FPL-014F

5. HYDROGEOLOGIC ASSESSMENT

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In the Matter of: FLORIDA POWER & LIGHT COMPANY
(Turkey Point Nuclear Generating, Units 3 and 4)
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5.1 Introduction

Geologic and hydrogeologic data were collected as part of the monitoring effort to better understand the movement of water within the Biscayne Aquifer in the vicinity of the CCS. The associated information is relevant because subsurface conditions influence the extent and rate of CCS migration. This information coupled with water level data and water quality data reported in previous sections aid in the understanding of how the groundwater system responds to environmental inputs and CCS operation.

While details for much of the geologic and hydrogeologic data can be found in the Geology and Hydrogeology Report for Turkey Point Plant Groundwater, Surface Water and Ecological Monitoring Plan (JLA Geosciences Inc. 2010), excerpts from this report have been provided to give a high-level overview of the geologic and hydrogeologic conditions in the vicinity of the CCS.

5.1.1 Overview of Biscayne Aquifer and Geologic Formations

Southeastern Miami-Dade County is underlain by two aquifer systems; the shallow unconfined Biscayne Aquifer/Surficial Aquifer System (BAS) and the deep Floridan Aquifer System (FAS). In Miami-Dade County, the unconfined BAS consists of all rock and sediment from land surface downward to the top of the intermediate confining unit (Cunningham 2004). While all the Turkey Point monitoring wells are screened in the BAS, the borehole of each deep well fully penetrated the BAS and the top of the intermediate confining unit. The focus of the Turkey Point Uprate monitoring effort is on the BAS due to its importance to the west as a drinking water supply and its shallow unconfined depth.

During the drilling and logging of all the monitoring well boreholes associated with this project, JLA Geosciences Inc. (2010) found that the BAS near the CCS extends from land surface to a depth of approximately 106 ft below sea level (BSL), where formation materials decrease in permeability (Fish and Stewart 1991). This depth of the base of the BAS decreases to the west.

From land surface, the geologic formations encountered during drilling of the monitoring wells for this project include the Miami Limestone, the Fort Thompson Formation, and the upper Tamiami Formation. The BAS is made up primarily of the Miami Limestone and the Fort Thompson formations. Higher permeability units in the upper Tamiami Formation may also form portions of the BAS (Cunningham 2004 and 2006); however the Tamiami Formation is considered to be the intermediate confining unit underlying the BAS where a significant decrease in permeability occurs (Fish and Stewart 1991). The lower boundary of the BAS is delineated by the transition between highly permeable beds of the Fort Thompson Formation or Tamiami Formation and lower permeability sands or silty sands of the Tamiami Formation (Fish 1988).

Based on project findings, the Miami Limestone thickness is between approximately 8 ft (TPGW-13) and 23 ft (TPGW-3) and extends to depths between approximately -11 ft to -30 ft NAVD 88 in the project area (JLA Associates, Inc. 2010). Note that the formation depths noted are slightly different than reported by JLA Geosciences, Inc.; JLA Geosciences, Inc. reported the depths in NGVD 29 and there were some subsequent corrections to survey elevations and transposing formation depths. The Miami Limestone is predominantly composed of pelloidal grainstone, packstone and wackestone, coral framestone and pedogenic limestone/calcrete (Cunningham 2004 and 2006). The base of the Miami Limestone is typically delineated by a wavy laminated calcrete and/or erosional surfaces (Cunningham 2004). In the study area, the Miami Limestone generally thins to the north and west and overlays the permeable limestone units of the Fort Thompson Formation.

The Fort Thompson Formation underlies the Miami Limestone in the study area. Regionally it has been defined as a northward thickening depositional sequence bounded by unconformities above and below corresponding to contacts with the overlying Miami Limestone and the underlying Tamiami Formation (Galli 1991). The Fort Thompson Formation is commonly composed of various sequences of floatstone, rudstone, grainstone, quartz sandstone, skeletal sandstone, pedogenic limestone, laminated calcrete, mudstone, and wackestone (Cunningham 2004 and 2006). The base of the Fort Thompson Formation is typically delineated by a wavy laminated calcrete and/or erosional surfaces (Cunningham 2004 and 2006). In the project area, the Fort Thompson Formation thickness is between approximately 46 ft (TPGW-8) and 95 ft (TPGW-12) and extends to depths between approximately -60 ft to -113 ft NAVD 88. Figures 5.1-1 through 5.1-4 show a cross-section plan view and several east-west cross-sectional views and a north-south cross-sectional view that were derived from the project boring logs.

Regionally, the units that underlie the Fort Thompson are the Tamiami Formation (Pliocene to Miocene age) and/or the formations of the Hawthorn Group (Miocene age) (Fish and Stewart 1988). Tamiami lithologies typically consist of sandy limestone, calcareous sandstone, shells and sand (Cunningham 2004 and 2006). With depth, these units undergo a downward fining trend and ultimately become the underlying confinement of the BAS. In the study area the Tamiami Formation underlies the Fort Thompson and consists of unconsolidated silty sands, shells, sandy limestone, and sandstone. It was penetrated to a total depth of approximately –154 ft NAVD 88 at site TPGW-11. The top of the Tamiami formation was encountered at depth between -46 ft NAVD 88 at site TPGW-9 and -120 ft NAVD 88 at site TPGW-11. The contact between the Tamiami Formation and the basal Fort Thompson formation generally decreased with depth to the south and west and was commonly delineated as the contact between lithified and unlithified formation materials. The intermediate confining unit was not fully penetrated during this project.

5.1.2 Overview of Biscayne Aquifer System Porosity and Flow Zones

Recent studies in northern Miami/Dade County have determined that porosity, permeability, and storage in the BAS limestone are related to lithofacies and depositional cycles identified in the

Miami Limestone and Fort Thompson Formation (Cunningham et al. 2004 and 2006). Cunningham et al. (2004) identified 16 sub-lithofacies in the BAS through use of core descriptions, thin section analysis and geophysical logs. Typically zones of high permeability in the BAS are associated with interconnected touching vug porosity, bedding planes flow zones, cavernous flow zones, and/or touching dissolutioned fossil molds (Cunningham 2004). Typically, within the Miami Limestone and Fort Thompson Formation, these high permeability zones occur at the base of depositional cycles which are characterized by touching-vug floatstone and rudstone, pelloidal packstone and grainstone, framestone, and vuggy wackestone and packstone (Cunningham 2004 and 2006). With the aid of geophysical logs, especially the optical borehole image (OBI) logs, and recovered core samples, all the wells installed as part of this monitoring effort were installed in these high flow zones of the BAS.

5.2 Regional Assessment and Extent of CCS Water

As described in Section 5.1, the BAS is a shallow aquifer with groundwater flow dominated by high permeability zones. The subsurface conditions range from hard rock to cavernous voids. For this monitoring effort, wells were installed in clusters and distinctly screened at three different depth intervals where high flow zones were observed. This well screen placement is helpful in determining the presence of CCS water vertically and its furthest lateral extent out to a point of regulatory relevance.

The USGS has previously shown that the regional groundwater flow direction in the general project area to be from the northwest to southeast (Fish and Stewart 1991). Based on data collected for the pre-Uprate monitoring effort and reports by others, the groundwater flow in the immediate vicinity of Turkey Point is affected by the CCS and local conditions. Golder Associates Inc. (2011b) reviewed groundwater density and water level data from two ID monitoring efforts (October 2010 and March 2011). Based on comparing density-corrected groundwater pressure gradients between historical monitoring wells L-3 and G-21 and L-5 and G-28, Golder Associates Inc. concluded that there was a seaward (eastward) gradient down to an elevation of approximately -35 ft NAVD 88 and a landward (westward) gradient from approximately -35 to -58 ft NAVD 88. Information presented in Section 5.4 shows that depending upon groundwater and surface water levels, groundwater flows in and out of the CCS.

While potentiometric maps can provide further insight into groundwater flow directions and gradients in the immediate project area, there are several complicating factors that make the interpretation of this information difficult and subject to errors. First, there is no guarantee that all the wells classified in the same zone are interconnected due to the complex geology of the area. The classification of shallow, intermediate, and deep wells is a function of the well placement in the upper, middle, and lower part of the Biscayne Aquifer and not a function of distinctly different lithology or hydrogeologic units. It is possible that a well classified, for example, as an intermediate zone well is interconnected to a series of shallow zone wells. Thus, any interpretation of the results would have to be used with caution.

Secondly, the presence of waters with different densities complicates the determination of groundwater flows and gradients. For groundwater of uniform density, hydraulic head gradient is sufficient for determining groundwater flow direction. For groundwater of variable density, density-related gravity forces can be a significant component of the forces driving groundwater flow, and hydraulic head gradient is insufficient to determine groundwater flow direction.

While Lusczynski (1961) presented a simple methodology to convert measured groundwater heads to equivalent freshwater heads, various papers (Van Dam 1977; Custodio 1987) have reported a lack of understanding in the use of freshwater head equivalents. Jorgenson et al. (1982) presented information that when calculating a freshwater head equivalent, groundwater flow could only be interpreted if the wells were all at the same depth. Simmons (2005) cautioned that the concept of equivalent freshwater heads is "too simple or erroneous especially in areas where vertical flow is of interest."

Post et al. (2007) presented a paper that attempted to clarify some of the misinterpretations and provide guidance for the interpretation of head measurements in variable density groundwater systems. Post et al. (2007) also provided an approach to deal with wells screened at different depths which is important since none of the FPL monitoring wells are at the same depth. The applicability of applying the method by Post et al. (2007) to determine groundwater flow directions and gradients in the vicinity of the CCS was assessed. FPL concluded that while the methodology can be applied, definitive interpretations are still difficult due to the complex geology. Post et al. (2007) states: "we intentionally refrain from presenting an analysis of the more complicated effects of anisotropy, heterogeneity, and dipping aquifer." The subsurface geology in the project area includes all those complicated effects. Furthermore, the gradients in the area are typically small, thus small errors in the water levels greatly impact the accuracy of the gradients. While some general assessments can be made using professional judgment, numerical modeling may better address the complexities. Even with modeling, there are some overlying simplifying assumptions that will affect the accuracy of the results.

Rather than preparing freshwater head equivalent potentiometric maps, which can be misinterpreted, or conducting complex modeling efforts, FPL proposes to use other pieces of information or analysis to assess groundwater flow and interactions with the CCS. These pieces of information include, but are not limited to the following:

- Time series plots showing responses in water levels and water quality following rain events and fluctuations at specific locations over time.
- Comparative time series plots of groundwater water levels during wet and dry periods.
- Time series plots comparing groundwater and surface water level changes with tide.
- Water quality and water level data in surface water and groundwater stations near the CCS during outage and non-outage periods in the CCS.
- Water levels in wells and surface water stations during and after pumping of the ID.
- Water quality tracer constituents that show the extent of CCS movement and facilitate the calculation of an average rate of migration.
- Water budget results showing estimated losses from the CCS to groundwater and estimated gains from ground to the CCS (Section 5.4).

An assessment of this information provides baseline information on how the groundwater system responds to different meteorological and tidal conditions, how the groundwater responds to CCS operations, how the CCS affects groundwater flow, and how far and fast the CCS water moves.

5.2.1 Groundwater Responses to Environmental Conditions

Based on a review of the groundwater time series plots, it appears water levels change rapidly in response to rainfall events. This is most evident in stations not significantly influenced by tides (TPGW-1, TPGW-2, TPGW-4 through TPGW-9, and TPGW-13). Typically, when there is a spike in water levels on the time series graphs, there is a corresponding rainfall event. This increase in water level occurs simultaneously at all depth intervals, suggesting good hydrologic connection with the surface. Figures 5.2-1 and 5.2-2 show typical examples where the water levels rise in response to rain events. The increase is obviously more notable for major rain events. While the water levels increase rapidly, the water quality time series data show that the temperature and specific conductance values in the shallow, intermediate, and deep screen intervals do not change with rainfall (refer to Section 2.2), indicating the buffering capacity of the groundwater over time.

The time series data also show that the amount of change in groundwater levels at most well clusters is typically the same at all depth intervals under wet or dry conditions. In most instances, the change in water elevation between the shallow, intermediate, and deep zones is within hundreds of a foot. For illustrative purposes, Tables 5.2-1 and 5.2-2 show the extent of change in groundwater over a period just before and after a heavy rainfall event (September 29, 2010, and October 8, 2011). The data for these tables were extracted from the automated database during similar tide stages to minimize tidal effects and reflect water level changes the day after the rain event and a period of a week or two after the rain event. The results show that even under extreme events with large groundwater fluctuations, the changes in groundwater levels within each well cluster are nearly identical, with a few exceptions. This suggests there is good vertical connectivity between zones at most locations. While these tables facilitate comparison of the depth intervals at each station, care must be used in trying to interpret differences among stations since the rainfall distribution is not likely uniform across the entire area.

Table 5.2-3 shows a snapshot of water elevations for two days in the wet season (October 14, 2010, and October 22, 2011) and two days in the dry season (May 14, 2011, and April 4, 2012). The wet season days were selected within a few days or weeks following a heavy rain and the dry season days were selected after a prolonged period of little rain (less than 1 inch in four weeks). All elevations are reported during periods of similar high tide elevations (water elevations at TPBBSW-3 within 0.1 ft of each other for all dates) to minimize the effect of tides in these comparisons. Figure 5.2-3 compares the water levels during the 2010 wet season day and the 2011 dry season day. Figure 5.2-4 compares the water levels for the 2011 wet season day and the 2012 dry season day. The results show that the inland stations are affected much more by drought conditions than the stations in Biscayne Bay. This is expected since there is a continual source of water in the Bay to maintain water levels. The wet and dry season water level data show water level variations between wet and dry seasons are generally greatest at inland stations TPGW-4, TPGW-5, and TPGW-7 through TPGW-9, and are smallest at TPGW13, TPGW12, and Biscayne Bay stations TPGW-10, TPGW-11, and TPGW14. This suggests the inland stations are affected by hydrologic conditions to a greater extent than the coastal and Biscayne Bay stations. The wet season water level data indicate gradients over the study area are generally seaward. In contrast, the dry season data indicate landward gradients can occur in eastern portions of the study area during the dry season. During both dry season events, landward gradients were present between Biscayne Bay station TPGW-10 and TPGW-1; Biscayne Bay station TPGW-11 and CCS station TPGW-13; and TPGW-3 and TPGW-4. The occurrence of landward gradients during the dry season may impact groundwater flow in the eastern portion of the study area during the dry season.

While rainfall or lack thereof affects the groundwater levels over the entire landscape, the tides only influence the stations in the Bay or in close proximity to the Bay. The time series plots presented in Section 2 clearly show that the groundwater levels at all three well clusters in the Bay are highly influenced by the tidal cycles. Also, the clusters at TPGW-12 and to a lesser extent at TPGW-3 are noticeably influenced by the tides. This influence in groundwater is not uncommon and shows good connectivity with Biscayne Bay. Further inland, there is very little (hundredths of a foot) or no influence of the tide. Figures 5.2-5 and 5.2-6 illustrates this diminishing effect of tides at groundwater stations from east to west in the northern half of the project area and the southern half of the project area, respectively. Figure 5.2-7 shows that there are negligible tidal effects in the CCS surface water and groundwater. This lack of tidal response in the CCS is consistent over the monitoring period and suggests limited direct communication between CCS with Biscayne Bay. While Section 5.4 clearly shows exchanges between the CCS and Biscayne Bay groundwater, this exchange is less than would have been estimated if the CCS responded more extensively with tidal fluctuations.

In the 2011 Annual Report (FPL 2011b), FPL reported groundwater data for two spring and two neap tide events. As expected, the tidally influenced stations in the Bay had a wider range in groundwater levels during a spring tide. Table 5.2-4 shows two additional representative spring tide events and these values are illustrated on Figures 5.2-8 and 5.2-9. These spring tide events are of interest since they have the greatest potential effect on groundwater gradients. As previously discussed, the effect of tide is limited inland so the greatest effect is at the coastline. Based on the spring tide data provided in the Annual Report (FPL 2011b) and Table 5.2-4, gradients between inland stations vary little between high and low tide during spring tide events. At low tide during spring tide events, gradients between coastal stations TPGW-1, TPGW-12, TPGW-3, CCS station TPGW-13, and the three Biscayne Bay stations become seaward, or steepen seaward relative to gradients present at high tide between these stations. For these stations, the change in gradients from high tide to low tide gradients is primarily due to water level declines in the Biscayne Bay well clusters. This variation in gradients may impact groundwater flow in the coastal portion of the study area during spring tide events. Since the CCS does not appear to respond to tidal changes, however, the increase in gradients during spring tide events has limited influence on groundwater movement in and out of the CCS.

5.2.2 Operational Effects of the CCS on Groundwater Levels

Water from the CCS is used year round to provide cooling water to fossil fuel units 1 and/or 2 and nuclear units 3 and 4. As shown in Section 2, water on the CCS discharge side of the plant ranges from 2 to 6 ft higher than water levels on the intake (eastern) side of the CCS. This results in having the highest hydraulic driving heads on the western side of the CCS and the lowest hydraulic driving heads on east/Biscayne Bay side of the CCS. Further assessment of the water movement in and out of the CCS is provided in Section 5.4.

The influence of the CCS operations on the surrounding groundwater flow is complex and in many cases is masked by meteorological or regional conditions. Some understanding of the groundwater response to CCS operations can be gained by looking at select time series plots over an extended period; before, during, and after unit outages/reduced CCS pumping; and during ID pumping. In the first Semi-Annual Report (FPL 2011a), the groundwater time series plots showed that the intermediate and shallow zone water levels were lower than the deep interval water levels in all three Biscayne Bay well clusters. This could be interpreted that the lower water levels on the east side of the CCS were also drawing down/influencing the groundwater levels in the shallow and intermediate zone to the east of the CCS. Furthermore, the time series data (FPL 2011a) showed that the groundwater water levels in the shallow and intermediate wells located between the CCS and Tallahassee Road (TPGW-1, TPGW-4, and TPGW-5) were higher than those in most of the deep zone wells. This could suggest some influence of the higher surface water levels on the west side of the CCS in the shallow and intermediate groundwater zones. The well clusters furthest to the west showed no differences in water levels which could be interpreted as there being no CCS effects. While some effect of the CCS is expected, the extent of those effects is not so clear upon further review of two years of data. It is possible that the water level differences with depth may be more reflective of, or partially masked by, groundwater responses to seasonal conditions and potentially differing hydrogeological properties.

Groundwater levels for the three well clusters in Biscayne Bay are shown on Figures 5.2-10, 5.2-11, and 5.2-12. The values reflect daily averages and the vertical scale is enhanced to facilitate a review of the differences between each zone. Since the TPGW-10 well cluster is located closest to the CCS plant intake where the CCS water levels are the lowest, the potential for drawing down the groundwater is the greatest at this location. However, based on a review of the time series plot for all wells at TPGW-10, there are times when the deep zone at this cluster is lower than the shallow and intermediate zone wells and vice versa; so the trend of the shallow and intermediate wells being lower in the TPGW-10 well is inconsistent. This same alternating trend was observed at well cluster TPGW-11. The only well cluster that consistently had the shallow and intermediate zones lower than the deeper zone groundwater levels was at well cluster TPGW-14, which is farthest away from the pump intakes in the CCS. The differences in water levels between zones seem to be more seasonally driven. During the dry season, there is more separation in water levels than during the wet season. For the TPGW-10 and TPGW-11 well clusters, there was no separation in water levels in the summer of 2011. Presumably, if the CCS was having a profound effect on the shallow and intermediate zones, those effects would exist year round unless there were changes in operating conditions; there were no major operational changes during that period.

Well clusters west of the CCS out to Tallahassee Road (specifically TPGW-1, TPGW-4, and TPGW-5) consistently display water levels over two years of monitoring with the shallow and intermediate zone groundwater levels higher than the deep zone groundwater levels (Figures 2.3-1, 2.3-4, and 2.3-5). However, that trend does not hold up in well clusters TPGW-2 (Figure 2.3-2) and those to the north and south of the CCS (TPGW-3, TPGW-6, and TPGW-12 (Figures 2.3-3, 2.3-6, and 2.3-12) which could be influenced by higher water levels in the CCS. While an exhaustive assessment was not conducted to explain why there are differing patterns, it is possible that the vertical gradients/differing water levels between zones are the result of differing hydrogeological connections and properties. It is unclear whether the water level trends in TPGW-1, TPGW-4, and TPGW-5, as well as TPGW-7, TPGW-8, and TPGW-9 are the result of CCS influences or lack thereof, or if they are also the result of differing hydrogeological characteristics.

In an effort to further determine if and how the groundwater responds to operation of the CCS, FPL reviewed groundwater levels during periods of outages and non-outages for the plant. Water levels in the CCS are affected to some degree when there is an outage of units (typically reduced pumping) for various maintenance reasons or refueling (Units 3 and 4). Figure 5.2-13 shows when outages occurred during the monitoring period for the nuclear units; however, as discussed in Section 2, not all outages result in the same pumping reductions. Refueling outages which result in turning off the four circulating pumps for one of the nuclear units have the biggest effect since flow can be reduced almost in half depending upon what is happening at the fossil fuel units. Two refueling outages occurred at the Turkey Point nuclear units during the monitoring period (Unit 3: September 27 through November 5, 2010 and Unit 4: March 21 through May 15, 2011). When pumping and associated flow is reduced, the CCS water levels may rise on the intake side and drop on the discharge side. Figures 5.2-14 through 5.2-17 show plots of flow for the nuclear units with CCS water levels and adjacent groundwater level superimposed for TPGW-1 and TPGW-10 before, during, after the outage periods noted above. The flow is based on the run time of the four circulating water pumps and assumed configuration of the three intake cooling water pumps for each nuclear unit. TPGW-1 would be the most likely location to see an effect of reduced flows/lower water levels on the discharge side of the CCS, and TPGW-10 would be the most likely location to see an effect of reduced flows/increased water levels on the intake side of the CCS as a result of an outage. Water levels at TPSWCCS-1 and TPSWCCS-6 are also included with TPGW-1 and TPGW-10, respectively.

At TPGW-1, any effects of the outage for September 27 through November 5, 2010 are initially masked by the heavy rainfall on September 29, 2010, when over 7 inches of rain were recorded at TPM-1. Water levels in the CCS and groundwater rose significantly in response to the rain and then began to drop. However, TPGW-1 water levels continued to drop even when the refueling outage was over, which is not what would be expected if there was an effect. For the second refueling outage, TPSWCCS-1 water levels declined less than 0.5 ft when the outage occurred, but the groundwater levels at TPGW-1 increased, which is opposite of what would be expected at TPGW-1 if there was a quick response. Even if some type of lag time is considered, there is no clear trend or influence at TPGW-1 associated with the outage.

On the intake side of the CCS, there are some changes in TPSWCCS-6 water levels in response to an outage. However, some of the associated rises or drops in TPSWCCS-6 water levels start prior to either the outage being initiated or being completed, respectively, so it is difficult to determine the exact change in water levels at TPSWCCS-6 associated with an outage. The estimated change in water at TPSWCCS-6 due to the refueling outages is between 0.5 and 1.0 ft. The groundwater levels at TPGW-10 do not correspond well with outage as there are times when the groundwater decreases rather than rises when an outage occurs or increases instead of falls when an outage is over. There is no clear evidence that the plant outages are affecting groundwater at the wells near the CCS or, if there are effects, they are too subtle and are masked by meteorological conditions. This suggests that other factors (perhaps meteorological or hydrological) exert a greater influence on groundwater in wells near the CCS than does operation of the CCS.

While there is no evident influence of outages on the adjacent groundwater levels, there does appear to be an effect of ID operations on adjacent groundwater levels. Figures 5.2-18 through 5.2-22 show the change in groundwater at various wells in response to lowering the water level in the ID during ID pumping. The results show a drop of up to 0.7 ft in the ID and a drop of 0.1 to 0.2 ft in the wells closest to the ID (TPGW-1 and TPGW-2) within hours of pumping at all depth intervals. Well clusters TPGW-4 and TPGW-5 farther west show no response to ID pumping. The fact that all wells at clusters TPGW-1 and TPGW-2 respond to ID pumping indicates that there is close communication with the ID.

5.2.3 Extent of CCS Water and Rate of Migration

When the groundwater levels are higher than water levels in the CCS, there is an increased potential for groundwater discharges into the CCS. However, when the CCS water levels are higher than the surrounding groundwater levels, flow may radiate from the CCS until equilibrium is met, it is intercepted by the ID at the shallow zone, or hydrologic conditions change. The density gradient between groundwater and surface water inside and outside the CCS also affects whether the water moves in or out of the CCS. Since there are higher densities in the CCS, the groundwater elevations outside the CCS must be higher to counteract the density effects. The estimated flows in and out of the CCS and the timing on a monthly basis are presented in Section 5.4.

While freshwater head equivalent potentiometric maps can be developed and groundwater flow directions established, FPL has previously stated these maps may yield inappropriate interpretations. As a surrogate to potentiometric maps, a review of changes in specific conductance concentrations and extent of tritium can give insight into changes over time and groundwater movement.

As discussed in the February 2011 Semi-Annual Report (FPL 2011a), the presence of saltwater in the aquifer west of Turkey Point pre-dates the CCS and was documented well inland in the

1950s (Klein 1957). This saltwater zone can move seasonally and year to year (Peters and Reynolds 2008), however, the results of FPL's two years of monitoring effort show very little change in chloride concentration west of the CCS except for some reduction in thickness of the fresher water surficial zone during the 2011 drought/dry season. Figure 5.2-23 shows the extent of saltwater intrusion as estimated by the USGS in 2008. This line is seaward of the USGS line in the 1950s (Figure 5.2-23). While the exact location of the estimated extent of the 2008 USGS line that extends to the south may be refined, it generally appears to reflect the extent of saltwater intrusion as defined by the 1,000-mg/L isochlor.

In comparing current data to historical data, there are more historical specific conductance data than chloride data in the project area, thus specific conductance provides a more robust assessment. Historical groundwater specific conductance data are available from sampling efforts conducted prior by to the startup of the CCS in the early 1970s. These data were compiled by Golder Associates, Inc. (2011a). While chloride concentrations provide more direct evidence of saltwater/ marine water intrusion, specific conductance can also be used as a surrogate, with the understanding that its value could be affected by salts found in fresh water. In nearly all the wells sampled for this current monitoring effort, a high specific conductance value (greater than 1,275 µS/cm) appears to indicate marine influences. Only one well (TPGW-8S) had specific conductance readings that were influenced by another ion (calcium) and may not reflect marine influences.

Figures 5.2-24, 5.2-25 and 5.2-26 show cross-section locations and cross-sections with pre-CCS (April 1, 1971, through February 1, 1972) and recent (March 2011) specific conductance data. Isopleths are drawn to show and the approximate change in specific conductance concentrations from the early 1970s (pre-CCS operation) to recent period. All isopleths represent estimations of historical and current water quality conditions and were developed based on interpolation methods and best professional judgment. The figures show the presence of high specific conductance water, most likely from predominantly marine influences, well inland prior to CCS operation. The figures also show that the specific conductance values in the immediate vicinity of the CCS have increased above values typically observed in Biscayne Bay, and are attributable to the CCS. Some specific conductance values to the west also increased, however, the westerly limit of the 10,000 µS/cm line has changed little. Plan view maps showing the approximate current limits of specific conductance in each zone (shallow, intermediate and deep) are provided in Figures 5.2.27, 5.2-28 and 5.2-29.

Figures 5.2-25 and 5.2-26 also show the approximate historical limit what would now be defined by FDEP as Class III groundwater (TDS greater than 10,000 mg/L per Chapter 62-520.430, F.A.C.). While historical TDS values are not available for all stations, there is a relationship between specific conductance and TDS; Based on the current analytical data the TDS value on average is 60% of the specific conductance value. This relationship was used to calculate historical TDS values and to estimate the approximate limits of GIII groundwater prior to CCS construction.

Since there is an interest in determining how much, if any, of the groundwater is affected by the hypersaline water in the CCS, a tracer or tracers that can distinguish CCS water from Biscayne

Bay marine water is needed. Based on the data and analyses conducted by FPL and the Agencies, the Agencies have selected tritium to be used as a tracer of the CCS water. Parameters such as cations, ions, or other isotopes did not distinguish CCS water from Biscayne Bay water below concentrations found in Biscayne Bay. The distribution of tritium may provide some insight into the possible movement and extent of CCS waters.

Figures 5.2-30 and 5.2-31 show cross-sections similar to the above specific conductance cross-sections except tritium values are shown. The figures include both the average tritium value for each well and corresponding average chloride value for the period when tritium data are currently available (June/September 2010 through December 2011). The figures show groundwater tritium concentrations in excess of 3,000 pCi/L near the CCS. These concentrations diminish with distance from the CCS. Values are in the hundreds of PCi/L three miles west of the CCS at depth. The extent of tritium in the groundwater is less to the east of the CCS. Note that much of the water in the vicinity of the CCS could historically be classified as non-potable based on pre-CCS TDS concentrations in the groundwater. Figures 5.2-32, 5.2-33 and 5.2-34 show plan view maps of tritium concentrations for the shallow, intermediate, and deep zones, respectively. All isopleths represent estimated locations of tritium contours and were developed based on interpolation methods and best professional judgment.

Over the two year period of monitoring, the tritium concentrations, along with chloride concentrations have remained relatively stable in the groundwater. No increasing trends were observed.

It is important to note that under this Monitoring Plan, tritium is being measured only as a chemical tracer in order to determine potential movement of CCS water. At the levels being measured, the tritium is not a public health concern. Tritium is also being routinely monitored in the CCS by the Florida Department of Health, Bureau of Radiation Control (FDOH-BRC).

Again, it is important to remember that all the new wells installed as part of this monitoring effort are screened below the shallow fresher lens of groundwater present in the area. The cross-sectional figures show that the lateral migration is not uniform in all directions. This is not unexpected due to density and hydraulic heads that are more conductive to gradients to the west than the east. Other regional factors also could be influencing movement to the west. FPL anticipates that a committee will be formed, including FPL representatives and Agency personnel, to look further into the causes of CCS migration and factors that may affect saltwater intrusions in the area surrounding the CCS.

The SFWMD has suggested that a threshold value of 20 pCi/L (averaged value) of tritium be used to reflect possible background conditions excluding effects of atmospheric exchange/deposition from the operation of Units 3 and 4 and the CCS. As discussed in Section 3, vapor exchanges and, to a lesser extent, rainfall can raise tritium concentrations in the porewater, surface water, and possibly the shallowest groundwater to hundreds of pCi/L in areas within 1 mile of the CCS. The effects of vapor exchanges diminish with distance away from the CCS; however, values of tritium near 50 pCi/L have been observed at the evaporation station next to TPGW-5. Also, the rain collector data from rainfall show a maximum tritium value approaching 40 pCi/L near TPGW-5. Rainwater or standing water in wetlands or in canals will be most directly affected by the atmospheric tritium; however, this water will percolate into the ground and affect the groundwater. The atmospheric influences of tritium are expected to decrease with depth due to dilution and natural decay of tritium depending on the rate of vertical migration. Thus, at depth and distances well away from the CCS (such as TPGW-5, TPGW-4), the atmospheric influences are more limited.

There is no apparent evidence that there is an upwelling of high specific conductance CCS water with commensurate levels of tritium that are affecting surface water or porewater throughout the study area. The tritium concentrations in Biscayne Bay and the L-31E canal as reported in Section 3.2 and porewater in Section 4 (both broad-scale and transects) are within the ranges observed in the evaporation pans and/or did not have higher specific conductance values that would potentially indicate CCS water. There are two surface water stations located in canals immediately adjacent to the CCS that potentially could be affected by the CCS via a groundwater pathway (TPSWC-4 and TPSWC-5). At both locations tritium values approached or exceeded 1000 pCi/L at depth during one sampling event. Also on occasion water that was warmer and more saline than Biscayne Bay was detected at TPSWC-5 and which cannot be readily explained by air temperatures. Both TPSWC-4 and TPSWC-5 are separated from the CCS by approximately 150 and 40 ft of land respectively. The water depths along the CCS at that location exceed 20 ft and the water depth at TPSWC-5 is also deep so it is possible that there could be some seepage between the two water bodies near the bottom.

For groundwater, there are also stations that show evidence of CCS water via a groundwater pathway. Figure 5.2-35 shows the wells that are suspected to be influenced by a groundwater pathway. The tritium concentrations in the shallow samples at fully screened wells L-3 and L-5 may be attributable to atmospheric influences, however, the higher values found at depth are associated with a groundwater pathway. The westerly extent of CCS water in the groundwater is near Tallahassee Road.

Using a tritium concentration of 20 pCi/L at depth and for calculation purposes, the rate of migration can be estimated. The approximate limit of the 20 pCi/L line is 20,000 ft west of the CCS around G-21 and 25,000 ft from the CCS west of G-28. Given that the CCS has been in operation since 1974 (approximately 38 years), the average rate of migration to the west is between 525 (northern part) and 660 (southern part) ft per year. There are many factors can cause saltwater intrusion, including groundwater withdrawals, agricultural uses, mining, government water management practices, etc.

To the east, there does not appear to be any influence of CCS at TPGW-10, but there does appear to be some influence at depth at TPGW-11 and TPGW-14. The extent of movement to the east appears to be less than what is observed to the west and with the approximate limit of the 20 pi/L line assumed to be slightly east of TPGW-11. For calculation purposes, assume the distance is 11,000 ft to the east of the CCS, which equates to a migration rate of 290 ft per year.

It is unknown whether the migration to the east and west has been steady or if the CCS water moved quickly and then slowed. As discussed above, during the two year period of the Monitoring Plan there has been no readily apparent movement further to the west.

The Monitoring Plan requires that the percentage of CCS water be estimated at different locations. This cannot be done with a high degree of precision or accuracy due to the complex nature of the aquifer and lack of historical data. Nonetheless, an approximation is being attempted by assuming a binary mixture between water in the CCS and background water that existed before the CCS was created. This mass balance is computed as:

$$\%CCS = 100 \times ((Cl_{well} - Cl_{background}) / (Cl_{CCS} - CL_{background}))$$

Where:

- % CCS = estimated percentage of CCS water in a given well
- $Cl_{background}$ = typically interpolated value from historical specific conductance data in nearby wells
- Cl_{CCS} = the average CCS chloride concentration (mg/L) from June 2010 through June 2012 for wells close to the CCS (newer water) or estimated chloride concentration from the late 1970s/early 1980s for outer wells
- Cl_{well} = the average chloride concentration (mg/L) in a given well from June 2010 through June 2012

Chloride is used in lieu of tritium in this calculation because chloride is a conservative constituent that does not biodegrade or decay over time like tritium. While the above binary mixing model can be more readily used for those wells where there is pre-CCS and post-chloride CCS well data (i.e., L-3, L5, G-21, and G-28), estimations have to be made for the pre-CCS chloride values in the newly installed wells. A pre-CCS chloride concentration equivalent to freshwater cannot be used at most locations since the presence of marine water in the groundwater pre-dates the CCS. An estimation of pre-CCS chloride concentrations can be made by interpolating historical/pre-CCS specific conductance and limited chloride data reported by Golder Associates, Inc. (2011a) for various wells and depths. For locations where only historical specific conductance values are available, the following empirical relationship was developed using wells where both chloride and specific conductance were measured:

$$Cl\ (mg/L) = EC(\mu mhos/cm) \times 0.4428 - 3332.3.$$

When calculating the percentage of CCS water based on chloride concentration, not only must the historical and current well concentration be known or estimated, but also the historical and current CCS chloride concentration. Water in wells close to the CCS likely reflects fairly young water and current CCS concentrations may be appropriate. However, water near Tallahassee Road is likely much older and from CCS water that was less saline in the 1970s and 1980s. For the outer wells such as TPGW-4 and TPGW-5, lower chloride levels should be used for the CCS water. Based on historical data (Golder Associates Inc. 2011b), a historical CCS chloride concentration is used for the outer wells and a current (June 2010 through June 2012) chloride concentration is used for the wells near the CCS.

Table 5.2-5 provides a summary of the approximate percentage of CCS water based on the above inputs and assumptions.

As an alternative check, a similar approach was used for estimating the percent of CCS water in a given well sample, but using tritium instead of chloride concentrations. Note, however, more assumptions are required with this method which can result in more uncertainty. Since tritium decays over time, the amount of decay that has occurred also must be considered. This can be approximated based on the estimated age of the water using an average rate of migration. For example, monitoring well cluster TPGW-4 is approximately 14,900 ft from the CCS. With an average rate of migration of 660 ft per year for westerly wells on the southern half of the CCS, the approximate age of the water is 22.9 years. Using an average concentration from June 2010 through December 2011 for each well and accounting for the half-life of tritium at 12.3 years, a tritium concentration can be estimated at each well that accounts for no decay. The resulting value can then be used to calculate percent CCS water by assuming a binary mixture between water in the CCS and background water that existed before the CCS was created. This mass balance is computed as:

$$\%\text{CCS} = 100 \text{ x } ((\text{Tritium}_{\text{well no decay}} - \text{Tritium}_{\text{reference background}}) / (\text{Tritium}_{\text{CCS}} - \text{Tritium}_{\text{reference background}}))$$

Where:

- % CCS = estimated percentage of CCS water in a given well
- $\text{Tritium}_{\text{well no decay}}$ = estimated tritium concentration for a given well accounting for no tritium decay
- $\text{Tritium}_{\text{reference background}}$ = estimated pre CCS tritium concentration
- $\text{Tritium}_{\text{CCS}}$ = estimated average CCS tritium concentration (pCi/L)

Similar to the chloride concentrations in the CCS, tritium concentrations, current and historical, have to be estimated. This can be a challenge since the tritium concentrations in the CCS vary considerably. For the Uprate monitoring period from June 2010 through December 2011, the tritium values in the CCS ranged from 1,260 to 14,280 pCi/L. Based on historical data from 1974 to 1975, the CCS values ranged from 1,556 to 4,846 pCi/L (Ostlund and Dorsey 1976). The groundwater at TPGW-13 seems to be buffered by these short-term fluctuations in the surface water and may serve as a better overall average of the CCS water. The average concentration in TPGW-13 from June 2010 through December 2011 is 4,100 pCi/L. While there are no hard data to support this, it is assumed for calculation purposes that the concentrations in the groundwater under the CCS have been somewhat similar over much of the CCS operation period since the operations are not dramatically different. With these assumptions, use of current tritium well data, and 20 pCi/L as a reference background at depth, an estimated percentage of CCS water in the well can be calculated.

Table 5.2-6 provides a summary of values used and the resulting percent CCS water. Generally, estimated values using tritium are comparable to values calculated using the chloride approach. However, the results from both estimation methods should be viewed as rough estimates of percent CCS water.

5.3 Biscayne Bay Continuous Resistivity Profile Survey

The Monitoring Plan (SFWMD 2009) states that "broad-scale estimates of specific conductance and temperature of waters potentially influenced by the CCS are needed to assess the spatial extent and magnitude of this influence (including the identification of potential groundwater upwelling zones) and provide information to improve the monitoring design within the adaptive protocols of this Plan." Electrical resistivity or magnetic surveys can provide such broad-scale salinity estimates for both surface water and groundwater (Fitterman and Desczcz-Pan 2001; Swarzenski et al. 2006).

In this Monitoring Plan, a boat-based geophysical survey was proposed south of the latitude of the Mowry Canal and over Card Sound using a combination of continuous resistivity profiling (CRP) and distributed temperature sensing (DTS) investigation. The USGS recommended that a CRP pilot study be conducted since it was not clear how far below the ground surface resistivity readings may be interpreted and whether or not high saline zones could be identified. The USGS did not include a DTS investigation as part of the pilot effort since this is typically deployed to cover a smaller area than is described in the Monitoring Plan (SFWMD, 2009).

On May 25-26 and July 28, 2011, the USGS conducted a CRP pilot survey using a boat-towed electrode array. The details of the survey include the following:

- Tow-cable length – 100 meters
- Number of electrodes – 11 (2 current, 9 potential)
- Electrode spacing – 10 meters
- Current electrode type – graphite
- Potential-electrode type – stainless steel
- Array geometry used – dipole-dipole
- Acquisition time – 8 potential measurements every 2.8 seconds
- Tow speed – approximately 4 kilometers per hour (km/hr)
- Number of survey lines – 12
- Total linear distance – 31.3 km

The pilot study survey lines are shown on Figure 5.3-1 and are located in the CCS, historical outfall canal, and in the vicinity of TPGW-14 where the highest salinities were observed in the Biscayne Bay wells at depth. Profile lines also extended to TPGW-11. This survey area represents the most viable locations to potentially see resistive/conductive differences.

Following the field effort, the USGS processed the data and assessed the results. The preliminary findings were presented to the Agencies on August 29, 2012. Due to internal QA/QC requirements, the USGS cannot publish the results or provide hard copies or an electronic version of their presentation or results without a formal review and publication process, which could take a minimum of five to six months. FPL has requested that the USGS present the data and, depending upon the findings, a decision could be made whether to formally publish a report.

The USGS assessed the depths at which the results could be reasonably interpreted and concluded the depth was typically limited to 12.5 to 15 m below the Bay bottom. The USGS stated that the data are considered to have a vertical resolution no better than 5 m and the horizontal resolution is generally considered to be ½ the electrode spacing (5 m).

Based primarily on the lack of depth penetration, it is FPL's interpretation that the CRP survey will not be very helpful to further delineate the extent of CCS water at depth nor conclusively discriminate between water of different densities and variations in the subsurface geology without the aid of substantial data collection. The porewater and surface water sampling in Biscayne Bay already provide insights into whether there is a measurable influence of the CCS in Biscayne Bay. As such, FPL recommends that further efforts associated with the CRP not be conducted. FPL also does not recommend the use of DTS to track warmer CCS water in the ground since the well temperature data indicate little to no thermal influences away from the CCS.

5.4 Water and Salt Balance Model

Tetra Tech GEO developed a model of the water and salt balance for the CCS. The purpose of this model is to quantify the volumes of water and mass of salt entering and exiting the CCS over a period of time. This analysis builds upon a prior study of the CCS water balance (Golder 2008) by revising methods of calculation for the various components of the CCS and by incorporating new hydrological, chemical, and meteorological data collected in and around the CCS between September 2010 and June 2012. The model described herein is an extension and update of the water and salt balance model presented in the 2011 Annual Monitoring Report (FPL 2011b). This section describes the conceptual model of the CCS water and salt balance, key calculations, and results to illustrate the components of the water and salt balance model. All assumptions are clearly indicated. These calculations are performed in an Excel spreadsheet, which is provided in a separate data file. Findings regarding the operation of the CCS are based upon the results of the current calibrated water and salt balance model and are provided herein.

5.4.1 Conceptual Model

The first step in the modeling process is the development of a hydrological conceptual model (HCM). All data available for the site are assimilated in the HCM in a framework that facilitates the development of a quantitative model. Such data includes information about the bathymetry of the CCS, Biscayne Bay, ID and SFWMD canal L-31E. The flow and chemical characteristics of these water bodies and of the underlying groundwater are thoroughly monitored. These monitoring data are also incorporated in the HCM and helped to formulate a control volume that is primarily comprised of the CCS.

A control volume defines the entity being analyzed. The transfer of water and salt within the control volume is not characterized. Rather, the water and salt balance model focuses upon the transfer of water and salt into and out of the control volume. The control volume analyzed is comprised of the canals of the CCS and the adjacent ID. Raised earth berms between the individual canals are not considered as a part of the control volume. The base of the control volume is assumed to be the bottom of the ID and the cooling canals, whose elevation ranges from approximately -3 feet NAVD 88 to approximately -30 feet NAVD 88. This interpretation of the control volume was developed based upon the hydrological monitoring plan in place for the CCS. The components of the water balance model for this control volume are depicted in Figure 5.4-1. In this figure, canal L-31E is red, the ID is green, discharge cooling canals are purple, return canals are dark blue, and Biscayne Bay is light blue.

Water elevation and quality are recorded at seven stations throughout the CCS, three locations in the ID, three stations in canal L-31E, two locations in other adjacent canals, seven locations in Biscayne Bay (four of which measure only salinity), and fourteen wells in Biscayne Aquifer (at 3 depths each); it is important to note that, based upon the control volume, only shallow groundwater monitoring stations contributed to the characterization of groundwater elevations and groundwater quality in this analysis. The surface and subsurface monitoring locations, in addition to data provided by SFWMD and FPL, facilitate straightforward calculation of the components of water and salt transfer into and out of the control volume:

- Surface water monitoring stations in canal L-31E and the ID permit a straightforward calculation of lateral seepage of water and salt between L-31E and the control volume;
- Surface water monitoring stations in the southern collector canal of the control volume and a monitoring station in a canal adjacent and parallel to the southern face of the control volume provide a means to calculate the seepage of water and salt through the southern face of the control volume;
- Surface water monitoring stations in the CCS return canals and in Biscayne Bay facilitate the calculation of seepage between Biscayne Bay and the control volume;
- Surface water monitoring stations in the CCS canals and groundwater monitoring stations beneath and adjacent to the CCS help to define water flow and salt transport through the bottom of the proposed control volume;
- Meteorological stations in the CCS and immediately to the north and south provide data to calculate the loss of water from the control volume to evaporation; and
- Next Generation Weather Radar (NEXRAD) precipitation data provided by SFWMD informed an accurate assessment of water gained by the CCS from rainfall.

Intermediate modeling results, based upon the control volume and the HCM presented herein, were presented to SFWMD for a calibration period between September 2010 and December 2011 (Andersen 2012). Based upon the intermediate results, FPL received concurrence from SFWMD on the proposed control volume and HCM.

5.4.2 Bathymetry

Certain components of the water and salt balance model require an understanding of the control volume's surface area. For instance, precipitation-based inflow to the control volume is a function of the amount of rainfall (e.g., in inches) and the surface area of the water body onto which the rain was deposited. Also, the conductances for the bottom seepage zone are a function of the water surface area. Due to the sloping sidewalls of the canals in the CCS, the water surface area changes as the water elevations in the CCS change. Based upon a detailed survey of the CCS bathymetry (Morgan and Eklund 2010), a relationship between surface area of the control volume (sub-divided into 5 zones, Figure 5.4-2) and water elevation was defined. Thus, because water elevations in the CCS vary daily so, too, does the water surface area (surface area is proportional to the water elevation); the time-varying surface areas for each of the 5 zones in Figure 5.4-2 are known for the calibration period. Likewise, the bathymetric survey results permitted the characterization of the relationship between the CCS water elevations and CCS storage volume; like surface area, storage volume decreases as water elevations decrease. This refined understanding of surface area and volume of the CCS significantly improved the performance of the model and eliminated much uncertainty with respect to the inflows to and outflows from the control volume.

5.4.3 Water Balance Calculations

As Figure 5.4-1 depicts, the water balance for the proposed control volume is comprised of seepage (lateral through the sides and vertical through the bottom), blowdown (additional water pumped from other units to the CCS), precipitation (including runoff from earth berms between canals) and evaporation. Water pumped into and out of the CCS from Units 1 through 4 is also a component of inflow to and outflow from the control volume; however, these flows are assumed to be equal and have a net zero effect on the water and salt balance. Seepage to and from the control volume comprises a significant component of the water balance. The approach to calculating seepage to and from the control volume, as well as necessary assumptions, is provided below. Other means by which water is transferred (e.g., evaporation) are calculated in distinct manners and are discussed separately. Calculations were performed for a 22-month period from September 2010 through June 2012. This period marks an extension of that which was defined in the preliminary model presented in the 2011 Annual Report (FPL 2011b). Average flows into and out of the control volume were calculated for each day of this period. The average daily flows were summed to estimate the amount of water that enters or exits the control volume during each month and the entire 22-month period. These calculations are intended to demonstrate and validate the methodology, as well as illustrate the hydrologic mechanisms by which the CCS functions.

The general equation for seepage flow employed in the water balance analysis is:

$$Q = C \times \Delta h \qquad (1)$$

Where:

- Q ≡ Volumetric flow, [Length3/Time]
- Δh ≡ Head gradient between control volume and external source/sink, [Length]
- C ≡ Conductance of the media between the control volume and the external source/sink with which it is transferring water, [Length2/Time]

$$C = \frac{K * A}{D} \tag{2}$$

Where:

- K ≡ Hydraulic conductivity of the media through which water flows, [Length/Time]
- A ≡ Area of the face of the control volume through which water flows, [Length2]
- D ≡ Distance water flows between the external source/sink and the control volume, [Length]

In accordance with widely accepted modeling convention, flow into the control volume is positive (+) and flow out of the control volume is negative (-). Calculated flows are reported in 10^6 gallons per day (millions of gallons per day [MGD]).

The mass flux into or out of the control volume is calculated by multiplying the volumetric flow by the salinity of the body of water from which the water is flowing. Salinity was monitored at all groundwater and surface water stations employed in the ensuing calculations and was reported in the practical salinity scale (PSS-78), which is equivalent to grams per liter (g/L). Calculated mass fluxes are reported in thousands of pounds per day (lb x 1000/day).

The data monitoring locations, seepage face dimensions (where relevant), additional equations, and assumptions that support the estimation of the individual components of the water balance for the control volume are discussed below. Draft results of water and salt balance for the entire 22-month period are discussed in Section 5.4.5 and are provided at the end of Section 5.4.

5.4.3.1 Seepage To/From L-31E (Western Seepage)

Three surface water monitoring stations record the water elevations and salinities in L-31E (TPSWC-1, TPSWC-2, and TPSWC-3). Three corresponding stations (at similar longitudes) record water elevations and salinities in the ID (TPSWID-1, TPSWID-2, and TPSWID-3). The locations of these monitoring stations are plotted in Figure 5.4-3.

Using data recorded at these monitoring stations, the seepage through the west face of the control volume was calculated. In order to calculate this seepage, the western face of the control volume was subdivided into two sub-faces (Figure 5.4-3). For this calculation, the following assumptions were made and seepage face dimensions estimated:

- TPSWC-1, TPSWC-2, and TPSWC-3 were used to interpolate water elevations and salinity along the L-31E;
- TPSWID-1, TPSWID-2, and TPSWID-3 were used to interpolate water elevations and salinity along the ID;
- The northernmost section of the west seepage face is approximately 18,800 ft long; the southernmost section of the west seepage face is approximately 10,200 ft long;
- Along the northernmost section of the west seepage face, L-31E and the ID are separated by approximately 950 ft; the average separation between the two canals in the southernmost portion is approximately 2,434 ft; and

- Elevation of base of the ID is approximately -20 ft NAVD 88.

The subdivision of seepage through the west face of the control volume is based on the orientation of L-31E. The conductance of and seepage through each of the sub-faces were calculated using Equations (1) and (2). The resulting component of the water balance is presented in Table 5.4-1. Salt balance estimates for this seepage face were calculated by multiplying the salinities in the sources of water by the calculated flow (Table 5.4-2). For instance, where the flow was to be calculated into the control volume, the salinity of L-31E would be multiplied by the calculated flow to derive the mass flux of this balance component.

5.4.3.2 Southern Seepage

Seepage through the south face of the proposed control volume is primarily driven by the water elevations in the southern end of the CCS and in the canal adjacent and parallel to the southern edge of the control volume. One monitoring station records water elevations and salinity in the southern end of the CCS (TPSWCCS-4). Likewise, one monitoring station measures water elevations and salinity in the adjacent canal (TPSWC-4). These monitoring stations are plotted in Figure 5.4-4.

Using observed data recorded at these monitoring stations, the seepage through the south face of the control volume was calculated. For this calculation, the following assumptions were made and seepage face dimensions estimated:

- Water elevations and salinities recorded in TPSWC-4 are representative of the southern external canal;
- Water elevations and salinities recorded in TPSWCCS-4 are representative of the southern CCS collector canal;
- The depth of the southern CCS canal is assumed to be that at TPSWCCS-4, where the canal bottom is an approximate elevation of -22 ft NAVD 88; and
- The length of the seepage face is approximately 9,300 ft.

The southern external canal is 155 ft south of and parallel to the southern edge of the CCS.

The application of data observed at TPSWC-4 to the entire southern canal was necessitated by the absence of other monitoring stations in this external canal. Likewise, TPSWCCS-4 is by far the most proximate and relevant monitoring station to the seepage face. The conductance for this seepage face was calculated using Equation (2). The flow through this seepage face was subsequently calculated by Equation (1) using water elevation differences between the two monitoring stations. The calculation flow associated with this component of the water balance is provided in Table 5.4-1. Salinities of the source water were multiplied by the calculated flows in order to estimate the salt mass flux and total mass through this seepage face (Table 5.4-2).

5.4.3.3 Eastern Seepage

Seepage through the eastern face is assumed to flow into the control volume from Biscayne Bay or out of the control volume into Biscayne Bay. In order to calculate this seepage, the eastern face of the control volume was subdivided into two sub-faces (Figure 5.4-5). Canal depths at these two locations and stage variation within the CCS necessitated the subdivision of the eastern seepage face. The elevation of the canal bottom at TPSWCCS-5 is approximately -22 ft NAVD 88; the elevation of the canal bottom in the vicinity of TPSWCCS-6 is lower (approximately -30 ft NAVD 88). Water characteristics in Biscayne Bay are observed at a number of monitoring stations along the seepage face; the monitoring station with the longest period of record for water elevations is TPBBSW-3.

Using observed water elevations from relevant monitoring stations, the seepage through the east face of the control volume was calculated. For this calculation, the following assumptions were made and seepage face dimensions estimated:

- TPSWCCS-5 water elevations and salinities effectively reflect conditions in the return canal adjacent to the southernmost seepage sub-face;
- TPSWCCS-6 water elevations and salinities effectively reflect conditions in the return canal adjacent to the northernmost seepage sub-face (TPSWCCS-5 salinity employed when data was not available for TPSWCCS-6);
- Reliable water elevations at TPSWCCS-6 were not available for much of September 2010 and all of April and May 2011; water elevations during these times were estimated from the measurements at TPSWCCS-5 by adding the average difference in water elevations between the two sensors to TPSWCCS-6; likewise, water elevations measured at TPSWCCS-6 were adjusted and employed as surrogates for TPSWCCS-5 water elevations when the latter were not available;
- TPBBSW-3 water elevations and salinities are representative of Biscayne Bay along the eastern seepage face of the return canals (TPBBSW-10 water elevations and TPBBSW-4 salinities were employed when data for TPBBSW-3 were not available);
- TPBBSW-10 water elevations and salinities are representative of Biscayne Bay along the intake canal seepage face (water elevation and salinity measurements at TPBBSW-3 and -4 were employed when data were not available for TPBBSW-10);
- The average elevation of the canal bottom along the southernmost seepage sub-face is assumed to be -22.5 ft NAVD 88 (elevation at TPSWCCS-5);
- Interval-valued bathymetric data defines a range of depths below water for the northernmost seepage sub-face between 20 ft and 40 ft. Based on this data, an approximate elevation of the canal bottom was defined to be -30 ft NAVD 88;
- The length of the southernmost seepage sub-face is approximately 22,500 ft; and
- The length of the northernmost seepage sub-face is approximately 8,340 ft.

The conductance for this seepage face was calculated using Equation (2). The flow through this seepage face was subsequently calculated by Equation (1) using water elevation differences between the each of the two monitoring stations in the control volume and the Biscayne Bay monitoring station. The calculation of flow associated with this component of the water balance is provided in Table 5.4-1. Salinities of the source water were multiplied by the calculated flows in order to estimate the salt mass flux and total mass through this seepage face (Table 5.4-2).

5.4.3.4 Northern Face Seepage

Seepage through the northern face of the control volume (Figure 5.4-6) is defined by the difference in water elevations between the northernmost discharge canal of the CCS and shallow groundwater elevations to the north of the control volume. TPSWCCS-1 is the most proximate monitoring station to the northern seepage face. Groundwater elevations were adjusted for freshwater equivalency and interpolated along a transect that is parallel to the northern edge of the CCS, starts at a point with the same latitude as TPGW-12 and same longitude at TPSWCCS-1, intersects TPGW-12, and terminates at a point with the same latitude at TPGW-12 and the same longitude as plant outflow meter TPFM-1 (Figure 5.4-6). Groundwater elevations along this transect were interpolated based on data recorded at shallow monitoring wells TPGW-6, TPGW-10, and TPGW-12. Freshwater equivalent heads were calculated using Equation (3).

$$h_f = (h - z) \times \left(\frac{\rho}{\rho_f} - 1\right) + h \tag{3}$$

Where:

- $h_f \equiv$ freshwater equivalent head, [Length]
- $h \equiv$ measured water elevation at the sensor, [Length]
- $z \equiv$ elevation of the sensor, [Length]
- $\rho \equiv$ measured density of water, [Mass/Length^3]
- $\rho_f \equiv$ freshwater density (0.997 g/cm^3)

Using freshwater equivalent water elevations from the CCS monitoring station and interpolated shallow groundwater elevations along the transect, the seepage through the north face of the control volume was calculated. For this calculation, the following assumptions were made and seepage face dimensions estimated:

- Water elevations, densities, and salinities recorded in TPSWCCS-1 applied to the entire north canal of the control volume (TPSWCCS-7 data were used when TPSWCCS-1 data were not reliable);
- A hydraulic gradient was calculated along a straight line between TPGW-6 and TPGW-12; this gradient was employed to estimate groundwater elevations along the transect west of TPGW-12;
- A hydraulic gradient was calculated along a straight line between TPGW-12 and TPGW-10; the gradient was employed to estimate groundwater elevations along the transect east of TPGW-12;
- The salinity at TPGW-12 was assumed to apply across the length of the transect;
- Length of the seepage face is the lateral distance between TPSWCCS-1 and the plant discharge pump station;
- The distance between the northern edge of the CCS and the transect is the difference between the latitudes of TPGW-12 and TPFM-1;

- Based on bathymetry data, the elevation of the bottom of the CCS varied from -11.5 to -25 ft NAVD 88 along the northern canal.

The conductance for this seepage face was calculated using Equation (2). The flow through this seepage face was subsequently calculated by Equation (1) using water elevation differences between the monitoring station in the control volume and interpolated shallow groundwater elevations along the transect. The calculation of flow associated with this component of the water balance is provided in Table 5.4-1. Salinities of the source water were multiplied by the calculated flows in order to estimate the salt mass flux and total mass through this seepage face (Table 5.4-2).

5.4.3.5 Bottom Seepage

The calculation of flow through the bottom of the control volume employed monitoring data from five shallow groundwater wells located beneath and adjacent to control volume (TPGW-1, TPGW-3, TPGW-11, TPGW-12, TPGW-13) and four monitoring stations in the CCS (TPSWCCS-1, TPSWCCS-2, TPSWCCS-4, TPSWCCS-5). For this calculation, the control volume was subdivided into four zones (Figure 5.4-7), based on the locations of the CCS monitoring stations and the conceptualization of bottom seepage to and from the control volume (primarily downward flow in the northern and middle portions of the discharge cooling canals; primarily upward flow in the return canals). The seepage through each zone of the control volume was calculated; bottom seepage was calculated by summing the flows through the four zones.

Surface water elevations and salinity for each zone were defined to be those measured at the monitoring station within the zone (e.g., water elevations and salinity observed at TPSWCCS-1 and TPSWCCS-7 were applied to Zone A; Zone B: TPSWCCS-2; Zone C: TPSWCCS-4; Zone D: TPSWCCS-5). In general, water elevations decreased from Zone A to Zone D. Groundwater elevations beneath each zone were defined based upon proximate groundwater monitoring stations (Zone A: TPGW-1, TPGW-10, and TPGW-12; Zone B: TPGW-13; Zone C: TPGW-3 and TPGW-11; Zone D: TPGW-11). Groundwater salinity flowing into each zone was characteristic of the salinity measured at each zone’s relevant groundwater monitoring station (Zone A: average of TPGW-1 and TPGW-12; Zone B: TPGW-13; Zone C: TPGW-10; Zone D: TPGW-10); the inflowing groundwater at Zones C and D was assumed to have a fraction (80% and 90%, respectively) of the salinity measured at TPGW-10 due to the mixing of regional freshwater and saline water. The thickness of the seepage face varied amongst the zones, since the approximate average elevation of canal bottoms for each zone varied (as approximated from bathymetric survey data).

The calculation of seepage through the bottom of the control volume was predicated on the following simplifying assumptions:

- Groundwater elevations beneath each zone are reflected by the groundwater elevations at underlying or proximate monitoring wells, as described above;
- The elevation of the canal bottom as representative for each zone was interpreted from bathymetric survey data and assumed to be constant throughout the zone;

- The surface water elevation and salinity observed at a monitoring station within each zone was applied to the entire zone, as described above;
- Water elevations employed in the seepage flow calculation were not adjusted for density. This assumption was made because although the concentration of the CCS water and the groundwater beneath the CCS may be different from ground or surface waters at other locations, the concentration of the CCS water and the concentration of groundwater immediately beneath the CCS at a given monitoring location are approximately the same. Because the concentrations are the same, the densities are the same, and no adjustment to account for density difference is required to compute flows; and
- Water elevations measured at TPGW-11M acted as surrogates for TPGW-11S water elevations when the latter were not available.

Based on these assumptions, the conductance of and flows through the four zones were calculated using Equations (2) and (1), respectively. The calculated flow is provided in Table 5.4-1. Mass flux was calculated by multiplying the volumetric flow by the salinity of the source (Table 5.4-2).

5.4.3.6 Evaporation

The estimation of evaporative loss from the control volume is a unique case of evaporation from a surface water body due to the elevated heat of water entering the CCS from the FPL Turkey Point power plant and the variability of salinity of water in the control volume. The elevated heat of water has the general effect of increasing evaporative loss, whereas salinity is inversely proportional to the rate of evaporation (Salhotra et al. 1985).

Numerous approaches for estimating evaporation have been developed; they generally fall into two categories: energy balance methods and Dalton Law methods. The former method is widely applied to surface water bodies in spite of being a “costly and time-consuming method” (Mosner and Aulenbach 2003). This approach to calculating evaporative losses requires calculation of individual components of energy flux into and out of the control volume due to solar radiation, surface water, groundwater and precipitation. Evaporative loss is then indirectly estimated as the difference between net energy flux from the control volume and the sum of the individual calculated energy flux components (Lensky et al. 2005; Mosner and Aulenbach 2003). This indirect approach can necessitate the detailed measurement of solar radiation, fraction of penetrating solar radiation, brine mass and cloud cover and can be unreliable for water bodies with elevated temperatures (Leppanen and Harbeck 1960; Bowen 1926).

The Dalton Law approach, on the other hand, relies upon an understanding of the vapor pressure gradient between the surface water and the overlying air, as well as the wind speed above the surface water. Use of this method is limited in practice since wind speed is often the least known parameter in evaporation estimation (Lensky et al. 2005).

For the control volume, wind speeds are measured at 15-minute intervals at meteorological station TPM-1 (Figure 5.4-8) and at 1-hour intervals north and south of the control volume. As such, the Dalton Law approach is employed herein to estimate the rate of evaporative loss, E, from the control volume. The general form of the equation is:

$$E = f(W) \cdot \{\beta \cdot e_{sat}(T_S) - \psi \cdot e_{sat}(T_A)\} \qquad \text{[Length/Time]} \qquad (4)$$

Where:

- $f(W) \equiv$ wind function; W is wind speed, [Length/Time]
- $\beta \equiv$ coefficient of water activity
- $e(T) \equiv$ saturation vapor pressure [Mass/(Length × Time^2)]
- T_S, $T_A \equiv$ temperature of surface water and air, respectively [°C]
- $\psi \equiv$ relative humidity [%]

The wind function, f(W), is an empirically derived formula that uses wind speed at 2 meters above surface to quantify to the effect of air convection above the water surface on the rate of evaporation. The thermal loading of the Turkey Point power plant can increase forced convection at the north end of the control volume. Approaches to explicitly consider free and forced convection are available (Adams et al. 1990), though they are tailored to estimating energy lost due to evaporation, rather than water lost due to evaporation. Though free and forced convection are not explicitly characterized herein, the wind function employed in these calculations was derived for heated cooling water and based upon the following equation:

$$f(W) = 0.301 + 0.113 \cdot W \qquad (5)$$

where wind, W, is measured in meters per second (m/s) (Williams and Tomasko 2009). In order to achieve a well-calibrated model, a coefficient C_W was incorporated into Equation (5) and was ultimately adjusted during calibration:

$$f(W) = C_W \times (0.301 + 0.113 \cdot W) \qquad (6)$$

The coefficient of water activity, β, varies in the range [0, 1] and is intended to account for the reduced evaporation from saline water bodies. It decreases with increasing salinity; at salinity levels in the CCS, β does not vary significantly (Salhotra et al. 1985) and is conservatively assumed to be 0.9; this value for β is empirically consistent with salinities approximately equal to 100 PSU (Salhotra et al. 1985).

The saturation vapor pressure relationship used in these calculations accounts for elevated water saturation gradients that result from heated water and provides reliable estimates of saturation vapor pressure for temperatures, T, up to 40 °C (Jobson and Schoelhamer 1987):

$$e_{sat}(T) = \exp(52.4185 - \frac{6788.6}{T-273.16} - 5.0016 \cdot \ln(T + 273.16))\ . \qquad (7)$$

Temperature of the surface water is measured at monitoring stations TPSWCCS-1, TPSWCCS-2, TPSWCCS-4, and TPSWCCS-5. Air temperature and relative humidity are measured at meteorological station TPM-1.

In order to estimate evaporative loss, the control volume was subdivided into four zones (Figure 5.4-8). Zone 1 covers the northern area of the discharge canals; wind speeds applied to this zone are measured north of the control volume and water temperatures are measured at TPSWCCS-1. Zone 2 covers the middle area of the discharge canals; wind speeds applied to this zone are measured at TPM-1 and water temperatures are measured at TPSWCCS-2. Zone 3 covers the south area of the discharge canals; wind speeds applied to this zone are measured south of the control volume and water temperatures are measured at TPSWCCS-4. Zone 4 covers the return canals; wind speeds applied to this zone are measured at TPM-1 and water temperatures are measured at TPSWCCS-5. The surface area from which water is lost to evaporation in each of these zones changes through time with the changing water elevations in the CCS, and is calculated based upon the 5 zones presented in Figure 5.4-2.

Additional assumptions made in order to estimate evaporative flux include:

- The air temperature and relative humidity measured at TPM-1 are applicable to the entire control volume;
- Wind speeds north and south of the control volume were measured at 10 meters above ground surface; an empirical relationship between wind speed and elevation was used to estimate wind speeds at 2 meters above ground surface at these stations; and
- Wind speeds employed in evaporative loss calculations were daily averaged values.

Calculated water flow from the control volume due to evaporation is provided in Table 5.4-1. No salt mass is lost from the control volume to evaporation.

5.4.3.7 Precipitation

Precipitation is measured at the site at meteorological station TPM-1 every 15 minutes, and these data informed the precipitation-based inflow in an earlier version of the model (FPL 2011b). However, a more accurate understanding of spatially-varying precipitation-based inflow was derived from NEXRAD rainfall data and provided by SFWMD. SFWMD converted NEXRAD precipitation data into daily rainfall amounts for the 5 zones depicted in Figure 5.4-2. Coupled with a detailed understanding of the changing surface areas for these zones, the NEXRAD data produced an accurate definition of the daily volumetric inflow of water to the control volume from precipitation. This approach to the calculation of precipitation-based inflow significantly improved the model's match to observed water elevations and salinities in the CCS, as well as eliminated the uncertainty introduced by applying TPM-1 rainfall amounts to the entire CCS. Quantities of water entering the control volume due to precipitation are provided in Table 5.4-1. No salt enters the control volume through the precipitation. Runoff into the control volume from earth berms between canals was initially assumed to be 50% of precipitation that falls on the berms. This percentage was adjusted during calibration.

5.4.3.8 Blowdown

Blowdown refers to water added to the control volume from a number of sources: the Unit 5 cooling tower (originally Floridan aquifer water), Miami-Dade wastewater, and Units 1 through 4. Flow from blowdown into the control volume was initially assumed to be a constant 7.8 MGD; this is an approximate value employed in a previous study of the CCS water balance

(Golder 2008). Estimates and measurements of blowdown contributions to the model were revised based upon available measurements and institutional knowledge. Added water from Units 3 and 4 were assumed to be freshwater (non-saline); Unit 5 blowdown salinities are not known with certainty and were adjusted to between 20% and 80% of seawater (35 PSU) to improve calibration to observed salinities. Inflows to the control volume are presented in Table 5.4-1 for water and Table 5.4-2 for salt mass.

5.4.3.9 Pumped Interceptor Ditch Water

The operation of the interceptor ditch requires that large volumes of water be pumped intermittently from the interceptor ditch in order to create seaward flow from L-31E. This pumped water is a blend of ID water and groundwater and is subsequently added to the CCS, comprising a component of inflow to the control volume that is much larger than the regional inflow through the western face of the control volume. Interceptor ditch operation occurs primarily between the months of January and June; pump rates have been as high as 50 MGD and average 4.5 MGD over the 22-month calibration period. The incorporation of this pumped water in the water and salt balance model significantly improved the simulation of water elevations and salinities over prior modeling efforts.

5.4.4 Storage

The gain/loss of water and salt mass within the control volume during some period of time results in a change in the control volume's water and salt mass storage. Increased water storage, for instance, occurs when more water enters the control volume than exits. Storage, then, can be estimated by summing all of the components of the water (and salt) balance. When the net flow is positive (into the control volume) during a specified period of time, the storage of control volume increases. Conversely, a net negative (out of the control volume) flow implies a decrease in storage during a specified time period.

Another manner in which a change in storage can be estimated relies on direct measurements of water elevations and salinities within the control volume. A change in water elevation within the control volume can be calculated as a difference between water elevations at the beginning and end of a specified time period. The product of this change in water elevations and the surface area of the control volume provide an estimate of the change in the volume of water contained in the control volume during that period of time. Estimates of daily storage changes derived from this method are used to further calibrate the water and salt balance model to ensure an accurate simulation of temporal trends CCS water elevation and salinity.

5.4.5 Results and Discussion

The individual components of the water and salt balance were simulated for each month from September 2010 through June 2012, as well as for the collective 22-month period. The individual components of flow are summed in order to calculate a simulated change in volume for each month and for the 22-month period. These simulated changes in storage were compared to observed changes in CCS water and salt storage for each month and the entire calibration period. Errors between the simulated and observed storage changes were minimized by adjusting key variables associated with the flow balance model; this process is called calibration. The calibration process ensures that the model can accurately reflect the average changes in CCS storage over the 22-month time frame, while also effectively capturing day-to-day changes in CCS water and mass storage. Calibration of the water and salt balance model was achieved by adjusting hydraulic conductivities of the aquifer materials adjacent to and beneath the CCS that factor into the calculation of seepage to/from groundwater and Biscayne Bay. Additional adjustable parameters include an evaporation factor that adjusts the coefficients in the wind function (Equation 6), the amount of runoff that enters the control volume as percentage of precipitation, the amount of Unit 5 cooling tower water that is lost to evaporation before entering the CCS, and the salinity of the Unit 5 blowdown as a percentage of seawater. The calibrated model parameter values are provided in Table 5.4-3.

The horizontal hydraulic conductivities laterally adjacent to the control volume were calibrated to range between 150 ft/day and 450 ft/day. The calibrated vertical conductivities beneath the control volume ranged from 0.1 ft/day to 2.6 ft/day. The northern portion of the discharge canals and return canals, where it is assumed deeper canals intersect a high flow zone underlying the muck and Miami limestone, were calibrated to have higher vertical hydraulic conductivities (1 ft/day and 2.6 ft/day, respectively). Lower vertical conductivities were calibrated for the mid- and southern portions of the discharge canals, as well as the southern portion of the return canals (0.1 ft/day).

Results of the simulated 22-month water and salt balance model are provided in Tables 5.4-1 and 5.4-2, respectively. Monthly balance results follow in Table 5.4-4 through Table 5.4-47. The modeled net flow of water, as calculated by the summing the components of the water balance for the 22-month calibration period, is denoted as the “Modeled Change in CCS Storage” and was calculated to be an average outflow of 0.62 MGD over the 22-month calibration period. The observed change in storage, which is the difference in the volume of water in the CCS between the final and first days of the calibration period, divided by the number of days in the period, was observed to be 0.11 MGD. Thus, the model correctly simulated an *increase* in CCS storage (a gain of water over the 22-month period). Though the model overestimated the change in storage by approximately 0.51 MGD, this error is small relative to the observed monthly changes in storage, which range between and loss of 46.6 MGD (October 2010) and a gain of 52.1 MGD (September 2010).

Likewise, the model correctly simulated a loss of salt over the 22-month period at rate of 607.9 (lb x 1000)/day. The observed rate of salt outflow was calculated by multiplying the average observed salinity in the CCS on the final and first day of the calibration period by the corresponding CCS volumes on those days. The difference between these two products, divided by the number of days in the calibration period, provides the net outflow of salt, 591 (lb x 1000)/day. As in the case of water flow, the model overestimates the rate of salt flow from the control volume; however, the overestimation is small (16.9 (lb x 1000/day) relative to the monthly average flows, which range from an outflow of 13790 (lb x 1000)/day (October 2010) to an inflow of 8659 (lb x 1000)/day (June 2011).

The model's capability to simulate day-to-day changes in average CCS water elevations and salinity is illustrated in Figure 5.4-9, which plots modeled average CCS water elevations and observed average CCS water elevations for each day in the 22-month calibration period. The observed values reflect the mean of daily-averaged water elevations across the seven sensors in the CCS. Simulated water elevations are calculated by dividing the simulated daily change in CCS storage by the average daily CCS surface area and adding the resulting value (which reflects a change in water level) to the previous day's simulated water elevation. It is evident from this figure that the model effectively captures the general trend in CCS water elevations over the 22-month period, and accurately simulates average CCS water elevations throughout much of the calibration period.

Similarly, Figure 5.4-10 demonstrates the model's ability to simulate average CCS salinity. Observed salinities are the mean of daily averaged salinities measured in the CCS sensors. The simulated CCS salinities are calculated in a manner similar to the CCS water elevations. The simulated daily net flow of salt is divided by the simulated volume of water in the CCS, which results in a change in salinity. This change in salinity is added to the simulated salinity calculated for the previous day to produce a simulated salinity for the current day. As in the case of water elevations, the model performs very well with respect to simulating both the temporal trends in CCS salinity and the magnitude of daily salinities throughout the calibration period.

Inspection of Tables 5.4-4 through 5.4-47 reveals clear trends in wet and dry season flow. For instance, bottom seepage, one of the most dominating components of the balance model, demonstrates a dichotomy associated with flow direction. Net flow through the bottom of the CCS is generally out between the months of September through February. This suggests that lower groundwater elevations from the end of the wet season through the middle of the dry season cause outward flow from the CCS. Conversely, higher water groundwater elevations during much of the wet season, drives flow into the CCS. Intuitively, precipitation-based inflows to the CCS are greater during the wet season; average inflow from precipitation during the wet season is more than twice that for the dry season.

Two major revisions that are included in this year's water and salt balance are the use of a surveyed bathymetric surface of the CCS and the use of a more spatially detailed precipitation function that relies on NEXRAD data derived by SFWMD. These two revisions are described below.

Though the surface area and storage of the CCS changes daily, as water and salt flow into and out of the CCS, the 9-month water and salt balance model (FPL 2011b) employed a constant surface area and assumed volume throughout the entire calibration period. However, based upon a bathymetric survey (Morgan and Eklund 2010), detailed information regarding CCS water surface area and volume was incorporated into the current water and salt balance model. This information provided a quantifiable relationship between CCS water elevations and both surface area and volume, such that daily averages of CCS water surface area and volume could be calculated from observed CCS water elevations. These relationships were critical to understanding how much water and salt was gained to and lost from the system on a daily and monthly basis, as wells as how these gains and losses impacted the daily water elevations and salinities in the CCS. As a result of their incorporation, the bathymetric data improved the accuracy of the model in simulating the changing water elevations and salinities in the CCS throughout the 22-month calibration period.

In addition to a detailed assessment of measured CCS storage characteristics, the simulation of precipitation-based inflows to the control volume was improved due to the availability of SFWMD-derived NEXRAD data. The NEXRAD data provided an accurate representation of the spatial variability in precipitation across the CCS. The spatially-variable daily rainfalls were defined for the five zones for which detailed water surface area data were available. Thus, the accuracy of precipitation inflow to the model due to spatial variability was improved through use of NEXRAD data and the more accurate surface area obtained from the bathymetric data (the model computes inflow volumes as the product of daily precipitation and CCS surface area).

Incorporation of the NEXRAD data, coupled with the detailed understanding of CCS surface areas, proved to be a key element in facilitating a model match to observed monthly flows, water elevations, and salinities. The superiority of the current model calibration, relative to that which employed solely TPM-1 precipitation data, suggests that the NEXRAD data be employed in future applications of the water and salt balance model. Though precipitation data from TPM-1 are not currently used to evaluate rainfall-based freshwater inflow to the CCS, these data are valuable inasmuch as they validate NEXRAD precipitation data. However, additional rain gauges located in the vicinity of the CCS provide no value to this model; the continued measurement of precipitation at these gauges is unnecessary.

The accurate simulation of changing CCS inflows, outflows, water elevations and salinities is complex due to the different components of the balance model and their varying impacts upon CCS water and salt storage. For instance, vertical flows into and out of the control volume are substantially larger than horizontal flows, and have a greater impact upon CCS water elevation. The salinity of inflowing water, however, can vary depending upon the source of the water. For example, horizontal flow from the west (L-31E) is non-saline and has a pronounced mitigating impact upon CCS salinities; vertical flow from groundwater beneath portions of the discharge canals is hyper-saline and generally increases the salinity of the CCS. The correct balance of both water and salt mass flow is difficult to procure. This complexity, however, constrains the number of possible solutions to the correct simulation of water and salt balance and bolsters confidence in the resulting calibrated model.

In spite of the complexity, this relatively simple spreadsheet-based model accurately simulates the processes that govern and impact the operation of the CCS. The accuracy of the model is evidenced by the model's ability to accurately simulate average net water and salt flows for the 22-month calibration period (Table 5.4-1 and Table 5.4-2) and for each individual month in the calibration period (Table 5.4-4 to Table 5.4-47). The simulation of transient water elevations and salinities in the CCS (Figure 5.4-9 and Figure 5.4-10) further demonstrates the quality of the model calibration.

The ability to model complex dynamics associated with the CCS over a 22-month timeframe demonstrates the value of the model as a tool for understanding how the CCS has and will operate under varying meteorological, hydrological, and operational conditions. The model's accuracy underpins FPL's firm understanding of processes that control the CCS and the manner in which the CCS interacts with the adjacent aquifer and water bodies. Additionally, the model accuracy validates the fact that the most appropriate data are being collected to effectively capture CCS operations, identify interactions between the CCS and the surrounding environment, and support FPL's comprehension of historical and future operations of the CCS.

TABLES

Table 5.2-1. Response in Water Levels Due to September 29, 2010 Rain Event

Monitoring Well	Water Elevations Pre-Rain Event 9/28/2010 2:00 hours (ft. NAVD 88)	Water Elevations Day after Major Rain Event 9/30/10 15:45 hours (ft. NAVD 88)	Change in Water Levels between 9/30/10 and 9/28/10 – One Day after Major Rain Event (ft.)	Water Elevations Several Weeks after Major Rain Event 10/14/10 4:30 hours (ft. NAVD 88)	Change in Water Levels between 10/14/10 and 9/30/10 – Several Weeks after Major Rain Event (ft.)
TPGW-1S	0.32	0.94	0.62	0.58	-0.36
TPGW-1M	-0.36	0.26	0.62	-0.09	-0.35
TPGW-1D	-0.17	0.45	0.62	0.09	-0.35
TPGW-2S	-0.02	0.62	0.64	0.25	0.37
TPGW-2M	0.95	NA	NC	0.82	NC
TPGW-2D	0.83	NA	NC	1.04	NC
TPGW-3S	0.04	0.38	0.34	0.48	0.10
TPGW-3M	0.09	0.43	0.34	0.57	0.13
TPGW-3D	0.07	0.41	0.34	0.48	0.07
TPGW-4S	0.77	1.34	0.57	1.04	-0.30
TPGW-4M	0.28	0.84	0.56	0.52	-0.32
TPGW-4D	0.17	0.72	0.55	0.40	-0.32
TPGW-5S	0.90	1.43	0.53	1.20	-0.23
TPGW-5M	0.43	0.95	0.52	0.72	-0.23
TPGW-5D	0.27	0.79	0.52	0.51	-0.28
TPGW-6S	0.82	1.45	0.63	1.03	-0.42
TPGW-6M	0.25	0.87	0.62	0.46	-0.41
TPGW-6D	0.34	1.37	0.63	0.96	-0.59
TPGW-7S	0.99	NA	NC	NA	NC
TPGW-7M	1.08	NA	NC	NA	NC
TPGW-7D	0.97	NA	NC	NA	NC
TPGW-8S	1.26	1.95	0.69	1.70	-0.25
TPGW-8M	NR	NA	NA	NA	NC
TPGW-8D	1.22	1.92	0.70	1.67	-0.25
TPGW-9S	1.19	1.74	0.55	1.40	-0.34
TPGW-9M	1.18	1.73	0.55	1.39	-0.34

Table 5.2-1. Response in Water Levels Due to September 29, 2010 Rain Event

Monitoring Well	Water Elevations Pre-Rain Event 9/28/2010 2:00 hours (ft. NAVD 88)	Water Elevations Day after Major Rain Event 9/30/10 15:45 hours (ft. NAVD 88)	Change in Water Levels between 9/30/10 and 9/28/10 – One Day after Major Rain Event (ft.)	Water Elevations Several Weeks after Major Rain Event 10/14/10 4:30 hours (ft. NAVD 88)	Change in Water Levels between 10/14/10 and 9/30/10 – Several Weeks after Major Rain Event (ft.)
TPGW-9D	1.22	1.77	0.55	1.43	-0.34
TPGW-10S	0.02	0.13	0.11	0.04	-0.09
TPGW-10M	-0.03	0.09	0.12	0.00	-0.09
TPGW-10D	0.15	0.26	0.11	0.18	-0.08
TPGW-11S	0.20	0.15	-0.05	0.18	0.03
TPGW-11M	0.25	0.19	-0.06	0.24	0.05
TPGW-11D	0.14	0.08	-0.06	0.11	0.03
TPGW-12S	0.39	0.41	0.02	0.39	-0.02
TPGW-12M	0.65	0.54	-0.11	0.60	0.06
TPGW-12D	0.29	0.49	0.20	0.55	0.06
TPGW-13S	-0.04	0.98	1.02	0.61	-0.37
TPGW-13M	-0.05	0.90	0.95	0.52	-0.38
TPGW-13D	-0.36	0.36	0.72	-0.03	-0.39
TPGW-14S	-0.02	0.13	0.06	0.12	-0.01
TPGW-14M	-0.30	-0.15	0.06	-0.12	-0.03
TPGW-14D	-0.02	0.11	0.04	0.09	-0.02
TPSWCCS-1	0.09	0.80	0.71	0.33	-0.47
TPSWCCS-5	-0.29	0.62	0.91	0.24	-0.38
TPBBSW-3	0.30	0.25	-0.05	0.23	-0.02

Note: 7.34 Inches recorded at TPM-1 on 9/29/10

Key:
ft NAVD 88 = Feet relative to the North American Vertical Datum of 1988.
NA = Not available.
NC = Not calculated.

Table 5.2-2. Response in Water Levels Due to October 8, 2011 Rain Event

Monitoring Well	Water Elevations Pre-Rain Event 10/7/2011 19:20 hours (ft. NAVD 88)	Water Elevations Day after Major Rain Event 10/9/10 21:00 hours (ft. NAVD 88)	Change in Water Levels between 10/9/11 and 10/7/11 – One Day after Major Rain Event (ft.)	Water Elevations 9 Days after Major Rain Event 10/7/11 1:15 hours (ft. NAVD 88)	Change in Water Levels between 10/9/11 and 10/17/11 – Several Weeks after Major Rain Event (ft.)
TPGW-1S	0.35	0.86	0.51	0.88	0.02
TPGW-1M	-0.19	0.32	0.51	0.31	-0.01
TPGW-1D	-0.15	0.35	0.50	0.37	0.02
TPGW-2S	0.00	0.54	0.54	0.52	-0.02
TPGW-2M	1.09	NA	NC	NA	NC
TPGW-2D	1.02	NA	NC	NA	NC
TPGW-3S	0.70	0.98	0.28	0.94	-0.04
TPGW-3M	0.70	1.03	0.33	0.99	-0.04
TPGW-3D	0.67	0.95	0.28	0.92	-0.03
TPGW-4S	0.60	1.44	0.84	1.32	-0.12
TPGW-4M	0.10	0.94	0.84	0.79	-0.15
TPGW-4D	-0.06	0.79	0.85	0.64	-0.15
TPGW-5S	0.73	1.42	0.69	1.30	-0.12
TPGW-5M	0.27	0.95	0.68	0.83	-0.12
TPGW-5D	0.12	0.81	0.69	0.68	-0.13
TPGW-6S	0.63	1.43	0.80	1.20	-0.23
TPGW-6M	0.34	1.12	0.78	0.91	-0.21
TPGW-6D	1.07	1.57	0.50	NA	NC
TPGW-7S	0.76	NA	NC	NA	NC
TPGW-7M	0.78	NA	NC	NA	NC
TPGW-7D	0.77	NA	NC	NA	NC
TPGW-8S	0.90	NA	NC	1.76	NC
TPGW-8M	0.90	2.07	1.17	1.75	-0.32
TPGW-8D	0.89	NA	NC	1.76	NC
TPGW-9S	0.91	1.67	0.76	1.60	-0.07
TPGW-9M	0.90	1.67	0.77	1.59	-0.08
TPGW-9D	0.94	1.68	0.74	1.60	-0.08

Table 5.2-2. Response in Water Levels Due to October 8, 2011 Rain Event

Monitoring Well	Water Elevations Pre-Rain Event 10/7/2011 19:20 hours (ft. NAVD 88)	Water Elevations Day after Major Rain Event 10/9/10 21:00 hours (ft. NAVD 88)	Change in Water Levels between 10/9/11 and 10/7/11 – One Day after Major Rain Event (ft.)	Water Elevations 9 Days after Major Rain Event 10/7/11 1:15 hours (ft. NAVD 88)	Change in Water Levels between 10/9/11 and 10/17/11 – Several Weeks after Major Rain Event (ft.)
TPGW-10S	0.55	0.63	0.10	0.70	0.07
TPGW-10M	0.49	0.58	0.09	0.65	0.07
TPGW-10D	0.49	0.57	0.08	0.66	0.09
TPGW-11S	0.83	0.85	0.02	0.90	0.05
TPGW-11M	0.84	0.85	0.01	0.92	0.07
TPGW-11D	0.83	0.85	0.02	0.89	0.04
TPGW-12S	NA	NA	NC	NA	NC
TPGW-12M	NA	NA	NC	NA	NC
TPGW-12D	0.69	NA	NC	NA	NC
TPGW-13S	0.34	0.80	0.46	0.86	0.06
TPGW-13M	0.36	0.83	0.47	0.88	0.05
TPGW-13D	-0.15	0.34	0.49	0.41	0.07
TPGW-14S	0.54	0.72	0.18	0.66	-0.06
TPGW-14M	0.44	0.61	0.17	0.56	-0.05
TPGW-14D	0.50	0.68	0.18	0.62	-0.06
TPSWCCS-1	0.08	0.48	0.40	0.52	0.04
TPSWCCS-5	-0.48	NA	NC	NA	NC
TPBBSW-3	0.90	0.93	0.03	0.95	0.02

Note: 6.33 Inches recorded at TPM-1 on 10/8/11

Key:
ft NAVD 88 = Feet relative to the North American Vertical Datum of 1988.
NA = Not available.
NC = Not calculated.

Table 5.2-3. Wet/Dry Season Water Elevations, October 14, 2010, May 14, 2011, October 22, 2011 and April 4, 2012

Monitoring	Water Elevation Well (ft. NAVD 88)			
	Wet Season 10/14/10 4:30 hours	Dry Season 5/14/11 7:30 hours	Wet Season 10/22/2011 18:45 hours	Dry Season 4/4/2012 21:00 hours
TPGW-1S	0.58	-1.10	0.68	-0.88
TPGW-1M	-0.09	-1.71	0.10	-1.41
TPGW-1D	0.09	-1.62	0.13	-1.30
TPGW-2S	0.25	-1.41	0.35	-1.33
TPGW-2M	0.82	-0.66	1.06	-0.11
TPGW-2D	1.04	-0.26	0.98	-0.48
TPGW-3S	0.48	-0.27	0.39	-0.26
TPGW-3M	0.57	-0.29	0.44	-0.29
TPGW-3D	0.48	-0.37	0.37	-0.46
TPGW-4S	1.04	-1.06	1.14	-0.59
TPGW-4M	0.52	-1.49	0.62	-1.01
TPGW-4D	0.40	-1.63	0.47	-1.14
TPGW-5S	1.20	-0.96	1.16	-0.42
TPGW-5M	0.72	-1.35	0.69	-0.86
TPGW-5D	0.51	-1.54	0.55	-1.08
TPGW-6S	1.03	-0.74	0.65	-0.10
TPGW-6M	0.46	-1.25	0.37	-0.36
TPGW-6D	0.96	-0.54	1.06	0.19
TPGW-7S	NA	-0.86	1.24	-0.24
TPGW-7M	NA	-0.89	1.24	-0.22
TPGW-7D	NA	-0.89	NA	-0.22
TPGW-8S	1.70	-0.82	1.52	-0.23
TPGW-8M	NA	-0.85	1.51	-0.23
TPGW-8D	1.67	-0.83	1.52	-0.24
TPGW-9S	1.40	NA	1.46	-0.25
TPGW-9M	1.39	-0.89	1.45	-0.27
TPGW-9D	1.43	-0.95	1.46	-0.23
TPGW-10S	0.04	-0.46	0.08	-0.17

Table 5.2-3. Wet/Dry Season Water Elevations, October 14, 2010, May 14, 2011, October 22, 2011 and April 4, 2012

Monitoring	Water Elevation Well (ft. NAVD 88)			
	Wet Season 10/14/10 4:30 hours	Dry Season 5/14/11 7:30 hours	Wet Season 10/22/2011 18:45 hours	Dry Season 4/4/2012 21:00 hours
TPGW-10M	0.00	-0.42	0.04	-0.18
TPGW-10D	0.18	-0.38	0.03	-0.30
TPGW-11S	0.18	0.00	0.23	0.23
TPGW-11M	0.24	0.23	0.23	0.22
TPGW-11D	0.11	0.21	0.21	0.13
TPGW-12S	0.39	-0.41	0.32	-0.12
TPGW-12M	0.60	-0.27	0.29	0.16
TPGW-12D	0.55	-0.41	0.42	-0.19
TPGW-13S	0.61	-0.52	0.70	-0.75
TPGW-13M	0.52	-0.57	0.73	-0.75
TPGW-13D	-0.03	-1.11	NA	-1.35
TPGW-14S	0.12	-0.41	0.09	-0.42
TPGW-14M	-0.12	-0.50	-0.02	-0.55
TPGW-14D	0.09	-0.07	0.06	-0.45
TPSWCCS-1	0.33	-0.03	0.47	-0.25
TPSWCCS-5	0.24	-1.90	0.04	-1.63
TPBBSW-3	0.33	0.28	0.31	0.23

Key:
ft NAVD 88 = Feet relative to the North American Vertical Datum of 1988.
NA = Not available.

Table 5.2-4. Spring High and Low Tide Water Elevations, December 24, 2011 and March 10, 2012

Monitoring Well	Water Elevation Well (ft. NAVD 88)			
	High Tide 12/24/11 10:15 Hours	Low Tide 12/24/11 04:30 Hours	High Tide 3/10/12 12:00 Hours	Low Tide 3/10/12 06:30 Hours
TPGW-1S	-0.30	-0.35	-0.42	-0.48
TPGW-1M	-0.86	-0.93	-0.95	-1.00
TPGW-1D	-0.81	-0.86	-0.85	-0.91
TPGW-2S	-0.63	-0.65	-0.81	-0.82
TPGW-2M	0.18	0.17	0.38	0.37
TPGW-2D	-0.01	-0.03	0.02	0.00
TPGW-3S	-0.06	-0.37	0.06	-0.25
TPGW-3M	-0.10	-0.41	0.08	-0.22
TPGW-3D	-0.18	-0.49	0.00	-0.32
TPGW-4S	0.11	0.11	-0.11	-0.10
TPGW-4M	-0.36	-0.36	-0.54	-0.54
TPGW-4D	-0.50	-0.50	-0.67	-0.67
TPGW-5S	0.02	0.03	-0.05	-0.03
TPGW-5M	-0.38	-0.38	-0.49	-0.46
TPGW-5D	-0.52	-0.51	-0.62	-0.59
TPGW-6S	-0.08	-0.06	0.15	0.16
TPGW-6M	-0.34	-0.32	-0.12	-0.11
TPGW-6D	0.38	0.40	0.56	0.58
TPGW-7S	0.12	0.12	0.06	0.07
TPGW-7M	0.11	0.12	0.12	0.13
TPGW-7D	0.10	0.09	0.08	0.09
TPGW-8S	0.31	0.31	0.15	0.17
TPGW-8M	0.30	0.30	0.14	0.16
TPGW-8D	0.27	0.28	0.15	0.17
TPGW-9S	0.44	0.44	0.16	0.18
TPGW-9M	0.41	0.41	0.13	0.14
TPGW-9D	0.44	0.44	0.15	0.17
TPGW-10S	-0.45	-1.97	0.06	-1.54

Table 5.2-4. Spring High and Low Tide Water Elevations, December 24, 2011 and March 10, 2012

Monitoring Well	Water Elevation Well (ft. NAVD 88)			
	High Tide 12/24/11 10:15 Hours	Low Tide 12/24/11 04:30 Hours	High Tide 3/10/12 12:00 Hours	Low Tide 3/10/12 06:30 Hours
TPGW-10M	-0.48	-2.02	0.09	-1.52
TPGW-10D	-0.50	-2.02	0.09	-1.51
TPGW-11S	-0.18	-2.00	NA	NA
TPGW-11M	-0.28	-2.07	0.34	-1.53
TPGW-11D	-0.20	-1.98	NA	NA
TPGW-12S	-0.18	-1.05	0.23	-0.71
TPGW-12M	0.11	-0.80	0.48	-0.50
TPGW-12D	-0.13	-0.99	0.20	-0.72
TPGW-13S	-0.13	-0.15	-0.39	-0.41
TPGW-13M	-0.11	-0.13	-0.41	-0.43
TPGW-13D	-0.65	-0.67	-0.85	-0.86
TPGW-14S	-0.52	-1.24	-0.17	-0.94
TPGW-14M	-0.62	-1.34	-0.26	-1.04
TPGW-14D	-0.44	-1.15	-0.09	-0.86
TPSWCCS-1	-0.07	-0.06	-0.37	-0.43
TPSWCCS-5	-1.03	-1.03	-1.09	-1.12
TPBBSW-3	-0.13	-2.05	0.45	-1.52

Key:
ft NAVD 88 = Feet relative to the North American Vertical Datum of 1988.
NA = Not available.

Table 5.2-5. Estimated Percent CCS Water Based on Chloride Concentrations

Well	Average Current Tritium Concentration (pCi/L)	Cl_{well}: Average Current Chloride Concentration (mg/L)	Cl_{CCS}: Assumed CCS Chloride Concentration (mg/L)	$Cl_{background}$: Estimated Pre-CCS Chloride Concentration (mg/L)	% CCS Water: Calculated Percent CCS Water
1S	968	17,714	34,000	6,483	41%
1M	2,578	28,571	34,000	14,607	72%
1D	2,406	28,000	34,000	21,667	51%
2S	3,260	30,143	34,000	5,987	86%
2M	3,534	31,286	34,000	10,748	88%
2D	3,315	31,571	34,000	15,447	87%
3S	682	25,000	34,000	18,384	42%
3M	2,014	27,429	34,000	20,804	50%
3D	1,918	27,571	34,000	21,529	48%
4M	298	13,857	24,000	2,941	52%
4D	526	15,429	24,000	8,095	46%
5M	219	10,171	24,000	32	42%
5D	290	11,286	24,000	318	46%
11M	34	22,000	34,000	21,667	3%
11D	416	22,333	34,000	21,667	5%
12S	219	15,143	34,000	14,879	1%
12M	1,408	24,429	34,000	17,894	41%
12D	1,617	25,429	34,000	18,635	44%
14S	204	22,833	34,000	21,667	9%
14M	725	24,167	34,000	21,667	20%
14D	2,588	30,167	34,000	21,667	69%
L3-58	3,938	32,625	34,000	16,594	92%
L5-58	3,364	30,750	34,000	11,103	86%
G28-58	421	14,375	24,000	11,313	24%

Notes: Wells with average current tritium concentrations below 20 pCi/L (+/- 1 sigma 5 piC/L) not shown.

Key:
Approx. = Approximate.
CCS = Cooling Canal System.
Cl = Chloride.
ft = Feet.
mg/L = Milligram(s) per liter.
NA = Not available.
pCi/L = Picocuries per liter.
yr = Year(s).

Table 5.2-6. Estimated Percent CCS Water Based on Tritium Concentrations

Monitoring Well	Approximate Distance from CCS (ft)	Approximate Rate of Migration (ft/yr)	Approximate Age of CCS Water in Well (yrs)	Tritium$_{CCS}$: Current Average Tritium Concentration (pCi/L)	Tritium$_{\text{well no decay}}$: Tritium Concentration Adjusted for No Decay (pCi/L)	%CCS: Calculated Percent CCS water (%)
TPGW-1S	1,500	525	2.9	968	1,137	28%
TPGW-1M	1,500	525	2.9	2,578	3,028	74%
TPGW-1D	1,500	525	2.9	2,406	2,826	69%
TPGW-2S	900	660	1.4	3,260	3,520	86%
TPGW-2M	900	660	1.4	3,534	3,816	93%
TPGW-2D	900	660	1.4	3,315	3,580	87%
TPGW-3S	4,400	660	6.7	682	993	24%
TPGW-3M	4,400	660	6.7	2,014	2,932	72%
TPGW-3D	4,400	660	6.7	1,918	2,793	68%
TPGW-4M	14,900	660	22.6	298	1,063	26%
TPGW-4D	14,900	660	22.6	526	1,877	46%
TPGW-5M	15,800	525	30.1	219	1,194	29%
TPGW-5D	15,800	525	30.1	290	1,581	39%
TPGW-11M	9,100	290	31.4	34	199	5%
TPGW-11D	9,100	290	31.4	416	2,438	59%
TPGW-12S	5,400	525	10.3	219	391	10%
TPGW-12M	5,400	525	10.3	1,408	2,514	61%
TPGW-12D	5,400	525	10.3	1,617	2,887	70%
TPGW-14S	2,100	290	7.2	204	307	7%
TPGW-14M	2,100	290	7.2	725	1,090	27%
TPGW-14D	2,100	290	7.2	2,588	3,892	95%

Table 5.2-6. Estimated Percent CCS Water Based on Tritium Concentrations

Monitoring Well	Approximate Distance from CCS (ft)	Approximate Rate of Migration (ft/yr)	Approximate Age of CCS Water in Well (yrs)	$\text{Tritium}_{\text{CCS}}$: Current Average Tritium Concentration (pCi/L)	$\text{Tritium}_{\text{well no decay}}$: Tritium Concentration Adjusted for No Decay (pCi/L)	%CCS: Calculated Percent CCS water (%)
L3-58	1,000	525	1.9	3,938	4,384	100%
L5-58	1,000	660	1.5	3,364	3,664	89%
G28-58	15,000	660	22.7	421	1,515	37%

Notes: Wells with average current tritium concentrations below 20 pCi/L (+/- 1 sigma 5 pCi/L) not shown.

Key:

Approx. = Approximate.
CCS = Cooling Canal System.
ft = Feet.
NA = Not available.
pCi/L = Picocuries per liter.
yr = Year(s).

Table 5.4-1. Water Balance for 22-Month Period (September 2010 through June 2012)

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.49	329.66
	E. Seepage	6.47	4329.53
	N. Seepage	0.00	2.28
	S. Seepage	0.74	493.67
	Bot Seepage	7.31	4887.72
	Precipitation and Runoff	24.20	16192.89
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.37	247.70
	Unit 5 Blowdown	0.87	583.87
	ID Pumping	4.59	3068.24
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**45.05**	**30135.56**
Out of CCS	W. Seepage	-0.06	-1.87
	E. Seepage	-1.77	-1186.58
	N. Seepage	-0.01	-3.92
	S. Seepage	0.00	-1.20
	Bot Seepage	-11.09	-7420.00
	Precipitation and Runoff	0.00	0.00
	Evaporation	-31.49	-21067.54
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-44.43**	**-29681.12**
Modeled Change in CCS Storage:		**0.62**	**454.44**
Observed Change in CCS Storage:		**0.11**	**74.55**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-2. Salt Balance for 22-Month Period (September 2010 through June 2012)

Water Balance Component		lb/day (x 1000)	Mass (lb x 1000)
Into CCS	W. Seepage	3.77	2519.53
	E. Seepage	1913.88	1280384.11
	N. Seepage	0.76	505.87
	S. Seepage	145.99	97668.79
	Bot Seepage	2021.90	1352651.06
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	50.98	34108.26
	ID Pumping	649.59	434574.13
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**4786.86**	**3202411.74**
Out of CCS	W. Seepage	-56.00	-37464.48
	E. Seepage	-656.46	-439170.75
	N. Seepage	-2.69	-1797.60
	S. Seepage	-0.78	-523.83
	Bot Seepage	-4678.82	-3130127.24
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-5394.74**	**-3609083.91**
Modeled Change in CCS Storage:		**-607.88**	**-406672.17**
Observed Change in CCS Storage:		**-590.61**	**-395118.74**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-3. Calibrated Model Parameter Values

Calibrated Model Parameter	Units	Value
Zone A Vertical Hydraulic Conductivity	ft/day	1.0
Zone B Vertical Hydraulic Conductivity	ft/day	0.10
Zone C Vertical Hydraulic Conductivity	ft/day	0.10
Zone D Vertical Hydraulic Conductivity	ft/day	2.6
North Seepage Face Horizontal Hydraulic Conductivity	ft/day	300
West Seepage Face Horizontal Hydraulic Conductivity	ft/day	450
South Seepage Face Horizontal Hydraulic Conductivity	ft/day	150
East Seepage Face Horizontal Hydraulic Conductivity	ft/day	400
Evaporation Factor (Equation 6)	Unitless	0.57
Runoff as Percentage of Rainfall (added to precipitation	Unitless	46%
Percentage of Unit 5 Blowdown Lost to Evaporation	Unitless	80%
Concentration of Unit 5 Blowdown as Percentage of Seawater (35 PSU)	Unitless	20%

Key: ft = Foot. PSU = Practical salinity units.

Table 5.4-4. Water Balance for September 2010

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.35	10.41
	E. Seepage	4.33	129.87
	N. Seepage	0.01	0.27
	S. Seepage	0.76	22.84
	Bot Seepage	2.36	70.86
	Precipitation and Runoff	81.96	2458.65
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.29	8.64
	Unit 5 Blowdown	0.98	29.36
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**91.03**	**2730.92**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-2.42	-72.73
	N. Seepage	0.00	-0.05
	S. Seepage	0.00	0.00
	Bot Seepage	-8.93	-267.82
	Precipitation and Runoff	0.00	0.00
	Evaporation	-37.98	-1139.48
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-49.34**	**-1480.08**
Modeled Change in CCS Storage:		**41.69**	**1250.84**
Observed Change in CCS Storage:		**52.14**	**1564.08**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-5. Salt Balance for September 2010

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	0.73	21.79
	E. Seepage	1000.37	30011.06
	N. Seepage	1.95	58.53
	S. Seepage	31.45	943.47
	Bot Seepage	492.65	14779.60
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	57.18	1715.41
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**1584.33**	**47529.85**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-977.74	-29332.09
	N. Seepage	-0.60	-18.07
	S. Seepage	0.00	0.00
	Bot Seepage	-4536.14	-136084.31
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-5514.48**	**-165434.47**
Modeled Change in CCS Storage:		**-3930.15**	**-117904.62**
Observed Change in CCS Storage:		**1464.29**	**43928.58**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-6. Water Balance for October 2010

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.12	3.73
	E. Seepage	0.30	9.19
	N. Seepage	0.00	0.09
	S. Seepage	0.61	18.96
	Bot Seepage	0.75	23.20
	Precipitation and Runoff	14.14	438.35
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.29	8.93
	Unit 5 Blowdown	0.75	23.11
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**16.95**	**525.56**
Out of CCS	W. Seepage	-0.01	-0.16
	E. Seepage	-9.77	-302.98
	N. Seepage	0.00	-0.12
	S. Seepage	-0.01	-0.34
	Bot Seepage	-22.44	-695.59
	Precipitation and Runoff	0.00	0.00
	Evaporation	-26.68	-827.09
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-58.91**	**-1826.27**
Modeled Change in CCS Storage:		**-41.96**	**-1300.71**
Observed Change in CCS Storage:		**-46.60**	**-1444.52**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-7. Salt Balance for October 2010

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	0.23	7.14
	E. Seepage	59.81	1854.15
	N. Seepage	0.61	19.05
	S. Seepage	2.18	67.44
	Bot Seepage	332.43	10305.45
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	43.54	1349.79
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**438.81**	**13603.03**
Out of CCS	W. Seepage	-50.77	-1573.99
	E. Seepage	-3777.60	-117105.67
	N. Seepage	-1.42	-43.87
	S. Seepage	-4.41	-136.56
	Bot Seepage	-8516.95	-264025.54
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-12351.15**	**-382885.62**
Modeled Change in CCS Storage:		**-11912.34**	**-369282.60**
Observed Change in CCS Storage:		**-13790.42**	**-427502.87**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-8. Water Balance for November 2010

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.14	4.32
	E. Seepage	1.94	58.25
	N. Seepage	0.00	0.08
	S. Seepage	0.53	15.95
	Bot Seepage	1.20	35.95
	Precipitation and Runoff	27.97	839.20
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.29	8.64
	Unit 5 Blowdown	0.50	14.98
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**32.58**	**977.38**
Out of CCS	W. Seepage	-0.03	-0.94
	E. Seepage	-3.16	-94.92
	N. Seepage	0.00	-0.06
	S. Seepage	-0.01	-0.20
	Bot Seepage	-14.43	-433.05
	Precipitation and Runoff	0.00	0.00
	Evaporation	-26.01	-780.31
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-43.65**	**-1309.48**
Modeled Change in CCS Storage:		**-11.07**	**-332.11**
Observed Change in CCS Storage:		**-5.02**	**-150.50**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-9. Salt Balance for November 2010

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	0.34	10.17
	E. Seepage	457.48	13724.36
	N. Seepage	0.61	18.16
	S. Seepage	19.19	575.66
	Bot Seepage	388.92	11667.59
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	29.18	875.37
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**895.71**	**26871.32**
Out of CCS	W. Seepage	-306.18	-9185.32
	E. Seepage	-1187.68	-35630.52
	N. Seepage	-0.82	-24.62
	S. Seepage	-2.61	-78.43
	Bot Seepage	-5336.39	-160091.80
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-6833.69**	**-205010.69**
Modeled Change in CCS Storage:		**-5937.98**	**-178139.37**
Observed Change in CCS Storage:		**-2876.16**	**-86284.89**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-10. Water Balance for December 2010

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.40	12.46
	E. Seepage	7.28	225.71
	N. Seepage	0.00	0.00
	S. Seepage	0.48	14.92
	Bot Seepage	3.90	120.81
	Precipitation and Runoff	3.90	120.88
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.29	8.93
	Unit 5 Blowdown	0.72	22.33
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**16.97**	**526.05**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-0.20	-6.10
	N. Seepage	-0.01	-0.25
	S. Seepage	0.00	-0.04
	Bot Seepage	-11.51	-356.87
	Precipitation and Runoff	0.00	0.00
	Evaporation	-24.73	-766.57
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-36.45**	**-1129.82**
Modeled Change in CCS Storage:		**-19.48**	**-603.78**
Observed Change in CCS Storage:		**-12.72**	**-394.29**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. ID = Interceptor Ditch.
MGD = Millions of gallons per day.

Table 5.4-11. Salt Balance for December 2010

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	1.44	44.71
	E. Seepage	1890.00	58590.08
	N. Seepage	0.00	0.00
	S. Seepage	90.83	2815.76
	Bot Seepage	990.62	30709.15
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	42.08	1304.34
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**3014.97**	**93464.05**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-72.24	-2239.56
	N. Seepage	-2.87	-88.91
	S. Seepage	-0.53	-16.39
	Bot Seepage	-4163.59	-129071.18
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-4239.23**	**-131416.04**
Modeled Change in CCS Storage:		**-1224.26**	**-37951.99**
Observed Change in CCS Storage:		**-1555.92**	**-48233.42**

Key: CCS = Cooling Canal System. lb = Pound.

Table 5.4-12. Water Balance for January 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.83	25.80
	E. Seepage	3.98	123.23
	N. Seepage	0.00	0.00
	S. Seepage	0.41	12.85
	Bot Seepage	2.62	81.37
	Precipitation and Runoff	19.86	615.73
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.29	8.93
	Unit 5 Blowdown	0.82	25.40
	ID Pumping	4.91	152.24
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**33.73**	**1045.54**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-1.67	-51.90
	N. Seepage	-0.01	-0.27
	S. Seepage	0.00	0.00
	Bot Seepage	-15.15	-469.50
	Precipitation and Runoff	0.00	0.00
	Evaporation	-24.18	-749.43
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-41.00**	**-1271.10**
Modeled Change in CCS Storage:		**-7.28**	**-225.56**
Observed Change in CCS Storage:		**-2.54**	**-78.88**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-13. Salt Balance for January 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	3.18	98.49
	E. Seepage	1077.95	33416.50
	N. Seepage	0.01	0.42
	S. Seepage	78.05	2419.52
	Bot Seepage	683.66	21193.44
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	47.87	1483.96
	ID Pumping	185.05	5736.69
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**2075.77**	**64349.02**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-654.00	-20273.95
	N. Seepage	-3.51	-108.76
	S. Seepage	0.00	0.00
	Bot Seepage	-6108.34	-189358.53
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-6765.85**	**-209741.24**
Modeled Change in CCS Storage:		**-4690.07**	**-145392.21**
Observed Change in CCS Storage:		**-910.35**	**-28220.95**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-14. Water Balance for February 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.59	16.65
	E. Seepage	10.09	282.47
	N. Seepage	0.00	0.00
	S. Seepage	0.84	23.51
	Bot Seepage	9.24	258.62
	Precipitation and Runoff	0.71	19.81
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.29	8.06
	Unit 5 Blowdown	0.70	19.46
	ID Pumping	2.25	63.03
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**24.70**	**691.62**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-0.15	-4.31
	N. Seepage	-0.01	-0.34
	S. Seepage	0.00	0.00
	Bot Seepage	-14.17	-396.64
	Precipitation and Runoff	0.00	0.00
	Evaporation	-29.42	-823.64
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-43.75**	**-1224.93**
Modeled Change in CCS Storage:		**-19.05**	**-533.31**
Observed Change in CCS Storage:		**-14.26**	**-399.40**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-15. Salt Balance for February 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	2.03	56.74
	E. Seepage	2692.11	75379.20
	N. Seepage	0.00	0.00
	S. Seepage	140.71	3939.92
	Bot Seepage	2305.86	64564.13
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	40.60	1136.86
	ID Pumping	73.70	2063.56
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**5255.02**	**147140.42**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-67.69	-1895.27
	N. Seepage	-5.44	-152.45
	S. Seepage	0.00	0.00
	Bot Seepage	-6339.60	-177508.74
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-6412.73**	**-179556.46**
Modeled Change in CCS Storage:		**-1157.72**	**-32416.04**
Observed Change in CCS Storage:		**1264.60**	**35408.76**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-16. Water Balance for March 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.67	20.71
	E. Seepage	8.33	258.32
	N. Seepage	0.00	0.04
	S. Seepage	0.92	28.50
	Bot Seepage	9.57	296.60
	Precipitation and Runoff	7.23	224.04
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.29	8.93
	Unit 5 Blowdown	0.66	20.55
	ID Pumping	9.37	290.40
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**37.04**	**1148.09**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-0.12	-3.80
	N. Seepage	0.00	-0.11
	S. Seepage	0.00	0.00
	Bot Seepage	-9.55	-295.97
	Precipitation and Runoff	0.00	0.00
	Evaporation	-30.85	-956.26
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-40.52**	**-1256.14**
Modeled Change in CCS Storage:		**-3.49**	**-108.05**
Observed Change in CCS Storage:		**3.19**	**99.02**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-17. Salt Balance for March 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	3.43	106.48
	E. Seepage	2496.42	77388.93
	N. Seepage	0.30	9.25
	S. Seepage	187.39	5809.16
	Bot Seepage	2394.47	74228.63
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	38.73	1200.58
	ID Pumping	774.24	24001.46
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**5894.98**	**182744.50**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-59.27	-1837.47
	N. Seepage	-1.57	-48.55
	S. Seepage	0.00	0.00
	Bot Seepage	-4384.63	-135923.56
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-4445.47**	**-137809.58**
Modeled Change in CCS Storage:		**1449.51**	**44934.91**
Observed Change in CCS Storage:		**2504.94**	**77653.08**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-18. Water Balance for April 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.53	15.82
	E. Seepage	11.76	352.70
	N. Seepage	0.00	0.00
	S. Seepage	1.13	33.79
	Bot Seepage	13.19	395.55
	Precipitation and Runoff	10.50	315.01
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.29	8.64
	Unit 5 Blowdown	1.13	33.95
	ID Pumping	7.46	223.80
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**45.98**	**1379.27**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	0.00	0.00
	N. Seepage	-0.01	-0.32
	S. Seepage	0.00	0.00
	Bot Seepage	-9.86	-295.69
	Precipitation and Runoff	0.00	0.00
	Evaporation	-31.86	-955.93
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-41.73**	**-1251.94**
Modeled Change in CCS Storage:		**4.24**	**127.33**
Observed Change in CCS Storage:		**-7.85**	**-235.45**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-19. Salt Balance for April 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	3.77	113.23
	E. Seepage	3758.99	112769.81
	N. Seepage	0.00	0.00
	S. Seepage	294.59	8837.65
	Bot Seepage	3318.51	99555.44
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	66.10	1983.01
	ID Pumping	751.05	22531.49
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**8193.02**	**245790.62**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	0.00	0.00
	N. Seepage	-4.51	-135.23
	S. Seepage	0.00	0.00
	Bot Seepage	-4200.79	-126023.58
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-4205.29**	**-126158.82**
Modeled Change in CCS Storage:		**3987.73**	**119631.80**
Observed Change in CCS Storage:		**-4057.29**	**-121718.78**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-20. Water Balance for May 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.68	21.08
	E. Seepage	19.10	592.18
	N. Seepage	0.00	0.00
	S. Seepage	1.31	40.72
	Bot Seepage	20.78	644.29
	Precipitation and Runoff	7.08	219.47
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.29	8.93
	Unit 5 Blowdown	1.16	35.93
	ID Pumping	14.81	459.13
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**65.22**	**2021.73**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	0.00	0.00
	N. Seepage	-0.02	-0.72
	S. Seepage	0.00	0.00
	Bot Seepage	-15.50	-480.56
	Precipitation and Runoff	0.00	0.00
	Evaporation	-37.32	-1156.97
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-52.85**	**-1638.25**
Modeled Change in CCS Storage:		**12.37**	**383.48**
Observed Change in CCS Storage:		**11.51**	**356.77**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-21. Salt Balance for May 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	12.42	384.92
	E. Seepage	6362.11	197225.56
	N. Seepage	0.00	0.00
	S. Seepage	433.44	13436.66
	Bot Seepage	5223.08	161915.41
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	67.70	2098.75
	ID Pumping	3405.55	105571.94
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**15504.30**	**480633.24**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	0.00	0.00
	N. Seepage	-11.06	-342.71
	S. Seepage	0.00	0.00
	Bot Seepage	-7418.52	-229974.09
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-7429.57**	**-230316.80**
Modeled Change in CCS Storage:		**8074.72**	**250316.44**
Observed Change in CCS Storage:		**6228.37**	**193079.32**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-22. Water Balance for June 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.75	22.58
	E. Seepage	15.32	459.74
	N. Seepage	0.00	0.00
	S. Seepage	1.28	38.38
	Bot Seepage	22.07	662.08
	Precipitation and Runoff	8.20	246.08
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.47	14.23
	Unit 5 Blowdown	1.02	30.60
	ID Pumping	16.13	483.83
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**65.25**	**1957.53**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	0.00	-0.11
	N. Seepage	-0.02	-0.60
	S. Seepage	0.00	0.00
	Bot Seepage	-12.21	-366.29
	Precipitation and Runoff	0.00	0.00
	Evaporation	-40.23	-1206.80
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-52.46**	**-1573.79**
Modeled Change in CCS Storage:		**12.79**	**383.74**
Observed Change in CCS Storage:		**10.30**	**309.07**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-23. Salt Balance for June 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	18.78	563.38
	E. Seepage	5643.47	169304.22
	N. Seepage	0.00	0.00
	S. Seepage	447.06	13411.94
	Bot Seepage	5591.99	167759.66
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	59.59	1787.60
	ID Pumping	4597.36	137920.85
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**16358.26**	**490747.65**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-1.84	-55.08
	N. Seepage	-9.89	-296.60
	S. Seepage	0.00	0.00
	Bot Seepage	-6075.97	-182279.20
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-6087.70**	**-182630.88**
Modeled Change in CCS Storage:		**10270.56**	**308116.77**
Observed Change in CCS Storage:		**8658.55**	**259756.64**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-24. Water Balance for July 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.91	28.14
	E. Seepage	2.01	62.39
	N. Seepage	0.00	0.00
	S. Seepage	0.47	14.67
	Bot Seepage	7.60	235.47
	Precipitation and Runoff	46.74	1449.08
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.48	14.76
	Unit 5 Blowdown	1.13	35.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**59.34**	**1839.51**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-4.11	-127.34
	N. Seepage	-0.01	-0.26
	S. Seepage	-0.02	-0.61
	Bot Seepage	-13.34	-413.61
	Precipitation and Runoff	0.00	0.00
	Evaporation	-41.06	-1272.84
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-58.54**	**-1814.66**
Modeled Change in CCS Storage:		**0.80**	**24.85**
Observed Change in CCS Storage:		**9.24**	**286.59**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-25. Salt Balance for July 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	12.43	385.28
	E. Seepage	673.04	20864.34
	N. Seepage	0.00	0.00
	S. Seepage	142.73	4424.78
	Bot Seepage	1535.56	47602.47
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	65.96	2044.75
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**2429.73**	**75321.62**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-2055.70	-63726.75
	N. Seepage	-4.13	-128.16
	S. Seepage	-9.25	-286.73
	Bot Seepage	-6701.62	-207750.29
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-8770.71**	**-271891.94**
Modeled Change in CCS Storage:		**-6340.98**	**-196570.32**
Observed Change in CCS Storage:		**3237.34**	**100357.40**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-26. Water Balance for August 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.02	0.75
	E. Seepage	6.85	212.30
	N. Seepage	0.00	0.07
	S. Seepage	0.77	23.82
	Bot Seepage	11.40	353.50
	Precipitation and Runoff	39.06	1210.89
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.47	14.56
	Unit 5 Blowdown	1.04	32.25
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**59.62**	**1848.14**
Out of CCS	W. Seepage	-0.01	-0.40
	E. Seepage	-0.38	-11.79
	N. Seepage	0.00	-0.02
	S. Seepage	0.00	0.00
	Bot Seepage	-8.82	-273.37
	Precipitation and Runoff	0.00	0.00
	Evaporation	-37.78	-1171.15
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-46.99**	**-1456.73**
Modeled Change in CCS Storage:		**12.63**	**391.41**
Observed Change in CCS Storage:		**20.17**	**625.23**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-27. Salt Balance for August 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	0.17	5.26
	E. Seepage	2391.19	74126.89
	N. Seepage	0.62	19.11
	S. Seepage	111.17	3446.41
	Bot Seepage	4186.36	129777.23
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	60.78	1884.07
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**6750.29**	**209258.97**
Out of CCS	W. Seepage	-483.19	-14978.79
	E. Seepage	-16.77	-519.93
	N. Seepage	-0.29	-9.02
	S. Seepage	0.00	0.00
	Bot Seepage	-3409.18	-105684.58
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-3909.43**	**-121192.33**
Modeled Change in CCS Storage:		**2840.86**	**88066.64**
Observed Change in CCS Storage:		**4028.64**	**124887.94**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-28. Water Balance for September 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.39	11.72
	E. Seepage	4.04	121.17
	N. Seepage	0.00	0.01
	S. Seepage	0.63	18.90
	Bot Seepage	3.05	91.40
	Precipitation and Runoff	38.92	1167.54
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.49	14.73
	Unit 5 Blowdown	0.98	29.36
	ID Pumping	5.74	172.08
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**54.23**	**1626.91**
Out of CCS	W. Seepage	-0.01	-0.33
	E. Seepage	-0.82	-24.55
	N. Seepage	0.00	-0.14
	S. Seepage	0.00	0.00
	Bot Seepage	-9.62	-288.60
	Precipitation and Runoff	0.00	0.00
	Evaporation	-40.57	-1217.25
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-51.03**	**-1530.87**
Modeled Change in CCS Storage:		**3.20**	**96.04**
Observed Change in CCS Storage:		**-5.14**	**-154.17**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-29. Salt Balance for September 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	1.34	40.22
	E. Seepage	1119.18	33575.49
	N. Seepage	0.07	2.07
	S. Seepage	81.28	2438.27
	Bot Seepage	888.78	26663.45
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	57.18	1715.41
	ID Pumping	406.90	12207.06
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**2554.73**	**76641.96**
Out of CCS	W. Seepage	-371.91	-11157.19
	E. Seepage	-322.30	-9669.08
	N. Seepage	-2.27	-68.02
	S. Seepage	0.00	0.00
	Bot Seepage	-4756.06	-142681.75
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-5452.53**	**-163576.04**
Modeled Change in CCS Storage:		**-2897.80**	**-86934.09**
Observed Change in CCS Storage:		**-3663.57**	**-109906.97**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-30. Water Balance for October 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.35	10.96
	E. Seepage	2.49	77.18
	N. Seepage	0.00	0.06
	S. Seepage	0.74	23.06
	Bot Seepage	2.99	92.81
	Precipitation and Runoff	55.25	1712.81
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.47	14.43
	Unit 5 Blowdown	0.75	23.11
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**63.05**	**1954.43**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-3.95	-122.51
	N. Seepage	0.00	-0.15
	S. Seepage	0.00	0.00
	Bot Seepage	-14.38	-445.78
	Precipitation and Runoff	0.00	0.00
	Evaporation	-29.09	-901.94
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-47.43**	**-1470.37**
Modeled Change in CCS Storage:		**15.61**	**484.05**
Observed Change in CCS Storage:		**8.79**	**272.51**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-31. Salt Balance for October 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	0.70	21.81
	E. Seepage	1244.83	38589.87
	N. Seepage	0.23	7.27
	S. Seepage	48.75	1511.19
	Bot Seepage	2437.55	75564.10
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	43.54	1349.79
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**3775.61**	**117044.03**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-440.32	-13649.83
	N. Seepage	-2.39	-74.02
	S. Seepage	0.00	0.00
	Bot Seepage	-1825.99	-56605.81
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-2268.70**	**-70329.66**
Modeled Change in CCS Storage:		**1506.92**	**46714.37**
Observed Change in CCS Storage:		**-3871.33**	**-120011.08**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-32. Water Balance for November 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.22	6.64
	E. Seepage	5.82	174.56
	N. Seepage	0.00	0.13
	S. Seepage	0.68	20.31
	Bot Seepage	4.03	120.94
	Precipitation and Runoff	1.29	38.61
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.42	12.59
	Unit 5 Blowdown	0.50	14.98
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**12.96**	**388.76**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-0.43	-12.93
	N. Seepage	0.00	-0.04
	S. Seepage	0.00	0.00
	Bot Seepage	-6.95	-208.54
	Precipitation and Runoff	0.00	0.00
	Evaporation	-33.96	-1018.90
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-41.35**	**-851.65**
Modeled Change in CCS Storage:		**-28.39**	**-462.88**
Observed Change in CCS Storage:		**-25.56**	**-766.91**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-33. Salt Balance for November 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	0.72	21.55
	E. Seepage	1026.23	30786.95
	N. Seepage	0.75	22.36
	S. Seepage	92.38	2771.44
	Bot Seepage	633.86	19015.69
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	29.18	875.37
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**1783.11**	**53493.35**
Out of CCS	W. Seepage	-1.42	-42.48
	E. Seepage	-175.61	-5268.21
	N. Seepage	-0.83	-24.90
	S. Seepage	0.00	0.00
	Bot Seepage	-3795.03	-113851.04
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-3972.89**	**-119186.63**
Modeled Change in CCS Storage:		**-2189.78**	**-65693.28**
Observed Change in CCS Storage:		**-3673.05**	**-110191.36**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-34. Water Balance for December 2011

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.49	15.07
	E. Seepage	8.46	262.14
	N. Seepage	0.00	0.09
	S. Seepage	0.76	23.45
	Bot Seepage	7.25	224.86
	Precipitation and Runoff	1.82	56.48
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.54	16.69
	Unit 5 Blowdown	0.72	22.33
	ID Pumping	9.14	283.37
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**29.18**	**904.48**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-0.09	-2.71
	N. Seepage	0.00	-0.08
	S. Seepage	0.00	0.00
	Bot Seepage	-7.26	-225.18
	Precipitation and Runoff	0.00	0.00
	Evaporation	-27.94	-866.27
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-35.30**	**-1094.23**
Modeled Change in CCS Storage:		**-6.12**	**-189.75**
Observed Change in CCS Storage:		**-11.66**	**-361.51**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-35. Salt Balance for December 2011

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	1.39	43.13
	E. Seepage	1598.07	49540.20
	N. Seepage	0.61	18.79
	S. Seepage	155.78	4829.10
	Bot Seepage	1112.42	34485.04
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	42.08	1304.34
	ID Pumping	431.13	13365.08
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**3341.47**	**103585.67**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-44.16	-1369.05
	N. Seepage	-1.21	-37.57
	S. Seepage	0.00	0.00
	Bot Seepage	-4135.25	-128192.86
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-4180.63**	**-129599.47**
Modeled Change in CCS Storage:		**-839.16**	**-26013.81**
Observed Change in CCS Storage:		**-3828.22**	**-118674.85**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-36. Water Balance for January 2012

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.79	24.34
	E. Seepage	10.17	315.38
	N. Seepage	0.00	0.01
	S. Seepage	0.84	25.94
	Bot Seepage	9.89	306.52
	Precipitation and Runoff	2.87	89.01
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.53	16.35
	Unit 5 Blowdown	0.89	27.50
	ID Pumping	15.39	476.96
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**41.36**	**1282.01**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-0.01	-0.39
	N. Seepage	-0.01	-0.33
	S. Seepage	0.00	0.00
	Bot Seepage	-11.42	-354.05
	Precipitation and Runoff	0.00	0.00
	Evaporation	-28.41	-880.83
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-39.86**	**-1235.60**
Modeled Change in CCS Storage:		**1.50**	**46.42**
Observed Change in CCS Storage:		**-9.98**	**-309.33**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-37. Salt Balance for January 2012

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	3.23	100.03
	E. Seepage	2454.87	76100.84
	N. Seepage	0.09	2.88
	S. Seepage	183.33	5683.23
	Bot Seepage	2919.37	90500.59
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	51.82	1606.43
	ID Pumping	2219.37	68800.40
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**7832.08**	**242794.40**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-6.39	-198.09
	N. Seepage	-5.00	-154.85
	S. Seepage	0.00	0.00
	Bot Seepage	-5281.53	-163727.51
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-5292.92**	**-164080.44**
Modeled Change in CCS Storage:		**2539.16**	**78713.95**
Observed Change in CCS Storage:		**-2625.35**	**-81385.79**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-38. Water Balance for February 2012

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.59	17.09
	E. Seepage	4.87	141.21
	N. Seepage	0.00	0.13
	S. Seepage	0.61	17.71
	Bot Seepage	5.40	156.46
	Precipitation and Runoff	36.40	1055.68
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.47	13.50
	Unit 5 Blowdown	0.78	22.68
	ID Pumping	1.50	43.56
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**50.62**	**1468.02**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-0.66	-19.12
	N. Seepage	0.00	-0.02
	S. Seepage	0.00	0.00
	Bot Seepage	-7.93	-230.08
	Precipitation and Runoff	0.00	0.00
	Evaporation	-27.84	-807.25
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-36.43**	**-1056.46**
Modeled Change in CCS Storage:		**14.19**	**411.56**
Observed Change in CCS Storage:		**12.36**	**358.44**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-39. Salt Balance for February 2012

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	2.62	75.86
	E. Seepage	1490.74	43231.51
	N. Seepage	1.06	30.70
	S. Seepage	139.50	4045.55
	Bot Seepage	2043.67	59266.34
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	45.68	1324.84
	ID Pumping	189.46	5494.29
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**3912.73**	**113469.10**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-11.04	-320.18
	N. Seepage	-0.31	-8.86
	S. Seepage	0.00	0.00
	Bot Seepage	-2808.80	-81455.07
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-2820.14**	**-81784.11**
Modeled Change in CCS Storage:		**1092.59**	**31684.99**
Observed Change in CCS Storage:		**3362.46**	**97511.42**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-40. Water Balance for March 2012

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.43	13.35
	E. Seepage	6.60	204.74
	N. Seepage	0.01	0.40
	S. Seepage	0.86	26.63
	Bot Seepage	9.11	282.49
	Precipitation and Runoff	2.46	76.17
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.32	9.78
	Unit 5 Blowdown	0.99	30.56
	ID Pumping	4.10	126.99
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**24.87**	**771.10**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-0.22	-6.83
	N. Seepage	0.00	-0.01
	S. Seepage	0.00	0.00
	Bot Seepage	-4.37	-135.32
	Precipitation and Runoff	0.00	0.00
	Evaporation	-28.85	-894.42
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-33.44**	**-1036.58**
Modeled Change in CCS Storage:		**-8.56**	**-265.48**
Observed Change in CCS Storage:		**-11.24**	**-348.30**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-41. Salt Balance for March 2012

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	1.91	59.15
	E. Seepage	2072.56	64249.32
	N. Seepage	2.96	91.61
	S. Seepage	199.90	6197.01
	Bot Seepage	2790.33	86500.25
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	57.59	1785.20
	ID Pumping	187.62	5816.11
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**5312.86**	**164698.66**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-16.20	-502.25
	N. Seepage	-0.13	-4.04
	S. Seepage	0.00	0.00
	Bot Seepage	-1733.97	-53753.20
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-1750.31**	**-54259.48**
Modeled Change in CCS Storage:		**3562.55**	**110439.17**
Observed Change in CCS Storage:		**-500.48**	**-15514.87**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-42. Water Balance for April 2012

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.69	20.65
	E. Seepage	7.18	215.31
	N. Seepage	0.01	0.15
	S. Seepage	0.84	25.21
	Bot Seepage	9.86	295.67
	Precipitation and Runoff	52.17	1565.03
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.35	10.44
	Unit 5 Blowdown	0.98	29.41
	ID Pumping	9.76	292.86
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**81.82**	**2454.73**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-0.11	-3.36
	N. Seepage	0.00	-0.03
	S. Seepage	0.00	0.00
	Bot Seepage	-5.44	-163.10
	Precipitation and Runoff	0.00	0.00
	Evaporation	-30.35	-910.52
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-35.90**	**-1077.01**
Modeled Change in CCS Storage:		**45.92**	**1377.72**
Observed Change in CCS Storage:		**33.69**	**1010.73**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-43. Salt Balance for April 2012

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	6.91	207.36
	E. Seepage	2259.55	67786.52
	N. Seepage	1.18	35.26
	S. Seepage	228.24	6847.28
	Bot Seepage	2634.67	79039.99
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	57.26	1717.78
	ID Pumping	1035.51	31065.19
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**6223.31**	**186699.39**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-54.03	-1620.98
	N. Seepage	-0.59	-17.72
	S. Seepage	0.00	0.00
	Bot Seepage	-2899.81	-86994.31
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-2954.43**	**-88633.01**
Modeled Change in CCS Storage:		**3268.88**	**98066.38**
Observed Change in CCS Storage:		**4132.59**	**123977.58**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-44. Water Balance for May 2012

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.58	18.00
	E. Seepage	0.22	6.82
	N. Seepage	0.01	0.44
	S. Seepage	0.28	8.68
	Bot Seepage	1.06	32.81
	Precipitation and Runoff	42.56	1319.51
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.36	11.22
	Unit 5 Blowdown	0.97	30.04
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**46.05**	**1427.54**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-6.10	-189.16
	N. Seepage	0.00	-0.01
	S. Seepage	0.00	-0.01
	Bot Seepage	-11.72	-363.27
	Precipitation and Runoff	0.00	0.00
	Evaporation	-29.06	-900.80
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-46.88**	**-1453.25**
Modeled Change in CCS Storage:		**-0.83**	**-25.72**
Observed Change in CCS Storage:		**-2.89**	**-89.62**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-45. Salt Balance for May 2012

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	3.99	123.80
	E. Seepage	66.83	2071.87
	N. Seepage	3.32	103.06
	S. Seepage	36.12	1119.86
	Bot Seepage	476.73	14778.51
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	56.61	1755.02
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**643.62**	**19952.13**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-2630.79	-81554.38
	N. Seepage	-0.18	-5.65
	S. Seepage	-0.18	-5.72
	Bot Seepage	-4991.24	-154728.51
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-7622.40**	**-236294.26**
Modeled Change in CCS Storage:		**-6978.78**	**-216342.13**
Observed Change in CCS Storage:		**-4664.11**	**-144587.53**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

Table 5.4-46. Water Balance for June 2012

Water Balance Component		Flow (MGD)	Volume (gal x 10^6)
Into CCS	W. Seepage	0.31	9.37
	E. Seepage	1.49	44.65
	N. Seepage	0.01	0.29
	S. Seepage	0.50	14.87
	Bot Seepage	3.52	105.45
	Precipitation and Runoff	31.83	954.85
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.19	5.80
	Unit 5 Blowdown	1.03	30.98
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**38.88**	**1166.26**
Out of CCS	W. Seepage	0.00	-0.03
	E. Seepage	-4.30	-129.06
	N. Seepage	0.00	-0.01
	S. Seepage	0.00	0.00
	Bot Seepage	-8.70	-261.14
	Precipitation and Runoff	0.00	0.00
	Evaporation	-28.76	-862.90
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-41.77**	**-1253.15**
Modeled Change in CCS Storage:		**-2.90**	**-86.88**
Observed Change in CCS Storage:		**-3.50**	**-105.04**

Key: CCS = Cooling Canal System. gal = Gallons. ID = Interceptor Ditch. MGD = Millions of gallons per day.

Table 5.4-47. Salt Balance for June 2012

Water Balance Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	0.97	29.03
	E. Seepage	326.55	9796.41
	N. Seepage	2.25	67.36
	S. Seepage	69.92	2097.49
	Bot Seepage	1092.63	32778.88
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	60.32	1809.60
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**1552.63**	**46578.77**
Out of CCS	W. Seepage	-17.56	-526.71
	E. Seepage	-1746.75	-52402.41
	N. Seepage	-0.17	-5.02
	S. Seepage	0.00	0.00
	Bot Seepage	-3478.73	-104361.78
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-5243.20**	**-157295.92**
Modeled Change in CCS Storage:		**-3690.57**	**-110717.15**
Observed Change in CCS Storage:		**-2740.38**	**-82211.41**

Key: CCS = Cooling Canal System. ID = Interceptor Ditch. lb = Pound.

FIGURES

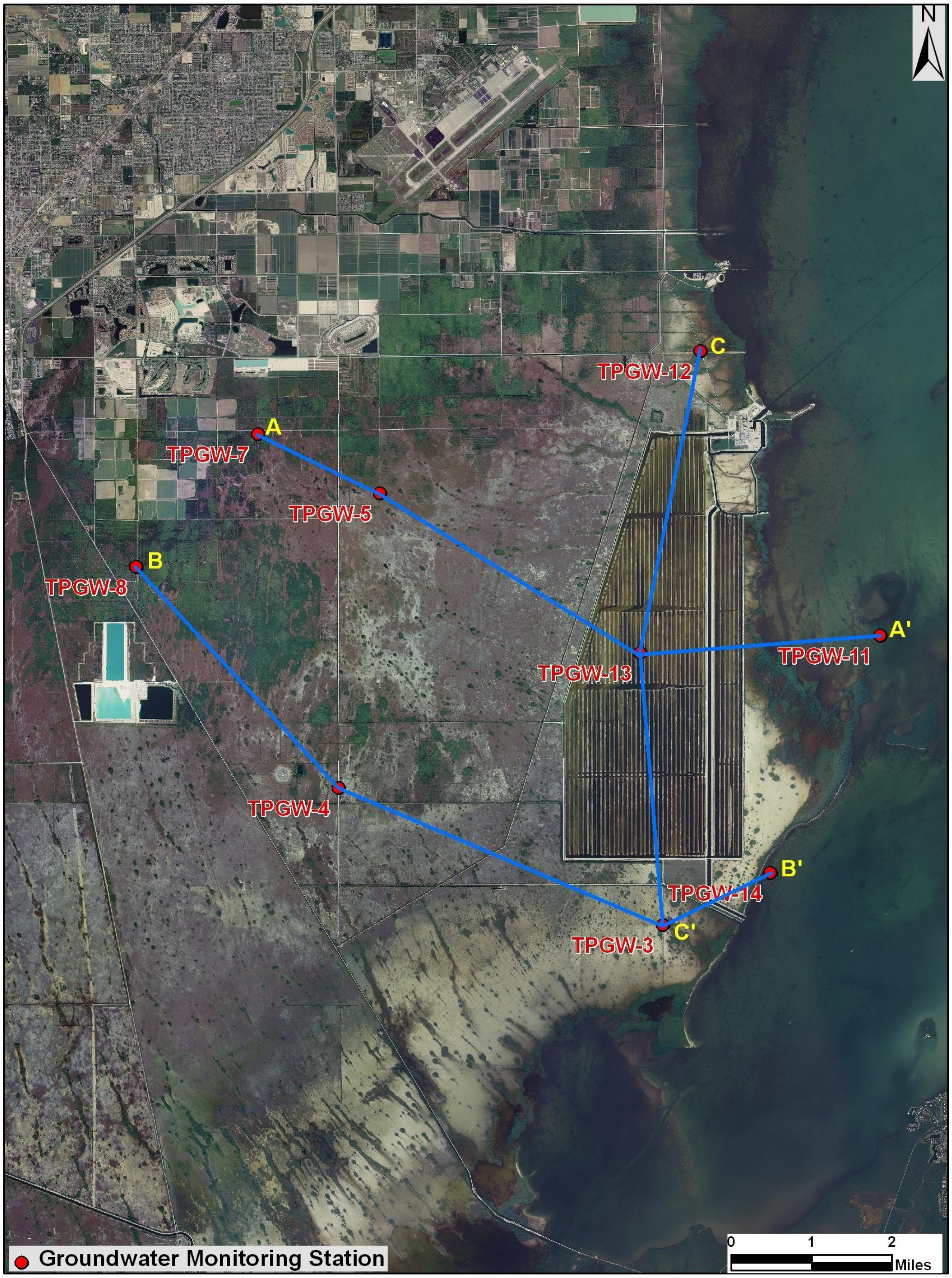
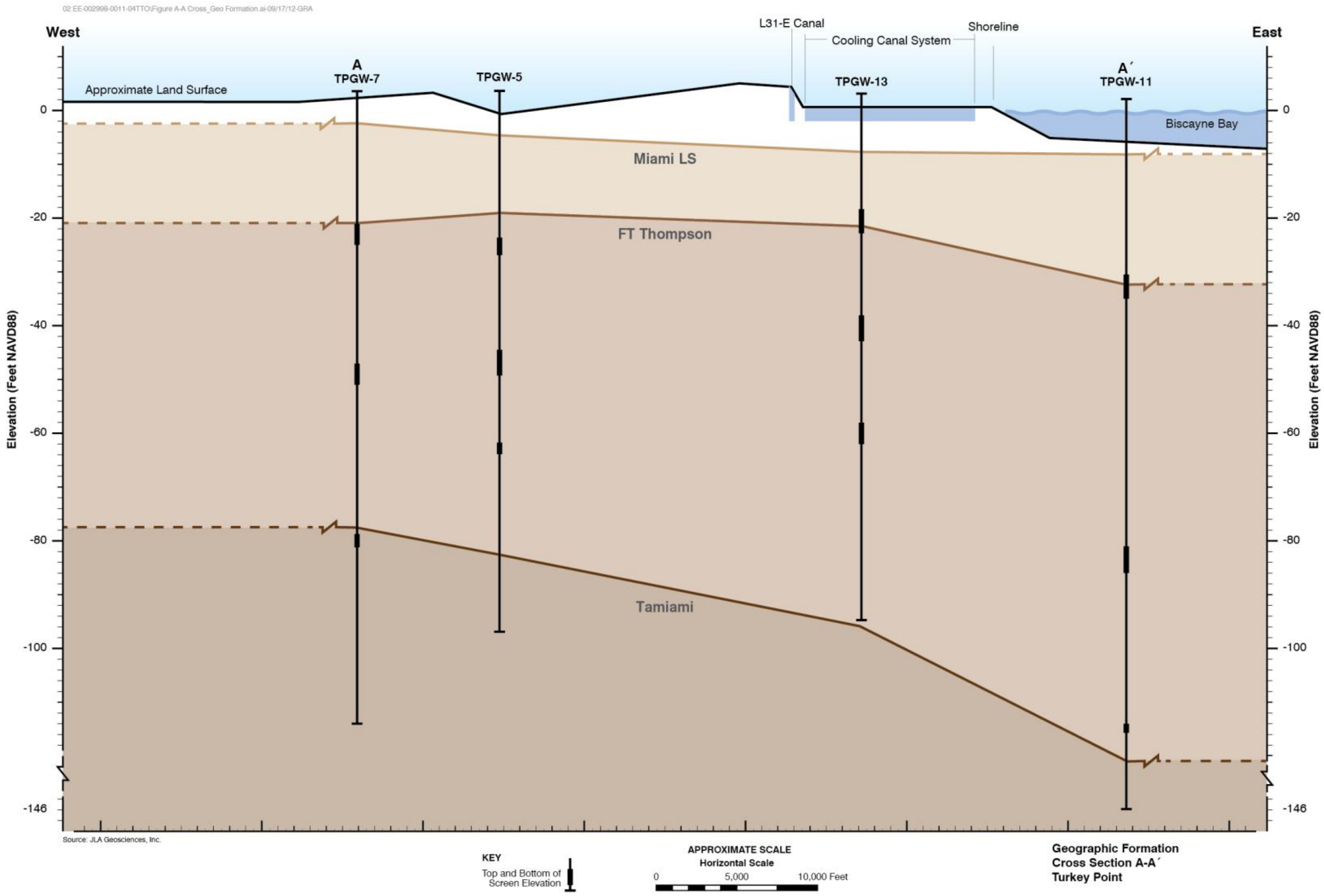
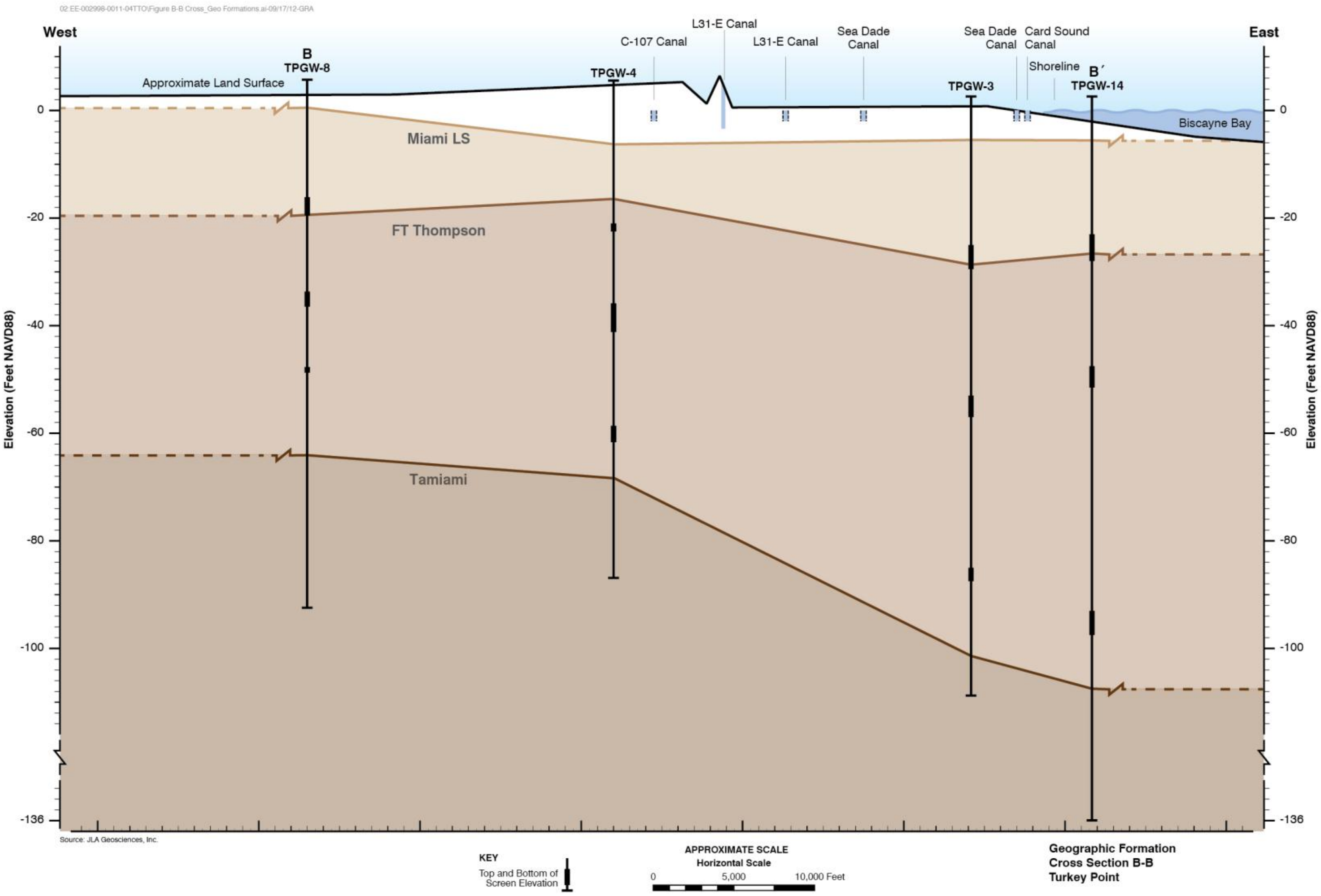


Figure 5.1-1. Geologic Formation Cross Section Location.



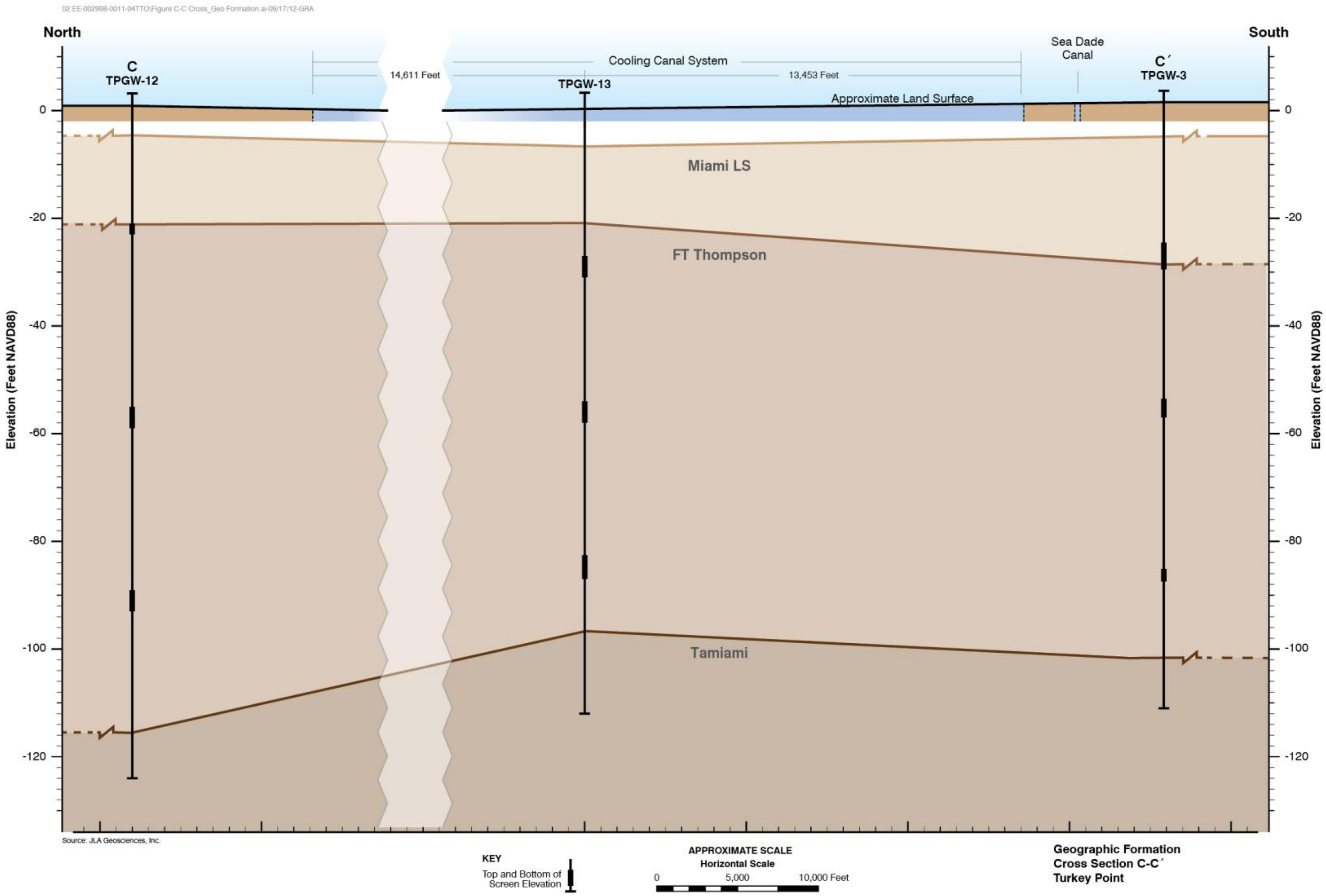
Source: JLA Geosciences, Inc.

Figure 5.1-2. Geologic Cross Section A-A.



Source: JLA Geosciences, Inc.

Figure 5.1-3. Geologic Cross Section B-B.



Source: JLA Geosciences, Inc.

Figure 5.1-4. Geologic Cross Section C-C.

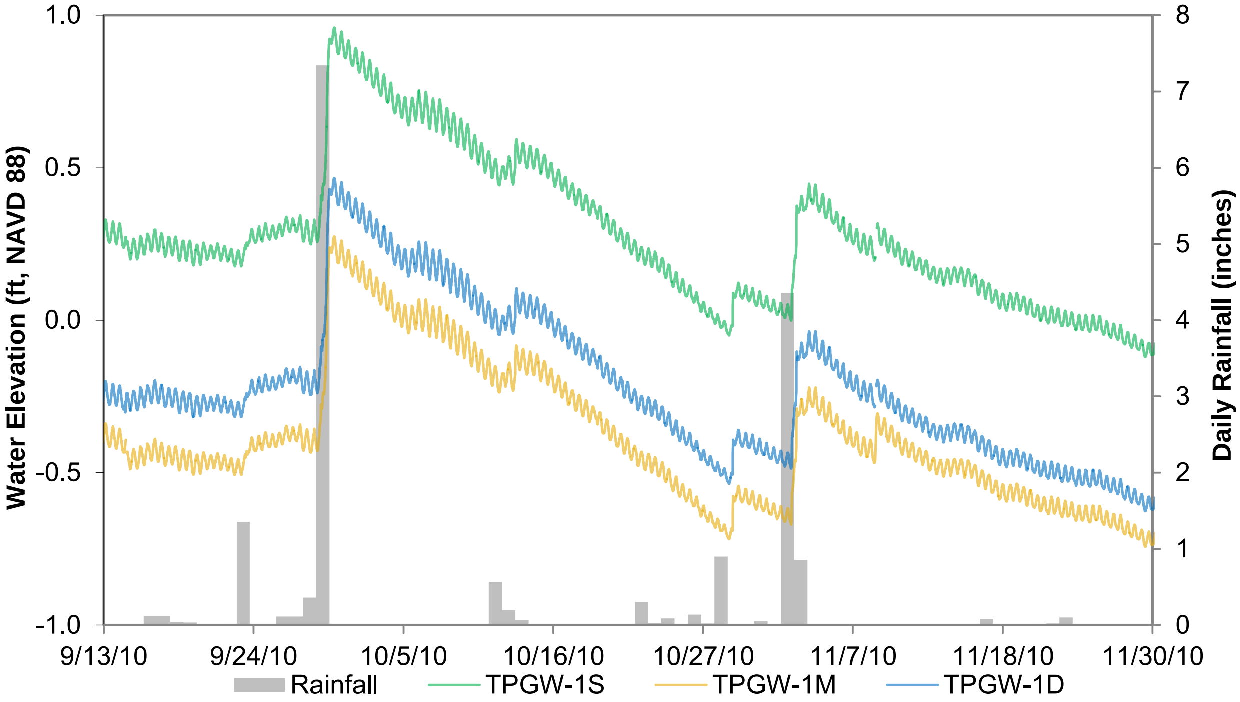


Figure 5.2-1. Groundwater Response to Rain Events – September through November 2010.

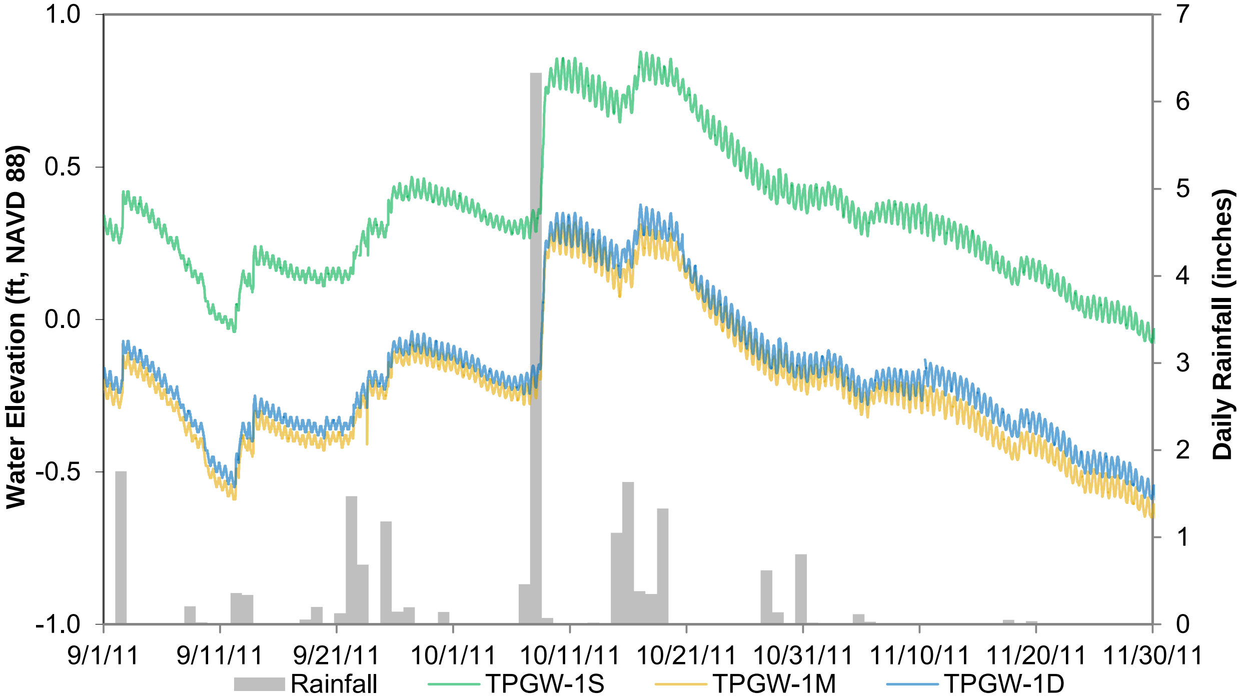
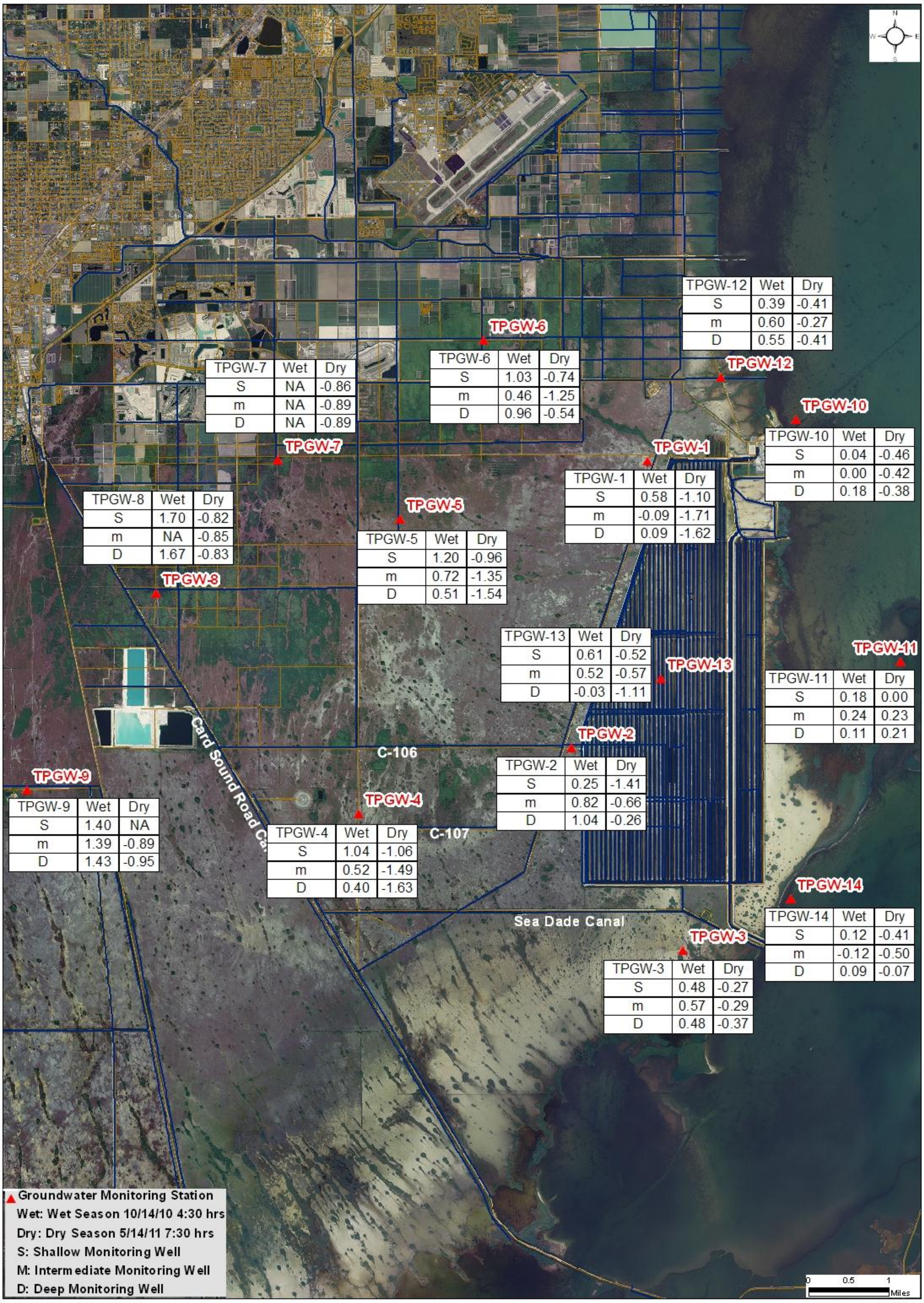


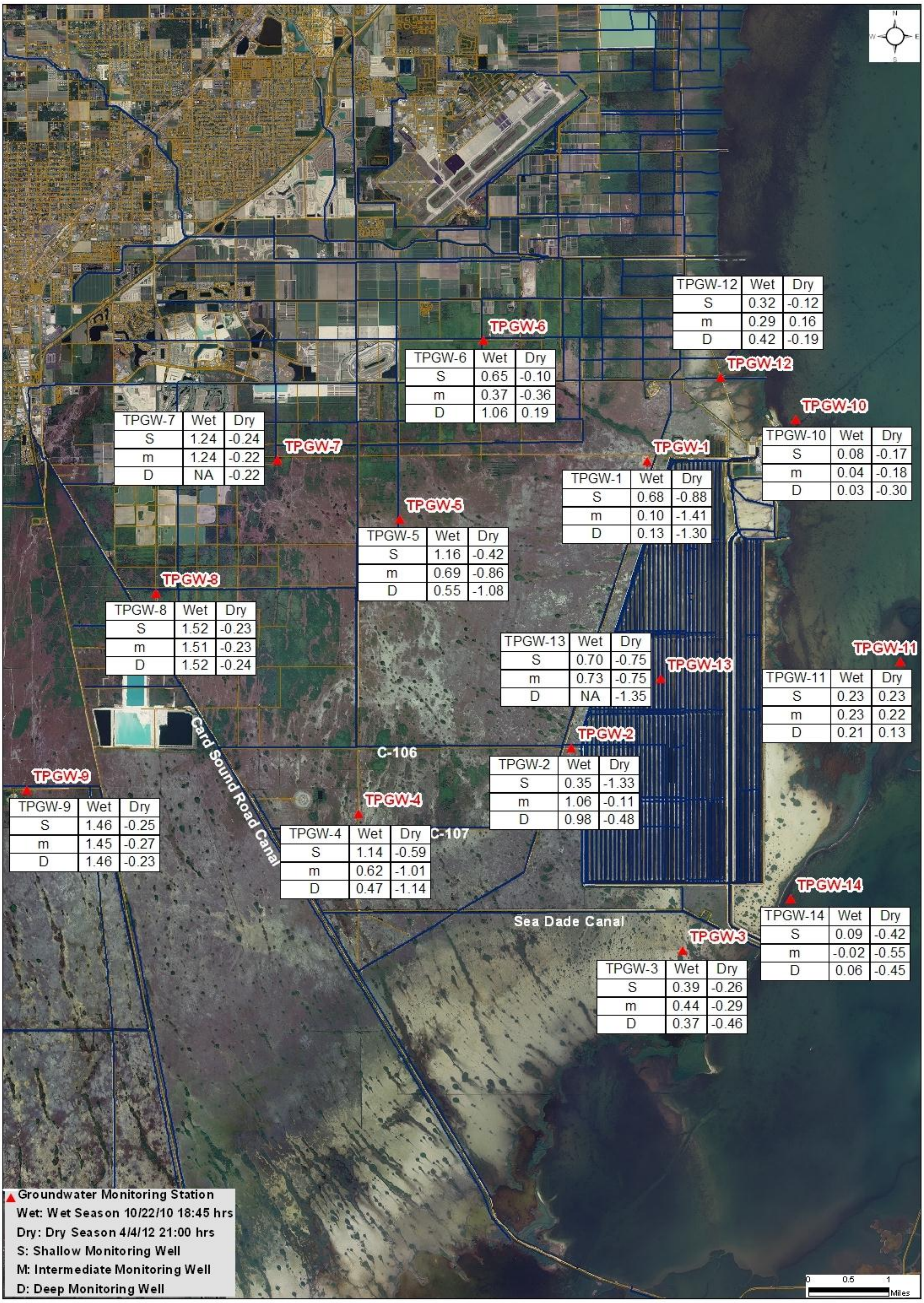
Figure 5.2-2. Groundwater Response to Rain Events – September through November 2011.



Note: NA: Not Available.

8-2012

Figure 5.2-3. Wet and Dry Season Day Water Elevation Comparison – October 14, 2010 and May 14, 2011.



TPGW-12	Wet	Dry
S	0.32	-0.12
m	0.29	0.16
D	0.42	-0.19

TPGW-6	Wet	Dry
S	0.65	-0.10
m	0.37	-0.36
D	1.06	0.19

TPGW-7	Wet	Dry
S	1.24	-0.24
m	1.24	-0.22
D	NA	-0.22

TPGW-10	Wet	Dry
S	0.08	-0.17
m	0.04	-0.18
D	0.03	-0.30

TPGW-1	Wet	Dry
S	0.68	-0.88
m	0.10	-1.41
D	0.13	-1.30

TPGW-5	Wet	Dry
S	1.16	-0.42
m	0.69	-0.86
D	0.55	-1.08

TPGW-8	Wet	Dry
S	1.52	-0.23
m	1.51	-0.23
D	1.52	-0.24

TPGW-13	Wet	Dry
S	0.70	-0.75
m	0.73	-0.75
D	NA	-1.35

TPGW-11	Wet	Dry
S	0.23	0.23
m	0.23	0.22
D	0.21	0.13

TPGW-2	Wet	Dry
S	0.35	-1.33
m	1.06	-0.11
D	0.98	-0.48

TPGW-9	Wet	Dry
S	1.46	-0.25
m	1.45	-0.27
D	1.46	-0.23

TPGW-4	Wet	Dry
S	1.14	-0.59
m	0.62	-1.01
D	0.47	-1.14

TPGW-14	Wet	Dry
S	0.09	-0.42
m	-0.02	-0.55
D	0.06	-0.45

TPGW-3	Wet	Dry
S	0.39	-0.26
m	0.44	-0.29
D	0.37	-0.46

Note: NA: Not Available.

8-2012

Figure 5.2-4. Wet and Dry Season Day Water Elevation Comparison – October 22, 2011 and April 4, 2012.

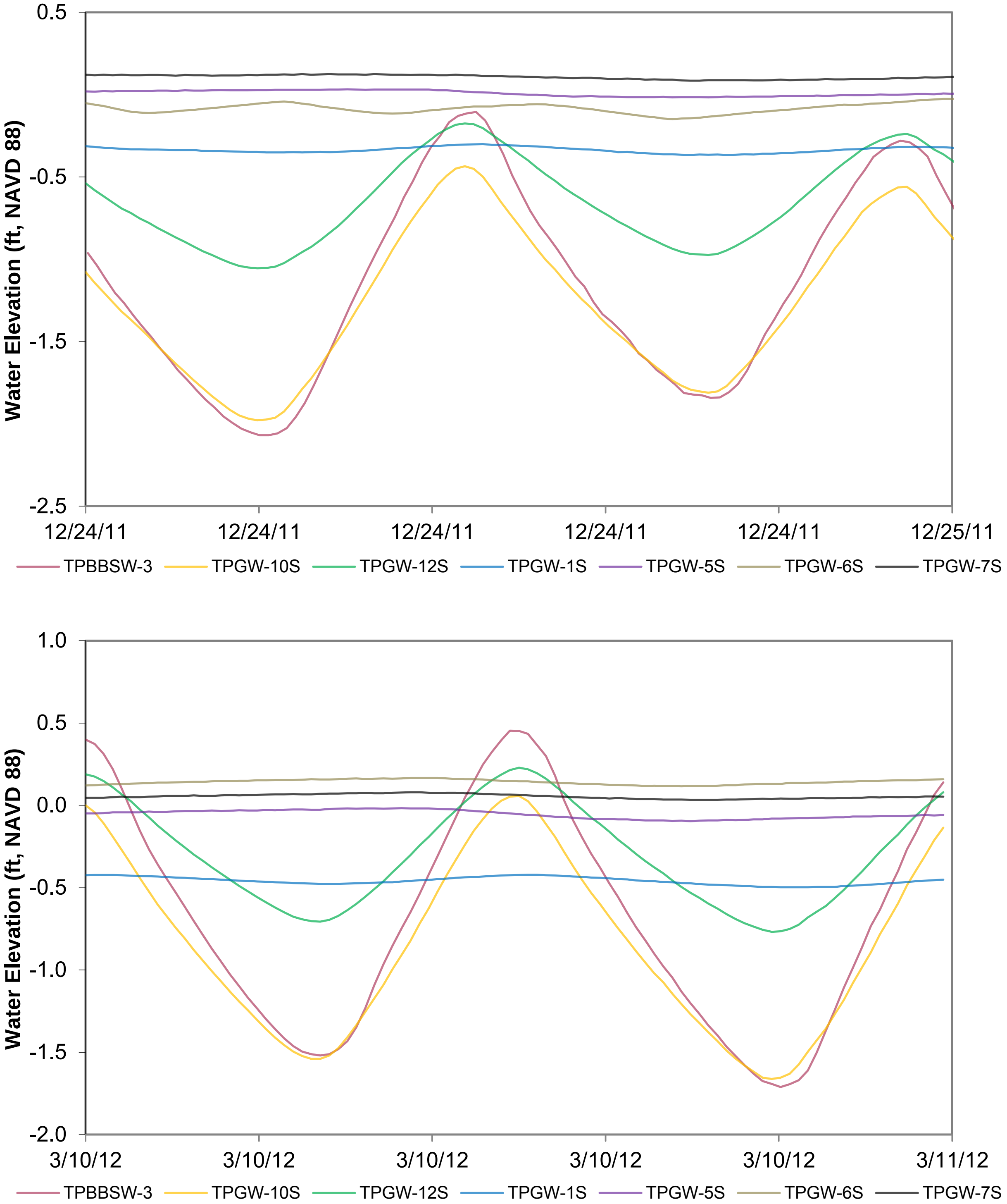
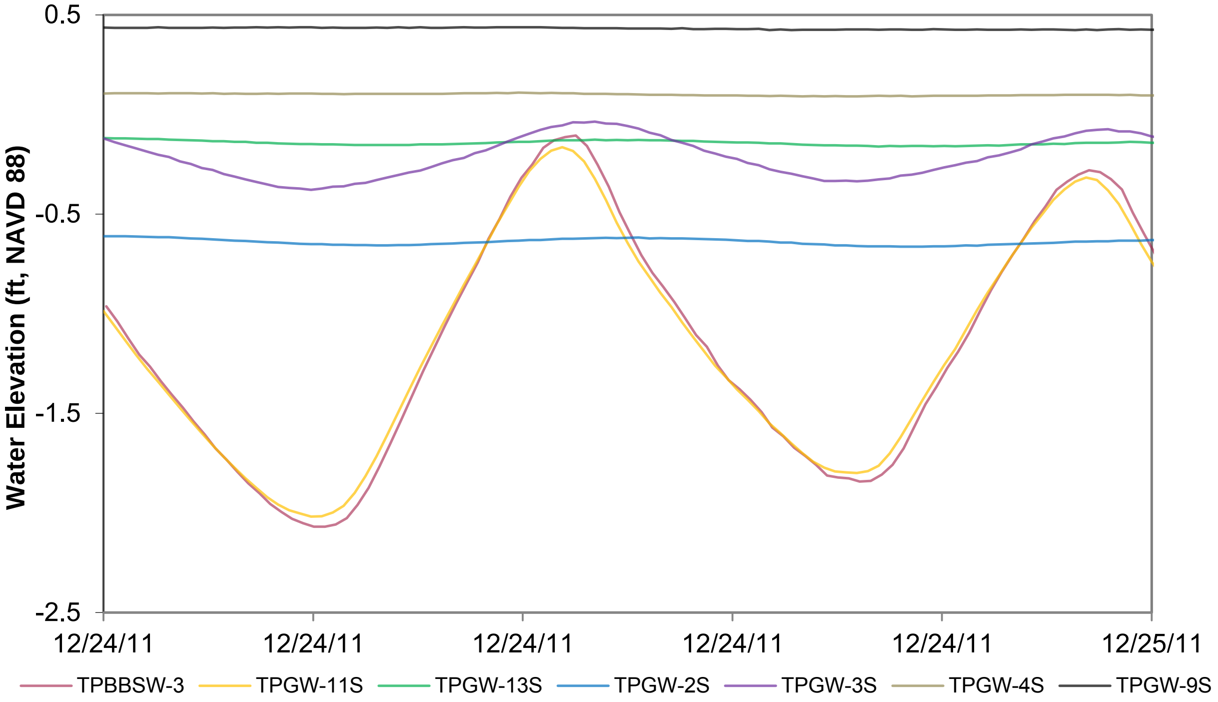


Figure 5.2-5. Tidal Effects at Biscayne Bay, Nearshore and Inland Stations in the Northern Part of Study Area.



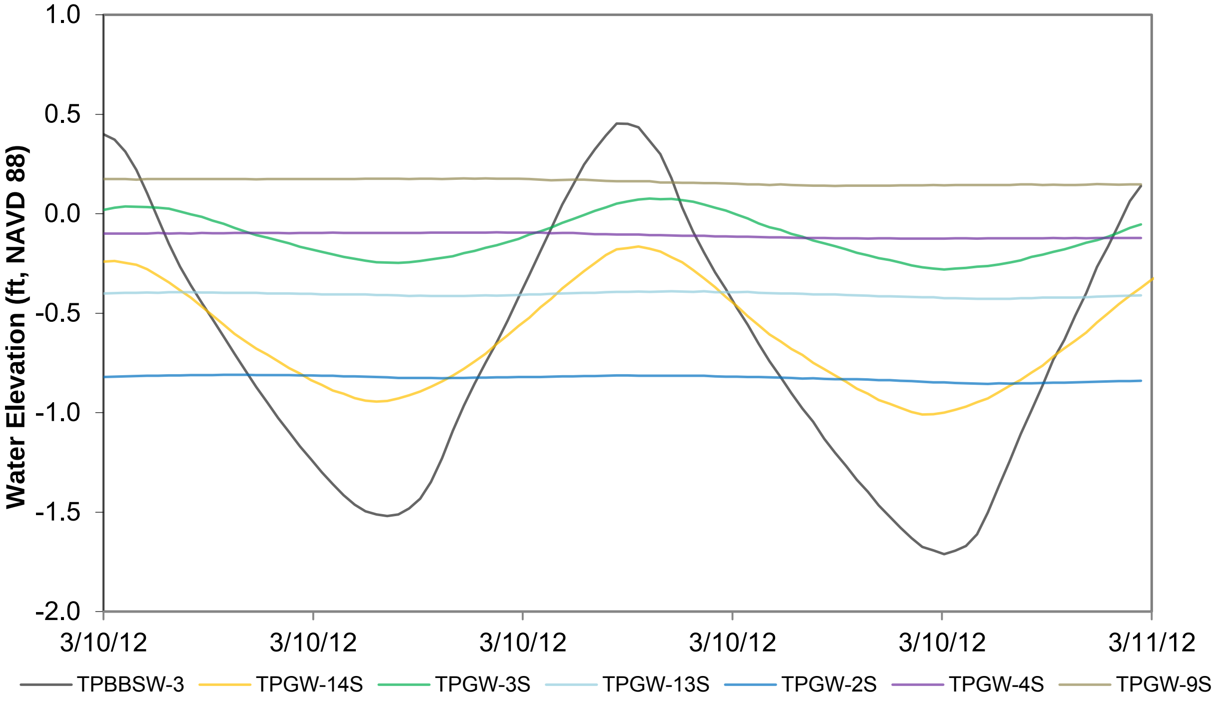


Figure 5.2-6. Tidal Effects at Biscayne Bay, Nearshore and Inland Stations in the Southern Part of Study Area

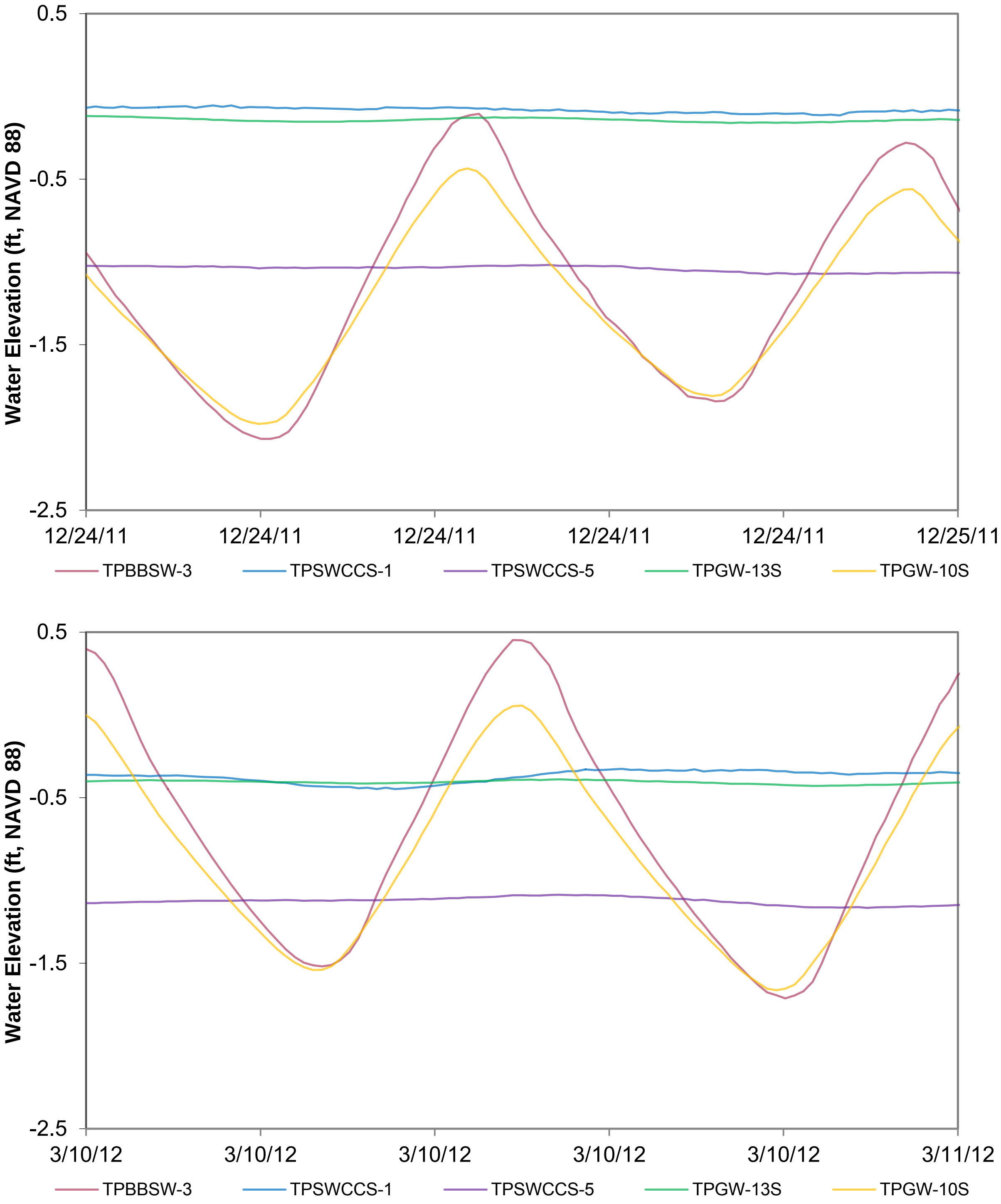
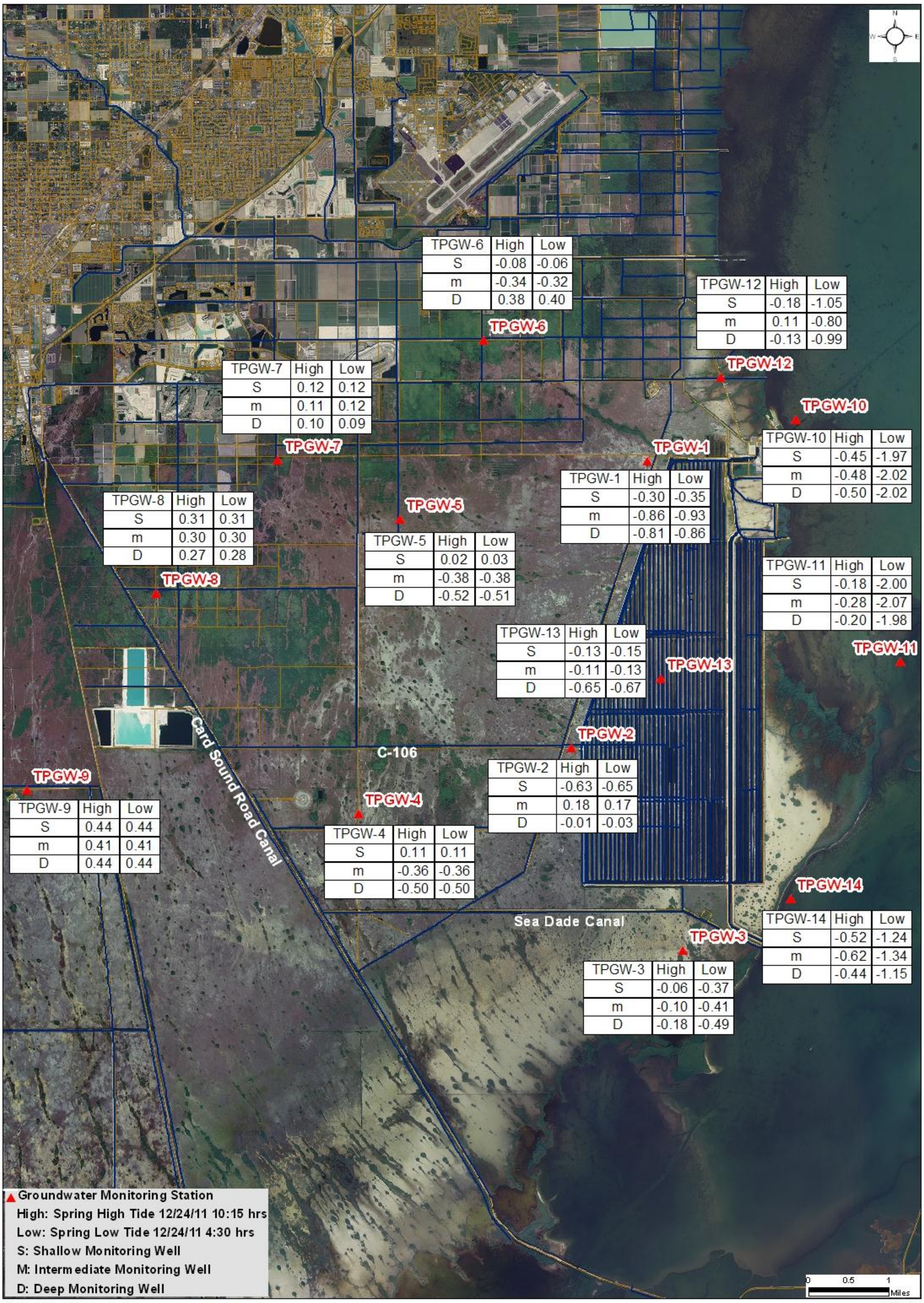


Figure 5.2-7. Lack of Tidal Effects in CCS Surface Water and Groundwater



TPGW-6	High	Low
S	-0.08	-0.06
m	-0.34	-0.32
D	0.38	0.40

TPGW-12	High	Low
S	-0.18	-1.05
m	0.11	-0.80
D	-0.13	-0.99

TPGW-7	High	Low
S	0.12	0.12
m	0.11	0.12
D	0.10	0.09

TPGW-10	High	Low
S	-0.45	-1.97
m	-0.48	-2.02
D	-0.50	-2.02

TPGW-1	High	Low
S	-0.30	-0.35
m	-0.86	-0.93
D	-0.81	-0.86

TPGW-8	High	Low
S	0.31	0.31
m	0.30	0.30
D	0.27	0.28

TPGW-5	High	Low
S	0.02	0.03
m	-0.38	-0.38
D	-0.52	-0.51

TPGW-11	High	Low
S	-0.18	-2.00
m	-0.28	-2.07
D	-0.20	-1.98

TPGW-13	High	Low
S	-0.13	-0.15
m	-0.11	-0.13
D	-0.65	-0.67

TPGW-2	High	Low
S	-0.63	-0.65
m	0.18	0.17
D	-0.01	-0.03

TPGW-9	High	Low
S	0.44	0.44
m	0.41	0.41
D	0.44	0.44

TPGW-4	High	Low
S	0.11	0.11
m	-0.36	-0.36
D	-0.50	-0.50

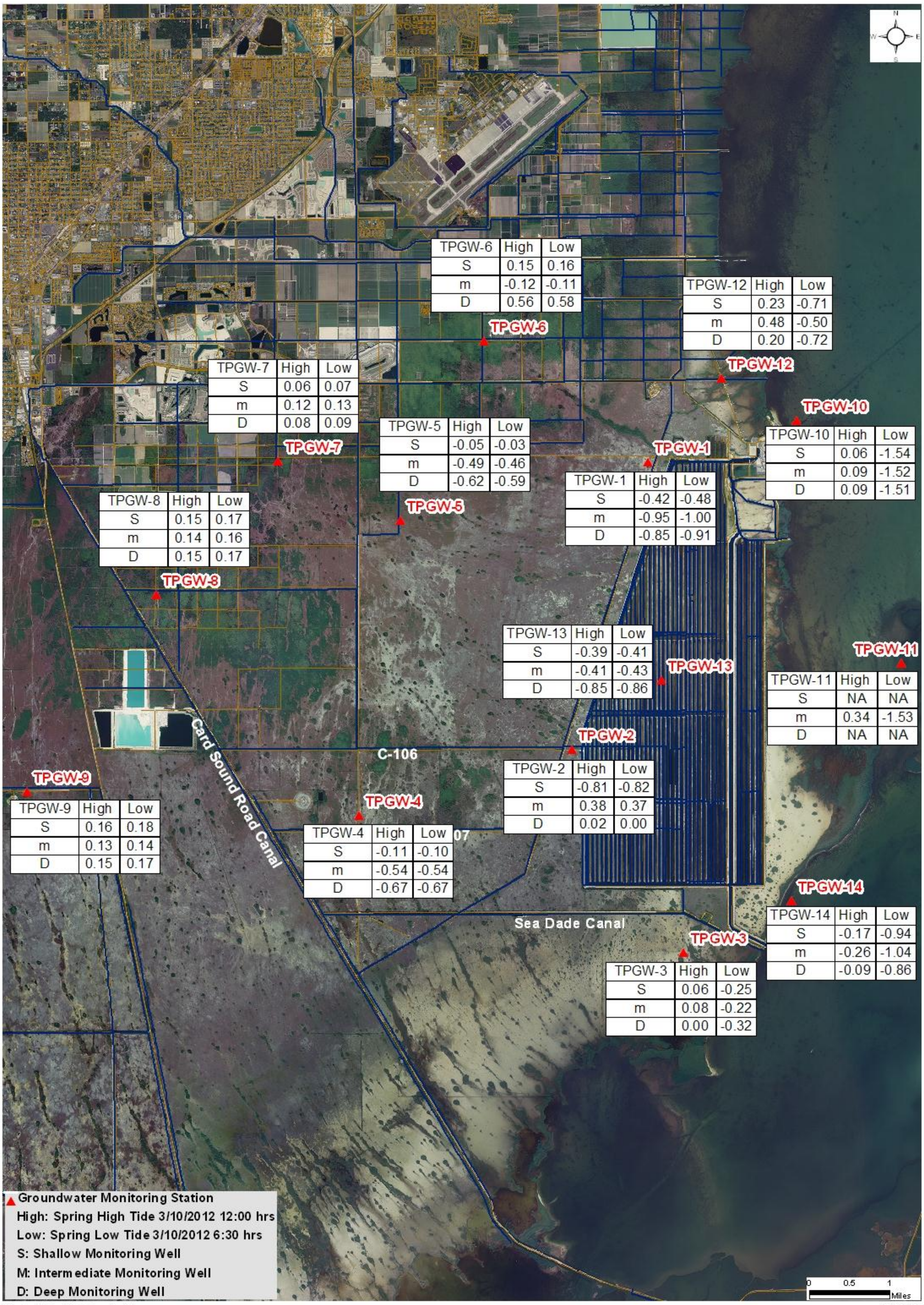
TPGW-14	High	Low
S	-0.52	-1.24
m	-0.62	-1.34
D	-0.44	-1.15

TPGW-3	High	Low
S	-0.06	-0.37
m	-0.10	-0.41
D	-0.18	-0.49

▲ Groundwater Monitoring Station
High: Spring High Tide 12/24/11 10:15 hrs
Low: Spring Low Tide 12/24/11 4:30 hrs
S: Shallow Monitoring Well
M: Intermediate Monitoring Well
D: Deep Monitoring Well

Note: NA: Not Available. 8-2012

Figure 5.2-8. Spring Tide Groundwater Elevations, December 24, 2011.



TPGW-6	High	Low
S	0.15	0.16
m	-0.12	-0.11
D	0.56	0.58

TPGW-12	High	Low
S	0.23	-0.71
m	0.48	-0.50
D	0.20	-0.72

TPGW-7	High	Low
S	0.06	0.07
m	0.12	0.13
D	0.08	0.09

TPGW-5	High	Low
S	-0.05	-0.03
m	-0.49	-0.46
D	-0.62	-0.59

TPGW-10	High	Low
S	0.06	-1.54
m	0.09	-1.52
D	0.09	-1.51

TPGW-1	High	Low
S	-0.42	-0.48
m	-0.95	-1.00
D	-0.85	-0.91

TPGW-8	High	Low
S	0.15	0.17
m	0.14	0.16
D	0.15	0.17

TPGW-13	High	Low
S	-0.39	-0.41
m	-0.41	-0.43
D	-0.85	-0.86

TPGW-11	High	Low
S	NA	NA
m	0.34	-1.53
D	NA	NA

TPGW-2	High	Low
S	-0.81	-0.82
m	0.38	0.37
D	0.02	0.00

TPGW-9	High	Low
S	0.16	0.18
m	0.13	0.14
D	0.15	0.17

TPGW-4	High	Low
S	-0.11	-0.10
m	-0.54	-0.54
D	-0.67	-0.67

TPGW-14	High	Low
S	-0.17	-0.94
m	-0.26	-1.04
D	-0.09	-0.86

TPGW-3	High	Low
S	0.06	-0.25
m	0.08	-0.22
D	0.00	-0.32

▲ Groundwater Monitoring Station
High: Spring High Tide 3/10/2012 12:00 hrs
Low: Spring Low Tide 3/10/2012 6:30 hrs
S: Shallow Monitoring Well
M: Intermediate Monitoring Well
D: Deep Monitoring Well

Note: NA: Not Available.

8-2012

Figure 5.2-9. Spring Tide Groundwater Elevations, March 10, 2012.

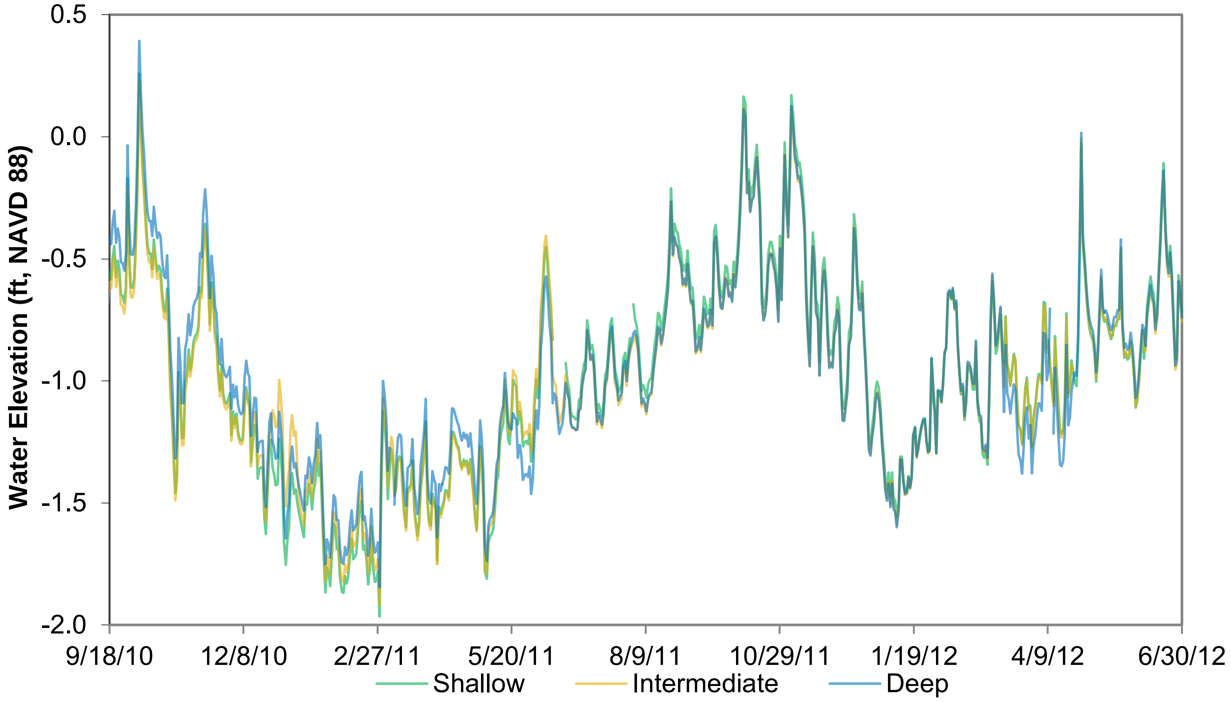


Figure 5.2-10. Averaged Daily Groundwater Elevations for TPGW-10 Wells.

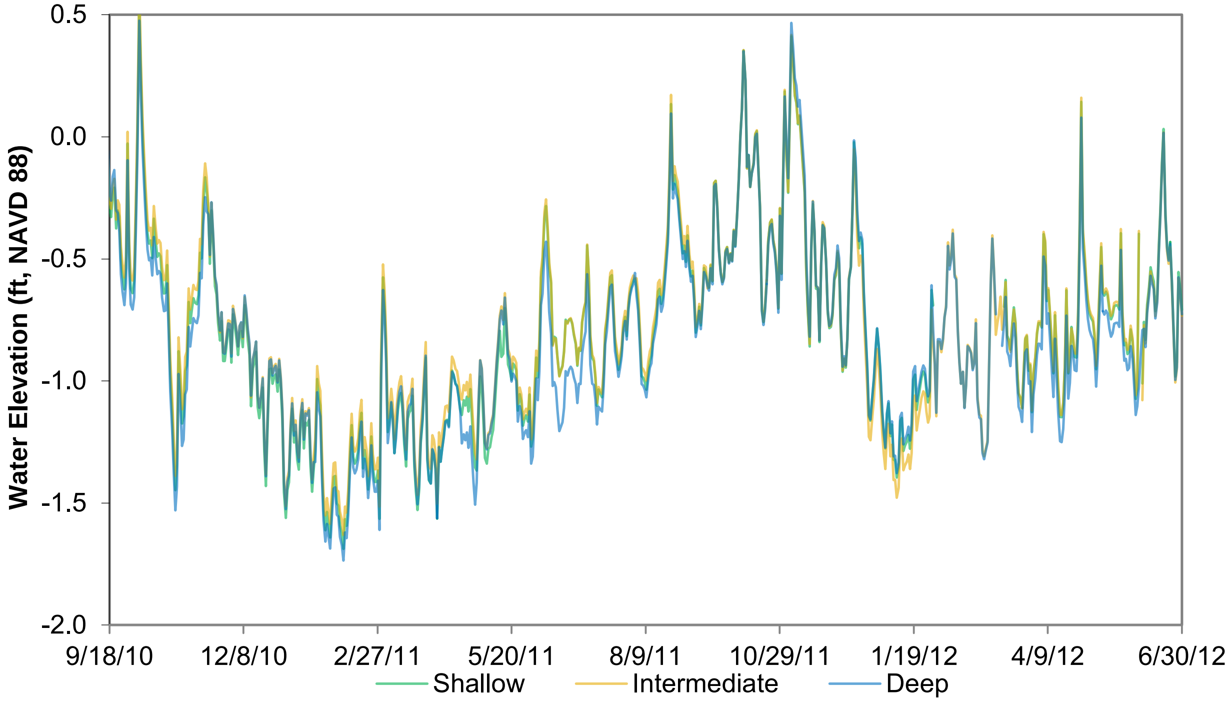


Figure 5.2-11. Averaged Daily Groundwater Elevations for TPGW-11 Wells.

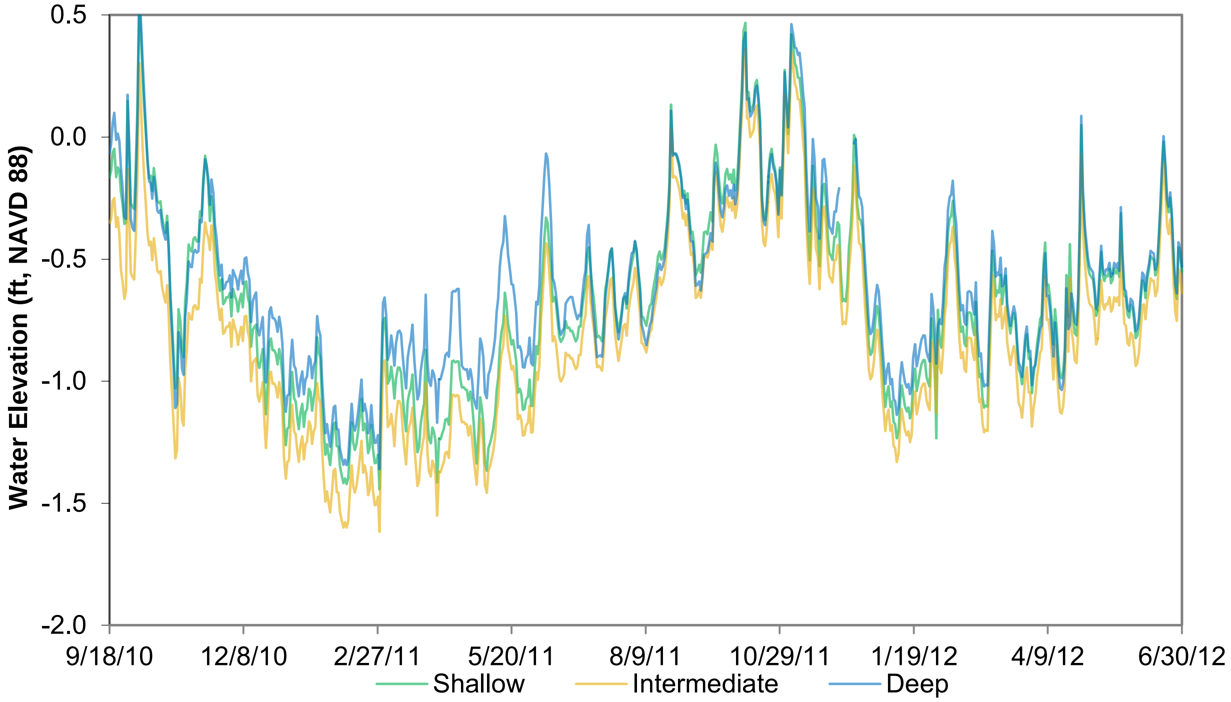


Figure 5.2-12. Averaged Daily Groundwater Elevations for TPGW-14 Wells.

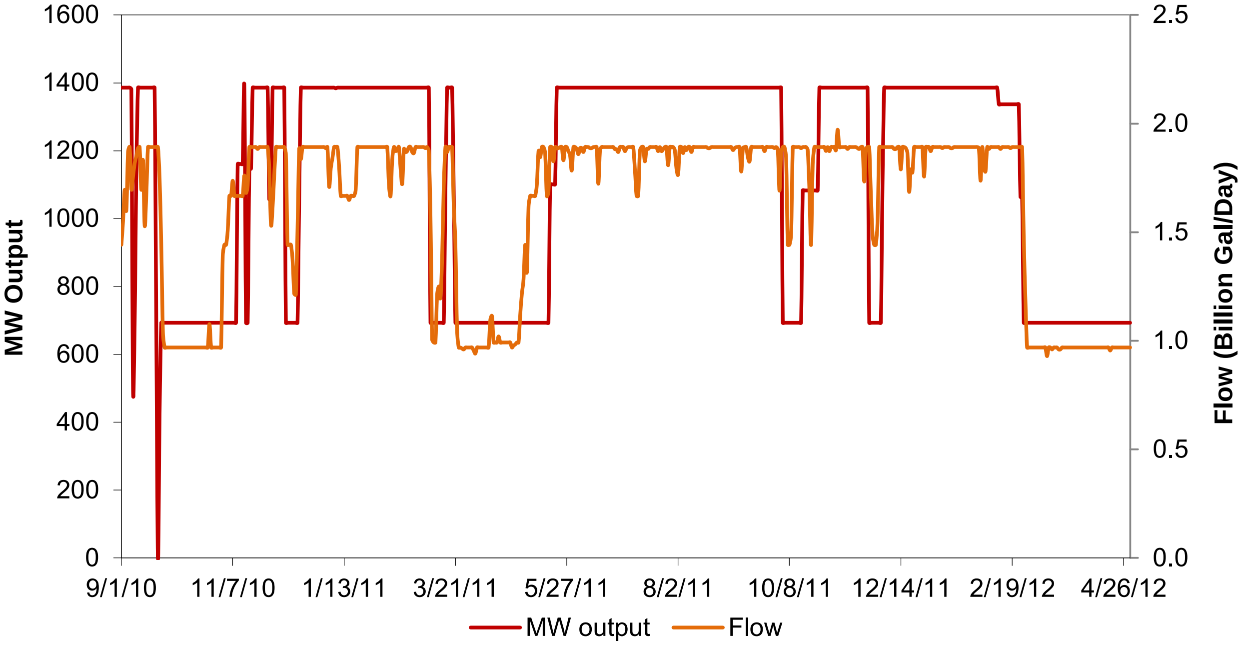
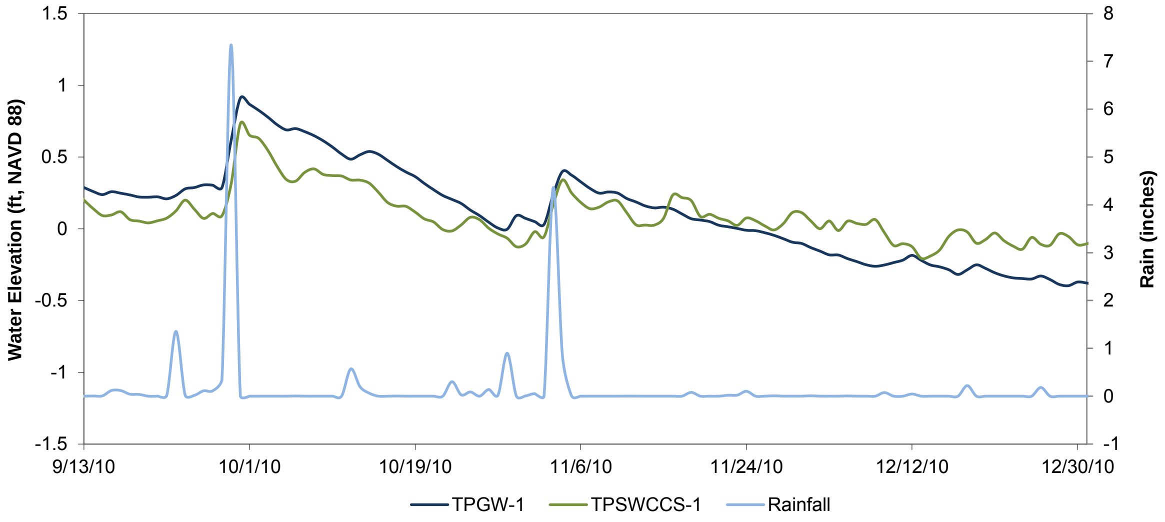


Figure 5.2-13. Nuclear Unit Estimated Flows and Outages/Megawatt (MW) Output Reduction.



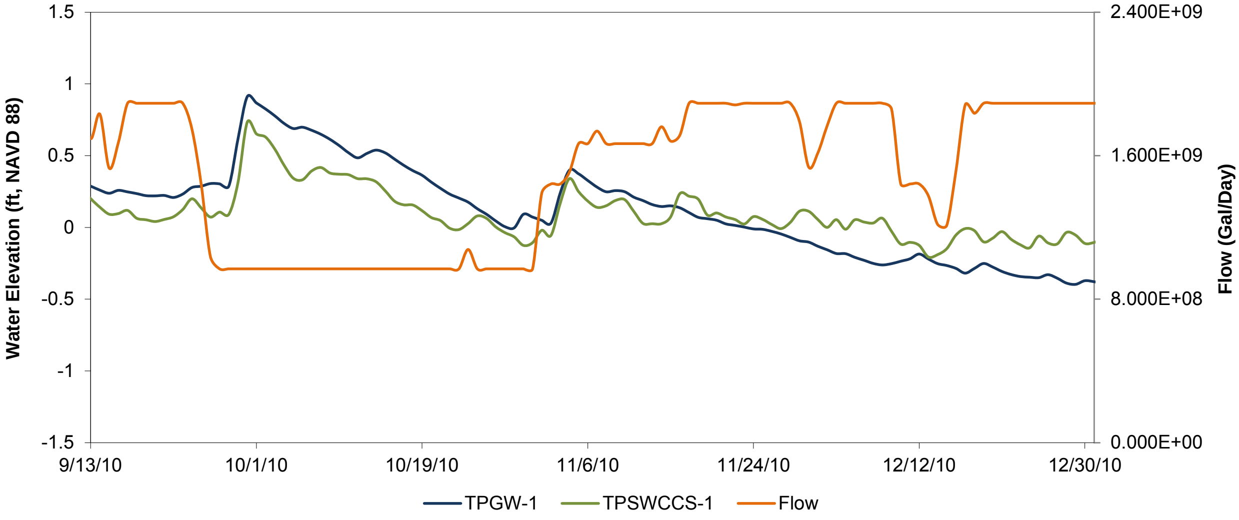
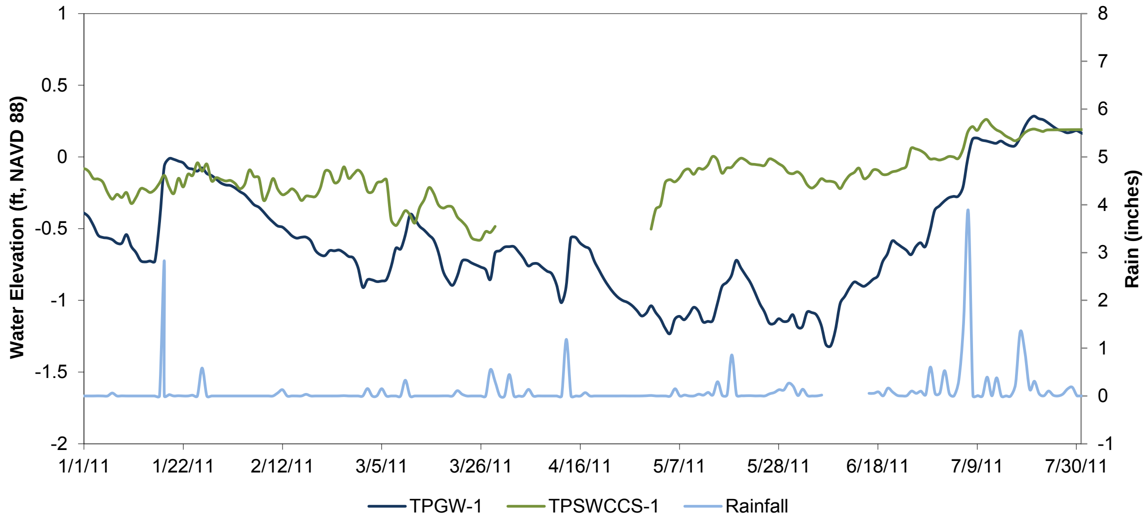


Figure 5.2-14. TPGW-1 Groundwater and TPSWCCS-1 Surface Water Responses to Rainfall and Nuclear Unit Power Outages, September 2010 – December 2010.



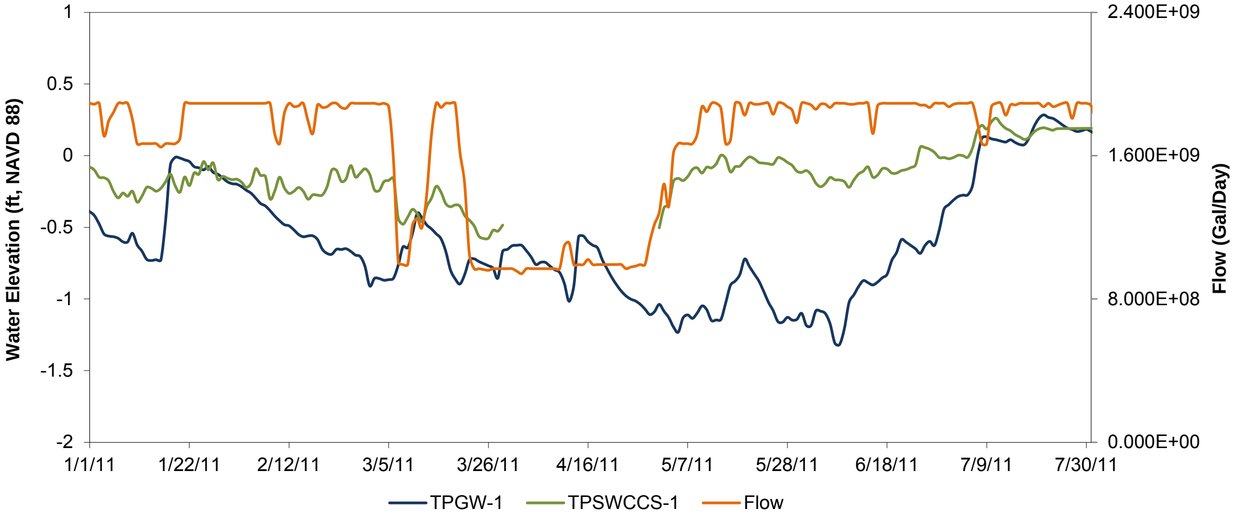


Figure 5.2-15. TPGW-1 Groundwater and TPSWCC-1 Surface Water Responses to Rainfall and Nuclear Unit Power Outages, January 2011 – June 2011.

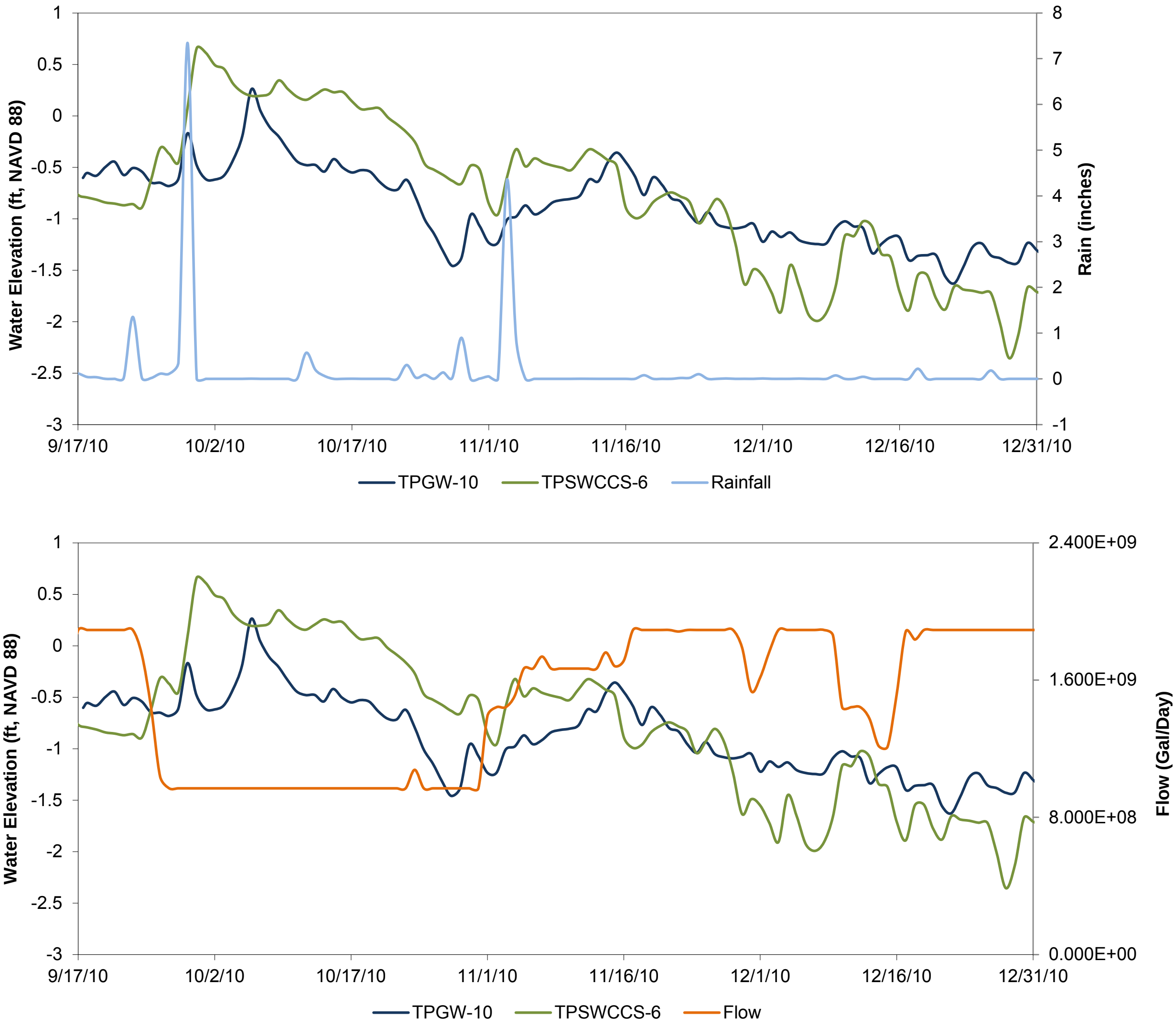


Figure 5.2-16. TPGW-10 Groundwater and TPSWCCS-6 Surface Water Responses to Rainfall and Nuclear Unit Power Outages, September 2010 – December 2010.

Figure 5.2-17. TPGW-10 Groundwater and TPSWCCS-6 Surface Water Responses to Rainfall and Nuclear Unit Power Outages, January 2011 – June 2011.

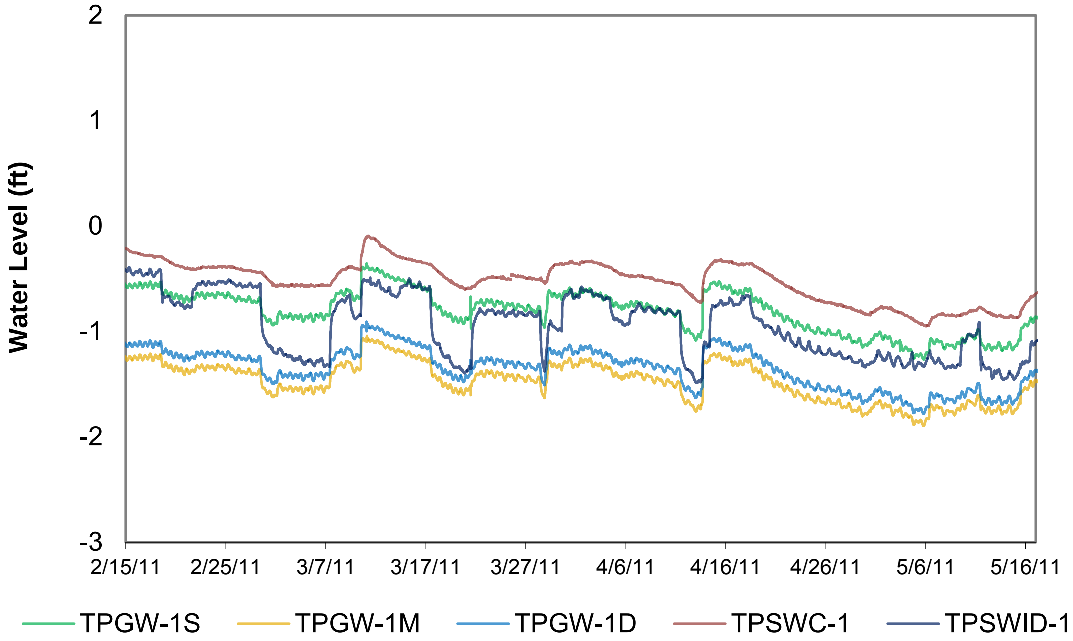


Figure 5.2-18. Effect of ID Operations on TPGW-1 Wells, TPSWC-1 and TPSWID-1.

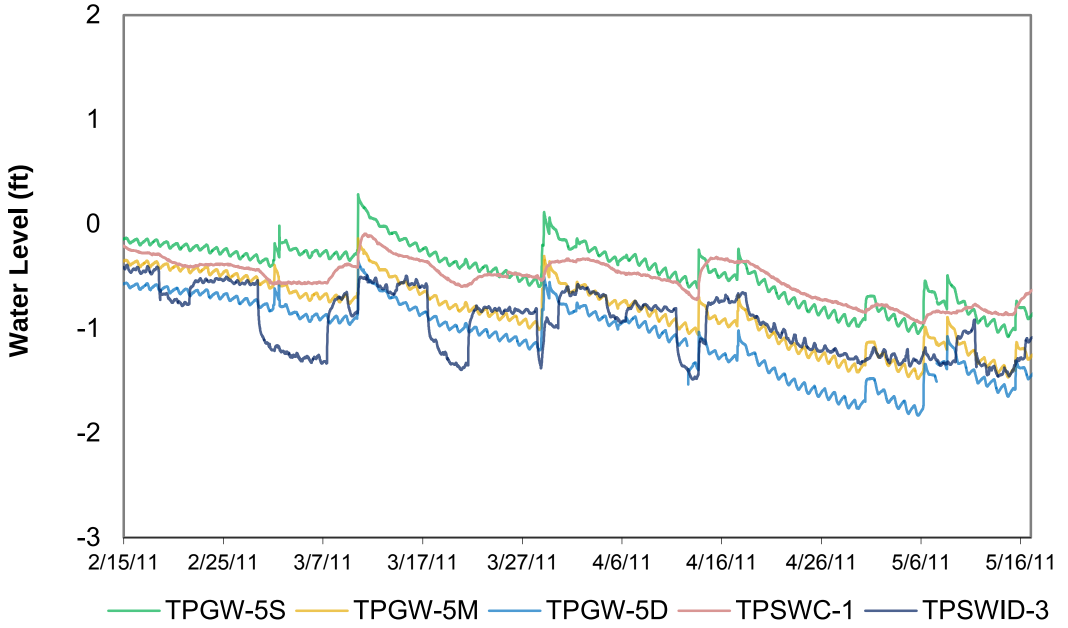


Figure 5.2-19. Effect of ID Operations on TPGW-5 Wells, TPSWC-1 and TPSWID-1.

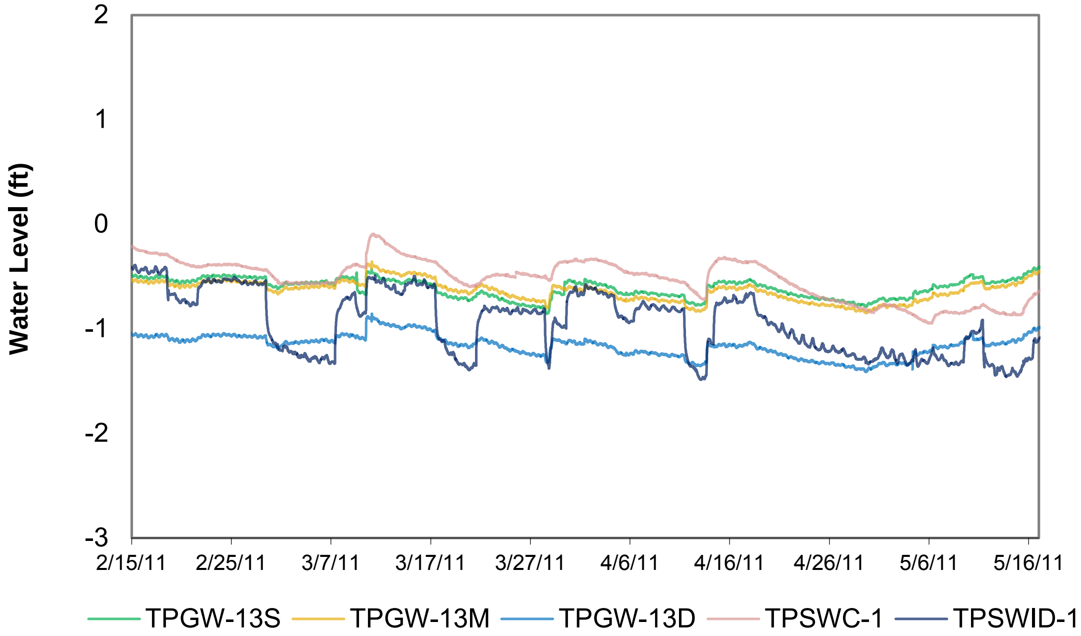


Figure 5.2-20. Effect of ID Operations on TPGW-13 Wells, TPSWC-1 and TPSWID-1.

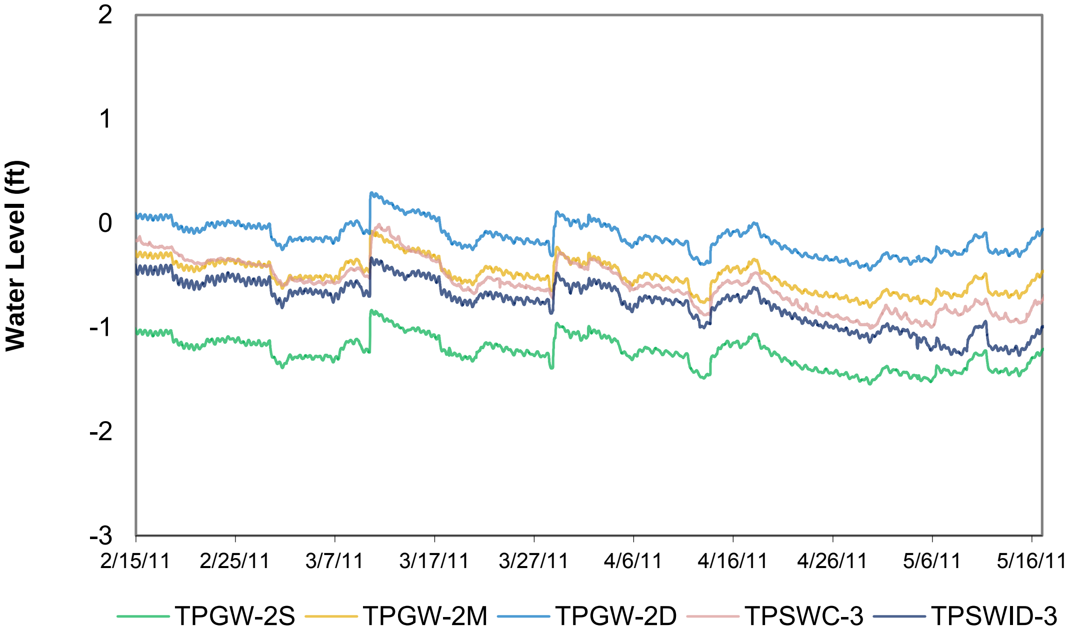


Figure 5.2-21. Effect of ID Operations on TPGW-2 Wells, TPSWC-3 and TPSWID-3.

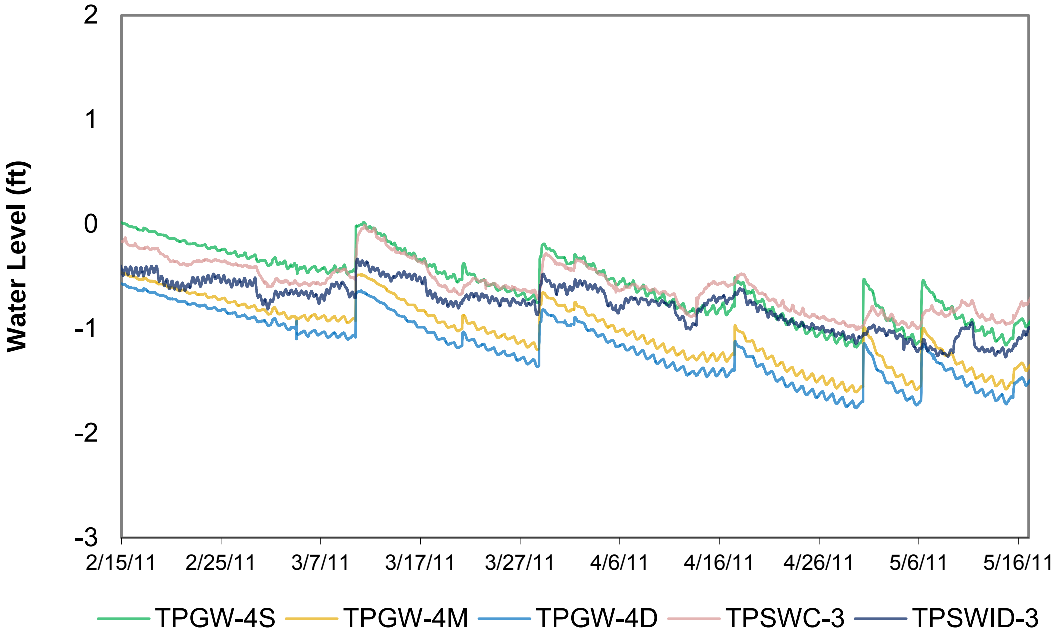
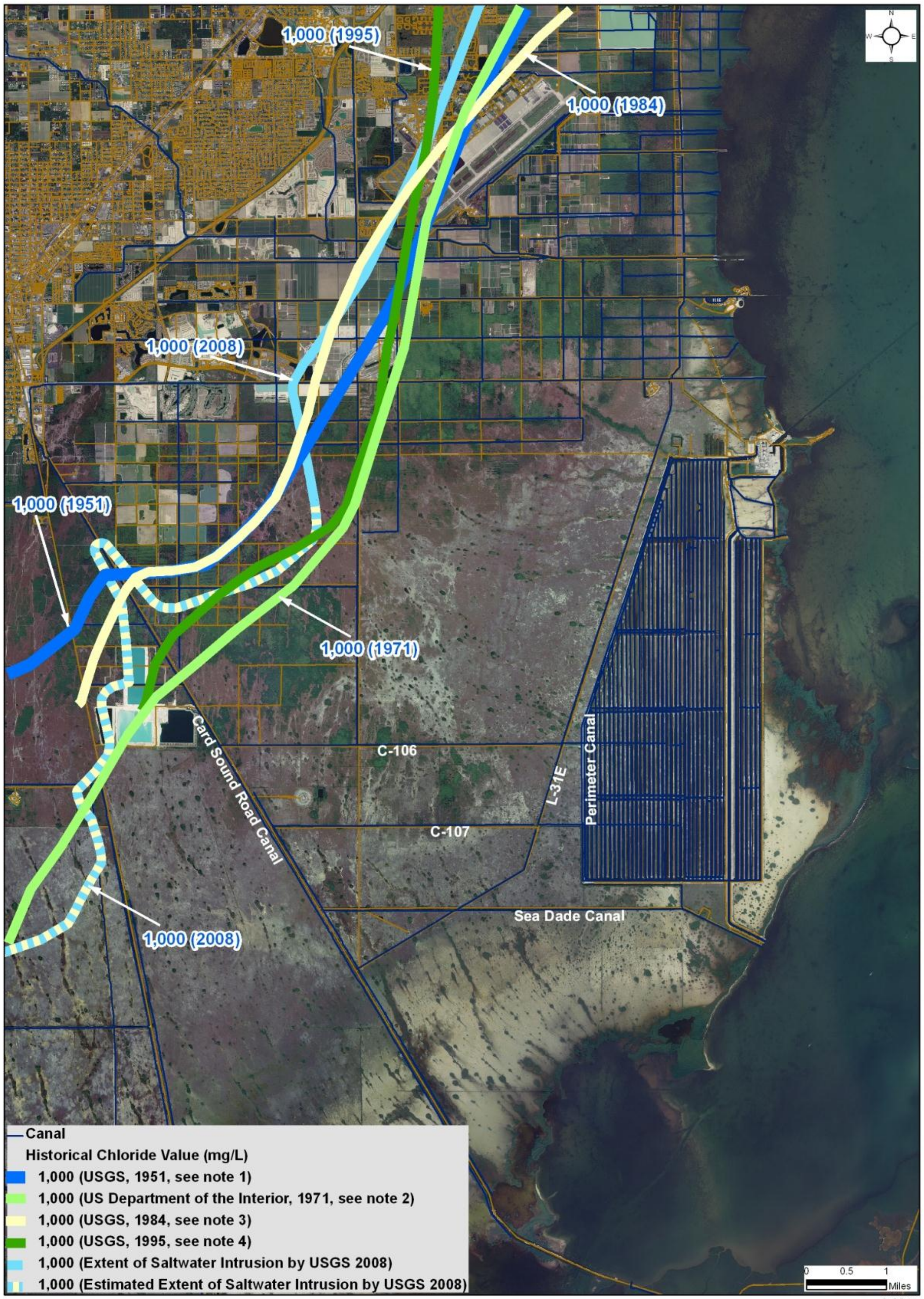


Figure 5.2-22. Effect of ID Operations on TPGW-4 Wells, TPSWC-3 and TPSWID-3.



Note 1: Source: US Department of the Interior. 1973. Resource and Land Information for South Dade County, Florida. Geological Survey Investigation I-850.
Note 2: Source: USGS, 1951. SaltWater Encroachment in Dade County, Florida. Information Circular No 9.
Note 3: Source: USGS, Delineation of Saltwater Intrusion in the Biscayne Aquifer, Eastern Dade County, Florida, 1995.
Note 4: Source: USGS, Delineation of Saltwater Intrusion in the Biscayne Aquifer, Eastern Dade County, Florida, 1995.

Figure 5.2-23. USGS Saltwater Intrusion Lines from 1951 through 2008.

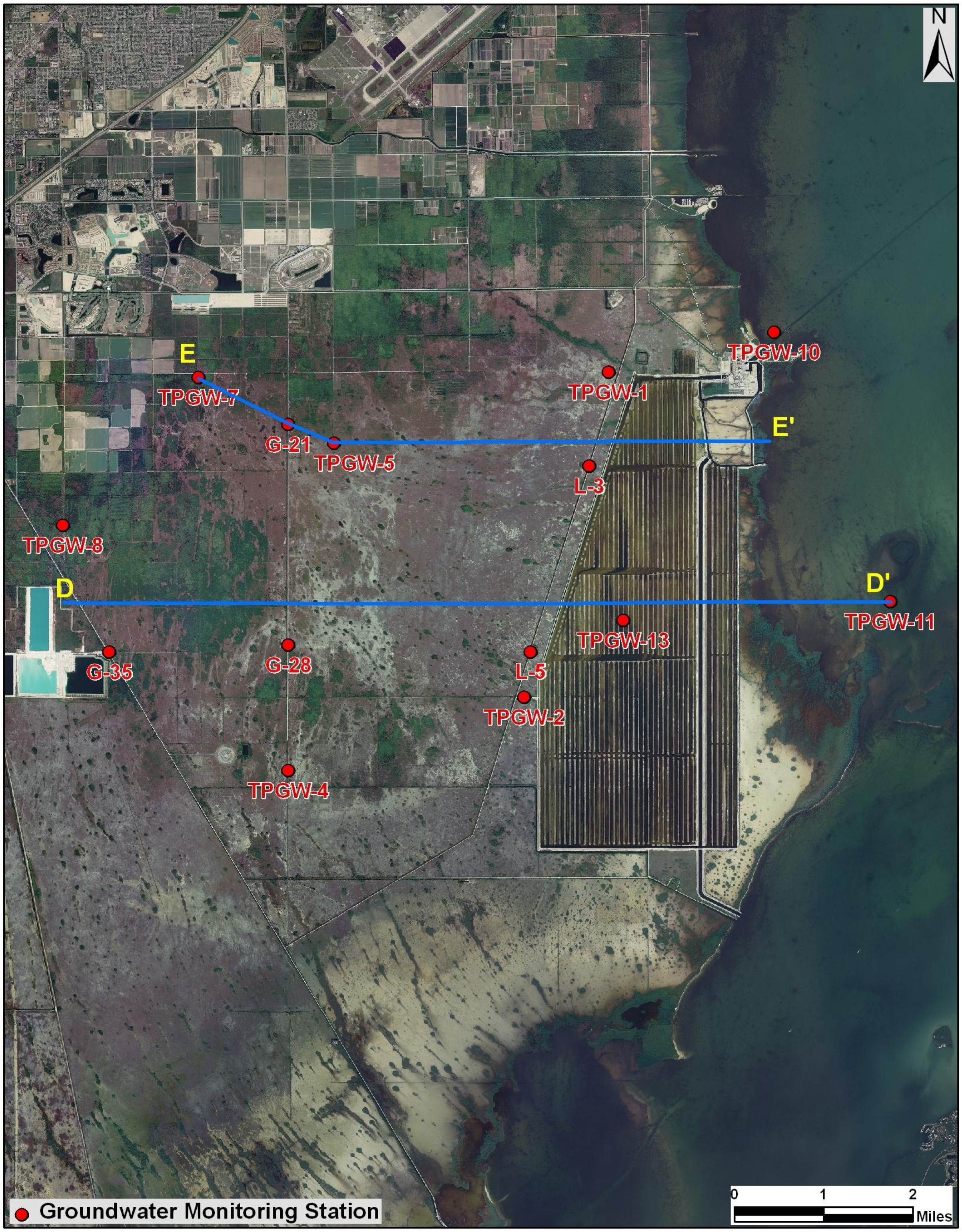
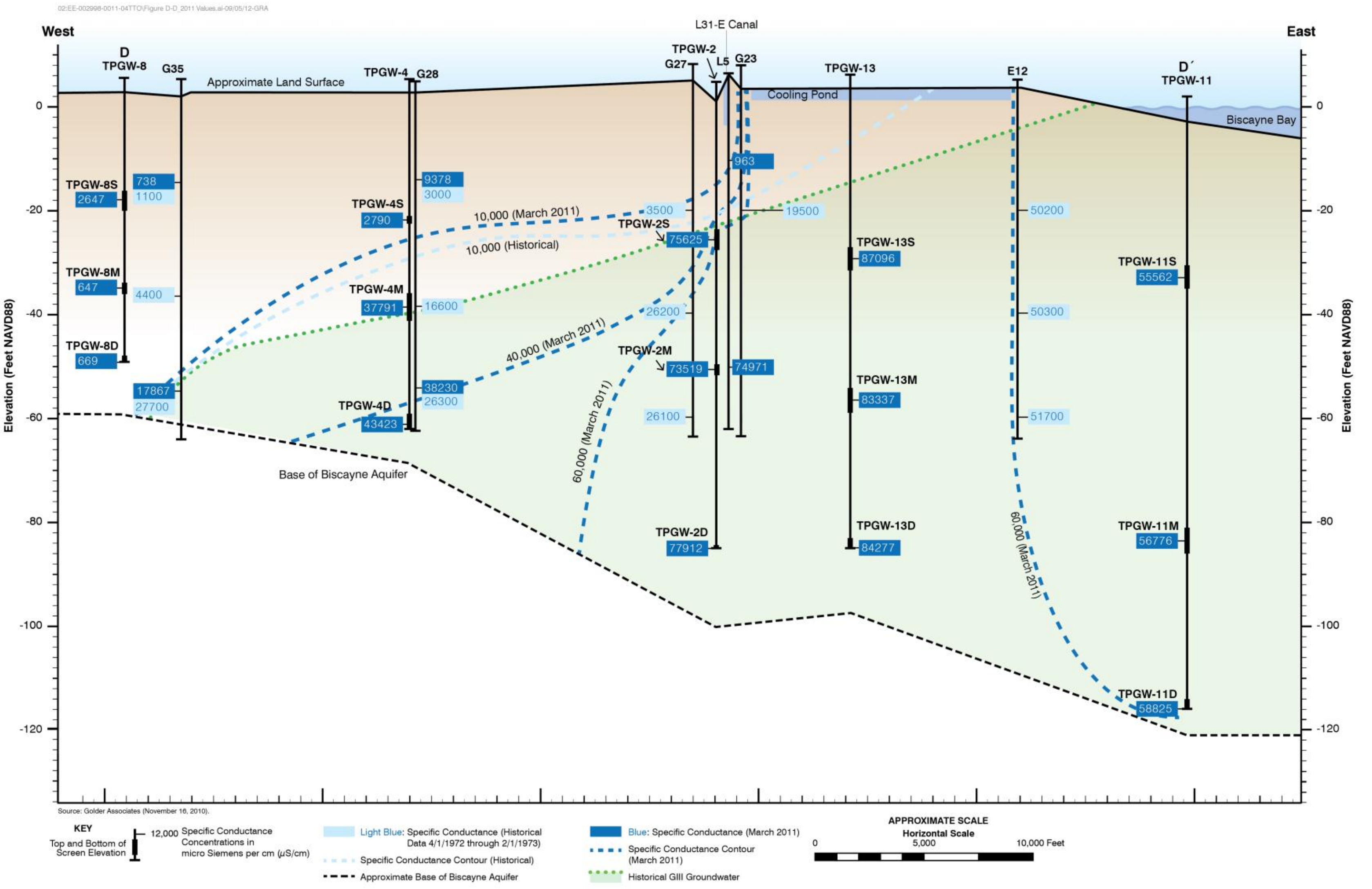
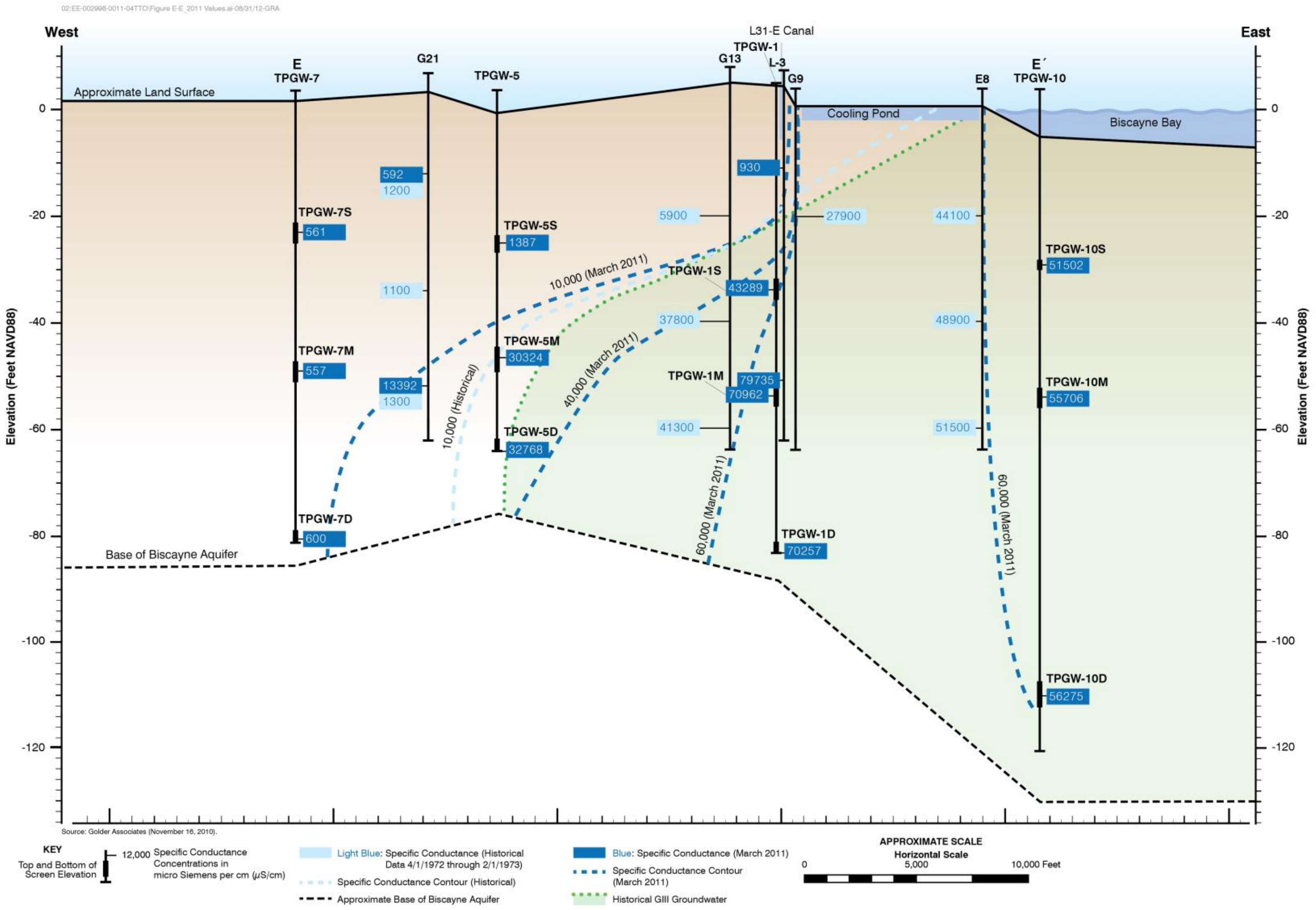


Figure 5.2-24. Locations of Specific Conductance and Tritium Cross Sections.



Source: Golder Associates (November 16, 2010).

Figure 5.2-25. Specific Conductance Cross Section D-D, Historical and Current Concentration Isopleths.



Source: Golder Associates (November 16, 2010).

Figure 5.2-26. Specific Conductance Cross Section E-E, Historical and Current Concentration Isopleths.

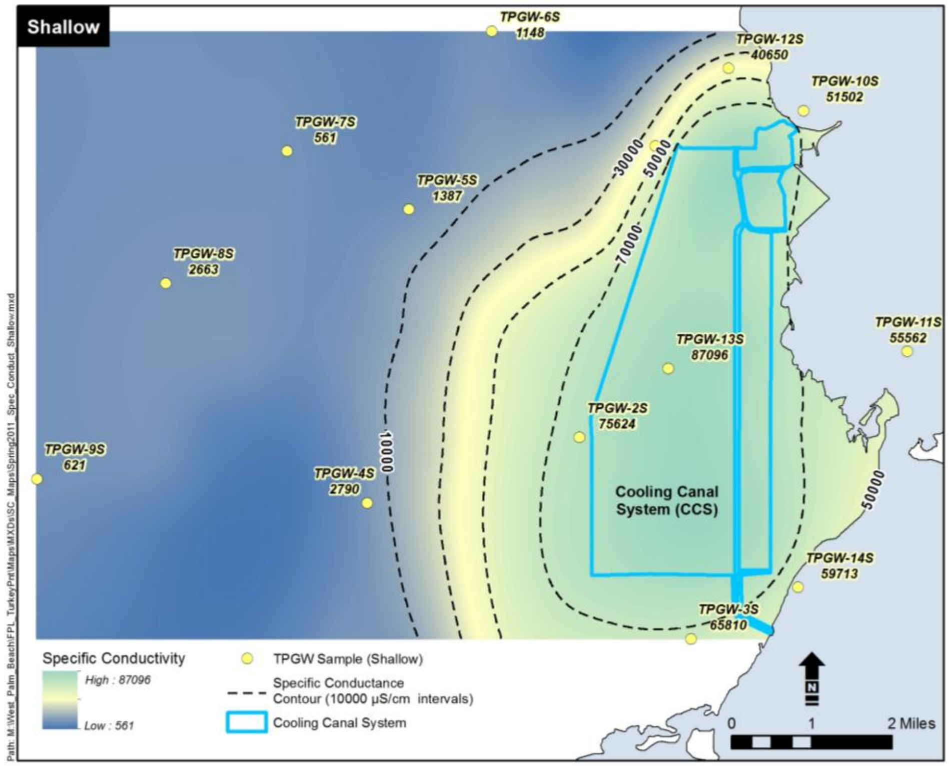


Figure 5.2-27. Plan View of Specific Conductance Isopleths, Shallow Zone Wells.

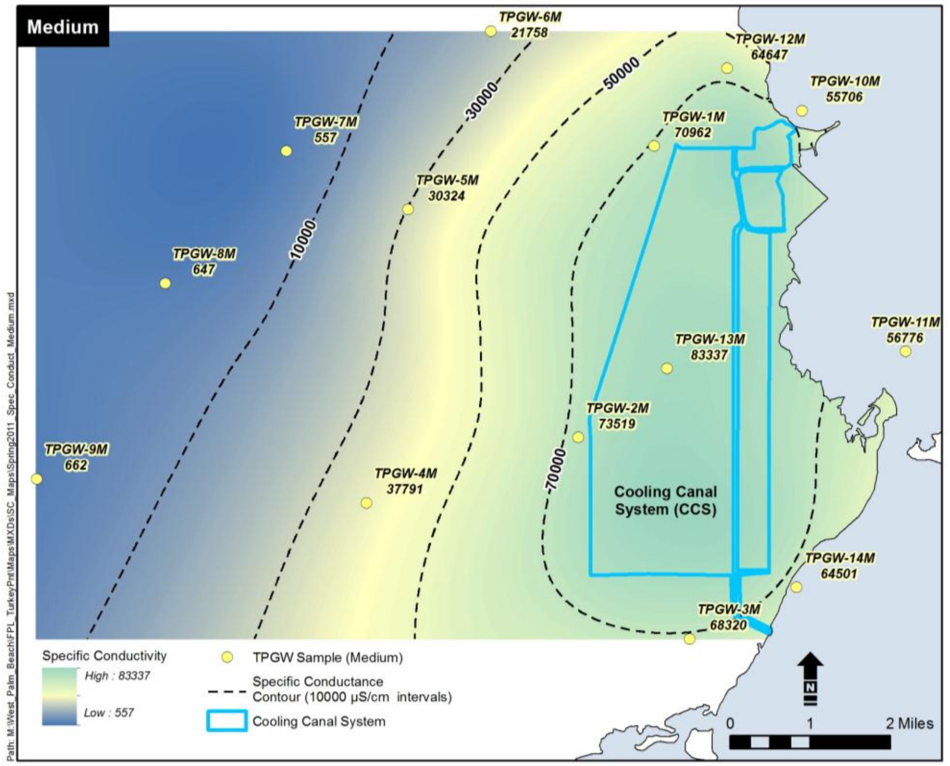


Figure 5.2-28. Plan View of Specific Conductance Isopleths, Intermediate Wells.

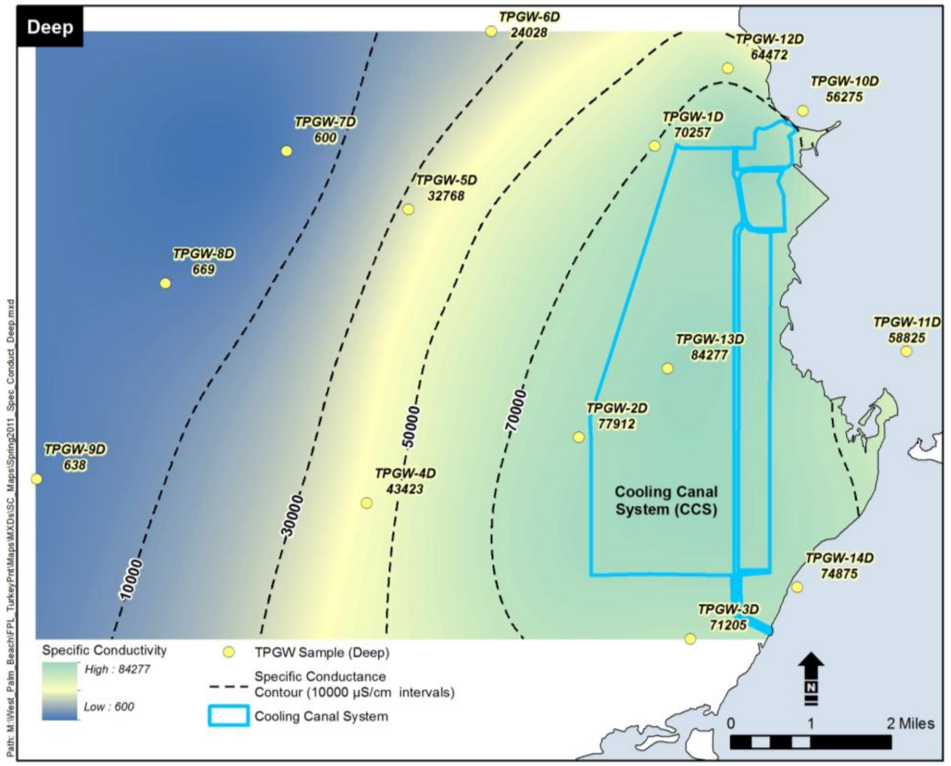
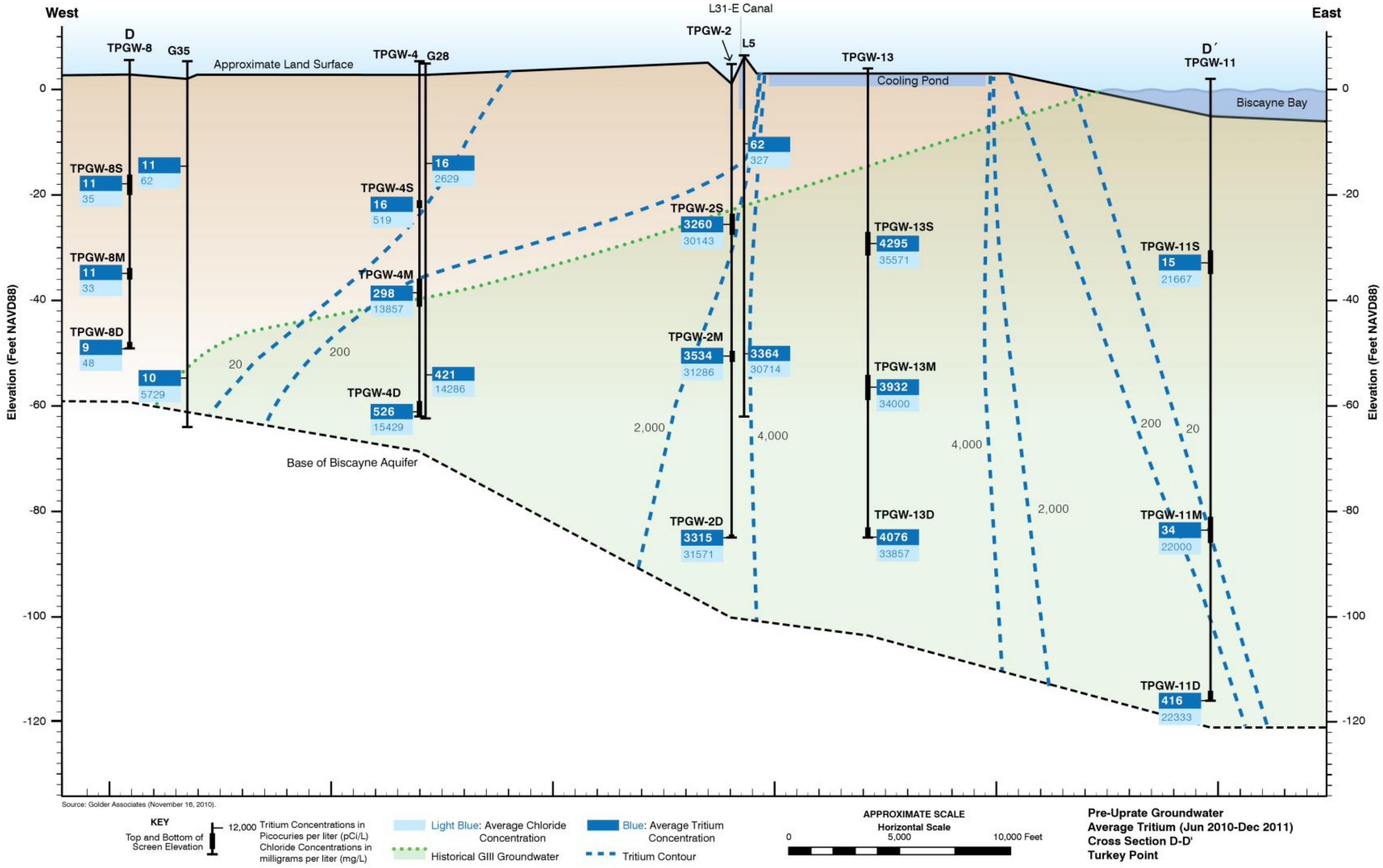


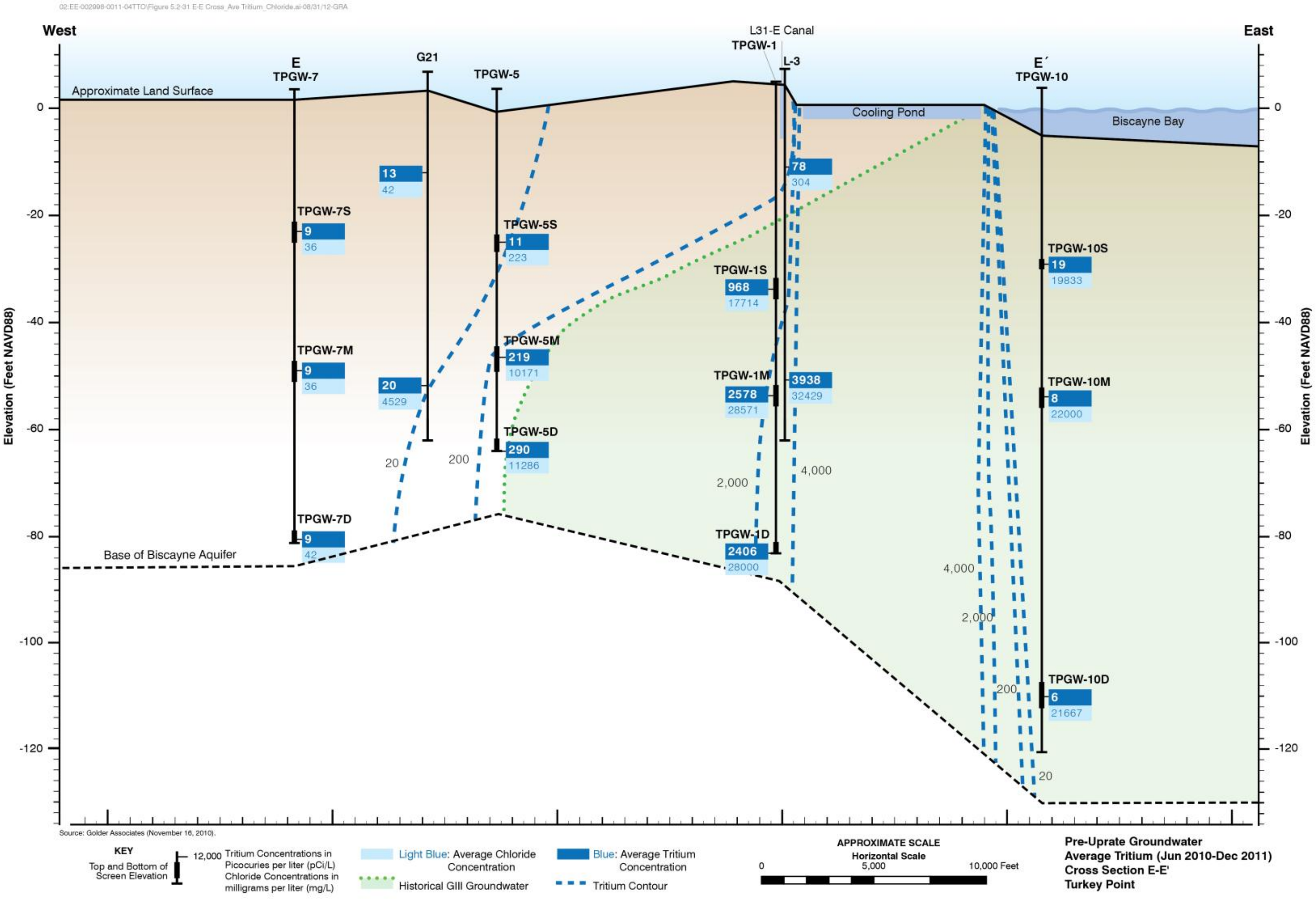
Figure 5.2-29. Plan View of Specific Conductance Isopleths, Deep Zone Wells.

02:EE-002998-0011-04TTO\Figure 5.2-30 D-D Cross_Ave Tritium_Chloride.ai-08/31/12-GRA



Source: Golder Associates (November 16, 2010).

Figure 5.2-30. Tritium Cross Section D-D, Average Concentration Isopleths.



Source: Golder Associates (November 16, 2010).

Figure 5.2-31. Tritium Cross Section E-E, Average Concentration Isopleths.

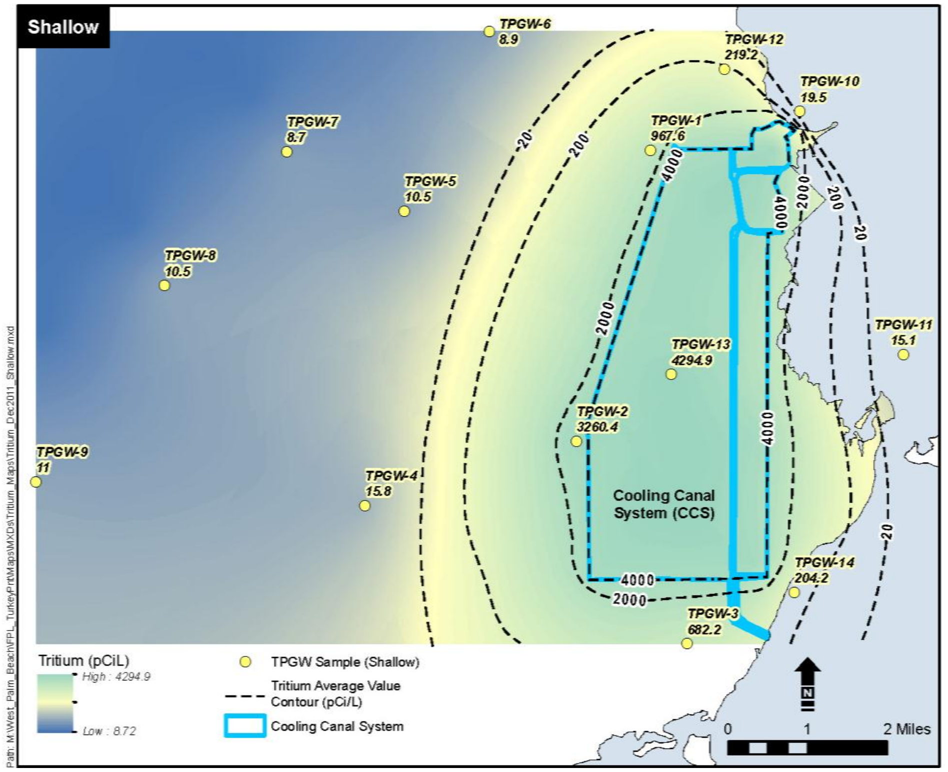


Figure 5.2-32. Plan View of Tritium Isopleths, Shallow Zone Wells.

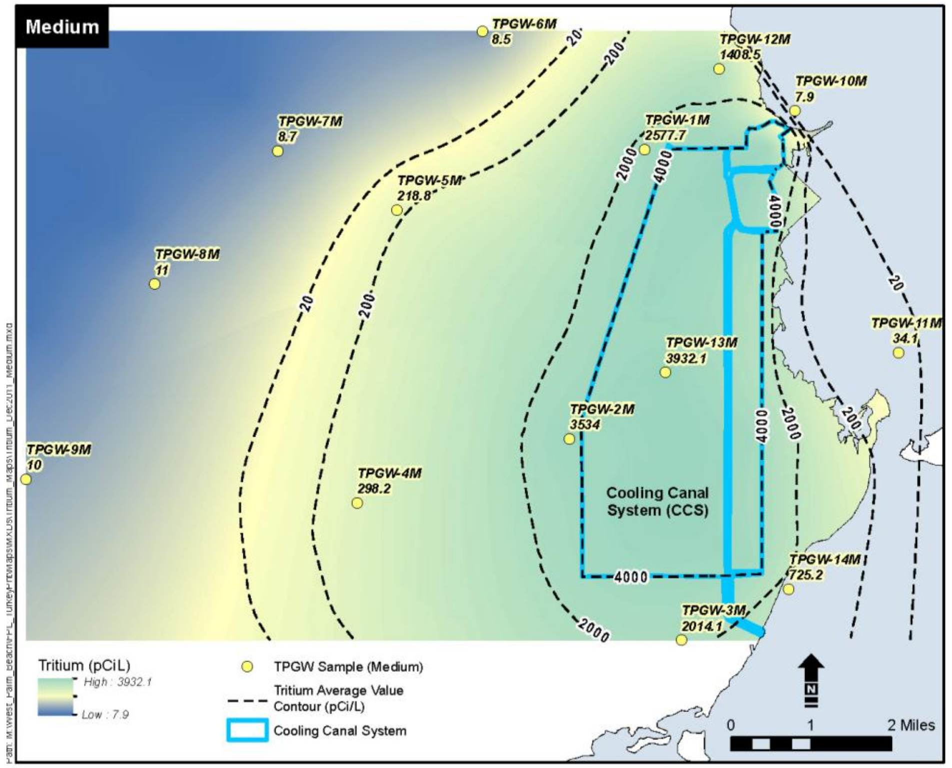


Figure 5.2-33. Plan View of Tritium Isopleths, Intermediate Zone Wells.

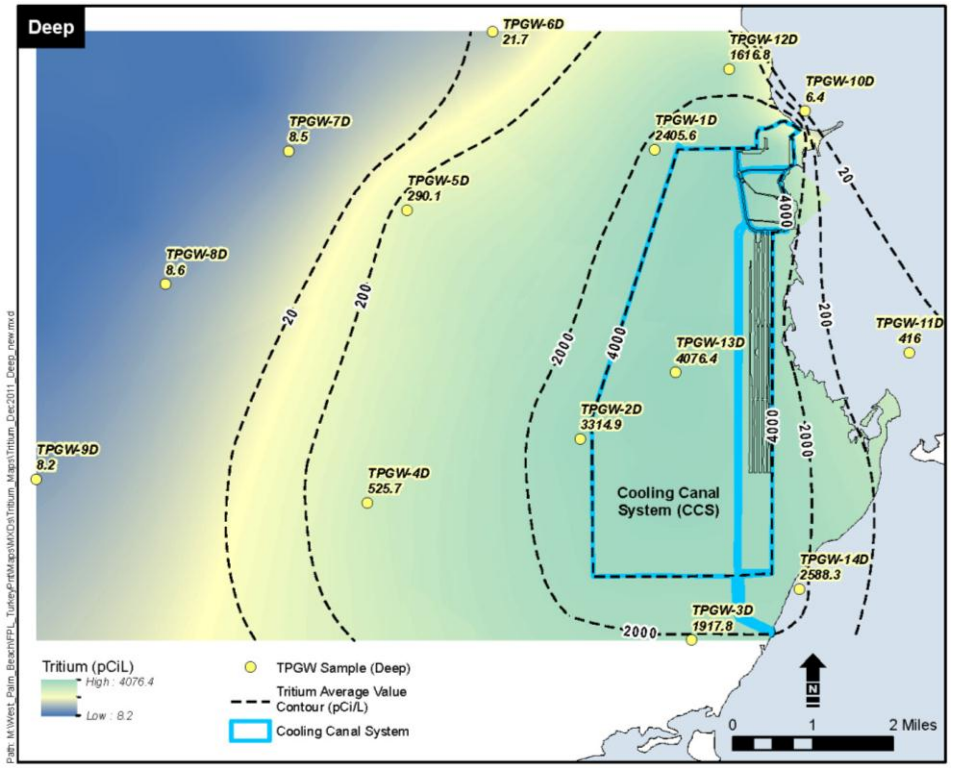


Figure 5.2-34. Plan View of Tritium Isopleths, Deep Zone Wells.

6

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	10	3	4	5	20	22	0
M	1	5	15	14	6	14	5
D	13	18	23	19	33	32	14

12

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	237	262	275	238	73	208	242
M	1795	1654	1740	1680	1260	1630	1630
D	1562	1830	1570	1640	1490	1706	1520

7

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	2	3	1	14	18	12	12
M	3	7	14	13	-1	14	12
D	4	4	6	2	5	25	13

1

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	1581	456	937	810	1320	830	840
M	2816	2653	2535	2440	2510	2740	2350
D	2579	2272	2658	2560	1980	2560	2230

10

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	NA	22	11	18	24	19	23
M	NA	8	12	3	15	7	3
D	NA	2	8	8	16	3	1

G-21

Dep	O-10	J-11	M-11	J-11	S-11	D-11
S	6	4	18	23	15	4
D	14	17	18	24	25	22

L-3

Dep	O-10	J-11	M-11	J-11	S-11	D-11
S	59	80	94	95	89	44
D	4070	4040	3960	3730	4010	3440

5

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	10	20	0	0	16	32	0
M	293	175	218	222	156	224	243
D	188	343	295	283	288	319	315

8

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	4	13	0	7	17	24	10
M	4	12	3	4	24	16	13
D	7	0	4	13	29	12	-2

11

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	NA	15	16	2	22	26	10
M	NA	27	28	34	26	43	48
D	NA	347	338	435	429	467	480

L-5

Dep	O-10	J-11	M-11	J-11	S-11	D-11
S	89	65	80	113	5	54
D	3380	3320	3270	3438	3350	4040

13

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	4370	3554	3460	3800	4190	6390	4300
M	4179	3986	3980	4030	3800	3910	3640
D	4785	4390	4180	3830	3650	3850	3850

G-35

Dep	O-10	J-11	M-11	J-11	S-11	D-11
S	12	16	12	8	2	19
D	2	0	0	16	-2	12

G-28

Dep	O-10	J-11	M-11	J-11	S-11	D-11
S	7	14	31	17	17	8
D	436	440	411	410	430	424

2

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	3168	3075	2910	3030	3670	3310	3660
M	3328	3460	3250	3520	3690	3720	3770
D	3232	3522	3420	3320	3270	3100	3340

9

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	4	7	10	11	10	24	11
M	16	0	8	8	16	19	7
D	8	0	5	2	13	17	14

4

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	9	19	15	19	10	24	15
M	325	321	277	246	281	340	297
D	506	611	581	519	433	520	510

14

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	NA	228	230	247	186	175	159
M	NA	688	851	772	600	790	650
D	NA	2580	2640	2660	2490	2620	2540

3

Dep	J-10	S-10	D-10	M-11	J-11	S-11	D-11
S	854	852	823	236	620	770	620
M	1990	2178	2110	1940	1960	2130	1790
D	1990	1041	2053	1980	2070	2270	2020

Note: 1) J-10: Jun-2010; S-10: Sep-2010; D-10: Dec-2010; M-11: Mar-2011; J-11: Jun-2011; S-11: Sep-2011; D-11: Dec-2011.
2) Samples for wells L-5, L-31, G-21, G-28, and G-35 were taken at depths of 18 ft and 58 ft.
3) NA: Not Available.

Tritium Samples Taken at 3 Depths (S: shallow; M: intermediate; D: deep)

Figure 5.2-35. FPL Monitoring Wells Potentially Influenced by CCS Water.

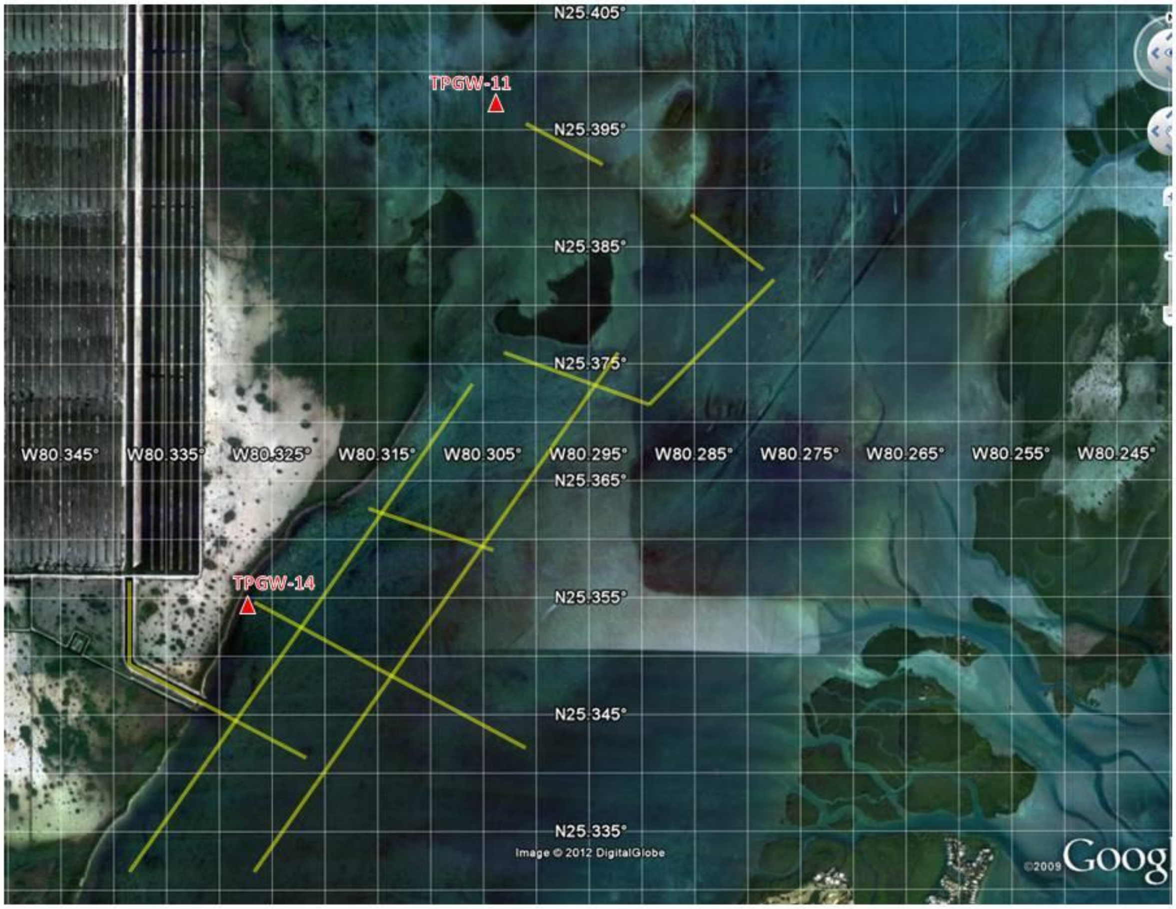
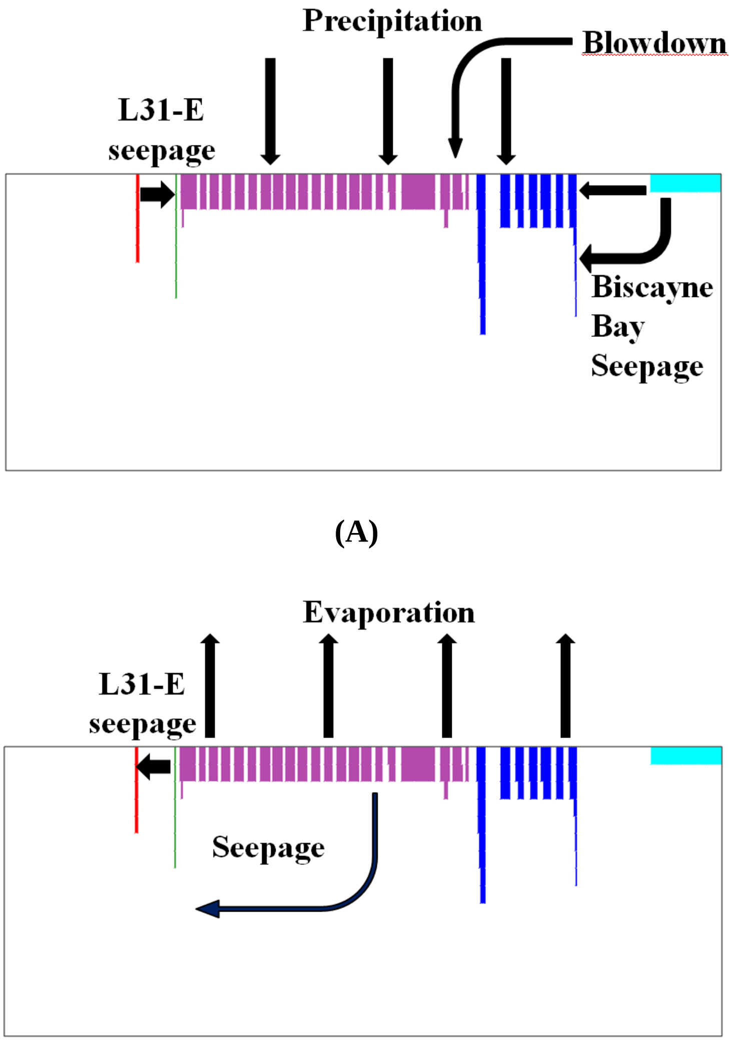


Figure 5.3-1. Transects for Biscayne Bay Pilot Geophysical Survey.



(A)

(B)

Figure 5.4-1. Flow (A) Into and (B) Out of the Proposed Control Volume, Shown in Cross-Section.

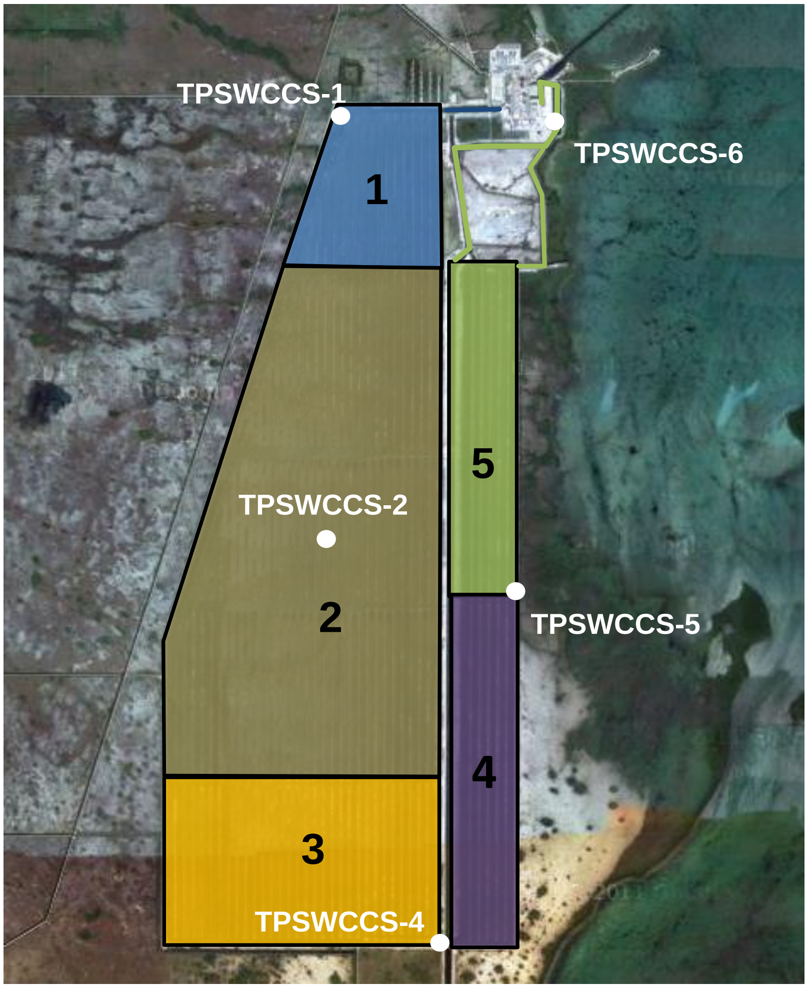


Figure 5.4-2. Locations of the Five Zones Where the Time-Varying Surface Areas and Storage Volumes are Known.

Figure 5.4-3. Locations of L-31E and ID Monitoring Stations; Conceptualized Seepage from L-31E into the ID is Shown.

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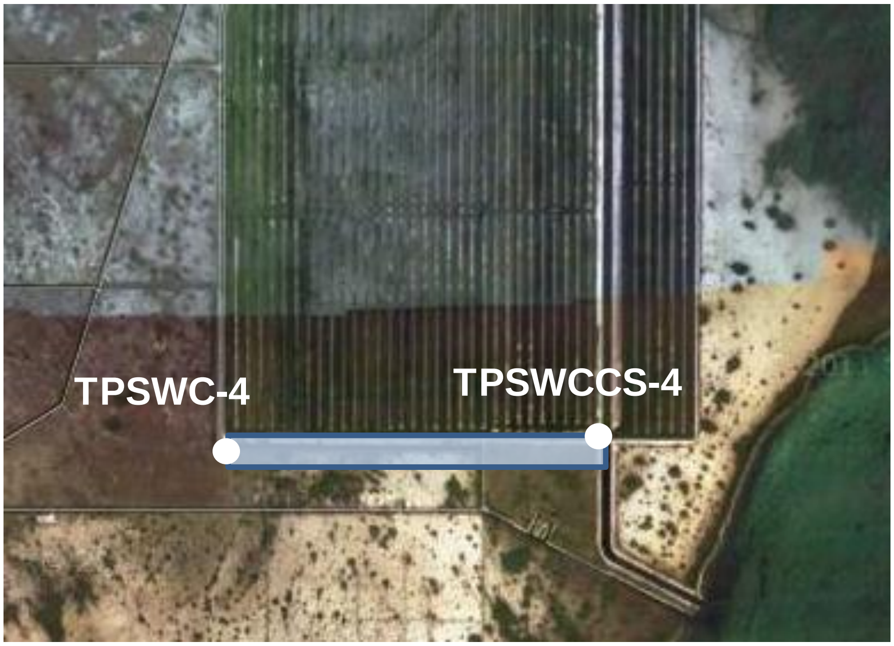

Figure 5.4-4. Locations of TPSWCCS-4 and TPSWC-4 Monitoring Stations; Conceptualized Seepage from Southern Collector Canal into the CCS is Shown.

Figure 5.4-5. Locations of TPSWCCS-5, TPSWCCS-6 and TPBBSW-3 Monitoring Stations; Conceptualized Seepage from Biscayne Bay into the CCS is Shown.

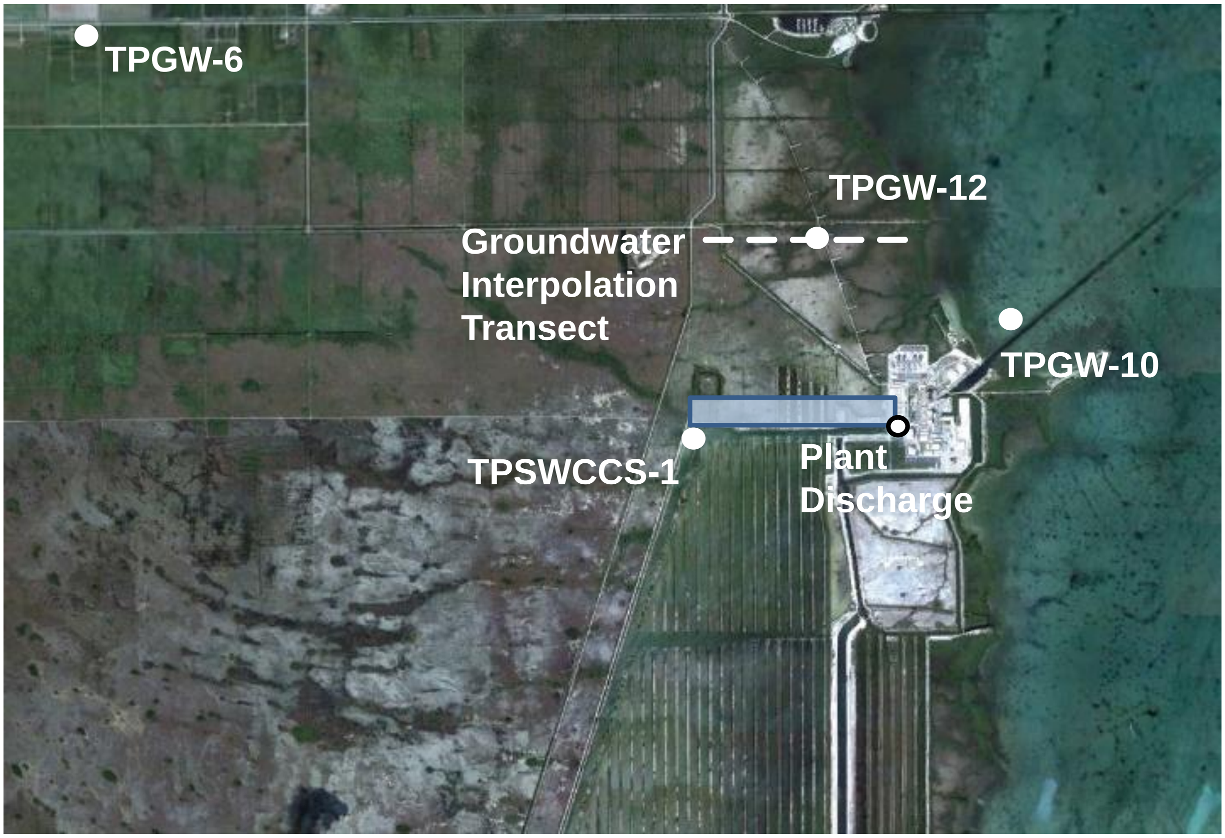

Figure 5.4-6. Locations of TPGW-6, TPGW-10, and TPGW-12 Shallow Groundwater Monitoring Stations, TPSWCCS-1 Surface Water Monitoring Station, and TPFM-1 Plant Outflow Meter; Conceptualized Seepage from the CCS into the Shallow Groundwater is Shown.

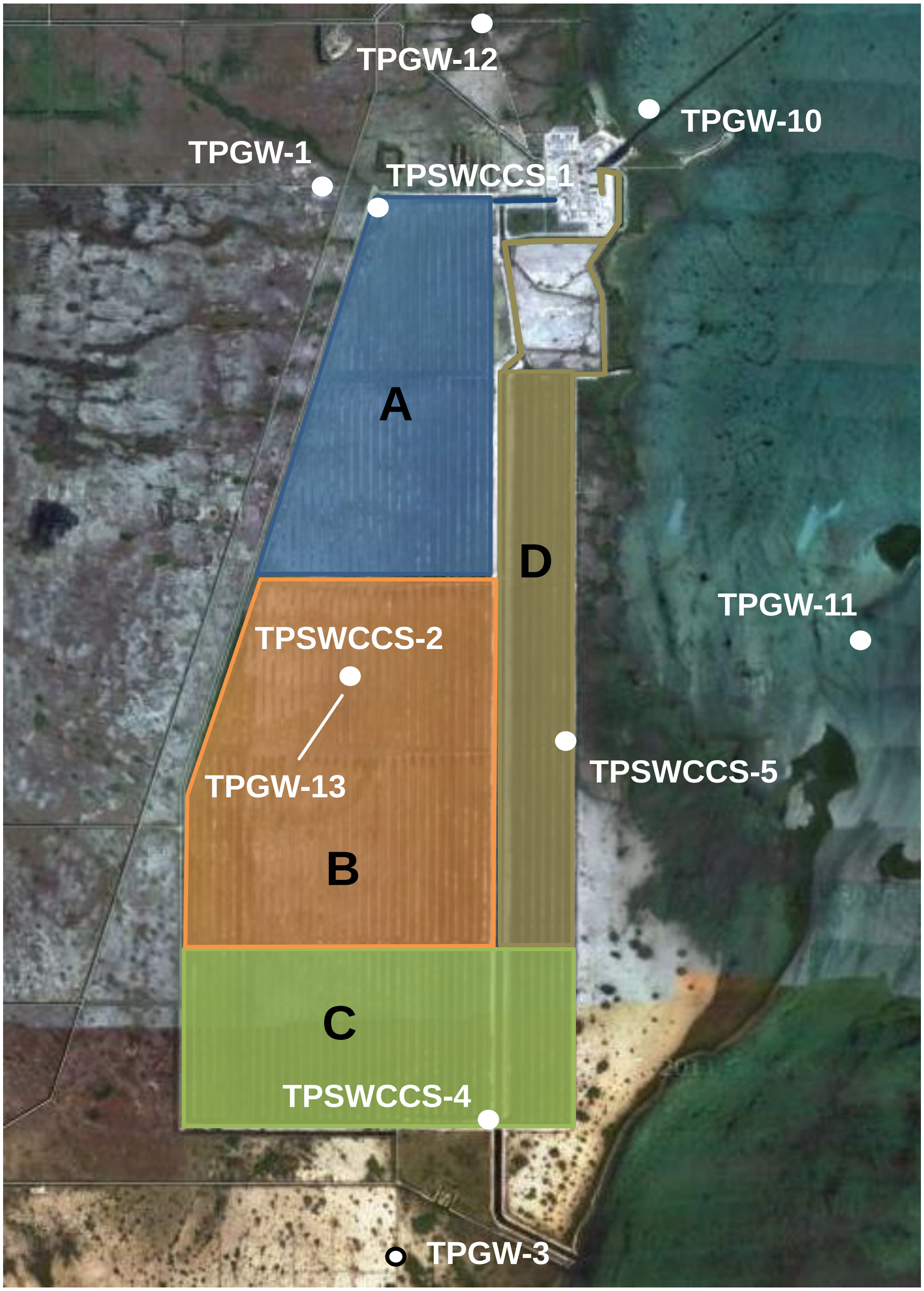

Figure 5.4-7. Locations of TPGW and TPSWCCS Monitoring Stations and Four Zones that Subdivide the Control Volume (Zone A Extends Eastward along the Northern Canal to Plant Outflow, Zone D Extends North to the Plant Intake).

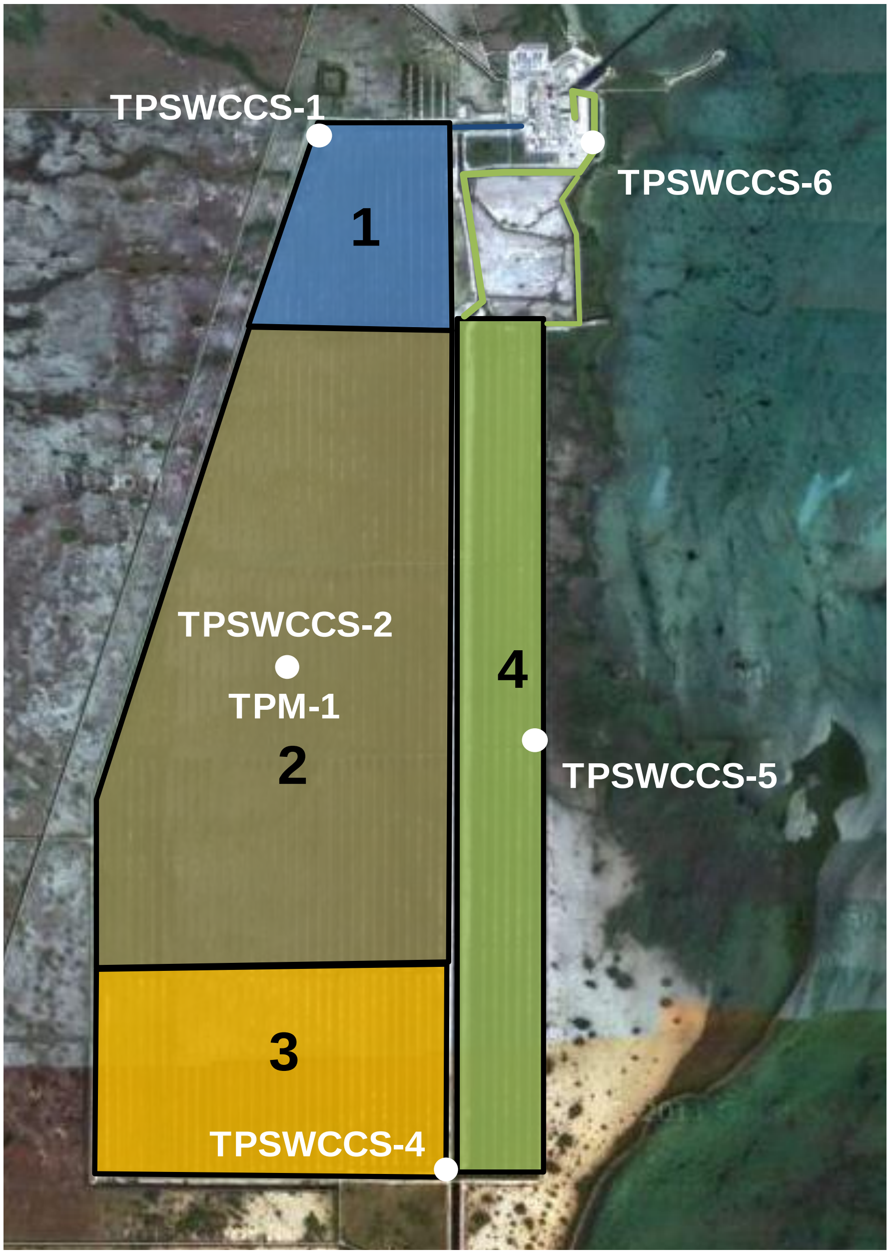

Figure 5.4-8. Locations of CCS Monitoring Stations, Meteorological Station TPM-1 and Four Zones that Subdivide the Control Volume (Zone 1 Extends Eastward along the Northern Canal to Plant Outflow, Zone 4 Extends North to the Plant Intake).

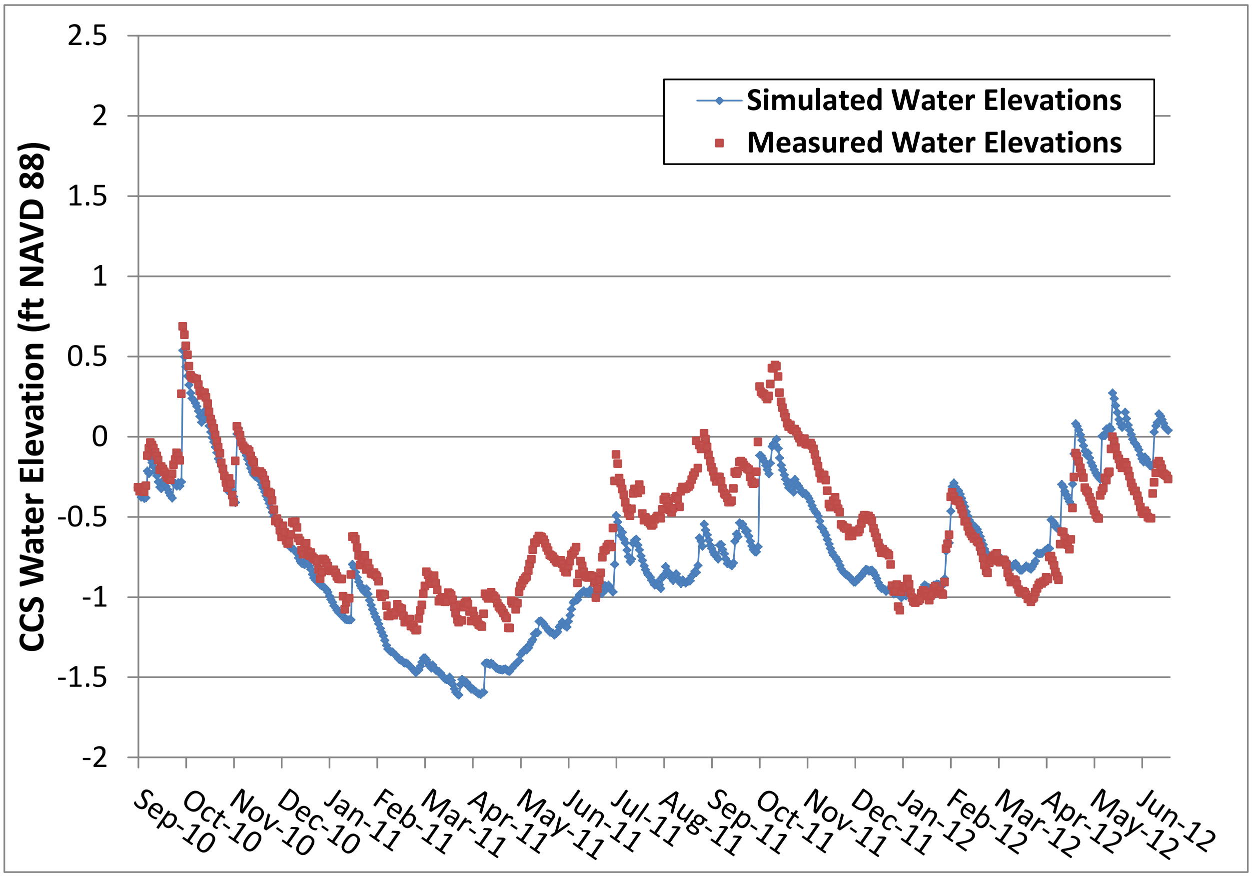

Figure 5.4-9. Modeled Versus Measured Water Elevations in the CCS over the 22-Month Period; Used to Validate the Conceptual Model and Calibrate the Water Balance Model to Temporal Trends in Water Elevation.

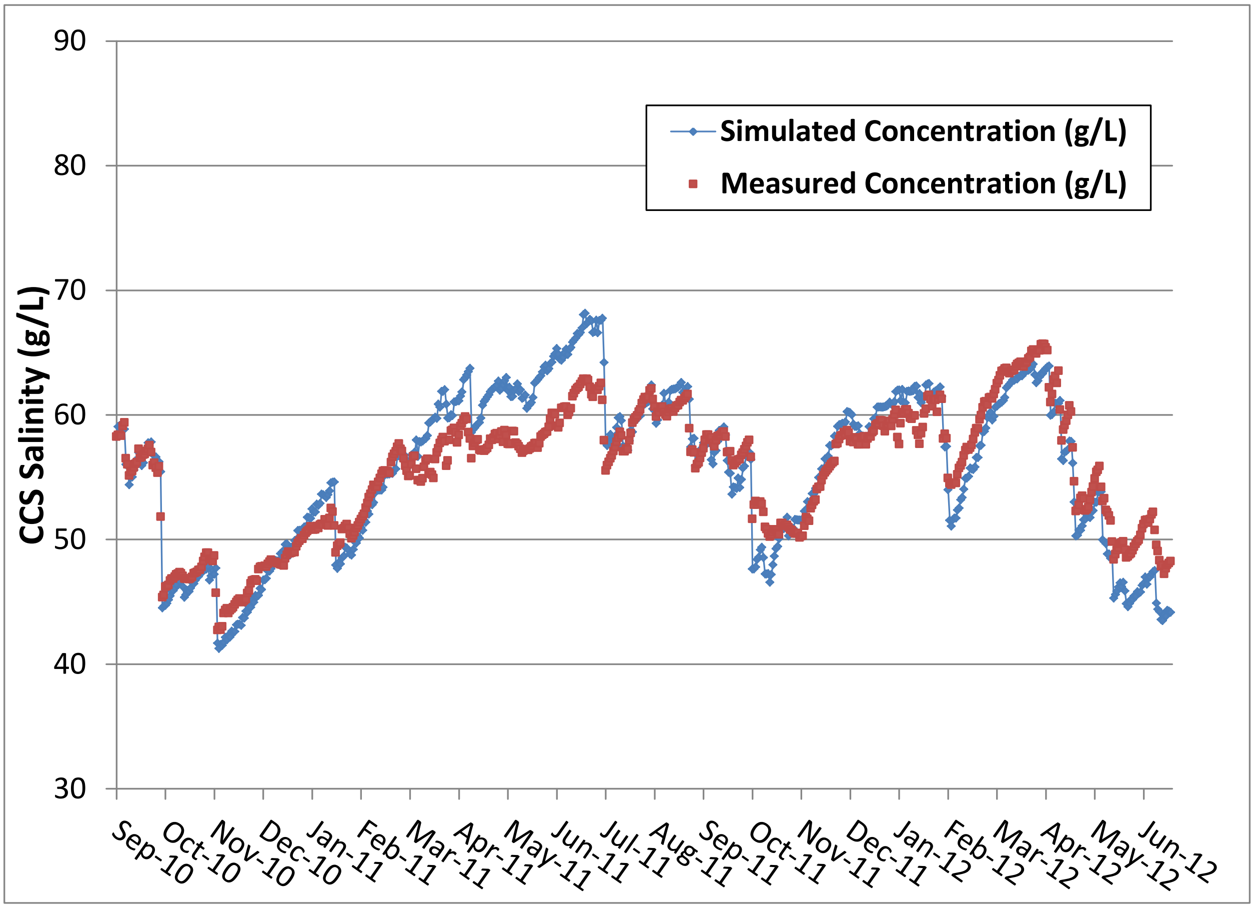

Figure 5.4-10. Modeled Versus Measured Salinities in the CCS over the 22-Month Period; Used to Validate the Conceptual Model and Calibrate the Salt Balance Model to Temporal Trends in Salinity.

6. INTERCEPTOR DITCH OPERATION

6.1 INTRODUCTION

FPL has prepared annual reports on the Interceptor Ditch (ID) operation and groundwater conditions (Annual Groundwater Monitoring Report) in compliance with the Agreement between FPL and the SFWMD, dated July 15, 1983 (the Agreement). The Agreement outlined the criteria for operating the ID pumps and the groundwater monitoring including groundwater levels, conductivities, and temperatures in wells L-3, L-5, G-21, and G-28. Also, surface water levels were required to be monitored in the L-31E, ID, and westernmost CCS canal (C-32) at five transects (A through E). The operation of the ID is designed to prevent any seasonal inland movement of the saltwater into the potable portion of the Biscayne aquifer west of the site. The saline groundwater is intercepted by the ditch and pumped back to the CCS during the dry season when natural freshwater hydraulic gradients are low and the potential for saltwater intrusion exists. Pumping the water from the ID to the CCS creates a seaward gradient east of the L-31E, thereby restricting inland movement of cooling canal water in the upper zones of the aquifer. The monitoring program provides water level information that triggers the need to pump the ID as well as assist in the evaluation of ID operations.

On October 14, 2009, the Agreement was modified to expand the monitoring program as part of the Units 3 and 4 Uprate Project and added well G-35 to the historical monitoring network. This modified agreement resulted in two annual reports being submitted: one for the ID operation/groundwater monitoring and one for the Units 3 and 4 Uprate monitoring. On August 2, 2012, FPL and SFWMD agreed to consolidate the annual ID reporting into the Turkey Point Plant Annual Report. Combining the reports helps improve the efficiency and consistency of reporting and storage of data.

The information presented in this section pertains to the operation of the ID from June 1, 2011 through May 31, 2012 and includes the same type of information as presented in previous ID operation reports (i.e., Golder Associates Inc. 2010, 2011b). For consistency, the focus of this section is the historical L and G wells and the operation of the ID. Figure 6.1-1 shows the well locations and five surface water transects A through E. Information on wells installed as part of the Uprate Project can be found in Sections 2 and 3 of this report. Where appropriate, references to the data in these sections will be made.

6.2 OPERATIONAL OR STRUCTURAL CHANGES

FPL proposed a more conservative, revised operation procedure for the ID based on consideration of freshwater head equivalents for the surface water transects. The proposed revisions were submitted to the SFWMD in 2011. The SFWMD requested clarification of several aspects of the monitoring procedures and FPL provided further clarification in October 2012.

Per the 1983 Agreement, the criteria basically were as follows:

- If the L-31E water elevation minus the C-32 water elevation is greater than 0.20 ft then no pumping of ID is necessary, a seaward gradient exists.
- If the L-31E water elevation minus the C-32 water elevation is less than 0.20 ft, a natural seaward gradient may still exist if the L-31E water elevation minus the ID water elevation is greater than 0.30 ft.
- If a natural seaward gradient does not exist, create an artificial gradient by pumping the ID until the ID is maintained at an elevation of at least 0.30 ft lower than L-31E.

FPL followed the above criteria until December 2011. Since that time, FPL opted to follow the more conservative operational criteria which were as follows:

- If the L-31E water elevation minus the C-32 water elevation is greater than 0.30 ft then no pumping of ID is necessary, and a seaward gradient exists
- If the L-31E water elevation minus the C-32 water elevation is less than 0.30 ft, a natural seaward gradient may still exist if the L-31E water elevation minus the ID water elevation is greater than 0.30 ft and the density of the water in the ID is less than or equal to 1.012 g/cm3. If a density in the ID is higher than 1.012 g/cm3, a higher elevation difference between L-31E and the ID is necessary and can be calculated by converting the surface water levels to freshwater head equivalents.
- If a natural seaward gradient does not exist, create an artificial gradient by pumping the ID until the ID is maintained at an elevation of at least 0.30 to 0.70 ft depending on the density of the ID water.

The primary change in operation is the increase in the L31E – C32 criteria and the consideration of variable density effects in the ID.

The operation of the ID pumps is based on water level readings at each of the five surface water transects. Traditionally, FPL has taken manual water level readings at least once every week during the dry season and at least twice a month during the wet season (Appendix M). When the Uprate Monitoring Plan was approved by the Agencies, automated stations were installed at Transects A, C, and E. As discussed in Section 2, these stations report data at 15-minute intervals and typically transmit by telemetry to a database every day. FPL is still going out at least once every week at each transect during the dry season, and at least twice per month during the wet season, to manually record water levels but is using the automated data to determine if they need to visit the sites more frequently and operate the ID pumps (Appendix M).

FPL has noted that over the last two dry seasons the transects which most often trigger ID pumping have changed from the northerly transect A to the southerly transects D and E. This has occurred since an earthen plug was installed by the SFWMD between Transects A and B in

L-31E. The plug holds back water north of it in L-31E; this keeps L-31E transect A water levels higher but adversely lowers L-31E water levels south of the plug. Since one of the primary criteria for pumping is controlled by maintaining higher water levels in L-31E, the plug is affecting the ID pumping, possibly in an adverse way by requiring more pumping. FPL has made the SFWMD aware of the situation and will discuss this further with the SFWMD.

6.3 Meteorological Conditions

Meteorological data are set forth in Section 2.4 of this report and include data collected from TPM-1 and a number of other rainfall gauges installed around the project area. Daily rainfall data have been traditionally recorded by SFWMD at structure S-20 located along the L-31E. Figure 6.3-1 shows the monthly rainfall at S-20F and TPM-1 for the ID reporting period from June 2011 through May 2012 and compares them to historical averages (1968 to 2011) at S-20F.

The rainfall measured for the 2011-2012 monitoring period was above the 1968 to 2011 average for the area for Station S-20F. Also, rainfall at TPM-1 was higher than at the S-20F station for the June 2011 through May 2012 time period. The rain gauge at structure S-20F recorded 54.28 inches of precipitation from June 2011 to May 2012, while 70.80 inches of rain was recorded at TPM-1. The historical average at S-20F is 46.03 inches.

As shown on Figure 6.3-1, the rainfall distribution for this past year was concentrated in the months of July through October in 2011 with additional heavy rainfall totals in February, April, and May 2012. February and April are traditionally designated as part of the dry season and June is typically designated as part of the wet season. During an average year, approximately 74% of the precipitation occurs during the wet season with the remainder occurring during the six-month-long dry season (November to April). During this past year, approximately 70% of the annual rainfall occurred during the wet season at S-20F and TPM-1,

The 2011 hurricane season produced no significant storms during the monitoring period.

6.4 WATER QUALITY AND WATER LEVEL RESULTS AND DISCUSSION

6.4.1 Groundwater Levels

Groundwater levels are manually measured and samples are collected quarterly in the historical wells L-3, L-5, G-21, G-28, and G-35. Prior to March 2011, these levels were measured near the start of July, October, January, and April. However, since March 2011, the measurements and samples are collected in June, September, December, and March to align the ID monitoring efforts with the Uprate monitoring efforts.

Figure 6.4-1 shows the groundwater levels measured during the period from June 2011 through March 2012 and the maximum and minimum levels recorded during the historical period. The start dates for the historical period for each well are as follows:

- L-3 - April 1974
- L-5 - January 1976
- G-21 - April 1972
- G-28 - April 1972
- G-35 - April 1972

The historical period for wells L-3, L-5, G-21, and G-28 was extended to include present data for this report. Data were not recorded for well G-35 between 1983 and 2010; therefore, the historical envelope for this well covers a limited period. Since sampling is now being taken one month later than previously conducted, the historical maximum and minimum may not be entirely applicable but do still provide a frame of reference.

In June 2011, the water levels were far below historical maximum values. Well G-35 had water at its lowest level (-0.78 ft) since data began to be recorded at this site. The other four wells had water levels from approximately 0.7 to 1.7 ft above their historical minimums and, with the exception of L-5, had water levels within a few tenths of a foot to those found in G-35. L-5 had the highest water levels (-0.19 ft NAVD 88) in June 2011. For the events in September 2011, December 2011, and March 2012, the water levels were much higher with the L-3 and L-5 water levels ranging between -0.1 and 0.5 ft NAVD 88 and the G-21 and G-28 water levels ranging between 0.1 and 1.1 ft NAVD 88. Well L-5 showed the least amount of variability. The water levels in G-35 showed the greatest variability and quickly rebounded with the onset of the rains in late June and July 2011. For the remaining three monitoring periods, the water levels in G-35 ranged from 1.5 to 2.25 ft NAVD 88 and came within several tenths of a foot to the historical maximum. Except for the water levels in the L-5 well in June 2011, water levels in the G-series wells were higher than those in the L-series wells.

6.4.2 Vertical Groundwater Temperature Profiles

Groundwater temperatures are measured on a quarterly basis at 1-ft intervals throughout the water column in L-3, F-5, G-21, G-28, and G-35. For this monitoring period, temperatures were recorded in June 2011, September 2011, December 2011, and March 2012. Figures 6.4-2 through 6.4-6 show the temperature profile with depth and are compared with the historical envelope for each well where available. As reported by Golder Associates Inc. (2011b), the historical envelope represents both the highest and lowest temperatures recorded during the period from July 1981 through June 1991. The historical period represents the time during which the CCS came to equilibrium, as first described in the 1990 Annual Report.

Well L-3 had only minor excursions (< 1°C) above the historical maxima for several depths intervals in June 2011 (-41 to -53 ft NAVD 88), September 2011 (-14 to -25 ft NAVD 88), and December 2011 (-20 to -25 ft NAVD 88). At L-5, the historical maxima was exceeded (less than 2°C) in the upper part of the aquifer in June 2011 (-12 to -14 ft NAVD 88) and September 2011 (-2 to -16 ft NAVD 88). Well G-21 temperatures were within historical values and well G-28 only exhibited one value above the historical maxima at the top of the water column (-5 ft) which is suspected to be affected by the air temperatures. The temperature profile for G-35 is similar to G-28; however, a historical profile is not available.

6.4.3 Vertical Groundwater Chloride Profiles

The groundwater is measured for specific conductance at 1-ft intervals in the entire water column in all five wells. The specific conductance data are then converted to chloride values according to the procedures outlined in the Agreement. For this monitoring period, specific conductance values were measured in June 2011, September 2011, December 2011, and March 2012 and corresponding chloride values were calculated. Similar to the temperature profiles, chloride profiles have been developed and compared to historical envelopes when available (Figures 6.4-7 through 6.4-11). The historical envelope represents both the highest and lowest chloride levels recorded during the period from July 1981 through June 1991. The historical period represents the time during which the cooling canal system came to equilibrium, as first described in the1990 Annual Report. In the 2011 Annual Report for the ID, Golder Associates Inc. (2011b) stated the following:

“Continuing the trend first reported in the 2005 Annual Report, none of the upper level recorded chloride data reported are outside the respective historical occurrence envelopes, down to the following elevations:

- L-3: -30 feet NAVD 88
- L-5: -23 feet NAVD 88
- G-21: -42 feet NAVD 88
- G-28: -14 feet NAVD 88

For the current reporting period, there are a few exceptions to the above statement. At L-3, calculated chloride values began to exceed the historical envelope in September 2011 at -15 ft NAVD 88 and in December 2011 and March 2012 at depths between -25 to -30 ft NAVD 88. Also at L-5 and G-21, one or two events have calculated chloride values at -22 and -41 feet respectively which is a foot higher than reported above by Golder Associates Inc. (2011b). At deeper depths, the chloride values exceed historical envelopes established for L-3, L-5, G-21, and G-28. The highest values are found at L-3 (39.3 ppt) and L-5 (42.1 ppt) at the bottom sample depth of approximately -53 ft NAVD 88. The lowest concentrations are at G-35 where the levels are minimal to about elevation -41 ft NAVD 88, below which they increase to about 7 ppt. Golder Associates Inc. (2011b) reports that the historical chloride levels at those depths in the 1970s ranged to about 10 ppt.

What is clear from the vertical profiles is the quick change in chloride values with depth indicating a fairly sharp transition in water quality. This transitional boundary moves up and down depending on seasonal variations. The profiles also show the presence of a shallow predominantly freshwater (per FDEP F.A.C. 62-302.200) lens in L-3, L-5, G-21, and G-35. The chloride values at G-28 indicate higher concentrations than found in the other wells in the upper 15 ft or so of the aquifer; however, that may be, in part, an artifact of the well construction. Unlike the other L and G series wells that have screen beginning near the surface, G-28 is hardcased to 16.6 ft below the top of casing. Thus, water measured from the surface to the downward extend of the hard casing is predominantly reflective of the water at quality at 16.6 ft below the top of casing.

6.4.4 Interceptor Ditch Operation and Transect Surface Water Levels

Surface water levels have been traditionally measured in L-31E, the ID, and C-32 as required by the ID operation procedure. The water levels are measured in these canals at pumping Lines A, B, C, D, and E, as shown previously on Figure 6.1-1. Water levels recorded during the past 12-month monitoring period are presented on Figures 6.4-12 through 6.4-16. The data for these figures are based on the manual readings by FPL staff at all five transect locations.

With a few exceptions, water levels in the L-31E were higher than in the C-32 at all transects. The exceptions include early June 2011 when the CCS water elevations at all locations were higher than L-31E water elevations. Also, for much of January 2012, the CCS water elevations in transects A, B, and C were the same as, or slightly higher than, the L-31E water elevations. Additionally, there were a few days in late March and/or early April when CCS water elevations in transects A, B, and C were the same as, or slightly higher than, the L-31E water elevations. Table 6.4-1 shows the range in head differences in L-31E and C-32 at each transect.

At all transects, the water elevations in the L-31E were higher than ID water elevations with the exception of one day on September 7, 2011. On that day, the water elevations at transects C, D, and E were reported to be less than 0.06 ft lower in the L-31E. Table 6.4-1 shows the range in head differences in L-31E and ID at each transect.

Operation of the ID pumps is shown on Figure 6.4-17, along with the measured rainfall. Table 6.4-2 shows how many days each pump operated each month. Table 6.4-3 presents data on when pumping was required by the water levels and when such pumping actually occurred.

6.4.5 Pressure Gradient Density Correction

In the previous annual report for the ID, Golder Associates Inc. (2011b) presented an analysis of the data to assess groundwater flow based on pressure gradients between L3 and G-21 and L-5 and G-28. The analysis was to address the Agencies' concerns over the fact that water level readings taken in wells and surface water bodies do not necessarily represent the actual pressure gradients within the ground or surface water because of differences in density and temperature between locations. Because surface water levels are being measured as proxies for groundwater levels in order to estimate groundwater movement, and groundwater levels are being estimated as proxies for pressure gradients, their analyses dealt with groundwater pressure gradients only.

This type of analysis lends itself favorably to the L and G series wells since they are screened across their entire (or nearly entire) depth, and temperature and specific conductance data are available at 1-ft intervals. This is important since the temperature and specific conductance do not vary linearly with depth. The temperature and specific conductance data can be used to calculate a density at each measurement point.

Using specific conductance and temperature data collected from September 2011 sampling episode, the water densities over depth for wells L-3 and G-21 have been calculated and are plotted on Figure 6.4-18. Based on the densities shown on Figure 6.4-18, the pressure over depth (pressure gradient) for wells L-3 and G-21 for the September 2011 sampling event has been calculated and is shown in Figure 6.4-19. The data shown on Figure 6.4-19 indicate that the pressure gradient at well G-21 is slightly higher than that at well L-3 from the surface down to about elevation -35 ft NAVD 88, below which that gradient is slightly higher at L-3 than at G-21. Because the pressure gradients are very close in value, it is easier to see the difference when plotted, as shown on Figure 6.4-20 which illustrates the pressure excess or deficit between the G and corresponding L series wells.

Similar analyses have been performed for wells G-21 and L-3 during the March 2012 sampling event (Figure 6.4-21) for well G-28 versus well L-5 during the September 2011 sampling episode (Figure 6.4-22) and for well G-28 versus well L-5 during the March 2012 sampling episode (Figure 6.4-23). In three of the cases examined (G-21 and L-3 in September 2011, G-28 and L-5 in September 2011, and G-28 and L-5 in March 2012), the groundwater gradient is seaward in the upper levels of the aquifer, down to about elevation -35 ft NAVD 88 for well G-21 versus well L-3, and down to about elevation -43 to -33 ft NAVD 88 for well G-28 versus well L-5. The other case (G-21 and L-3 in March 2012) did not show a seaward gradient. However, a review of the water levels in the ID during that sampling event revealed a seaward gradient from L-3 to the ID. The recorded NAVD 88 water elevation in L-3 on March 6, 2012, was -0.13 ft; the automated measurement from the ID at TPSWC-1 and TPSWC-2 were -0.35 and -0.29 ft, respectively; and the ID water had a density of fresh water. While not plotted, the water levels in June 2011did not indicate a seaward gradient from G-21 to L-3 and from G-28 to L-5. Again, the ID water levels are lower than the L-series wells which resulted in a seaward gradient from the L wells to the ID. On June 7, 2011, the recorded NAVD 88 water elevation in L-3 was -1.20 feet and L-5 was -0.3 ft. At the time the L-series well groundwater measurements were recorded, the ID water elevations in TPSWC-1, TPSWC-2, and TPSWC-3 were much lower with NAVD 88 elevation levels of -1.84, -1.73, and -1.38 ft, respectively. While the ID had densities ranging from 1.012 to 1.028 g/cm3, the elevation difference between the L-series wells and the ID was large enough to counter any effects of density. The operation of the ID still maintains a seaward gradient from the L-31E and/or the L-series wells in the upper levels of the aquifer.

TABLES

Table 6.4-1. Range in Surface Water Head Differences (ft)

Date	Line A		Line B		Line C		Line D		Line E	
	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID
6/2/11	-0.64	0.74	-0.66	0.56	-0.74	0.49	-0.53	0.48	-0.27	0.31
6/6/11	-0.54	0.44	-0.62	0.27	-0.59	0.23	-0.33	0.19	-0.10	0.17
6/7/11										
6/8/11										
6/9/11	-0.64	0.96	-0.74	0.76	-0.82	0.50	-0.64	0.42	-0.39	0.17
6/13/11	-0.33	0.48	-0.40	0.30	-0.38	0.25	-0.15	0.17	0.04	0.14
6/14/11										
6/15/11										
6/16/11	-0.31	0.79	-0.41	0.57	-0.44	0.56	-0.20	0.54		
6/20/11	-0.18	0.58	-0.27	0.37	-0.18	0.36	0.03	0.33	0.24	0.32
6/27/11	-0.21	0.50	-0.28	0.31	-0.21	0.31	0.08	0.24	0.44	0.24
6/28/11										
6/29/11										
6/30/11	0.17	0.75	0.09	0.56	0.23	0.60	0.49	0.67	0.73	0.63
7/5/11	0.26	0.60	0.22	0.42	0.27	0.45	0.47	0.41	0.65	0.39
7/18/11	0.66	0.72	0.55	0.49	0.62	0.46	0.82	0.44	1.00	0.43
8/2/11	0.69	0.63	0.60	0.44	0.65	0.43	0.65	0.43	1.07	0.38
8/17/11	0.82	0.56	0.72	0.40	0.78	0.37	0.99	0.35	1.09	0.35
9/7/11	0.33	0.26	0.31	0.07	0.25	-0.01	0.38	-0.07	0.39	-0.06
9/8/11										
9/9/11	0.30	0.48	0.22	0.27	0.22	0.22	0.37	0.07	0.50	0.02
9/10/11										
9/11/11										
9/12/11	0.32	1.00	0.30	0.80	0.34	0.76	0.47	0.32	0.57	0.29

Table 6.4-1. Range in Surface Water Head Differences (ft)

Date	Line A		Line B		Line C		Line D		Line E	
	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID
9/19/11	0.55	0.45	0.50	0.28	0.53	0.27	0.69	0.25	0.82	0.22
10/3/11	0.82	0.47	0.70	0.28	0.76	0.29	0.88	0.26	0.97	0.25
10/17/11	0.86	0.36	0.76	0.18	0.75	0.18	0.79	0.17	0.78	0.14
11/4/11	0.54	0.26	0.44	0.07	0.51	0.09	0.59	0.04	0.62	0.02
11/17/11	0.50	0.33	0.40	0.16	0.49	0.17	0.62	0.18	0.72	0.16
12/1/11	0.55	0.37	0.47	0.19	0.51	0.17	0.65	0.17	0.74	0.16
12/5/11	0.49	0.33	0.37	0.13	0.44	0.12	0.57	0.10	0.67	0.09
12/8/11	0.39	0.36	0.30	0.20	0.38	0.18	0.55	0.14	0.68	0.12
12/9/11										
12/10/11										
12/11/11										
12/12/11	0.31	0.81	0.30	0.65	0.28	0.34	0.37	0.22	0.57	0.17
12/14/11	0.39	0.37	0.30	0.16	0.34	0.16	0.49	0.12	0.53	0.09
12/15/11	0.32	0.77	0.26	0.58	0.27	0.31	0.42	0.16	0.50	0.18
12/16/11										
12/19/11	0.36	0.34	0.26	0.12	0.25	0.15	0.43	0.09	0.50	0.10
12/20/11	0.12	0.90	0.13	0.65	0.17	0.57	0.35	0.29	0.53	0.09
12/27/11	0.08	0.40	0.06	0.18	0.10	0.20	0.51	0.21	0.65	0.12
12/28/11	0.30	0.94	0.16	0.76	0.22	0.62	0.36	0.34	0.44	0.24
12/30/11	0.28	0.30	0.16	0.20	0.22	0.22	0.44	0.16	0.54	0.16
12/31/11										
1/1/12										
1/2/12	0.04	1.12	-0.04	0.90	0.06	0.78	0.26	0.42	0.40	0.38
1/4/12	0.03	0.47	-0.02	0.28	0.05	0.27	0.31	0.25	0.49	0.22

Table 6.4-1. Range in Surface Water Head Differences (ft)

Date	Line A		Line B		Line C		Line D		Line E	
	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID
1/5/12	-0.02	1.06	-0.11	0.85	-0.05	0.69	0.24	0.40	0.41	0.35
1/9/12	-0.01	0.45	-0.07	0.23	-0.01	0.27	0.28	0.22	0.43	0.21
1/10/12	-0.08	1.10	-0.16	0.90	-0.08	0.80	0.08	0.68	0.31	0.49
1/12/12	0.03	0.43	-0.05	0.25	0.06	0.31	0.30	0.25	0.45	0.24
1/13/12	0.02	1.08	-0.06	0.76	0.06	0.64	0.31	0.56	0.48	0.48
1/17/12	0.03	0.44	-0.05	0.26	0.07	0.31	0.31	0.25	0.51	0.25
1/18/12	-0.08	0.93	-0.11	0.69	0.01	0.45	0.28	0.34	0.50	0.34
1/20/12	0.05	0.41	-0.06	0.18	0.09	0.27	0.28	0.19	0.50	0.21
1/21/12										
1/22/12										
1/23/12	-0.16	1.26	-0.28	1.01	-0.23	0.89	-0.01	0.75	0.20	0.58
1/30/12	0.33	0.47	0.21	0.25	0.17	0.29	0.45	0.23	0.59	0.21
1/31/12	0.25	0.75	0.15	0.53	0.18	0.53	0.35	0.32	0.51	0.31
2/2/12	0.18	0.50	0.08	0.28	0.14	0.28	0.35	0.25	0.54	0.24
2/3/12	0.20	0.76	0.06	0.54	0.04	0.48	0.26	0.34	0.46	0.31
2/6/12	0.20	0.41	0.16	0.18	0.24	0.24	0.48	0.18	0.68	0.18
2/7/12	0.42	0.70	0.46	0.48	0.45	0.48	0.64	0.30	0.82	0.33
2/13/12	0.75	0.51	0.65	0.33	0.67	0.33	0.81	0.28	0.85	0.26
2/20/12	0.76	0.50	0.66	0.34	0.68	0.30	0.81	0.28	0.89	0.27
2/27/12	0.61	0.47	0.49	0.25	0.56	0.28	0.73	0.23	0.83	0.21
3/5/12	0.65	0.45	0.50	0.20	0.50	0.21	0.60	0.17	0.69	0.15
3/12/12	0.56	0.35	0.48	0.11	0.46	0.10	0.55	0.10	0.61	0.11
3/19/12	0.47	0.36	0.38	0.12	0.40	0.09	0.54	0.10	0.66	0.10
3/21/12	0.33	0.41	0.26	0.16	0.28	0.14	0.46	0.12	0.65	0.11

Table 6.4-1. Range in Surface Water Head Differences (ft)

Date	Line A		Line B		Line C		Line D		Line E	
	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID
3/22/12										
3/23/12	0.32	0.67	0.20	0.44	0.08	0.32	0.31	0.21	0.48	0.18
3/26/12	0.48	0.58	0.22	0.22	0.18	0.13	0.31	0.21	0.52	0.10
3/27/12										
3/28/12	0.20	0.59	0.12	0.42	0.08	0.29	0.21	0.19	0.42	0.16
3/29/12	0.14	0.60	0.04	0.48	-0.05	0.45	0.12	0.41	0.33	0.31
4/2/12	0.15	0.33	0.05	0.20	0.00	0.08	0.23	0.11	0.44	0.09
4/3/12										
4/4/12	-0.08	1.12	-0.16	1.01	-0.18	0.25	0.03	0.29	0.25	0.20
4/5/12	-0.01	0.41	-0.07	0.31	0.09	0.31	0.32	0.32	0.53	0.26
4/9/12	0.25	0.35	0.16	0.22	0.12	0.12	0.31	0.14	0.50	0.14
4/10/12										
4/11/12										
4/12/12	0.20	0.58	0.09	0.44	0.00	0.29	0.17	0.29	0.34	0.27
4/13/12	0.13	0.54	0.08	0.45	-0.02	0.30	0.14	0.30	0.35	0.40
4/14/12										
4/15/12										
4/16/12	0.19	0.50	0.12	0.37	0.20	0.37	0.30	0.38	0.52	0.36
4/18/12	0.18	0.38	0.11	0.22	0.11	0.17	0.25	0.17	0.43	0.17
4/19/12	0.07	0.73	0.06	0.60	-0.11	0.44	0.08	0.45	0.29	0.35
4/20/12	0.06	0.37	-0.01	0.25	0.00	0.17	0.16	0.16	0.38	0.16
4/23/12	0.74	0.53	0.64	0.38	0.68	0.42	0.74	0.37	0.82	0.37
4/30/12	0.76	0.20	0.67	0.16	0.70	0.21	0.64	0.25	0.64	0.24
5/7/12	0.85	0.43	0.73	0.31	0.82	0.32	0.88	0.30	0.97	0.31

Table 6.4-1. Range in Surface Water Head Differences (ft)

Date	Line A		Line B		Line C		Line D		Line E	
	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID
5/14/12	0.89	0.41	0.82	0.29	0.82	0.26	0.91	0.24	1.06	0.30
5/21/12	0.98	0.39	0.90	0.27	0.92	0.30	0.99	0.28	1.03	0.30
5/29/12	0.74	0.27	0.67	0.14	0.61	0.07	0.68	0.05	0.72	0.06

Table 6.4-2. Days of ID Pump Operation per Month

ID Pump	2011							2012			
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Mar	Apr	May
N1	3.0	0.0	0.0	2.9	0.0	0.0	8.0	7.4	0.0	0.0	0.0
N2	0.0	0.0	0.0	5.0	0.0	0.0	2.0	7.0	2.0	5.0	4.0
S1	7.4	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	7.9
S2	6.1	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.9	2.9

Table 6.4-3. Pumping Summary

Date	Pumping Required					Actual Pumping Performed
	Line A	Line B	Line C	Line D	Line E	
6/2/11		Yes				Yes
6/6/11			Yes	Yes	Yes	Yes
6/7/11	NA	NA	NA	NA	NA	Yes
6/8/11	NA	NA	NA	NA	NA	Yes
6/9/11		Yes			Yes	Yes
6/13/11			Yes	Yes	Yes	Yes
6/14/11	NA	NA	NA	NA	NA	Yes
6/15/11	NA	NA	NA	NA	NA	Yes
6/16/11		Yes				Yes
6/20/11		Yes				
6/27/11		Yes		Yes		Yes
6/28/11	NA	NA	NA	NA	NA	Yes
6/29/11	NA	NA	NA	NA	NA	Yes
6/30/11		Yes				Yes
7/5/11						
7/18/11						
8/2/11						
8/17/11						
9/7/11						Yes
9/8/11	NA	NA	NA	NA	NA	Yes
9/9/11						Yes
9/10/11	NA	NA	NA	NA	NA	Yes
9/11/11	NA	NA	NA	NA	NA	Yes
9/12/11						Yes
9/19/11						
10/3/11						
10/17/11						
11/4/11						
11/17/11						
12/1/11						
12/5/11						
12/8/11		Yes				Yes
12/9/11	NA	NA	NA	NA	NA	Yes
12/10/11	NA	NA	NA	NA	NA	Yes
12/11/11	NA	NA	NA	NA	NA	Yes

Table 6.4-3. Pumping Summary

Date	Pumping Required					Actual Pumping Performed
	Line A	Line B	Line C	Line D	Line E	
12/12/11						Yes
12/14/11		Yes				Yes
12/15/11						Yes
12/16/11	NA	NA	NA	NA	NA	Yes
12/19/11		Yes	Yes			Yes
12/20/11						Yes
12/27/11		Yes	Yes			Yes
12/28/11			Yes			Yes
12/30/11	Yes	Yes	Yes			Yes
12/31/11	NA	NA	NA	NA	NA	Yes
1/1/12	NA	NA	NA	NA	NA	Yes
1/2/12			Yes	Yes		Yes
1/4/12		Yes	Yes			Yes
1/5/12			Yes	Yes		Yes
1/9/12		Yes	Yes	Yes		Yes
1/10/12			Yes	Yes		Yes
1/12/12		Yes	Yes	Yes		Yes
1/13/12			Yes			Yes
1/17/12		Yes	Yes			Yes
1/18/12			Yes	Yes		Yes
1/20/12		Yes	Yes	Yes		Yes
1/21/12	NA	NA	NA	NA	NA	Yes
1/22/12	NA	NA	NA	NA	NA	Yes
1/23/12	Yes	Yes	Yes	Yes	Yes	Yes
1/30/12		Yes	Yes			Yes
1/31/12	Yes	Yes	Yes			Yes
2/2/12	Yes	Yes	Yes			Yes
2/3/12	Yes	Yes	Yes	Yes		Yes
2/6/12		Yes	Yes			Yes
2/7/12						Yes
2/13/12						Yes
2/20/12						Yes
2/27/12						Yes
3/5/12						Yes
3/12/12						Yes

Table 6.4-3. Pumping Summary

Date	Pumping Required					Actual Pumping Performed
	Line A	Line B	Line C	Line D	Line E	
3/19/12						Yes
3/21/12		Yes	Yes			Yes
3/22/12	NA	NA	NA	NA	NA	Yes
3/23/12						Yes
3/26/12		Yes	Yes			Yes
3/27/12	NA	NA	NA	NA	NA	Yes
3/28/12			Yes	Yes		Yes
3/29/12			Yes	Yes		Yes
4/2/12		Yes	Yes	Yes		Yes
4/3/12	NA	NA	NA	NA	NA	Yes
4/4/12	Yes	Yes	Yes	Yes	Yes	Yes
4/5/12	Yes	Yes				Yes
4/9/12		Yes	Yes			Yes
4/10/12	NA	NA	NA	NA	NA	Yes
4/11/12	NA	NA	NA	NA	NA	Yes
4/12/12			Yes	Yes		Yes
4/13/12			Yes	Yes		Yes
4/14/12	NA	NA	NA	NA	NA	Yes
4/15/12	NA	NA	NA	NA	NA	Yes
4/16/12						Yes
4/18/12		Yes	Yes	Yes		Yes
4/19/12					Yes	Yes
4/20/12		Yes	Yes	Yes		Yes
4/23/12						Yes
4/30/12						
5/7/12						
5/14/12						
5/21/12						
5/29/12						

FIGURES

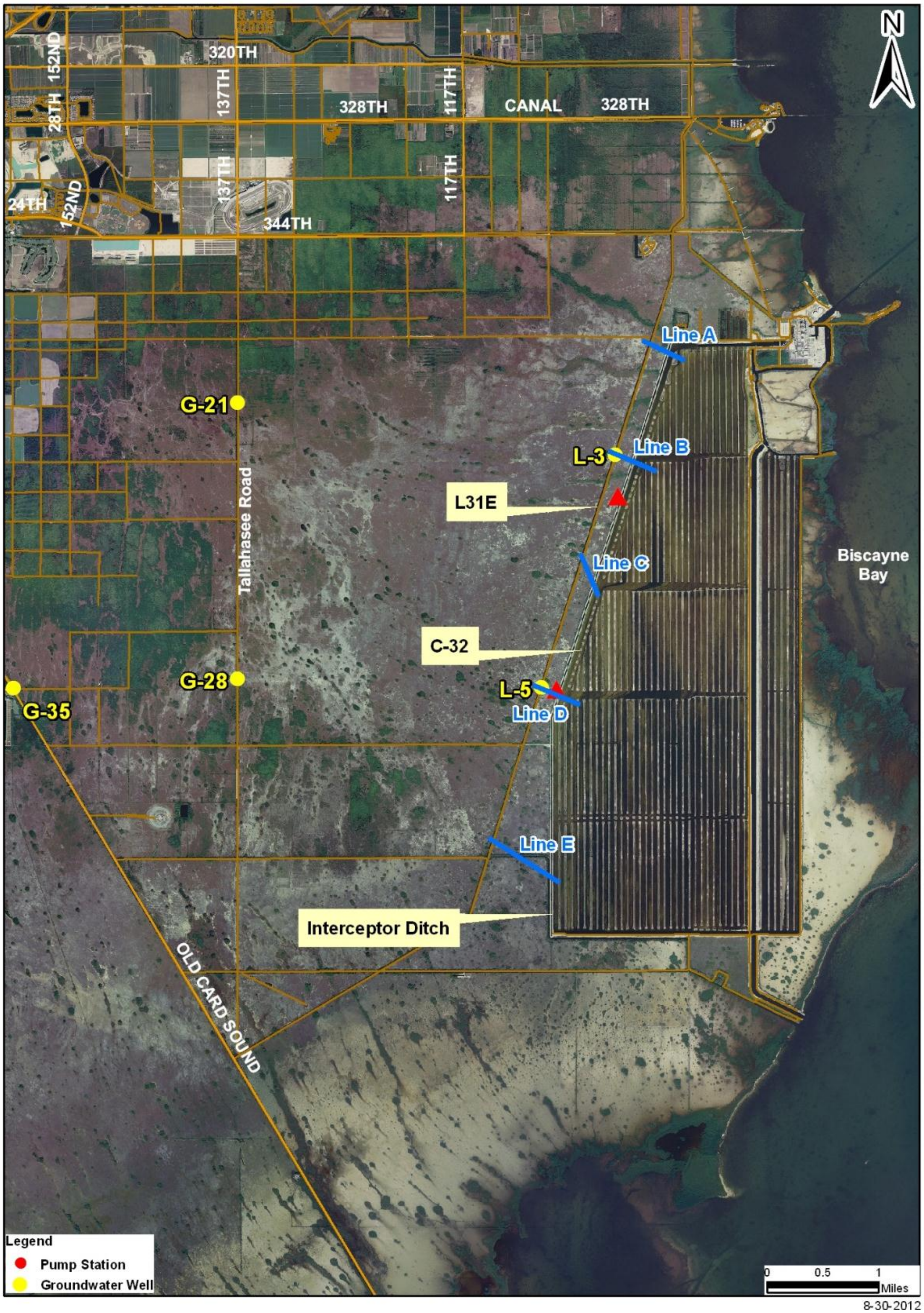

Figure 6.1-1. Historic ID Monitoring Wells and Transects.

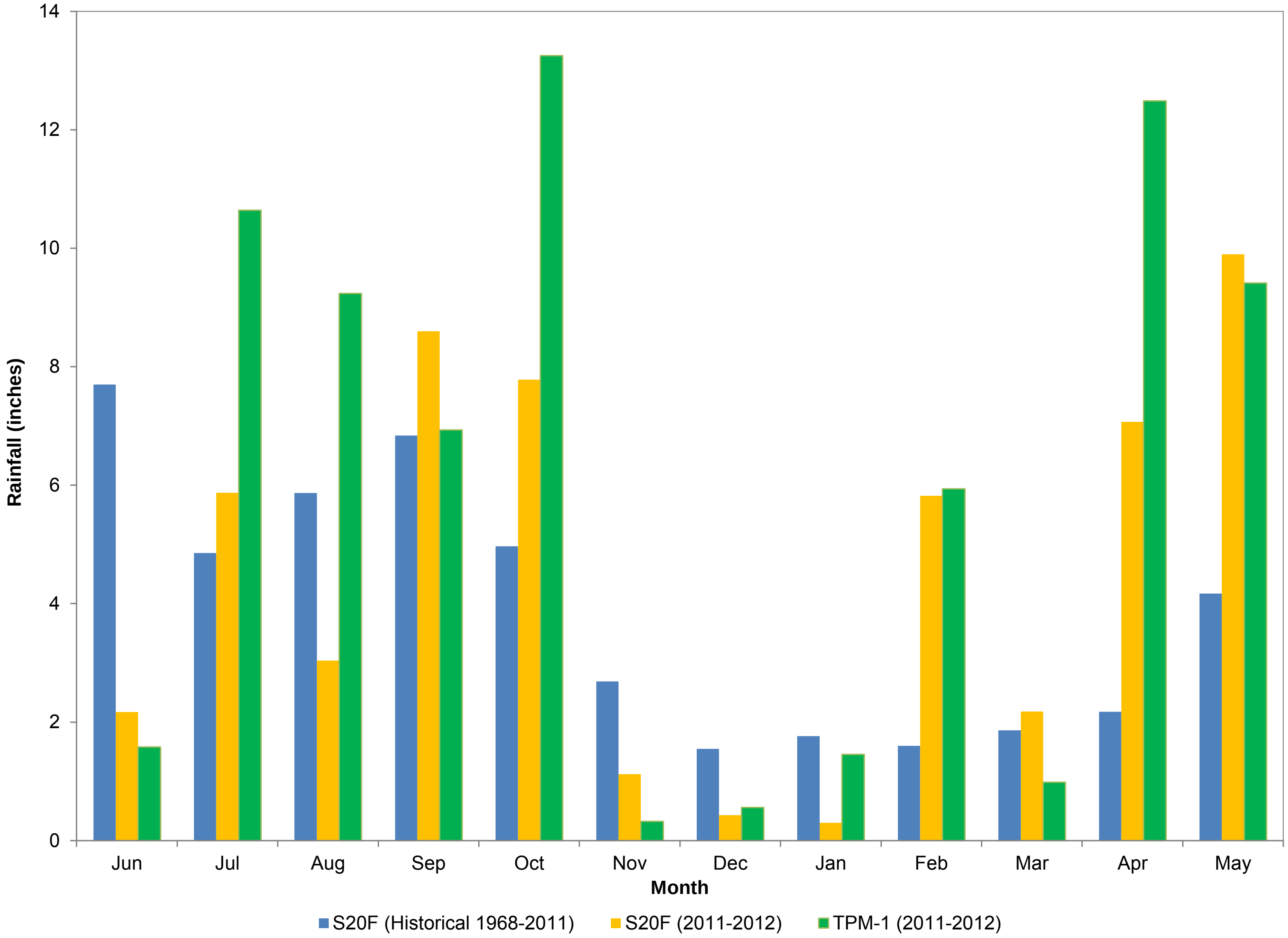

Figure 6.3-1. Comparison of ID Monitoring Period to Historic Rainfall.

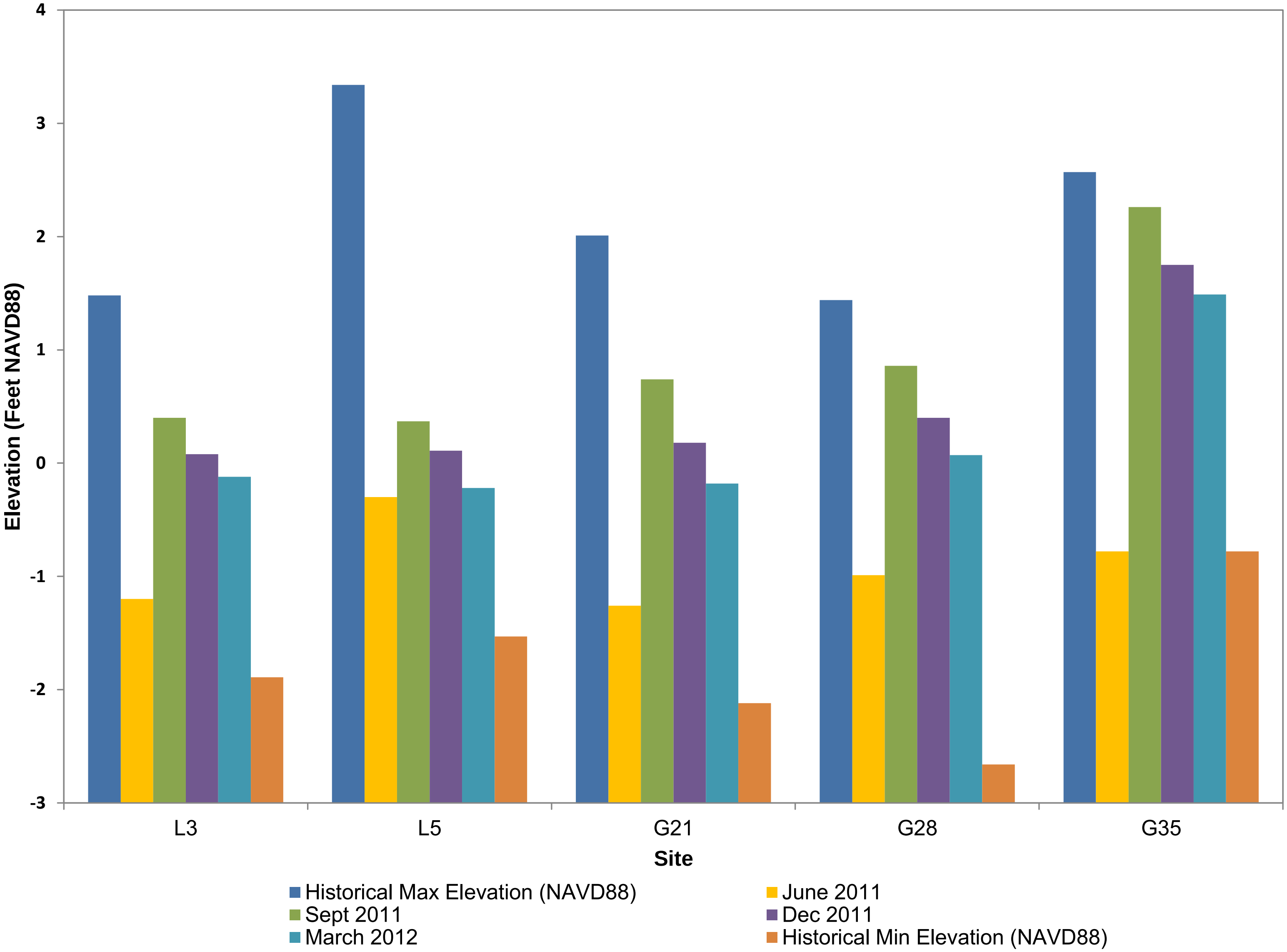

Figure 6.4-1. L-3, L-5, G-21, G-28, and G-35 Groundwater Levels.

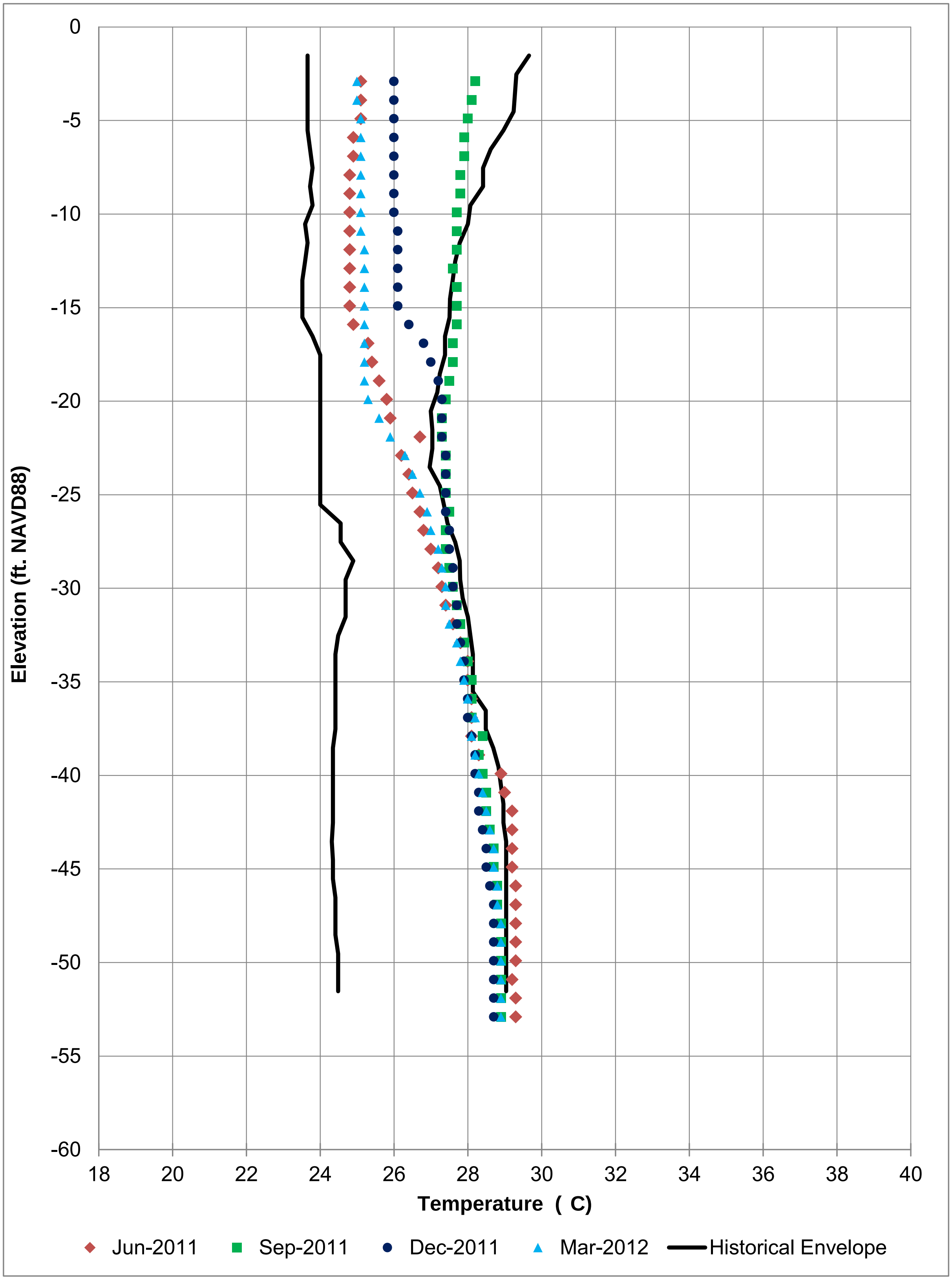

Figure 6.4-2. L-3 Vertical Temperature Profile June 2011 through March 2012.

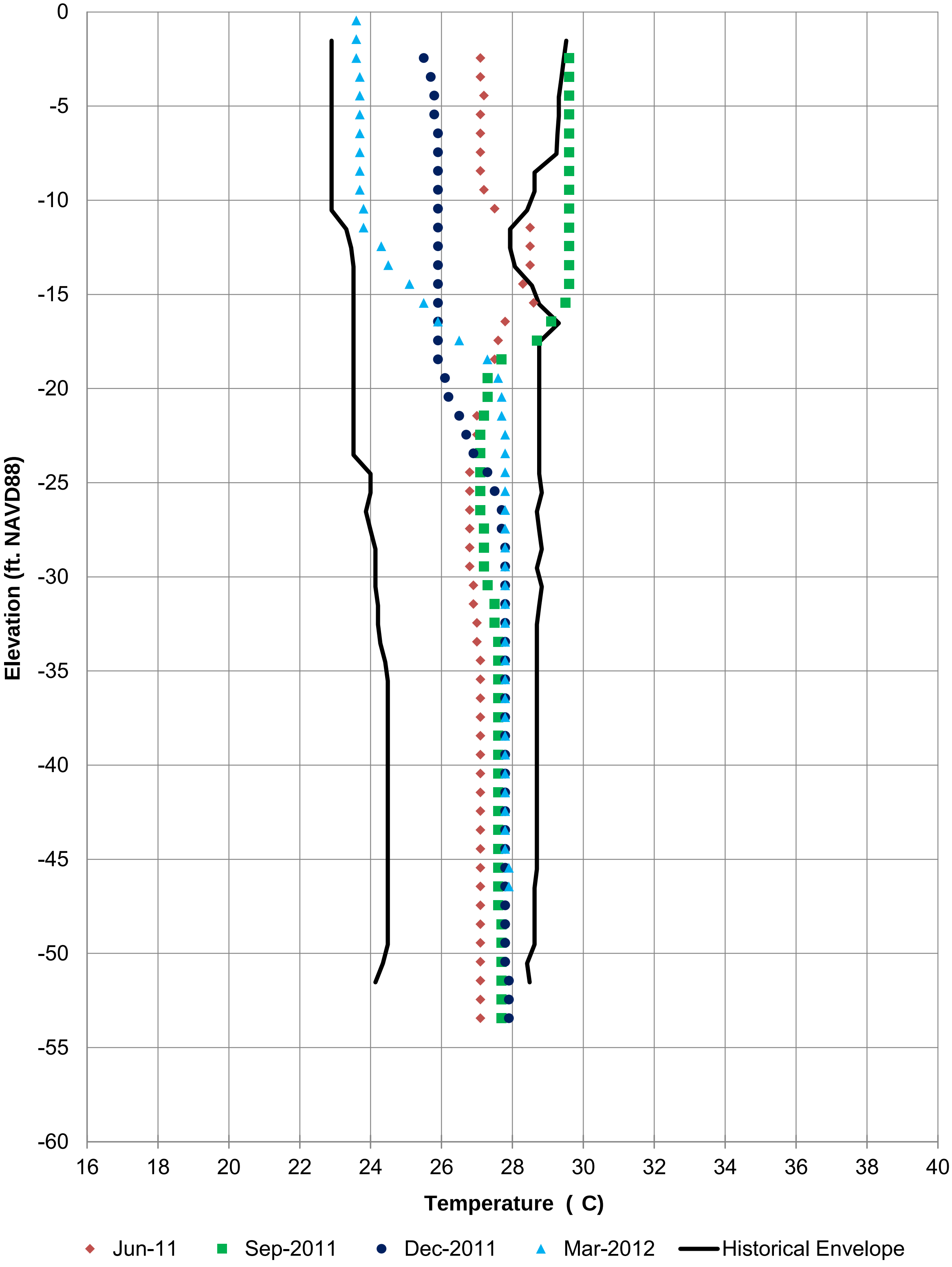

Figure 6.4-3. L-5 Vertical Temperature Profile June 2011 through March 2012.

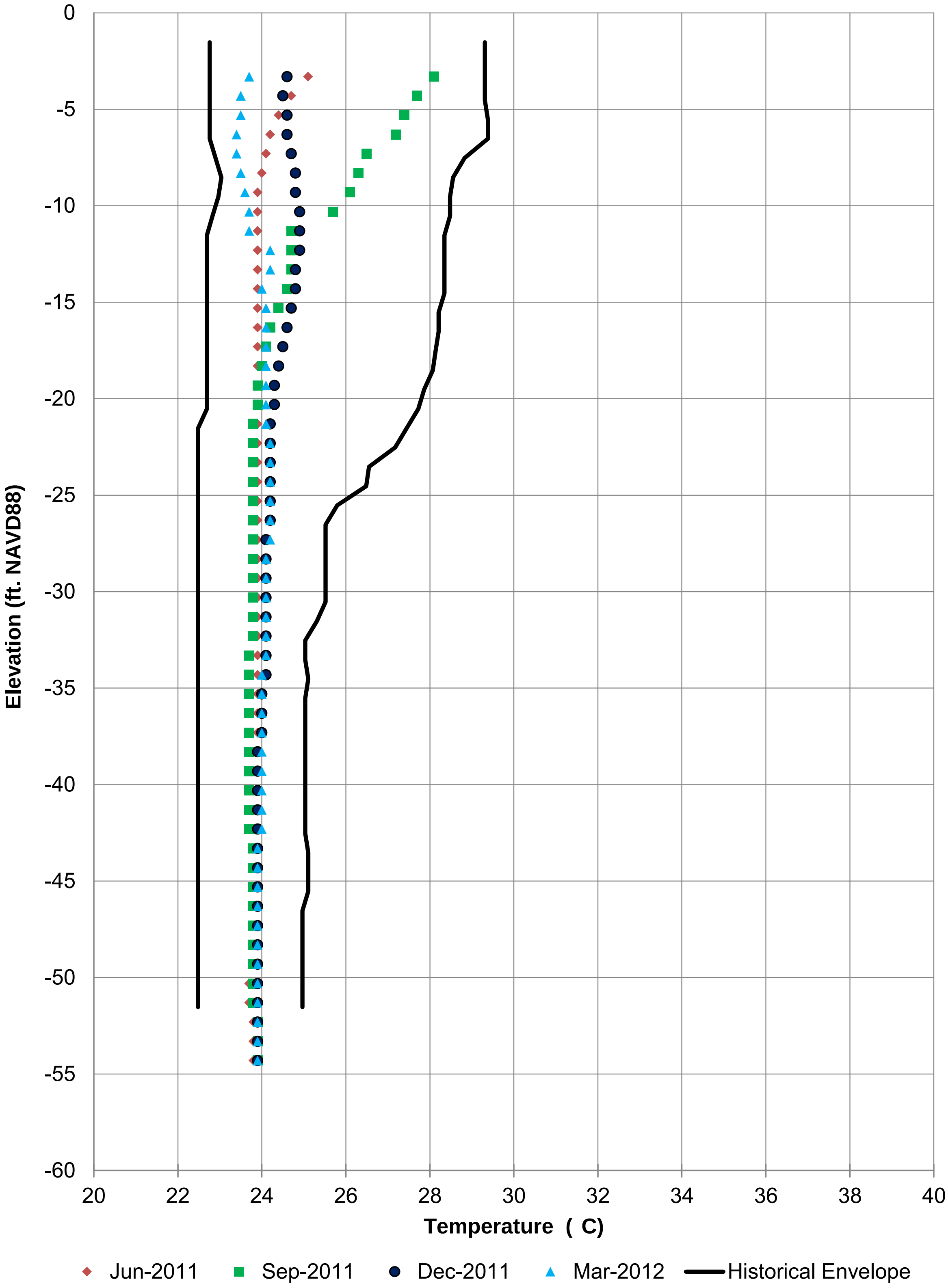

Figure 6.4-4. G-21 Vertical Temperature Profile June 2011 through March 2012.

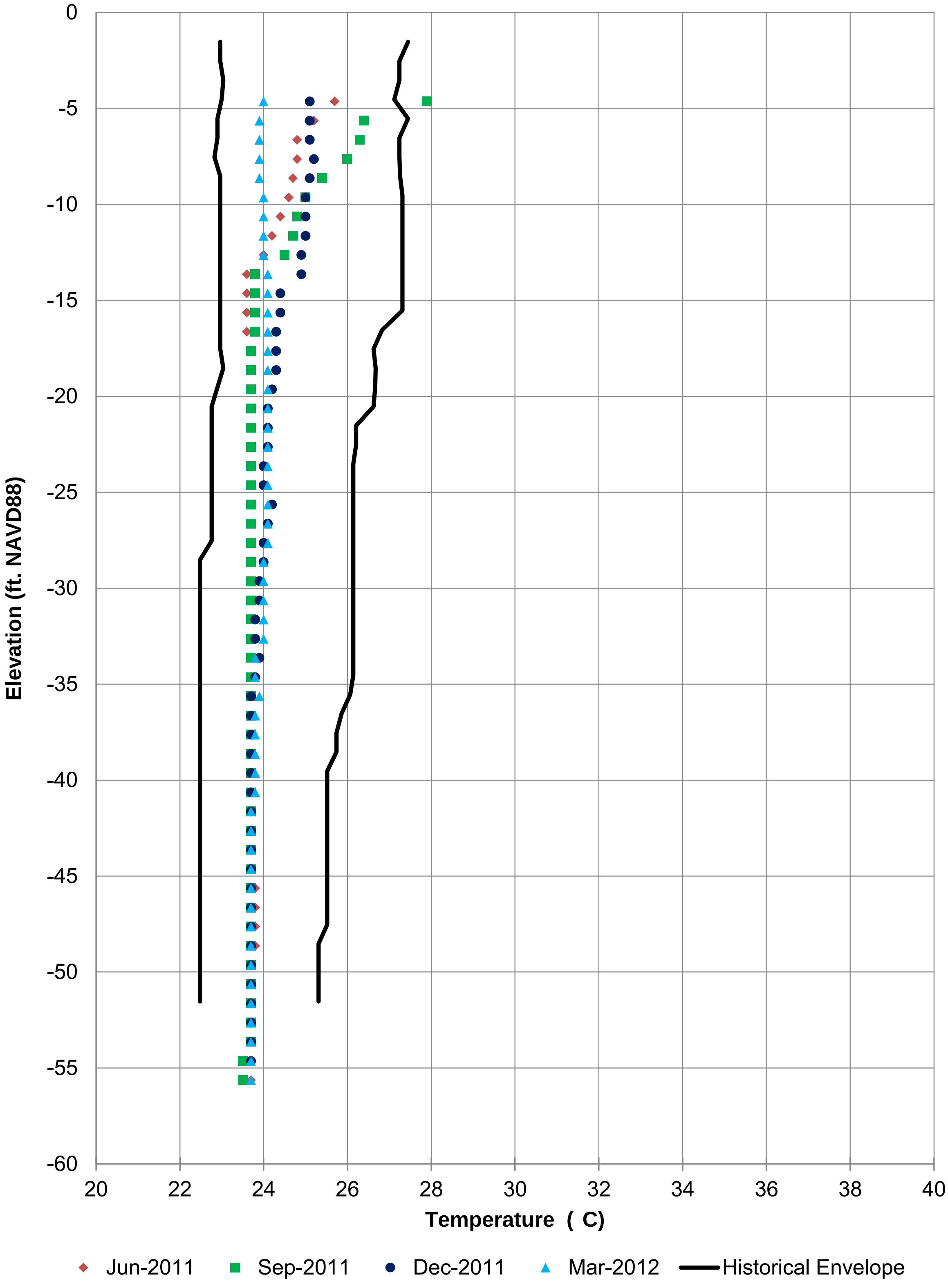

Figure 6.4-5. G-28 Vertical Temperature Profile June 2011 through March 2012.

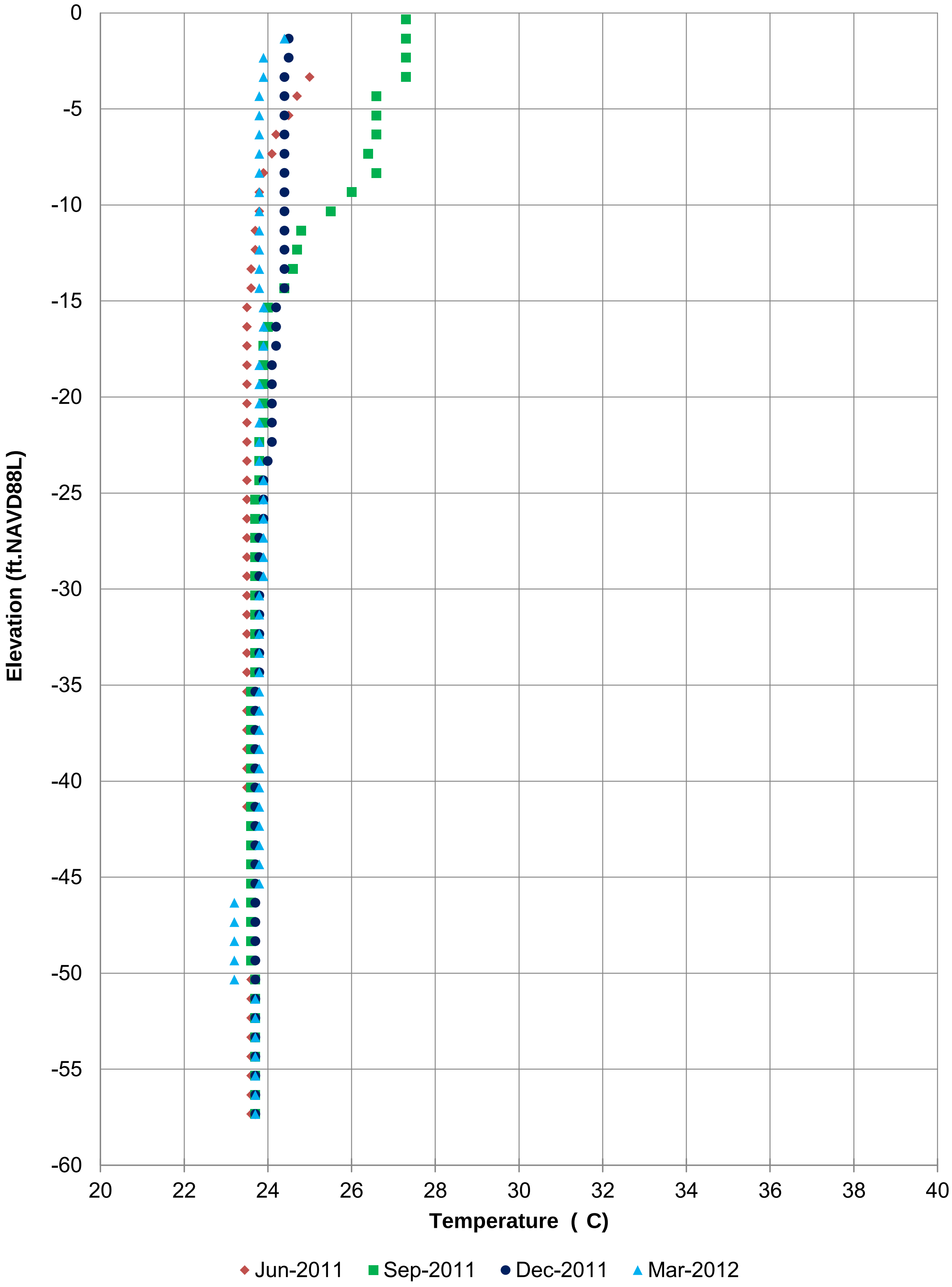

Figure 6.4-6. G-35 Vertical Temperature Profile June 2011 through March 2012.

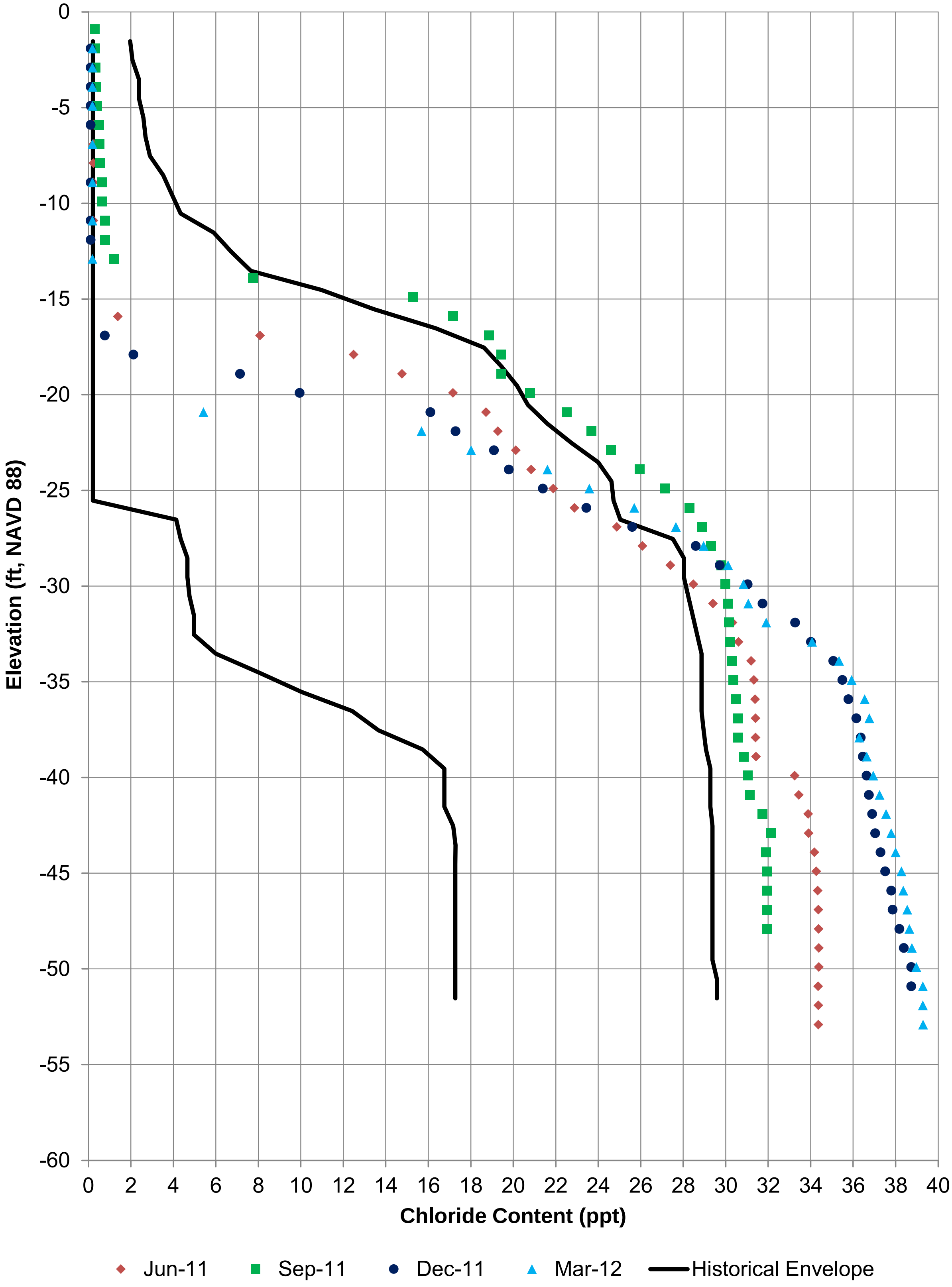

Figure 6.4-7. L-3 Vertical Chloride Profile June 2011 through March 2012.

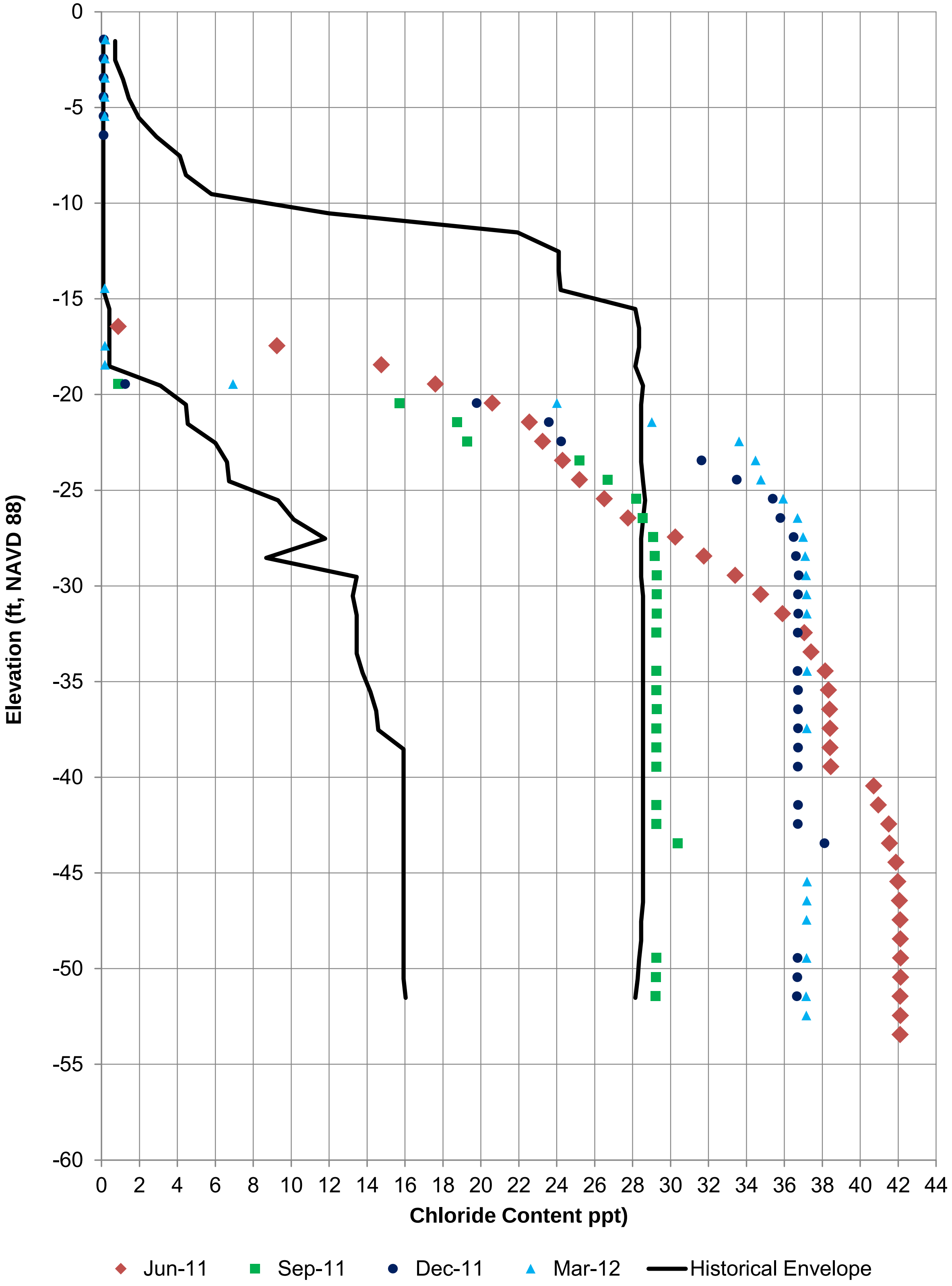

Figure 6.4-8. L-5 Vertical Chloride Profile June 2011 through March 2012.

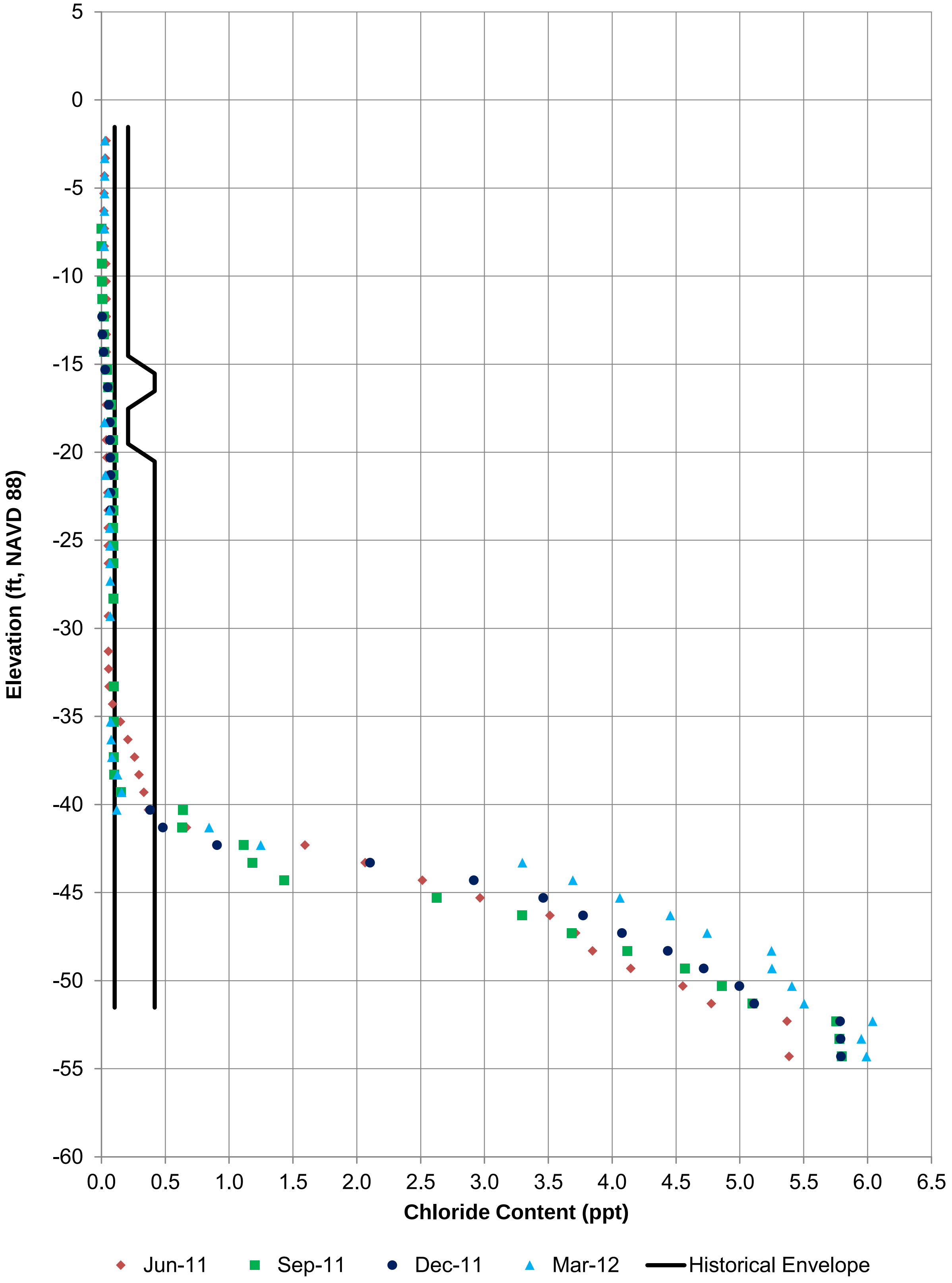

Figure 6.4-9. G-21 Vertical Chloride Profile June 2011 through March 2012.

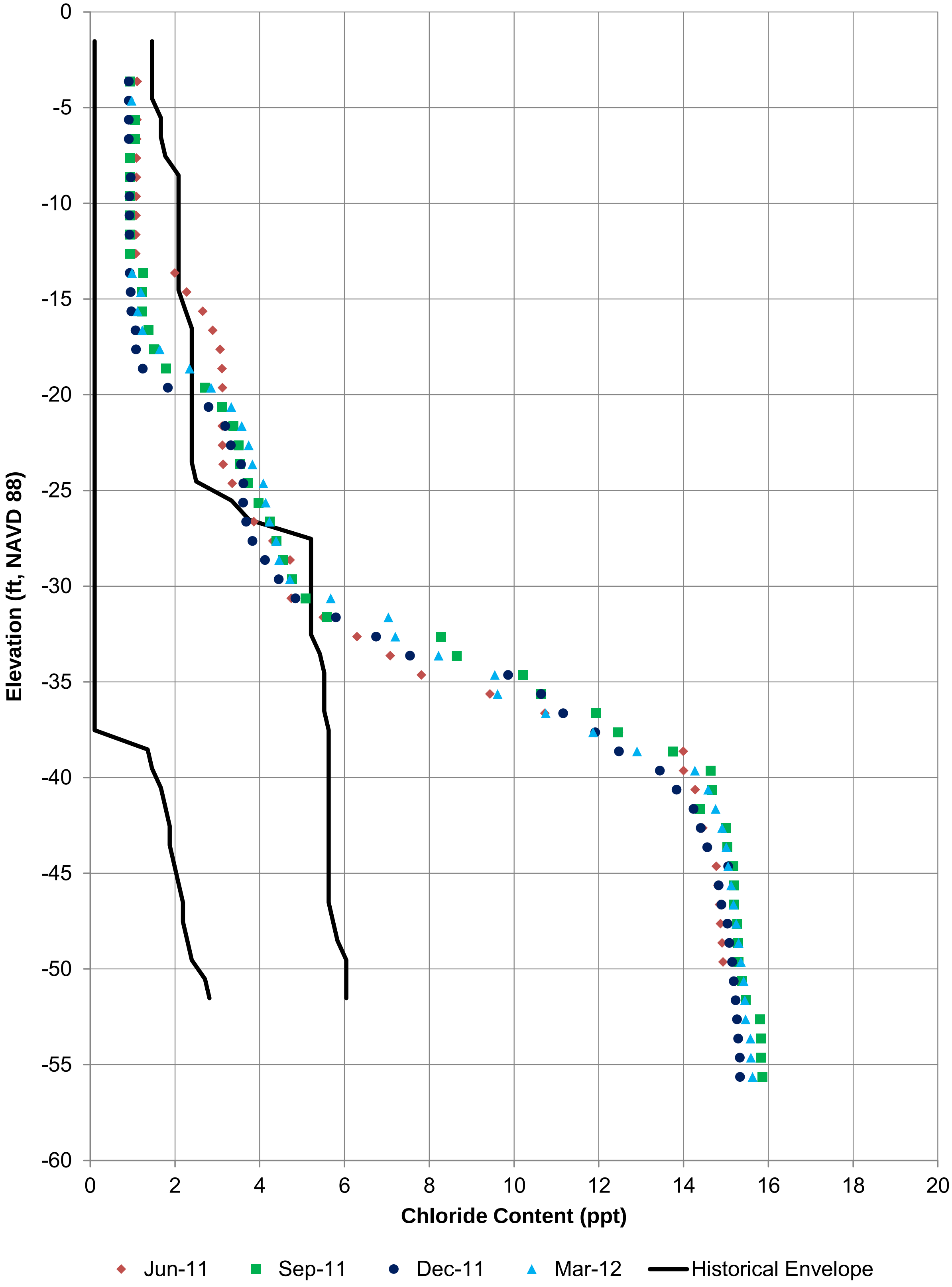

Figure 6.4-10. G-28 Vertical Chloride Profile June 2011 through March 2012.

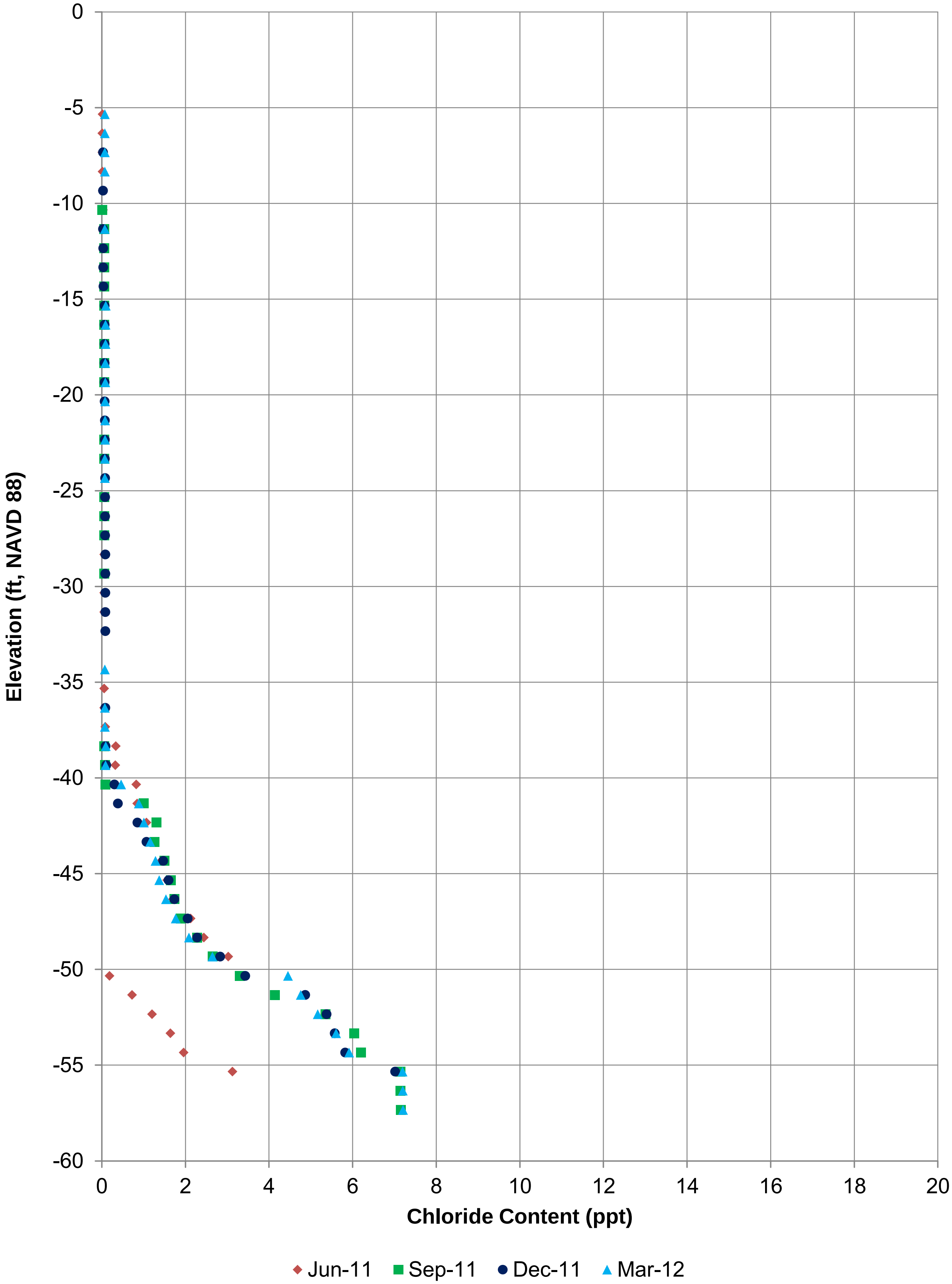

Figure 6.4-11. G-35 Vertical Chloride Profile June 2011 through March 2012.

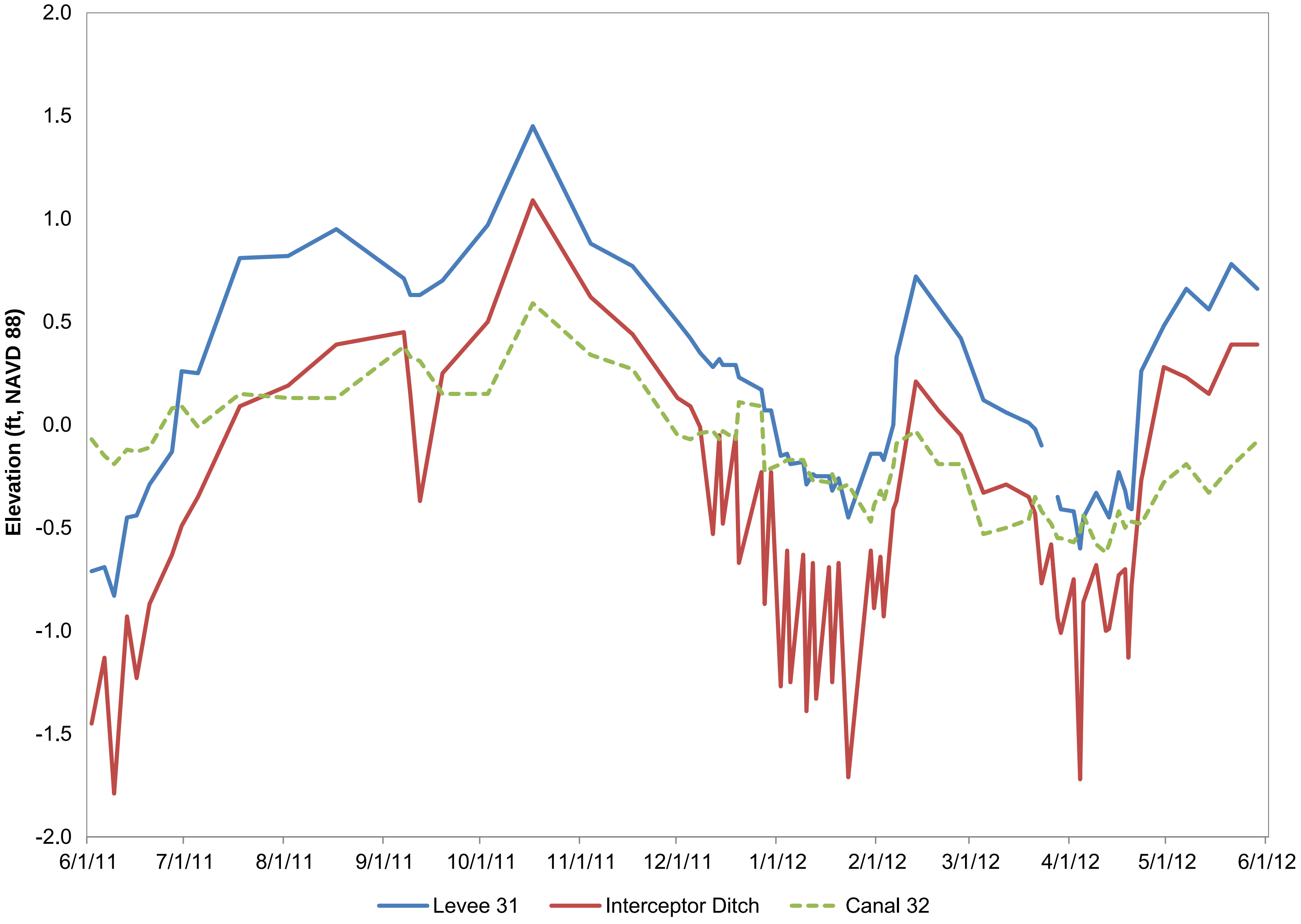

Figure 6.4.12. Transect A Water Levels June 2011 through May 2012.

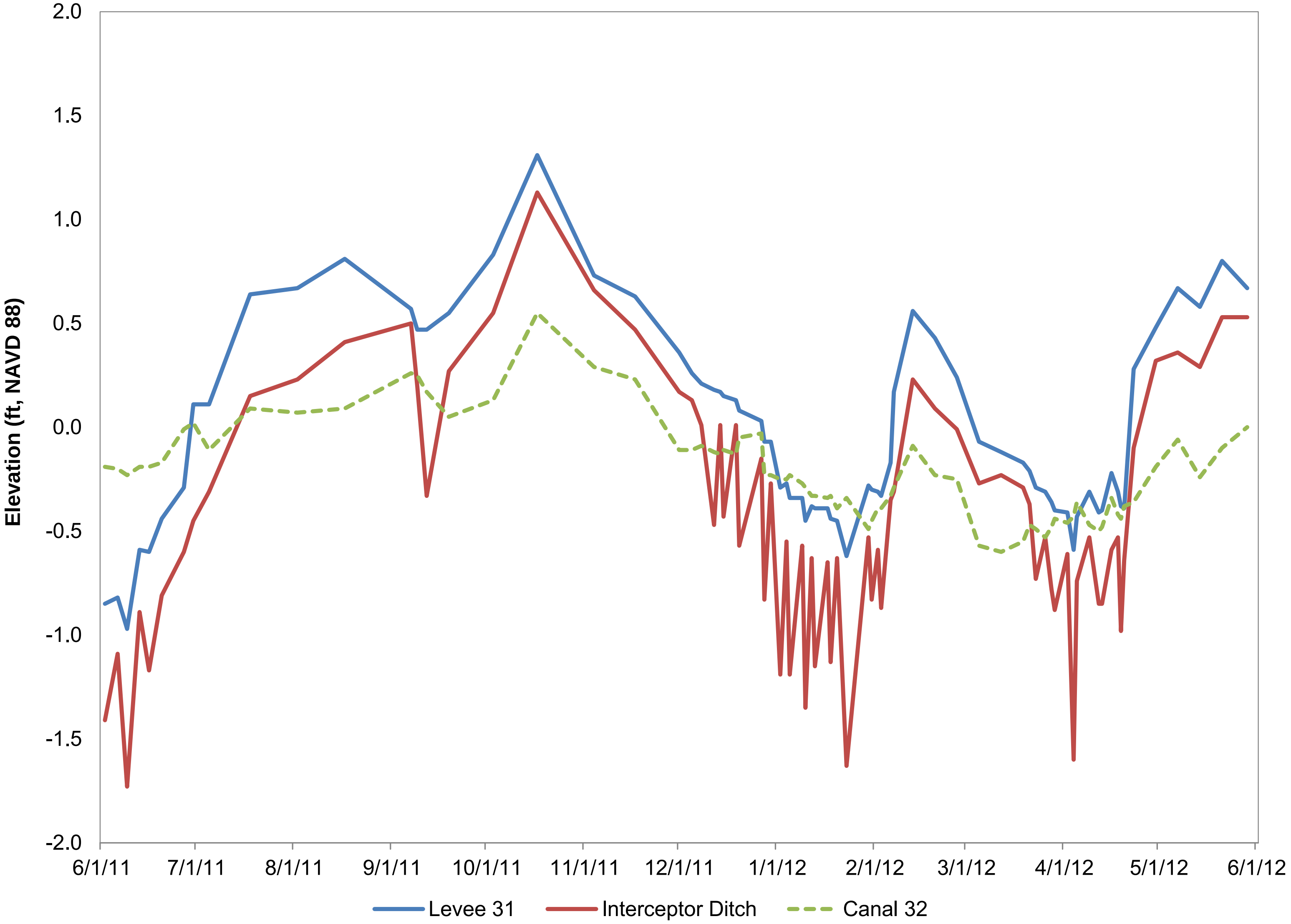

Figure 6.4-13. Transect B Water Levels June 2011 through May 2012.

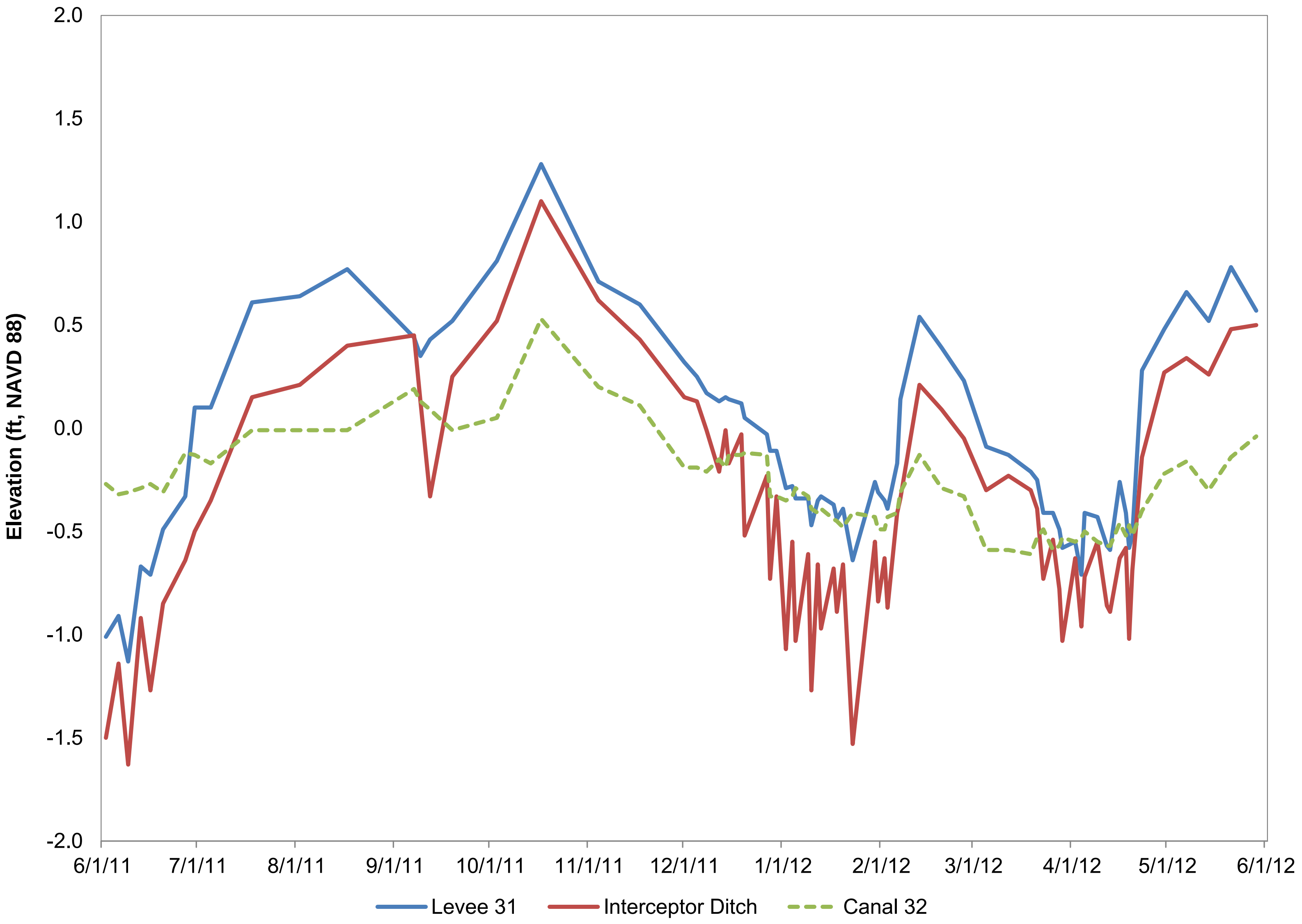

Figure 6.4-14. Transect C Water Levels June 2011 through May 2012.

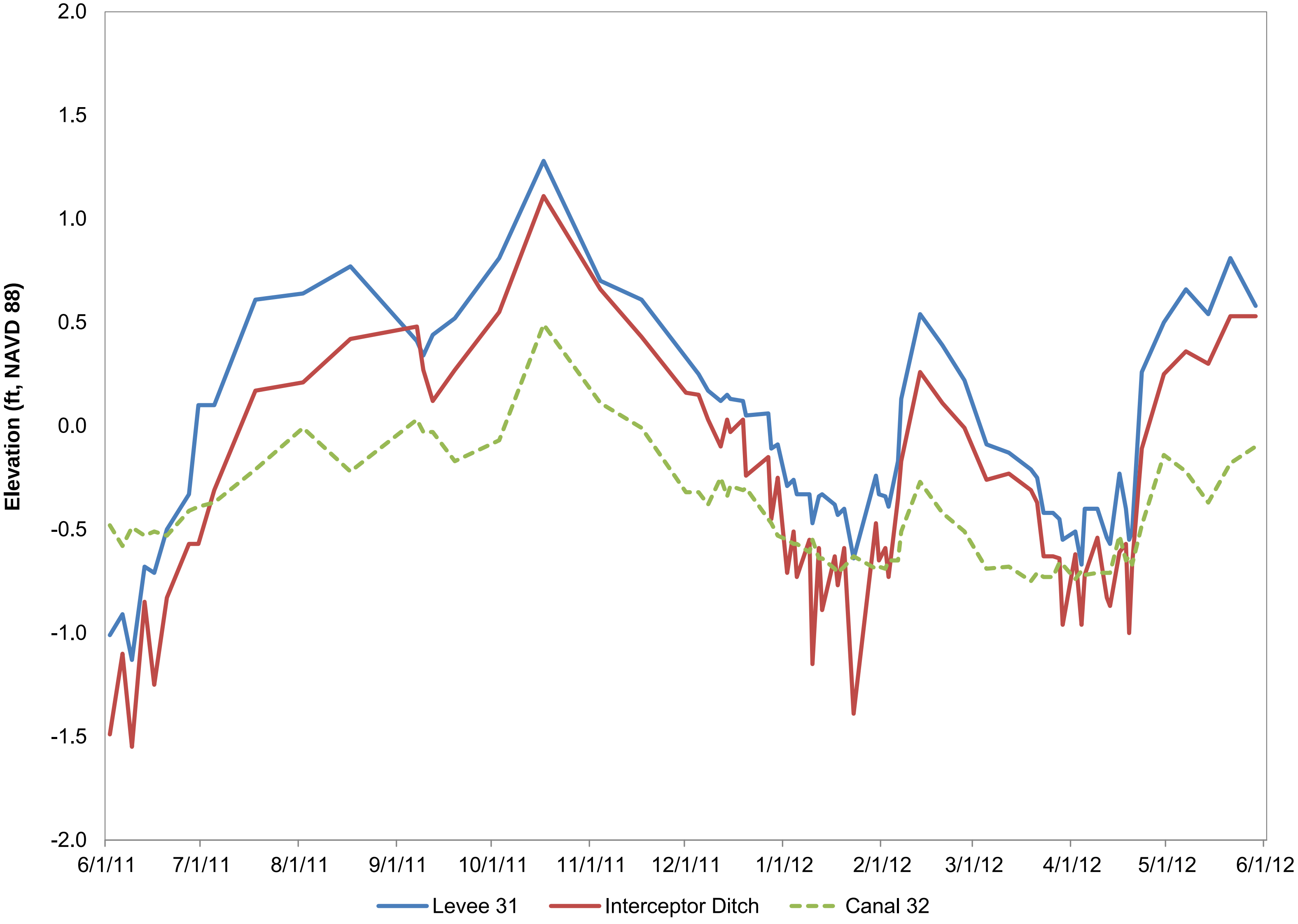

Figure 6.4-15. Transect D Water Levels June 2011 through May 2012.

Figure 6.4-16. Transect E Water Levels June 2011 through May 2012.

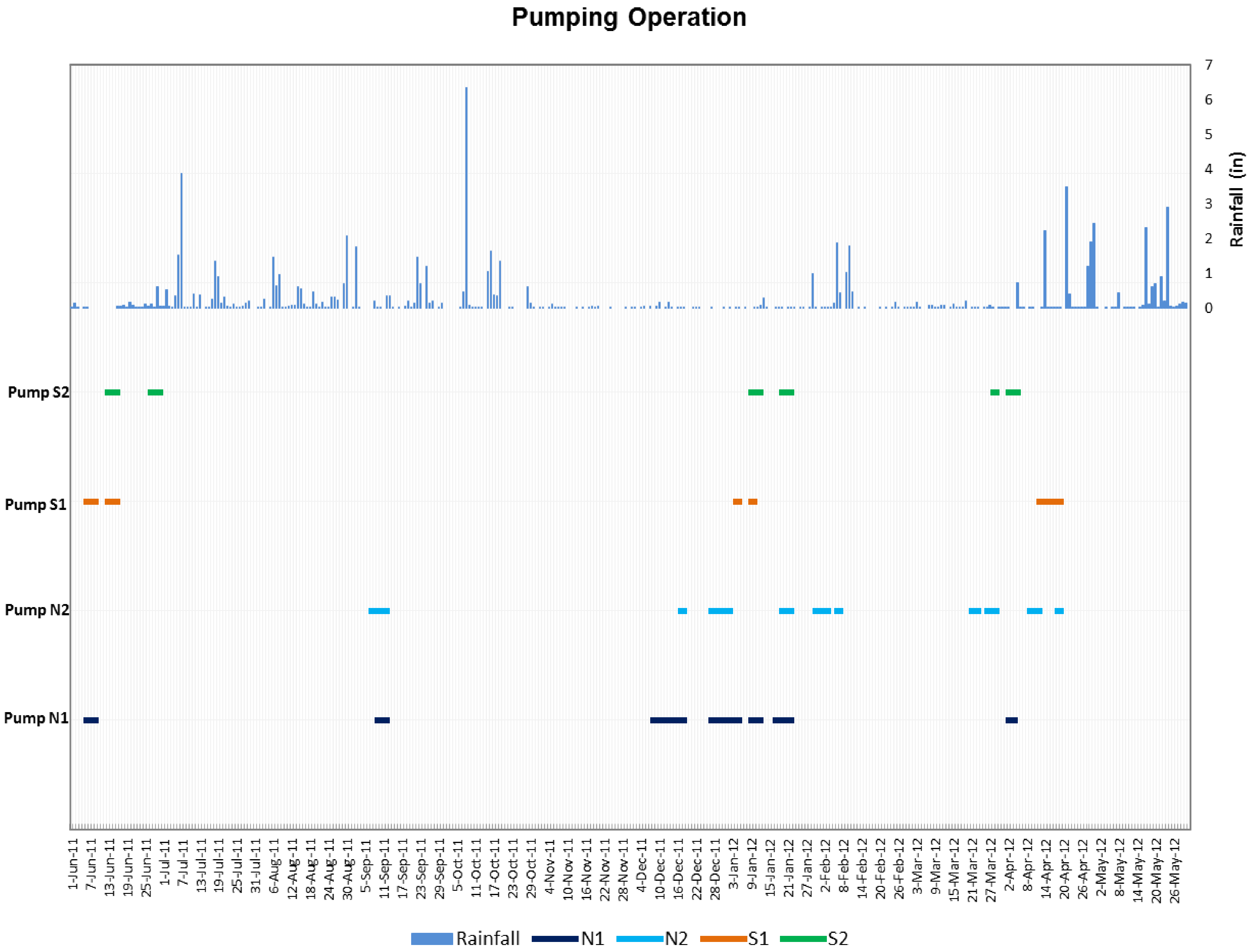

Figure 6.4-17. Inteceptor Ditch Pump Operation and Rainfall.

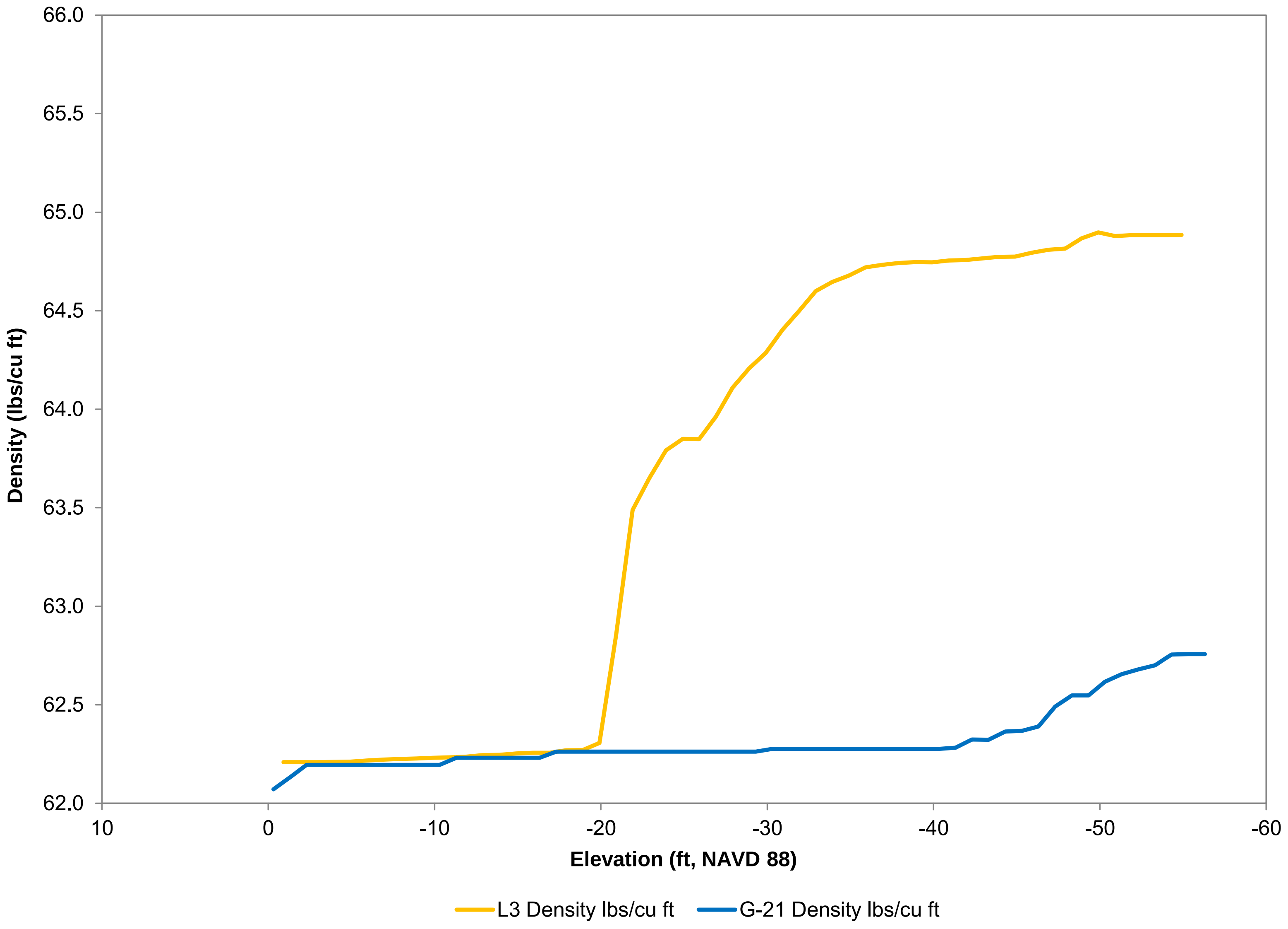

Figure 6.4-18. Density vs. Elevation Wells L-3 and G-21 during September 2011 Sampling Episode.

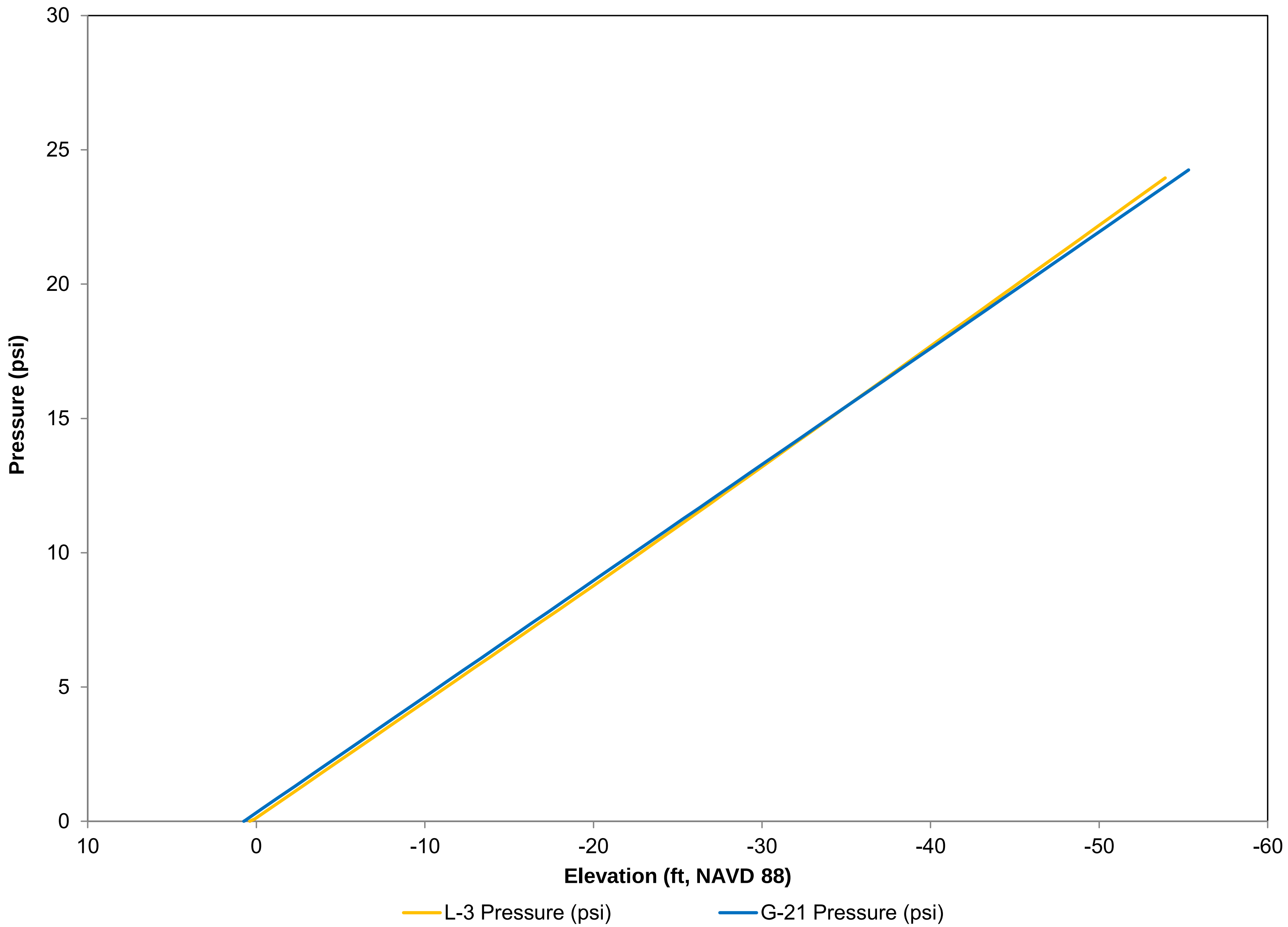

Figure 6.4-19. Pressure vs. Elevation Wells L-3 and G-21 during September, 2011 Sampling Episode.

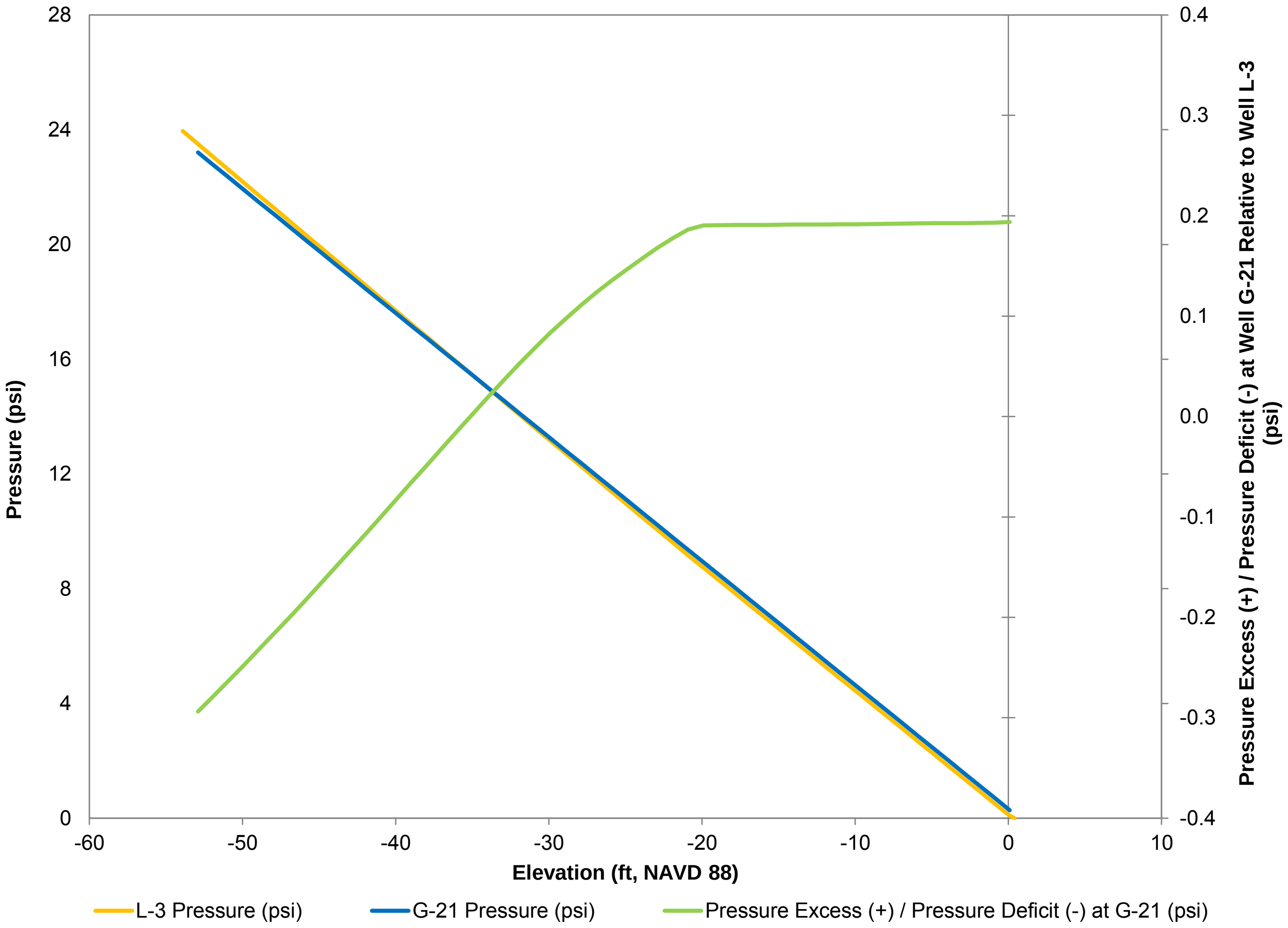

Figure 6.4-20. Pressure Gradient Difference between Well L-3 and Well G-21 during September, 2011 Sampling Episode.

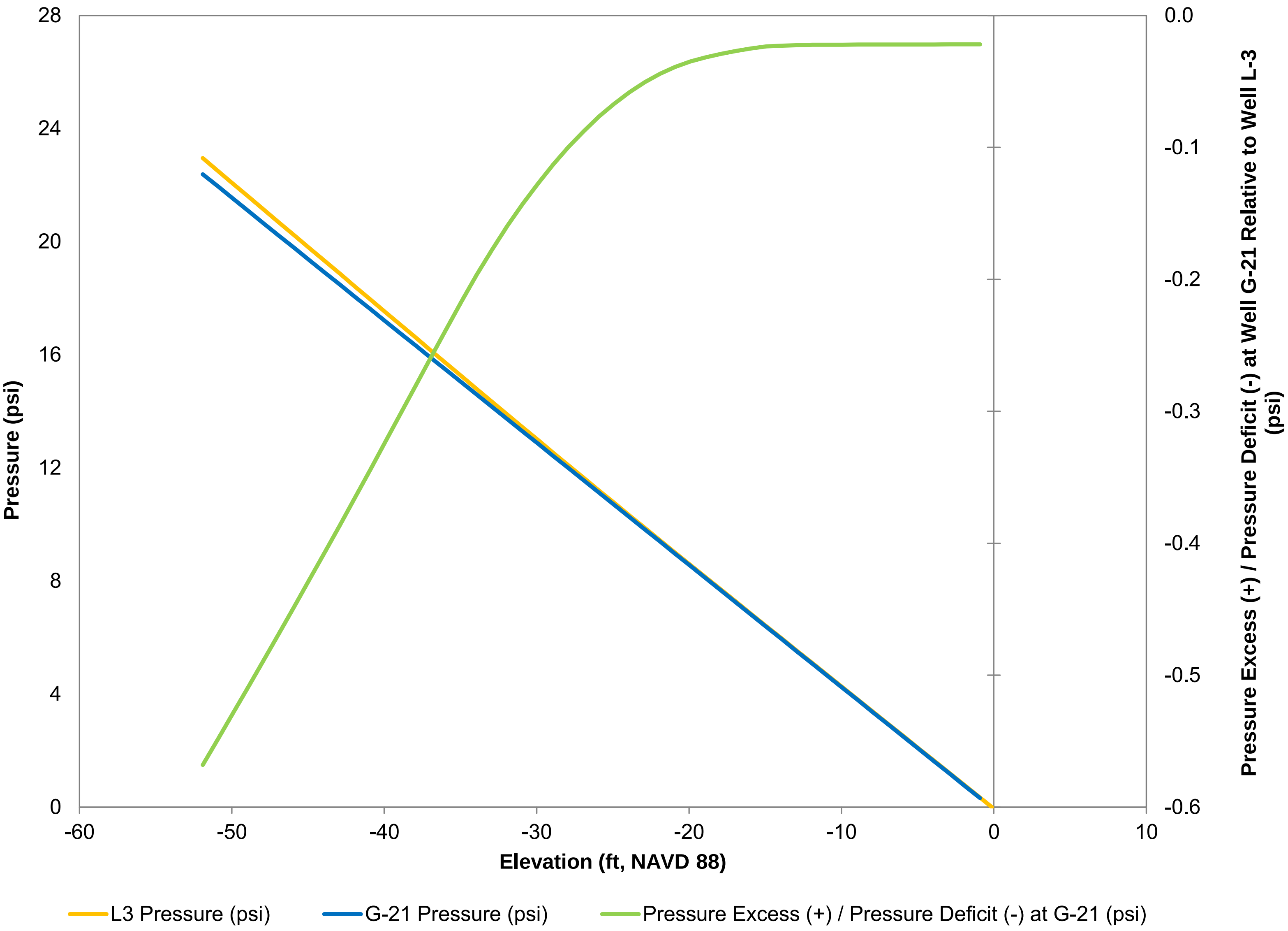

Figure 6.4-21. Pressure Gradient Difference between Well L-3 and Well G-21 during March, 2012 Sampling Episode.

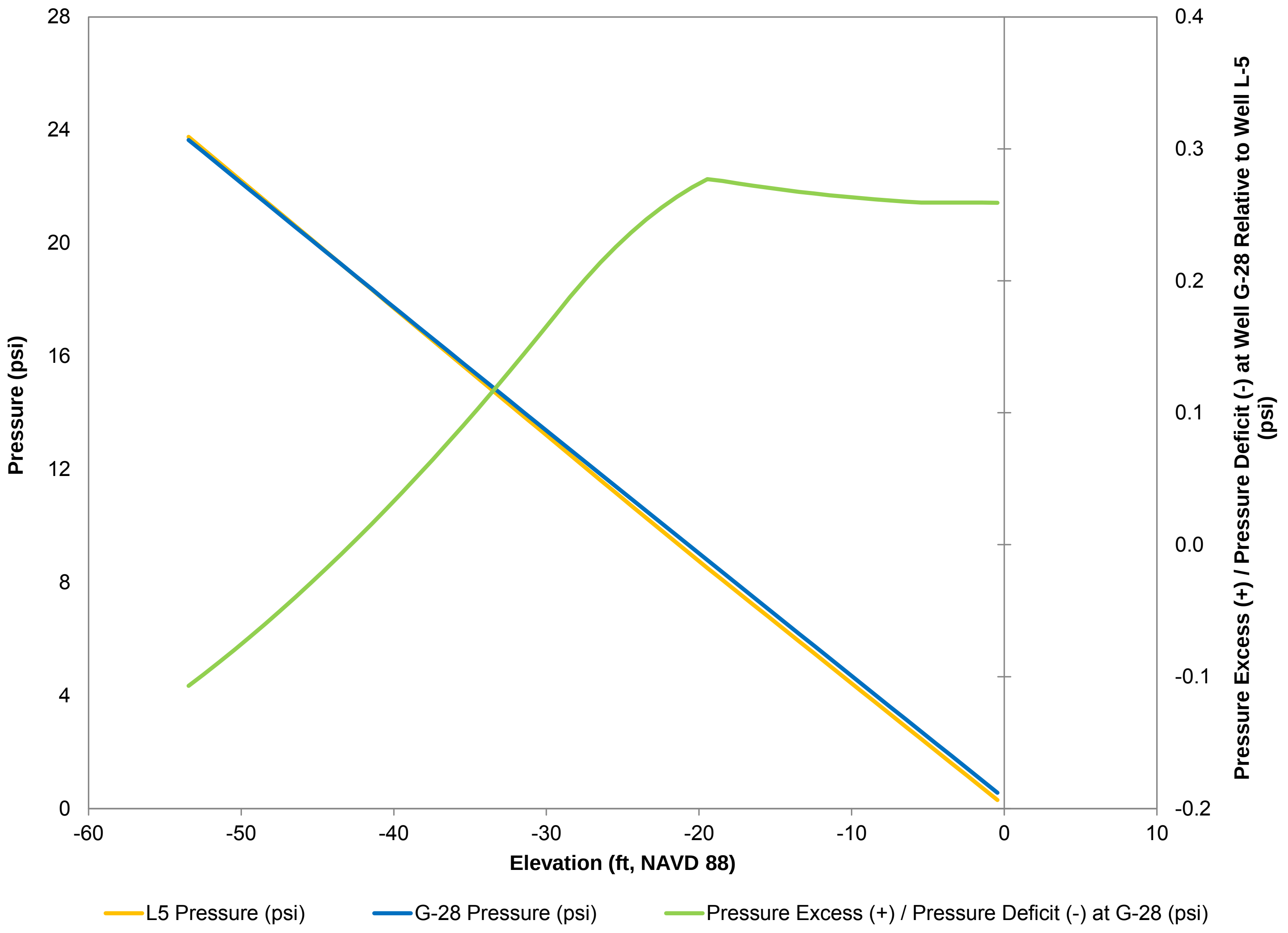

Figure 6.4-22. Pressure Gradient Difference between Well L-5 and Well G-28 during September, 2011 Sampling Episode.

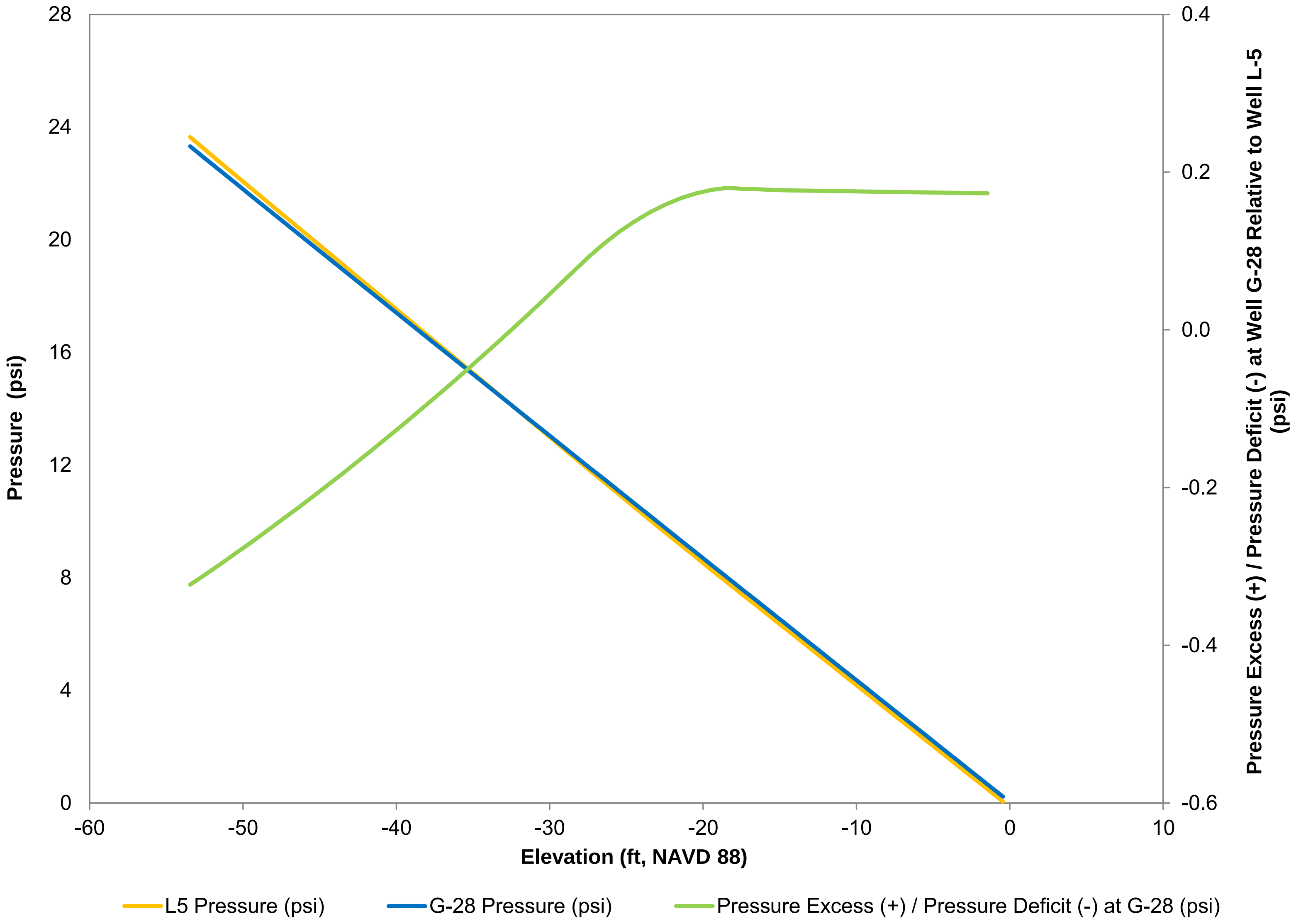

Figure 6.4-23. Pressure Gradient Difference between Well L-5 and Well G-28 during March, 2012 Sampling Episode.

7.0 SUMMARY AND INTERPRETATIONS

The Monitoring Plan incorporates contributions from the Florida Department of Environmental Protection (FDEP), the South Florida Water Management District (SFWMD), and Miami-Dade County's Department of Environmental Resources Management (DERM), (collectively, the Agencies), and FPL. The Monitoring Plan requires the collection of groundwater, surface water, meteorological, flow, and ecological data in and around the plant to establish pre-Uprate baseline conditions and determine the horizontal and vertical effects and extent, if any, of the cooling canal system (CCS) water. This annual report includes data that were collected as part of the Turkey Point Uprate monitoring that began in June 2010 and extended through June 2012. This section provides a summary and interpretation of the results.

7.1 Groundwater

7.1.1 Major Findings

- Over the two year monitoring period, the results indicate the salt constituents and tracer have remained consistent for all wells. This is indicative of the groundwater maintaining a relatively stable condition during this time period.

- Biscayne Bay groundwater results support the conclusion that there is little or no influence from the CCS in the area fronting the northern half of the CCS. However, there is evidence of CCS water under Biscayne Bay in close proximity to the southern tip of the CCS.

- The results indicate there is CCS water immediately adjacent to the west in the groundwater. Further west from the CCS, there is evidence of CCS water in decreasing concentrations at depth out approximately 3 miles. The outermost wells to the west are fresh at all depths.

- TDS values were calculated based on historic specific conductance groundwater data and the pre-CCS limits of groundwater exceeding 10,000 mg/L of TDS were estimated. Based on this determination, much of the pre-CCS groundwater in the study area would be classified as G-III groundwater and designated as non-potable.

- While there is exchange between the CCS and the surrounding environment, there appears to be a limited connection between CCS and Biscayne Bay. At well cluster TPGW-13, which is located in the CCS, water levels change only a few hundredths of a foot in response to several feet of tidal change in Biscayne Bay.

7.1.2 Additional Findings

- Groundwater levels respond quickly to rainfall events, suggesting good connectivity with the ground surface. However, the groundwater temperature and specific conductance remained unaffected following a rainfall event, suggesting a lag time in vertical migration and buffering effect of the groundwater.

- At each well cluster, fluctuations in stage for all three depth intervals track closely, indicating a good hydrologic connection between intervals.

- Water levels at stations in or immediately adjacent to Biscayne Bay (TPGW-3, TPGW-10, TPGW-11, TPGW-12, and TPGW-14) exhibit tidal influence at all three depths. The amplitude of the tidal changes decreases across the landscape from north to south.

- Groundwater levels, in general, are highest at the shallow zone, followed by the intermediate and deep wells. TPGW-2 has the opposite pattern with the deepest well having the highest elevation. For some wells, however, particularly those to the far west, the water levels are essentially the same for all intervals.

- Stations farthest from the coast (TPGW-7, TPGW-8, and TPGW-9) exhibit few water level differences among the shallow, intermediate, and deep wells. The groundwater in these wells is all fresh as defined by FDEP.

- Midpoint groundwater stations, located between the westernmost wells and the CCS (e.g., TPGW-4 and TPGW-5), have brackish water in the intermediate and deep zones and overlying fresher water in the shallow zone. The shallow zone water elevations in these wells are always higher than the deep zone.

- Closer to Biscayne Bay and the CCS, several well clusters have deep or intermediate zones with the highest water elevation, such as TPGW-2; at this cluster, the deep and intermediate interval water levels alternate between having higher water levels with time.

- At TPGW-13, the shallow and intermediate zones have nearly identical water levels but the deep zone is consistently about 0.5 ft lower.

- Following heavy rainfall events (more than several inches in a day), the groundwater level in TPGW-13 rises above water levels in the CCS and an extended period passes before these levels drop below the CCS water levels. This same response occurs in wells just west of the CCS.

- The groundwater levels in TPGW-13 tend to be within the high tide range of the wells that exhibit tidal influences.

- Despite seasonally variable groundwater elevations, the well depth measurement interval that had the highest head remained the same in most wells regardless of wet or dry conditions.

- Water levels in wells farthest from the Bay were affected more by drought conditions than wells close to or in Biscayne Bay.

- There are no evident effects of power plant outages on groundwater levels in wells near the CCS.

- When the ID is pumped, there is a quick and measurable response in water levels in L-31 and the wells closest to the ID (TPGW-1 and TPGW-2 at all depths). This indicates that there is good connectivity among the ID, L-31, and nearby wells.

- Groundwater temperature and specific conductance are consistent in nearly every well over the entire time period. The most notable exception is a regional rise in groundwater temperature in the shallow interval starting around November of each year and extending into March or April, depending on the location. Otherwise, there is little variability in values.

- Based on a comparison of induction logs from the spring of 2010 to spring of 2012, there have been no notable changes in resistivity/saltwater in the groundwater.

- Specific conductance values in groundwater greater than 60,000 µS/cm were consistently found in TPGW-1 (M and D), TPGW-2 (S, M and D), TPGW-3 (S, M and D), TPGW-12 (M and D), TPGW-13 (S, M and D), TPGW-14 (M and D), L-3, and L-5 (at depth).

- Based on USGS estimates, the limits of the 1,000 mg/L chloride line at depth extended west of Tallahassee Road prior to the construction of the CCS.

- Since the construction of the CCS, the specific conductance values within 1 mile west of the CCS have increased at depth by 20,000 to 30,000 µS/cm. The effects are less substantial to the east, further to the west, and in the shallow screened intervals. All the well clusters farthest to the west (TPGW-7, TPGW-8, and TPGW-9) contain freshwater.

- Among all the sites, groundwater chloride concentrations were lowest (<250 mg/L) at TPGW-7, TPGW-8, and TPGW-9, followed by wells TPGW-4S, TPGW-5S, and TPGW-6S. The highest chloride levels were consistently observed at TPGW-13 with an average concentration of 34,444 mg/L. These patterns are similar for the other major ions.

- Specific conductance in the historic wells versus nearby new well clusters is comparable and shows that both types of wells may be equally reflective of groundwater conditions at the screened interval.

- Trace metals in select wells adjacent to the CCS and previous samples from the CCS collected during the SFWMD synoptic sampling event in 2009 do not reveal any appreciably high levels of constituents that would be originating from the CCS. There have been some issues with the level of detection due to inferences from the saltwater and one of the Agencies noted that some of the detection limits are above drinking water standards in groundwater. However drinking water standards do not apply to the non-potable zones where trace metals samples are collected since the wells are screened in high TDS water that pre-dates the CCS.

- High levels of ammonia are found in TPGW-13 located in the CCS and adjacent wells TPGW-1, TPGW-2, and TPGW-14 with values at most locations increasing with depth.

7.2 Surface Water

7.2.1 Major Findings

- For most surface water stations there was no evidence of CCS water via groundwater pathway. However, there were two possible exceptions in two canal stations immediately adjacent to the south end of the CCS.

- Surface water levels in the CCS exhibit limited response (hundredths of a foot) to tidal changes. Similar to groundwater in the CCS, this observation indicates a limited connection of the CCS with Biscayne Bay.

7.2.2 Additional Findings

- Water levels on the plant discharge side have lower ranges in variability (<1 ft at TPSWCCS-1) than stations on the intake side (up to 4 ft at TPSWCCS-6). Water levels on the discharge side of the CCS are generally at least 1 ft higher than those on the CCS plant intake side.

- The difference in stage between the discharge and intake side increased during the 2011 and 2012 dry seasons and decreased during the wet season. CCS surface water levels at all stations were similar in late September and October 2010, October 2011 and February 2012 following a heavy rainfall event.

- Surface water temperature and specific conductance vary more with meteorological conditions than groundwater.

- The water temperatures on the CCS discharge side of the plant at TPSWCCS-1B are 7.5°C warmer on average for the entire monitoring period (June 2010 through June 2012) than at the intake side of the plant at TPSWCCS-6B. The water cools quickly as it moves south within the CCS with the average temperature at the south end of the CCS (TPSWCCS-4B) being only 1.1°C warmer than at the intake side of the plant.

- The water temperature in Biscayne Bay tracks the air temperature, and the CCS water temperatures are always higher than in Biscayne Bay with one exception. The one instance where a Biscayne Bay station was slightly higher in temperature was on February13, 2011when the air temperature dropped rapidly and the CCS cooled faster than Biscayne Bay. Also, the surface water temperature in SFWMD monitoring well location (several miles north of the CCS) BBCW-10 tracked closely with FPL's surface water stations in Biscayne Bay. There are no discernible influences of higher temperatures in the CCS on Biscayne Bay surface water.

- Specific conductance values in the CCS ranged from 50,528 µS/cm (TPSWCCS-4B) to 93,594 µS/cm (TPSWCCS-6B), while Biscayne Bay values were lower and ranged from 18,922 µS/cm (TPBBSW-10B) to 66,884 µS/cm (TPBBSW-1B). The average specific conductance values in the individual CCS stations were consistently over 70,000 µS/cm in comparison to Biscayne Bay station average values that ranged between 43,433 and 51,006 µS/cm.

- When the ID is pumped, the specific conductance values increase in the ID as a result of CCS water seepage.

- The ID continues to operate essentially as designed, however, it was noted that in June 2011 near the end of an extreme dry period, the groundwater elevations in the L series wells were higher than the G series wells. Also, in March 2012, the groundwater elevation in L-5 was higher than the L-31E canal stage. A seaward gradient was still maintained from the L series wells to the ID since the ID was maintained at a lower water elevation.

- Typically, the surface water stations in the L-31 canal (TPSWC-1, TPSWC-2, and TPSWC-3) and the background reference canal on Card Sound Road (TPSWC-6) have specific conductance values reflective of freshwater (<1,275 µS/cm). However, as a result of the drought in 2011, the specific conductance values increased in all locations. In June 2012, specific conductance values at TPSWC-2B, TPSWC-3B, and TPSWC-6B were 9,507 µS/cm, 22,776 µS/cm, and 59,045 µS/cm, respectively. Since there was not an incremental increase in tritium concentrations, these increases in specific conductance tend to indicate regional Biscayne Bay influences instead of CCS influences. Other spikes in specific conductance values have been noted in TPSWC-3B in November 2011 and near the end of the dry season in April-May 2012.

- The water in the historical outfall canal (TPSWC-5) reflects marine conditions, but the bottom of the water column periodically exhibited specific conductance values in excess of those found in Biscayne Bay and similar to those observed in the CCS. This site is over 20 ft deep and is located at the terminus of the dead-end Card Sound Canal. The depth and restricted flushing of this canal may contribute to the observed specific conductance values. However, when reviewing all the data, this station may be affected by the CCS. The water temperature for several extended periods exceeded the temperatures in the CCS and could not be explained by changes in air temperature.

Tritium concentrations, discussed further in this section, also support this preliminary conclusion.

- In Biscayne Bay, average chloride concentrations for the period from June 2010 through June 2012 were 18,900 mg/L, while CCS average chloride concentrations were 33,900 mg/L. In comparison, average seawater chloride levels are 19,840 mg/L at a salinity of 35 on PSS-78 (Millero 1996).
- Ion concentrations in the canals and Biscayne Bay surface waters are more seasonally variable when compared to the groundwater wells. The highest ionic concentrations (as well as specific conductance) were observed in June 2011 at the end of the extreme drought.
- The greatest increase in sodium and chloride concentrations from March to June 2011 was observed at the bottom of the reference station, TPSWC-6 (e.g., sodium: 54 to 12,000 mg/L, a 22,222% increase).
- Nutrient values in the CCS tend to be higher than surrounding stations. Total phosphorus (TP) concentrations in the CCS are similar or less than those reported in the SFWMD C-3 Canal located approximately 15 miles north of the CCS. The nitrate and nitrite values reported in SFWMD canals (C-102 and C-103) within 5 miles north of Turkey Point often exceed the TN reported in the CCS (Graves et al. 2005). Nitrate and nitrite are part of TN.
- In Biscayne Bay, the average TP concentration between the stations in front of the CCS (0.024 mg/L) is comparable to the average TP concentration (0.025 mg/L) in the southernmost Biscayne Bay reference station, several miles south of the CCS in Card Sound.
- Aside from the CCS, the surface station with the next highest TN level (3.42 mg/L) was recorded at the background surface water reference station (TPSWC-6) in March 2012.
- In conjunction with specific conductance and tritium data the data indicate there is no measurable contribution of nutrients in the Bay that can be attributed to the CCS.

7.3 Tracer

7.3.1 Major Findings

- The analysis of ions does not help distinguish CCS water from Biscayne Bay water at concentrations below those typically found in seawater. The isotope data also do not help distinguish CCS from the Biscayne Bay water with the possible exception of tritium.
- The Agencies have recommended that tritium be used as the tracer of CCS water. The Agencies have also established a threshold value of 20 pCi/L for which concentrations below 20 pCi/L are presumed not to be affected by the CCS. Concentrations in excess of

20 pCi/L may or may not reflect CCS influence; FPL needs to further evaluate and provide justification why the values do not indicate a groundwater pathway (i.e., laboratory issue, error band for results, atmospheric deposition/vapor exchange). To account for variability in sample results and laboratory precision, an average value for tritium is being used as directed by the Agencies.

- It is important to note that tritium is being measured only as a chemical tracer in order to determine potential movement of CCS water. At the levels being measured, the tritium is not a public health concern. Tritium is routinely monitored in the CCS by the Florida Department of Health, Bureau of Radiation Control and there have never been results detected near the drinking water standard (20,000 pCi/L).

- FPL does not concur with the selection of 20 pCi/L as a threshold or background for surface water, porewater, or very shallow groundwater. The values measured do not indicate a groundwater pathway. FPL has demonstrated that multiple factors can influence tritium levels in the region including atmospheric influences.

7.3.2 Additional Findings

- Based on evaporation pan and rainfall samples that were collected and analyzed for tritium, atmospheric influences of tritium can exceed several hundred pCi/L within 1 mile of the CCS and reach 50 pCi/L at distances over 3 miles from the CCS. Surface water, porewater, and shallow groundwater (particularly in fully screened wells) are most susceptible to atmospheric influences of tritium. There is no evidence that high chloride/specific conductance CCS water with commensurate levels of tritium are seeping up and affecting Biscayne Bay surface water, L-31 Canal surface water, or porewater in the area surrounding the CCS. These surface water bodies and the porewater have tritium concentrations similar to those found in the evaporation pans and/or rainfall and cannot be attributed to a groundwater pathway.

- Results from surface water in TPSWC-4 and TPSWC-5 indicates tritium concentrations were detected near the bottom of the water body, at levels higher than might not be solely attributable to atmospheric inputs since the highest values were at depth. The maximum tritium concentrations at both of these stations exceeded 900 to 1,000 pCi/L; however, much lower values less than 100 pCi/L have been reported. This may indicate that there is groundwater seepage on occasion through the narrow land that separates these canals from the CCS.

- Using 20 pCi/L as a reference and assuming the atmospheric effects are less with depth, the extent of CCS water in the groundwater near the base of the Biscayne Aquifer extends approximately 3 miles west of the CCS. Given that there are various mechanisms that can contribute to the movement of saltwater, it is unclear how much the CCS density gradients have affected the movement of CCS water verses other factors.

- The extent of CCS water in the offshore groundwater appears to be limited mostly to the deeper depths of TPGW-14 (between 2,490 and 2,660 pCi/L at TPGW-14D). This well cluster is closest to the CCS where the highest water levels (biggest gradients) on the east side of the CCS occur. Some evidence of CCS water was also noted at depth in well cluster TPGW-11 with tritium concentrations ranging from 338 to 480 pCi/L. Since tritium concentrations were much lower at the shallower intervals, these values appear to be related to a groundwater pathway.

7.4 Water Budget

7.4.1 Major Findings

- Based upon data collected as a part of the pre-uprate monitoring program, as well as information furnished by SFWMD, a water and solute mass (salt) balance model was developed and calibrated to effectively match changing water levels and water quality in the CCS between September 2010 and June 2012.

- The ability to match both CCS water levels and salinities over the period of record with a relatively simple water and salt balance model indicates that FPL has a firm understanding of the processes that govern CCS hydraulics.

- Results of the water and salt balance model indicate that precipitation, Biscayne Bay water inflow, and groundwater discharge are critical to the maintenance of long-term salinity equilibrium in the CCS.

- The water and salt balance model is a useful tool for understanding the dynamics of the CCS and its effect on the environment.

7.5 Ecological

7.5.1 Major Findings

- FPL concludes the CCS does not have any ecological impact on the surrounding areas. FPL further concludes there is no evidence of CCS water in the surrounding ecosystems from a groundwater pathway.

7.5.2 Additional Findings

- The marsh transects in the Model Lands marsh (F2 to F4) are vegetatively typical of coastal marshes in South Florida. These habitats are dominated by sawgrass and spikerush. The marsh transects to the north (F1) and south (F5) of the CCS, however, are brackish mixed marsh-mangrove habitats. The marsh vegetation characteristics and sawgrass community composition are representative of the hydrologically modified marshes found throughout southern Florida.

- High conductivities (up to 3,200 µS/cm) observed at some of the F2-F4 sites are caused by the higher calcium contents rather than sodium, indicating a carbonate origin contributing to the conductance values.

- Soil phosphorous is the main driver of sawgrass community structure. The low productivity at transects F2 and F3 and the high productivity of plot F4-1 are all tied to soil phosphorous levels.

- Soil nutrient patterns indicate that there is a higher concentration of nitrogen and phosphorus in the F1 and F4 transects, as well as in the tree islands compared to the other F2, F3 and the reference F6 plots. The higher soil nutrients patterns in the tree islands are typical for South Florida and this observation helps explain, in part, the denser and taller vegetation observed at F4.

- The mangrove transects (M1 to M6) are all scrub mangroves. Areas to the east of the CCS (M2 to M4) are typical of scrub basin forests in South Florida. The scrub nature of this habitat is supported by stable isotope data supporting evaporative rates in these habitats.

- Vegetation nutrient patterns indicate that the both the marsh and mangrove habitats are both P-limited systems. The tree islands however, are N-limited.

- There are no significant differences in porewater specific conductance with distance from the CCS or compared to the reference transects in either the marsh or mangrove habitats.

- Large areas (>70%) of the Bay habitat along the transects were hard-bottom. This limits productivity to the small areas where sediment is found. Consequently, the area has low cover and is not very diverse.

- Although seagrasses were present in >80% of the quadrants along the transects, the seagrass component rarely exceeded 25% in cover. Additionally, the Bay sediments were nutrient-poor, further limiting the productivity and biodiversity of these habitats.

- The number of organisms captured reflects the habitat cover of an area. More organisms were captured in spring 2011 compared to the fall 2010 sampling event. Caridean shrimp were the most common organisms caught as the throw traps tend to capture small, cryptic, and sedentary species.

- There were no indications of CCS effects on bottom water temperatures, bottom water specific conductance, salinity, ORP, or porewater temperatures.

- There was a very weak tendency for bottom DO values to be higher at stations closer to the CCS. However, bottom DO values for all sampling events combined were significantly lower in the control area than in the three study areas.

- The control area, BB4, had significantly higher bottom turbidity than the three study areas, and turbidities were significantly higher at nearshore transects than at offshore transects. This is an artifact of the more silty substrates near shore in Area BB4.

- There was a very weak negative correlation between distance from shore and porewater specific conductance. There were no statistical differences in porewater tritium concentrations among any of the study areas during any of the four sampling events, suggesting that the higher nearshore porewater conductance values are not associated with CCS seepage.

- Thalassia sp. was the dominant seagrass and occurred throughout most of the study area, however, the Braun-Blanquet scores for seagrasses were relatively low along most transects. High cover and low-standing crops of seagrasses in Biscayne Bay have been reported by others and are attributed to the shallow depth of sediments.

- Throw-trap collections were dominated by caridean shrimp, followed by crabs (primarily hermit crabs), fish, and penaeid shrimp (primarily pink shrimp).

- Densities of organisms were generally higher in Areas BB1 and BB3 than in Areas BB2 and BB4 (the control); however, these differences were not found to be statistically significant during spring 2012. Densities of organisms were correlated with SAV (particularly macroalgae) during spring 2012.

8.0 RECOMMENDATIONS

The two year, pre-Uprate monitoring period is complete. We are now in a period of time prior to the full operation of the two Uprated nuclear units. The first unit (Unit 3) returned to service in September 2012 but to date has not operated at the uprated power levels. The second unit (Unit 4) is currently scheduled to be taken offline in November 2012 and is anticipated to return to service in the spring of 2013.

FPL recommends some reductions in the monitoring during this interim period. The post-Uprate period is defined as both units operating at the uprate power levels. This interim monitoring period reduction should include the elimination of certain water quality sampling events and the terrestrial ecological monitoring such as the December 2012 and March 2013 groundwater and surface water sampling events and February 2013 ecological event. FPL will further discuss the merits of continuing ecological monitoring after the November 2012 event with the Agencies.

In addition, FPL recommends the following changes be adopted for the post-Uprate monitoring period:

a) Discontinue sampling for the trace metals in the five well clusters in close proximity to the CCS based on the lack of findings and the lack of any relevant standards.

b) Continue chloride, sodium, and tritium sampling and analysis. Eliminate all isotopes and ions. Since the Agencies have selected tritium as the tracer for the CCS and it has been shown that the other isotopes and ions have shown no value as tracers of CCS water, continued analyses for all these parameters have limited merit.

c) Eliminate sampling and analysis of the nutrients. The discharge of nutrients into the CCS from the plant is negligible.

d) Continue automated data collection, but reprogram all stations to one-hour intervals. By reprogramming the stations to one-hour intervals, the amount of data retrieved from the automated stations on a daily basis and processed will be reduced by 75%.

e) Eliminate the rain gauge stations around the CCS and use the NEXTRAD data collected by the SFWMD. The NEXTRAD data provides better coverage of the CCS and prevents having to interpolate rain values across the CCS from rain gauge stations outside the CCS. Continue operation of the meteorological station and rain gauge within the CCS (TPM-1).

f) Eliminate the CCS flow meters. This data is not being used as originally envisioned and thus there is a limited benefit of continued data collection. These meters are located at depth in a harsh environment (i.e., within the CCS) and are difficult to maintain. Logistical and security constraints also restrict placement of the flow meters.

g) Eliminate the ID flow meters since pump operational data provides more reliable information. Pump tests more closely matched flows being discharged into the CCS from the ID compared to the flow meters.

h) Eliminate the requirement for the automated data being reported every 24 hours. The automated data will either be manually downloaded or transmitted via telemetry when a reliable signal is available.

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