.318[b][d]	1,730[b]	0.0354	525[b]	0.729	<250[b][c]	14,400[b]
OW-621L[a]	6/4/2008	64,935[i][k], 48, 045[i][j]	574[b]	<50[b][c]	1,960[b]	<2[b][c]	586[b]	133[d][e]	62.1[b][d][e]	16,300[b]
OW-621U[a]	5/29/2008	59,150[i], 37,901[i][j]	492[b]	0.453[b][d]	1,600[b]	0.0368	476[b]	0.637	<250[b][c]	13,100[b]
OW-706L[a]	5/29/2008	30,160[i], 31,610[i][j]	413[b]	0.531[b][d]	1,170[b]	0.0083	327[b]	8	<250[b][c]	9,440[b]
OW-706U[a]	5/29/2008	49,790[i], 50,229[i][j]	725[b]	0.178[b][d]	2,150[b]	0.0435	658[b]	2	<250[b][c]	17,500[b]
OW-721L[a]	5/28/2008	48,295[i], 47,912[i][j]	667[b]	0.362[b][d]	2,020[b]	0.0462	587[b]	3	<250[b][c]	16,300[b]
OW-721U[a]	5/28/2008	34,515[i], 41,472[i][j]	603[b]	0.329[b][d]	1,890[b]	0.0581	569[b]	0.848	<250[b][c]	15,400[b]
OW-735U[a]	5/27/2008	56,290[i], 50,351[i][j]	749[b]	0.133[b][d]	2,140[b]	0.0327	655[b]	<0.250[c]	<250[b][c]	17,700[b]
OW-802U[a]	6/5/2008	53,820[i], 46,022[i][j]	579[b]	<50[b][c]	1,980[b]	<2[b][c]	586[b]	143[e]	66.7[b][e]	16,400[b]
OW-805U[a]	6/5/2008	39,585[i], 38,853[i][j]	447[b]	<50[b][c]	1,570[b]	<2[b][c]	493[b]	107[e]	49.9[b][e]	13,200[b]
OW-809U[a]	5/27/2008	54,535[i], 51,356[i][j]	704[b]	0.158[b][d]	2,040[b]	0.0281	607[b]	<0.250[c]	<250[b][c]	16,700[b]
OW-606L[l]	11/12/2009	49,500	808[b][d]	<2.5[d]	2500[b][d]	0.0379[b][e]	735[b][d]	6.68	3.12[b][e]	15,000[b][d]
OW-606U[l]	11/12/2009	38,500	820[b][d]	0.593[b][d][e]	2680[b][d]	0.0504[b][e]	757[b][d]	6.03	2.82[b][e]	12,000[b][d]
OW-621L[l]	11/13/2009	46,200	910[b][d]	0.549[b][d][e]	3080[b][d]	0.0334[b][e]	844[b][d]	7.79	3.64[b][e]	14,800[b][d]
OW-621U[l]	11/16/2009	34,600	602[b]	0.754[b][d][e]	2030[b][d]	0.0397[b][e]	550[b][d]	4.77	2.23[b][d][e]	11,800[b][d]
OW-706L[l]	11/12/2009	27,600	831[b][d]	1.340[b][d][e]	2330[b][d]	0.0113[b][e]	616[b][d]	22.90	10.70[b][e]	8,920[b][d]
OW-706U[l]	11/12/2009	48,900	1120[b][d]	0.829[b][d][e]	3760[b][d]	0.0739[b][e]	1030[b][d]	7.08	3.31[b][e]	15,200[b][d]
OW-721L[l]	11/16/2009	45,700	1200[b][d]	0.782[b][d][e]	4000[b][d]	0.0669[b][e]	1110[b][d]	12.30	5.77[b][d][e]	15,300[b][d]
OW-721U[l]	11/16/2009	40,500	673[b]	<2.5[b][d]	2110[b][d]	0.0669[b][e]	614[b][d]	4.99	2.33[b][d][e]	12,600[b][d]
OW-735U[l]	11/12/2009	54,500	1070[b][d]	0.656[b][d][e]	3740(b)[d]	0.0491[b][e]	1010[b][d]	7.36	3.44[b][e]	14,700[b][d]
OW-802U[l]	11/13/2009	44,200	988[b][d]	1.030[b][d][e]	3310[b][d]	0.0805[b][e]	889[b][d]	7.58	3.54[b][e]	14,100[b][d]
OW-805U[l]	11/16/2009	32,300	645[b]	0.908[b][d][e]	2140[b][d]	0.0311[b][e]	602[b][d]	4.62	2.16[b][d][e]	11,800[b][d]

Table 2.3-22 (Sheet 2 of 4)
Hydrogeochemical Data

Constituent		TDS	Calcium	Iron	Magnesium	Manganese	Potassium	Silica	Silicon	Sodium
Location ID	**Date Collected**	**milligrams/Liter**								
OW-809U[l]	11/13/2009	54,200	1110[b][d]	0.946[b][d][e]	3810[b][d]	0.0554[b][e]	1050[b][d]	6.57	3.07[b][e]	16,100[b][d]
ENP Precipitation[f][g]	mean		0.36		0.2		0.2			1.32
Surficial Aquifer SFWMD[g]	median	388	98	0.88	3.9		1.3			21.1
Floridan Aquifer SFWMD[g]	median	1,138	67.2	<0.05[c]	46.4		9.5			220.5
Cooling Canal	average	54,500	720		2,050		680	0.52		
L-31N	average	370	70		5.35		6.3			
Biscayne Bay	average	33,757	446		1,270		421	0.32		
Upper Floridan Production well	average	5,451	149	0.28	177	<0.07	77	12		

Table 2.3-22 (Sheet 3 of 4)
Hydrogeochemical Data

Constituent		Bromide	Chloride	Fluoride	Sulfate	Nitrate	Nitrite	Bicarbonate	Carbonate	Total Alkalinity	Ammonia[h]
Location ID	Date Collected	milligrams/Liter									
OW-606L[a]	5/28/2008	62.5	29,600	<20.0[c]	3,860	<0.20[c]	<200[c]	165	<5.0[c]	165	1.58
OW-606U[a]	5/28/2008	56.6	27,900	<20.0[c]	3,470	<0.20[c]	<200[c]	155	<5.0[c]	155	0.844
OW-621L[a]	6/4/2008	65.9	31,300[d]	<20.0[c]	3,610	<0.20[c]	<200[c]	181	<5.0[c]	181	1.30
OW-621U[a]	5/29/2008	50.6	25,500	<1.0[c]	3,210	<4.0[c]	<200[c]	189	<5.0[c]	189	0.588
OW-706L[a]	5/29/2008	37.7[e]	19,100	<1.0[c]	2,280	<4.0[c]	<200[c]	191	<5.0[c]	191	0.61
OW-706U[a]	5/29/2008	70.5	33,300	<1.0[c]	3,850	<4.0[c]	<200[c]	204	<5.0[c]	204	2.09
OW-721L[a]	5/28/2008	64.9	31,100	<20.0[c]	3,990	<0.20[c]	<200[c]	180	<5.0[c]	180	1.82
OW-721U[a]	5/28/2008	60.1	29,900	<20.0[c]	3,860	<0.20[c]	<200[c]	164	<5.0[c]	164	1.68
OW-735U[a]	5/27/2008	262	37,500	<20.0[c]	4,090	<4.0[c]	<200[c]	179	<5.0[c]	179	2.15
OW-802U[a]	6/5/2008	65.1	31,600[d]	<20.0[c]	3,720	<0.20[c]	<200[c]	178	<5.0[c]	178	1.40
OW-805U[a]	6/5/2008	53.6	27,600[d]	<20.0[c]	3,070	<0.20[c]	<200[c]	177	<5.0[c]	177	0.548
OW-809U[a]	5/27/2008	241[e]	35,900	<1.0[c]	4,050	<4.0[c]	<200[c]	177	<5.0[c]	177	2.21
OW-606L[l]	11/12/2009	107	28,800	<2.0[c]	3,870	<0.40[c]	<4.0[c]	148[d]	<5.0[c]	148[d]	1.30
OW606U[l]	11/12/2009	85.7	22,600	<2.0[c]	3,560	<0.40[c]	<4.0[c]	163[d]	<5.0[c]	163[d]	0.486
OW-621L[l]	11/13/2009	101	29,000	<2.0[c]	3,880	<0.40[c]	<4.0[c]	168[d]	<5.0[c]	168[d]	1.26
OW-621U[l]	11/16/2009	83.3	24,800	<2.0[c]	3,280[d]	<0.40[c]	<4.0[c]	177[d]	<5.0[c]	177[d]	0.385
OW-706L[l]	11/12/2009	62.9	16,300	<2.0[c]	2,450	<0.40[c]	<4.0[c]	168[d]	<5.0[c]	168[d]	0.485
OW-706U[l]	11/12/2009	112	30,700	<2.0[c]	4,110	<0.40[c]	<20[c]	162[d]	<5.0[c]	162[d]	1.43
OW-721L[l]	11/16/2009	104	31,000	<2.0[c]	4,400[d]	0.14[e]	<4.0[c]	166[d]	<5.0[c]	166[d]	1.31
OW-721U[l]	11/16/2009	88.8	27,100	<2.0[c]	3,720[d]	<0.40[c]	<4.0[c]	164[d]	<5.0[c]	164[d]	0.796
OW-735U[l]	11/12/2009	119	32,300	<2.0[c]	4,330	<0.40[c]	<20[c]	161[d]	<5.0[c]	161[d]	1.63
OW-802U[l]	11/13/2009	97.5	27,700	<2.0[c]	3,710	<0.40[c]	<4.0[c]	163[d]	<5.0[c]	163[d]	1.05
OW-805U[l]	11/16/2009	86	24,000	<2.0[c]	3,510[d]	<0.40[c]	<4.0[c]	173[d]	<5.0[c]	173[d]	0.424
OW-809U[l]	11/13/2009	115	33,700	<2.0[c]	4,400	<0.40[c]	<4.0[c]	170[d]	<5.0[c]	170[d]	1.64
ENP Precipitation[f][g]	mean		2		1.14	0.73					0.22
Surficial Aquifer SFWMD[g]	median		48	0.2	12	<0.01[c]		263		251	
Floridan Aquifer SFWMD[g]	median		420	0.81	176	<0.01[c]				130	
Cooling Canal	average		30,000		3,950			165		165	0.16
L-31N	average		59		26	1.05		200		200	
Biscayne Bay	average		18,582		2,447			102		102	0.1

Table 2.3-22 (Sheet 4 of 4)
Hydrogeochemical Data

Constituent		Bromide	Chloride	Fluoride	Sulfate	Nitrate	Nitrite	Bicarbonate	Carbonate	Total Alkalinity	Ammonia[h]
Location ID	Date Collected	milligrams/Liter									
Upper Floridan Production well	average		2,909	1.6	661	<0.01[c]		196			

Not analyzed (shaded)

SFWMD = South Florida Water Management District
(a) MACTEC 2008.
(b) Spiked analyte recovery is outside stated control limits. Method performance confirmed using Laboratory Control Spike sample results.
(c) Analyte not detected at or above the method detection limit.
(d) Method blank contamination. The associated method blank contains the target analyte at a reportable level. These data should be used with caution.
(e) Estimated result. Result is less than the reporting limit.
(f) Everglades National Park.
(g) FGS 1992.
(h) Test conducted on Nitrogen, as Ammonia.
(i) TDS is estimated as specific conductance in milliSiemens per centimeter x 1000 x 0.65, specific conductance values are listed in Table 2.3-21.
(j) Based on specific conductance measurements collected February 3-5, 2009.
(k) Assumes specific conductance equals 99 milliSiemens per centimeter.
(l) Samples collected and analyzed during routine groundwater level monitoring.

Table 2.3-23 (Sheet 1 of 2)
Staff Gage Readings at L-31E, Interceptor Ditch, and Industrial Wastewater Facility Canal 32

	Line A			Line B			Line C			Line D			Line E		
Date	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)
1/8/2008	1.50	1.36	1.56	1.54	1.24	1.72	1.47	1.28	1.60	1.48	1.28	1.22	1.45	1.28	0.98
1/14/2008	1.39	0.90	1.62	1.38	0.88	1.60	1.36	0.90	1.50	1.38	0.90	1.10	1.36	1.02	0.80
1/23/2008	1.46	1.27	1.61	1.50	1.26	1.58	1.48	1.28	1.46	1.48	1.26	1.08	1.44	1.28	0.92
1/28/2008	1.68	1.24	1.58	1.70	1.10	1.56	1.68	1.16	1.46	1.68	1.14	1.10	1.64	1.26	0.92
2/4/2008	1.55	1.26	1.38	1.58	1.20	1.80	1.54	1.20	1.62	1.52	1.22	1.20	1.48	1.18	0.90
2/14/2008	1.54	1.22	1.58	1.58	1.22	1.50	1.56	1.22	1.43	1.56	1.24	0.90	1.52	1.20	0.82
2/21/2008	1.51	1.20	1.72	1.56	1.19	1.62	1.54	1.20	1.50	1.50	1.20	0.60	1.46	0.74	1.20
2/29/2008	ND	1.19	1.48	1.56	1.15	1.50	1.54	1.16	1.40	1.54	1.20	1.00	1.50	1.18	0.79
3/4/2008	ND	1.00	1.78	1.40	0.98	1.40	1.32	1.00	1.34	1.32	1.00	1.10	1.22	0.94	0.80
3/13/2008	ND	0.90	1.80	NR	0.90	1.65	0.94	1.10	1.60	0.90	1.00	1.10	1.20	ND	ND
3/17/2008	ND	0.68	1.70	1.10	0.66	1.60	1.10	0.70	1.60	1.08	0.70	1.12	1.06	0.76	0.88
3/27/2008	1.64	1.28	1.68	1.64	1.28	1.58	1.64	1.28	1.48	1.64	1.32	1.08	1.64	1.30	0.84
4/2/2008	1.40	1.10	1.58	1.40	1.10	1.48	1.40	1.10	1.38	1.40	1.12	1.00	1.40	1.14	0.70
4/7/2008	1.66	1.40	1.54	NR	1.40	1.44	NR	1.36	1.34	1.66	1.40	0.96	1.66	1.40	0.74
4/9/2008	1.66	0.94	1.38	1.66	0.94	1.36	1.68	0.98	1.30	1.68	1.04	1.02	1.68	1.28	0.90
4/17/2008	1.58	1.20	1.30	1.58	1.20	1.26	1.58	1.20	1.20	1.60	1.24	0.92	1.58	1.24	0.78
4/24/2008	1.46	1.20	1.58	1.46	1.20	1.50	1.46	1.20	1.46	1.46	1.24	1.08	1.46	1.30	0.82
4/28/2008	1.29	0.70	1.74	1.29	0.64	1.64	1.28	0.60	1.54	1.28	0.60	1.12	1.28	0.60	0.96
5/7/2008	1.38	1.12	1.82	1.38	1.10	1.70	1.38	1.10	1.58	1.38	1.14	1.10	1.38	1.18	0.80
5/8/2008	1.28	0.70	2.00	1.28	0.70	1.86	1.28	0.68	1.70	1.28	0.70	1.22	1.26	0.70	0.92
5/14/2008	1.14	0.94	1.90	1.14	0.94	1.78	1.14	0.94	1.68	1.14	1.00	1.18	1.15	1.00	0.80
5/15/2008	1.06	0.50	1.96	1.06	0.54	1.84	1.06	0.53	1.72	1.06	0.52	1.24	1.06	0.52	1.13
5/20/2008	1.20	1.00	1.94	1.20	1.00	1.80	ND	1.00	1.64	1.20	1.00	1.18	1.20	1.00	0.80
5/21/2008	1.12	0.56	2.00	1.12	0.56	1.84	1.12	0.52	1.70	1.10	0.54	1.20	1.10	0.52	0.90
5/30/2008	1.66	1.29	1.77	1.66	1.29	1.67	1.66	1.30	1.62	1.66	1.35	1.14	1.65	1.29	0.83
6/3/2008	1.62	1.23	1.91	1.61	1.29	1.86	1.62	1.28	1.68	1.63	1.30	1.24	1.64	1.28	0.95
6/16/2008	1.44	1.16	1.85	1.44	1.15	1.45	1.44	1.13	1.61	1.43	1.17	1.14	1.42	1.20	0.82
6/18/2008	2.00	1.46	1.91	2.02	1.46	1.80	2.02	1.46	1.64	2.00	1.48	1.35	2.10	1.46	0.99

Table 2.3-23 (Sheet 2 of 2)
Staff Gage Readings at L-31E, Interceptor Ditch, and Industrial Wastewater Facility Canal 32

Date	Line A			Line B			Line C			Line D			Line E		
	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)
6/25/2008	1.99	1.57	1.80	1.99	1.58	1.70	1.99	1.59	1.30	2.10	1.57	1.10	2.10	1.60	0.99
7/3/2008	1.90	1.50	1.99	1.93	1.49	1.63	1.90	1.50	1.51	1.90	1.45	1.16	1.90	1.54	0.99
7/18/2008	2.10	1.63	1.80	2.09	1.64	1.75	2.09	1.64	1.60	2.15	1.66	1.66	2.14	1.66	1.10
7/29/2008	1.90	1.68	1.80	1.95	1.64	1.70	1.95	1.62	1.60	1.99	1.66	1.22	1.88	1.68	1.08
8/20/2008	2.44	2.00	2.15	2.44	2.18	2.00	2.40	2.18	1.84	2.36	2.18	1.58	2.28	2.20	1.46
8/27/2008	1.88	1.85	1.84	1.88	1.85	1.70	1.87	1.85	1.65	1.85	1.87	1.39	1.75	1.90	1.30
9/3/2008	2.25	1.84	1.86	2.25	1.55	1.50	2.25	1.85	1.75	2.26	1.90	1.59	2.25	1.99	1.58
9/10/2008	2.20	2.04	1.98	2.21	2.04	1.90	2.20	2.02	1.75	2.20	2.06	1.60	2.20	2.08	1.52
9/15/2008	2.16	1.94	1.88	2.16	1.94	1.80	2.16	1.94	1.70	2.16	1.96	1.52	2.16	2.00	1.48
9/17/2008	2.14	1.92	1.82	2.14	1.92	1.75	2.14	1.92	1.70	2.14	1.96	1.51	2.14	1.98	1.50
10/6/2008	2.50	2.38	2.14	2.50	2.39	2.10	2.50	2.38	2.06	2.48	2.40	1.94	2.42	2.40	1.92
10/28/2008	1.98	1.96	1.72	1.98	1.98	1.71	1.98	1.96	1.68	1.96	2.00	1.58	1.94	2.06	1.66
11/3/2008	1.74	1.82	1.70	1.74	1.80	1.68	1.80	1.78	1.48	1.86	1.84	1.48	1.84	1.92	1.48
11/18/2008	1.82	1.62	1.58	1.82	1.60	1.52	1.84	1.60	1.58	1.84	1.64	1.16	1.84	1.68	1.12
12/3/2008	1.68	1.40	1.42	1.70	1.40	1.36	1.70	1.46	1.30	1.70	1.44	1.02	1.72	1.44	0.94
12/9/2008	1.62	1.32	1.42	1.62	1.32	1.34	1.60	1.34	1.24	1.61	1.34	0.96	1.61	1.34	0.80
12/16/2008	1.52	1.20	1.50	1.54	1.20	1.40	1.54	1.20	1.28	1.54	1.22	0.90	1.56	1.24	0.74
12/22/2008	1.44	1.14	1.32	1.46	1.14	1.20	1.46	1.14	1.12	1.46	1.16	0.80	1.48	1.18	0.68
12/29/2008	1.38	1.04	1.28	1.40	1.04	1.16	1.38	1.04	1.06	1.38	1.04	0.70	1.40	1.00	0.56

Pumping Required (highlighted) ND = No data; NR = Data not readable

Table 2.3-24
Surface Water Uses in Miami-Dade County Permitted by SFWMD

Use Category	Number of Permits	Annual Allocation[(a)] (Million Gallon)
Public supply	1	0.04[(b)]
Industrial	6	9,411
Agricultural	3	57
Nursery	2	23
Aquaculture	1	27
Golf Course	7	1,360
Landscape	115	1,123
Dewatering	4	N.S.[(c)]

(a) For some permits that have no annual allocation data, the average daily allocations multiplied by 365 are assumed.
(b) This use is for a temporary construction trailer bathroom purposes.
(c) Not Specified.
Source: Estimates based on SFWMD 2008c

Table 2.3-25 (Sheet 1 of 3)
SFWMD Surface Water Use Permits within a 10-mile Radius of the Units 6 & 7 Plant Area

Permit No.	Expiration Date	Permit Type	Water Use	Acres	Water Source	Permitted Allocation (million gallons) Annual	Maximum Monthly	Maximum Daily	Location from the Site Direction	Approximate Distance (Mile)
13-00168-W	3/1/2013	General (>3, <=15 MGM[(a)])	Golf Course	100	Onsite Lake(s)	115.8	14.7		WNW	7
13-00221-W	9/26/2009	General	Landscape	4.02	SFWMD Canal (C-1)	—	—	18,300 gallons	NNW	9
13-02079-W	9/16/2023	General (<3 MGM)	Landscape	15.64	Onsite Lake(s)	17.383	2.1178		NW	7
13-02354-W	10/6/2024	General (minor)	Landscape	26.41	Onsite Lake(s)	20.73	2.8		WNW	7.5
13-02429-W	11/16/2024	General (<3 MGM)	Landscape	8.09	Onsite Lake(s)/Pond(s)	6.3503	0.868		NW	6.5
13-02461-W	12/15/2024	General (<3 MGM)	Landscape	15	Onsite Lake(s)	11.7744	1.6095		N	9
13-02518-W	3/8/2025	General (<3 MGM)	Landscape	6.64	Onsite Lake(s)/Pond(s)	5.2121	0.7125		NW	6.5
13-02571-W	7/17/2025	General (minor)	Landscape	10.75	Onsite Lake(s)/Pond(s)	8.4383	1.1534		NW	7.2
13-02578-W	1/9/2026	General (<3 MGM)	Landscape	4.24	Onsite Lake(s)	3.3282	0.4549		N	9
13-02613-W	9/16/2025	General (<3 MGM)	Landscape	6.1	Biscayne Aquifer/ Onsite Canal(s)	7.0618	0.8956		NW	8
13-02624-W	1/30/2027	General (<3 MGM)	Landscape	21.3	Onsite Lake(s)/Pond(s)	21.2379	2.6613		N	9
13-02633-W	6/30/2026	General (<3 MGM)	Agricultural	27.5	Onsite Lake(s)	21.5864	2.9507		NNW	6.6
13-02643-W	10/17/2025	General (<3 MGM)	Landscape	3.82	Onsite Lake(s)/Pond(s)	2.9986	0.4099		NW	6.5
13-02723-W	5/1/2026	General (<3 MGM)	Landscape	10.37	Onsite Lake(s)/Pond(s)	8.14	1.1127		WNW	8
13-02754-W	4/9/2026	General (<3 MGM)	Landscape	7.93	Onsite Lake(s)/Pond(s)	6.2247	0.8509		WNW	6

Table 2.3-25 (Sheet 2 of 3)
SFWMD Surface Water Use Permits within a 10-mile Radius of the Units 6 & 7 Plant Area

Permit No.	Expiration Date	Permit Type	Water Use	Acres	Water Source	Permitted Allocation (million gallons)			Location from the Site	
						Annual	Maximum Monthly	Maximum Daily	Direction	Approximate Distance (Mile)
13-02778-W	5/27/2026	General (<3 MGM)	Landscape	6.32	Onsite Lake(s)	6.199	0.9793		N	9
13-02823-W	1/14/2027	General (<3 MGM)	Landscape	9.64	Onsite Lake(s)	—	—		N	9
13-02844-W	10/26/2026	General (<3 MGM)	Landscape	7.22	Onsite Lake(s)	5.6517	0.7725		N	9
13-02858-W	8/13/2026	General (<3 MGM)	Landscape	9.5	Onsite Lake(s)/Pond(s)	7.4571	1.0193		NW	7.2
13-02864-W	8/13/2026	General (<3 MGM)	Landscape	6.67	Onsite Lake(s)/Pond(s)	5.2357	0.7157		NW	7.2
13-02886-W	9/23/2026	General (<3 MGM)	Landscape	0.82	SFWMD Canal (C-103)	0.9493	0.1204		NW	8
13-02911-W	8/22/2026	General (<3 MGM)	Landscape	5.25	Onsite Canal(s)	6.0778	0.7708		NW	8
13-02915-W	1/12/2027	General (<3 MGM)	Landscape	1.5	SFWMD Canal (C-1)	1.1774	0.1609		NNW	9
13-03023-W	12/18/2026	General (<3 MGM)	Landscape	8	Onsite Lake(s)/Pond(s)	9.2614	1.1746		NW	7.5
13-03046-W	12/22/2026	General (<3 MGM)	Landscape	8.32	Onsite Lake(s)	8.2957	1.0395		N	9
13-03105-W	2/16/2027	General (<3 MGM)	Landscape	2.2	Onsite Lake(s)	2.5469	0.323		WNW	8
13-03201-W	4/3/2027	General (<3 MGM)	Landscape	1	SFWMD Canal (C-1)	—	—	5,000 gallons	NNW	10
13-03469-W	5/18/2027	General (<3 MGM)	Landscape	10.91	Onsite Lake(s)/Pond(s)	12.6302	1.6019		NW	8.2
13-03492-W	7/12/2012	General (minor)	Landscape	62.17	Onsite Lake(s)	71.9727	9.1282		NNW	8.5
13-03586-W	5/20/2027	General (<3 MGM)	Landscape	18	Onsite Lake(s)	14.1293	1.9313		WNW	6.3
13-03796-W	7/13/2009	Individual	Industrial	320	Onsite Borrow Pit(s)	504	42		WNW	7

Table 2.3-25 (Sheet 3 of 3)
SFWMD Surface Water Use Permits within a 10-mile Radius of the Units 6 & 7 Plant Area

Permit No.	Expiration Date	Permit Type	Water Use	Acres	Water Source	Permitted Allocation (million gallons)			Location from the Site	
						Annual	Maximum Monthly	Maximum Daily	Direction	Approximate Distance (Mile)
13-03960-W	11/4/2028	General (<3 MGM)	Landscape	6.6	Biscayne Aquifer/ Onsite Lake(s)	7.6407	0.9691		WNW	7.5
13-04010-W	1/8/2028	General (<3 MGM)	Landscape	5	Onsite Lake(s)	3.9248	0.5365		WNW	9
13-04043-W	3/14/2028	General (<3 MGM)	Landscape	15	Biscayne Aquifer/ Onsite Lake(s)	11.7744	1.6095		NNW	9

(a) MGM: Million Gallons per Month.

Source: SFWMD 2008c

Table 2.3-26
Wastewater Discharges into Surface Water of the Miami-Dade County

Wastewater	Facility ID	Facility Name	FDEP Rated Capacity (mgd)	Surface Discharge (mgd)[(a)]	Water Body		Location from the Site	
					Source	Discharge	Direction	Approximate Distance (mile)
Domestic	FL0032182	MDWASD North District WWTP	112.5	72.76	Groundwater (Wastewater)	Ocean Outfall	NNE	36.5
	FLA024805	MDWASD Central District WWTP	143	112.86	Groundwater (Wastewater)	Ocean Outfall	NE	25
	FLA013623	Casa Granada Condominium	0.02	—	Groundwater	C-100 Canal	N	15
Industrial	FL0001481	FPL Cutler Power Plant	313	177.4	Seawater (Biscayne Bay)	Biscayne Bay	NNE	14.7
	FL0036978	Elizabeth Arden	0.14	0.04	Groundwater + Stormwater	Graham Dairy Canal (via Storm sewer system)	N	33
	FL0002721	Homestead Municipal Power Plant	7.248	1.35	Groundwater (Onsite well)	C-103 Canal (via Unnamed drainage ditch)	WNW	9.2

(a) Estimated average flow.

MGD = million gallons per day
Source: FDEP 2004a, FDEP 2004b, FDEP 2005, FDEP 2006a, FDEP 2008c, and SFWMD 2006c

Table 2.3-27
Present and Future Consumptive Water Use for Lower East Coast Region[(a)] of SFWMD

	Use Categories						
	Public Water Supply	Domestic Self-Supply	Agriculture	Power Generation	Recreation	Commercial & Industrial	Total
Estimated, 2005 (MGD)	869.0	36.6	429.7	4.5	48.6	61.3	1,449.7
Projected, 2025 (MGD)	1,173.6	48.9	393.0	102.6	63.6	61.3	1,843.0
% Change	35%	34%	–9%	2,180%	31%	0%	27%

(a) The Lower East Coast region includes all of Miami-Dade, Broward and Palm Beach counties, most of Monroe County, and the eastern portions of Hendry and Collier counties.
Source: SFWMD 2006b.

Table 2.3-28
Visitation of Biscayne National Park in 2005–2007

Month	Visitors (persons)				Visitor-Days (person-days)[(a)]			
	2005	2006	2007	Average	2005	2006	2007	Average
January	36,890	41,208	44,672	40,923	9,222	14,850	15,248	13,107
February	29,993	34,520	34,284	32,932	7,498	10,828	11,369	9,898
March	35,935	39,131	45,363	40,143	8,983	12,886	12,496	11,455
April	49,550	50,254	45,652	48,485	12,387	14,095	14,677	13,720
May	50,283	50,464	40,736	47,161	12,570	14,758	11,263	12,864
June	61,005	65,065	52,932	59,667	15,251	16,266	13,233	14,917
July	87,592	83,212	62,126	77,643	21,898	20,803	15,531	19,411
August	45,859	47,226	52,222	48,436	11,464	11,806	13,055	12,108
September	26,186	34,903	41,955	34,348	6,546	8,725	10,888	8,720
October	75,962	97,418	31,017	68,132	18,990	25,258	8,754	17,667
November	26,160	31,227	32,998	30,128	6,540	8,818	9,706	8,355
December	38,313	34,208	33,485	35,335	9,578	9,112	10,307	9,666
Annual	563,728	608,836	517,442	563,335	140,927	168,205	146,527	151,886

(a) A visitor-day is defined as number of visitor hours divided by 12.
Source: NPS 2009.

Table 2.3-29
Historical and Projected Groundwater Use in Miami-Dade County

Year	Groundwater Use/Projected Use in million gallons per day					
	Public Supply	Domestic	Commercial	Agricultural	Recreational	Power Generation
1965	202.3	9.6	5	67.9		0.3
1970	212.1	9.13	7.7	44.8		0.04
1975	270.5	9.5	3.38	87.66		0.04
1977	280.15	3.98	6.73	101.06		0
1980	314.29	18.38	19.73	86.98		0
1985	339.77	13.32	15.78	103.68	13.5	0
1990	337.69	10.75	40.34	115.01	20.55	2.26
1995	386.6	12.71	38.82	95.95	14.24	2.1
2000	394.29	4.85	41.65	86.55	8.51	2.08
2005	400.01	2.78	40.08	58.06	13.40	0.42
2010	407.8		41.7	92.1	10.4	14.2
2015	435.2		41.7	91.5	12	14.2
2020	459.6		41.7	90.8	13.6	14.2
2025	483.1		41.7	90.2	15.1	69.8

[shaded box] Projected (Projected use includes public supply and domestic as a single value)

Sources:
1965-2000 Appendix 1 of Marella 2005
2005 Marella 2008
2010-2025 SFWMD 2006b

Table 2.3-30 (Sheet 1 of 6)
Public Water Supply Systems in Miami-Dade County

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4130077	Community	Bal Harbour Village	Bal Harbour	Municipality	3,309	3,672,000
4130089	Community	Bay Harbor Islands Town of	Bay Harbor Islands	Municipality	5,146	1,500,000
4130255	Community	Florida City	Florida City	Municipality	9,445	4,000,000
4130588	Community	Redlands Mobile Home Park	Miami	Investor	160	100,000
4130604	Community	Hialeah City of	Hialeah	Municipality	110,000	40,000,000
4130645	Community	Homestead City of	Homestead	Municipality	39,000	16,900,000
4130662	Community	Indian Creek Village	Miami Beach	Authority/Commission/District	103	1,080,000
4130833	Community	Jones' Trailer Park	Miami	Investor	120	50,000
4130871	Community	Mdwasa — Main System	Miami	Municipality	2,100,000	442,740,000
4130901	Community	Miami Beach City of	Miami Beach	Municipality	87,933	65,000,000
4130904	Community	Miami Springs City of	Miami Springs	Municipality	14,000	5,472,000
4130970	Community	North Bay Village City of	North Bay Village	Municipality	6,733	6,480,000
4130977	Community	North Miami City of	North Miami	Municipality	80,000	9,300,000
4131001	Community	Opa Locka City of	Opa Locka	Municipality	15,250	6,900,000
4131202	Community	Mdwasa/Rex Utilities	Miami	Investor	41,500	12,030,000
4131206	Community	Rex Utilities Inc/Redavo	Homestead	Municipality	385	570,000
4131312	Community	Silver Palm Mobile Homes	Miami	Investor	250	122,000
4131403	Community	Americana Village	Miami	Investor	2,100	500,000
4131424	Community	Surfside Town of	Surfside	Municipality	5,600	1,512,000
4131474	Community	Medley Water Department	Miami	Municipality	1,098	1,800,000
4131531	Community	Virginia Gardens Village of	Virginia Gardens	Municipality	2,212	5,000,000
4131558	Community	West Miami City of	West Miami	Municipality	5,863	1,000,000
4131618	Community	North Miami Beach	North Miami Beach	Municipality	160,000	32,000,000
4134357	Community	FKAA J. Robert Dean W.T.P.	Florida City	State	80,500	22,000,000

Table 2.3-30 (Sheet 2 of 6)
Public Water Supply Systems in Miami-Dade County

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4134358	Community	Dade Juvenile Residential Facility	Florida City	Investor	290	35,000
4134365	Community	Hialeah Gardens	Hialeah Gardens	Municipality	19,297	1
4130048	Noncommunity	Anderson's Corner Grocery	Miami	Investor	35	8,000
4130053	Noncommunity	Hightailin' It	Miami	Investor	205	28,000
4130112	Noncommunity	Benson Lighting	Miami	Investor	25	36,000
4130159	Noncommunity	Brooks (J R) & Son	Homestead	Investor	100	28,000
4130320	Noncommunity	Camp Owaissa Bauer	Miami	Municipality	146	183,000
4130496	Noncommunity	Franksher Building	Miami	Investor	25	64,000
4130721	Noncommunity	Miami Everglades Campground	Miami	Unknown	562	122,000
4130736	Noncommunity	Villa De Don Pollo	Miami	Investor	599	36,000
4130793	Noncommunity	Deluxe Motel	Leisure City	Investor	50	46,000
4130811	Noncommunity	De Leon Harvesting	Homestead	Investor	25	36,000
4130823	Noncommunity	Dan Lewis Properties	Miami	Investor	25	15,000
4130891	Noncommunity	Roberts Air	Homestead	Municipality	25	28,000
4130893	Noncommunity	Dade Homestead GAA - Admin.	Homestead	Municipality	25	28,000
4130894	Noncommunity	Dade Homestead GAA Skydive	Homestead	Municipality	30	28,000
4130897	Noncommunity	Dade Landscape Nursery	Miami	Municipality	40	86,000
4130933	Noncommunity	Monkey Jungle	Miami	Investor	300	122,000
4130951	Noncommunity	Last Chance Lounge	Florida City	Investor	100	5,000
4131080	Noncommunity	Pedersen Building	Miami	Investor	25	17,000
4131185	Noncommunity	Grove Inn	Miami	Investor	25	36,000
4131192	Noncommunity	Redland Golf & Country Club	Homestead	Investor	380	57,000
4131217	Noncommunity	Rinker Cement Mill	Miami	Investor	130	720,000
4131250	Noncommunity	America's Best Inn	Homestead	Investor	50	61,000
4131313	Noncommunity	Silver Palms Methodist Church	Homestead	Other	200	36,000

Table 2.3-30 (Sheet 3 of 6)
Public Water Supply Systems in Miami-Dade County

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4131454	Noncommunity	R & R Cafe	Homestead	Investor	100	36,000
4131961	Noncommunity	Redland Fruit And Spice Park	Miami	County	55	46,000
4131962	Noncommunity	Castellow Hammock Park	Miami	County	68	1,700
4134228	Noncommunity	Chevron Krome	Homestead	Investor	25	1,000
4134234	Noncommunity	Cemex Materials — Sweetwater	Miami	Investor	50	5,000
4134237	Noncommunity	Jack's Bait & Tackle	Florida City	Investor	200	3,200
4134239	Noncommunity	Liberty (Formerly Shell Gas Station)	Miami	Investor	25	9,600
4134301	Noncommunity	Iglesia Buen Samaritano	Miami	Investor	100	12,000
4134328	Noncommunity	Atlantic Fertilizer	Homestead	Investor	40	1,000
4134334	Noncommunity	Costa Nursery Ii	Miami	Investor	25	1,000
4134338	Noncommunity	Benito Juarez Park	Homestead	County	100	1,700
4134363	Noncommunity	Homestead Jehovah's Witness	Homestead	Other	100	1
4134364	Noncommunity	Dade Corners	Miami	Investor	25	10,000
4134379	Noncommunity	Bernecker's Nursery	Miami	Investor	25	5,000
4134382	Noncommunity	Butler's Nursery	Miami	Investor	25	5,000
4134384	Noncommunity	Cauley Square Tea Room	Miami	Investor	40	10,000
4134387	Noncommunity	Coconut Palm Trading Post	Homestead	Investor	300	5,000
4134388	Noncommunity	Coffey's Market	Miami	Investor	35	5,000
4134393	Noncommunity	Coopertown	Miami	Investor	100	5,000
4134394	Noncommunity	Costa Nursery	Miami	Investor	150	5,000
4134400	Noncommunity	El Nopal	Miami	Investor	25	5,000
4134402	Noncommunity	Greenleaf Nursery	Homestead	Investor	25	5,000
4134404	Noncommunity	Gulfstream Tomato Growers	Miami	Investor	100	5,000
4134414	Noncommunity	Playpen South (Gator Kicks)	Miami	Investor	50	5,000

Table 2.3-30 (Sheet 4 of 6)
Public Water Supply Systems in Miami-Dade County

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4134417	Noncommunity	Redland Tavern	Goulds	Investor	40	5,000
4134420	Noncommunity	Safari Restaurant	Miami	Investor	25	5,000
4134422	Noncommunity	South Florida Testing Service	Hialeah	Investor	50	5,000
4134430	Noncommunity	Tom Thumb #122	Miami 33170	Investor	25	5,000
4134431	Noncommunity	Redland Exxon	Miami	Investor	25	5,000
4134434	Noncommunity	Community Asphalt	Hialeah	Investor	25	5,000
4134439	Noncommunity	Cemex-F.E.C. office	Hialeah	Investor	160	3,000
4134442	Noncommunity	Redland Community Church	Miami	Investor	500	3,000
4134443	Noncommunity	Comcast Cable	Miami	Other	225	3,000
4134445	Noncommunity	First Grace Faith Pentecost	Princeton	Investor	25	3,000
4134446	Noncommunity	Kent Motel	Goulds	Investor	50	3,000
4134448	Noncommunity	Palms Professional Center	Miami	Investor	25	3,000
4134451	Noncommunity	Farm Credit Service	Homestead Fl 33090	Investor	25	2,720
4134453	Noncommunity	Cemex-F.E.C. Shop	Hialeah	Investor	35	16,000
4134454	Noncommunity	Rancho Okeechobee	Hialeah Gardens	Investor	200	3,000
4134459	Noncommunity	Circle D Farms	Homestead	Investor	25	3,000
4134462	Noncommunity	Redlands Grocery	Homestead	Investor	200	3,000
4134464	Noncommunity	Sunrise Adult Group Home (15190)	Naranja	Investor	25	3,000
4134465	Noncommunity	Sunrise Adult Services (29800)	Homestead	Investor	80	3,000
4134468	Noncommunity	U-Haul Rental & Services	Miami	Investor	25	3,000
4134471	Noncommunity	Certified Auto	Miami	Investor	25	3,000
4134494	Noncommunity	Dinas Quick Mart	Miami	Investor	25	3,000
4134499	Noncommunity	Our Lady of Mercy Cemetery	Doral	Investor	50	2,000
4134506	Noncommunity	First Baptist Church Redland	Homestead	Other	120	2,000

Table 2.3-30 (Sheet 5 of 6)
Public Water Supply Systems in Miami-Dade County

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4134508	Noncommunity	Aviary Bird Shop	Goulds	Investor	25	2,000
4134512	Noncommunity	De Leon Bromeliads	Miami	Investor	54	5,000
4134516	Noncommunity	Tom Thumb #127	Hialeah	Investor	25	2,400
4134518	Noncommunity	Christ Life Center	Miami	Other	485	500
4134519	Noncommunity	Okeechobee Barrier	Miami	State	39	9,600
4134522	Noncommunity	1st Baptist Church of Homestead	Homestead	Other	300	5,000
4134523	Noncommunity	Women’s Club of Homestead	Homestead	Other	25	3,300
4134524	Noncommunity	Redland Church of the Nazarene	Miami	Other	150	7,200
4134525	Noncommunity	Cemex Hydro-Conduit	Miami	Investor	28	1,400
4134527	Noncommunity	Cemex Employees	Miami	Investor	150	3,750
4134528	Noncommunity	Fruticuba	Miami	Investor	50	0
4134529	Noncommunity	US 1 Motors	Miami	Unknown	25	2,000
4134531	Noncommunity	Tom Thumb 131	Homestead	Investor	25	1,000
4134532	Noncommunity	Sunoco Krome Ave	Miami	Investor	25	50
4134533	Noncommunity	Gator Park	Miami	Investor	25	3,000
4134535	Noncommunity	Vila & Sons	Medley	Investor	25	50
4134536	Noncommunity	Everglades Store	Florida City	Investor	25	15
4134537	Noncommunity	Mannheime Foundation	Homestead	Investor	50	0
4134538	Noncommunity	BT South DBA Boody Trap	Homestead	Investor	30	120
4134540	Noncommunity	Chevron Gas Station	Miami	Investor	80	320
4134542	Noncommunity	Las Margaritas Shopping Center	Miami	Investor	50	3,200
4134543	Noncommunity	Schnebly Winery	Homestead	Investor	25	4,800
4134544	Noncommunity	Fruteria Cachita	Miami	Investor	25	2,000
4134545	Noncommunity	Cope Produce	Homestead	Investor	50	0
4130322	Nontransient Noncommunity	Redland Jr. High School	Homestead	Municipality	1,496	144,000
4130445	Nontransient Noncommunity	Tropical Research & Education Center	Homestead	State	75	36,000

Table 2.3-30 (Sheet 6 of 6)
Public Water Supply Systems in Miami-Dade County

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4130934	Nontransient Noncommunity	Montessori Country School	Homestead	Investor	120	38,000
4131958	Nontransient Noncommunity	Sunrise Community	Miami	Investor	120	150,000
4134300	Nontransient Noncommunity	Redland Christian Academy	Homestead	Other	300	10,000
4134385	Nontransient Noncommunity	Unitarian Universal Congr'n of Miami	Miami	Investor	75	5,000
4134498	Nontransient Noncommunity	Creative Years	Miami	Investor	100	2,000
4134502	Nontransient Noncommunity	Christian Family Worship Center	Homestead	Investor	400	9,600
4134513	Nontransient Noncommunity	Miami Intl Airport	Miami	County	26,800	1

Note: gpd = gallons per day

Source: FDEP 2008a

Table 2.3-31 (Sheet 1 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC135 — Average Monthly Results for 1993–2007																		
Jan	<1	14	19.6	7.22	8.17	0.3355	0.00561	0.00117	0.00996	0.0000	0.00536	0.02301	0.300	0.00411	0.315	32.1	3.60	0.083
	1-3.5	8	18.9	6.96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	31.4	ND	ND
Feb	<1	13	22.1	7.24	8.22	0.4125	0.01020	0.00153	0.01051	0.00063	0.00420	ND	0.380	0.00753	0.334	32.5	3.65	0.213
	1-3.5	7	21.4	7.61	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.1	ND	ND
Mar	<1	15	23.4	6.68	8.19	0.4100	0.0059	0.00084	0.00737	0.107	0.00381	0.00800	0.311	0.00412	0.211	34.3	3.36	0.110
	1-3.5	9	23.6	6.69	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.8	ND	ND
Apr	<1	13	24.9	6.62	7.72	0.5188	0.00455	0.00071	0.00661	0.0028	0.00809	0.03113	0.243	0.00316	0.275	35.9	3.67	0.134
	1-3.5	9	25.0	6.43	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.4	ND	ND
May	<1	13	27.1	6.42	8.29	0.3456	0.00408	0.00108	0.00930	0.0009	0.00881	0.04750	0.344	0.00291	0.242	36.6	3.82	0.169
	1-3.5	9	27.7	6.73	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.1	ND	ND
Jun	<1	12	28.7	5.93	8.16	0.5750	0.01277	0.00200	0.02163	0.00106	0.00816	ND	0.456	0.00868	0.340	34.6	4.51	0.165
	1-3.5	9	29.0	5.69	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.4	ND	ND
Jul	<1	15	30.7	5.82	8.23	0.4033	0.00925	0.00136	0.0125	0.0024	0.00849	0.12086	0.332	0.00841	5.326	34.6	5.08	0.197
	1-3.5	8	30.6	5.93	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.6	ND	ND
Aug	<1	15	30.6	5.60	8.15	0.2980	0.00843	0.00183	0.01665	0.0016	0.00652	0.07000	0.451	0.00701	7.640	34.1	15.41	0.179
	1-3.5	9	30.8	5.56	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.5	ND	ND
Sep	<1	14	29.5	5.76	7.93	0.4650	0.01080	1.00226	0.02489	0.0025	0.00563	ND	0.342	0.01098	5.035	33.2	5.46	0.146
	1-3.5	8	30.2	5.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.5	ND	ND
Oct	<1	15	26.8	6.59	8.08	0.9464	0.04369	0.00430	0.03239	0.00184	0.00611	0.109	0.578	0.03772	0.310	29.1	5.11	0.146
	1-3.5	9	26.7	5.89	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.9	ND	ND
Nov	<1	14	23.7	6.75	8.00	0.7891	0.04736	Nov	0.02425	0.0007	0.00603	0.02400	0.578	0.04082	0.333	28.8	4.25	0.113
	1-3.5	9	23.3	7.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	29.2	ND	ND
Dec	<1	14	22.4	7.46	8.00	0.6864	0.01990	0.00271	0.01579	0.0015	0.00588	ND	0.389	0.01714	0.227	30.0	3.96	0.092
	1-3.5	9	21.9	7.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	31.6	ND	ND

Table 2.3-31 (Sheet 2 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC121 — Average Monthly Results for 1993–2008																		
Jan	<1	17	19.7	7.22	8.15	0.7371	0.01021	0.001309	0.00821	0.1680	0.0007	0.00485	0.037	0.30500	0.00737	0.325	32.99	3.381
	1-3.5	12	19.5	6.93	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	31.86	ND
Feb	<1	15	22.2	6.94	8.15	0.8565	0.00930	0.00162	0.01331	0.2070	0.0005	0.00426	ND	0.44778	0.00737	0.330	33.51	3.557
	1-3.5	11	21.9	7.21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.32	ND
Mar	<1	18	23.2	6.46	8.19	0.7417	0.00551	0.001091	0.00752	ND	0.0007	0.00389	0.064	0.32467	0.00371	0.208	35.21	3.139
	1-3.5	15	23.7	6.49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.99	ND
April	<1	16	25.4	6.66	7.69	0.9038	0.00487	0.000980	0.00675	ND	0.00056	0.00482	0.027	0.26429	0.00384	0.262	36.81	3.076
	1-3.5	15	25.8	6.58	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.40	ND
May	<1	16	27.4	6.22	8.30	0.5683	0.00485	0.001011	0.00974	ND	0.0007	0.00657	0.036	0.319	0.00387	0.231	37.00	3.865
	1-3.5	15	28.1	6.34	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.92	ND
Jun	<1	14	28.8	5.75	8.18	0.7550	0.00833	0.001333	0.01301	ND	0.0009	0.00589	ND	0.61449	0.00656	0.310	34.40	3.554
	1-3.5	13	29.1	5.71	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.28	ND
Jul	<1	17	30.9	5.69	8.17	0.5755	0.00868	0.001420	0.0124	ND	0.00062	0.00725	0.106	0.25676	0.00762	6.018	34.96	3.933
	1-3.5	12	30.7	5.76	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.60	ND
Aug	<1	17	30.7	5.57	8.08	0.4392	0.01002	0.001540	0.01623	ND	0.00105	0.00639	0.136	0.27042	0.00901	5.647	35.14	3.826
	1-3.5	13	30.8	5.74	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.63	ND
Sep	<1	16	29.7	5.61	7.88	0.6220	0.01003	0.00161	0.01708	ND	0.00106	0.00808	ND	0.27492	0.00844	5.560	34.08	4.200
	1-3.5	12	29.9	5.32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.02	ND
Oct	<1	19	27.1	6.15	8.05	0.9893	0.03198	0.003223	0.02784	0.2415	0.00093	0.00651	0.113	0.51385	0.02852	0.365	30.57	3.943
	1-3.5	13	27.3	5.72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.82	ND
Nov	<1	17	23.9	6.76	8.01	0.9304	0.04125	0.002975	0.01669	0.2610	0.00116	0.00590	ND	0.42083	0.03588	0.293	30.16	3.857
	1-3.5	13	23.6	7.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.17	ND
Dec	<1	17	22.2	7.13	8.01	0.7232	0.02296	0.003209	0.01883	0.1790	0.0012	0.00647	ND	0.35083	0.01912	0.233	31.33	3.730
	1-3.5	13	22.2	6.85	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.71	ND

Table 2.3-31 (Sheet 3 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC116 — Average Monthly Results for 1993–2007																		
Jan	<1	15	19.6	7.10	8.21	1.6571	0.01449	0.001109	0.00734	0.1440	0.0004	0.00500	0.061	0.42333	0.01272	0.315	34.05	2.810
	1-3.5	12	19.4	6.78	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.78	ND
Feb	<1	13	21.5	7.02	8.20	1.1259	0.00830	0.001190	0.00838	0.1800	0.0004	0.00459	ND	0.38889	0.00633	0.360	34.75	2.972
	1-3.5	11	21.8	7.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.46	ND
Mar	1	16	23.2	6.45	8.19	1.0738	0.00533	0.000927	0.00729	ND	0.00014	0.00350	0.018	0.30036	0.00413	0.186	35.96	2.668
	1-3.5	15	23.5	6.51	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.71	ND
Apr	<1	16	25.0	6.49	7.73	0.9200	0.00530	0.00076	0.00617	ND	0.00083	0.00457	0.018	0.21247	0.00473	0.235	37.65	2.614
	1-3.5	15	25.6	6.31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.32	ND
May	<1	16	27.5	6.25	8.29	0.7479	0.00572	0.000103	0.00966	ND	0.00083	0.00544	0.025	0.24155	0.00460	0.227	37.58	3.620
	1-3.5	15	28.2	6.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.55	ND
Jun	<1	14	28.6	5.51	8.14	0.8545	0.00999	0.001367	0.01104	ND	0.0011	0.00571	ND	0.28470	0.00811	0.270	36.09	2.848
	1-3.5	13	28.8	5.72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.78	ND
Jul	<1	17	30.8	5.26	8.14	0.8264	0.00797	0.001370	0.0119	ND	0.00107	0.00630	0.068	0.20618	0.00697	6.168	36.08	2.927
	1-3.5	12	30.5	5.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.60	ND
Aug	<1	17	30.6	5.28	8.07	0.6067	0.01238	0.001520	0.01297	ND	0.00133	0.00612	0.049	0.21553	0.01088	6.278	35.49	2.934
	1-3.5	13	30.6	5.38	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.31	ND
Sep	<1	16	29.6	5.20	7.96	0.7782	0.01503	0.00128	0.01512	ND	0.00122	0.00864	ND	0.21017	0.01367	4.843	34.98	2.820
	1-3.5	12	29.7	5.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.65	ND
Oct	<1	18	26.9	5.93	8.10	1.4929	0.04678	0.002685	0.02302	0.1315	0.00092	0.00653	0.020	0.44692	0.03937	0.243	31.75	2.957
	1-3.5	13	27.1	5.24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32.78	ND
Nov	<1	16	24.0	6.59	8.00	1.5162	0.02799	0.001892	0.01335	0.1850	0.00068	0.00624	0.002	0.36500	0.02665	0.327	32.42	2.946
	1-3.5	13	23.9	6.83	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32.67	ND
Dec	<1	16	22.2	6.90	7.99	1.2962	0.01775	0.001475	0.01284	0.1410	0.00104	0.00614	ND	0.33167	0.01541	0.200	33.52	2.909
	1-3.5	13	22.1	6.61	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.00	ND

Table 2.3-31 (Sheet 4 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC122 — Average Monthly Results for 1993–2007																		
Jan	<1	17	20.3	7.36	8.18	0.6636	0.08004	0.002927	0.01571	0.2210	0.00099	0.00525	0.090	0.34333	0.07619	0.390	29.59	3.687
	1-3.5	12	19.4	7.24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	28.24	ND
Feb	<1	16	22.3	6.90	8.28	0.5954	0.04183	0.002070	0.01555	ND	0.00083	0.00432	ND	0.44	0.04384	0.373	30.97	3.903
	1-3.5	11	22.4	7.37	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.35	ND
Mar	<1	19	23.2	6.79	8.22	0.6940	0.01237	0.001450	0.00964	ND	0.0012	0.00424	0.014	0.27989	0.01004	0.239	34.27	4.034
	1-3.5	15	23.9	7.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.03	ND
Apr	<1	16	25.2	6.82	7.80	0.5379	0.01156	0.00128	0.00855	ND	0.00068	0.00434	0.028	0.25634	0.00945	0.315	36.36	3.562
	1-3.5	15	25.7	6.72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.11	ND
May	<1	16	27.6	6.23	8.28	0.4863	0.00562	0.00117	0.01433	ND	0.00070	0.00645	0.064	0.28103	0.00525	0.246	37.21	4.226
	1-3.5	15	28.3	6.40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.13	ND
Jun	<1	14	28.5	5.99	8.22	0.6564	0.02719	0.002033	0.02190	ND	0.00120	0.00640	ND	0.45833	0.02299	0.415	34.82	4.389
	1-3.5	13	28.7	6.18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.70	ND
Jul	<1	17	30.8	5.76	8.24	0.6391	0.01125	0.001800	0.01880	ND	0.00112	0.00658	0.156	0.31563	0.01040	7.336	35.00	5.269
	1-3.5	12	30.6	5.97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.16	ND
Aug	<1	17	30.8	5.47	8.17	0.5467	0.05062	0.003018	0.02275	ND	0.00127	0.00611	0.168	0.26136	0.04760	5.638	33.68	4.814
	1-3.5	13	30.7	5.45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.67	ND
Sep	<1	16	29.5	5.85	8.00	0.7664	0.07902	0.00351	0.02971	ND	0.00146	0.00928	ND	0.31275	0.07469	5.708	31.88	4.316
	1-3.5	12	29.7	5.73	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32.01	ND
Oct	<1	19	27.0	6.63	8.13	0.9613	0.13725	0.006892	0.03925	0.2995	0.00228	0.00664	0.197	0.7175	0.09543	0.425	25.65	4.293
	1-3.5	13	27.1	6.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	26.45	ND
Nov	<1	17	23.8	7.06	8.10	0.8796	0.10459	0.004883	0.02813	0.2600	0.00117	0.00628	ND	0.42750	0.10976	0.410	25.44	4.295
	1-3.5	13	23.6	7.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	24.88	ND
Dec	<1	18	22.0	7.40	8.12	0.7339	0.07089	0.00462	0.02082	0.2380	0.00181	0.00623	ND	0.38000	0.07186	0.405	26.84	4.227
	1-3.5	13	21.9	7.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	26.15	ND

Table 2.3-31 (Sheet 5 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC123 — Average Monthly Results for 1993–2007																		
Jan	<1	17	20.0	7.20	8.02	1.0061	0.05039	0.002164	0.01369	0.1650	0.00117	0.00498	0.083	0.24800	0.04993	0.335	31.94	3.229
	1-3.5	12	19.3	7.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.76	ND
Feb	<1	16	22.0	6.76	8.22	0.7627	0.04415	0.001980	0.01676	0.1840	0.00045	0.00407	ND	0.37556	0.04477	0.356	32.65	3.167
	1-3.5	11	21.7	7.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32.11	ND
Mar	<1	18	22.9	6.64	8.17	0.7893	0.01350	0.001225	0.00893	ND	0.0008	0.00355	0.017	0.393	0.01229	0.213	34.85	3.485
	1-3.5	15	23.3	6.65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.75	ND
Apr	<1	16	25.2	6.58	7.77	0.8417	0.00840	0.001020	0.00855	ND	0.00117	0.00441	0.025	0.21568	0.00829	0.289	37.13	3.078
	1-3.5	15	25.6	6.51	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.70	ND
May	<1	16	27.4	6.09	8.28	0.6767	0.01035	0.00133	0.01283	ND	0.00063	0.00526	0.035	0.255	0.00952	0.212	37.80	3.503
	1-3.5	15	28.0	6.08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.67	ND
Jun	<1	14	28.3	5.78	8.18	0.7518	0.04097	0.002533	0.02177	ND	0.00128	0.00586	ND	0.49680	0.03601	0.395	35.10	3.309
	1-3.5	13	28.6	5.64	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.07	ND
Jul	<1	17	30.7	5.40	8.24	0.7900	0.02699	0.002382	0.02142	ND	0.0008	0.00620	0.096	0.26335	0.02706	7.066	35.01	4.515
	1-3.5	12	30.4	5.49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.05	ND
Aug	<1	17	30.3	5.57	8.13	0.5417	0.02383	0.002609	0.02019	ND	0.00197	0.00568	0.042	0.27533	0.02124	6.828	34.94	3.758
	1-3.5	13	30.3	5.56	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.48	ND
Sep	<1	16	29.3	5.85	7.68	0.7691	0.06945	0.00357	0.03264	ND	0.00153	0.00731	ND	0.28258	0.06569	5.530	32.36	3.597
	1-3.5	12	29.5	5.68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32.45	ND
Oct	<1	19	27.4	6.27	8.10	0.9760	0.11473	0.004954	0.02965	0.2005	0.00106	0.00587	0.067	0.4558	0.09810	0.290	29.51	3.453
	1-3.5	13	27.1	5.84	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.20	ND
Nov	<1	17	23.7	6.78	8.05	1.1882	0.06585	0.003650	0.02002	0.2410	0.00118	0.00610	ND	0.33250	0.06186	0.257	29.32	3.424
	1-3.5	13	23.6	6.89	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	29.25	ND
Dec	<1	17	22.2	7.24	8.06	0.9468	0.06158	0.002736	0.01937	0.2000	0.00128	0.00574	ND	0.30750	0.05928	0.297	30.56	3.583
	1-3.5	13	22.1	6.89	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.29	ND

Table 2.3-31 (Sheet 6 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC113 — Average Monthly Results for 1993–2007																		
Jan	<1	15	20.0	6.92	8.23	1.0875	0.01003	0.00099	0.01135	0.1400	0.00038	0.00554	0.015	0.29444	0.00974	0.315	34.86	2.651
	1-3.5	12	19.3	6.87	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.54	ND
Feb	<1	13	21.2	7.05	8.20	0.7736	0.00630	0.001110	0.01346	0.1390	0.00035	0.00449	ND	0.384	0.00598	0.310	35.26	2.769
	1-3.5	11	21.3	7.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.85	ND
Mar	<1	16	23.1	6.65	8.17	0.8396	0.00516	0.00097	0.00983	ND	0.00083	0.00332	0.007	0.30890	0.00389	0.203	36.70	2.429
	1-3.5	15	23.3	6.70	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.19	ND
Apr	<1	16	25.1	6.46	7.91	0.8458	0.00474	0.00072	0.01066	ND	0.00102	0.00460	0.013	0.22437	0.00408	0.227	37.90	2.781
	1-3.5	15	25.5	6.32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.61	ND
May	<1	16	27.4	6.19	8.26	0.7963	0.00533	0.00094	0.01432	ND	0.00076	0.00479	0.015	0.25324	0.00442	0.228	38.06	3.805
	1-3.5	15	28.0	6.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.91	ND
Jun	<1	14	28.6	5.85	8.18	0.7868	0.03219	0.001900	0.02238	ND	0.00089	0.00740	ND	0.34641	0.02761	0.220	36.09	2.910
	1-3.5	13	28.6	5.90	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.87	ND
Jul	<1	17	30.6	5.59	8.21	0.9100	0.00929	0.001200	0.02290	ND	0.00128	0.00722	0.057	0.25788	0.00785	5.634	36.49	3.335
	1-3.5	12	30.5	5.67	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.07	ND
Aug	<1	17	30.5	5.74	8.21	0.6650	0.01062	0.001464	0.02860	ND	0.00087	0.00650	0.028	0.22565	0.00905	6.462	36.09	2.909
	1-3.5	13	30.4	5.68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.24	ND
Sep	<1	16	29.5	5.79	8.04	0.9100	0.01490	0.000146	0.03209	ND	0.00113	0.00586	ND	0.24992	0.01441	8.067	35.65	2.848
	1-3.5	12	29.6	5.54	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.78	ND
Oct	<1	17	27.0	6.04	8.11	1.0000	0.01557	0.001525	0.02702	0.1735	0.00070	0.00668	0.032	0.4125	0.01347	0.295	33.79	2.534
	1-3.5	13	27.0	5.77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.56	ND
Nov	<1	16	23.8	6.72	8.03	1.4519	0.02047	0.001600	0.02660	0.1880	0.00070	0.00576	ND	0.32833	0.01830	0.327	33.56	2.704
	1-3.5	13	23.6	6.95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.37	ND
Dec	<1	16	22.1	7.07	7.99	1.1667	0.01566	0.00138	0.02113	0.1230	0.00127	0.00575	ND	0.35917	0.01309	0.173	33.61	2.583
	1-3.5	13	22.1	6.73	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.72	ND

Table 2.3-31 (Sheet 7 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC124 — Average Monthly Results for 1993–2007																		
Jan	<1	14	19.4	7.06	8.21	0.9896	0.00643	0.001027	0.01145	0.1710	0.00055	0.00453	0.012	0.24333	0.00574	0.280	33.94	2.662
	1-3.5	13	19.3	6.85	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.26	ND
Feb	<1	12	21.0	6.96	8.25	0.8973	0.00713	0.001140	0.01216	0.1710	0.0009	0.00415	ND	0.379	0.00600	0.330	35.04	2.686
	1-3.5	12	20.9	7.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.76	ND
Mar	<1	15	23.1	6.68	8.18	0.9150	0.00414	0.00128	0.00879	ND	0.0007	0.00323	ND	0.30317	0.00232	0.204	36.32	2.483
	1-3.5	16	23.2	6.73	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.98	ND
Apr	<1	16	25.3	6.46	7.76	0.8329	0.00418	0.000775	0.00923	ND	0.00092	0.00429	0.009	0.23181	0.00283	0.306	37.61	2.834
	1-3.5	14	25.6	6.41	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.41	ND
May	<1	16	27.3	6.38	8.30	0.5817	0.00260	0.000744	0.01212	ND	0.00046	0.00456	0.022	0.25226	0.00196	0.225	37.92	2.821
	1-3.5	15	27.8	6.45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.80	ND
Jun	<1	14	28.6	6.07	8.26	0.8332	0.01994	0.001244	0.02028	ND	0.0012	0.00496	ND	0.23684	0.01528	0.440	36.58	3.491
	1-3.5	13	29.0	6.21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.65	ND
Jul	<1	17	30.7	5.48	8.23	0.8973	0.00839	0.001140	0.02081	ND	0.00116	0.00561	0.071	0.19189	0.00762	6.610	36.12	4.186
	1-3.5	12	30.6	5.64	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.71	ND
Aug	<1	17	30.5	5.73	8.25	0.6592	0.01026	0.001520	0.02638	ND	0.00173	0.00556	0.052	0.26117	0.00815	4.948	35.87	3.377
	1-3.5	13	30.4	5.69	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.22	ND
Sep	<1	17	29.2	5.65	8.02	0.8742	0.00776	0.00144	0.03669	0.1420	0.00149	0.00528	ND	0.32069	0.00606	5.858	35.26	2.901
	1-3.5	12	29.4	5.62	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.63	ND
Oct	<1	16	27.0	6.03	8.10	1.0192	0.01389	0.001464	0.02399	0.1760	0.0009	0.00490	0.027	0.339	0.00971	0.200	33.84	2.788
	1-3.5	14	27.1	5.81	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.11	ND
Nov	<1	15	23.9	6.61	8.04	0.9135	0.01491	0.001682	0.02498	0.2890	0.00087	0.00530	ND	0.33167	0.01182	0.177	33.73	2.617
	1-3.5	14	23.5	6.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.01	ND
Dec	<1	16	22.3	7.11	8.00	0.8938	0.02208	0.00156	0.02225	0.2360	0.00109	0.00606	ND	0.29154	0.01700	0.163	33.79	2.799
	1-3.5	14	22.4	6.82	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.40	ND

Table 2.3-31 (Sheet 8 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC101 — Average Monthly Results for 1993–2008																		
Jan	<1	17	20.4	7.85	8.20	0.7254	0.12840	0.0044	0.02126	0.7120	0.00120	0.00658	0.185	0.33111	0.13631	0.466	25.91	3.988
	1-3.5	12	19.8	7.78	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	26.48	ND
Feb	<1	16	22.7	7.44	8.25	0.8519	0.06015	0.002510	0.01086	0.3870	0.00062	0.00475	ND	0.47889	0.06360	0.345	29.18	3.876
	1-3.5	11	22.6	8.24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	28.34	ND
Mar	<1	18	23.3	6.96	8.22	0.6570	0.03890	0.002109	0.01023	ND	0.00146	0.00394	0.028	0.36548	0.03378	0.284	31.28	3.859
	1-3.5	15	23.9	7.37	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.36	ND
Apr	<1	16	26.1	7.18	7.76	0.5342	0.03858	0.001370	0.01099	ND	0.00147	0.00441	0.079	0.24233	0.03408	0.412	34.57	4.787
	1-3.5	14	26.4	6.94	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.60	ND
May	<1	16	27.9	6.66	8.29	0.5400	0.00724	0.00107	0.01076	ND	0.00094	0.00467	0.147	0.33302	0.00688	0.338	35.90	5.916
	1-3.5	15	28.8	7.88	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.55	ND
Jun	<1	14	28.8	6.37	8.19	0.9414	0.30013	0.008589	0.03950	ND	0.00476	0.00841	ND	0.45938	0.26315	0.480	30.11	4.320
	1-3.5	13	29.3	6.51	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32.65	ND
Jul	<1	18	31.3	6.16	8.16	0.6700	0.07382	0.003336	0.01520	ND	0.00151	0.00647	0.140	0.33356	0.08616	8.280	33.51	4.734
	1-3.5	13	31.3	6.63	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	31.99	ND
Aug	<1	18	30.8	5.33	8.12	0.6433	0.22639	0.007527	0.03994	ND	0.00158	0.00622	0.174	0.30268	0.21888	4.590	29.57	5.124
	1-3.5	12	31.2	5.34	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.48	ND
Sep	<1	17	29.1	5.75	7.96	1.1192	0.20596	0.008082	0.04617	0.4300	0.00134	0.00940	ND	0.42192	0.19789	11.808	26.91	4.766
	1-3.5	12	29.8	5.94	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	27.40	ND
Oct	<1	18	27.4	6.49	8.09	1.7543	0.29872	0.009050	0.04503	0.2910	0.00258	0.01093	0.477	0.52333	0.30747	0.541	22.54	4.310
	1-3.5	13	27.7	7.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	26.12	ND
Nov	<1	17	24.0	7.41	8.08	0.5918	0.20673	0.010664	0.04396	0.8250	0.00011	0.00711	0.189	0.36917	0.19364	0.510	22.19	4.493
	1-3.5	13	23.8	7.73	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	21.68	ND
Dec	<1	18	22.5	7.74	8.15	0.7143	0.15975	0.007482	0.02851	0.2200	0.00140	0.00725	ND	0.37750	0.15550	0.655	24.36	4.022
	1-3.5	13	22.5	7.68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	24.52	ND

Table 2.3-31 (Sheet 9 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC110 — Average Monthly Results for 1993–2008																		
Jan	<1	17	20.5	7.32	8.14	0.7031	0.06065	0.002427	0.01295	0.2670	0.0007	0.00491	0.018	0.25700	0.06343	0.380	30.45	3.368
	1-3.5	12	19.7	7.32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	28.36	ND
Feb	<1	15	22.4	6.89	8.19	0.7869	0.03971	0.002110	0.01462	0.2570	0.0009	0.00452	ND	0.45	0.03998	0.310	32.08	3.270
	1-3.5	11	22.2	7.60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30.87	ND
Mar	<1	18	23.2	6.53	8.14	0.5847	0.03473	0.001736	0.01098	ND	0.00094	0.00365	0.021	0.31313	0.03308	0.201	33.77	3.442
	1-3.5	15	23.7	6.74	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	31.75	ND
Apr	<1	16	25.9	6.87	7.60	0.6483	0.01019	0.001340	0.00843	ND	0.00087	0.00448	0.054	0.22846	0.00943	0.260	35.81	3.588
	1-3.5	14	26.2	6.47	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.46	ND
May	<1	16	27.7	6.37	8.24	0.5904	0.01010	0.0014	0.01287	ND	0.00047	0.00478	0.081	0.24551	0.00865	0.256	36.94	3.720
	1-3.5	15	28.5	6.64	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.69	ND
Jun	<1	14	28.8	6.38	8.21	0.9118	0.14109	0.005811	0.03031	ND	0.0014	0.00699	ND	0.32844	0.12236	0.445	32.57	3.754
	1-3.5	13	29.2	6.60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.18	ND
Jul	<1	17	31.0	6.06	8.16	0.6545	0.06162	0.003255	0.01576	ND	0.00084	0.00676	0.089	0.26193	0.05836	8.214	33.43	3.938
	1-3.5	12	31.0	6.46	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32.54	ND
Aug	<1	17	30.5	5.62	8.11	0.4458	0.04964	0.003191	0.02220	ND	0.0018	0.00603	0.294	0.27364	0.04644	4.512	33.02	4.260
	1-3.5	13	30.7	5.52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	32.54	ND
Sep	<1	17	29.1	5.99	8.00	0.7467	0.00674	0.733400	0.03911	0.2600	0.00149	0.00758	ND	0.30731	0.13886	7.042	30.29	3.684
	1-3.5	12	29.4	6.19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	28.71	ND
Oct	<1	17	27.2	6.51	8.08	0.8664	0.09791	0.005808	0.03326	0.2380	0.00123	0.00621	0.164	0.3727	0.09226	0.355	27.84	3.773
	1-3.5	13	27.4	6.53	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	27.88	ND
Nov	<1	17	23.9	7.12	8.05	0.5400	0.08743	0.004192	0.01990	0.2380	0.00109	0.00564	0.018	0.31667	0.08363	0.293	28.60	3.408
	1-3.5	13	23.6	7.35	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	27.22	ND
Dec	<1	17	22.3	7.19	8.05	0.7932	0.14183	0.005555	0.02707	0.2290	0.00170	0.00646	ND	0.30583	0.14280	0.350	29.16	3.804
	1-3.5	13	22.4	7.31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	27.81	ND

Table 2.3-31 (Sheet 10 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC111 — Average Monthly Results for 1993–2008																		
Jan	<1	17	20.0	7.19	8.17	1.0514	0.00198	0.000770	0.00572	0.1440	0.00038	0.00529	0.006	0.26200	0.00154	0.320	35.29	2.608
	1-3.5	12	19.1	6.90	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.47	ND
Feb	<1	15	22.3	6.73	8.24	0.9592	0.00468	0.000840	0.00684	0.1700	0.00059	0.00516	ND	0.27889	0.00338	0.270	35.73	2.530
	1-3.5	11	21.6	7.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.48	ND
Mar	<1	18	23.0	6.81	8.27	0.9077	0.00228	0.000891	0.00713	ND	0.00102	0.00379	0.017	0.29853	0.00176	0.159	36.58	2.243
	1-3.5	15	23.2	6.69	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.05	ND
Apr	<1	16	25.3	6.53	7.80	0.9229	0.004	0.00076	0.00634	ND	0.00088	0.00479	0.012	0.20298	0.00313	0.216	36.70	2.507
	1-3.5	14	25.6	6.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.29	ND
May	<1	16	27.3	6.32	8.33	0.7563	0.00303	0.00092	0.00841	ND	0.00048	0.00483	0.038	0.23122	0.00185	0.204	37.51	3.281
	1-3.5	15	27.9	6.39	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.45	ND
Jun	<1	14	28.8	6.11	8.26	0.7841	0.02156	0.001967	0.01331	ND	0.00085	0.00557	ND	0.28320	0.01590	0.225	36.30	3.048
	1-3.5	13	29.0	6.24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.07	ND
Jul	<1	17	30.6	5.49	8.27	0.7382	0.00921	0.001382	0.01150	ND	0.00108	0.00623	0.049	0.22361	0.00832	6.164	36.37	3.293
	1-3.5	12	30.5	5.65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.18	ND
Aug	<1	17	30.5	5.42	8.19	0.6692	0.00484	0.001470	0.01313	ND	0.00105	0.00580	0.021	0.25102	0.00388	8.980	36.66	3.210
	1-3.5	13	30.5	5.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.15	ND
Sep	<1	17	29.3	5.28	7.93	1.1300	0.01153	0.00209	0.02157	0.1340	0.00144	0.00590	ND	0.30138	0.00941	5.607	35.21	2.594
	1-3.5	12	29.4	5.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.09	ND
Oct	<1	17	26.9	6.03	8.05	1.1486	0.02473	0.001933	0.01130	0.1600	0.00100	0.00530	0.031	0.29667	0.02299	0.260	33.47	2.643
	1-3.5	13	27.0	5.61	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.31	ND
Nov	<1	17	23.7	6.49	8.03	2.1639	0.00798	0.001533	0.00820	0.1490	0.00064	0.00605	0.006	0.31667	0.00596	0.240	34.14	2.414
	1-3.5	13	23.4	6.58	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.89	ND
Dec	<1	17	22.1	7.05	8.03	1.6979	0.01399	0.00147	0.00946	0.1120	0.00104	0.00646	ND	0.27500	0.01395	0.163	34.84	2.504
	1-3.5	13	22.2	6.76	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	33.80	ND

Table 2.3-31 (Sheet 11 of 11)
Biscayne Bay Water Quality

Month	Depth M	Count	TEMP Deg C	D.O. mg/L	PH UNITS	TURB NTU	NOx mg/L	NO2 mg/L	NH4 mg/L	TKN mg/L	OPO4 mg/L	TPO4 mg/L	SIO2 mg/L	CHLOR A mg/M3	NO3 mg/L	TOT N MG N/L	SAL. ppt	TOC mg/L
BISC Program Sample Location BISC112 — Average Monthly Results for 1993-2008																		
Jan	<1	17	20.3	7.13	8.16	0.9381	0.00151	0.000590	0.00484	0.1530	0.00036	0.00585	0.006	0.24100	0.00103	0.275	35.59	2.663
	1-3.5	12	19.4	6.94	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.05	ND
Feb	<1	15	22.2	6.75	8.23	1.1754	0.00243	0.000760	0.00749	0.1550	0.00032	0.00508	ND	0.34000	0.00156	0.290	35.90	2.328
	1-3.5	11	21.6	7.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.78	ND
Mar	<1	18	23.1	6.82	8.24	1.0293	0.00256	0.000764	0.00692	ND	0.0009	0.00393	0.042	0.30835	0.00180	0.162	36.55	2.044
	1-3.5	15	23.1	6.65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.03	ND
Apr	<1	16	25.4	6.60	7.76	0.7979	0.00424	0.00086	0.00633	ND	0.00073	0.00504	0.013	0.23371	0.0027	0.215	37.25	2.426
	1-3.5	14	25.7	6.44	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.21	ND
May	<1	16	27.5	6.25	8.23	0.7204	0.00248	0.0008	0.00901	ND	0.0008	0.00515	0.028	0.23419	0.00164	0.202	37.10	2.664
	1-3.5	15	28.1	6.16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	37.01	ND
Jun	<1	14	28.9	6.05	8.18	0.7914	0.02880	0.001489	0.01149	ND	0.00108	0.00686	ND	0.31090	0.02440	0.180	35.57	2.802
	1-3.5	13	29.0	6.21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.58	ND
Jul	<1	17	30.8	5.33	8.20	0.6791	0.00488	0.001120	0.01072	ND	0.00109	0.00723	0.033	0.21932	0.00401	5.296	36.60	2.672
	1-3.5	12	30.6	5.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36.13	ND
Aug	<1	17	30.6	5.40	8.14	0.6842	0.00474	0.001160	0.01321	ND	0.00078	0.00610	0.022	0.21997	0.00392	9.338	36.38	2.611
	1-3.5	13	30.4	4.93	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.75	ND
Sep	<1	17	29.5	5.29	7.96	0.8242	0.00643	0.00126	0.01489	0.1590	0.00164	0.00650	ND	0.31192	0.00480	5.007	35.74	2.255
	1-3.5	12	29.6	4.99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35.25	ND
Oct	<1	17	27.0	5.90	8.09	0.8271	0.00322	0.00077	0.00765	0.1320	0.00082	0.00673	0.015	0.5	0.00237	0.250	34.38	2.440
	1-3.5	13	27.1	5.63	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.28	ND
Nov	<1	17	23.9	6.63	8.04	1.4571	0.00323	0.000891	0.00601	0.1750	0.0005	0.00705	0.004	0.33500	0.00299	0.260	35.04	2.235
	1-3.5	13	23.4	6.22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.71	ND
Dec	<1	17	22.3	7.15	8.04	1.0218	0.00505	0.00087	0.00692	0.1050	0.00111	0.00689	ND	0.32500	0.00319	0.167	35.54	2.290
	1-3.5	13	22.2	6.72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34.99	ND

Notes:
1. ND – No Data
2. Source: SFWMD 2008a.
3. TEMP = Temperature, D.O. = Dissolved Oxygen, TURB = Turbidity, NOx = Nitrogen Oxides, NO_2 = Nitrites, NH_4 = ammonia, TKN = Total Kjeldahl Nitrogen, OPO4 = orthophosphate, TPO4 = Total Phosphate, SiO2 = Silica, CHLOR A = chlorophyll A, NO3 = Nitrate, TOT N = Total Nitrogen, SAL. = Salinity, TOC = Total Organic Carbon.

Table 2.3-32 (Sheet 1 of 2)
Industrial Wastewater Facility System Water Quality Data

Parameter	Unit	Maximum	Average
pH	SU	8.21	8.02
TSS	mg/L	19	16
COD	mg/L	2,100	1,650
BOD (5-day)	mg/L	ND	ND
Soluble BOD	mg/L	ND	ND
Total Residual Chlorine	mg/L	0.8	0.8
Total Dissolved Solids (TDS)	mg/L	56,000	54,500
Ammonia as N	mg/L	0.16	0.16
Kjeldahl Nitrogen	mg/L	1.9	1.8
Nitrite as N	mg/L	ND	ND
Nitrate as N	mg/L	ND	ND
Total Phosphorus	mg/L	0.11	0.0965
Dissolved Oxygen	mg/L	12.02	8.7
Total Hardness	mg/L as CaCO3	10,000	10,000
Total Alkalinity	mg/L as CaCO3	170	165
Nitrogen (total)	mg/L	1.9	1.8
Fluoride	mg/L	ND	ND
Chloride	mg/L	33,000	30,000
Iron Total	mg/L	ND	ND
Magnesium	mg/L	2,200	2,050
Calcium	mg/L	760	720
Manganese	mg/L	0.0089	0.00855
Sulfate	mg/L	4,200	3,950
Temperature	°C	31.5	30.05
Antimony	mg/L	ND	ND
Arsenic	mg/L	0.042	0.0295
Beryllium	mg/L	ND	ND
Cadmium	mg/L	ND	ND
Chromium	mg/L	ND	ND
Copper	mg/L	0.021	0.0175
Lead	mg/L	0.0001	0.0001
Soluble Lead	mg/L	0.00021	0.000152
Mercury	mg/L	ND	ND

Table 2.3-32 (Sheet 2 of 2)
Industrial Wastewater Facility System Water Quality Data

Parameter	Unit	Maximum	Average
Molybdenum	mg/L	0.018	0.018
Nickel	mg/L	0.05	0.0395
Selenium	mg/L	0.67	0.3475
Silver	mg/L	ND	ND
Thallium	mg/L	0.0018	0.00107
Zinc	mg/L	0.019	0.019
Cyanide	mg/L	ND	ND
Phenols	mg/L	ND	ND
Oil & Grease	mg/L	ND	ND
Silica	mg/L	0.61	0.52
Orthophosphate	mg/L	ND	ND
Alkalinity (Bicarbonate)	mg/L	170	165
Turbidity	NTU	2	1.915
Sulfides	mg/L	ND	ND
Aluminum	mg/L	0.017	0.014
Barium	mg/L	0.08	0.073
Iron (Dissolved)	mg/L	ND	ND
Potassium	mg/L	690	680
Vanadium	mg/L	0.0056	0.004

Notes:
1. All tested as total unfiltered
2. ND = non-detected